CONFERENCE BOOK

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AICHEAS 2ND INTERNATIONAL CONFERENCE ON HEALTH, ENGINEERING AND APPLIED SCIENCES
MARCH 22 - 24, 2024
MUŞ

Edited By
ASSOC. PROF. DR. ELIF AKPINAR KÜLEKÇI

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DATE – PLACE

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ORGANIIZATION

ACADEMY GLOBAL CONFERENCES & JOURNALS

EVALUATION PROCESS

All applications have undergone a double-blind peer review process.

PARTICIPATING COUNTRIES

Turkey – Italy- Iran- Greece- India- Libya- Nigeria – Bangladesh- Indonesia- China- United States- Germany- Thailand- France- Australia- Japan- Egypt- Colombia- Malaysia-

PRESENTATION

Oral presentation

PERCENTAGE OF PARTICIPATION

More than 55% of the papers were presented by foreign participants.

23 Papers from Turkey and 39 paper form other countries

Members of the organizing committees of the conference perform their duties with an "official assignment letter"

LANGUAGES

Turkish, English, Russian, Persian, Arabic

Scientific & Review Committee

AICHSS 2nd INTERNATIONAL CONFERENCE ON HUMANITY AND SOCIAL SCIENCES
AICHEAS 2nd INTERNATIONAL CONFERENCE ON HEALTH, ENGINEERING AND APPLIED SCIENCES
MARCH 22 - 24, 2024
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Join Zoom Meeting
https://us06web.zoom.us/j/81604584722?pwd=y2kFvDBw8AEhxbZ5eSknYVkdXt0yTt.1
Meeting ID: 816 0458 4722
Passcode: 202224

ÖNEMLİ AÇIKLAMA (Lütfen okuyunuz)

- ZOOM bağlantısı için yukarıda verilen bağlantıyı veya yine yukarıda verilen giriş bilgilerini kullanabilirsiniz.
- Oturum içerisinde en KIDEMLİ olan moderator olarak seçilir. Moderatörün oturum düzenini gözetmesi, akademisyen adaylarını yönlendirmesi beklenmektedir.
- Oturuma bağlanmadan önce Salon numaranızı adınızın önüne aşağıdaki gibi ekleyiniz. Bu sayede kongre açılışında beklemeden oturumlarınıza gönderilebileceksiniz. Ör. 5 Ahmet Ahmetoglu
- Sunum süresi 10 dakikadır. Bu sürenin aşılmamasını moderatörler temin edecektir.
- Sunum sonrası 5 dakikayı geçmeyen soru-cevap, tartışma süresi verilmektedir.
- Sunumlar TÜRKÇE veya İNGİLİZCE yapılabilmektedir.
- Kameralar, oturum süresince toplam % 70 oranında açık olmak zorundadır.
- Sunum yapan katılımcının kamerası açık olmak zorundadır.
- Sunum yapmak zorunludur. Herhangi bir nedenle sunum yapmamış olan katılımcıya sertifika verilmesi ve çalışmasının yayınlanması sözkonusu olamaz.
- Katılımcı, kendi oturumda, oturum bitene kadar bulunmak zorundadır.
- Katılımcıların kendi oturumları dışındaki oturumlara katılma zorunluluğu yoktur.
- ZOOM platformunun kapasite sınırı nedeniyle, DİNLEYİCİ, sadece kapasite izin verdiği sürece kabul edilebilmektedir.

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- To be able to make a meeting online, login via https://zoom.us/join site, enter ID instead of “Meeting ID
- or Personal Link Name” and solidify the session.
- The Zoom application is free and no need to create an account.
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- All congress participants can connect live and listen to all sessions.
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- Moderator is responsible for the presentation and scientific discussion (question-answer) section of the session.

TECHNICAL INFORMATION

- Make sure your computer has a microphone and is working.
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- Attendance certificates will be sent to you as pdf at the end of the congress.
- Moderator is responsible for the presentation and scientific discussion (question-answer) section of the session.
- Before you login to Zoom please indicate your name surname and hall number,

AICHSS 2nd INTERNATIONAL CONFERENCE ON HUMANITY AND SOCIAL SCIENCES AICHEAS 2nd INTERNATIONAL CONFERENCE ON HEALTH, ENGINEERING AND APPLIED SCIENCCES MARCH 22 - 24, 2024 MUŞ Meeting ID: 816 0458 4722 Passcode: 202224				
23 Mart / March 23, 2024 / 11:00 – 13:00 Time zone in Turkey (GMT+3)				
Salon	Moderator		Bildiri No ve Başlığı / Paper ID and Title	Authors
SALON 1	**Dr. Meryem ÇEKİM**	1	ABOUT THE SUFİ HERİTAGE OF ABULKASİM QUSHAYRİ	Davronbek Kodirov
		2	ÖĞRETMENLER İÇİN BİR YOL HARİTASI: DİSİPLİN MODELLERİNİN DEĞERLENDİRİLMESİ	Öğretmen, BETÜL KAŞ
		3	SOSYAL BİLGİLER ÖĞRETMENLERİNİN KAYNAŞTIRMA EĞİTİMİ İLE İLGİLİ GÖRÜŞLERİ	Arş. Gör. Gülenay Esranur AKTEPE Dr. Öğr. Üyesi Mine SÖNMEZ KARTAL
		4	SERVET-İ FÜNÛN DERGİSİ PERSPEKTİFİNDEN IYD-İ SAİD-İ FITR (1876-1909)	Dr. Meryem ÇEKİM
		5	OSMANLI'DA MUHTÂCÎN MAAŞI ÖDENEĞİNİN SOSYAL HİZMET POLİTİKASI KAPSAMINDA DEĞERLENDİRİLMESİ	Dr. Meryem ÇEKİM

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SALON 2	**Asst. Prof. Dr. ABDULLAH TÜRK**	1	REFLECTION OF THE 22nd TERM GENERAL ELECTIONS ON ŞIRNAK PROVINCE	Dr. Lecturer, PINAR KAŞ
		2	SOSYOLOJİK BAĞLAMDA GAZZE'NİN DİNİ VE SİYASİ MEŞRUTİYETİ: TÜRKİYE'NİN ORTADOĞU VE İSLAM DÜNYASINDAKİ KONJEKTÖREL ROLÜ	Dr. Selameddin BAYSAL
		3	TÜRKİYE'DEKİ CEZA VE İNFAZ KURUMLARININ TUTUKLU VE HÜKÜMLÜLERE YÖNELİK İNFAZ SÜRECİNDEKİ İYİLEŞTİRME ÇALIŞMALARI	Dr. Selameddin BAYSAL
		4	MODERN DÜNYADA DİJİTAL PAZARLAMANIN GÖRSEL İLETİŞİMİ	Dr. Öğr. Üyesi, Bilge ÇAĞLAR DEMİR
		5	ÖRGÜTSEL DUYGU YÖNETİMİNDE LİDERLİK UYGULAMALARININ ROLÜ: HAVACILIK SEKTORÜNDE NİTELİKLİ BİR ARAŞTIRMA	Asst. Prof. Dr. ABDULLAH TÜRK

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SALON 3	**Doç. Dr. AHMET SALİH İKİZ**	1	ÜNİVERSİTE KENT ETKİLEŞİMİ MUĞLA ÜNİVERSİTESİNİN KENTE KATKILARI	Doç. Dr. AHMET SALİH İKİZ
		2	CHILD PROTECTION POLICIES IN TÜRKİYE: THE ROLE OF CHILDREN'S HOMES	Sahra Melisa AKPINAR Mehtap DEMİR
		3	CHOICE AND MORALITY IN DAVID HUME'S PHILOSOPHY	Mehmet Nuri DEMİR
		4	AN EPISTEMIC EVALUATION OF TESTIMONY	Dr, Mehmet Nuri DEMİR
		5	BESNİ BEKİRBEY HAMAMI	Yasemin Yaşar

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SALON 4	**Dr. Jelena Bijeljic**	1	FOSTERING COLLABORATION: EXAMINING TEAMWORK IN COMMUNITY SERVICE PROJECTS THROUGH COOPERATIVE LEARNING	Dr. Jelena Bijeljic
		2	SOCIAL MEDIA INTEGRATION IN BUSINESS EDUCATION: EXPLORING CHALLENGES AND OPPORTUNITIES FOR NIGERIAN UNIVERSITY STUDENTS	Edwin Lim Wei Bin Mohd Kamarul Irwan Abdul Rahim
		3	MOBILE COLLABORATION LEARNING IN DEVELOPING NATIONS: IMPACT ON STUDENTS AND OPPORTUNITIES FOR GROWTH	Ikramuddin Junejo Soonh Mangi
		4	NAVIGATING COMPLEXITY: LEADERSHIP STRATEGIES AND KNOWLEDGE MANAGEMENT IN HIGHER EDUCATION	Ummi Naiemah Sarai Muhammad Saad
		5	STRATEGIC EDUCATIONAL PLANNING: ENSURING THE MAINTENANCE OF ELECTRIC POWER EQUIPMENT	Chennai Yassmine Belaidi Salah
		6	PRINCIPALS' INTERPERSONAL EMOTIONAL INTELLIGENCE AND JOB SATISFACTION: INSIGHTS FROM TEACHERS' PERSPECTIVES	Imola Katalin NAGY
		7	PROFESSIONAL DEVELOPMENT PRACTICES AMONG SECONDARY SCHOOL TEACHERS IN BRUNEI DARUSSALAM	Baiju Thomas
		8	FROM TRADITIONAL TO ENTREPRENEURIAL UNIVERSITIES: A SWEDISH PERSPECTIVE ON TRANSFORMATIVE APPROACHES	Ouassaf Mebarka

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SALON 5	**Dr. Deepali Rawat**	1	EXPLORING GENDER DISPARITIES IN BASIC MATH SKILLS PERFORMANCE: A STUDY IN LEBANESE STATISTICS COURSES	Hiba Naccache
		2	UNVEILING LEARNERS' PERSPECTIVES ON CODE SWITCHING AMONG TERTIARY LEVEL EDUCATORS IN VIETNAM	BENNANI Fatima Zahra DINAR Brahim BENJOUID Zakaria
		3	ENHANCING LEARNER-CENTERED APPROACHES IN HIGHER EDUCATION INSTRUCTION	Nataliia Antoniuk
		4	BRIDGING HIGHER ORDER THINKING SKILLS WITH GEOGEBRA IN PRE-SERVICE TEACHER TRAINING	Dr. Deepali Rawat Ms. Sapna Tomar
		5	FLIPPED CLASSROOM METHODOLOGY FOR LIBERAL ARTS STUDENTS	Okorafor Uneke Josephine
		6	NAVIGATING THE DIGITAL PEDAGOGICAL LANDSCAPE: CRAFTING A WRITING TOOL FOR EDUCATION	DEEPALI TOMAR
		7	EVALUATING THE FEASIBILITY OF ONLINE ASSESSMENT IN FOSTERING CRITICAL THINKING	Jelena Lutovac
		8	UNDERSTANDING FACTORS AFFECTING ENGLISH LANGUAGE LEARNING AT BISHA COLLEGE OF TECHNOLOGY	Jelena Lutovac

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SALON 6	**Imola Katalin Kovács**	1	ENHANCING MATHEMATICS LEARNING ONLINE THROUGH OPEN EDUCATIONAL RESOURCES	Haohao Wang
		2	TOWARDS A MEANINGFUL REFORM IN GENERAL EDUCATION: INTEGRATING CORE CURRICULA WITH INSTITUTIONAL VALUES	Mahran Al-Ghayeb Nayef Jomaa Jomaa
		3	HARNESSING THE POWER OF BIG DATA IN EDUCATION: PRACTICAL APPLICATIONS AND IMPLICATIONS	Francis, A. JERO Edirin IKENGA
		4	EXPLORING FACEBOOK AS AN ALTERNATIVE LEARNING TOOL IN MALAYSIAN HIGHER EDUCATION: A STRUCTURAL EQUATION MODELING PERSPECTIVE	Imola Katalin Kovács
		5	LEVERAGING INFORMATION AND COMMUNICATION TECHNOLOGY TO ENHANCE CHILDREN'S POTENTIAL IN SCIENCE: ADDRESSING CHALLENGES FOR SUSTAINABLE DEVELOPMENT IN NIGERIA	Dr. Gabriella NAGY
		6	DEVELOPING A TRANSNATIONAL STUDENT SUCCESS FRAMEWORK FOR PRE-CLINICAL MEDICAL EDUCATION: AN ACTION RESEARCH INITIATIVE IN TRANSNATIONAL HIGHER EDUCATION	Ayesha Batool
		7	CASE STUDY: FACILITATING COLLABORATIVE TEAMWORK IN HIGHER EDUCATION	Dr. Farkhanda Iqbal
		8	EXAMINING TEACHER DISCOURSE IN LEARNER-CENTERED TEACHING PRACTICES	Assoc. Prof. Asif Anjum

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SALON 7	**Svitlana Hanaba**	1	"EXPLORING ACCESS TO HIGHER EDUCATION: INSIGHTS FROM THE UNIVERSITY OF CALABAR PRE-DEGREE PROGRAM"	Eni I. Eni, James Okon, Ashang J. Ashang
		2	"FACILITATING COOPERATIVE LEARNING: PRINCIPLES OF MATHEMATICS INSTRUCTION FOR GRADUATE-LEVEL STUDENTS"	Abdulgaffar Muhammad Sunday Jones ANIEFOR
		3	RELATIONSHIP OF ARM ACUPRESSURE POINTS AND THAI TRADITIONAL MASSAGE	Svitlana Hanaba
		4	DESIGNING EFFECTIVE RUBRICS FOR VOCATIONAL EDUCATION ASSESSMENT	Phan Kim Huong Bui Hoang Tan
		5	UNDERSTANDING DRUG USE KNOWLEDGE AND ANTIMICROBIAL BEHAVIOR: A STUDY	Ionela RUS Prof. Dr. Remus RUNCAN
		6	UTILIZING PROJECT-BASED LEARNING TO ADDRESS NATIONAL QUALIFICATIONS FRAMEWORK: TQF LEARNING DOMAINS	Muhammad Bello DROBOT
		7	INNOVATIVE ONLINE LESSONS TO ENHANCE MASTER'S DEGREE LEARNING IN CURRICULUM AND INSTRUCTION	Assoc. Prof. Dr. Dr. PatriciaRUNCAN
		8	FOSTERING COLLABORATIVE ONLINE LEARNING EXPERIENCES FOR EDUCATORS	Mina Mahbod

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SALON 1	**Doç. Dr. Enver KENDAL**	1	Uteroimplantation Growth Restriction during Early Gestation in Rats is triggered through ADM 22-52 Antagonist	Assist. Prof. K.R.Padma Reader K.R.Don Prof. P.Josthna
		2	ANTIBACTERIAL EFFECTS OF BOLETUS EDULIS, CANTHARELLUS CIBARIUS, CRATERELLUS CORNUCOPIOIDES, AGARICUS BISPORUS, PLEUROTUS OSTREATUS AND MORCHELLA ESCULENTA MUSHROOMS	Dr. Özge ÖZCAN Dr. Gamze ALTINTAŞ KAZAR Elif GEZER ASLAN
		3	EXPLORING THE ANTIBIOFILM ACTIVITY OF FOMITOPSIS PINICOLA EXTRACT AGAINST METHICILLIN-RESISTANT STAPHYLOCOCCUS AUREUS: IMPLICATIONS FOR COMBATING ANTIBIOTIC RESISTANCE	Dr. Öğretim Üyesi Başar KARACA
		4	DETERMINATION OF THE EFFECTS OF WORM FERTILIZER 0N YIELD AND YIELD TRAITS OF LENTIL (LENS CULINARIS MEDIK.) CULTIVARS	Aynur EREN Doç. Dr. Enver KENDAL
		5	INVESTIGATION OF THE EFFECT OF DIFFERENT NITROGEN DOSES ON YIELD AND TRAITS IN SECOND CROP CORN CULTIVATION	Servet COŞKUN Doç. Dr. Enver KENDAL
		6	METAVERSE'İN PSİKOSOSYAL RİSKLER AÇISINDAN DEĞERLENDİRİLMESİ	Dr., Süleyman ŞİMŞEK İrem Nazlı ERKUL Habibe ER

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SALON 2	**Prof Dr Deniz Hasirci**	1	INVESTIGATING THE IMPACT OF FENG SHUI PRINCIPLES ON RESIDENTIAL BEDROOM INTERIOR DESIGN	Güneş Boy Nisan Çömezoğlu Zeynep Yıldırım Nilhan Aydın Deniz Hasirci
		2	IMPROVING THE DESIGN OF PUBLIC SEATING AREAS	Ecem Naz Duva Busem Doğdu Asya Karafırtınalar Deniz Hasirci
		3	DUYUSAL BAHÇELERE YÖNELİK TASARIM VE UYGULAMA ÖRNEKLERİNİN DEĞERLENDİRİLMESİ	GİZEM SENANUR GÖZLER Prof. Dr., TUĞBA KİPER
		4	PEYZAJ TASARIM ÖLÇEĞİNDE İKLİM DEĞİŞİKLİĞİ YEŞİL ALAN İLİŞKİSİNE YÖNELİK YAKLAŞIM VE UYGULAMALAR	GİZEM SENANUR GÖZLER Prof. Dr. TUĞBA KİPER
		5	EXAMINATION OF EXAMPLES OF APPLICATION OF LANDSCAPE AND DESIGN PRINCIPLES IN SOME CITY SQUARES	Masters Student, Gökçe CAN Associate Professor, ELİF AKPINAR KÜLEKÇİ
		6	THE USE OF WATER ELEMENT IN LANDSCAPE ARCHITECTURE NEW APPROACHES	Masters Student, Gökçe CAN Associate Professor, ELİF AKPINAR KÜLEKÇİ
		7	EXAMINATION OF EXAMPLES OF APPLICATION OF LANDSCAPE AND DESIGN PRINCIPLES IN SOME CITY SQUARES	Masters Student, NİSANUR GÜL Associate Professor, ELİF AKPINAR KÜLEKÇİ

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SALON 3	**Assist. Prof. CEM ÖZKURT**	1	CELLULAR METABOLIC NETWORKS AND CONSTRUCTAL LAW	Muhammed Erkan Karabekmez
		2	SEMIPRIME IDEALS AND MULTIPLICATIVE GENERALIZATION DERIVATIONS	Emine KOÇ SÖGÜTCÜ
		3	IMPROVING BALANCE SKILLS WITH MOBILE APPLICATIONS DEVELOPED WITH FLUTTER	ENSAR TOKYAY Assist. Prof. CEM ÖZKURT
		4	IMPROVING THE TRACKING OF RADIO FREQUENCY DEVICES WITH 10-STEP KAIZEN IN E-COMMERCE WAREHOUSES	İbrahim ÇİL Alişan ARASLI Ayşe Nur TOPCAN Damla PINAR M. Fatih AKAY

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SALON 4	**Prof. Dr. Abdullah Göktaş**	1	ARDIŞIK GÜNLÜK AKIŞLILIK KATSAYILARI İLE GÜNLÜK AKIŞ SÜREÇLERİNİN STASYONER HALE GETİRİLMESİ	Dr. Öğr. Üyesi AHMET ALKAN
		2	ACTIVE POWER FACTOR CORRECTION CIRCUITS IN SINGLE PHASE POWER SUPPLY	Dr.Öğr.Üyesi AHMET ILICA
		3	TRAPEZOIDAL AND S-CURVE MOTION PROFILES IN SERVO SYSTEMS	Dr.Öğr.Üyesi AHMET ILICA
		4	ALÜMİNYUM ALAŞIMLI BİNEK ARAÇ JANTLARININ BURULMA RİJİTLİĞİ ANALİZİ İÇİN OPTİMİZASYONU	Ür-Ge Uzman Mühendisi, İLKE ŞİMŞEK Ar-Ge Kıdemli Uzmanı, MERİÇ IŞIK
		5	Photocatalytic and Optical Properties of Mn-doped ZnS thin films derived by sol-gel	Sultan GÖKTAŞ Gülsen ŞAHİN Abdullah GÖKTAŞ

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SALON 5	**Assoc. Prof. Dr. Hasna Huwaidah**	1	MOLECULARLY IMPRINTED POLYMERS (MIPS): TARGETED REMOVAL OF CARBAMAZEPINE FROM WATER	Bianca Schweiger, Lucile Bahnweg, Barbara Palm, Ute Steinfeld
		2	DUAL APPROACH FOR PENTACHLOROPHENOL REMOVAL: ADSORPTION AND BIODEGRADATION	Ayətxan ZİYAD (İsgəndərov) Dr.Elvan CAFEROV Dr. Zemfira Azizah
		3	ENHANCED VAGINAL SUPPOSITORIES WITH LACTOBACILLUS: FORMULATION AND ASSESSMENT	Assoc. Prof. Dr. Hasna Huwaidah Muhamad Syahrul Arifin
		4	INFLUENCE OF SERICIN CONCENTRATION ON FILM PROPERTIES: A STUDY	Laila Kholisa Azzahra Lizianil Anacan
		5	NEW RP-HPLC METHOD VALIDATION FOR NORFLOXACIN DETECTION	Prof. Dr. Angga Candra Winata Dr. Minkhatul Maula
		6	EXPLORING ANTIBACTERIAL POTENTIAL OF PLUMERIA ALBA PETALS	Aulia Nailis Slamah Ria Anisatus Solihah
		7	PROACTIVE DETECTION OF FALSE DRUG-DRUG INTERACTION ALERTS	Lilis Arviani Umi Fikriyah
		8	COMPARATIVE ANTIBACTERIAL EFFECTS OF ETHANOL AND ISOPROPYL EXTRACTS OF ZINGIBER OFFICINALE ROSE	Ridwan Abu Djibran Aris Syafi'i

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SALON 6	**Prof. Dr. Tri Ayu Surur**	1	ENHANCING SHEAR STRENGTH PARAMETERS OF LOESS WITH COMMON ADMIXTURES IN GORGAN, IRAN	Seyed Erfan Hosseini Mohammad K. Alizadeh, Amir Mesbah
		2	ADVANCEMENTS IN BIM SOFTWARE DEVELOPMENT IN CLOUD COMPUTING ENVIRONMENT	Assis. Prof. Dr. Zulfatus Saroya Dr. Anisa Kamila Dr. Muhammad Sultan Mubarok
		3	FINITE ELEMENT SIMULATION AND PARAMETERIZATION OF A C-SHAPED ELECTROMAGNET FOR MAGNETIC MATERIAL CHARACTERIZATION	Laila Ameliya Muhammad Sultan Mubarok
		4	THERMAL CONVECTION IN LIGHTWEIGHT TIMBER CONSTRUCTIONS ENHANCED WITH MINERAL WOOL	Dina Lutfiyana Muhammad Sultan
		5	UNDERSTANDING THE CAUSES OF POOR CONSTRUCTION SITE SAFETY AND PRIORITIZING SOLUTIONS	Prof. Dr. Tri Ayu Surur Achmad Tubagus Widyastuti
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INVESTIGATING THE IMPACT OF FENG SHUI PRINCIPLES ON RESIDENTIAL BEDROOM INTERIOR DESIGN

Güneş BOY [1], Nisan ÇÖMEZOĞLU [2], Zeynep YILDIRIM [3], Nilhan AYDIN [4], Deniz HASIRCI [5]

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ABSTRACT

This research delves into the nuanced impact of Feng Shui principles on residential interior design, specifically focusing on bedrooms. Rooted in ancient Chinese tradition, Feng Shui offers a unique perspective on how spatial arrangements influence energy flow and overall harmony, and is a prevalent approach in interior design around the world. Investigating the authenticity of Feng Shui influences, the study explores its use in interior design –particularly, residential bedroom design. The study employs online surveys and comparative analysis as methodology, to examine Feng Shui and influences on bedroom experiences, irrespective of occupants' awareness. Participants, categorized into two groups, provided insights into their bedrooms, with questions designed to elicit candid reflections while assessing their awareness of Feng Shui without its explicit identification. Categorizing participants into groups based on their familiarity with Feng Shui enabled the revelation of the interplay between awareness, belief, and practical application. The comparative analysis aims to reveal how knowledge of Feng Shui shapes its overall meaning in residential bedroom design, providing valuable data on

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potential benefits and challenges. In relation, possible interior design guidelines and assessments are presented. This research contributes to a deeper understanding of how Feng Shui shapes bedroom environments, offering guidance for interior designers, researchers, and users, ultimately leading to more effective designed living spaces for today and the future.

Keywords: Feng Shui, interior design, bedroom design, user experience

1. INTRODUCTION

This research project explores the nuanced effects and perceptions of Feng Shui principles in residential interior design, with a specific focus on bedrooms. Rooted in a centuries-old Chinese practice, Feng Shui offers a distinctive perspective on how spatial arrangement and design elements influence energy flow and overall harmony within living spaces. While existing research has delved into the specific principles and effects of Feng Shui on practitioners, a critical gap remains unexplored: does Feng Shui impact individuals through a placebo effect, driven by psychological factors in those aware of the method, or does it genuinely bring positive effects through design changes resulting in energy shifts?

Employing a combination of survey and comparative analysis, this study aims to illuminate the extent to which Feng Shui shapes the experiences of bedroom occupants, irrespective of their awareness, leading to a deeper understanding of its broader implications on environmental behavior and emotional states.

Participants, divided into groups - one with prior knowledge and experience in Feng Shui practices and the other with no exposure - will be surveyed specifically about their bedrooms. Questions will be crafted to elicit honest and open thoughts and feelings, and participants' awareness of Feng Shui will be assessed. Through this, the study seeks to determine whether Feng Shui operates as a placebo effect, a central focus of our research.

The comparative analysis of responses from both groups aims to unveil insights into the impact of knowledge and awareness on the application of Feng Shui in bedroom interiors. The findings will provide valuable data on the potential benefits and challenges of adopting Feng Shui practices in bedroom design.

This research contributes to a deeper understanding of the role Feng Shui can play in shaping bedroom environments, fostering balanced and harmonious spaces. The insights gained will

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guide homeowners, interior designers, and architects in incorporating Feng Shui principles into their bedroom design processes while addressing preconceived notions or barriers that may affect its implementation.

In summary, this research holds the promise of benefiting various professionals, and the general public by providing valuable insights into the subconscious influence of Feng Shui specifically in bedroom settings, contributing to better-designed bedrooms, enhanced user experiences, and a profound understanding of the interplay between culture, environment, and human behavior.

2. EXPERIMENTAL RESEARCH

An insightful look at the difficulties faced by Feng Shui researchers can be found in the previous article by Kryžanowski [1], "Impact of Feng Shui Bedrooms on Self-Assessed Sleep and Well-Being: A Randomized Double-Blind Field Research with Instrumental Biocommunication" (2021a). The paper points out a number of deficiencies and restrictions in the current corpus of work, opening the door for a more thorough analysis.

First of all, the essay recognizes the cultural and historical significance of Feng Shui, which has its roots in conventional Chinese medicine and philosophy. It highlights the rise in popularity of Feng Shui in the West, especially around the year 2000, but also points out that mainstream professions, like architecture, cannot agree on whether or not Feng Shui principles are beneficial in fostering well-being. A review of scientific papers indicates that there is a dearth of studies devoted to evaluating the effects of Feng Shui recommendations on health. The article identifies a number of obstacles as the cause of this discrepancy, such as the multiplicity and diversity of Feng Shui methods, the use of oblique translations from authentic Chinese sources, and the complexity of Chinese expressions associated with Feng Shui.

The essay also discusses the subjectivity of applying Feng Shui knowledge, highlighting how crucial it is to comprehend the cultural-historical context of the practice's inception. Developing scientific procedures to separate the effects of Feng Shui from other influencing elements, like the placebo effect, is another challenge. The current methods used by Feng Shui researchers are examined, including theoretical comparisons with findings from contemporary science and real-world investigations involving subjects and site analyses. The paper emphasizes that while

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some Feng Shui suggestions have been incorporated into modern design techniques, the overall efficacy is still debatable.

To fill in these gaps, Kryžanowski (2021b) [2], presents a research protocol that looks into how bedrooms are affected by Feng Shui recommendations, with a particular emphasis on sleep quality and overall wellbeing. Feng Shui recommendations can be implemented without physically rearranging the room by using the Quantec biocommunication system, which is based on quantum physics principles.

The study's methodology, which involved 134 adult participants divided into trial, mixed, and control groups, is described in the article. It emphasizes the importance of the double-blind protocol, which keeps the group assignments a secret from both the participants and the operator. The trial group will implement Feng Shui recommendations using the Quantec system as part of the research design, while the control group will receive inactive information sheets. The paper concludes by outlining the field research's findings and the statistical analysis that was done to determine how Feng Shui affected people's health, well-being, quality of sleep, and awakenings. The explanation of p-value correction and the application of linear mixed models shows a methodical approach to data analysis.

Thus, the study skillfully evaluates the current level of Feng Shui research and presents a thorough research methodology to fill in the gaps. The study's legitimacy is increased by the inclusion of thorough procedures and statistical analyses, which pave the way for a more complex understanding of how Feng Shui principles affect people's well-being when it comes to bedroom design.

Jan Cisek [3], wrote the article titled "How does feng shui work Placebo. The secret of feng shui is placebo and the power of intention and belief (2017). "The Secret of Feng Shui is placebo and the power of intention and belief." By comparing Feng Shui to a placebo, it highlights the psychological effects of having optimistic expectations on wellbeing. The tale of a woman who trusted a feng shui master serves as an example of how belief and intention affect results. The use of treatments that may not have any therapeutic value but result in positive outcomes because the patient believes they are effective is known as the placebo effect, and it has been studied in great detail in medical contexts.

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The article presents research showing that positive responses can still be elicited by placebos, even when they are openly acknowledged as such. The wider applicability of the placebo effect is discussed, citing research in a number of domains including sports, lifestyle modifications, and mental health. The article highlights the value of strong relationships, trust, and belief in reaching desired results, and offers strategies for utilizing the placebo effect in daily life and Feng Shui practice. All in all, it promotes a conscientious approach to intention, belief, and Feng Shui rituals for beneficial outcomes.

In these studies, technological and scientific instruments are utilized for experimentation, as evident upon examination. However, the application of a technique that poses open-ended questions regarding the fundamentals of Feng Shui without prior disclosure to the subjects, followed by the collection of responses, is not observed. As also stated by Rahman (2018) [4] and Matthews (2019) [5], through conducting studies and experiments involving individuals both familiar with and unfamiliar with Feng Shui practices, the efficacy of the placebo effect in Feng Shui could be determined. Nonetheless, such methodologies are not reported in these studies.

3. METHOD

3.1. Participants

In the process of determining the participant group for the research, people who are interested in feng shui, or who use feng shui but are not aware of it, or who do not have any knowledge about feng shui but use it without being aware of it were sought out. A total of 63 adult participants were included in this study. The participants consisted of people who were interested in feng shui and those who were not, and the selection of people was random. The people who conducted this survey consist of people of different age groups, different genders, different professions, and different lifestyles.

To find participants, people interested in feng shui was reached out, and with their help, more people with knowledge about this subject participated in the survey. Additionally, the survey was delivered to the people from the close circle who may or may not have knowledge about feng shui.

Participants were asked to voluntarily participate in the research process and answer the questions asked about the effects of Feng Shui practices in bedrooms. Additionally, broad

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demographic information was collected about participants' bedroom arrangements, lifestyles, and experiences.

3.2. Instruments

The main tool used in the research is a survey form directed to the participants. The survey includes questions that ask participants to evaluate the Feng Shui arrangements in their bedrooms. The survey also includes questions scaled between 1 and 5 to measure participants' perceived energy levels, quality of their sleep and general life satisfaction, and questions that can only be answered yes or no (See Figure 1).

Figure 1. Bedroom Design Preferences Survey

The data collection tool used within the scope of the research includes a survey form specially designed for participants to comprehensively evaluate the Feng Shui arrangements in their bedrooms. This survey consists of two parts. In the first part, questions suitable for feng shu that participants could apply in their bedrooms were asked. In the second part, questions were asked about whether they knew Feng Shui and whether they used it, and information was collected.

The survey was conducted through an online survey platform. Participants were given time to submit their answers within a certain date range. The data was stored anonymously and used only for aggregate data analysis.

4. FINDINGS AND DISCUSSION

The research project delves into the nuanced effects of Feng Shui principles in residential interior design, specifically focusing on bedrooms. Yielding insightful findings, the study explores whether the perceived positive effects of Feng Shui are placebo-driven or genuinely result from design changes and energy shifts.

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Benefiting from a deeper understanding of these effects, designers, homeowners, and practitioners of Feng Shui can apply these insights with a nuanced perspective, guiding the implementation of Feng Shui principles. Additionally, the research investigates how participants' awareness of Feng Shui influences their bedroom experiences, comparing those with prior knowledge to those with no exposure.

This exploration aims to provide valuable insights for designers, educators, and institutions involved in disseminating Feng Shui knowledge. Understanding the significance of awareness in harnessing the potential benefits of Feng Shui practices can contribute to more informed and effective educational approaches.

Furthermore, the research addresses application challenges and benefits associated with incorporating Feng Shui in bedroom design. Designers, architects, and homeowners can gain practical insights into overcoming challenges and optimizing the benefits of Feng Shui principles in residential spaces.

The study also contributes to a deeper understanding of the interplay between culture, environment, and human behavior, particularly in the context of Feng Shui in bedroom design. Designers, educators, and institutions engaged in cross-cultural design considerations stand to benefit from insights into integrating cultural practices like Feng Shui into design processes for more inclusive and harmonious spaces.

Lastly, the research is expected to provide practical guidance for homeowners, interior designers, and architects in incorporating Feng Shui principles into bedroom design. This information can empower homeowners seeking balanced and harmonious living spaces, as well as design professionals looking to enhance their expertise in Feng Shui-informed design (See Figure 2).

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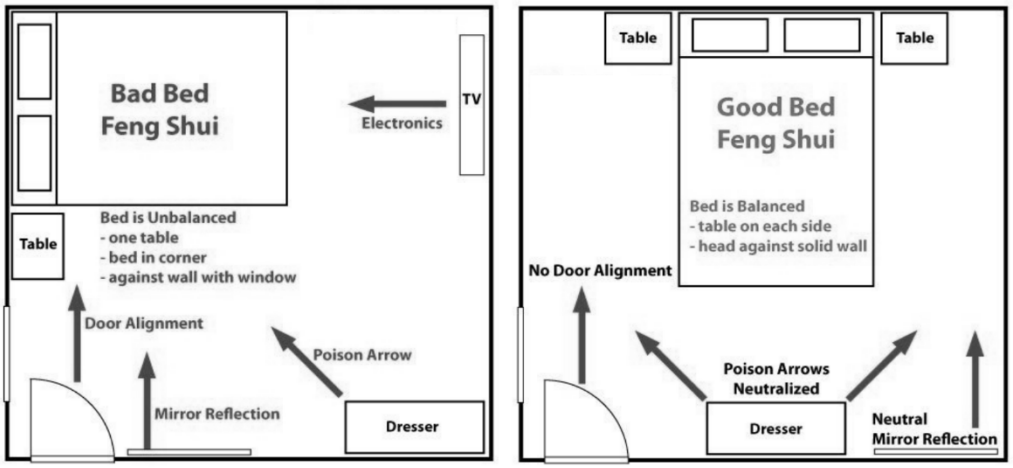

Figure 2. Kim, J. (2015). How to Position Your Bed for Good Feng Shui [6], adapted by the authors

In conclusion, the anticipated findings from this research hold the potential to benefit a diverse range of stakeholders, including design professionals, educators, institutions, and homeowners. By shedding light on the nuanced effects of Feng Shui in bedroom settings, the research contributes to enhanced design practices, improved user experiences, and a deeper understanding of the intricate relationship between culture, environment, and human behavior.

5. CONCLUSION

In conclusion, our investigation into the nuanced impact of Feng Shui principles on residential interior design, particularly in bedrooms, has revealed valuable insights. Rooted in ancient Chinese tradition, Feng Shui's unique perspective on spatial arrangements and energy flow prompted us to explore whether its effects are placebo-driven or genuinely positive.

The surveys and comparative analysis sought to understand how Feng Shui shapes bedroom experiences, regardless of occupants' awareness. Categorizing participants into groups based on their familiarity with Feng Shui allowed us to uncover the interplay between awareness, belief, and practical application.

The findings shed light on the potential benefits and challenges associated with adopting Feng Shui principles in bedroom design. This research contributes to a deeper understanding of how

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knowledge and awareness influence the application of Feng Shui, offering practical insights for designers and homeowners.

In essence, this study holds promise for both professionals and the public by unraveling the subconscious influence of Feng Shui in bedroom settings. The insights gained aim to contribute to better-designed bedrooms, improved user experiences, and an enriched understanding of the interplay between culture, environment, and human behavior in residential interior design.

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IMPROVING THE DESIGN OF PUBLIC SEATING AREAS

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ABSTRACT

The main aim of the study is to investigate the influence of public seating areas on users' environmental behavior. Public seating areas influence human behavior by making possible social interactions, promoting relaxation and comfort, enabling involvement with the environment, creating community participation, and may affect cultural and aesthetic values. All together, these factors contribute to a more positive and respectful social atmosphere in public areas. Public seating areas can impact positive environmental behavior in a variety of ways. They promote social responsibility by encouraging environmental discourse, support correct waste disposal, and developing environmental awareness through connections with nature. Furthermore, well-designed seating places can inspire sustainable practices and contribute to people's well-being, making them more likely to make environmentally responsible decisions. By prioritizing seats and activity-based components, the aim is to encourage greater community engagement. The key question guiding the research, is how to foster a stronger connection with nature through biophilic design, among individuals in the area and increase its utilization, as determined through an exploration of current patterns of use. The application was carried out at the Muzaffer İzgü Park in Mavişehir, İzmir, Turkey. Methods include behavioral mapping and surveys. The findings helped identify the deficiencies which led to the design proposals. The unique aspect of the research lies in improving people's connection with nature in an existing green space, aiming to create a more welcoming urban environment. By prioritizing seats and activity-based components, the study may help inspire greater community engagement, with lessons for future researchers and designers.

Keywords: biophilic design, city parks, public seating areas, community engagement

1. INTRODUCTION

The main aim of the study is to investigate the impact of public seating areas on users' environmental behavior, focusing on how these spaces facilitate social interactions, relaxation,

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and connection with the environment. By promoting a positive social atmosphere and encouraging sustainable practices, well-designed seating areas contribute to community engagement and environmental awareness (Browning et al., 2014; Goreta, 2023).

Human beings have a predisposition to the “natural habitat” due to having evolved in these spaces for many years. Social interaction is promoted by activity that is held outdoors. However, today people spend a great portion of their lives indoors (Green, 2024; Kellert and Wilson, 1993; Ulrich et al., 1991). Environmental awareness is needed today as countries continue to harm the environment at a massive scale. Therefore, there is a need for ecological approaches in outdoor spaces, which are less invasive and less destructive to the environment. These spaces act to reduce stress, as well as deriving value from a variety of benefits regarding physical, psychological and spiritual well-being (Martino, 2024; Nevzati, Demirbaş, and Hasirci, 2021).

The research, conducted at Muzaffer İzgü Park in Mavişehir, İzmir, Turkey, using many different research methods to explore current patterns of use and identify opportunities for improvement. Through its emphasis on biophilic design and community involvement, this study seeks to enhance people's connection with nature in urban spaces, offering insights for future researchers and designers aiming to create more welcoming and sustainable environments (Figures 1 and 2).

Figure 1: Muzaffer İzgü Park, Turkey

Figure 2 :Plan of Muzaffer İzgü Park, Turkey

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There are currently a number of issues that need to be improved in Muzaffer İzgü Park, including walkways that need to be made better, not enough protection from wind and sun, lightning for better ambiance and view, weak connections to the large central water pool, a lack of facilities for forming relationships with the surrounding area, and a lack of activity areas that need to be created better. At the same time, there is no element that we can use for our purpose and that will strengthen people's bond with the environment (Figure 3).

Figure 3: New design idea for Muzaffer Izgu Park

2. METHOD

The aim is to gather insights from individuals who frequent the urban space, both children and adults. To understand the current usage patterns and perceptions of the urban space, a multi-method approach was conducted (Florian, 2024; Gattupalli, 2023).

Behavioral Mapping: Behavioral mapping was utilized to visually record and analyze the activities and movements of individuals within the urban space. This method allowed us to

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identify popular areas, traffic flow, and usage patterns over different times of the day. In this way, we created the map of the analysis and determined the requirements on the urban space (Figure 4).

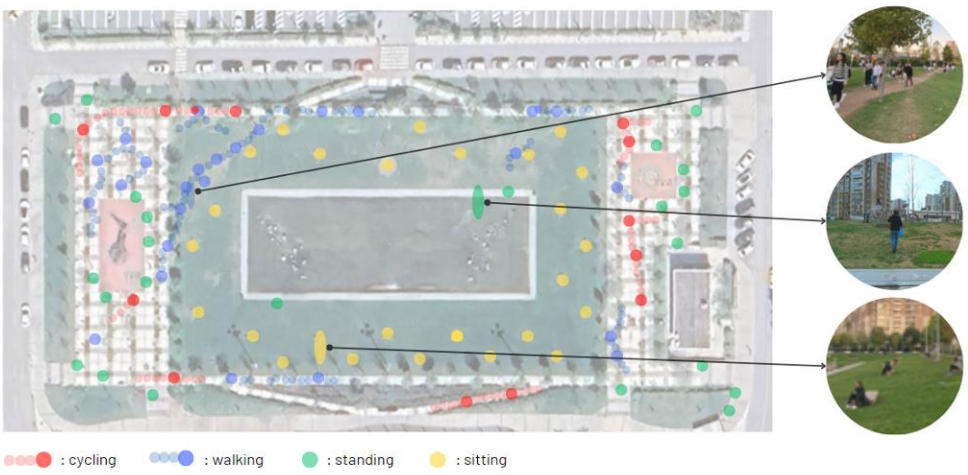

Figure 4: The occurrence and frequency of people's daily behaviors in Muzaffer Izgu Park (Behavioral map)

Observation Checklists: Observation checklists were employed to document specific features and issues in the urban space. Like quality of walkways, protection from weather conditions, connections to the central water pool, and the availability of facilities for community engagement.

Interviews: Interviews were conducted with a sample of participants to gather qualitative insights into their experiences and suggestions for improvement. Open-ended questions were tailored to explore individuals' connection with nature and their expectations from the urban space. Participants were provided with clear explanations of the study's purpose and informed (Figure 5). As seen in Figure 5, new features were added to the public park by prioritizing the result percentages.

The data allowed for an analysis of the current urban space usage. The findings served as a foundation for promoting a stronger connection with nature and enhancing the overall appeal of the Mavişehir urban space.

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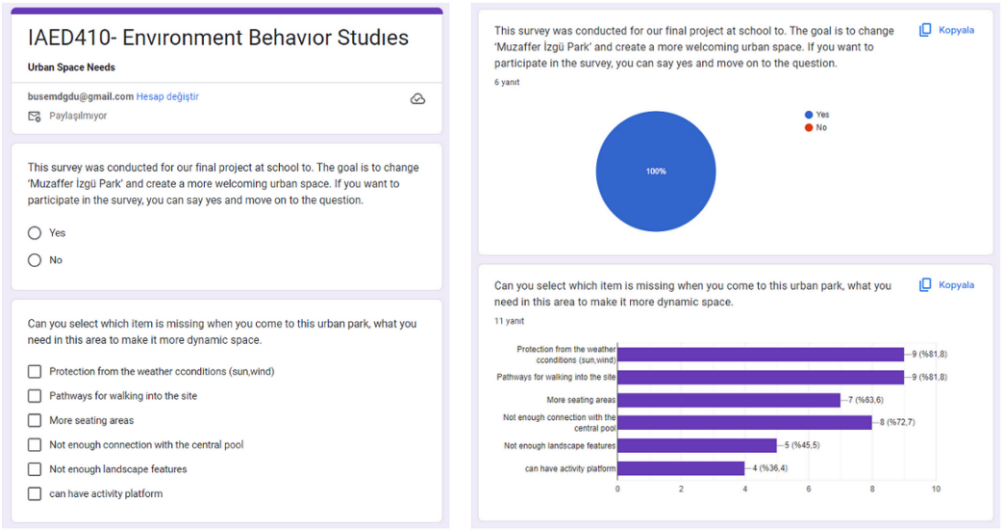

Figure 5: Questions asked to participants in online interview and response rates.

2.1. Benefits of Using Behavioral Mapping

- Insights Uncover: valuable insights into how people use public seating, identifying popular areas and factors affecting usage.
- Data-Driven Decisions: Make informed decisions on seating area design and layout based on realworld usage patterns and behaviors.
- User-Centric Designs: Create seating areas that truly cater to the needs and preferences of the community, enhancing overall user satisfaction.

2.2. Benefits of Using Observation Checklists

- Data Collection Efficiency: Efficiently gather structured data on seating area usage, facilitating comprehensive analysis and decision-making.
- Identifying Patterns: Recognize usage patterns and identify areas of improvement through systematic observation and documentation.
- Evaluating Effectiveness: Evaluate the effectiveness of design changes by tracking behavioral shifts over time and comparing observations.

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2.3. Benefits of Conducting Interviews

- User-Centered Insights: Gather firsthand insights directly from users, ensuring that seating areas are designed with their needs at the forefront.
- Community Engagement: Encourage community involvement and co-creation, fostering a sense of belonging over public seating areas.
- Feedback-Driven: Design Implement targeted improvements based on specific feedback, resulting in more user-friendly.

3. RESULTS AND DISCUSSION

Understanding visitor demographics and usage patterns will help improve Muzaffer İzgü Park's efficiency and appeal. The study was conducted out on the park's utilization patterns in Mavişehir, İzmir. A variety of significant findings were drawn from close observation and analysis, providing insights for future development and throwing light on the dynamics of the park as it exists today (Figure 6). Occupancy Patterns Throughout the Day were as follows;

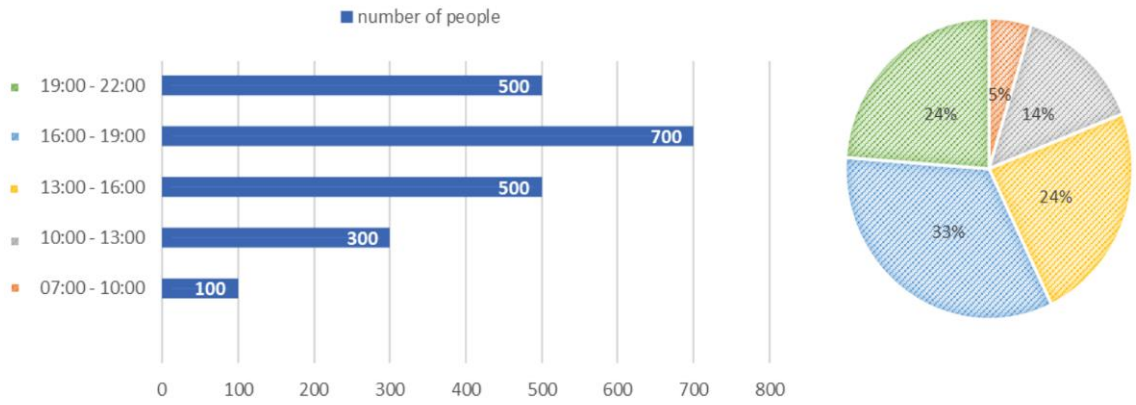

Figure 6: Chart showing the number of individuals visiting Muzaffer İzgü Park within specific time intervals.

The observations revealed distinct occupancy patterns across different time intervals;

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07.00-10.00 (%5): During these hours, characterized by the rush of individuals commuting to work and the commencement of school hours, the park experienced relatively low density. This suggests that the park is underutilized during peak morning hours.

10.00-13.00 (%14): A moderate increase in park occupancy was observed during this timeframe, possibly due to individuals taking breaks from work or students and teachers returning from educational institutions. However, the park still did not reach its full potential in terms of utilization.

13.00-16.00 (%24): The density of the park notably increased during these hours, likely as people sought leisure and relaxation after lunch. This period marks a peak in park activity, indicating a preference for midday visits among the public.

16.00-19.00 (%33): With the overlap of post-work and post-school hours, the park experienced another surge in occupancy during the late afternoon and early evening. This suggests that the park serves as a popular destination for both relaxation and recreational activities after daily commitments.

19.00-22.00 (%24): Evenings saw a moderate decrease in park usage, possibly due to individuals opting for rest, entertainment, or shopping at nearby facilities. However, the park still attracted a notable number of visitors seeking leisure activities during these hours. Demographic Trends in Park Utilization can be observed below;

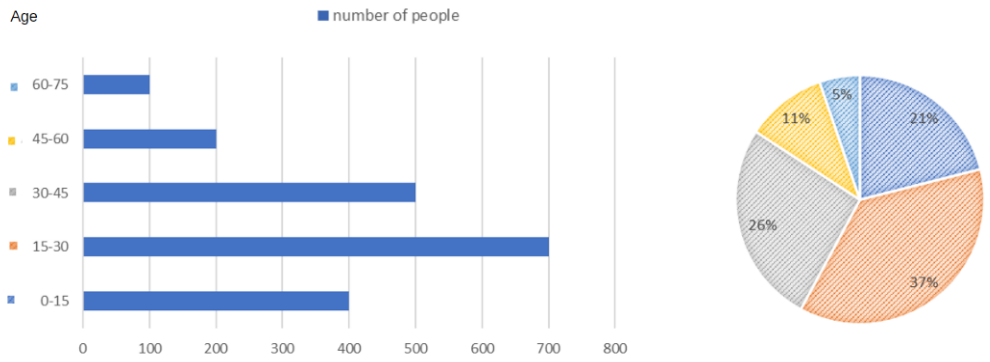

Figure 7: Chart showing the number of individuals visiting Muzaffer İzgü Park within different age groups.

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The study also identified distinct age groups (Figure 7) that frequent the park;

0-15 (%21): The presence of a children's playground contributed to high intensity among this age group, indicating that families with young children are significant users of the park.

15-30 (%37): Individuals in this age range, attracted by the nearby high school and shopping opportunities, were observed to utilize the park frequently. The presence of a high school and a shopping mall in the vicinity makes the park an attractive social and recreational hub for young adults.

30-45 (%26): Families residing in nearby residential buildings were noted to prefer the park, likely for recreational purposes and social gatherings. This age group represents another significant demographic utilizing the park's amenities.

45-75 (%16): The elderly demographic exhibited lower intensity in park usage, possibly due to the absence of activities tailored to their needs. This highlights a potential area for improvement in making the park more inclusive and accessible to individuals of all ages.

The findings from this study provide valuable insights for the renovation and design of Muzaffer İzgü Park, offering opportunities to enhance its appeal and functionality. By comprehensively understanding the park's occupancy patterns and demographic trends, targeted interventions can be devised. Improving public seating areas throughout the park can create comfortable spaces for visitors to rest, socialize, and connect with nature, fostering a stronger sense of community engagement. Additionally, introducing activity-based components, including recreational facilities and interactive elements, can cater to the diverse needs and interests of park users across different age groups, promoting active participation and a healthier lifestyle (Figure 8).

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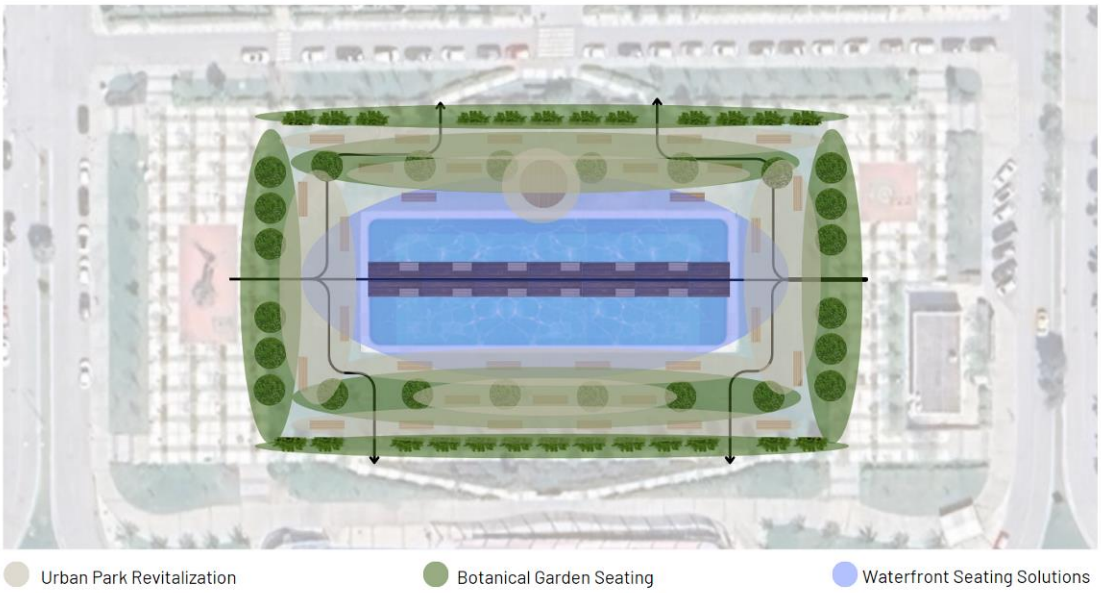

Figure 8: A proposal for how the land can be designed as a place more suitable for human use while establishing a stronger connection with nature.

4. CONCLUSION

In conclusion, the results of this study underscore the importance of understanding user behavior and demographic trends in optimizing urban green spaces like Muzaffer İzgü Park in Izmir-Turkey. There are countless benefits of bringing people back outdoors and enable environments that promote social interaction through design. By implementing targeted interventions informed by these insights, park planners and designers can create inclusive, vibrant, and sustainable environments that cater to the diverse needs of the community, fostering a stronger connection with nature and promoting greater utilization of public spaces through biophilic design.

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A STUDY IN THE CONTEXT OF THE CONSERVATION OF WATER CULTURE THROUGH BUILDINGS IN ELAZIĞ: HISTORICAL FOUNTAINS AND KARAÇALI FOUNTAINS

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ABSTRACT

Water, as an element of vital importance for humans, has also affected settlements and spaces. Throughout history, many settlements were established close to water resources; on the other hand, various water structures were built to take this water into the settlements and make it accessible to everyone. Fountains, one of these structures, are built in central places of many areas or at points where the population is concentrated and transportation is possible, for the controlled and direct use of water. Some of them are fountain structures designed to be monumental, while others are quite modest and built only to meet needs. Nowadays, although access to water has become much easier and water can be delivered into houses; the existence and construction of fountains for public use continues.

The need for water has brought with it many cultural data. This body of data, which can be described as water culture, is also found in Elazığ, one of the important settlements of Anatolia. In Elazığ, where water culture and related structures are densely seen, it is seen that this culture and the structures that reflect it continue to exist. In this sense, the aim of the study is to examine and emphasize the conservation of water culture, from historical fountains to today's Karaçalı fountains, through the structures in Elazığ. In this context, the general qualities of Elazığ in terms of culture-water culture concepts were examined and these qualities were associated with fountain structures and evaluations were made regarding both architectural and cultural conservation. The study method consists of literature research, on-site observations and comparative evaluations. As a result of the study, suggestions were put forward for the continuation of water culture through spaces in Elazığ and attention was drawn to the conservation of fountain structures through this culture and the problems related to this.

Keywords: Aquaculture, conservation, culture, Elazığ, historical fountains, Karaçalı fountains.

1. INTRODUCTION

Water has been an indispensable need for people and societies to continue their lives throughout history. Since ancient times, human beings have needed to live near a water source, and for this

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reason, societies that make up all civilizations have produced various architectural solutions to provide water and to access it easily and uninterruptedly [1].

Anatolia is an ancient settlement where water culture has been passed on for generations thanks to its rich water resources. Turks who came to Anatolia continued to use the waterways and resources of previous civilizations. They collected snow and rain water in cisterns; they built dams by blocking the flowing waters at a suitable place. Water taken from dams or springs was conveyed to the cities by canals and aqueducts. This water was collected in cellars and divided with spirit scales. In addition, fountains, cisterns, water fountains and pools are structures built in Anatolia to meet the water needs of the people [1].

The importance of water for human life has led to the development of fountain culture and the emergence of different fountain types such as road, square, park and garden fountains. Reflections of this can also be seen in Elazığ, which stands out with its rich water resources [2]. Fountains also had an important place in Harput, the old settlement of Elazığ province and became the starting point of fountain culture for the city.

The aim of the study is to reveal the conservation and sustainability of water culture in Anatolia through Elazığ fountains. In this context, the general characteristics of fountain structures are discussed; the fountains in Harput, the historical settlement area of Elazığ, were mentioned and the Karaçalı fountains, which are found in almost every part of the city today, were discussed in the context of water culture. The method of the study consists of examining the relevant literature, multifaceted evaluation of the data obtained here and field studies. As a result of the study, the relationship between the conservation and sustainability of fountain structures and water culture was revealed and the contribution of this relationship to the conservation discipline was pointed out.

2. WATER CULTURE AND GENERAL QUALIFICATION OF THE HISTORICAL FOUNTAINS IN ANATOLIA

Culture is the main subject of anthropology. The concept of culture, which has many definitions, is defined by Sapir as "Culture is the unity of material and spiritual elements, practices and beliefs that we learn through a social process, which determine the structure (relationships) of our existence." and by Tylor as "Culture or civilization is a complex whole that includes skills, skills and habits such as knowledge, art, traditions and customs that human beings learn (acquire) as a member of a society." [3].

A versatile understanding and evaluation of culture is possible by examining its characteristics. These features are that culture is learned, historical and continuous, social, ideal or idealized system of rules, need-satisfying and satisfying, changing, integrating and abstracting [3]. Considering all these features, it is understood that the relationship between people and culture is two-sided. While culture affects people; human beings are also a factor that creates culture. In this case, human needs and obligations for life also affect culture. One of these needs is water, which is vital for human life.

The way water has been integrated into human life in different societies has led to the formation of a water culture. This culture enabled the production of many water structures

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in Anatolia, which contains rich water resources. Many civilizations that settled in Anatolia built hundreds of water structures in their settlement areas. These structures, whose number increased significantly with the Ottoman Empire, continued their existence in the Republic Period [4]. This shows that water culture has continued to exist in Anatolia by changing and transforming from history to the present.

In addition to being used for water supply, fountains also served as important parts of social and religious life. Especially in the Ottoman Period, the respect and need for water in life under the influence of Islam led to the construction of many fountains in settlements. However, fountains have become a socialization area for women. Events such as welcoming and sending off were also held in front of the fountains. Fountains, which were also considered as stopping and resting points during journeys, thus existed in every aspect of life and directly represented water culture [4].

Anatolia, fountains appear in different areas of use and with different architectural elements. In addition to fountains named as square fountain, street fountain, wall fountains, prayer fountain, pit fountain, fork fountain, mosque fountain fountain, shepherd fountain, there are also fountains named as separation fountain and salvation fountain in connection with social qualities [4]. Although they vary, generally the units found in these fountains are items such as tanks, inscriptions, bowls, mirror stones and troughs [2, 5] (Figure 1).

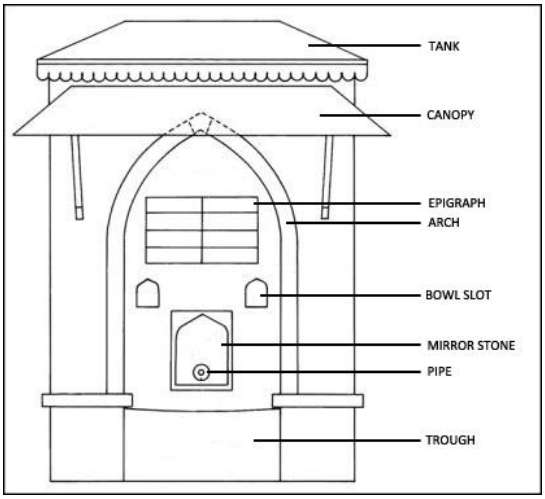

Figure 1. General elements of Anatolian fountains [2, 5]

Elazığ is one of the settlements that stands out with its rich water resources in Anatolia. In Elazığ, which contains many rivers and small lakes, as well as the Euphrates River and the Hazar Lake, the density of these resources has enabled the development of water culture. In this context, many fountain structures have been built in Elazığ throughout history and some of them have survived to the present day. Today, the fact that there are

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dozens of Karaçalı Fountains in many parts of the city can be considered as an issue worth examining in the context of the conservation and sustainability of water culture.

3. CONSERVATION OF HISTORICAL FOUNTAINS AND KARAÇALI FOUNTAINS IN ELAZIĞ

Elazıg has become an important transition point between eastern and western civilizations with its strategic location in the Anatolian geography and its rich historical past. Elazıg, which has been inhabited continuously since the Paleolithic Age, is an Anatolian city that keeps the traces of past civilizations alive today [6].

There is a rich cultural heritage in Harput, the first settlement area of Elazıg. Archaeological findings take the history of Harput back to 2000 BC. Many civilizations, including the Hurrians, Hittites, Urartians, Medes, Persians, Sassanids, Byzantines, Anatolian Seljuks and the Ottoman Empire, have lived in these lands without interruption. Each civilization has conserved the works of the civilizations that existed before it and used them in their original form or evaluated them for a different function. In this sense, many works such as churches, mosques, masjids, tombs, baths and fountains have survived to the present day in Harput. Some of these works have been repaired; Some of them consist of buildings whose repair works are ongoing [7].

Many water structures have been built and used throughout history in Harput, which has hosted a large population for many years. Among these, fountains have an important place. According to Sunguroğlu, there are a total of 55 fountains in the settlement, 37 in the neighborhoods and 18 on the road routes reaching the city [6]. While some of them have survived to the present day, some have disappeared (Figure 2).

Figure 2. Some of the historical fountain structures that have survived to the present day in Harput

Harput lost its political importance in the 19th century and the population living here moved to the settlement area called "Mezra". The settlement established here became a province until 1867, and then became a sanjak named "Ma'muratü'l-Aziz" by being

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connected to the Diyarbakır Province. The sanjak, which was separated from Diyarbakır in 1871, became a province in 1878. In 1937, it became a province named Elazığ [8]. When Elazığ started to move to the settlement area called Mezre, fountain structures began to be built in this area. One of these, White Fountain, has become one of the important landmarks showing the continuity of water culture. This fountain, also called Beyaz Pahar (Ak Pahar), has been an important gathering point for many years; Address descriptions are made based on this fountain. Pahar is used in the meaning of enchanted and healing. This also shows that the water flowing from Beyaz Çeşme is considered healing. Not only the people of Elazığ, but also the caravans that used Elazığ as a transit route benefited from Beyaz Çeşme. White Fountain and many other fountain structures built recently have not survived to the present day. The white fountain continues to exist [9] (Figure 3).

(a) (b)

Figure 3. Past (a) and present (b) view of Beyaz Çeşme [9, 10]

When the people of Elazığ started to use the area called Mezre as a settlement, the need for water in the region increased. In order to meet this need, in 1947, Hazar Lake spring water from Karaçalı Village in Elazığ's Sivrice district was brought to the center of Elazığ by placing heavy water pipes on a 35 km road by human power (Figure 4). This water is poured from Sivrice to the tank located in the center, without any vehicle [11].

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Figure 4. Images from the process of bringing Karaçalı water to the center of Elazığ [11]

In the 1960s, neighborhood fountains called Karaçalı began to be built in the center of Elazığ. The number of Karaçalı fountains, which became widespread between 1994 and 2004, is 162 according to 2023 data. Drinking water is supplied from these fountains and the water quality is inspected by Elazığ Municipality every month. The fountains located in almost all neighborhoods of Elazığ and built by philanthropists to meet the need for fresh water have their own tanks [11]. Karaçalı fountains, whose outer surfaces are generally covered with marble material, have the name of the person who built them or have them built on their behalf written on one side, while verses are written on the other side as a continuation of the inscription tradition (Figure 5).

Figure 5. Karaçalı fountain examples

Karaçalı fountains are located in squares within the city, as well as in neighborhood parks and in places where residents can easily reach and provide clean drinking water. These fountains, in addition to providing drinking water, have cultural value as social gathering points. As places where neighborhood residents have the opportunity to socialize, talk, meet and spend time,

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Karaçalı fountains play an important role in conserving and sustaining the water culture from the past with their locations in parks.

4. CONCLUSIONS

Throughout history, water has been an indispensable natural resource for people and human communities to continue their lives. Since the dawn of humanity, societies have always needed to live near a water source. However, due to its importance in human life, all civilizations throughout history have put forward various architectural solutions to access water easily and uninterruptedly. Fountains come first among these solutions. Fountain structures are monumental works that reflect the cultural and architectural qualities of the societies they belong to.

Many historical fountain structures have survived to the present day in Elazığ, where fountain structures are abundant, in Harput, the old settlement area of the city, and in Mezre, which later became a settlement. These structures reveal the socio-cultural, economic and architectural qualities of Elazığ's past. Today, many Karaçalı fountains built in many parts of the city are important symbols in the context of sustaining the water culture in Elazığ.

Karaçalı Fountains are structures built with modern materials and construction techniques in Elazığ city center. These structures are used intensively by the urban people, even though water directly reaches today's modern residences. This situation reveals the continuity and variability of the concept of culture in terms of the relationship between water culture and fountain structures. As a result, the study draws attention to the fact that the concepts of conservation and sustainability can be monitored not only in terms of the physical qualities of the buildings but also in terms of cultural values.

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PEYZAJ TASARIM ÖLÇEĞİNDE İKLİM DEĞİŞİKLİĞİ YEŞİL ALAN İLİŞKİSİNE YÖNELİK YAKLAŞIM VE UYGULAMALAR

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ÖZET

İklim değişikliği yerel ölçekten küresel ölçeğe kadar farklı ölçekte etki yaratan önemli bir çevresel sorundur. İklim değişikliği, sıcaklık değerlerindeki ani değişimler, yağış miktarındaki artışlar, mevsimler arası geçişlerdeki düzensizlikler gibi pek çok unsur ile kendini göstermektedir. Bu durum, insan sağlığı ve toplumsal yaşam kalitesini etkileyen, kuraklık, taşkın ve sel gibi olumsuz sonuçları beraberinde getirmektedir. Özellikle de kentsel alanlar, yoğun nüfus artışına bağlı olarak ortaya çıkan yoğun yapılaşma, geçirimsiz yüzey miktarındaki artış, dolu-boş dengesindeki düzensizlik gibi durumlardan dolayı, iklim değişikliğinin olumsuz sonuçlarından daha fazla oranda etkilenmektedirler. Bu süreç iklim değişikliği ile mücadelenin önemi ve gerekliliğini ortaya çıkarmıştır. Kentsel yeşil alanlar, farklı boyut ve biçimleri ile kentsel alanların birer parçasıdırlar. Kentsel yeşil alanlar; çevresel açıdan, iklimi düzenleme, hava ve toprak kalitesini iyileştirme, biyoçeşitliliğini güçlendirme, sel ve taşkın etkisini azaltma gibi çeşitli etkilere sahiptirler. Dolayısıyla yeşil alanlar hem iklim değişikliğini etkileyen hem de iklim değişikliğinden etkilenen bir konumda yer alırlar. Bu noktada iklim değişikliğine yönelik risklerin azaltılması ve uyumun sağlanması anlamında, yeşil alanlar önemli bir araçtır. Bu çerçevede çalışma, "iklim değişikliğine uyum sürecinde peyzaj tasarım ölçeğinde kentsel yeşil alanlara yönelik uygulama ve yaklaşımlar nelerdir? sorusu temeline dayandırılmıştır. İlgili soru çerçevesinde; kentsel yeşil alan-iklim değişikliği ilişkisi temelinde; yeşil alt yapı bileşenlerine yönelik yaklaşımlar ve uygulamalar incelenmiştir. Bu kapsamda; geçirgen yüzeyler, yeşil sokaklar, yeşil kaldırımlar, yeşil otoparklar, yeşil çatılar, yağmur bahçeleri, yağmur suyu depolama alanları, bitki örtüsünden yapılan hendekler ile ağaç kümeleri görseller ve literatür taramaları çerçevesinde değerlendirilerek, çeşitli öneriler sunulmuştur.

Anahtar Kelimeler: İklim değişikliği, Kentsel yeşil alan, İklim odaklı peyzaj tasarımı.

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1. GİRİŞ

Kentler, insanın doğal yaşam alanları olup süreç içerisinde; nüfus yoğunluğu ve kentleşmenin etkileriyle birlikte, geniş artan oranda inşa edilmiş yapısal kullanımları ve geçirimsiz yüzeyleri nedeniyle artan iklim risklerine karşı özellikle hassas bir yapıya sahip olmuştur (Emmanuel ve Steemers, 2018; Chapman vd., 2017).

Kentsel alanların önemli bir parçası olan yeşil alanlar, kentlerdeki insan ve doğa arasındaki dengeyi sağlamak ve yaşam kalitesini artırmakta (Gül ve Küçük, 2001) önemli bir araçtırlar. Kentsel alanlarda sağladığı görevler arasında; rekreasyonel ve estetik değer oluşturma, fiziksel-sosyal-ruhsal sağlığı iyileştirmede etken olma, biyolojik çeşitliliği koruma, şehrin kültürel kimliğine katkıda bulunma, doğa deneyimleri için mekân oluşturma, şehrin çevresel kalitesinin korunmasına ve iyileştirilmesine yardımcı olma ile şehirlerdeki teknik sorunlara doğal çözümler getirme (örneğin kanalizasyon arıtma, taşkın düzenlemesi) sayılabilir (Sandström ve diğerleri, 2006). Bütün bunların yanı sıra, kentsel yeşil alanlar, gölgeleme ve buharlaşma yoluyla kentsel iklimi düzenleyerek iklim değişikliğine uyum sürecinde etkin bir rol oynamaktadırlar (Bowler vd., 2010; Norton vd., 2015). Bu durum, yeşil alanların, iklim değişikliğine uyum için kentsel stratejilerde önemli bir unsur haline gelmesinde etkili olmuştur (Pancewicz ve Kurianowicz, 2024). Diğer taraftan kentleşme ve nüfusun hızlı artmasıyla birlikte kentlerde yoğun yapılaşma, kentsel yeşil alanlar üzerinde yüksek baskı oluşturabilir (Balıkçı vd., 2021, Pauleit vd., 2005; Haaland ve Van den Bosch, 2015). Bu süreçte iklim değişikliği ile mücadelede, önlem olarak özellikle yeşil altyapının güçlenmesi gerekliliği bulunmaktadır (İklimi Duy, 2021). Bu doğrultuda, iklim değişikliğine dirençli ve uyumlu kentler yaratmak için yeni kentsel planlama ve tasarım stratejilerinin oluşturulması önemli olacaktır. Bu çerçevede çalışma, "***iklim değişikliğine uyum sürecinde peyzaj tasarım ölçeğinde kentsel yeşil alanlara yönelik uygulama ve yaklaşımlar nelerdir?*** sorusu temeline dayandırılmıştır. İlgili soru çerçevesinde; öncelikle kentlerde iklim değişikliğinin genel nedenleri ve sonuçları belirtilmiş olup, iklim değişikliği yeşil alan ilişkisi değerlendirilmiştir. Paralelinde kentsel yeşil alan-iklim değişikliği ilişkisi temelinde; yeşil alt yapı bileşenlerine yönelik yaklaşımlar ve uygulamalar incelenerek çeşitli öngörüler geliştirilmiştir.

2. KENTSEL YEŞİL ALAN KAVRAMI

Kentler sürekli gelişme içinde olan ve toplumun barınma, çalışma ve sosyalleşme gibi etkinliklere imkân sağlayan, nüfus yoğunluğunun fazla olduğu ve komşuluk birimlerinden oluşan yerleşme birimi olarak tanımlanmaktadır. Kentlerde toplumun ihtiyaçlarına olanak sağlayan alanlar bulunmaktadır. Bu alanlar işlevlerine göre, yerleşim, ticaret, sanayi, ulaşım, sosyal, rekreasyonel ve doğal alanlar olarak sınıflandırılmaktadır (Keleş,1998; Ceylan,2007).

Yeşil alanlar, insanların birbirleriyle pasif veya aktif olarak etkileşimde bulunabilecekleri kültürel, eğitsel ve rekreasyonel kullanımlara imkân sağlayan alanlardır. Kentsel yeşil alan kavramının evrensel olarak kabul edilmiş net bir tanımı bulunmamakla birlikte; "Çevresel Planlama, Tasarım ve Koruma Sözlüğünde "kentsel alanlarda bulunan kamusal ya da özel yeşil

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alanlar için kullanılan genel bir terim" şeklinde tanımlanmıştır (Boles, 2012). Planlı Alanlar İmar Yönetmeliği'nde ise yeşil alan; "toplumun yararlanması için ayrılan oyun bahçesi, çocuk bahçesi, dinlenme, gezinti, piknik, eğlence, rekreasyon ve rekreaktif alanları toplamını ve metropol ölçekteki fuar, botanik ve hayvan bahçeleri ile bölgesel parklar bu alanlar kapsamındadır" şeklinde ifade edilmektedir (URL-1).

Yeşil alan kavramı ile ilgili tanımlamalar genel olarak ele alındığında; yeşil alanlar kentlerde insanların farklı ihtiyaçlarını karşılayan dinlenme, eğlenme gibi sosyal imkanlar sağlayan alanların bütünü olarak belirtilebilir. Kentsel yeşil alanlar genel olarak, kısmen veya tamamen çimen, ağaç, çalı veya diğer bitki örtüsüyle kaplı kentsel araziler olarak tanımlanmakta olup; fuar ve sergi alanları, meydanlar, kıyı düzenlemeleri, kent içi yollar, kaldırımlar, kavşaklar, refüjler, yaya yolları, hobi bahçeleri, kent bostanları, çocuk bahçeleri, oyun ve spor alanları, kent parkları, hayvanat bahçeleri, botanik bahçeleri, arberetumlar, su kanalları, konut ve toplu konut bahçeleri, çocuk oyun alanları, okul bahçeleri, spor alanları, mesire alanları, koruluklar, tarım arazileri, meralar, kent ormanları, yeşil kuşaklar ve mezarlıkların yanı sıra çatı bahçeleri, dikey bahçeler, çayırlar ve ormanları da içerirler (Chen, 2003; Akpınar, 2013; İstanbul Kent Konseyi, 2020; De Hass vd., 2021). Aynı zamanda kentsel yeşil alanlar, mavi-yeşil bölge olarak da değerlendirilmektedir. Bu kapsamda; hendekler, kanallar, iç su yolları ve nehirler ile nehir kıyılarının çevreleri de kentsel yeşil alan olarak tanımlanmaktadır (Haase vd., 2014).

Kentsel yeşil alanlar, farklı araştırıcılar tarafından çeşitli şekillerde gruplandırılmışlardır. Örneğin; Yıldızcı (1982) tarafından, kentsel yeşil alanlar, aktif (çocuk oyun alanları, mahalle parkı, kent parkı, komşuluk parkı, semt parkı, bölge parkı) yeşil ve pasif (ağaçlık alanlar, eğlence yerleri, refüjler, mesire yerleri, mezarlıklar) yeşil alan olmak üzere iki grupta ele alınmıştır (Yıldızcı, 1982).

Arabi vd. (2014) tarafından ise; kentsel yeşil alanlar dört kategori altında değerlendirilmişlerdir. Bunlar; park olarak adlandırılan kamusal yeşil alanlar, hastanelerdeki, kamu veya özel departmanlardaki vb. açık alanlar gibi yarı kamusal yeşil alanlar, kent sakinleri tarafından bakımı yapılan konut bahçe birimleri olan özel yeşil alanlar ile yollar boyunca ağaç düzenlemeleri olan sokak yeşil alanlarıdır (Arabi vd., 2014).

Kentsel yeşil alanlar, aşağıda maddeler altında verilen biyolojik, iklimsel, fiziksel, sosyal, psikolojik, ekonomik ve estetik açıdan farklı işlevler içerirler (Aydoğdu, 2018; Gül ve Küçük, 2001).

- Fiziksel ve estetik değer sağlama
- Kentlerin yapılaşmadan kaynaklanan sert ve keskin hatlarını yumuşatıp, insan ve çevre arasında denge sağlama
- Havayı temizleme, tozu tutma, nem dengesini sağlama, sıcaklık miktarını azaltma, rüzgâr hızını azaltma vb. gibi iklimsel olaylar üzerinde olumlu etkiler oluşturma
- Sınır, engel veya perde oluşturarak, gizlilik ve mahremiyet yaratma
- Rekreasyonel değer oluşturma
- Fiziksel-sosyal-ruhsal sağlık üzerinde olumlu etkiler oluşturma

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- Kentsel yaşam kalitesini arttırma
- Ekonomik yarar sağlama.

3. İKLİM DEĞİŞİKLİĞİ KAVRAMI

İklim değişikliği kavramı ilk olarak 1827 yılında Joseph Fourier tarafından ele alınmıştır (Dispensa ve Brulle, 2003). Havadaki CO_2 miktarının artışıyla doğru orantılı olarak, iklimin farklılaşabileceği de ilk kez 1896 tarihinde İsveçli S. Arrhenius tarafından öngörülmüş olup, 1979'da da Dünya Meteoroloji Örgütü tarafından düzenlenen 1. Dünya İklim Konferansı'nda iklim değişikliği konusunun önemi vurgulanmıştır (İklimi Duy, 2021). İklim değişikliği, iklimsel olayların ortalama durumu veya değişimlerinde uzun süre yaşanan istatiksel olarak anlamlı değişimleridir (Gündoğan, Baş, Sayman, 2015). İklim değişikliği kavramı pek çok farklı şekillerde tanımlanmıştır. Ulusal Havacılık ve Uzay Dairesi'ne (NASA) göre; iklim değişikliği fosil yakıtların yakılmasıyla atmosfere eklenen gazlar ile, artan sıcaklık değişimleri, deniz seviyesinin yükselmesi, büyük buz kütlelerinin kaybı, aşırı hava olaylarında içinde olduğu küresel olaylar olarak tanımlamaktadır (NASA, 2020). Birleşmiş Milletler İklim Değişikliği Çerçeve Sözleşmesi'nde ise iklim değişikliği, "Karşılaştırabilir zaman dilimlerinde gözlenen doğal iklim değişikliğine ek olarak, doğrudan veya dolaylı olarak küresel atmosferin bileşimini bozan insan faaliyetleri sonucunda iklimde oluşan bir değişiklik" olarak tanımlamıştır (BMİDÇS, 2002).

İklim değişikliği son yıllarda gözlemlenen, bütün canlıların etkilendiği doğa ve yaşam üzerinde olumsuz etkilerinin bulunduğu bir süreç (Bayramoğlu ve Seyhan,2019) olup, başlıca sebepleri ve potansiyel etkileri Çizelge 1.'debelirtilmiştir.

Çizelge 1. İklim değişikliğinin başlıca sebepleri ve potansiyel etkileri (IPCC,2007; Schurer, Hegerl ve Obrochta, 2015; Jackson, 2018; Turetsky vd., 2019; Çiftçioğlu ve Alvan Bozdereli, 2020).

İklim Değişikliğinin Nedenleri	**Potansiyel Etkisi**
Doğal unsurlardan kaynaklanan etkiler -Volkanik kaynaklı etki -Tektonik kaynaklı etki -Güneş kaynaklı enerjide değişim -Sera gazı etkileşimi -Donmuş toprakların (Permafrost) çözünmesi	- Hava ve suya CO_2 ve diğer gazların yayılımı -Okyanusların derinlik ve kimyasal yapısındaki farklılaşma -Kıtalardaki değişim (şekil ve boyut) -Güneşte meydana gelen patlamalar -Güneş lekeleri
İnsan faaliyetleri -Sera gazı oranının artması - Fosil yakıtların kullanılması	-Meteorolojik verilerin değişiklik göstermesi -Havadaki CO_2, CH_4 ve N_2O oranının artması -Yağış miktarının artması -Buzulların erimesi, okyanusların ısınması ve deniz seviyesinin artması - Taşkınların miktarında ve sayısal dağılımında artışın görülmesi, toprak kaybı ve gıda güvenliği problemleri -Kuraklık ve çölleşme etkisi -Orman yangınları - Tarımsal üretimin dönem ve ürün açısından değişimi -Su döngüsünün değişim göstermesi -Ekosistemin etkilenmesi -Bitki hastalıklarının artması -Kıyı ekosistemlerinin etkilenmesi -Peyzaj yapısındaki farklılaşma -Salgın hastalık riski

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4.İKLİM DEĞİŞİKLİĞİ YEŞİL ALAN İLİŞKİSİ

Yeşil alanlar, çeşitli ekosistem işlevleri ve hizmetleri sağlayarak kompakt yeşil şehirlerin gelişiminde önemli bir rol oynamakta olup, mikroklimatik açıdan kent iklimine katkıda bulunurlar (Bowler vd., 2010). Kentsel yeşil alanlar, Jenerette vd. (2011)'e göre; genel olarak ısıyı emer, gölge sağlar ve nemi yükselterek çevredeki yüzey ve hava sıcaklıklarını korur ve böylece kentsel ısı adası etkilerini azaltırlar. Aynı zamanda Kleidon vd. (2000)'nin çalışmalarında; kentsel yeşil alanların, bölgesel olarak, buharlaşma-terlemeyi artırarak bulut örtüsünün ve yağışın artmasında aracı oldukları vurgulanmıştır. Bununla birlikte birçok çalışmada da kentsel yeşil alanların, küresel iklim düzenleyicisi olarak sağladıkları katkılar ortaya konulmuştur (Beard ve Green, 1994; Qian ve Follett, 2002; Pouyat vd., 2006; Zirkle vd., 2011; Acuñavd., 2017). Yeşil alanlar; ortam ısısını azaltma, CO_2 absorbe etme, temiz hava sağlama, toprağı besleme, ekosistemdeki yaşamı çeşitlendirme, su kaynaklarını besleme, rüzgâr ve yağış erozyonunu azaltma, gürültü azaltma, enerji tüketimini olumlu yönde etkileme, rekreasyonel etki sağlama ve ekonomik değer kazandırma gibi birçok işleve sahiptirler (Landsberg 1981; Önder ve Polat,2012: Forman, 2014; Hepcan,2019).

İklim değişikliğinin etkilerini azaltmada ve uyumlamada yeşil alanlar bir direnç oluşturmaktadırlar (IPCC, 2007). İklim değişikliğine dirençli kentler oluşturmak için, yeşil alanların miktarını arttırmak ve kenti yeşil altyapı sistemlerini güçlendirmek önemli olacaktır (İklimi Duy,2021). Özellikle de kentsel alanlarda iklim değişikliği etkisine yönelik azaltma ve uyum çalışmalarında, enerji sistemleri ve kullanımında, binalarda, ulaşımda, yeşil alan temelli önlemlerin alınması gerekmektedir (Uncu, 2019).

İklim değişikliği ile uyum için, farklı ölçek ve biçimlerde ele alınabilecek araçlar ve bunların sağladığı katkılar Çizelge 2. de verilmiştir.

Çizelge 2. İklim değişikliğine yönelik etkin kentsel peyzaj planlama ve tasarım yaklaşımları (Landscape Institute, 2008).

Peyzaj planlama ve tasarıma yönelik yaklaşımlar	**İklim değişikliği ile mücadeleye katkı**
Açık-yeşil alanlar	• Hava kalitesini iyileştirme • Yüzey akışını iyileştirme • Taşkınları azaltma • Canlılar için yaşam alanı sağlama • Biyolojik çeşitliliği koruma • Çevresel kaliteyi arttırma
Yeşil odaklı çatılar ve duvarlar	
Lineer yeşil alanlar	
Yerel bitki çeşitlerinin kullanımı	
Yapısal tasarımda sürdürülebilir malzemelerin kullanımı	
Mezarlıklar ve korulukların korunması	
Yenilenebilir enerji kaynaklarının kullanımı	
Kent parklarının tesis edilmesi	
Akarsu kenarı yeşil yolların korunarak, iyileştirilmesi	
Mavi-yeşil odaklı planlama-tasarım ve uygulama yaklaşımlarının geliştirilmesi	

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4.1. Peyzaj Tasarım Ölçeğinde İklim Değişikliği Yeşil Alan İlişkisi

Kentsel alanlarda iklim değişikliği yeşil alan ilişkisi temelinde, en önemli tasarım aracı yeşil altyapı sistemidir. Öyle ki Ikeobilor (2022) tarafından; İklim değişikliğinin etki ve sonuçları ile mücadelede, sağlıklı yapılı çevreler yaratmada ve yaşam kalitesini arttırmada yeşil altyapı önemli bir araç olarak öngörülmüştür. Pauleit vd. (2013) ile Mathevs (2015) de çalışmalarında; yeşil altyapı, kentsel ısı adası etkisini azaltarak ve yağmur suyu akışını yöneterek şehirlerin iklim değişikliğine uyum sağlamasında etkili olduğu belirtilmiştir. Bununla birlikte, AB Stratejisinin (2013) hedefleri arasında yeşil alt yapıya vurgu yapılarak, iklim değişikliğini azaltmak, uyum sağlamak, dayanıklılığı artırmak hedeflenmiştir. 2030 Avrupa Biyoçeşitlilik Stratejisinde de yeşil alanlar yaratmanın önemi vurgulanarak, iklim değişikliğinin olumsuz etkilerini hafifletmek ve azaltmada yeşil atyapının gerekliliğine dikkat çekilmiştir (Environment Directorate-General for the Environment, 2013; Romanello, 2021)

Yeşil altyapı, ekosistem değerlerini ve işlevlerini korumak için birbirine bağlanan doğal, yarı doğal ve kültürel alanlardan oluşan bir ağı kapsamakta olup, bitki örtüsü veya toprak sistemleri, geçirgen kaldırım veya diğer gözenekli yüzeyler veya alt tabakalar, yağmur suyunun toplanması ve yeniden kullanımı veya depolamak, sızmak veya yağmur suyunu buharlaştırarak kanalizasyon sistemlerine veya yüzey sularına akışı azaltmak olarak tanımlanmaktadır (Ikeobilor, 2022). Yeşil altyapı, büyük ölçekli çalışmalardan küçük ölçekli çalışmalara kadar geniş bir yelpazedeki uygulama alanlarını içermektedir. Kentin sorunlarına ekonomik, ekolojik ve sosyal avantajlar sunan çözümler yaratmaktadır (Hepcan,2019; Semiz,2016; Aslan ve Yazıcı, 2016).

Kentsel yeşil altyapı bileşenleri; geçirgen yüzeyler, yeşil temalı sokaklar, kaldırımlar, otoparklar, çatılar ile yağmur bahçeleri, yağmur suyu depolama alanları, bitki topluluklarından oluşan hendekler ve ağaç kümeleridir (Hepcan, 2019; Semiz, 2016; Aslan ve Yazıcı, 2016; Arslantaş, Sanalan ve Çil, 2020; Kaya, 2018).

Geçirgen Yüzeyler: İklim değişikliğinin bir sonucu olarak, taşkınlardan ve kentsel su hidrolojisinden korunmak için kentsel akışın sürdürülebilir bir şekilde yönetilmesi gerekmektedir. 1970'li yıllarda artan yağış olayları nedeniyle geçirgen yüzeyler, özellikle Amerika Birleşik Devletleri gibi ülkeler ve birçok Avrupa ülkesinde ilgi odağı haline gelmiştir (Beecham, vd., 2010; Scholz vd., 2007; Cui ve Bhattacharya, 2015; Brown ve Brost, 2014). Geçirgen yüzeyler, yağmur suyunun depolanmasını ve filtrelenmesine olanak sağlayan yüzey kaplamalarıdır (Semiz, 2016; Akbulut ve Haksever, 1996).

Görsel 1'de geçirgen yüzey örneğine yer verilmiştir.

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Görsel 1. Gaziantep Kavaklık Park'tan geçirgen yüzey örneği (URL-2)

Yeşil Sokaklar / Sokak Ağaçlandırması: bu uygulamada; ilkimden kaynaklı sorunlara karşı, kentin yeşil alan miktarını artırma, hava kalitesini artırma, yüzey suyunun azaltılması, ısı adası oluşumunu azaltma gibi etkiler oluştururlar (Arslantaş, Sanalan ve Çil, 2020; Hepcan, 2019; Semiz,2016). Pansinger (2018)'in çalışmasında da enerji ile fonksiyon, çevre ile estetik, teknoloji ile doğa arasında dengenin olduğu, insan ihtiyaçlarının ön planda olduğu, akıllı ve yeşil sokakların tasarlanmasının iklim değişikliğinin etkileri ile mücadelede etkili olduğu vurgulanmıştır. Fallast, vd. (2021)'in çalışmasında da iklime duyarlı şekilde tasarlanan sokaklarda; soğutma, sürdürülebilir yağmur suyu yönetimi ve sokak drenajı, estetik ve akustik iyileştirme sağlandığına dikkat çekilmiştir. Görsel 2'de yeşil sokak örneğine yer verilmiştir.

Görsel 2. Diyarbakır yeşil sokak örneği (URL-3).

Yeşil Kaldırımlar / Yeşil Yaya Yolları: Yağmur suyunun toplanması ve filtrelenmesi amacıyla yeşil altyapı bileşenlerinin birleştirilmesiyle yeşil cadde ve sokaklar oluşturulmaktadır. Geçirgen kaldırımlar, biyolojik göller, saksılar ve ağaçlar sokağa veya tasarıma dahil edilebilecek bileşenlerin örnekleridir (EPA,2024). Görsel 3'te yeşil kaldırım örneğine yer verilmiştir.

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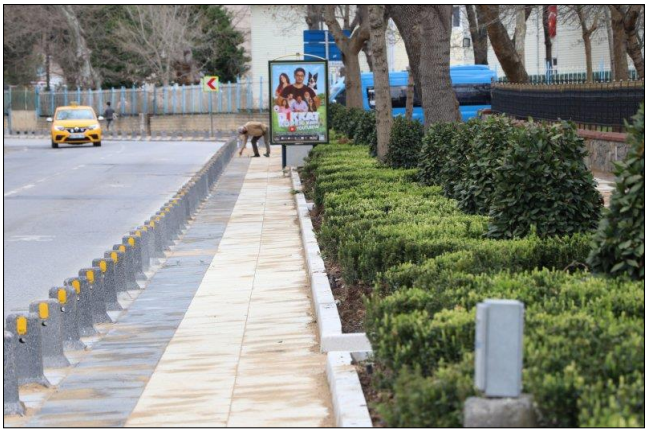

Görsel 3.İstanbul/Beykoz yeşil kaldırım örneği (URL-4).

Yeşil Otoparklar: Yeşil altyapı sisteminde otopark uygulamaları; doğal bitki türlerinin kullanıldığı ve geçirgen yüzeyler kullanılarak oluşturulmakta olup, yağmur suyunu toplayan, filtreleyen geçirimli yüzeye sahip alanlardır (Hepcan, 2019; İnan, 2020). Görsel 4'te yeşil otopark örneğine yer verilmiştir.

Görsel 4. Yeşil otopark örneği (URL-5)

Yeşil Çatılar: Bir yapının çatısında uygulanmış bitkilendirme ve düzenlemeyi ifade etmektedir (Ekşi, 2014). Yeşil çatılar iklim değişikliği sürecinde alternatif bir tasarım biçimidir. Keza Willenbrock (2020)'nin yapmış olduğu çalışmada; bir metrekarelik yeşil çatı alanı günde iki litre suyu buharlaştırmaya ve yılda on gram ince tozu bağlamanın yanı sıra 375 gram CO_2'yi emmeye yeterli olduğunun vurgulanması bunu destekler niteliktedir. Ayrıca sokak gürültüsünü azaltmada ve enerji tasarrufunda etkilidirler (Willenbrock, 2020). Görsel 5'te yeşil çatı örneğine yer verilmiştir.

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Görsel 5. İzmir üçkuyular aktarma ve otopark merkezi yeşil çatı örneği (URL-6)

Yağmur Bahçeleri: Yağmur bahçeleri, yağmur suyunu toprak bazlı bir ortam aracılığıyla toprağa emen, patojenleri ortadan kaldıran, yağmur suyu akışında bulunan besin maddelerini, organik maddeleri ve çeşitli ağır metalleri azaltan küçük süngerler görevi görür (Müftüoğlu ve Perçin,2015; Malaviya vd., 2019). Görsel 6'de yağmur bahçesi örneğine yer verilmiştir.

Görsel 6. Trakya Üniversitesi yağmur bahçesi örneği (URL-7)

Yağmur Suyu Depolama Tankı: Çatılardan akan yağmur suyunu toplamak için tasarlanmıştır (Görsel 7). Bu sistemde yağmur suyu toplanır, bir oluk sistemi aracılığıyla depolama tanklarına iletilir ve son olarak çeşitli alanlara dağıtılır. Yağış sırasında toplanan su, yağmur suyu çeşitli su ihtiyacını karşılamak üzere kullanılır (Selimoğlu ve Yamaçlı,2022).

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Görsel 7. İzmir Büyükşehir Belediyesi yağmur suyu depolama tankı örneği (URL-8)

Bitki Örtüsünden Yapılan Hendekler: Bitki hendeklerinin temel işlevi ekosistemlerde, özellikle de tarımsal ekosistemlerde hava-su ilişkilerini düzenlemektir. Hendekteki bitki örtüsü akıntı suyunun hızını azaltır, bu su daha sonra filtrelenir ve sonunda toprağa veya yağmur kanalizasyonuna ulaşır, bu da suyun kalitesini artırır. (The City of Lancaster, 2011; Brankoviç vd., 2019, Kiryluk, 2022). Bu uygulamaya ilişkin görsel Görsel 8. de verilmiştir.

Görsel 8. Bitki örtüsünden yapılan hendekler örneği (URL-10)

Ağaç Kümeleri/Bitki Kutuları: Kentsel alanlarda ağaç kümeleri; estetik değer, yaban hayatı ile etkileşim, mekân duygusu, eğitim ve dinlenme vb. olmak üzere önemli kültürel hizmetler sunar (Hirons ve Sjöman, 2019).

Görsel 9. Ağaç kümeleri örneği (URL-11)

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Yeşil altyapı, kentsel alanlarda ısıyı emen yüzeyleri azaltır, güneşten korumayı arttırır, gölgeleme ve buharlaşma ile soğutmayı sağlar (kentsel alanlarda mikro klimatik bölgelerin oluşumunu sağlar), havanın kalitesini ve doğal su tutma oranını arttırıp, havadaki kirleticilerin tutulmasını, gürültünün maskelenmesi gibi çevresel kirleticileri filtrelemektedir. Bu nedenle, kentsel yeşil alanlarla doğrudan bağlantılı ekosistem hizmetleri, hava filtreleme (karbon tutma), mikro iklim düzenlemesi, yağmur suyu drenajı (su düzenlemesi veya yağmur suyu yönetimi), tür çeşitliliğinin ve kompozisyonunun kültürel ve eğitimsel değerin artması gibi birçok işleve sahiptir (Semeraro vd., 2021).

5. SONUÇ VE ÖNERİLER

Günümüz koşullarında; iklim değişikliği, küresel-bölgesel-yerel düzeyde çeşitli etkiler yaratması nedeniyle önemli bir sorun olarak çıkmıştır. İklim değişikliği etkisi ile oluşabilecek ve/veya oluşan sorunlarla mücadelede ise yeşil alanlar önemli bir araç olmuş ve kentsel yaşam kalitesi ile ilişkilendirilmiştir. Bu doğrultuda; günümüzde küresel iklim değişikliğinin etkilerini en aza indirebilmek ve daha yaşanabilir kentler planlayabilmek için dirençli peyzaj tasarım yaklaşımından daha fazla yararlanılması ve entegrasyonunun sağlanması önerilmektedir. Yeşil alanlar iklim değişikliği ile uyum ve risklerin azaltılmasında önemli bir araç olup, tasarım ölçeğindeki çalışmalarda temel oluşturmalıdır. Bu kapsamda peyzaj tasarım ölçeğinde iklim değişikliği yeşil alan ilişkisine ilişkin öneriler geliştirilerek aşağıda maddeler şeklinde sunulmuştur.

Peyzaj tasarım ölçeğinde iklim değişikliği yeşil alan ilişkisi için öneriler:

- Kentsel koridorları (sokak, cadde, kaldırım) oluşturan açık alanlarda yerel dokuya uygun bitkilerin seçilerek, uygulanması
- Otoparklar alanlarında geniş taç yapan ağaçlar kullanılması, zemin alanında yeşil alan oranının arttırılması
- Ağaç dikiminin uygun olmadığı alanlarda tekerlekli saksılar içerisinde bitkilendirme çalışmalarının yapılması
- Yağmur bahçelerinin kentsel alanlarda yaygın kullanımının sağlanması
- Geçirgen malzeme kullanımının yaygınlaştırılması
- Yeşil çatı, dikey bahçe, balkon bitkilendirmesi gibi uygulamaların geliştirilmesi
- Otopark, meydan vb. gibi alanlarda geçirimli yüzeyler oluşturularak, sert zemin miktarı azaltılması olarak belirtilebilir.

Sonuç olarak; iklim değişikliği özellikle kentsel alanlarda, yerel ölçekten küresel ölçeğe kadar farklı boyutlarda olumsuz etkiler göstermekte olup, yeşil alanlar ise kentlerde iklim değişikliğinin etkilerinin azaltılmasında önemli bir etki oluşturmaktadır. Bu durum, küresel iklim değişikliği sürecinde, tasarım ve uygulama çalışmalarında yeşil alanların başrol oynaması gerekliliğini göstermiştir. Bu kapsamda iklim değişikliği yeşil alan etkisi konusunda yapılacak çalışmalar, olası iklim değişikliğinin olumsuz etkileri ile mücadelede önemli bir farkındalık oluşturacak olup, konu ile ilgili çalışan araştırıcılar için de katkı sağlayacaktır.

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DUYUSAL BAHÇELERE YÖNELİK TASARIM VE UYGULAMA ÖRNEKLERİNİN DEĞERLENDİRİLMESİ

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ÖZET

Geçmişten günümüze kentsel nüfus miktarı ve yoğunluğundaki artış, yaşlı nüfus oranındaki değişim ve dezavantajlı grupların varlığı ile pandemi, iklim değişikliği vb.nin etkisinde; yaşanılabilir şehirlerin gelişiminde kentsel yeşil alanlar önemli bir rol oynamaktadır. Bu noktada yeşil alanlar kişiler üzerinde; doğa ile etkileşim kurma, fiziksel-ruhsal-sosyal sağlığı iyileştirme, biyoçeşitliliğe katkıda bulunma, doğa odaklı deneyim kazanma gibi farklı etkiler oluştururlar. Kentsel alanlarda, sürdürülebilir yaşama dair çeşitli etkiler oluşturan yeşil alanlar, farklı sınıf ve biçimlerde adlandırılırlar. Birçok çalışma kapsamında da duyusal bahçeler, kentsel yeşil alanların yeni bir biçimi olarak tanımlanmış olup, genel çerçevede eğitim, sağlık, deneyim, rekreasyon ve bahçecilik gibi kişisel kazanımlarda önemli bir rol oynayarak, tarih boyunca çeşitli amaçlarla kullanılmışlardır. Bu çerçevede bildiri ana konusunu "duyusal bahçeler" oluşturmuştur. Ana konu paralelinde; duyusal bahçe kavramı, özellikleri ve faydalarına ilişkin bilgiler verildikten sonra, ulusal ve uluslararası ölçekli örnekler üzerinden duyusal bahçelere ilişkin genel değerlendirmeler yapılması planlanmıştır. Çalışma literatür verilerine dayalı olarak gerçekleştirilmiş olup, ilgili değerlendirmeler çeşitli görsellerle desteklenerek sunulmuştur. Çalışmadan elde edilen sonuçlar, duyusal bahçe kavramının önemi ve amacına bağlı olarak kentsel yeşil alanlar içerisindeki rolü ve etkisinin tanımlanması hususuna katkı sağlayacağı düşünülmektedir.

Anahtar Kelimeler: Kentsel yeşil alan, Duyusal bahçe, Bahçe tasarımı, Peyzaj tasarım.

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1.GİRİŞ

Günümüzde küresel nüfusun büyük bir bölümü kentsel alanlarda yaşamakta (Gonçalves vd., , iklim değişikliği vb.nin etkisinde yaşanılabilir şehir odaklı yaklaşımlar geliştirilmiştir. Yaşanılabilir şehir konseptinde de kentsel yeşil alanlar önemli bir rol oynamıştır (Gonçalves vd., 2019, Zajadacz ve Lubarska, 2023).

Birçok çalışma kapsamında da; duyusal bahçeler, kentsel yeşil alanların yeni bir biçimi olarak tanımlanmış (Ellis, 2011; Wintherbottom vd., 2015; Brown vd., 2021; Zajadacz, ve Lubarska, 2023; Krzeptowska-Moszkowicz vd., 2023) olup, genel çerçevede eğitim, sağlık, deneyim, rekreasyon ve bahçecilik gibi kişisel kazanımlarda önemli bir rol oynayarak (Keniger vd., 2013; Shanahan vd., 2015; Wintherbottom vd., 2015; Krzeptowska-Moszkowicz vd., 2023), tarih boyunca çeşitli amaçlarla kullanılmışlardır. Günümüzde de duyusal bahçeler, insanın doğayla temasına aracılık ederek, modern insanın bu ihtiyaçlarını karşılamak üzere tasarlanmışlardır (Fetell Lee, 2018). Bu çerçevede çalışma "duyusal bahçeler kentsel yeşil alanların bir parçası olup, kişiler üzerinde önemli kazanımlar oluşturarak sağlıklı kentlerin gelişiminde etkilidirler" hipotezi üzerinde kurgulanmıştır. Hipotez çerçevesinde; duyusal bahçe kavramı, özellikleri ve faydalarına ilişkin bilgiler verildikten sonra, ulusal ve uluslararası ölçekli örnekler üzerinden duyusal bahçelere ilişkin genel değerlendirmeler yapılması planlanmıştır. Çalışma literatür verilerine dayalı olarak gerçekleştirilmiş olup, ilgili değerlendirmeler çeşitli görsellerle desteklenerek sunulmuştur.

2. DUYUSAL BAHÇE KAVRAMI VE GELİŞİMİ

Duyusal bahçeler, çeşitli duyusal deneyimlerin yoğunlaştığı, eğitimden rekreasyona geniş bir kullanıcı kitlesine olanak sağlayan, kullanıcıların doğayı deneyimledikleri bahçeler olarak tanımlanmaktadırlar. Duyusal bahçelerde, tüm bileşenlerin (sert ve yumuşak peyzaj, renk, doku vb.) duyuları uyaracak şekilde tasarlanması hususu diğer bahçelerden farkını ortaya koymaktadır (Raveendra, 2014; de Wit, 2016). Duyusal bahçelerde ana amaç, bahçenin peyzaj elemanlarıyla etkileşimiyle, farklı kullanıcı gruplarının iyileştirilmesine olanak tanıyacak şekilde insan duyularını harekete geçirmektir (Zajadacz, ve Lubarska,2023).

Duyusal bahçe, bahçecilik ve kentsel yeşil alan kavramlarına yönelik hızla gelişen bir yaklaşım olup, doğa unsurlarını ve çevredeki manzarayı deneyimlemek için yüksek kaliteli, erişilebilir bir ortam sağlamaktadır (Ellis, 2011; Brown vd., 2021). Biyolojik çeşitliliğe sahip, stresi azaltan sağlıklı yaşam bahçeleri yaratılması amacıyla doğayla bağlantı kurulacak yerler olarak tasarlanmıştır (Keniger vd., 2013; Shanahan vd., 2015).

Duyusal bahçelerin tarihi çok eskilere dayanmakta olup; bitki, güneş ışığı, su, kum, kuş sesleri, hayvanlar ve diğer birçok bileşen tedavi edici olarak kullanılmıştır. Eski Çin filozoflarının ve doktorlarının yazılarında müzik, Eski Mısır'da da hayvanlar ve bitkiler tedavi yöntemi olarak kullanılmışlardır (Zajadacz, ve Lubarska, 2023). Bununla birlikte; duyusal bahçe fikri ilk olarak 1970'li yıllarda Birleşik Krallık'ta bahçecilik terapisi hareketinden ortaya çıkmıştır. İlk duyusal

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bahçeler genellikle halka açık parklarda bulunan genellikle 'Körler Bahçesi' olarak kokulu bitkiler, kabartma etiketler ile yükseltilmiş çiçekliklerin birleşiminden oluşan, tabelalarla gösterilen küçük alanlarda görülmüşlerdir. Ancak sonrasında, engelli insanlar için oluşturulan özel alanlar yerine duyusal deneyime olanak tanıyan kapsayıcı tasarım yaklaşımı ile yeşil alanların oluşturulması gerektiği fikri ortaya çıkmıştır (Hussein,2012). Türklerde İslamiyet'ten sonra çeşitli meyvelerin, çiçeklerin, akarsuların bulunduğu bir 'cennet bahçesi' benzetmesi ile bahçeler oluşturmuşlardır. Ancak Osmanlı Devleti'nin kurulmasıyla bu bahçeler, toplumun şifa için yararlanabileceği alanlar haline gelmiştir. Özellikle hastane bahçeleri hastaların su sesi ve şifalı bitkiler ile tedavi edileceği alanlar olarak kullanılmıştır (Çalışkan, 2020).

Özellikle; 2010'lu yıllarla birlikte duyu bahçelerinin kullanıcılar üzerindeki pozitif etkileri sebebiyle dünya çapında daha fazla ilgi görmüştür. Günümüzde ise; duyusal bahçe, kentsel tasarımda yeni bir multidisipliner yönelim olarak; peyzaj, sanat, çevre, pedagoji, tıp ve sosyal bilimlerin ilgisini çekerek önemli bir araştırma konusu haline gelmiştir (Fetell Lee, 2018). Vukovic ve Mingaleva (2023)'ün çalışmasına dayanarak; duyusal bahçelerin tarihsel süreçteki kullanımlarına ilişkin değişim Çizelge 1. de verilmiştir.

Çizelge 1. Duyusal bahçelerin tarihsel süreçteki kullanımları (Vukovic ve Mingaleva, 2023).

Yıllar	**Kullanım türü**
1900'lü yıllardan önce	Refah
1900–1950	Yetişkinler için şifa
1950–2000	Özel ihtiyaçları olan çocuklar ve yetişkinler için şifa
2000–2010	Eğitim
2020'li yıllarda	Anti-stres ve genel refah

3. DUYUSAL BAHÇELERİNİN ÖZELLİKLERİ VE FAYDALARI

Duyusal bahçeler, kullanıcılar üzerinde çeşitli işlevlere sahip olup, iyileştirme, eğitim ve onarım-yenileme olmak üzere üç temele dayandırılmıştır (Zajadacz ve Lubarska, 2023).

Duyusal bahçeler, duyuları harekete geçiren özel nitelikli alanlar oluşturarak, kullanıcıları stresten uzaklaştıran, memnuniyet ve güvenlik duygusu sağlayarak, sosyalleşme, zihinsel ve fiziksel sağlık sorunları olan kişiler için yaşam kalitesi arttırma, eğitim, dinlenme ve çoklu terapiler gibi işlevleri bulunmaktadır (Clatworthy vd., 2013; Gonzalez ve Kirkevold, 2016; URL-1).

Duyusal bahçeler genel olarak, kullanım şekline göre aktif ve pasif bahçe olmak üzere 2 ana temelde sınıflandırılmakta olup,

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Aktif bahçeler, içerinde faaliyetlerin olduğu, kullanıcıların bahçeyle uğraştığı aktif kullanıma olanak sağlanan alanlardır. Pasif bahçeler ise koku, görme gibi sadece duyusal uyarımların olduğu alanlardır (Gonzalez ve Kirkevold, 2016).

Duyusal bahçeler, park, okul, hastane, huzurevi ile ev bahçelerinde yer almakta olup, farklı kullanıcı gruplarına çeşitli faydalar sunmaktadır.

Çocuklar için: Duyusal bahçeler, çocukların motor becerilerini, bilişsel gelişimlerini ve sosyalleşmelerini destekleyerek, farklı doku ve kokularla etkileşim kurarak öğrenmelerini ve hayal güçlerini geliştirmelerine olanak sağlar (Nikravesh ve Tabaeian, 2016).

Yetişkinler için: Duyusal bahçeler, yetişkinler için stresi azaltma, rahatlama ve doğayla bağlantı kurma imkânı sunarak (de Wit, 2016; Vukovic ve Mingaleva,2023), hafıza ve konsantrasyon gibi bilişsel fonksiyonları da geliştirmeye yardımcı olabilir. Öyleki; Souter-Brown (2021) tarafından; duyusal bir bahçenin stresi etkili bir şekilde azalttığı, refahı artırdığı ve iyileştirdiği, biyolojik çeşitliliğe katkıda bulunduğu ve sürdürülebilir yaşamı desteklediği belirtilmiştir.

Özel gereksinimli bireyler için: Duyusal bahçeler, görme, işitme engelli ve otizm spektrum bozukluğu gibi özel gereksinimli bireyler için uyarıcı ve kapsayıcı bir ortam sunarak, duygularını ifade etmelerine ve çevreleriyle etkileşime girmelerine yardımcı olur. Örneğin; Malaya Üniversitesi Tıp Merkezi'ndeki Terapötik Duyusal Stimülasyon Bahçesi özelinde yapılan çalışmada; kullanıcıların duyusal uyaranlarının peyzaj özellikleriyle etkileşiminin sosyal davranışlarda olumlu gelişmeleri desteklediği ortaya konulmuştur (Hussein vd., 2016). Şensoy (2017)'un çalışmasında da otizmli bireyler için özel olarak tasarlanan bir duyu bahçesinin, motivasyon kaynağı olabileceği ve kişinin yeteneklerinin geliştirmesinde etkili olacağı belirtilmiştir (Şensoy, 2017).

Duyusal bahçeler, insan refahı üzerindeki etkilerinin dışında, eğitimsel veya sosyal işlevleri de bulunmakta olup, kentsel yeşillik sistemi içerisinde de bir araçtırlar (Wintherbottom vd., 2015; Krzeptowska-Moszkowicz vd., 2023).

Dolayısıyla, duyusal bir bahçe tasarlarken, kullanıcı kitlesinin ihtiyaçlarını ve tercihlerini göz önünde bulundurmak önemli olup, duyuları temel alarak tasarlanmalıdır. Çünkü, duyusal bahçenin temel dayanağı, kullanıcıya duyusal deneyimler sunmaktır. Bunlar, görme, dokunma, koku, tat ve işitme olup, tasarımda farklı duyulara hitap eden çeşitli öğeler olarak kullanılmaktadır (URL-2; URL-3; Keçecioğlu, 2014; Jasmin, Sathyan ve Beela, 2023). (Çizelge 2).

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Çizelge 2. Duyular ve uyaracak ögeler (URL-1; URL-4).

Duyular	Öğeler ve görselleri
Görme	Renk, doku, ışık, gölge, formlar 
Koklama	Kokulu ağaç, çalı, mevsimlik ve yer örtücü bitkiler 
İşitme	Kuru yapraklar, çakıllı yürüyüş yolları, rüzgar, kuş-kelebek-martı vb. hayvan sesleri, su 
Dokunma	Bitki kabuğu, yapraklar, çiçekler, tohumlar ve meyveler 

Tat alma	Meyveler, sebzeler ve aromatik bitkiler 

4. DUYUSAL BAHÇE ÖRNEKLERİ

Ulusal ve uluslararası ölçekli örnekler üzerinden duyusal bahçelere ilişkin genel değerlendirmeler yapılmıştır.

4.1. Duyusal Bahçelere İlişkin Ulusal Örnekler

Ülkemiz özelinde, farklı kullanıcı gruplarına hitap eden duyusal tasarıma hitap eden bahçeleri bulunmakta olup, bu bölümde üç adet örnek üzerinde çeşitli değerlendirmeler yapılmıştır. İlgili değerlendirmeler; park ve/veya bahçelerin yapım yılı, büyüklüğü, kullanım amacı, kullanıcı tipleri ile aktivite türleri açısından görsellerle desteklenerek yapılmış olup, açıklamalar Çizelge 3. de sunulmuştur.

Çizelge 3. Ülkemiz özelinde duyusal tasarıma hitap eden bahçe örnekleri (URL-5; URL-6; URL-7; Çalışkan Mimarlar ve Çelik Canga, 2021).

Gebze/İzmit Duyu Parkı Örneği		
		
Yapım Yılı-Büyüklüğü	**Aktivite Türleri ve Alanları**	**Kullanıcı Kitlesi**
2017 21.000 m^2	Oyun grubu, atlama parkurları, macera parkuru, duyu parkuru, hobi bahçeleri, basketbol sahası, spor aletleri, ahşap atölyesi, kümes, oturma bankları ve fiskiye	Engelli çocuklar ile tüm kullanıcı grupları
Kullanım Amacı:		

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Engelli çocukların renkler, kokular, şekiller, hayvanlar ve bitkilerle iletişime geçerek duyusal algıları yoluyla eğlenmeleri ve doğa ile iletişim kurmaları amaçlanmıştır.

Zeytinburnu Tıbbi ve Aromatik Bitkiler Bahçesi/İstanbul



2005 14.000 m^2	Tropik sera ve üretim serası, herbaryum, tohum bankası, laboratuvar, eğitim ve araştırma merkezi, kütüphane ve hayvan bahçesi	Tüm kullanıcı grupları

Kullanım Amacı:

Doğanın iyileştirici ve bütünleştirici rolünden yararlanarak, tıbbi bitkilerin üretilmesi, tanıtılması, korunması ve geliştirilmesi amaçlanmıştır.

Alanya Terapi Parkı / Antalya


Yapım Yılı-Büyüklüğü	Aktivite Türleri ve Alanları	Kullanıcı Kitlesi
2022 2133 m^2	Kafe, biyolojik havuz, şifalı bitkiler bahçesi, doku yürüyüş yolları, heykel, mini kaskatlı havuz, oturma alanları, bitki tünelleri, gezinti yolları	Tüm kullanıcı grupları

Kullanım Amacı:

Kullanıcılara yönelik olarak; yenilebilir ve tıbbi bitkiler, renkler, dokular, yürüyüş yolları, rüzgâr çanları, kuş evleri, baharatlı dokunma masası ve su alanları vasıtasıyla duyuları harekete geçirerek doğanın iyileştirici ve sakinleştirici etkisinden faydalanmak amaçlanmıştır.

4.2. Duyusal Bahçelere İlişkin Uluslararası Örnekler

Bu bölümde, farklı ülke örnekleri üzerinden duyu bahçelerine ilişkin genel değerlendirmeler yapılmış olup, Çizelge 4. de sunulmuştur.

Çizelge 4. Farklı ülke örnekleri üzerinden duyusal tasarıma hitap eden bahçe örnekleri (URL-8; URL-9; URL-10; URL-11; URL-12; URL-13).

Magnetten Duyu Bahçesi/ Danimarka -Kopenhag		
		
Yapım Yılı-Büyüklüğü	**Aktivite Türleri ve Alanları**	**Kullanıcı Kitlesi**
2017 3500 m^2	Sebze bahçesi, şenlik ateşi bahçesi, çiçek bahçesi.	Özel bakıma ihtiyaç duyan kişiler ve tüm kullanıcılar
Kullanım Amacı		
Özel bakıma gereksinim duyan kişiler için, duyuları kullanarak doğayla etkileşim kurmak ve çeşitli etkinliklerde bulunmaktır. 2018 yılında "özgün bütünlüğü ve içinde bulunduğu toplumun kamusal alanına önemli katkı sağlaması" nedeniyle ASLA Landmark ödülünü almıştır.		
Sensational Garden / İtalya -Frosinone		
		
Yapım Yılı-Büyüklüğü	**Aktivite Türleri ve Alanları**	**Kullanıcı Kitlesi**
2014 2500 m^2	Yürüyüş yolları, meyve ağaçları, koni biçimli yükseltiler, oturma alanları, deneyim alanları otopark	Tüm kullanıcı grupları
Kullanım Amacı		
Bahçenin amacı, alanın tamamını göremedikleri ve manzaranın sürekli değiştiği bir yola davet etmektir. Bahçe, kullanıcıya farklı deneyim sunmak amacıyla 5 alandan oluşmaktadır. Her bir alan duyusal bir deneyimi temsil etmektedir. Bu alanda kullanılan malzeme ve bitki örtüsü de bunlarla ilişkili olacak şekilde kullanılmıştır. Alanların arasında geçen yol ile bahçeyi yavaş yavaş keşfetmek ve deneyimlemek amaçlanmıştır. Tat alma duyusunun deneyimlenmesi için; limon (*Citrus limon*), süs eriği (*Prunus cerasifera*), armut (*Pyrus communis*), portakal (*Citrus sinensis*), kayısı (*Prunus armeniaca*) ve şeftali (*Prunus persica)* gibi meyve ağaçları kullanılmıştır.		

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İşitme duyusu için ses çanları ve oyun alanı bulunmaktadır. Ayrıca yürürken ses çıkaracak malzeme olan çakıl taşlarına da yer verilmiştir.
Dokunma duyusunu harekete geçirmek amacıyla oluşturulan alanda; yeşil zemin ve kum kullanılmıştır.
Koku duyusunu temsil eden alanda kokulu bitkiler kullanılmıştır.
Görme duyusu içinde gül bahçesi tasarlanmıştır.

Elsie McCarthy Sensory Garden/ABD-Arizona



Yapım Yılı-Büyüklüğü	Aktivite Türleri ve Alanları	Kullanıcı Kitlesi
2002 64.000 m^2	Bilgelik Bahçesi, kutlama bahçesi, tefekkür bahçesi, yansıma bahçesi, hikaye totem bahçesi, doku yürüyüş yolları, heykel, oturma alanları, su alanları	Görme engelliler

Kullanım Amacı

Görme engelliler için dokunma, ses ve koku duyularıyla sürükleyici bir deneyim yaratmak amaçlanmıştır.

Toa Payoh Sensory Park/Avustralya-Singapur


Yapım Yılı-Büyüklüğü	Aktivite Türleri ve Alanları	Kullanıcı Kitlesi
2009 114.403 m^2	Belediye parkı, pasif alanlar, geniş kapsamlı bitki paleti, ses üreten unsurlar, yürüyüş yolları	Yaşlılar, tüm kullanıcılar

Kullanım Amacı:

Duyusal unsurlardan yararlanarak, doğaya dayalı deneyimlerin kazanılması amaçlanmıştır.

Örnekler incelendiğinde; duyusal bahçelerin, renk, doku, ışık, gölge, formlar, kokulu ve aromatik ağaç, çalı, mevsimlik ve yer örtücü bitkiler, çakıllı yürüyüş yolları, rüzgar, kuş-kelebek-martı vb. hayvan sesleri, durgun ve hareketli su yüzeyleri ile yükseltilmiş yapısal unsurları kullanarak, deneyim, etkileşim, iletişim ve iyileşme gibi farklı etkiler oluşturacak tasarımlar ve uygulamalar üzerinde kurgulandığı görülmüştür.

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5.SONUÇ VE ÖNERİLER

Çalışmanın genel çerçevesini duyusal bahçeler oluşturmuş olup "duyusal bahçeler kentsel yeşil alanların bir parçası olup, kişiler üzerinde önemli kazanımlar oluşturarak sağlıklı kentlerin gelişiminde etkilidirler" hipotezi üzerinden literatür verilerine dayalı olarak geliştirilmiştir. Çalışma kapsamı çerçevesinde elde edilen sonuçlar aşağıda maddeler şeklinde verilmiştir.

- Duyusal bahçe tanımlanarak, tarihi süreç içerisindeki gelişimine ilişkin genel değerlendirmeler yapılmıştır.
- Duyusal bahçelerin çocuklar, yetişkinler ve özel gereksinime sahip bireyler üzerindeki faydalarına ilişkin bilgilendirmeler yapılmıştır.
- Ülkemiz özelinde duyusal tasarıma hitap eden Gebze, Zeytinburnu, Alanya özelinde bahçe ve park örneklerine ilişkin genel değerlendirmeler çizelge ve görseller aracılığıyla sunulmuştur.
- Dünyadan, Danimarka, İtalya, ABD ve Avustralya örneğinde duyusal bahçelere ilişkin genel değerlendirmeler yapılmıştır.

Sonuç olarak, tarihi süreçte kişiler duyuları aracılığıyla çevrelerini keşfederek, doğayı çeşitli amaçlarla kullanmışlardır. Bu noktada duyusal bahçeler; çocuklar, yetişkinler ve özel gereksinime sahip bireylerin duyusal deneyimlerini teşvik etmek ve doğayla etkileşimlerini artırmak amacıyla özel olarak tasarlanmış alanlar olarak yer almışlardır. Çeşitli bitki türleri, dokular, renkler, formlar, kokular aracılığıyla kişilerin duyularını etkileyerek, genel çerçevede eğitim, sağlık, deneyim, iletişim, rekreasyon ve bahçecilik gibi kişisel katkılar sağlamışlar ve bu durum birçok çalışmada da vurgulanmıştır (Keniger vd., 2013, Shanahan vd., 2015; Wintherbottom vd., 2015; Krzeptowska-Moszkowicz vd., 2023). Nordh vd. (2009), Adevi ve Mårtensson (2013)'ün çalışmalarında da bahçelerin kişilerin doğal çevreyle bağlantısını güçlendirerek, fiziksel-sosyal-ruhsal iyileşme sürecini olumlu etkileyerek, etkileşim ve keşif imkânı sağladıkları belirtilmiştir. Buradan yola çıkılarak, duyuların kentsel yeşil alanların tasarımında bir araç olarak kullanılması, sağlıklı ve yaşanılabilir şehirlerin gelişiminde önemli olacak olup, duyu bahçesi odaklı uygulamaların teşvik edilmesinin gerekli olacağı düşünülmektedir.

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ANTIBACTERIAL EFFECTS OF BOLETUS EDULIS, CANTHARELLUS CIBARIUS, CRATERELLUS CORNUCOPIOIDES, AGARICUS BISPORUS, PLEUROTUS OSTREATUS AND MORCHELLA ESCULENTA MUSHROOMS

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ABSTRACT

In this study, the antimicrobial effects of *Boletus edulis, Cantharellus cibarius, Craterellus cornucopioides, Agaricus bisporus, Pleurotus ostreatus* and *Morchella esculenta* mushrooms on 8 human pathogenic bacteria (*Enterococcus faecalis* ATCC 29212, *Staphylococcus aureus* ATCC 29213 (1), *Staphylococcus aureus* ATCC 6538 (2), *Escherichia coli* 0157H7 NCTC 11774, *Enterobacter aerogenes* -Clinical Isolate-, *Listeria monocytogenes* ATCC 13932, *Bacillus cereus* ATCC 14774, *Salmonella enteritidis* ATCC 13076) were determined. For this purpose, methanol and acetone extracts of dried edible mushroom species were obtained. Disc diffusion method was used to determine antimicrobial activity. As a result of the analyses, it was determined that different mushroom species showed varying rates of antimicrobial activity on different bacteria. In this study, *M. esculenta* methanol extract showed the highest antimicrobial effect on 7 different bacteria at varying rates (31.67-15.10 mm). It was determined that the zone diameters were close to the widths of the antibiotic disks. Following *M. esculenta*, the methanol extract of *B. edulis* was effective on 5 bacteria in the disk diffusion method (28.05-13.27 mm). In the disk diffusion method, all mushroom samples (acetone and/or methanol extracts) were effective on *S. aureus* (2) bacteria at different rates (31.67-9.37 mm). None of the mushroom species studied showed antimicrobial effect on *L. monocytogenes* bacteria. In conclusion, it was observed that acetone and methanol extracts of mushrooms had varying levels of antimicrobial activity against many Gram positive and Gram negative microorganisms tested.

Keywords : mushroom, antimicrobial, antibacterial, extract

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EXPLORING THE ANTIBIOFILM ACTIVITY OF *FOMITOPSIS PINICOLA* EXTRACT AGAINST METHICILLIN-RESISTANT *STAPHYLOCOCCUS AUREUS*: IMPLICATIONS FOR COMBATING ANTIBIOTIC RESISTANCE

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ABSTRACT

Methicillin-resistant *Staphylococcus aureus* (MRSA) is a common pathogen of nosocomial and community-acquired infections. *Fomitopsis pinicola* is used in traditional medicine and its constituents have antimicrobial effects, especially on Gram-positive species. However, its antivirulence and antibiofilm effects on *S. aureus* have not yet been discovered. In this study, antimicrobial, antibiofilm and antivirulence effects of the ethanolic extract of *F. pinicola* on *S. aureus* ATCC 43300 and *S. aureus* ATCC 25923 strains were determined. Agar well diffusion and minimum inhibitory concentration tests were performed. Growth inhibition rates under the influence of the extract were determined by time-kill assay. The extract was then examined for the formation of biofilms and mature biofilms. The sub-MIC concentration values on expression levels of virulence-related genes such as *agrA* and *hld* were examined. Finally, the extract was combined with clinically used antibiotics such as oxacillin, ampicillin, and tetracycline using checker-board assay. As a result, the MIC values for both strains were determined to be 625 µg/mL. It was found that the growth of ATCC 43300 was inhibited within 2 h and the growth of ATCC 25923 was inhibited within 1 h. While even sub-MIC concentrations were effective in preventing biofilm formation, 4-fold MIC concentration was effective in eradicating biofilm samples. As for antivirulence effect, sub-MIC concentrations significantly decreased the expression of *agrA* gene, while no significant change was observed in the expression of *hld* gene. It was concluded that the extract of *F. pinicola* could be as effective against multidrug-resistant *S. aureus* as antibiotics.

Keywords : Antibiofilm; *Antivirulence*; *Fomitopsis pinicola*; Methicillin-resistant *Staphylococcus aureus* (MRSA)

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FARKLI AZOT DOZLARININ II. ÜRÜN MISIR YETİŞTİRİCİLİĞİNDE VERİM VE ÖZELLİKLERİNE OLAN ETKİSİNİN İNCELENMESİ

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ÖZET

Bu araştırma, 2022 yılında Kızıltepe koşullarında farklı azot dozlarının mısır çeşitlerinde verim ve verimle ilgili özelliklere olan etkisinin belirlenmesi amacıyla II. ürün koşullarında yürütürmüştür. Çalışmada iki adet mısır çeşidi (Carpuzi ve Pioneer) kullanılmıştır. Azot gübresi dört farklı dozda (8-16, 24 ve 32 kg/da) kullanılmıştır. Azotun hiç uygulanmadığı kontrol parseli mısırda kötü sonuçlara sahip olduğu bilindiğinden dolayı kullanılmamıştır. Deneme Tesadüf Bloklarında Bölünmüş Parseller Deneme Desenine göre üç tekerrürlü olarak yürütülmüştür. Çalışma sonucunda elde edilen sonuçlara göre; önemli çıkan bazı özelliklerde Poineer çeşidi Carpuzi çeşidine göre daha yüksek değerlere sahip olmuştur. Azot gübresi uygulamalarında ise verim öğeleri bakımından en yüksek değerler dekara 32 kg azot gübresi uygulamasından, en düşük değerler 8 kg/da kontrol uygulamasından elde edilmiştir. Varyans analiz sonuçlarına göre tüm özellikler bakımından çeşit*uygulama interaksiyonu önemsiz bulunmuştur. Sonuç olarak Kızıltepe ikinci ürün mısır yetiştiriciliğinde veya yapılacak çalışmalarda dekara 24 kg azot dozunun uygun olduğu ve tavsiye edilmesi gerektiği aynı şekilde verimi etkileyen özellikler bakımından Pioneer çeşidinin öne çıktığı ve tercih edilmesi gerektiği sonucuna varılmıştır. Azot doz çalışmaları için gerçek sonuçlara ulaşmak için çalışmanın bir yıl daha sürdürülmesi ve dekara 32 kg N azot dozuna ilaveten dekara 36 kg N dozunun da denenmesi önerilmektedir.

Anahtar Kelimeler: Mısır, Çeşit, Azot, Özellik.

INVESTIGATION OF THE EFFECT OF DIFFERENT NITROGEN DOSES ON YIELD AND TRAITS IN SECOND CROP CORN CULTIVATION

ABSTRACT

This research was conducted under II. crop conditions in 2022 in Kızıltepe conditions to determine the effect of different nitrogen doses on yield and yield-related characteristics of corn varieties. Two corn varieties (Carpuzi and Pioneer) were used in the study. Nitrogen fertilizer was used at four different doses (8-16, 24 and 32 kg/da). The control plot, where no nitrogen was applied, was not used because it was known to have poor results in corn. The experiment was carried out with three replications according to the Split Plots in Randomized Blocks Trial Design. According to the results obtained as a result of the study; Poineer variety had higher values than Carpuzi variety in some important characteristics. In

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nitrogen fertilizer applications, the highest values in terms of yield elements were obtained from the 32 kg nitrogen fertilizer application per decare, and the lowest values were obtained from the control application of 8 kg per decare. According to the variance analysis results, the type*application interaction was found to be insignificant in terms of all features. As a result, it has been concluded that 24 kg nitrogen dose per decare is appropriate and should be recommended for Kızıltepe second crop corn cultivation or studies to be carried out. Likewise, the Pioneer variety stands out and should be preferred in terms of features affecting the yield. In order to reach real results for nitrogen dose studies, it is recommended that the study be continued for another year and in addition to the 32 kg N per decare nitrogen dose, 36 kg N per decare dose should also be tried.

Keywords: Corn, Variety, Nitrogen, Trait.

1.GİRİŞ

Dünya genelinde en yaygın yetiştirilen (190 milyon hektar) ürünlerden biri de Mısır (*Zea mays* L.) olup gıda, hayvan yemi ve biyoyakıt kaynağı olarak kullanılmaktadır (USDA, 2022). Mısır ülkemizde ana ürün ve ikinci ürün olmak üzere iki şekilde gerçekleşmektedir. Ana ürünün tamamı ve ikinci ürün olarak üretilen ürünün bir bölümü tane olarak değerlendirilmektedir. İkinci ürün olarak üretimin yapıldığı yerlerde ürünün bir kısmı da slaj olarak değerlendirilmektedir. Hem tane hem de slaj olarak üretilen mısırın büyük çoğunluğu hayvan yeminde kullanılmaktadır.. 2023 yılı verilerine göre Dünya'da 1.16 milyon ton üretim gerçekleşmiştir. 2023 yılı verilerine göre ülkemizde ekim alanı 9.1 milyon dekar, üretim 8,5 milyon ton olup bir önceki yıla göre 5'lik artış olmakla birlikte dekar başına elde edilen ortalama verim ise 902 kg/da olarak gerçekleşmiştir. Üretimde Konya, Şanlıurfa ve Adana ilk sıralarda yer alırken, Mardin ilimiz 569.000 ton ikinci ürün üretimi ile ülkemizde 4. sırada yer almaktadır (Tüik, 2023).

Mısır, dünya çapında N gübresinin en büyük tüketicisidir (%16,2), ancak yalnızca Amerika Birleşik Devletleri'nde toplam N gübresinin yaklaşık yarısını tüketmektedir (Uluslararası Gübre Birliği ve Uluslararası Bitki Besleme Enstitüsü, 2017). Kullanmış olduğumuz N gübresinin yaklaşık yarısı kaybedilmekte (Omara ve ark., 2019) ve bu da çevresel ve ekolojik sorunları beraberinde getirmektedir (Billen ve ark., 2010; Kahrl ve ark., 2010; Raza ve ark., 2021). Bu nedenle, N kayıplarını ve buna bağlı çevresel riskleri minimumda tutmak ve dekara verimi artırmak için N gübresinin etkili yönetimi oldukça önemlidir.

Nihai tane veriminin belirlenmesinde azot en önemli bitki besin maddesidir. Verim hedeflerine dayalı azotlu (N) gübre tavsiyeleri yaygın olmasının aksine tarlalar arasında toprağın N tedarikindeki değişkenlik pek dikkate alınmamaktadır. Topraklardaki azot dönüşümleri dinamik olup farklı topraklar, iklimler, yetiştirme sistemleri ve bazı uygulamalar arasında büyük farklılıklar olduğundan dolayı bir bölge, il, ilçe ve hatta bir köy için genel N öneri oranlarının belirlenmesini zorlaştırmaktadır (Raza ve

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Farmaha, 2022). Bu nedenle dar alanlarda bile azot uygulamaları üzerinde araştırmalar yapılarak uygun azot dozları belirlenip ilgili alanda uygulanması gerekmektedir. Böylece hem fazla azot uygulamalarının önüne geçilecek hem de eksik uygulamalar takviye edilerek optimum yetiştiricilik yapılabilmektedir.

Mısırın N gübrelemesine tepkisi, N mevcudiyetine ve bunun bitki tarafından alımına bağlıdır. Azot dönüşümleri mikrobiyal aktivite, mikrop kaynaklı nitrifikasyon ve denitrifikasyon süreçleri ve toprak özellikleri (doku, pH, organik madde ve elektriksel iletkenlik) gibi çok çeşitli faktör ve süreçlere bağlıdır (Nair ve ark., 2021). Toprak işleme, sulama miktarı ve yöntemi, azotlu gübre uygulamasının zamanı, kaynağı ve yöntemi ile sıcaklık, nem ve rüzgar hızı gibi iklim koşulları ve yönetim uygulamalarının tümü topraktaki azot varlığını güçlü bir şekilde etkileyebilmektedir (Halvorson ve ark., 2010). Güneydoğu Anadolu Bölgesi de gerek toprak yapısı gerekse yılda iki ürünün yetiştirilmesi nedeni ile N uygulamalarına gerekli özenin gösterilmesi gerekmektedir. Birim alana uygulanan N miktarının belirlenmesi oldukça önemlidir.

Sürdürülebilir tarımda, çevreyi bozmadan etkili bir N uygulaması ile verim ve kalitenin artırılması ancak etkili araştırma sonuçları ile birim alana uygulanacak N miktarının belirlenmesi ile mümkündür. Bu kapsamda, ikinci ürün mısır yetiştiriciliği konusunda bölgemizde uygun çeşitlerin seçilmesinin yanında, en uygun azot doz uygulamasının verim ve kalite üzerindeki etkisini incelemek bir ihtiyaç olduğu görünmektedir. Tarımsal potansiyelimiz açısından büyük öneme sahip ikinci ürün yetiştiriciliği ekim nöbetinde, sürdürülebilirliğin devam etmesinde ve tarımsal üretimin artırılmasının yanında proteini yüksek mısır üretimine ihtiyaç duyulmaktadır.

Bu amaçla ikinci ürün açısından önemli bir yere sahip olan Mardin ilimizde azot gübresinin mısır bitkisinde en uygun dozunun belirlenmesi amaçlanmıştır. Elde edilecek iyi bir sonuç ile Mardin ve çevre illerde gereksiz azot kullanımının önüne geçmek, doğal çevrenin korunmasına katkı sağlamak, yetersiz azot kullanımından dolayı üretilen düşük proteinli ürünün önüne geçmek, bölge ve ülkemizin ekonomisini geliştirmek üzere bu çalışma yürütülmüştür.

2. MATERYAL VE METOT

Bu araştırma 2022 üretim yılında Mardin ili Kızıltepe ilçesine bağlı Elbeyli mahallesinde yürütülmüştür. Bu çalışmada bitki materyali olarak bölgede tercih edilen 2 adet at dişi mısır çeşidi kullanılmıştır (Carpuzi ve Pioneer).

2.1 Araştırma Yerinin İklim Özellikleri

Mardin ili Kızıltepe ilçesine ait 2022 yılı ile uzun yıllar meteorolojik verileri Çizelge 1'de gösterilmiştir.

Çizelge 1'de, araştırmanın yürütüldüğü yıl ile uzun yıllar ortalama sıcaklık değerleri incelendiğinde araştırmanın yürütüldüğü yıl daha sıcak geçmiş ve ortalama yağış daha düşük gerçekleşmiştir. Nisbi nem değerlerinde uzun yıllar ortalamasından daha düşük olduğu görünmektedir.

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Bu durum ikinci ürün mısır yetiştiriciliğinde mısır bitkisinin Bitkisel özelliklerini olumsuz yönde etkilemiştir.

Çizelge 1. Araştırma lokasyonuna ait ortalama aylık meteorolojik veriler

Aylar	Sıcaklık (°C)		Yağış (mm)		Nispi Nem (%)	
	2022	UYO	2022	UYO	2022	UYO
Haziran	29.1	26.6	0.02	7.9	25.0	31.0
Temmuz	33.0	31.6	0.05	0.5	19.5	27.0
Ağustos	30.1	31.1	0.00	0.4	33.5	28.0
Eylül	26.8	24.7	0.00	4.1	30.5	32.0
Ekim	22.0	18.7	0.11	23.3	33.4	43.2
Kasım	14.2	12.8	1.68	30.2	52.5	64.4
Aralık	10.3	6.0	0.13	40.7	56.0	74.1
Toplam			0.61	15.3		
Ortalama	23.7	21.6			35.8	42.8

Araştırmanın yapıldığı lokasyona ait toprak örnekleri buğday bitkisi hasta edildikten sonar uygun yöntemlerle alınarak, kurutulmuş ve laboratuarda analiz edilmiştir (Çizelge 2).

Çizelge 2. Araştırma lokasyonuna ait toprak analiz sonuçları

Toprak özellikleri	Miktar	Toprak özellikleri	Miktar
Tekstür sınıfı	7.44	CaCO3 (%)	0.775
pH	0.285	N (%)	2.525
Tuz%	1.3	Fosfor (P2O5) (kg/da)	268
Organik madde%	4.625	Potasyum (K2O) (kg/da)	7.44

2.2. Ekim ve Bakım İşleri

Çalışmada ekimle birlikte tüm parsellere 20.20.0 taban gübresi dekara 8 kg olacak şekilde saf olarak eşit miktarda verilmiştir. Üst gübrelemede ise çalışmanın özünü teşkil eden %46 oranında azotlu gübre olarak üre 4 farklı dozda (8, 16, 24, 32 kg/da) parsellere uygulanmıştır. Çalışma Tesadüf Bloklarında Bölünmüş Parseller Deneme desenine göre üç tekerrürlü olarak yürütülmüştür. Çeşitler ana parsellere azot dozları ise alt parsellere dağıtılmıştır. Denemede sıra arası 70 cm, sıra üzeri 10 cm ve her parselde 4 sıra olacak şekilde ekim yapılmıştır. Her parsel arasında 1 m ve bloklar arasında ise 1.5 m mesafe boşluk bırakılmıştır. Parsel boyutları ise eni 2.5 m ve boyu 6 m olacak şekilde planlanmıştır.

Deneme ekimi, 5 ağustos 2022 tarihinde pönomatik ekim makinası ile yapılmıştır. Üre gübresinin yarısı mısırın 5-6 yapraklı olduğu gelişme döneminde diğer yarısı ise büyüme ve gelişme döneminde (diz boyu yükseklikte) elle serpilerek uygulanmıştır. Deneme süresi boyunca gerekli olan kültürel işlemler zamanında yapılmıştır. 24 Eylül 2022 tarihinde mısırın 5-6 yaprak olduğu dönemde (15-20 cm) ilk doz gübre ile birlikte birinci çapa yapılmış, ikinci çapa ise 22 Ekim 2022 tarihinde ikinci

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doz gübre ile birlikte yapılmıştır. Yabancı otlar elle alınarak temizlenmiştir. Mısırda çizgili yaprak kurdu zararına karşı 6 Eylül 2022 tarihinde 100 g/l Alpha- cypermethrin ilaç gurubu sırt pompası ile uygulanmıştır. Hasat olgunluğuna gelen bitkiler her parselden parselleri temsil eden 10 adet bitki örnekleme yapılarak alınmış ve etiketlenmiştir. Bitki özellikleri bu örnekler üzerinde incelenmiştir. Hasat işlemi parsellerin her iki dış kenarı ve parsel başlarından 50 cm kenar tesiri olarak saf dışı bırakıldıktan sonra gerçekleştirilmiştir. Hasat işlemi 30 Aralık 2022 tarihinde yapılmıştır.

2.4 Verilerin Değerlendirilmesi

Araştırmada; bitki boyu (BB), ilk koçan yüksekliği (İKY), koçan uzunluğu (KU), koçan çapı (KÇ), koçanda sıra sayısı (KSS), koçandaki her bir sırada tane sayısı (KSTS), koçandak tane sayısı (KTS), Yüz tane sayısı (100 TS), tanede rutubet oranı (TRO), sıvı yağ oranı (SYO), protein oranı (PO), nişasta oranı (NO), hektolitre ağırlığı (HA) üzerinde incelemeler yapılmıştır. Araştırmaya ait veriler J.M.P 5.0 (Copyright © 2007 SAS Institute Inc.) programında Tesadüf Blokları Bölünmüş Parseller Deneme Desenine göre analizleri yapılmış, ortalamalar A.Ö.F. testi ile gruplandırılmıştır.

3. ARAŞTIRMA BULGULARI

Araştırmada incelenen özelliklere ait varyans analiz sonuçları faktörlerin Çizelge 3' de verilmiştir. Uygulama bakımından koçan uzunluğu, koçan çapı, koçanda sıra sayısı, tanede rutubet oranı, sıvı yağ oranı, protein oranı ve nişasta oranı hariç diğer parametreler istatistiki açıdan önemli ($p<0.05$-$p<0.01$) bulunmuştur.

Çizelge 2. Parametrelere ait varyans analiz sonuçları (Kareler toplamı)

VK	SD	BB	İKY	KU	KÇ	KSS	KSTS	KTS	100TS	TRO	SYO	PO	NO	HA
Azot	3	8702.1**	1518.0**	16.2	3.8	4.3	320.2**	127481**	6276.0*	5.3	0.06	2.4	2.26	73.1*
Hata 1	8	835.6	410.8	11.6	6.6	3.1	50.2	14530	1752.0	6.7	0.35	5.7	2.80	43.4
Çeşit	1	213.6	10.2	0.03	1.7	14.0**	0.1	11353.5*	3750*	0.1	0.20*	0.4	0.03	9.2
Ç*A İnt.	3	29.9	29.3	2.4	2.5	1.1	2.6	2782.8	677.1	0.9	0.03	2.9	1.80	10.3
Model	15	9781.2	1968.1	30.2	14.7	22.4	373.1	156147.3	12455.2	13.0	0.64	11.3	6.90	136.0
Hata 2	8	1050.1	187.3	12.2	7.5	2.8	39.7	16878.7	1922.9	9.2	0.26	3.6	3.25	72.9
Toplam	23	10831.3	2155.5	42.4	22.2	25.2	412.9	173026	14378.1	22.2	0.90	14.9	10.15	208.9
D.K(%)		**5.48**	**0.06**	**6.31**	**17.1**	**3.43**	**8.25**	**9.83**	**7.63**	**7.67**	**6.45**	**5.79**	**0.88**	**4.64**

*:p<0.05,**:<0.01,öd: önemli değil, VK: varyasyon kaynakları, SD: serbestlik derecesi, BB: bitki boyu, İKY: ilk koçan yüksekliği, KU: koçan uzunluğu, KÇ: koçan çapı, KSS: koçanda sıra sayısı, KSTS: koçandaki her bir sırada tane sayısı, KTS: koçandak tane sayısı, 100 TS: Yüz tane sayısı, TRO: tanede rutubet oranı, SYO: sıvı yağ oranı, PO: protein oranı, NO: nişasta oranı, HA: hektolitre ağırlığı

Bitki boyu bakımından varyasyon kaynaklarından uygulama $p<0.1$ seviyesinde önemli, çeşit ve çeşit*uygulama interaksiyonu ise önemsiz bulunmuştur (Çizelge 3). Bitki boyu Carpuzi çeşidinde 205.8 cm, Pioneer çeşidinde 211.8 cm olarak ölçülmüştür (Çizelge 4). Uygulamalarda ise bitki boyu 177.3 - 227.8 cm arasında değişim göstermiştir. Uygulamalarda en yüksek bitki boyu 227.8 cm ile 24 kg/da azot dozundan elde edilirken, en düşük bitki boyu ise 177.3 kg/da ile 8 kg/da olan en düşük uygulama

dozundan elde edilmiştir. Yapılan benzer çalışmalarda çevresel faktörler ve çeşitlerin genotipik özelliklerinden dolayı bitki boylarının değişebileceğini bildirmişlerdir (Tanrıverdi ve Kabakçı, 1999, Öktem ve Öktem, 2009; Çağtay, 2016). Azotlu gübreler bitkide vejetatif gelişmeyi teşvik etmekte ve dolayısı ile bitki boyu uzamaktadır (Kün, 1994).

Çizelge 3. Çalışmada gözlemlenen parametrelere ait veriler

	Azot Dozu (kg/da)	Çeşitler				Azot Dozu (kg/da)	Çeşitler		
		Carpuzi	Pioneer	Ort.			Carpuzi	Pioneer	Ort.
Bitki boyu(cm)	8	173.4	181.1	177.3 C	İlk Koçan Yüksekliği(cm)	8	60.1	58.6	59.4 B
	16	211.5	213.6	212.6 B		16	72.0	72.1	72.1 A
	24	224.2	231.5	227.8 A		24	78.5	81.0	79.7 A
	32	214.4	221.0	217.7 AB		32	75.7	79.9	77.8 A
	Ortalama	205.8	211.8			Ortalama	71.6	72.9	
AÖF(0.05)	Çeşit: 10.8, Azot: 13,6, Çeş. x Azot: 21.6					Çeşit: 4.6, Azot: 9.5, Çeş. x Azot:9.1			
Koçan Uzunluğu(cm)	8	18.9	18.0	18.4	Koçan Çapı (cm)	8	5.2	5.0	5.1
	16	19.2	19.3	19.2		16	7.0	5.4	6.2
	24	19.4	20.2	19.8		24	5.5	5.6	5.6
	32	20.8	20.5	20.7		32	5.9	5.5	5.7
	Ortalama	19.6	19.5			Ortalama	5.9	5.4	
AÖF(0.05)	Çeşit:1.2, Azot.:1.6, Çeş. x Azot:2.3					Çeşit:0.9, Azot:1.2, Çeş. x Azot:1.8			
Koçanda Sıra Sayısı(Adet)	8	15.7	17.3	16.5	Koç.Her Bir Sır.Tane Sayısı(adet)	8	20.8	21.8	21.3 C
	16	16.9	18.0	17.5		16	27.8	27.0	27.4 B
	24	16.8	18.1	17.4		24	27.8	28.0	27.9 B
	32	16.5	18.7	17.6		32	31.4	31.5	31.5 A
	Ortalama	16.5 B	18.0 A			Ortalama	26.9	27.1	
AÖF(0.05)	Çeşit:0.6, Azot:0.6, Çeş. x Azot:1.1					Çeşit:2.1, Azot:3.3, Çeş. x Azot:4.2			
Koçandaki Tane sayısı (Adet)	8	326.0	376.7	351.3 C	100 Tane ağırlığı (g)	8	195.8	170.8	183.3 B
	16	471.7	484.0	477.8 B		16	195.8	187.5	191.7 B
	24	466.3	505.3	485.8 B		24	241.7	204.2	222.9 A
	32	517.0	589.0	553.0 A		32	229.2	200.0	214.6 A
	Ortalama	445.3 B	488.8 A			Ortalama	190.6 B	215.6 A	
AÖF(0.05)	Çeşit:43.2, Azot:56.7, Çeş. x Azot:86.5					Çeşit:14.6, Azot:19.7, Çeş. x Azot:			
Tanede Rutubet Oranı(%)	8	13.2	14.0	13.6	Sıvı Yağ Oranı (%)	8	3.13	3.00	3.07
	16	14.8	14.6	14.7		16	3.13	3.00	3.07
	24	13.6	13.5	13.5		24	3.27	2.97	3.12
	32	14.0	14.2	14.1		32	3.27	3.10	3.18
	Ortalama	13.9	14.1			Ortalama	3.20 A	3.02 B	
AÖF(0.05)	Çeşit:1.01, Azot:1.22, Çeş. x Azot:2.01					Çeşit:0.17, Azot:0.28, Çeş. x Azot:0.34			
Protein Oranı (%)	8	11.2	10.5	10.9	Nişasta Oranı (%)	8	70.9	71.7	71.3
	16	9.8	10.2	10.0		16	72.3	71.9	72.1
	24	9.7	10.9	10.3		24	72.0	71.3	71.7
	32	10.6	10.7	10.6		32	71.3	71.4	71.4
	Ortalama	10.3	10.6			Ortalama	71.7	71.6	
AÖF(0.05)	Çeşit:0.63, Azot:1.12, Çeş. x Azot:1.27					Çeşit:0.60, Azot:0.70, Çeş. x Azot:1.20			
Hektolitre	8	66.4	64.8	65.6 AB					

	16	63.6	63.6	63.6 B		
	24	63.2	63.0	63.1 B		
	32	69.1	65.9	67.5 A		
	Ortalama	65.6	64.3			
AÖF(0.05)	Çeşit:2.84, Azot:3.10, Çeş. x Azot:5.68					

Bitki boyu 20 kg N/da dozuna kadar artmış daha sonra azalmıştır (Turgut, 2000). Benzer olarak, (Altıparmak, 2001; Kara, 2006) gibi araştırmacılar tarafından da azot uygulamalarına bağlı olarak bitki boyunun artış gösterdiğini bildirilmişlerdir.

İlk koçan yüksekliği bakımından varyasyon kaynaklarından uygulama $p<0.01$ seviyesinde önemli, çeşit ile çeşit*uygulama interaksiyonu ise önemsiz bulunmuştur (Çizelge 3). İlk koçan yüksekliği Carpuzi çeşidinde 71.6 cm, Pioneer çeşidinde 72.9 cm olarak ölçülmüştür (Çizelge 4). Uygulamalarda ise ilk koçan yüksekliği 59.4 -79.7 cm arasında değişim göstermiştir. Uygulamalarda en yüksek ilk koçan yüksekliği 79.7 cm ile 24 kg/da azot doz uygulamasından elde edilirken 16 ve 32 kg/da uygulamaları arasında fark oluşmamış ve aynı grupta yer almışlardır. En düşük ise 59.4 kg/da ile 8 kg/da azot dozu uygulamasından elde edilmiştir. Yapılan benzer çalışmalarda azotlu gübre miktarının artmasına paralel olarak ilk koçan yüksekliğinin uzadığını bildirmişlerdir (Koçak, 1991; Gözübenli, 1997; Turgut, 2000; Kara, 2006) bildirmişlerdir.

Koçan uzunluğu bakımından varyasyon kaynakları önemsiz bulunmuştur (Çizelge 3). Koçan uzunluğu Carpuzi çeşidinde 19.6 cm, Pioneer çeşidinde 19.5 cm olarak ölçülmüştür (Çizelge 4). Uygulamalarda ise koçan uzunluğu 18.4 -20.7 cm arasında değişim göstermiştir. Uygulamalarda en uzun koçan 20.7 cm ile 32 kg/da doz uygulamasından elde edilirken en kısa koçan ise 18.4 cm ile 8 kg/da uygulamasından elde edilmiştir. Bulgularımız; Kara (2013) ve Kahraman (2016)'nın bulgularıyla paralellik göstermiştir.

Koçan çapı bakımından varyasyon kaynakları önemsiz bulunmuştur (Çizelge 3). Koçan çapı Carpuzi çeşidinde 5.9 cm, Fırat çeşidinde 5.4 cm olarak sayılmıştır (Çizelge 4). Uygulamalarda ise koçan çapı 5.1 -6.2 cm arasında değişim göstermiştir. Uygulamalarda koçan çapı en büyük 6.2 cm ile 16 kg/da doz uygulamasından elde edilmiştir. Yapılan benzer çalışmalarda Kara ve ark., (1999), Turgut (2000), Altıparmak (2001), Saruhan ve Şireli (2005), Kara (2006) yaptıkları çalışmalarda azot dozu miktarı arttıkça koçan çapının yükseldiğini bildirmişlerdir.

Koçanda sıra sayısı bakımından varyasyon kaynaklarından çeşit $p<0.01$ seviyesinde önemli, uygulama, çeşit*uygulama interaksiyonu ise önemsiz bulunmuştur (Çizelge 3). Koçanda sıra sayısı Carpuzi çeşidinde 16.5 adet/sıra, Pioneer çeşidinde 18.0 adet/sıra olarak sayılmıştır (Çizelge 4). Uygulamalarda ise Koçanda tane sayısı 16.5 -17.6 adet/sıra arasında değişim göstermiştir. Uygulamalarda koçanda tane sayısı en fazla 17.6 adet/sıra 32 kg/da doz uygulamasından elde edilirken, en düşük koçanda sıra sayısı ise 16.5 adet/sıra ile 8 kg/da doz uygulamasından elde edilmiştir. Yapılan benzer çalışmalarda azotlu gübrelerin bitki büyüme ve gelişmesini teşvik ederek dolaylı olarak koçanda sıra sayısını da olumlu etkilemektedir (Kün, 1994; Turgut, 2000). Nitekim Bazı araştırıcılar azot dozuna

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bağlı olarak koçanda sıra sayısında artış olduğunu bildirerek araştırmamızı teyit etmişlerdir (Al-Ruhda ve AlYounis, 1978; ile Koçak, 1991).

Koçandaki her bir sıradaki tane sayısı bakımından varyasyon kaynaklarından uygulama $p<0.01$ seviyesinde önemli, çeşit ile çeşit*uygulama interaksiyonu ise önemsiz bulunmuştur (Çizelge 3). Koçandaki her bir sıradaki tane sayısı Carpuzi çeşidinde 26.9 adet/koçan, Pioneer çeşidinde 27.1 adet/koçan olarak sayılmıştır (Çizelge 4). Uygulamalarda ise koçandaki her bir sıradaki tane sayısı 21.3 -31.5 adet/koçan arasında değişim göstermiştir. Uygulamalarda koçandaki her bir sıradaki en düşük tane sayısı ise 21.3 adet/koçan ile 8 kg/da uygulamasından, koçandaki her bir sıradaki en yüksek tane sayısı ise 31.2 adet/koçan ile 32 kg/da doz uygulamasından elde edilmiştir.

Koçandaki tane sayısı bakımından varyasyon kaynaklarından uygulama $p<0.01$, çeşit $p<0.05$ seviyesinde önemli, çeşit*uygulama interaksiyonu ise önemsiz bulunmuştur (Çizelge 3). Koçandaki tane sayısı Carpuzi çeşidinde 445.3 adet/koçan, Pioneer çeşidinde 488.8 adet/koçan olarak sayılmıştır (Çizelge 4). Uygulamalarda ise koçandaki tane sayısı 351.3 -553.0 adet/koçan arasında değişim göstermiştir. Uygulamalarda koçandaki en düşük tane sayısı ise 351.3 adet/koçan ile 8 kg/da uygulamasından, koçandaki en yüksek tane sayısı ise 553.0 adet/koçan ile 32 kg/da doz uygulamasından elde edilmiştir. Yapılan benzer çalışmalarda azotlu gübrelerin gelişmeyi artırarak dolaylı olarak koçanda tane sayısınıda artırdığını bildirmişlerdir (Kün, 1994; Turgut, 2000). Ayrıca Turgut (2000), Çokkızgın (2001), Gökmen ve ark., (2001), Kara (2006) azot dozuna bağlı olarak koçanda tane sayısın da artış olduğunu bildirmektedirler.

100 tane ağırlığı bakımından varyasyon kaynaklarından uygulama ve çeşit $p<0.05$ seviyesinde önemli, çeşit*uygulama interaksiyonu ise önemsiz bulunmuştur (Çizelge 3). 100 tane ağırlığı Carpuzi çeşidinde 190.6 g, Pioneer çeşidinde 215.6 g olarak hesaplanmıştır (Çizelge 4). Uygulamalarda ise 100 tane ağırlığı 183.3 -222.9 g arasında değişim göstermiştir. Uygulamalarda 100 tane ağırlığı en fazla 222.9 g 24 kg/da doz uygulamasından elde edilirken, en düşük 100 tane ağırlığı ise 183.3 g ile 8 kg/da doz uygulamasından elde edilmiştir.

Tanede rutubet oranı bakımından varyasyon kaynakları önemsiz bulunmuştur (Çizelge 3). Tanede rutubet oranı Carpuzi çeşidinde %13.9, Pioneer çeşidinde %14.1 olarak belirlenmiştir (Çizelge 4). Uygulamalarda ise tanede rutubet oranı %13.6-14.7 arasında değişim göstermiştir. Uygulamalarda tanede rutubet oranı en yüksek %14.7 g 16 kg/da doz uygulamasından elde edilirken, en düşük tanede rutubet oranı ise 13.6 g ile 8 kg/da doz uygulamasından elde edilmiştir.

Sıvı yağ oranı bakımından varyasyon kaynaklarından çeşit $p<0.05$ seviyesinde önemli, uygulama ile çeşit*uygulama interaksiyonu ise önemsiz bulunmuştur (Çizelge 3). Sıvı yağ oranı Carpuzi çeşidinde %3.20, Pioneer çeşidinde %3.02 olarak belirlenmiştir (Çizelge 4). Uygulamalarda ise sıvı yağ %3.07-3.18 arasında değişim göstermiştir. Uygulamalarda sıvı yağ oranı en yüksek %3.18 g 32 kg/da doz uygulamasından elde edilirken, en düşük sıvı yağ oranı ise 3.07 g ile 8 ve 16 kg/da doz

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uygulamalarından elde edilmiştir. Çalışmamızın ikinci ürün olması nedeni ile Bulgularımız; Koca (2009), Özsisli (2010), Özata ve Kapar (2014), Kahraman (2016), Cengiz ve ark. (2014)'nın bulgularından daha düşük değerler elde edilmiştir.

Protein oranı bakımından varyasyon kaynaklarından çeşit, uygulama ve çeşit x uygulama interaksiyonu önemsiz bulunmuştur (Çizelge 3). Protein oranı Carpuzi çeşidinde % 10.3, Pioneer çeşidinde %10.6 olarak elde edilmiştir (Çizelge 4). Uygulamalarda önemli olmamakla birlikte protein oranı % 10.0 – 10.9 arasında değişim göstermiştir. Uygulamalarda en düşük protein oranı %10.0 ile 16 kg/da uygulamasından, en yüksek protein oranı ise %10.9 ile 8 kg/da doz uygulamasından elde edilmiştir. Önemsiz olmakla birlikte Azot dozu arttıkça ham protein oranının yükseldiğini (Koçak, 1991; Altıparmak, 2001) yapmış oldukları çalışmalarda bildirmişlerdir.

Nişasta oranı bakımından varyasyon kaynaklarından çeşit, uygulama ve çeşit x uygulama interaksiyonu önemsiz bulunmuştur (Çizelge 3). Nişasta oranı Carpuzi çeşidinde % 71.7, Pioneer çeşidinde %71.6 olarak elde edilmiştir (Çizelge 4). Uygulamalarda önemli olmamakla birlikte protein oranı % 71.3 – 72.1 arasında değişim göstermiştir. Uygulamalarda en düşük nişasta oranı %71.3 ile 8 kg/da uygulamasından, en yüksek nişasta oranı ise %72.1 ile 16 kg/da doz uygulamasından elde edilmiştir. Bulgularımız önemli olmamakla birlikte Özsisli (2010), Özata ve Kapar (2014) ve Kahraman (2016)'nın bulgularından daha yüksek değerler göstermiştir.

Hektolitre ağırlığı bakımından varyasyon kaynaklarından uygulama $p<0.05$ seviyesinde önemli, çeşit ve çeşit x uygulama interaksiyonu ise önemsiz bulunmuştur (Çizelge 3). Hektolitre ağırlığı Carpuzi çeşidinde 65.6 kg/hl, Pioneer çeşidinde %64.3 kg/hl olarak tartılmıştır (Çizelge 4). Uygulamalarda hektolitre ağırlığı 63.1 – 67.5 kg/hl arasında değişim göstermiştir. Uygulamalarda en düşük hektolitre ağırlığı 63.1 kg/hl ile 24 kg/da uygulamasından, en yüksek hektolitre ağırlığı ise 67.5 kg/da ile 32 kg/da doz uygulamasından elde edilmiştir. Bulgularımız; Koca (2009), Özsisli (2010), Elmalı ve Soylu (2008)'nun bulgularından daha düşük değerler elde edilmiştir.

SONUÇ

2022 yılında Kızıltepe koşullarında buğday hasadından sonra 2. Ürün olarak farklı iki çeşit ve dört azot dozu (8,16,24,32 kg/da) uygulanmak sureti ile azot dozlarının ikinci üründe mısır çeşitlerinde bitkisel özelliklere olan etkisi incelenmiştir. Varyans analiz sonuçlarına göre çeşit x uygulama interaksiyonun tüm özelliklere olan etkisi önemsiz bulunmuştur. Çalışma sonucunda elde edilen sonuçlara göre; önemli çıkan bazı özelliklerde Poineer çeşidi Carpuzi çeşidine göre daha yüksek değerlere sahip olmuştur. Azot gübresi uygulamalarında ise verim öğeleri bakımından en yüksek değerler dekara 32 kg azot gübresi uygulamasından, en düşük değerler 8 kg/da uygulamasından elde edilmiştir. Sonuç olarak Kızıltepe ikinci ürün mısır yetiştiriciliğinde veya yapılacak çalışmalarda dekara 24 kg azot dozunun uygun olduğu ve tavsiye edilmesi gerektiği aynı şekilde verimi etkileyen özellikler bakımından Pioneer çeşidinin öne

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çıktığı ve tercih edilmesi gerektiği sonucuna varılmıştır. Azot doz çalışmaları için gerçek sonuçlara ulaşmak için çalışmanın bir yıl daha sürdürülmesi ve dekara 32 kg N azot dozuna ilaveten dekara 36 kg N dozunun da denenmesi önerilmektedir.

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SOLUCAN GÜBRESİNİN MERCİMEK (*LENS CULİNARİS* MEDİK.) ÇEŞİTLERİNDE VERİM VE VERİMLE İLGİLİ ÖZELLİKLERE OLAN ETKİSİNİN BELİRLENMESİ

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ÖZET

Bu araştırma, Mardin ekolojik koşullarında 2018-2019 yetiştirme sezonunda solucan gübresinin mercimek çeşitlerinde verim ve verimle ilgili özelliklere olan etkisinin belirlenmesi amacıyla kuru şartlarda yürütürmüştür. Çalışmada GAP Uluslararası Tarımsal Araştırma ve Eğitim Merkezinde tescil edilmiş iki adet mercimek çeşidi (Fırat-87 ve Çağıl) kullanılmıştır. Organik gübre olarak üç farklı doz da (0, 60,120 ve 180 kg/da) solucan gübresi kullanılmıştır. Deneme tesadüf bloklarında bölünmüş deneme desenine göre üç tekerrürlü olarak yürütülmüştür. Çalışma sonucunda elde edilen sonuçlara göre; önemli çıkan tüm özelliklerde Çağıl çeşidi Fırat 87çeşidine göre daha yüksek değerlere sahip olmuştur. Solucan gübresi uygulamalarında ise tane verimi bakımından en yüksek verim 194.1 kg/da ile dekara 180 kg solucan gübresi uygulamasından, en düşük verim 144.4 kg/da ile 0 kg/da kontrol uygulamasından elde edilmiştir. Protein oranı %24.33-26.60 arasında değişmiş en düşük protein oranı kontrol uygulamasından, en yüksek protein oranı ise en yüksek solucan gübresinin uygulandığı (180 kg/da) uygulamadan elde edilmiştir. Bin tane ağırlığı 29.4-31.12 g arasında değişmiş en düşük değer kontrol uygulamasından, en yüksek değer ise 60 kg/da solucan gübresinin uygulandığı uygulamadan elde edilmiştir. Hasat indeksi %29.6-33.4 arasında değişirken, en yüksek hasat indeksi dekara 180 kg gübrenin uygulandığı dozdan elde edilmiş, en düşük hasat indeksi ise kontrol uygulamasından (0 kg/da) elde edilmiştir.

Anahtar Kelimeler: Mercimek, Çeşit, Solucan Gübresi, Özellik.

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DETERMINATION OF THE EFFECTS OF WORM FERTILIZER 0N YIELD AND YIELD TRAITS OF LENTIL (*Lens Culinaris* Medik.) CULTIVARS

ABSTRACT

This research was carried out in dry conditions in Mardin ecological conditions in the 2018-2019 growing season in order to determine the effect of worm manure on yield and yield related properties of lentil varieties. Two lentil varieties (Fırat-87 and Çağıl) registered in the GAP International Agricultural Research and Training Center were used in the study. Three different doses (0, 600, 1200 and 1800 kg/da) of worm manure were used as organic fertilizers. The trial was carried out in three replications according to the trial pattern divided in random blocks. According to the results obtained as a result of the study; In all the important traits, Çağıl variety has higher values than Fırat 87 variety. In worm fertilizer applications, the highest yield (1941 kg/ha^{-1}) was obtained from 1800 kg of worm fertilizer per hectar and the lowest grain yield (1444 kg/ha^{-1}) was obtained from and 0 kg/ha^{-1} control application. The protein ratio ranged between 24.33-26.60%, and the highest protein rate was obtained from the application where the highest worm fertilizer was applied (1800 kg/ha^{-1}), the lowest protein rate was obtained from the control application. The thousand grain weight changed between 29.4-31.12 g, the lowest value was obtained from the control application, and the highest value was obtained from the application where 600 kg/ha^{-1} worm manure was applied. The harvest index ranged from 29.6-33.4%, the highest harvest index was obtained from the dose of 1800 kg/ha^{-1} fertilizer per decare, while the lowest harvest index was obtained from the control application (0 kg / ha).

Keywords: Lentil, Cultivar, Worm Fertilizer Trait.

1. GİRİŞ

Mercimek (*Lens culinaris* Medik.) bitki gen kaynakları açısından hem Dünya hem de ülkemiz açısından önemli bir yere sahip olup; Türkiye, Filistin ve Suriye ile birlikte mercimeğin doğal gen merkezi konumundadır [Köse ve ark., 2017; Cubero, 1984]. Günümüzde dengeli ve sağlıklı beslenmek oldukça önemli olup, sağlıklı beslenmenin yolu doğal ürünlerin kullanılmasından geçmektedir. Gün geçtikçe nüfusun artması ve buna bağlı olarak üretim kaynaklarının azalması, çevre şartları ve gelir seviyesine bağlı olarak pek çok ülkede dengesiz beslenme sorunu ortaya çıkmaktadır (Doğan ve ark., 2014). Beslenmeye bağlı oluşan sorunlar, besin kaynaklarının (protein, vitamin, enerji ve minareler bakımından zengin) daha fazla üretimi ve düzenli tüketimi ile giderilebilecektir.

Mercimek üretim bakımından ülkemiz, 1990 yılların sonuna kadar Dünya'da ilk sırada yer

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aldığı gibi aynı zamanda uluslararası ticareti belirleyen bir konumdayken günümüzde bu üstünlüğü kaybetmiştir (Şahin, 2016). Mercimek yetiştiriciliği bölgemizde özellikle kuru tarım alanlarının değerlendirilmesinde ve münavebede kullanılması oldukça önemlidir. 2021 yılı verilerine göre Dünya'da ekim alanı olarak 5.5 milyon ha üretim, 5,6 milyon ton ve ortalama verim 100 kg/da olarak gerçekleşmiştir. 2022 yılı verilerine göre ülkemizde ekim alanı 2.998 bin dekar, üretim 400. 000 ton ve dekar başına elde edilen ortalama verim ise 133 kg/da olarak gerçekleşmiştir. Mardin ilimizde 174.000 dekar ekim alanı, 24.000 ton üretim, ortalama verim ise 137 kg/da olarak Türkiye ve Dünya ortalamasının üstündedir (Burucu, 2023).

Küresel ısınma ile birlikte yağışların gün geçtikçe azalması ve aylara dağılışındaki dalgalanmaların oluşması nedeni ile yağışa dayalı şartlarda tarla tarımında ciddi sorunları beraberinde getirmektedir. Yağışa dayalı şartlarda fazla su tüketen bitkilerin yetiştirilmesi imkansız hale gelmektedir. Bu nedenle kuraklık ve sıcaklık şartlarına dayanıklı, derin köklü aynı zamanda toprağı iyileştirme özelliği olan kırmızı mercimek yetiştiriciliği ön plana çıkmaktadır. Her geçen gün toprakların daha da fakirleşmesi bunun önemini daha da artırmaktadır. Tüm bu sorunlar karşısında münavebede toprağa azot bağlayan ve kazık kökleri vasıtasıyla toprağın yapısını koruyan veya iyileştiren, aynı zamanda ithal ettiğimiz bir ürün haline gelen kırmızı mercimeğin gerek ülkemizde gerekse Mardin ilinde farklı uygulamalar ile veriminin artırılmasına yönelik araştırmaların yapılması oldukça önemlidir.

Sürdürülebilir tarımda, yapay uygulamaların yerine üretim olanaklarını artıracak doğal uygulamaların çiftçiye kazandırmak sureti ile verim ve kalitenin artırılması alternatif bitki besleme ürünlerine bağlıdır. Bu açıdan yeterli sayıda çalışmanın olmadığı doğal uygulamaların farklı bitki türlerinin gelişimleri üzerine etkilerinin incelendiği çalışmalara daha fazla ağırlık vermek gerekmektedir. Bu kapsamda, mercimek yetiştiriciliği konusunda bölgemizde uygun çeşitlerin seçilmesinin yanında, doğal bazı gübreler (solucan gübresi) kullanarak onları geleneksel gübrelerle kıyaslamak verim ve kalite üzerindeki etkisini incelemek bir ihtiyaç olduğu görünmektedir. Tarımsal potansiyelimiz açısından büyük öneme sahip nadas alanların daraltmasında, ekim nöbetinde, sürdürülebilirliğin devam etmesinde tarımsal üretimin artırılmasının yanında verimli, kaliteli ve güvenilir ürünlerin üretimine ihtiyaç duyulmaktadır. Baklagillerin üretiminde önemli bir yere sahip olan Mardin ilimizde "Sürdürülebilir Tarım" kapsamında, organik gübrelerden biri olan solucan gübresinin mercimek bitkisinde kullanım olanaklarının araştırılması amaçlanmıştır. Elde edilecek iyi bir sonuç ile Mardin ve çevre illerde kimyasal gübre kullanımını azaltmak, tüketicilerin sağlığını korumak, bölge ve ülkemizin

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ekonomisini geliştirmek ve sürdürülebilir tarım bilincinin oluşmasına katkı sağlamak üzere bu çalışma yürütülmüştür.

2. MATERYAL VE METOT

Bu araştırma 2018-2019 üretim sezonunda Mardin ili Artuklu ilçesine bağlı Çağıl köyünde çiftçi tarlasında yürütülmüştür. Bu çalışmada bitki materyali olarak bölgede tercih edilen 2 adet mercimek çeşidi kullanılmıştır (Çağıl ve Fırat 87).

2.1 Araştırma Yerinin İklim Özellikleri

Mardin Artuklu ilçesine ait 2018-2019 yetiştirme sezonu ile uzun yıllar meteorolojik verileri Çizelge 1'de gösterilmiştir.

Çizelge 1. Araştırma lokasyonuna ait ortalama aylık meteorolojik veriler

Aylar	Sıcaklık (°C)		Yağış (mm)		Nispi Nem (%)	
	2018-2019	UYO	2018-2019	UYO	2018-2019	UYO
Kasım	11.5	10.7	27.2	69.7	35.2	57.0
Aralık	3.2	5.3	128.4	106.9	71.3	67.0
Ocak	2.2	3.0	146.3	112.3	74.1	70.0
Şubat	8.5	4.0	3.6	108.1	66.2	66.0
Mart	10.0	8.0	119.8	96.8	59.1	61.0
Nisan	16.8	13.4	27.1	83.6	41.3	56.0
Mayıs	19.8	19.6	20.0	40.4	42.0	45.0
Haziran	26.2	25.6	1.0	4.9	28.2	34.0
Toplam			473.4	655.3		
Ortalama	14.0	11.8			52.2	55.8

Çizelge 1'de, araştırmanın yürütüldüğü yıl ile uzun yıllar ortalama sıcaklık değerleri incelendiğinde araştırmanın yürütüldüğü yıl daha sıcak geçmiş ve ortalama yağış daha düşük gerçekleşmiştir. Nisbi nem değerlerinde uzun yıllar ortalamasının daha yüksek olduğu görünmektedir. Ancak yetiştirme sezonundaki yağış ve aylara dağılışı mercimek yetiştiriciliği için her hangi bir sorun teşkil etmemiştir.

2.2 Araştırmada Kullanılan Gübre ve Özellikleri

Araştırmada kullanılan solucan gübresinin içerdiği makro ve mikro besin elementleri ve değerleri Çizelge 2'de verilmiştir. Araştırmada 1. Kontrol (0 kg/da), 1.Uygulama (60 kg/da), 2. Uygulama (120 kg/da) ve 3. Uygulama (180 kg/da) solucan gübresi parsellere uygulanmıştır.

Çalışmanın yapıldığı deneme alanında farklı toprak derinliğinde alınan toprak örneklerinin bazı fiziksel ve kimyasal analizleri MAÜ Bilimsel araştırma merkezinde yapılarak elde edilen

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sonuçlar Çizelge 3'te verilmiştir. Farklı toprak derinliklerinden alınan toprakların analiz sonuçlarına göre, toprak bünyesi kili-tınlı yapıda, toprak rengi kahverengi, pH değeri 8 civarı olup, alkalin reaksiyon göstermektedir. Organik madde içerikleri bakımında çok az, kireç değeri fazla, hafif tuz yapısında olup, potasyum içeriği açısında yüksek olduğu fosfor bakımında ise olması gerekenin altında bir değer olduğu, potasyum içeriği yüksek, fosfor içeriği yeterli seviyenin altında, alt toprak katmanında ise az bulunmuştur.

Çizelge 2. Araştırmada kullanılan Solucan gübrenin içeriği ve değerleri

Özellikleri	Miktar
Organik madde (%)	49.60
Azot (N) (%)	2.12
Fosfor (P_2O_5) (%)	1.21
Potasyum (K_2O) (%)	1.60
Organik karbon (%)	26.20
pH	7.40
Nem (%)	12.6
Demir (Fe) (%)	0.56
Magnezyum Mg (%)	4.60
Sodyum Na (%)	0.60
Mangan (%)	0.05

Çizelge 3. Deneme alanı topraklarının bazı fiziksel ve kimyasal özellikleri

Derinlik (cm)	Kum (%)	Silt (%)	Kil (%)	Tekstür Sınıfı	pH (1:2.5 su)	Kireç (%)	Fosfor (ppm)	Potasyum (me/100g)	Organik madde (%)
0-20	26.5	3.2	37.2	Killi-Tınlı	8.01	16.9	6.29	2.84	1.78
0-40	28.7	3.1	39.2	Killi-Tınlı	8.27	13.5	4.02	1.25	1.51

2.3 Ekim ve Bakım İşleri

Araştırma 2018-2019 yetiştirme sezonunda kışlık olarak yürütülmüştür. Çalışma Tesadüf Bloklarında Bölünmüş Parseller deneme desenine göre üç tekerrürlü olarak yürütülmüştür.

Denemede toplam 24 parsel olacak şekilde kurulmuştur. Her bir parsel 5 sıradan oluşmuş, sıra arası 20 cm'dir. Parsel aralarında boşluk olarak 1.5 m, bloklar arasındaki mesafe ise 2 m olarak bırakılmıştır. Parsel alanı; 1.0 m x 5.0 m = 5.0 m², ekim normu olarak m²'ye 350 tohum kullanılmıştır. Denemede kullanılan çeşitler ana parsellerde, solucan gübre dozları alt parsellerde yer almıştır. Solucan gübresi parsele atıldıktan sonra tırmık ile toprağa iyi bir şekilde karıştırılmıştır. Deneme 24.11.2018 tarihinde el ile ekilmiş, 29.05.2019 tarihinde ise hasadı yapılmıştır. Yabancı ot kontrolü için iki sefer elle yabancı ot mücadelesi yapılmıştır. Çalışma yağışa dayalı şartlarda yürütülmüştür.

Hasat olgunluğuna gelen bitkiler her parselden parselleri temsil eden 10 adet bitki alınarak etiketlenmiş ve örnekleme yapılarak bitki özellikleri incelenmiştir. Hasat için geri kalan parsellerde 5 sıradan her iki yandaki birer sıra ve parsel başlarından 50 cm'nin içerisinde bulunan bitkiler kenar tesiri olarak gözlem dışı bırakıldıktan sonra hasat işlemi gerçekleştirilmiştir. Hasat edilen bitkiler 5 gün kurutulduktan sonra elle harman edilmiştir. Ölçüm ve tartım işlemleri 0.6m x 4 m= 2.4 m2'lik alan üzerinden yapılmıştır.

2.4 Verilerin Değerlendirilmesi

Araştırmada; bitki boyu (BB), ilk bakla yüksekliği (İBY), dal sayısı (DS), bakla sayısı (BS), baklada tane sayısı (BTS), bin tane ağırlığı (BTA), tane verimi (TV), biyolojik verim (BV), hasat indeksi (Hİ), protein oranı (PO) incelenmiştir. Araştırmaya ait veriler J.M.P 5.0 (Copyright © 2007 SAS Institute Inc.) programında Tesadüf Blokları Bölünmüş Parseller Deneme Desenine göre analizleri yapılmış, ortalamalar A.Ö.F. testi ile gruplandırılmıştır.

3. ARAŞTIRMA BULGULARI

Araştırmada incelenen özelliklerin varyans analiz sonuçlarına göre dal sayısı hariç diğer parametreler bakımından çeşit ve uygulamalar istatistiki açıdan önemli($p<0.1$, $p<0.5$), çeşit x uygulama interaksiyonu ise önemsiz olduğu anlaşılmıştır (Çizelge 4).

Çizelge 4. Özelliklere ait varyans analiz sonuçları (Kareler toplamı)

VK	SD	BB	İBY	DS	BS	BTS	BTA	TV	BV	Hİ	PO
Çeşit	1	73.2*	207.7*	0.09öd	110.5*	136.3**	35.8**	1157.9*	555.8	26.0*	12.5*
Hata 1	4	5.5	49.7	0.13	30.7	39.2	1.1	418.0	1073.0	5.2	2.1
Gübre	3	133.2**	52.7öd	0.00öd	136.5*	143.4 **	13.0*	7731.0**	28794.4*	43.9**	15.8**
Ç*G İnt.	3	7.4öd	3.0öd	0.15öd	28.8öd	26.7öd	4.5öd	17.7öd	75.0öd	1.9öd	0.2öd
Model	11	219.3	313.1	0.39	306.5	345.6	54.3	9324.6	30498.3	77.0	30.6
Hata 2	12	36.0	65.1	0.35	64.8	86.9	6.7	670.7	4110.5	15.3	3.9
Toplam	23	255.3	378.2	0.74	371.3	432.5	60.9	9995.3	34608.8	92.3	34.5
D.K(%)		**4.1**	**10.0**	**7.72**	**11.7**	**11.4**	**2.43**	**4.5**	**3.29**	**3.57**	**2.25**

*:p<0.05,**:<0.01,öd: önemli değil, VK: varyasyon kaynakları, SD: serbestlik derecesi, BB: bitki boyu, İBY: ilk bakla yüksekliği, DS: dal sayısı, BS: bakla sayısı, BTS: baklada tane sayısı, BTA: bin tane ağırlığı, TV: tane verimi, BV: biyolojik verim, Hİ: hasat indeksi, PO: protein oranı

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Bitki boyu bakımından varyasyon kaynaklarından çeşit p<0.5, uygulama p<0.1 seviyesinde önemli, çeşit*uygulama interaksiyonu ise önemsiz bulunmuştur (Çizelge 5). Bitki boyu Fırat 87 çeşidinde 44.1 cm, Çağıl çeşidinde 40.6 cm olarak ölçülmüştür (Çizelge 5). Uygulamalarda ise bitki boyu 39.6 -45.6 cm arasında olduğu hesaplanmıştır. Uygulamalarda en yüksek bitki boyu 45.5 cm ile 180 kg/da doz uygulamasından elde edilirken 120 kg/da doz uygulaması ile aralarında fark tespit edilememiştir. En düşük bitki boyu ise 39.6 kg/da ile kontrol uygulamasından elde edilmiştir.

Çizelge 5. Çalışmada gözlemlenen parametrelere ait veriler

Bitki boyu(cm)	Uygulamalar (Solucan gübresi) (kg/da)	Çeşitler			İlk Bakla Yüksekliği(cm)	Uygulamalar (Solucan gübresi) (kg/da)	Çeşitler		
		Fırat 87	Çağıl	Ort.			Fırat 87	Çağıl	Ort.
	0	42.0	37.3	39.6 B		0	24.0	17.7	20.8
	60	42.5	38.9	40.7 B		60	27.0	20.6	23.8
	120	45.7	41.7	43.7 A		120	26.7	20.5	23.6
	180	46.4	44.7	45.6 A		180	27.2	22.5	24.8
	Ortalama	44.1 A	40.6 B			Ortalama	26.2 A	26.3 B	
AÖF(0.05)	Çeşit: 1.3, Uyg.:2.2, Çeş. x Uyg: 3.1					Çeşit: 4.0, Uyg.:2.9, Çeş. x Uyg: 4.1			
Dal sayısı(adet)	0	2.23	2.23	2.23	Bakla Sayısı(Adet)	0	18.1	18.7	18.4 B
	60	2.17	2.23	2.20		60	14.9	20.3	17.6 B
	120	2.37	2.07	2.22		120	16.4	22.5	19.5 B
	180	2.37	2.10	2.23		180	21.3	26.3	23.8 A
	Ortalama	2.28	2.16			Ortalama	17.7 B	22.0 A	
AÖF(0.05)	Çeşit: 0.2, Uyg.:0.2, Çeş. x Uyg: 0.3					Çeşit: 3.1, Uyg.:2.9, Çeş. x Uyg: 4.1			
BitkideTane Sayısı(Adet)	0	20.7	23.0	21.9 B	Bin Tane Ağırlığı(g)	0	27.5	31.3	29.4 B
	60	17.6	25.2	21.4 B		60	29.0	31.7	30.4 A
	120	20.6	26.5	23.6 B		120	30.3	32.2	31.3 A
	180	25.9	29.3	27.6 A		180	30.4	31.9	31.1A
	Ortalama	21.2 B	26.0 A			Ortalama	29.3 B	31.8 A	
AÖF(0.05)	Çeşit: 13.9. Uyg.:8.14. Çeş. x Uyg: 14.10					Çeşit: 6.8, Uyg.:2.1, Çeş. x Uyg: 1.3			
Tane verimi (kg/da)	0	136.3	152.5	144.4 D	Biyolojik Verim	0	481.8	491.7	486.8 D
	60	155.2	168.9	162.1 C		60	509.9	518.2	514.1 C
	120	166.3	177.7	172.0 B		120	532.2	547.3	539.8 B
	180	187.0	201.2	194.1 A		180	578.1	583.5	580.8 A
	Ortalama	161.2 B	175.1 A			Ortalama	525.5	535.2	
AÖF(0.05)	Çeşit: 11.6, Uyg.:9.4, Çeş. x Uyg: 13.3					Çeşit: 11.6, Uyg.:9.4, Çeş. x Uyg: 13.3			
Hasat İndeksi(%)	0	28.2	31.0	29.6 C	Protein Oranı(%)	0	23.8	24.9	24.3 C
	60	30.4	32.6	31.5 B		60	24.5	26.1	25.3 B
	120	31.3	32.5	31.9 B		120	24.5	25.9	25.2 B
	180	32.3	34.5	33.4 A		180	25.8	27.4	26.6 A
	Ortalama	30.6 B	32.6 A			Ortalama	24.6	26.1	
AÖF(0.05)	Çeşit: 1.3, Uyg.:4.9, Çeş. x Uyg: 2.2					Çeşit: 0.8, Uyg.:0.7, Çeş. x Uyg: 1.0			

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Yapılan benzer çalışmalarda Stoilova (1998), çeşit özelliğinin ve genetik yapının bitki boyu üzerinde etkili olabileceği, ayrıca diğer bazı araştırıcılar bitki boyunun araştırmanın yürütüldüğü lokasyonun iklim ve toprak yapısından etkilenebileceğini bildirmiştir (Zulkadir, 2015; Doğan ve Doğan, 2020). Yapılan benzer çalışmalarda uygulanan solucan gübresinin bitki boyu üzerinde olumlu etki yaptığı ve kontrol parsellerine göre solucan gübresi verilen parsellerde bitki boyunun daha çok uzadığını bildirerek çalışmamızı teyit etmişlerdir (Saket ve ark., 2014; Doğan 2019).

İlk bakla yüksekliği bakımından varyasyon kaynaklarından çeşit $p<0.5$ seviyesinde önemli, uygulama ile çeşit*uygulama interaksiyonu ise önemsiz bulunmuştur (Çizelge 5). İlk bakla yüksekliği Fırat 87 çeşidinde 26.2 cm, Çağıl çeşidinde 20.3 cm olarak ölçülmüştür (Çizelge 6). Uygulamalarda ise ilk bakla yüksekliği 20.8 -24.8 cm arasında değişim göstermiştir. Uygulamalarda ilk bakla en yüksek 24.8 cm ile 180 kg/da doz uygulamasından, en düşük ise 20.8 kg/da ile kontrol uygulamasından elde edilmiştir. Yapılan benzer çalışmalarda Köse (2018), çeşit özelliğinin ve genetik yapının ilk bakla yüksekliği üzerinde etkili olabileceğini, ayrıca diğer bazı araştırıcılar ilk bakla yüksekliğinin araştırmanın yürütüldüğü lokasyondaki sıcaklık ve kuraklıktan etkilenebileceğini bildirmiştir (Hakkoymaz, 2018; Köse, 2018). Yapılan benzer çalışmalarda uygulanan solucan, organik veya inorganik gübrelerin ilk bakla yüksekliği üzerinde olumlu etki yaptığı ve kontrol parsellerine göre solucan gübresinin uygulandığı parsellerde ilk bakla yüksekliğinin daha çok uzadığını ve hasatta kolaylık sağlayabileceğini bildirerek çalışmamızı teyit etmişlerdir (Yeşilbaş 2015; Doğan 2019).

Dal sayısı bakımından varyasyon kaynaklarından çeşit, uygulama ve çeşit*uygulama interaksiyonu önemsiz bulunmuştur (Çizelge 5). Dal sayısı Fırat 87 çeşidinde 2.28 cm, Çağıl çeşidinde 2.16 adet/bitki olarak ölçülmüştür (Çizelge 6). Uygulamalarda ise dal sayısı 2.20 - 2.23 adet/bitki arasında değişim göstermiştir. Uygulamalarda en yüksek dal sayısı 2.23 adet/bitki ile 180 kg/da doz uygulamasından ve kontrolden elde edilirken en düşük dal sayısı ise 2.20 adet/bitki ile 60 kg/da uygulamasından elde edilmiştir. Yapılan benzer çalışmalarda Şehirali (1988), çeşit özelliği, genetik yapı, çevre ve toprak özelliğinin ana dal sayısı üzerinde etkili olabileceğini bildirmiştir. Ayrıca benzer çalışmalarda uygulanan solucan, organik veya inorganik gübrelerin ana dal sayısı üzerindeki etkisinin önemsiz olduğunu bildirerek çalışmamızı teyit etmişlerdir 8Saket ve ark., 2014; Singh ve ark., (2012).

Bakla sayısı bakımından varyasyon kaynaklarından çeşit ve uygulama $p<0.1$ seviyesinde önemli, çeşit*uygulama interaksiyonu ise önemsiz bulunmuştur (Çizelge 5). Bakla sayısı Fırat 87 çeşidinde 17.7 adet/bitki, Çağıl çeşidinde 22.0 adet/bitki olarak sayılmıştır (Çizelge 6).

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Uygulamalarda ise bakla sayısı 17.6 -23.8 adet/bitki arasında değişim göstermiştir. Uygulamalarda en yüksek bakla sayısı 23.8 adet/bitki ile 180 kg/da doz uygulamasından elde edilirken en düşük bakla sayısı ise 17.6 adet/bitki ile 60 kg/da doz uygulamasından elde edilirken kontrol ve 120 kg/da doz uygulaması ile aralarında fark görülmemiş ve aynı grupta yer almışlardır. Yapılan benzer çalışmalarda Doğan ve Doğan (2020), bakla olum döneminde sıcaklığın aniden yükselmesi bakla sayısını düşürebileceğini, ayrıca diğer bazı araştırıcılar bakla sayısının fazla olması istenen bir durum olup verimi artıran bir unsur olduğunu bildirmiştir (Abo-Hegazy ve ark., 2012). Yapılan benzer çalışmalarda uygulanan solucan, organik veya inorganik gübrelerin bakla sayısı üzerinde olumlu etki yaptığı ve kontrol parsellerine göre solucan gübresinin uygulandığı parsellerde bakla sayısını artırdığını ve verimi artırabileceğini bildirerek çalışmamızı teyit etmişlerdir (Singh ve ark., 2012; Amin ve Moghadasi 2015; Doğan (2019).

Bitkide tane sayısı bakımından varyasyon kaynaklarından çeşit ve uygulama $p<0.1$ seviyesinde önemli, çeşit*uygulama interaksiyonu ise önemsiz bulunmuştur (Çizelge 5). Baklada tane sayısı Fırat 87 çeşidinde 21.2 adet/bakla, Çağıl çeşidinde 26.0 adet/bakla olarak sayılmıştır (Çizelge 6). Uygulamalarda ise baklada tane sayısı 21.4 -27.6 adet/bakla arasında değişim göstermiştir. Uygulamalarda en yüksek baklada tane sayısı 27.6 adet/bakla ile 180 kg/da doz uygulamasından elde edilirken, en düşük baklada tane sayısı ise 21.4 adet/bakla ile 60 kg/da doz uygulamasından elde edilirken kontrol ve 120 kg/da doz uygulaması ile aralarında fark görülmemiş ve aynı grupta yer almışlardır. Yapılan benzer çalışmalarda Abo-Hegazy ve ark. (2012), baklada tane sayısı istenen bir durum olup verimi artıran özelliklerden olduğunu, ayrıca benzer çalışmalarda uygulanan solucan, organik veya inorganik gübrelerin baklada tane sayısının üzerinde olumlu etki yaptığı ve kontrol parsellerine göre solucan gübresinin uygulandığı parsellerde baklada tane sayısını artırdığını ve verimi artırabileceğini bildirerek çalışmamızı teyit etmişlerdir (Saket ve ark., 2014; Amin ve Moghadasi 2015; Doğan 2019).

Bin tane ağırlığı bakımından varyasyon kaynaklarından çeşit $p<0.1$ ve uygulama $p<0.5$ seviyesinde önemli, çeşit*uygulama interaksiyonu ise önemsiz bulunmuştur (Çizelge 5). Bin tane ağırlığı Fırat 87 çeşidinde 29.3 g, Çağıl çeşidinde 31.2 g olarak sayılmıştır (Çizelge 6). Uygulamalarda ise bin tane ağırlığı 29.4 -31.2 g arasında değişim göstermiştir. Uygulamalarda en düşük bakla sayısı ise 29.4 g ile kontrol uygulamasından, en yüksek bin tane ağırlığı ise 31.2 g ile 120 kg/da doz uygulamasından elde edilirken 60 kg/da doz uygulaması ve 180 kg/da doz uygulaması ile aralarında fark görülmemiş ve aynı grupta yer almışlardır. Yapılan benzer çalışmalarda Hakkoymaz, (2018), genotiplerin genetik yapısına bağlı olarak değişebilen bin

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tane ağırlığı ekolojik faktörler ile yetiştirme tekniklerinden de etkilenebileceğini, ayrıca diğer bazı araştırıcılar bin tane ağırlığı ile verim arasında pozitif bir ilişki olduğunu bildirmişlerdir (Sharma ve ark., 2014; Nath ve ark., 2014). Yapılan benzer çalışmalarda uygulanan solucan, organik veya inorganik gübrelerin bin tane ağırlığı üzerinde olumlu etki yaptığı ve kontrol parsellerine göre solucan gübresinin uygulandığı parsellerde bin tane ağırlığını artırdığını ve verimi artırabileceğini bildirerek çalışmamızı teyit etmişlerdir (Saket ve ark., 2014; Singh ve ark., 2012).

Tane verimi bakımından varyasyon kaynaklarından çeşit $p<0.5$ ve uygulama $p<0.1$ seviyesinde önemli, çeşit*uygulama interaksiyonu ise önemsiz bulunmuştur (Çizelge 5). Tane verimi Fırat 87 çeşidinde 161.2 kg/da, Çağıl çeşidinde 175.1 kg/da olarak elde edilmiştir (Çizelge 6). Uygulamalarda ise tane verimi 144.4 -194.1 kg/da arasında değişim göstermiştir. Uygulamalarda en düşük tane verimi 144.4 kg/da ile kontrol uygulamasından, en yüksek tane verimi ise 194.1 kg/da ile 180 kg/da doz uygulamasından elde edilmiştir. Yapılan benzer çalışmalarda Koç (2015), genotiplerin genetik yapısına bağlı olarak değişebilen tane verimi ekolojik faktörler ile yetiştirme tekniklerinden de etkilenebileceğini, ayrıca çiçeklenme döneminde ve tane dolum dönemindeki yüksek sıcaklıktan etkilenmeyen çeşitlerde verimin artabileceğini bildirmiştir. Aynı ve benzer baklagil bitkilerinde yapılan çalışmalarda uygulanan solucan, organik veya inorganik gübrelerin verim üzerinde olumlu etki yaptığı ve kontrol parsellerine göre solucan gübresinin uygulandığı parsellerde verimi artırdığını bildirerek çalışmamızı teyit etmişlerdir (Saket ve ark.,(2014; Singh ve ark., 2012; Amin ve Moghadasi, 2015; Doğan (2019).

Biyolojik verim bakımından varyasyon kaynaklarından uygulama $p<0.5$ seviyesinde önemli, çeşit ve çeşit*uygulama interaksiyonu ise önemsiz bulunmuştur (Çizelge 5). Biyolojik verim Fırat 87 çeşidinde 525.5 kg/da, Çağıl çeşidinde 535.2 kg/da olarak elde edilmiştir (Çizelge 6). Uygulamalarda ise biyolojik verim 486.8 -580.8 kg/da arasında değişim göstermiştir. Uygulamalarda en düşük biyolojik verimi 486.8 kg/da ile kontrol uygulamasından, en yüksek biyolojik verim ise 580.8 kg/da ile 180 kg/da doz uygulamasından elde edilmiştir. Yapılan benzer çalışmalarda Hakkoymaz (2018), hayvan beslemesinde biyolojik verimin önemli olduğunu, ayrıca biyolojik verimin çeşitlere göre değişebileceğini bildirmiştir. Aynı ve benzer baklagil bitkilerinde yapılan çalışmalarda uygulanan solucan, organik veya inorganik gübrelerin biyolojik verim üzerinde olumlu etki yaptığı ve kontrol parsellerine göre solucan gübresinin uygulandığı parsellerde biyolojik verimi artırdığını bildirerek çalışmamızı teyit etmişlerdir (Sadeghipour 2017). Mercimeğin besleyiciliği iyi bilinmesine rağmen son

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20 yıla kadar ıslahçılar tarafından biyomas üretimi dikkate alınmadığı bildirilmiştir (Biçer ve Şakar 2014).

Hasat indeksi bakımından varyasyon kaynaklarından çeşit $p>0.5$, uygulama $p<0.1$ seviyesinde önemli, çeşit ve çeşit*uygulama interaksiyonu ise önemsiz bulunmuştur (Çizelge 5). Hasat indeksi Fırat 87 çeşidinde % 30.6, Çağıl çeşidinde 32.6 olarak elde edilmiştir (Çizelge 6). Uygulamalarda ise hasat indeksi % 29.6 - 33.4 arasında değişim göstermiştir. Uygulamalarda en düşük hasat indeksi %29.6 ile kontrol uygulamasından, en yüksek hasat indeksi ise %33.4 ile 180 kg/da doz uygulamasından elde edilmiştir. Yapılan benzer çalışmalarda Koç (2015), genotiplerin genetik yapısına bağlı olarak değişebilen tane verimi ekolojik faktörler ile yetiştirme tekniklerinden de etkilenebileceğini bildirmiştir. Aynı ve benzer baklagil bitkilerinde yapılan çalışmalarda uygulanan solucan, organik veya inorganik gübrelerin hasat indeksi üzerinde olumlu etki yaptığı ve kontrol parsellerine göre solucan gübresinin uygulandığı parsellerde hasat indeksini artırdığını bildirerek çalışmamızı teyit etmişlerdir (Saket ve ark., 2014; Singh ve ark., 2012).

Protein oranı bakımından varyasyon kaynaklarından çeşit $p<0.5$, uygulama $p<0.1$ seviyesinde istatistiki açıdan önemli, çeşit x uygulama interaksiyonu ise önemsiz bulunmuştur (Çizelge 5). Protein oranı Fırat 87 çeşidinde % 24.6, Çağıl çeşidinde %26.1 olarak elde edilmiştir (Çizelge 6). Uygulamalarda ise protein oranı % 24.3 – 26.6 arasında değişim göstermiştir. Uygulamalarda en düşük protein oranı %24.3 ile kontrol uygulamasından, en yüksek protein oranı ise %26.6 ile 180 kg/da doz uygulamasından elde edilmiştir. Yapılan benzer çalışmalarda Köse (2018), tanede protein oranı kalıtım derecesi yüksek, ancak çevresel faktörler ve yetiştirme tekniklerine bağlı olarak da değişim etkilenebileceğini bildirmiştir. Aynı ve benzer baklagil bitkilerinde yapılan çalışmalarda uygulanan solucan, organik veya inorganik gübrelerin protein oranı üzerinde olumlu etki yaptığı ve kontrol parsellerine göre solucan gübresinin uygulandığı parsellerde protein oranını artırdığını bildirerek çalışmamızı teyit etmişlerdir (Saket ve ark., 2014; Doğan, 2019).

4. SONUÇLAR

Bu araştırma, Mardin koşullarında solucan gübresinin farklı uygulamaları ile mercimek bitkisinde verim, verim öğeleri ile bazı kalite kriterleri üzerindeki etkileri incelenmiştir. İncelenen birçok özellik bakımından çeşitler ve uygulamalar arasındaki fark önemli bulunurken interaksiyonun etkisi tüm özelliklerde önemsiz bulunmuştur. Araştırma sonuçları dekara 180 kg solucan gübresinin uygulandığı 3. Uygulamanın mercimek çeşitlerinde etkisini belirgin bir

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şekilde göstermiş ve birçok özelliği olumlu yönde etkilemiştir. Özellikle dekara 180 kg solucan gübresi uygulamasının (3. Uygulama) mercimek yetiştiriciliğinde verim ve verim özelliklerini iyileştirmek için uygun olduğu sonucuna varılmıştır. Solucan gübreleri de bunlardan biridir. Bu araştırma sonuçları solucan gübresinin etkinliği ve kullanımı ile ilgili bize bazı ipuçları vermiştir. Organik gübre olarak mercimek yetiştiriciliğinde dekara 180 kg solucan gübresinin kullanılması önerilmektedir. Ayrıca mercimek yetiştiriciliğinde solucan gübresinin uygulamalarında pik noktayı yakalayabilmek için dekara 180 kg'a ilaveten bazı dozların da çalışmalarda kullanılmasında fayda olduğu sonucuna varılmıştır.

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METAVERSE'İN PSİKOSOSYAL RİSKLER AÇISINDAN DEĞERLENDİRİLMESİ

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ÖZET

Dijital ekonominin istihdam üzerine etkisi, iş sağlığı ve güvenliği açısından da dikkate alınmalıdır. Sanal gerçeklik, bize ideal hayatlar sunarken, aynı zamanda teknoloji bağımlılığı, gerçeklik algısının bozulması, benlik algısının kaybedilmesi, zaman kavramının yitirilmesi gibi psikososyal riskler de yaşamımıza getirmektedir. Bu çalışmada, Metaverse teknolojisi ile çalışan işgücünün karşılaşacağı psikososyal riskler belirlenmeye, iş hayatının değişimi iş sağlığı ve güvenliği perspektifinden değerlendirilmeye ve metaverse ile ilişkisi konusunda bir kaynak oluşturulmaya çalışılmaktadır. "Metaverse", "occupational health and safety" "Science Direct" n=3 ve "Springer" n=83 "Taylor Fancis" n=3 or ve and bağlaçları ile veri tabanlarında aratılmıştır. Sonuçlar, iş yaşamındaki dönüşümü fırsat ve tehditleri, güçlü ve zayıf yanları ile iç ve dış kaynaklarla yararlı ve zararlı amaçları SWOT analizi ile bütünsel olarak ortaya konmuştur. Literatür taramasında, metaverse ile ilişkili psikososyal riskler geliştiği bulunmuştur. Gerçeklik ve benlik algısını bozarak zaman kavramını etkileyebilir. Bu da bilişsel işlevlerde azalmaya neden olabilir. Metaverse'de çalışanların haklarını, sorumluluklarını, yükümlülüklerini ve güvenliklerini koruyacak yasal çerçeveler oluşturulmalıdır. Yanı sıra psikososyal riskleri önlemek ve yönetmek için, işverenlerin metaverse çalışma ortamını düzenli olarak değerlendirmeleri, çalışanların psikososyal durumlarını ölçmeleri ve gerekli müdahaleleri yapmaları psikososyal durumu ölçmek içinde, iş memnuniyeti, tükenmişlik, iş tatmini ve aidiyet gibi değişkenleri içeren standart testler kullanmaları önerilir. Bu testlerin metaverse ortamına uygun olarak uyarlanması ve geçerlilik ve güvenilirliklerinin test edilmesi önemlidir. Çalışanlara gerçeklik algısı hakkında farkındalık eğitimleri verilebilir.

Anahtar Kelimeler: Metaverse, iş sağlığı ve güvenliği, psikososyal risk

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CELLULAR METABOLIC NETWORKS AND CONSTRUCTAL LAW

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ABSTRACT

The Constructal law explains life and evolution in terms of power, movement, or flow, flow configuration, reconfiguration to increase efficiency, and heat production. It attempts to build a universal law governing all movement patterns on Earth and bridge the gap between physics and biology. Within cells, the movement of matter cannot be explained by fluid mechanics alone because thousands of distinct biochemical reactions take place in each cell. Therefore, metabolic transformations are important components of flow within cells. In this study, I tried to integrate chemistry into the biophysical Constructal law. Metabolic reactions were connected to form hypothetical pathways, and metabolic pathways formed a cellular metabolic network where flow is defined as the flux of reactions. Each species, or even each tissue, has a different set of enzymes - biochemical catalyzers - leading to different metabolic capabilities. Although the branching of a metabolic network is hypothetical, and its characterization is incomplete, an investigation of biochemical reactions and their Gibbs Free Energies, as well as cross-species topological investigation of metabolic networks, provides interesting generalizations for the Constructal law.

Keywords : Metabolic Networks, Constructal Law, Gibbs Free Energy

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SEMIPRIME IDEALS AND MULTIPLICATIVE GENERALIZATION DERIVATIONS

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ABSTRACT

A map $F: R \to R$ is called a multiplicative generalized derivation if there exists a map $d: R \to R$ such that $F(xy) = F(x)y + xd(y)$, for all $x, y \in R$. Accordingly, let R be a ring, P a semiprime ideal of R. Then, d is P-commuting map on R, if R admits a multiplicative generalized derivation F associated with a nonzero map d, m,n$\in Z$ such that: (i) F([x,y])±[x,y]∈P, (ii) F([x,y])±(xoy)∈P, (iv) F(xoy)±(xoy)∈P, (v)F(xoy)±[x,y]∈P, (vi) F([x,y])±x^m[x,y] x^n∈P, (vii) F(x∘y)± x^m(x∘y) x^n∈P, $\forall x, y \in R$.

K**eywords**: semiprime ring, derivation, multiplicative generalization derivation.

1. INTRODUCTION

Throughout this article, R will represent an associative ring. Recall that a proper ideal P of R is said to be semiprime if for any x∈ R, xRx ⊆ P implies that x ∈ P. Therefore, R is called a semiprime ring if for any x, y ∈ R, xRx = (0) implies that x = 0. For any $x, y \in R$, the symbol $[x, y]$ stands for the commutator $xy - yx$ and the symbol $x \circ y$ denotes for the anti-commutator $xy + yx$. An additive mapping $d: R \to R$ is called a derivation if $d(xy) = d(x)y + xd(y)$ holds for all $x, y \in R$. For a fixed $a \in R$, the mapping $I_a: R \to R$ given by $I_a(x) = [a, x]$ is a derivation which is said to be an inner derivation. An additive function $F: R \to R$ is called a generalized inner derivation if $F(x) = ax + xb$ for fixed $a, b \in R$. For such a mapping F, it is easy to see that

$F(xy) = F(x)y + x[y, b] = f(x)y + xI_b(y)$ for all $x, y \in R$.

This observation leads to the following definition given by Bresar: An additive mapping $F: R \to R$ is called a generalized derivation if there exists a derivation $d: R \to R$ such that

F(xy)=F(x)y+xd(y), for all x,y∈R.

The commutativity of prime or semiprime rings with derivation was initiated by Posner. Thereafter, several authors have proved commutativity theorems of prime or semiprime rings with derivations. The notion of multiplicative derivation was introduced by Daif motivated by Martindale. $d: R \to R$ is called a multiplicative derivation if $d(xy) = d(x)y + xd(y)$ holds for all $x, y \in R$. These maps are not additive. Goldman and Semrl gave the complete description of these maps. We have $R = C[0,1]$, the ring of all continuous (real or complex valued) functions and define a map $d: R \to R$ such as

$$d(f)(x) = \begin{cases} f(x)\log|f(x)|, & f(x) \neq 0 \\ 0, otherwise \end{cases}.$$

It is clear that d is multiplicative derivation, but d is not additive. Inspired by the definition multiplicative derivation, the notion of multiplicative generalized derivation was extended by Daif and Tamman El-Sayiad as follows:

F:R→R is called a multiplicative generalized derivation if there exists a derivation d:R→R such that $F(xy) = F(x)y + xd(y)$, for all $x, y \in R$. Dhara and Ali gave a slight generalization of this definition taking g is any map (not necessarily an additive map or a derivation). Every generalized derivation is a multiplicative generalized derivation. But the converse is not ture in general Hence, one may observe that the concept of multiplicative generalized derivations includes the concept of derivations, multiplicative derivation and the left multipliers. So, it should be interesting to extend some results concerning these notions to multiplicative generalized derivations. But there are only few papers about this subject.

Let S be a nonempty subset of R. A mapping F from R to R is called commuting on S if [F(x),x]=0, for all x∈S. A map F:S→R is called a D-commuting map on S if [F(x),x]∈D , for all x∈S and some D⊆R. In particular, if D=0, then F is called a commuting map on S if [F(x),x]=0. Note that every commuting map is a D-commuting map (put 0=D). But the converse is not true in general. Take D some a set of R has no zero such that [F(x),x]∈D; then F is a D-commuting map but it is not a commuting map.

Daif and Bell proved that R is semiprime ring, I is a nonzero ideal of R and d is a derivation of R such that $d([x,y]) = \pm[x,y]$, for all $x, y \in U$, then $U \subseteq Z$. This theorem considered for generalized derivations by Quadri et al. and extended by Dhara proving $F([x,y]) \pm [x,y] \in Z$

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, for all $x, y \in U$, when F is a generalized derivation of R. This result was examined by Argaç. Gölbaşı generalized the same result for the generalized derivation in a semi-prime ring. The above conditions were studied on Lie ideals by Gölbaşı and Koç. Hongan proved that if a 2-torsion free semiprime ring R admits a derivation d such that d([x, y]) ± [x, y] ∈ Z(R) for all x,y ∈ R, then R is commutative. Ashraf and Rehman prove that if R is a 2-torsion free prime ring and L a nonzero Lie ideal of R such that u^2 ∈ L for all u ∈ L and d a derivation which satisfies d(u ◦ v) − u ◦ v for all u, v ∈ L, then L ⊆ Z(R).

During the past few years several authors have proved commutativity theorems for prime rings or semiprime rings admitting automorphisms or derivations on appropriate subsets of R. Shang proved that if N is a 3-prime near ring and D is a derivation of N such that D([x, y]) = ±x^m[x, y] x^n or D(xo y) = ±x^m(xo y) x^n for all x, y ∈ N, then N is commutative ring. Koç and Gölbaşı have been studied for the multiplicative generalized derivations by generalizing these conditions on the semiprime ring.

We aim to investigate the d is P-commuting map on R where R any ring, P is semiprime ideal of R which admits a multiplicative generalized derivations associated with an map d of R are satisfying some identities acting on semiprime ideal P.

Results

We will make some extensive use of the basic commutator identities:

[x,yz]=y[x,z]+[x,y]z

[xy,z]=[x,z]y+x[y,z]

xo(yz)=(xoy)z-y[x,z]=y(xoz)+[x,y]z

(xy)oz=x(yoz)-[x,z]y=(xoz)y+x[y,z].

Theorem: Let R be a 2-torsion free ring with P a semiprime ideal of R. Suppose that R admits a multiplicative generalized derivation F associated with a nonzero map d, m,n∈ Z. If any of the following conditions is satisfied for all x,y∈R, then d is P-commuting map on R:

(i) F([x,y])∈P,

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(ii) F([x,y])±[x,y]∈P,

(iii) F([x,y])±(xoy)∈P,

(iv) F(xoy)∈P,

(v) F(xoy)±(xoy)∈P,

(vi)F(xoy)±[x,y]∈P,

(vii) F([x,y])±x^m[x,y] x^n∈P,

(viii) F(x∘y)± x^m(x∘y) x^n∈P.

Proof.

(i) By the hypothesis, we have

F([x,y])∈P, for all x,y∈R.

Replacing yx by y in the above expression and using this expression, we get

[x,y]d(x)∈P, for all x,y∈R. (1)

Writing d(x)y for y in (1) and using (1), we obtain that

[x,d(x)]yd(x)∈P, for all x,y∈R. (2)

Replacing y by yx in (2), we find that

[x,d(x)]yxd(x)∈P, for all x,y∈R. (3)

Multiplying (2) on the right by x, we have

[x,d(x)]yd(x)x∈P, for all x,y∈R. (4)

Subtracting (4) from (3), we arrive at

[x,d(x)]y[x,d(x)]∈P, for all x,y∈R.

That is

[x,d(x)]R[x,d(x)]⊆P, for all x∈R.

Since P is a semiprime ideal of R, we conclude that

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$[x,d(x)]\in P$, for all $x\in R$

and so d is P-commuting map on R.

(ii) Suppose that

$F([x,y])\pm[x,y]\in P$, for all $x,y\in R$.

Replacing y by yx in this expression and using this expression, we arrive that

$[x,y]d(x)\in P$, for all $x,y\in R$.

Using the same arguments after (1) in the proof of Theorem (i), we get the required result.

(iii) Assume that

$F([x,y])\pm(xoy)\in P$, for all $x,y\in R$.

Replacing yx by y in the last expression and using this expression, we get

$[x,y]d(x)\in P$, for all $x,y\in R$.

This expression is same as (1) in the proof of Theorem (i). Hence, using the same arguments in there, we get the required result.

iv) Assume that

$F(xoy)\in P$, for all $x,y\in R$.

Writing yx for y in this expression and using this expression, we have

$(xoy)d(x)\in P$, for all $x,y\in R$. (5)

Substituting d(x)y for y in (3) and using this expression, we arrive at

$[x,d(x)]yd(x)\in P$, for all $x,y\in R$.

Using the same arguments after (2) in the proof of Theorem (i), we get the required result.

(v) We have

$F(xoy)\pm(xoy)\in P$, for all $x,y\in R$.

Replacing y by yx in this expression and using this, we arrive that

$(xoy)d(x)\in P$, for all $x,y\in R$.

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Using the same arguments after (5) in the proof of Theorem (iv), we conclude the required result.

(vi) Suppose that

$F(xoy)\pm[x,y]\in P$, for all $x,y\in R$.

Replacing yx by y in this expression and using this, we get

$(xoy)d(x)\in P$, for all $x,y\in R$.

This expression is same as (5) in the proof of Theorem (iv).

(vii) By the hypothesis, we have

$F([x,y])\pm x^m[x,y]\,x^n\in P$, for all $x,y\in R$.

Replacing y by yx in this expression, we get

$F([x,y]x)\pm x^m[x,y]\,x^{n+1}\in P$

and so

$F([x,y])x+[x,y]d(x)\pm x^m[x,y]\,x^{n+1}\in P$, for all $x,y\in R$.

Using the hypothesis, we obtain that

$[x,y]d(x)\in P$, for all $x,y\in R$.

Using the same arguments after (1) in the proof of Theorem (i), we get the required result.

(viii) We assume that

$F(x\circ y)\pm x^m(x\circ y)\,x^n\in P$, for all $x,y\in R$.

Replacing y by yx in this expression, we obtain

$F(x\circ yx)\pm x^m(x\circ y)\,x^{n+1}\in P$

and so

$F(x\circ y)x+(x\circ y)d(x)\pm x^m(x\circ y)\,x^{n+1}\in P$.

Using the hypothesis, we get

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$(x \circ y)d(x) \in P$, for all $x,y,z \in R$.

Arguing the same methods after (5) in the proof of Theorem (iv), we obtain the required result.

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FLUTTER İLE GELİŞTİRİLEN MOBİL UYGULAMALARLA DENGE BECERİLERİNİN İYİLEŞTİRİLMESİ

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ÖZET

Bu araştırma, denge makinelerinin maliyeti, erişilebilirliği ve bakım zorlukları gibi önemli engellerle karşılaşan bireylerin denge yeteneklerini ölçme ve iyileştirme sürecinde devrim niteliğinde bir yaklaşım sunmak amacıyla geliştirilen bir mobil uygulamayı tanıtmaktadır. Geleneksel denge makineleri pahalıdır ve genellikle sınırlı sayıda sağlık merkezinde bulunurlar, bu da kullanıcıların bu hizmetlere erişimini kısıtlar. Bununla birlikte, bu mobil uygulama, herhangi bir akıllı telefon veya tablet kullanarak denge yeteneklerini ölçme ve geliştirme fırsatı sunar. Uygulama, telefonunun yerleşik gyroscope ve accelerometer sensörlerini kullanarak kullanıcının hareketlerini hassas bir şekilde izler ve bu sensörler sayesinde, telefonun ivmesini, salınımını ve üç eksende yaptığı açıyı öğrenerek kullanıcının denge yeteneklerini değerlendiren bir skor değerlendirir. Kullanıcılar, telefonlarını göğüslerine sabitleyerek belirli talimatları uygularlar ve bu süreç boyunca telefonunun hareketlerini takip ederler. Uygulama, kullanıcıların denge skorlarını belirlerken yaş, fiziksel aktivite seviyesi ve geçmiş denge problemleri gibi kişisel faktörleri dikkate alır. Bu skorlar, kullanıcının denge seviyesini anlamasına ve gelişimini takip etmesine olanak tanır. Dahası, uygulama kullanıcıların denge seviyelerine uygun kişiselleştirilmiş egzersiz programları sunar. Bu egzersizler, kullanıcının yaşına, spor geçmişine ve ölçülen denge skoruna göre özel olarak tasarlanır ve kullanıcının denge yeteneklerini güçlendirmeye yardımcı olur. Ayrıca, uygulama Firebase entegrasyonu sayesinde kullanıcıların denge skorlarını sağlık profesyonelleri ile paylaşmasına olanak tanır. Bu, doktorların hastalarının denge iyileşme sürecini izlemesine ve gerektiğinde müdahale etmesine yardımcı olur. Sonuç olarak, bu mobil uygulama, denge yeteneklerini ölçme ve iyileştirme sürecini erişilebilir, etkili ve kişiselleştirilmiş bir şekilde sunarak bireylerin sağlık ve yaşam kalitesini artırma potansiyelini ortaya koyar. Bu yaklaşım, mobil teknoloji ve sağlık hizmetlerinin entegrasyonuyla sağlık bilincini artırır ve sağlık hizmetlerine erişimi kolaylaştırır.

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Anahtar Kelimeler: Denge Değerlendirmesi, Sağlık Teknolojisi, Duruş Tespiti, Mobil Uygulama, Flutter, Firebase

1. GİRİŞ

Günümüzde mobil teknolojinin hızla gelişmesiyle birlikte, sağlık sektöründe mobil uygulamaların kullanımı da artmaktadır. Özellikle, bireylerin sağlık durumlarını izlemelerine ve iyileştirmelerine yardımcı olacak uygulamaların popülaritesi giderek artmaktadır. Bu bağlamda, denge yeteneklerini ölçmek ve iyileştirmek için geliştirilen mobil uygulamalar da dikkat çekmektedir. Bu çalışmada, geleneksel denge makinelerinin pahalı maliyeti ve sınırlı erişilebilirliği gibi engelleri aşmak amacıyla geliştirilen bir mobil uygulamanın tanıtımı yapılmaktadır.

Mobil uygulama, kullanıcıların denge yeteneklerini telefonlarının gyroscope ve accelerometer sensörlerini kullanarak ölçmelerine ve geliştirmelerine olanak tanımaktadır. Bu uygulama, kullanıcıların denge seviyelerini belirlemek için özel olarak tasarlanmış egzersiz programları sunmakta ve bu sayede bireylerin sağlık ve yaşam kalitelerini artırmayı hedeflemektedir. Ayrıca, Firebase entegrasyonu sayesinde, kullanıcılar denge skorlarını sağlık profesyonelleri ile paylaşabilir ve bu profesyonellerin hastalarının denge iyileşme sürecini izlemesine yardımcı olabilirler.

Diğer benzer uygulamalardan farklı olarak [1], geliştirdiğimiz uygulama daha düşük maliyetli ve daha geniş erişilebilirlik sunmaktadır. Ayrıca, özel olarak tasarlanmış egzersiz programları ve Firebase entegrasyonu gibi özelliklerle kullanıcıların denge seviyelerini belirlemelerine ve sağlık profesyonelleriyle etkileşimde bulunmalarına olanak tanımaktadır. Bu çalışmanın amacı, mobil teknolojinin sağlık sektöründeki potansiyelini vurgulamak ve denge yeteneklerini ölçmek ve iyileştirmek için erişilebilir ve etkili bir çözüm sunmaktır.

2. YÖNTEMLER

2.1. Flutter

Flutter, Google tarafından geliştirilen ve özellikle çapraz platform mobil uygulama geliştirmek için kullanılan açık kaynaklı bir UI yazılım geliştirme kitidir [1]. Dart programlama dilini kullanarak, tek bir kod tabanı üzerinde hem iOS hem de Android için yüksek performanslı ve

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görsel olarak çekici mobil uygulamalar oluşturmayı sağlar. Flutter'ın en belirgin özelliklerinden biri, hızlı derleme süreleri ve canlı önizleme yetenekleri sayesinde geliştiricilere verimlilik sağlamasıdır. Ayrıca, zengin bir widget koleksiyonu ve kolay özelleştirme imkanlarıyla geliştiricilere esneklik sunar. Bu özellikleriyle Flutter, modern mobil uygulama geliştirmenin öncü bir aracı haline gelmiştir.

2.2. Firebase

Firebase, Google tarafından sunulan bulut tabanlı bir platformdur ve uygulama geliştiricilerine çeşitli hizmetler sağlar [2]. Bu hizmetler arasında gerçek zamanlı veritabanı, kimlik doğrulama, bulut depolama ve analitik araçlar yer alır. Firebase'in sunduğu bu araçlar, mobil uygulama geliştiricilerinin uygulamalarını hızlı bir şekilde büyütme ve ölçekleme imkanı verir.
Uygulamamızda Firebase'i kullanmamızın gerekçesi, belirli hastaların belirli doktorlar ile denge egzersizlerini kontrol etmesine olanak sağlamaktır. Firebase entegrasyonu sayesinde, doktorlar hastalarının denge seviyelerini izleyebilir ve egzersiz programlarını kişiselleştirebilirler. Firebase'in sağladığı kolaylık ve güvenilirlik sayesinde, bu süreci en etkili şekilde yönetebiliyoruz.

2.3. Gyroscope

Telefonlarımızdaki gyroscope, cihazın hareketini algılamak için kullanılan bir sensördür. Gyroscope, cihazın üç boyutlu hareketini ölçerek dönme, eğilme ve yön değişikliklerini belirler [3]. Görsel 1 (a)'da, gyroscopenun çalışma prensibi gösterilmiştir. Gyro, telefonda oluşan anlık ivmeleri kullanarak kişinin hangi eksene ne kadar hızlı bir şekilde gittiğini anlamak için kullanılmıştır. Bu sayede, hangi eksende ne kadar hızlı bir salınım yapıldığını öğrenebiliriz. Görsel 1 (b)'de salınım hareketlerinin grafiği verilmiştir. Bu bilgi, denge yeteneklerini değerlendirmek ve geliştirmek için kullanılabilir. Bu sensör, mobil uygulamaların kullanıcıların fiziksel aktivitelerini takip etmesine ve belirli hareketleri algılamasına olanak tanır. Özellikle, denge yeteneklerini ölçmek ve iyileştirmek amacıyla geliştirilen mobil uygulamalarda gyroscope'un önemi büyüktür. Bu sensör, kullanıcıların telefonlarını göğüslerine sabitleyerek belirli talimatları uygulamalarını ve bu sırada cihazın hareketini takip etmelerini sağlar. Bu sayede, uygulama kullanıcıların denge seviyelerini hassas bir şekilde değerlendirebilir ve onlara kişiselleştirilmiş egzersiz programları sunabilir. Gyroscope'un bu özelliği, denge salınımı gibi uygulamalar için kritik bir öneme sahiptir ve kullanıcıların denge yeteneklerini geliştirmelerine yardımcı olur.

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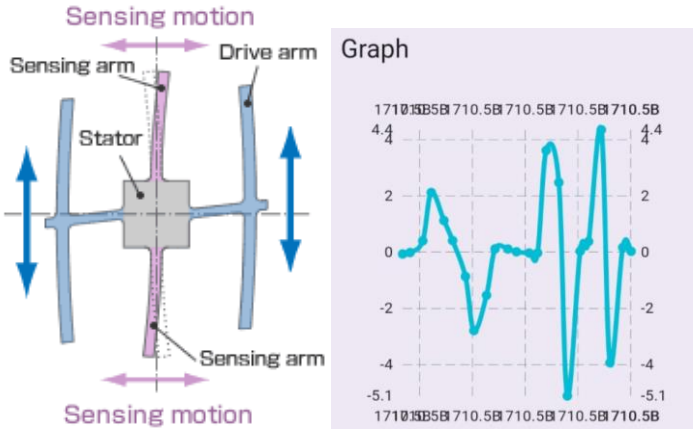

(a) (b)

Görsel 1. (a) Gyroscope sensörünün çalışma mantığı verilmiştir. (b) Kullanıcıya ait gyroscope verilerinin grafiği verilmiştir.

2.3. Accelerometer

Telefonlarımızdaki accelerometer, cihazın ivmesini ölçmek ve cihazın hareketini belirlemek için kullanılan bir sensördür. Acc, her üç eksendeki sensörlerin yer çekiminden etkilenme derecesini belirleyerek kullanıcının cihazı nasıl hareket ettirdiğini belirler [4]. Bu sayede, mobil uygulamalar kullanıcının fiziksel aktivitelerini takip edebilir ve belirli hareketleri algılayabilir. Görsel 2 (b)'deki formül, bu eksenler arasındaki açıları hesaplamak için kullanılır. Özellikle, denge yeteneklerini ölçmek ve iyileştirmek amacıyla geliştirilen uygulamalarda accelerometer sensörünün önemi büyüktür. Accelerometer, kullanıcının 3 eksende yaptığı açıları belirleyerek kişinin fiziksel eğilme açısını ölçer ve belirli sınırlar içinde tutar. Görsel 1 (a)'da, accelerometer sensörünün x, y ve z ekseni boyunca nasıl çalıştığı ve bu eksende yapılan hareketlerin nasıl algılandığı gösterilmiştir. Bu görsel, accelerometer sensörünün üç boyutlu hareketleri nasıl ölçtüğünü ve kullanıcının hareketlerini nasıl izlediğini daha iyi anlamamıza yardımcı olur. Görsel 3'te ise uygulamadan accelerometer verilerinin grafik hali verilmiştir. Bu sınırlar, kişinin dengesini korumasına yardımcı olur ve aşırı eğilme durumlarında kullanıcıya uyarılar gönderebilir. Eğer bir kişi belirlenen eğilme sınırlarını aşarsa, bu durum kullanıcının düşmüş olabileceğini gösterebilir ve testin tekrarlanmasını gerektirebilir. Bu nedenle, accelerometer sensörünün doğru çalışması ve doğru veri sağlaması, denge ölçüm uygulamaları için büyük önem taşır.

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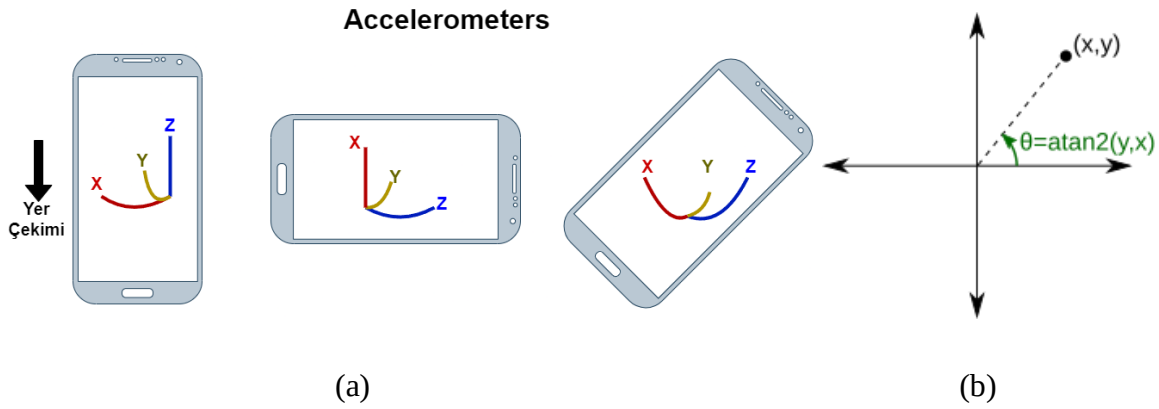
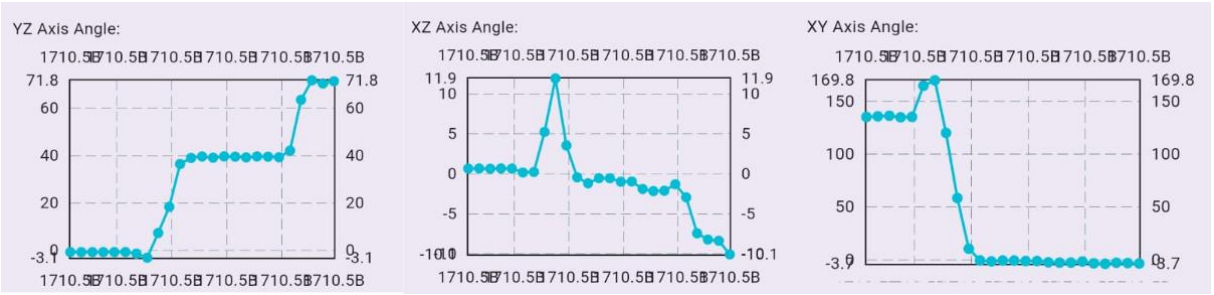


(a) (b)

Görsel 2. (a) Accelerometer sensörünün çalışma mantığı verilmiştir. (b) Accelerometer'dan gelen verileri açıya çevirmek için kullanılan yöntem gösterilmiştir.



Görsel 3. Üç eksende, kullanıcıya ait accelerometer verilerinin grafiği verilmiştir.

3. SONUÇLAR VE DEĞERLENDİRME

Bu çalışma, mobil teknolojinin gücünü kullanarak denge yeteneklerini ölçme ve iyileştirme sürecini daha erişilebilir hale getirmeyi amaçladı. Geliştirilen mobil uygulama, yüksek maliyetli denge makinelerinin yerine geçerek, herkesin kolaylıkla erişebileceği bir çözüm sunar. Telefonun gyroscope ve accelerometer sensörlerinden gelen verileri kullanarak, kullanıcıların denge seviyelerini hızlı ve etkili bir şekilde değerlendirebilir ve kişiselleştirilmiş egzersiz programları sunarak denge yeteneklerini geliştirmelerine yardımcı olur.

Bu çalışmanın sonuçları, mobil teknolojinin sağlık sektöründe nasıl kullanılabileceğini göstermektedir. Geliştirilen uygulama, hastaların sağlık durumlarını takip etmelerine ve doktorlarla etkileşimde bulunmalarına olanak sağlayarak, sağlık hizmetlerine erişimi kolaylaştırır. Ayrıca, bu uygulama, hastaların günlük yaşamlarına entegre edilebilecek

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pratik bir çözüm sunar ve denge sorunlarıyla mücadele eden bireylerin yaşam kalitesini artırabilir.

Sonuç olarak, mobil teknoloji ve sağlık hizmetlerinin entegrasyonu, sağlık sektöründe önemli bir ilerlemedir ve bireylerin sağlık ve yaşam kalitesini artırmak için büyük bir potansiyele sahiptir. Bu çalışma, bu alandaki gelişmelere bir katkı sağlamak amacıyla yapılmıştır ve mobil uygulamaların denge iyileştirme sürecindeki rolünü vurgulamaktadır.

4. TARTIŞMALAR

Denge makinelerinin mobil uygulamalarla taklit edilmesi, doğal olarak bazı endişelere neden olabilir. Gerçekten de, sadece gyro ve accelerometer verileriyle yüksek hassasiyet ve doğruluk sağlamak, karmaşık bir denge makinesini tam olarak replike etmek kadar kolay değildir. Ancak, bu zorluklarla karşılaşmamıza rağmen, mobil uygulamalarla elde edilen sonuçlar oldukça umut vericidir.

Mevcut yaklaşım, sadece gyro ve accelerometer verileriyle denge yeteneğini değerlendirmeyi amaçlar. Ancak, bu yaklaşımın tam olarak denge makineleriyle eşleşmesi mümkün değildir. Bununla birlikte, yapay zeka kullanarak bu zorluğun üstesinden gelmek mümkündür. Yeterli miktarda veri toplanarak ve gerçek denge makinelerinde yapılan testlerden elde edilen verilerle eğitilerek, mobil uygulamaların daha doğru sonuçlar sağlaması mümkündür. Bu, dengeli ve dengesiz insan verilerini kullanarak yapay zeka algoritmalarının geliştirilmesi ile gerçekleştirilebilir.

Ancak, bu yaklaşımın başarısı için hastanelerden yeterli miktarda veri toplanması gerekmektedir. Bu veriler, mobil uygulamaların denge yeteneğini değerlendirmesi için gerekli olan karmaşık algoritmaların geliştirilmesine yardımcı olacaktır. Eğer bu koşullar sağlanırsa, yapay zeka destekli mobil uygulamalar, geleneksel denge makinelerine göre daha etkili bir şekilde çalışabilir ve kullanıcıların denge yeteneklerini daha doğru bir şekilde değerlendirebilir.

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ATIKSU ARITMA TESISLERINDE BAKIM VE REVIZYONLARIN ENERJI VERIMLILIĞINE ETKILERI : ŞARKIŞLA ÖRNEĞI

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- 0000000238057147

ÖZET

Dünya nüfusunun sürekli artması teknolojinin sürekli gelişmesi fosil enerji kaynaklarının giderek azalması ve çevreyi kirletmesi gibi nedenler ülkelerin enerji politikalarının temiz ve yenilenebilir enerji kaynakları arayışına götürdü. Bu enerji kaynaklarının oluşturulmasıyla ilgili çalışmalar sürdürülürken bir yandan da enerji tüketimini verimli hale getirilmesi enerji kaynaklarının daha dikkatli kullanılması çalışmaları yürütülmekte yeni teknolojilerde cihazlarda enerjinin verimliliği ön plana çıkmaktadır. Bu da bize Dünya genelinde enerji verimliliği ile ilgili çalışmaların en az yeni enerji kaynaklarının bulunması kadar önem taşıdığını göstermektedir. Enerji verimliliği ile ilgili çalışmalar her alanda olduğu gibi atıksu arıtma tesisi işletmelerinde artık ön plana çıkmaktadır. Çünkü belediyelerin enerji giderlerinin önemli bir bölümünü bu tesislerdeki tüketimler oluşturmaktadır. Atıksu arıtma tesislerinin temel amacı atıksulardaki kirletici parametrelerin istenilen bir seviyeye düşürülerek atıksuların arıtılması ve alıcı ortama verilmesidir. İlk tesis kurulum aşamasında tesisin prosesin oluşturulması ve kullanılacak makinelerin seçiminde bu parametreler önem taşımaktadır. Ancak tesislerin kurulumunda parametrelerin takiplerinin düzgün yapılmaması kullanılacak makine seçimlerinin yanlış olması gibi nedenler enerji tüketiminin artmasına sebep olmaktadır. Ayrıca diğer bir yanlış ise tesislerdeki makinaların kurulması ve işletilmesi aşamasındadır. Tesisler kurulurken makine seçiminde verimlilik ön planda tutulmalı ayrıca işletme aşamasın da arıtma ve enerji verimliliğinin optimum şekilde olması sağlanmalıdır. Bu çalışmada Şarkışla Atıksu Arıtma Tesisi uygulama alanı olarak seçilmiş ve işletme enerji verimliliği üzerine yapılan ve planlanan çalışmalar tartışılmıştır.

Anahtar Kelimeler: Enerji, Verimlilik, Revizyon

1. GİRİŞ

Atıksu arıtma tesislerinin temel amacı atıksulardaki kirletici parametrelerin istenilen bir seviyeye düşürülerek atıksuların arıtılması ve alıcı ortama verilmesidir. İlk tesis kurulum aşamasında tesisin prosesin oluşturulması ve kullanılacak makinelerin seçiminde bu parametreler önem taşımaktadır. Ancak tesislerin kurulumunda parametrelerin takiplerinin düzgün yapılmaması kullanılacak makine seçimlerinin yanlış olması gibi nedenler enerji

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tüketiminin artmasına sebep olmaktadır. Ayrıca diğer bir yanlış ise tesislerdeki makinaların kurulması ve işletilmesi aşamasındadır. Tesisler kurulurken makine seçiminde verimlilik ön planda tutulmalı ayrıca işletme aşamasın dada arıtma ve enerji verimliliğinin optimum şekilde olması sağlanmalıdır.

Enerji tüketim maliyetinin atık su tesislerine önemli bir maliyet oluşturduğunu göz önünde bulundurduğumuzda enerji genellikle birincil arıtmadan çamur ürünlerinin parçalanmasına kadar tüketildiğinden, periyodik olarak enerji denetimleri yapmak ve enerji tasarrufuna neden olabilecek bazı operasyonlar ve altyapı değişikliklerini gerçekleştirmek gereklidir. Son yıllarda atıksu arıtma tesislerinde işletme maliyeti üzerine çalışmalar yapılmaktadır. Atıksu arıtma tesislerindeki işletme maliyeti, enerji, personel, kimyasallar malzeme ve bakımdır. Bunlar içerisinde en büyük pay enerjiye aittir. Enerji maliyeti, toplam işletme maliyetlerinin % 50-60'lar mertebelerindedir (Meral Ve Cavadzade, 2013).

Mevcut atıksu arıtma tesislerinde, işletim masraflarının neredeyse tamamı, blowerlar ve akış pompalarının enerji tüketimi ile olmaktadır Özellikle biyolojik arıtma yapan tesislerde havalandırma maliyeti tesis işletme maliyetinin önemli bir kısmını oluşturmaktadır. AAT'lerin enerji verimli hale gelmesinde tasarım ve proje sürecinin yanı sıra proses ve uygun ekipman seçimi de büyük rol oynamaktadır. AAT'lerde dış enerji alımını azaltmak ve hatta sıfıra indirmek mümkündür. Ancak enerji kullanımının azaltılmasının, deşarj kalitesini etkilememesi de önemli bir husustur. Arıtma verimi ile enerji tüketimi dengesinin iyi ayarlanması gerekmektedir (Erşahin ve diğ.,2017).

Günümüzde atıksu arıtma tesislerinin enerji verimliliğiyle ilgili olarak bir çok çalışma yapılmış ve konuyla ilgili bir çok fikir ortaya atılmıştır. Trapote ve ark., (2012) Tarafından yapılan çalışmada , atıksu arıtma tesislerinin bakımı, işletmesi ve enerji kullanımları incelenmiş ve arıtma tesisinin boyutu ve enerji tüketimi arasındaki ilişki araştırılmıştır. Çalışma sonucunda arıtma tesisi kapasitesinin 547 ila 1057 milyon kWh arasında değişen yıllık tasarruf sağlandığı ve böylece enerji tüketimininim % 6 oranında azaltıldığı tespit edilmiştir. Buna ek olarak, birincil ve ikincil çamur işleme, çamur pompalama, işleme ve çamur giderimi önemli miktarda elektrik enerjisinin kullanılmasını gerektirir (Tchobanoglous ve diğ., 2003).

Evsel atıksularının arıtılmasında aktif çamur süreci en yaygın olan işlemdir. Konvansiyonel aktif çamur süreci ile atık su arıtımında enerji gereksinimlerinin 1.1 ila 2.4 MJ/m3 (0.3-0.65 kWh/m3) arasında olduğu tahmin edilmektedir. Evsel atıksularının konvansiyonel arıtımı için hacim başına elektrik enerjisi ihtiyacı (kWh/m3) havalandırma dozajı, dezenfeksiyon işlemi, çamur yönetimi, tesisin hidrolik profili ve tesis boyutu gibi bir dizi faktöre bağlı olarak (Tchobanoglous ve diğ., 2003; Westerhoff ve diğ.,2005; Venkatesh ve diğ.,2011; Pan ve diğ.,2001) yaklaşık 0.26-0.84 kWh/m3 (Friedrich ve diğ.,2017; Venkatesh ve diğ.,2011; Pan ve diğ.,2001) arasında değişebilir. Almanya, Birleşik Krallık ve Birleşik Devletler için ortalama enerji tüketimi tesis şekline bağlı olarak sırasıyla 0.67, 0.64 ve 0.45, İtalya'da 0.40 ile 0.70, Avustralyada 0.46, Çin de 0.269 ve Japonyada 0.30-1.89 kWh/m3, arasındaki tüketim değerleri ölçülmüştür (Guerrini ve diğ., 2017; Aynur, 2014) Yapılan diğer bir çalışmada da azot giderimi ile birlikte ortalama boyuttaki geleneksel aktif çamur süreci için atıksu arıtımına ilişkin enerji gereksinimlerinin yaklaşık 0.65 kWh/m3 olarak hesaplandığı bununla birlikte bu enerjinin

yaklaşık %20'sinin yardımcı süreçler (giriş pompalama istasyonu, su alma yapısı, aydınlatma, soğutma, ısıtma) için tüketildiği tespit edilmiştir. Dolayısıyla sadece atık su arıtımına yönelik enerji ihtiyacı, yaklaşık 0.52 kWh/m3 olarak hesaplanmıştır (Tchobanoglous et al., 2003; Shi, 2011; Gikas, 2017,).

2. DENEYSEL ÇALIŞMALAR (veya UYGULAMALAR)

VEYA VARSA DİĞER BAŞLIKLAR

2.1. Materyal ve metot

Bu çalışmada Şarkışla (Sivas) ilçesinde bulunan mevcut atıksu arıtma tesisinin enerji tüketimi analiz edilmiştir. Çalışmada atıksu arıtma tesisinin tasarımı tesisin işletme süreci ve bakım çalışmaları ve bu süreçte tesiste arıtılan atıksuyun özellikleri tesisi verimi ve enerji verimi arasındaki ilişki enerji ve arıtma veriminin arttırılabilmesi için gerekli revizyon çalışmalar tartışılmıştır.

2.2. 3 Bulgular ve tartışma

Şarkışla Atıksu Arıtma Tesisine ait üniteler ve kapasiteleri aşağıdaki Tablo da verilmiştir. Tesisin yıllık BOİ KOİ AKM giriş ve çıkış ile yıllık toplam enerji tüketimleri (kW-ay) incelenmiştir. Tesiste yapılan bakımlar işletme aşamasında yapılan gözlemler bu gözlemler sonucu yapılan değişikliler belirtilmiştir. Yapılan bakım ve değişiklilerin arıtma ve enerji verimine etkileri incelenmiştir.

Çizelge 1. Şarkışla Atıksu Arıtma Tesisine ait mevcut üniteler ve kapasiteleri

Üniteler	**Ünite adedi ve kapasitesi**
Kaba Izgaralar	(1+1 adet) 705,6 m^3/saat
İnce Izgaralar	(1+1 adet) 705,6 m^3/saat
Terfi Merkezi	(2+1 adet) 50 L/sn
Havalandırmalı Kumtutucu ve Yağ Sıyırıcı	(2 adet) YHY 20-25 m^3/m^2/saat , yatay hız 0,2 m/sn
Havalandırma Havuzu	(3 adet) Bir havuziçin; hacmi 2464 m^3 , 2 adet P=37 kwh yüzeysel havalandırıcı
Son Çökeltme Havuzu	(3 adet) YHY 0,45 m^3/m^2/sa
Çamur Geri Devir Ünitesi	(2+1) Q = 50 lt/sn., Hm = 10 m., Nm = 15 kW. Çamurun Belt Presse gönderilmesi için ise iki adet monopomp kullanılmaktadır.
Belt Press Ünitesi	Bir adet Belt Press bulunmaktadır ortalama su ihtiyacı 11 m^3/saattir.

Şarkışla Atıksu Arıtma Tesisi 2017 yılında işletme olarak Şarkışla Belediyesi bünyesine geçmiştir. Belediye tarafından işletilmeye başladığı günden itibaren tesisin enerji giderleri takip edilmiş ve ünitelerdeki makinelerin işleyişleri ve çalışma prensipleri incelenmiştir. Ve temel problemin havalandırma ünitelerinde olduğu anlaşılmıştır. Çünkü tesise yerleştirilen yüzey havalandırıcıların çektikleri akımın yüksekliği bu havalandırıcıların devirlerini tamamlarken

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zorlandıklarının ve daha yüksek enerji kullanmasına sebep olduğunun göstergesidir. Ayrıca tesise verilen oksijen miktarın istenilen seviyeye getirilmesinde zorluklar yaşanmaktadır. Yüzey havalandırıcılardaki temel probleminde havalandırıcıların gereğinde daha düşük kotta (yükseklikte) yerleştirilmesi olduğu anlaşılmıştır. Havalandırıcıların suya fazla gömülmesi devir sırasında zorlanmasına enerjinin fazla tükenmesine ve istenildiği gibi suya oksijen verilememesine sebep olduğu anlaşılmıştır. Ve yüzey havalandırıcılar dolu savak seviyesine kadar yükseltilmiştir. Şekil 2 ve Şekil 3 te yüzey havalandırıcıların ilk işletmeye alındığı kot (yükselik) ve sonraki kot (yükseklik) gösterilmiştir.

Şekil 2 Yüzey Havalandırıcının İşletmeye Alındığı Kotu

Şekil 3 Yüzey Havalandırıcının Revizyon Sonrası Kotu

Şarkışla Atıksu Arıtma Tesinin ızgara ünitesinden sonra gelen ünitedir. Enerji giderleri içerisinde yüzey havalandırıcılardan sonra en yüksek enerji sarfiyatına neden olan ekipmanlardır. Terfi pompalarının çalışma verimi tesis prosesini baştan sona etkilemektedir. Çünkü iyi bir mekanik ve biyolojik arıtma verimi için giriş suyu miktarı önemlidir. Eğer giriş suyu miktarı iyi ayarlanamaz ise tesisteki ekipmanların bazılarının enerji sarfiyatları değişmezken arıtılan atıksu miktarı azalacaktır. Bu da tesisin enerji ve arıtma verimini direkt olarak olumsuz yönde etkileyecektir. Bunun için terfi pompalarının çalışma verimi tesis işletmeye açıldığı süreçten itibaren gözlenmektedir.

Bu gözlemler sonucunda özellikle 2020 yılının son aylarında terfi pompalarının veriminde büyük bir düşüş gözlenmiştir. İki adet pompanın çalışmasıyla tesise verilen atıksu miktarı üç adet pompanın aynı anda devreye alınmasının yeterli olmayacağı bir seviyeye ulaşmıştır. Ancak enerji sarfiyatında ise hiçbir düşüş olmamıştır. Bu da bize pompaların devir sayısının değişmediğini göstermektedir.
Bu gözlemlerde yola çıkarak terfi pompalarının birinin içinin açılmasına ve incelenmesine karar verilmiştir. Bu işlem sonucunda yapılan incelemede pompaların içerisine bulunan çarkların eskidiği çark uçlarının zamanla atıksu ile beraber gelen kum ve benzeri malzemeler tarafında törpülendiği gözlenmiş ve bununda tesise verilen atıksu miktarının azalttığı pompaların verimini düşürdüğü anlaşılmıştır.

Bundan sonraki süreçte ise çarkların değişim maliyetinin üç pompanın çalıştığı süreçteki enerji tüketim maliyetine bakılarak çark değişim maliyetinin sürbanse edilme zamanı ve değişimin

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günlük aylık ve yıllık enerji kazanım miktarı hesaplanmıştır. Hesaplamalar 2020 yılı fiyatlarına göre yapılmıştır.
Motorların Aylık Çalışma Saatleri = 3 adet motor X 7 gün X 22 saat X4hafta =1848 saati
Motorların Bir Aylık Enerji Maliyeti = 30 TL X 1848 saat = 13860 TL= 55440 TL
Tek Bir Motorun Aylık Enerji Maliyeti = 55440 TL/3= 18.480 TL
Çarkların toplam Değişim Maliyeti = 42000 TL
Bu gözlemlerden yola çıkarak pompaların içerisindeki çarkların değiştirilmesine karar verilmiştir. Ve üretici firma ile iletişime geçerek yeni çarklar tesise getirilmiş değiştirilmiştir.

Yüzey havalandırıcılarda ve terfi pompalarında yapılan revizyon sonrası aşağıdaki tablolarda görüldüğü üzere2020 yılı 1 m3 atıksuyu arıtma için gerekli birim enerji tüketim miktarında düşüş yaşanmış ve enerji verimi arttırılmıştır.

Görsel 4 Terfi pompalarının ve kum tutucu Pomplarının çarkları

Görsel 5 Terfi pompasının çark değişimi

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Çizelge 2. Şarkışla Atıksu Arıtma Tesisi Enerji Tüketimi ve Verim tablosu

ŞARKIŞLA ATIKSU ARITMA TESİSİ YILLARA GÖRE ENERJİ SARFİYATI VE TESİS VERİMİ									
	2018			2019			2020		
AYLAR	Parametre	Verim %	Toplam Enerji Sarfiyatı KWH	Parametre	Verim %	Toplam Enerji Sarfiyatı KWH	Parametre	Verim %	Toplam Enerji Sarfiyatı KWH
OCAK	BOİ	89,7	90000,855	BOİ	87,37	89826,030	BOİ	78,62	78484,140
	KOİ	81,5		KOİ	88,27		KOİ	77,6	
	AKM	85,4		AKM	83,44		AKM	68,1	
ŞUBAT	BOİ	83	83192,130	BOİ	92,01	72915,255	BOİ	91,83	77749,870
	KOİ	87		KOİ	90,78		KOİ	87,85	
	AKM	86		AKM	89,38		AKM	81,65	
MART	BOİ	91	90911,835	BOİ	90,05	93578,625	BOİ	90,16	67830,210
	KOİ	91,8		KOİ	85,63		KOİ	83,36	
	AKM	88,8		AKM	85,89		AKM	81,16	
NİSAN	BOİ	94,5	87410,610	BOİ	92,51	89020,890	BOİ	93,17	54510,430
	KOİ	88,9		KOİ	90,77		KOİ	83,18	
	AKM	92,2		AKM	93,09		AKM	83,85	
MAYIS	BOİ	93,3	91237,860	BOİ	91,97	97140,330	BOİ	91,89	58961,385
	KOİ	90,27		KOİ	87,43		KOİ	83,72	
	AKM	93,6		AKM	88,9		AKM	89,13	
HAZİRAN	BOİ	93,5	79558,575	BOİ	95,04	85427,050	BOİ	88,9	55896,570
	KOİ	85,7		KOİ	90,26		KOİ	81,67	
	AKM	94,6		AKM	87,54		AKM	81,3	
TEMMUZ	BOİ	91,21	96015,780	BOİ	92,98	102270,700	BOİ	90,16	73234,665
	KOİ	88		KOİ	81,86		KOİ	83,6	
	AKM	86,23		AKM	87,7		AKM	83,73	
AĞUSTOS	BOİ	92,8	98334,810	BOİ	94,57	99773,100	BOİ	89,86	71390,025
	KOİ	88,2		KOİ	87,36		KOİ	79,85	
	AKM	87		AKM	86,36		AKM	86,86	
EYLÜL	BOİ	92,8	87796,170	BOİ	95,79	82622,290	BOİ	95,79	65144,520
	KOİ	89,7		KOİ	91,81		KOİ	91,81	
	AKM	88,4		AKM	88,34		AKM	88,34	
EKİM	BOİ	87,8	82251,855	BOİ	92,96	72694,120	BOİ	92,96	58967,055
	KOİ	85,7		KOİ	77,72		KOİ	77,72	
	AKM	89,4		AKM	90,89		AKM	90,89	
KASIM	BOİ	91,3	77904,855	BOİ	85,17	69809,980	BOİ	89,11	62644,050
	KOİ	88,4		KOİ	84,67		KOİ	84,67	
	AKM	85,9		AKM	82,04		AKM	82,04	
ARALIK	BOİ	91,4	54099,670	BOİ	88,77	74762,640	BOİ	91,53	65764,440
	KOİ	88		KOİ	83,77		KOİ	87,46	
	AKM	85,6		AKM	80,09		AKM	80,95	
YILLIK VERİM /TOPLAM ENERJİ SAFİYATI	BOİ KOİ AKM	91,03 87,76 88,59	1018715,005	BOİ KOİ AKM	92,57 86,69 86,97	1029841,010	BOİ KOİ AKM	90,32 83,54 83,16	790577,360

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3. SONUÇLAR VE DEĞERLENDİRME

Şarkışla Atıksu Arıtma Tesisi örneğinde görüldüğü gibi tesis enerji verimliğinin arttırılmasında ilk proje aşamasındaki proses ve kullanılacak makine seçiminin öneminin yanında işletme aşamasında yapılacak revizyon ve bakım çalışmalarının öneminin göz ardı edilmemesi gerektiğini göstermektedir. Tesis işletme aşamasında sadece arıtma verimi önemsenmemeli ayrıca enerji verimi kullanılan makinelerin çalışma verimleri de gözetilmeli ve yerinde doğru revizyon ve bakım çalışmalarıyla hem tesisin enerji verimi ve makina verimleri arttırılmalı aynı zamanda arıtma verimi de korunmalı veya arttırılmalıdır. Arıtma tesislerin kurulum ve ilk işletme aşamasında fark edilemeyen ya da işletme sırasında ortaya çıkacak sorunlar ve tesis verimini düşürebilecek, yanlış işletme yöntemleri, makine cihaz seçimleri gibi tercihler göz ardı edilmemeli tesis işletme verileri sürekli irdelenmeli , optimum tesis verimi ve işletme maliyeti gözetilmelidir.

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IMPROVING TRACKING OF RF DEVICES WITH 10 STEP KAIZEN IN TRENDYOL E-COMMERCE WAREHOUSES

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ABSTRACT

Kaizen is an approach that is applied to processes in the areas of time, employees and technology in order to increase customer satisfaction and strengthen the company's competitive position. With Kaizen, it is possible to increase profitability through rapid development and cost reduction. This approach is making continuous improvements in business processes with small beginnings to achieve a large impact. This study aims to present the 10-step Kaizen approach implemented in the e-commerce warehouses of Trendyol, one of Turkey's leading companies in the e-commerce sector. For this purpose, the contributions achieved by ensuring a waste-free and more efficient operation of the e-commerce warehouse through the 10-step Kaizen application have been explained. Each step of the 10-step Kaizen approach which includes defining the problem, determining the team, determining the goal, analyzing the current situation, analyzing the problem, determining the actions, implementing the actions, controlling the solution, standardization and dissemination have been described. This study has been a testament to the Kaizen approach that delivers improved business efficiency, productivity, elimination of waste and savings in warehouse operating costs.

Keywords: 10-Step Kaizen, E-Commerce Warehouse, Radio Frequency Devices

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1. INTRODUCTION

The growth of e-commerce has an impact on warehousing as well as on inbound and outbound logistics. As the warehouse logistics industry evolves and introduces innovations related to e-commerce logistics, the need for lean measures increases [1]. One of the ways to improve the performance of e-commerce warehouses is to conduct continuous improvement (Kaizen) studies. The 10-step Kaizen principle, one of the best-known methods for eliminating waste and optimizing efficiency and costs, has the potential to make an important contribution in this area. One of the places where 10-step Kaizen, which can be applied in almost any area, can be implemented flawlessly is in e-logistics warehouses. 10-step Kaizen is a Lean strategy that helps to achieve the core objectives of Lean: it creates an awareness of problem solving, it determines the way to deal with the problem and it makes problems visible [2]. A 10-step Kaizen implementation in e-commerce warehouses not only creates a waste-free, safe, clean and efficient working environment, but also shows employees that you care about them, their job and their safety. And when an employee realizes that their company cares about them, their morale increases, and they become more interested in their work. More efficient storage improves training and communication, saving time and money. A warehouse that applies the 10-step Kaizen concept can quickly identify or uncover problems, address the basic causes and fix those problems to prevent recurrence.

Radio Frequency (RF) technologies offer great convenience in tracking goods in warehouses. However, in very large locations such as e-commerce warehouses, where thousands of RF readers are used, tracking the RF devices themselves is a problem. The monitoring of RF reader devices is typically facilitated by the systems and software with which they are integrated.

This study discusses the issues recently encountered in effectively monitoring handheld terminals with RF readers used in Trendyol e-commerce logistics warehouses, as well as the Kaizen study conducted to address these issues.

The rest of the study is structured as follows: Section 2 presents the conceptual framework and Section 3 outlines the methodology. Section 4 presents the results and discussion of the 10-step kaizen study for effective tracking of Trendyol RF devices. Section 5 concludes the paper.

2. CONCEPTUAL FRAMEWORK

In this section, notional explanations have been made about E-Commerce Warehouse and the RF Handheld Terminal used in these warehouses.

2.1. E-Commerce Warehouse

Today, e-commerce is the leading sales channel [3]. E-commerce companies, which play a leading role in this success, operate at high speed and capacity in tens of thousands of square metres of e-commerce warehouses.

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E-Commerce Warehouse is a service provider that offers storage, management and distribution of products for online retailers. E-Commerce Warehouse provides a warehousing and logistics solution where companies can store inventory, manage orders and quickly deliver products to customers.

Although they are often confused with each other, ordinary warehouses and e-commerce warehouses, also known as order fulfilment centers, have very different meanings. Both are large structures that hold inventory for companies that sell products. However, the use cases and services of these structures are very different.

It is possible to list the functions of e-commerce warehouses as follows [3]:

1) Deliver the products purchased by the customer in full and as quickly as possible,

2) Carry out all operations with a minimum of stock,

3) Feed the minimum stock, kept in small batches, during the day and accept the products,

4) Receiving product returns as quickly as goods are accepted, completing the control and classification processes and including them in the operation cycle,

5) Ensure communication between the customer and the distribution channel in order to solve delivery problems,

6) Manage all these processes in an effective, measurable and reportable way using warehouse management software.

2.2. Radio Frequency Reader Devices

RF readers are frequently utilized for inventory management and tracking in warehouses and e-commerce operations. These devices are multifunctional, but their primary purpose is to identify products by reading barcodes or Radio-Frequency Identification (RFID) tags. The use of RF reader devices accelerates warehouse operations, reduces error rates, and improves inventory management efficiency. This ensures a more organized and effective workflow in e-commerce warehouses. However, the use and integration of RF readers may vary depending on the specific requirements and needs of the business [4].

The RF handheld terminal is a mobile computer used in logistics. It collects information by scanning barcodes, QR codes, or through manual key operation. The collected information is then delivered to the desired system database online via RF without any loss or errors. Additionally, it displays information from the system database on the screen to direct personnel [5]. They are commonly used in logistics, warehousing, distribution centers, van delivery, and retail and supermarket outlets for faster and automated supply chain delivery [6].

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RF handheld terminals are devices that use RF waves to allow for automatic tracking and identification of various assets. Handheld terminals for information transfer are equipped with advanced technology, making them extremely easy and quick to use. This makes them advantageous in many different sectors. RF handheld terminals have a direct connection or Bluetooth function to communicate with devices such as tablets and mobile phones. It is important to ensure a large distance for information exchange. It is a highly effective solution for mobile work environments where a stationary reader is not suitable.

Logistics monitoring, warehouse management, retail management, and smart production have a wide range of uses. They are employed to produce effective solutions in various areas, including manufacturing, transportation, retail, logistics, service, and healthcare. When evaluating these solutions, it is important to consider different features such as processor, Random Access Memory (RAM), memory, drop range, operating system, working distance, and device compatibility based on the specific area of use.

Bringing a new level of comfort to business processes makes a great contribution to preventing human-caused errors and increasing efficiency by ensuring tasks are completed accurately and quickly. In addition, using a fixed reader is considered a much more accurate choice for reading labeled objects compared to moving the object. RFID technology does not require line-of-sight access to read tags. The technical benefits of RFID underpin real business benefits. It can increase process efficiency and save money. Reviewing the overall benefits of the system and return on investment is a key issue. RFID handheld terminals can increase a business's productivity, as both goods and information are processed more efficiently. An RFID system makes it easier to respond to new conditions due to information obtained from supply networks. It provides fewer errors and higher security [7].

3. METHODOLOGY OF KAIZEN

Kaizen is a Japanese term meaning continuous improvement or change for the better. It is a fundamental principle of lean thinking and involves examining a process, identifying waste and making small, incremental improvements to make work easier, safer and more productive while ensuring the highest quality. Since no process can be perfect, there is always room for improvement [8].

The main purpose of Kaizen is to eliminate inefficiencies, waste and problems in business processes, improve quality and create a culture of continuous improvement through employee involvement. Kaizen is an approach where everyone can contribute and achieve big results with small changes [9].

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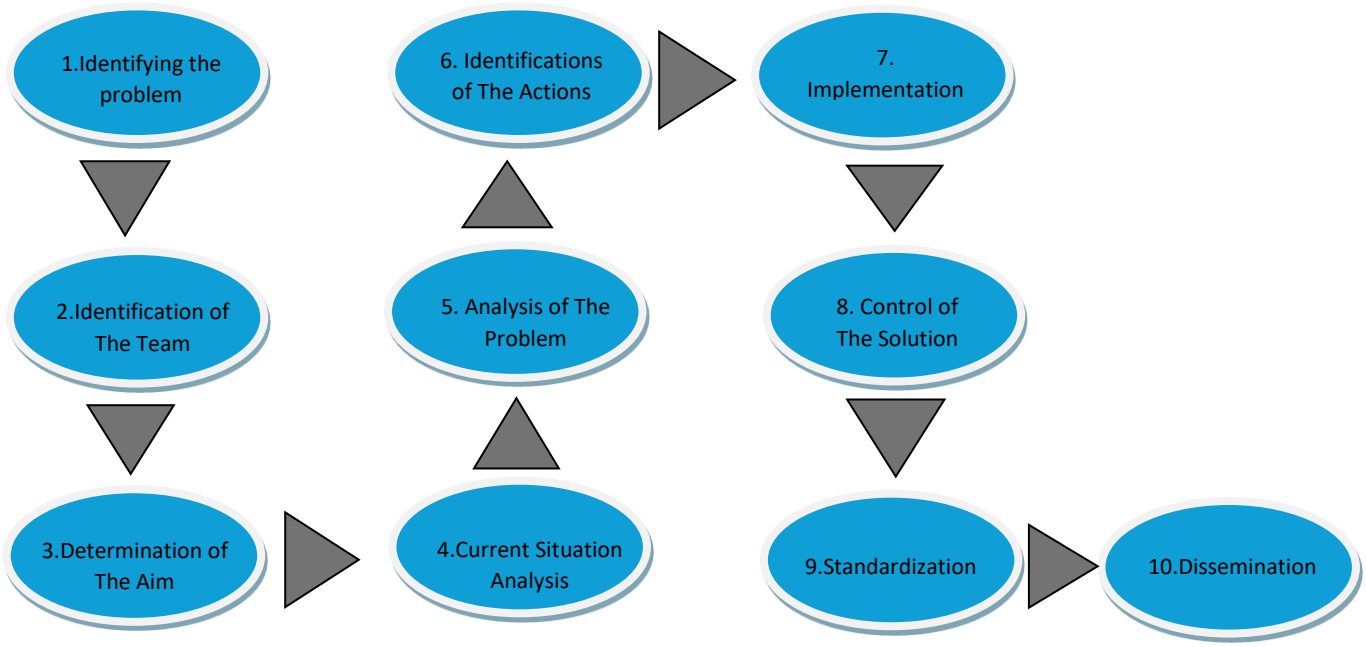

Figure 1. 10 Steps Kaizen Implementation Steps

At the heart of this system is the PICT (Plan, Implement, Check, Take Precautions) cycle, which plays a crucial role. This cycle is the main reason for the continuity of improvement. Continuous improvement is the basis of the Kaizen approach, and there is no end to it. Kaizen is about building teams and working with the whole team, not just one person. The approach is to move towards the target step by step. Significant progress cannot be achieved immediately, but rather through continuous small improvements.

When implementing Kaizen, different literature may present it in various steps depending on company culture, such as Kaizen in 7, 8, 10, or 12 steps. However, all of these steps complete the PICT cycle and are interconnected. There is no difference between the 12-step Kaizen and the 7-step Kaizen. However, the standard 10-step format is widely used in the Kaizen improvement methodology.

The standard 10 steps of focused Kaizen progress are as follows:

3.1 Step 1 Topic Selection: The reason for choosing the kaizen topic is presented with statistical data where appropriate.

3.2 Step 2 Target**:** The numerical target envisages and desired to be achieved by the Kaizen Team is stated.

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Figure 2. Step 1 and step 2 of the Kaizen

3.3 Step 3 Our Team: The people who will take part in the Kaizen project are included with their titles.

3.4 Step 4 Current Situation: By determining the current situation, how the problem occurred, and the details are highlighted.

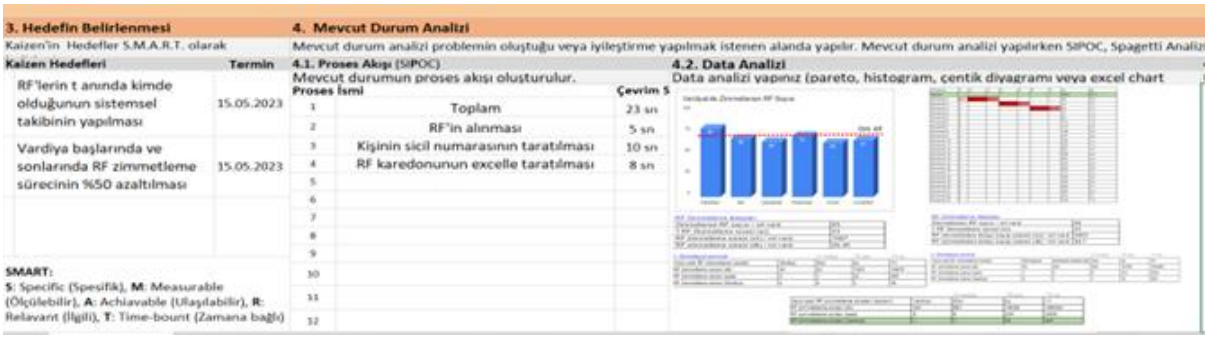

Figure 3. Step 3 and step 4 of the Kaizen

3.5 Step 5 Project Plan: The Kaizen Project Activity Plan is created, and the roles and responsibilities of the team members are defined.

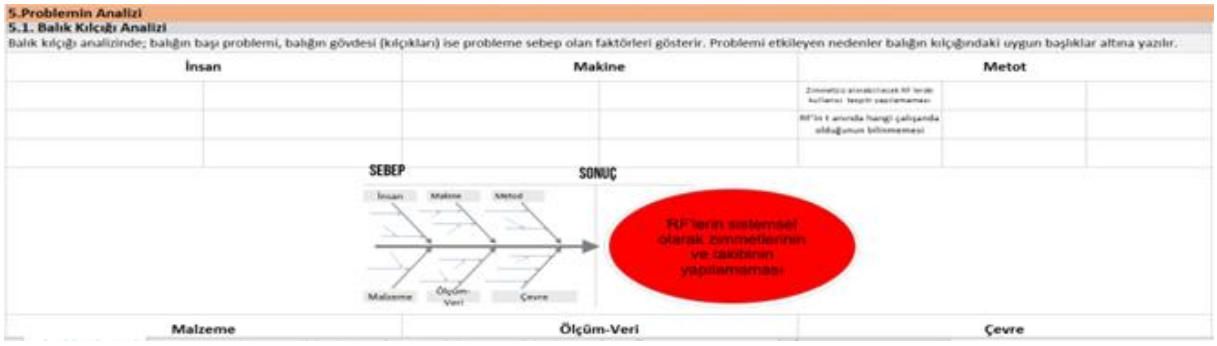

Figure 4. Step 5 of the Kaizen

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5.2. 5 Neden Analizi

Problemin oluşmasına yol açabilecek tüm sebepleri 5 Neden analizi ile sorgulanır. 5 Neden analizinde Konu başlığı altına şüphelenilen genel sebep başlığı yazılır ve daha sonra Neden sorusu sorulur. Sorulan soruya anlamlı bir cevap alınıyorsa Neden soruları sorulmaya devam eder. Maksimum 5 defa Neden sorusu sorulması önerilir

No	Konu	NEDEN?	NEDEN?	NEDEN?	NEDEN?	NEDEN?
1	RF'lerin sistemsel olarak takibinin yapılamaması	Zimmetsiz alınabiliecek RF lerde kullanıcı tespiti yapılamaması	RF'in t anında hangi çalışanda olduğunun bilinmemesi	RF'lerde kullanıcı takibinin yapılamaması	RF üzerinde takip programı yok	
2	RF'lerin sistemsel olarak takibinin yapılamaması	Zimmetsiz alınabiliecek RF lerde kullanıcı tespiti yapılamaması	Personeller, RF'leri vardiya başında rasgele seçiyor	RF'lerin kim tarafından alınacağı belirli değil	Personel ve RF eşleştirme sistemi yok	

Figure 5. Step 5 of the Kaizen

3.6 Step 6 Analysis: Root causes and areas for improvement are identified using problem solving techniques appropriate to our problem (cause and effect analysis, process analysis, ECRS analysis, comparison matrix, etc.).

6. Aksiyonların Belirlenmesi

5 Neden analizinde bulduğunuz kök nedenler tabloya işlenir ve her bir kök nedeni ortadan kaldırmak için en az 1 aksiyon belirlenir		Aksiyonların uygulama maliyetleri, aksiyon alacak kişi, tarihi ve aksiyonun durumu belirlenir		
Kök Neden	Aksiyonlar	Uygulama Maliyeti	Sorumlu	Tarih
RF üzerinde takip programı yok	RF'in t anında takibinin yapılabilmesi için araştırma yapılacak, daha önce alınmış teklifler değerlendirilecek	0	Alişan Aralı	15 Mart 2023
	İç takip programının yapılabilirliği çalışılacak		AA	25 Mart 2023
RF üzerinde takip programı yok	RF Tracking systemin yazılması	0	AA	3 Nisan 2023
	RF Trackking system saha denemelerinin yapılması	0	BB	15 Nisan 2023
Personel ve RF eşleştirme sistemi yok	Personel numaraları ile RF'ler zimmetlenecek. Random RF seçme süreci kaldırılacak	0	AA	27 Mart 2023

Figure 6. Step 6 of the Kaizen

3.7 Step 7 Improvement: The solution suggestions we put into practice for our problem are included.

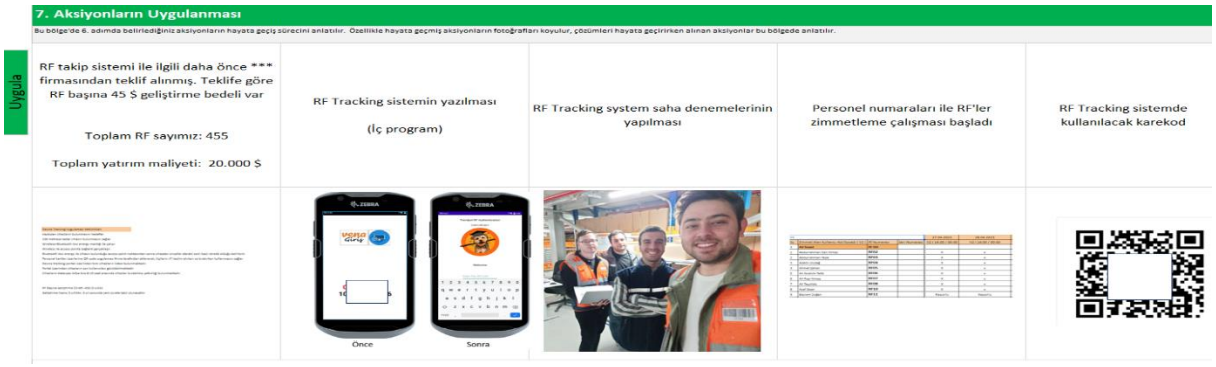

Figure 7. Step 7 of the Kaizen

3.8 Step 8 Verification and Earning**:** By query whether we have achieved the goal we set in Step 2, the annual kaizen return calculates in TL once it confirms that the goal has been achieved.

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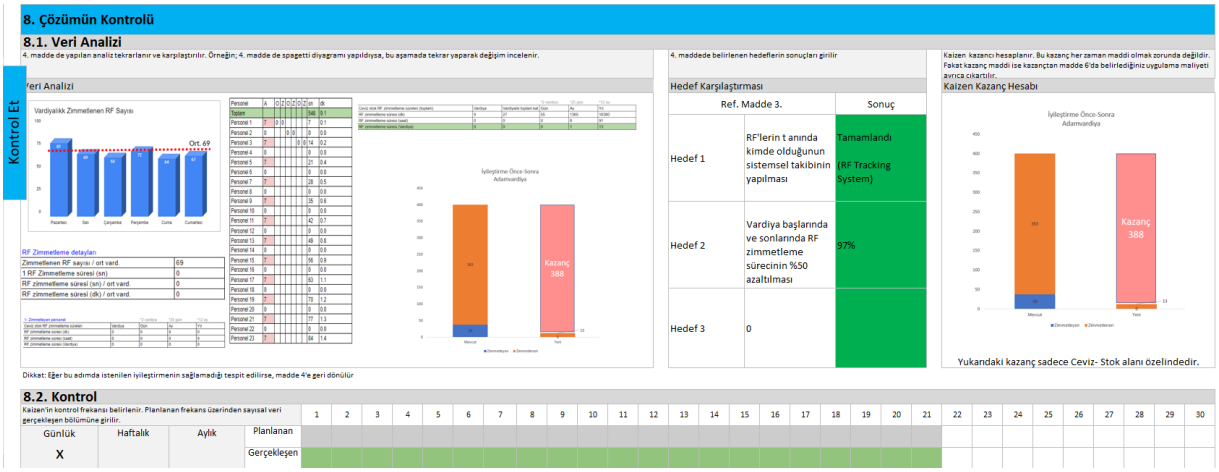

Figure 8. Step 8 of the Kaizen

3.9 Step 9 Standardization: Regression is prevented with standardization methods (creation of instructions, technical drawings, project, company contracts, etc.).

Figure 9. Step 9 of the Kaizen

3.10 Step 10 Dissemination: The training provided to ensure the adoption of Kaizen by all relevant employees is mentioned and/or other Kaizen practices planned to be launched are briefly mentioned.

All improvements achieved are evaluated and rewarded within the reward system. The team members to be rewarded are determined by the team leader, and team members who did not attend the meetings during the kaizen activities are not included in the scope of the reward.

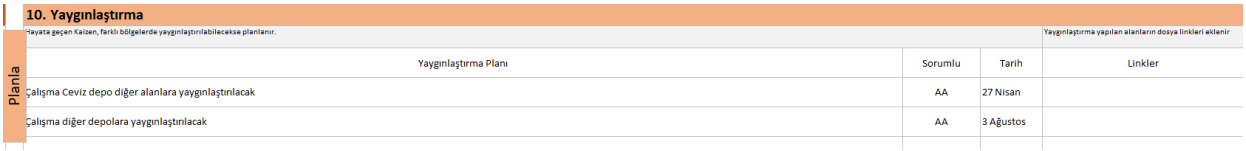

Figure 10. Step 10 of the Kaizen

4. RESULTS OF THE ANALYSIS

Within the scope of the study, the analysis results are shown with RF current state analysis and RF new state analysis tables. Tables 2 and 3 give detailed results for both situations. The organization has been achieved a financial gain of ***.*** TL by eliminating non-value added work and continuing the culture of continuous improvement. In addition, this study is a valuable

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resource that provides ideas about the Kaizen technique and its potential applications for logistics companies, academics and researchers working in the logistics sector.

Chart 1. RF Current Status Embezzlement

Walnut stock RF deposition time (total)	Shift	Day	Month	Year
RF deposition time (min)	281	561	14028	168330
RF deposition time (hour)	5	9	234	2806
RF deposition time (shift)	1	1	33	401

Chart 2. RF New Status Embezzlement

Walnut stock RF deposition time (total)	Shift	Total floor per shift	Day	Month	Year
RF deposition time (min)	9	27	55	1365	16380
RF deposition time (hour)	0	0	0	8	91
RF deposition time (shift)	0	0	0	1	13

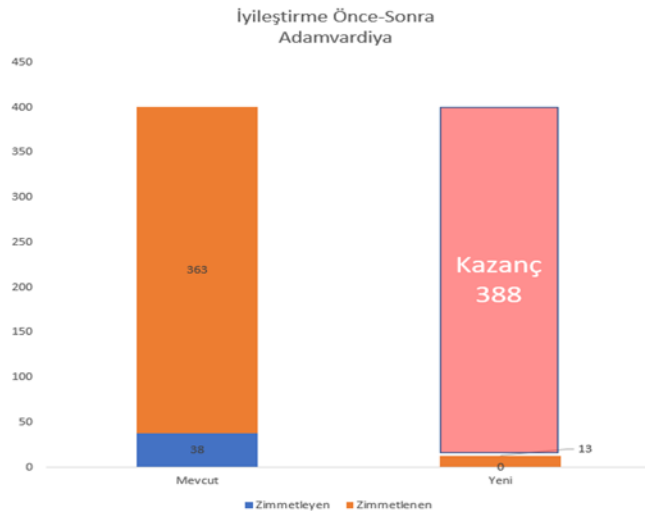

Figure 11. Situation before and after improvement

5. CONCLUSION

RF devices are a new technology that allows warehouse staff to exchange data quickly, easily and accurately, speeding up operations. This helps to make warehouse operations more efficient and error-free. However, it is not enough to simply purchase and implement new technology, as various problems can arise due to differences in warehouse management systems and company cultures. Applying the continuous improvement or Kaizen approach to all processes throughout the organization and involving all employees in continuous improvement efforts

can yield significant benefits. The 10-stage Kaizen studies in Trendyol's e-commerce warehouses have shown significant improvements. In the future studies, implementing the applications of this approach in other warehouse processes will offer potential benefits. In addition, RF devices are often integrated into a warehouse management system so that real-time inventory tracking, order management and other operational information can be provided.

ACKNOWLEDGEMENT

We would like to thank Trendyol R&D Center and Opex Department for supporting this study.

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ARDIŞIK GÜNLÜK AKIŞLILIK KATSAYILARI İLE GÜNLÜK AKIŞ SÜREÇLERİNİN STASYONER HALE GETİRİLMESİ

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ÖZET

Akım gözlemlerinin yapılması hem zamana hem de ekonomik güce bağlı olarak gerçekleştirilebilmektedir. Ancak bu işlemin yapılması su kaynaklarının geliştirilebilmesi açısından önemli bilgilerin temin edilmesini sağlamaktadır.

Su kaynaklarının geliştirilebilmesini sağlamak için yapılacak çalışmalarda; akarsulardaki akım gözlemleri temel bilgi aktarımını sağlamaktadır.

Bilindiği gibi yıldan daha kısa süreli (aylık, haftalık ve günlük) akım gözlemleri yıl periyod olmak üzere periyodik bileşen, sıçrama ve trend gibi unsurları barındırdıkları için stasyoner süreçler değildir. Aynı zamanda kendinden önceki gözlenmiş değerlere de bağımlı olan günlük debi süreçleri stokastik bir yapıya sahiptir.

Bu süreçlerin ileriye yönelik tahminlerde (minimum akım, ekosistem ihtiyacı ve biriktirmesiz hidroelektrik santral çalışmalarında kullanılan akım sürek eğrilerinin oluşturulmasında) kullanılabilmesi için, geleneksel yöntemlerle, öncelikle sürecin stasyoner hale getirilmesi gerekmektedir. Bunun için seride varsa öncelikle sıçrama ve trendin ayıklanması gerekmektedir. Sonrasında periyodik bileşen ayrılarak sürecin stasyoner hale getirilmesi gerekmektedir. Günümüzde bilgisayar olanakları ile kısa sürede yapılabiliyor olsa da zamana ihtiyaç duyulmaktadır. Aynı zamanda parametre sayısının artması; güvenirliği de olumsuz yönde etkilemektedir.

Bu çalışmada sunulan ‘ardışık günlük akışlılık katsayıları’ yaklaşımı ile akım süreci doğrudan stasyoner hale getirilebilmektedir. Bu stasyoner hale getirilmiş süreç kullanılarak, çevrimsel seri yaklaşımıyla, ileriye dönük veya belirli bir günde ölçülen debi değeri kullanılarak geleceğe yönelik tahminler yapılabilmektedir.

Anahtar kelimeler: Ardışık günlük akışlılık katsayısı, akışlılık katsayısı, satasyoner, stokastik

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ALÜMİNYUM ALAŞIMLI BİNEK ARAÇ JANTLARININ BURULMA RİJİTLİĞİ ANALİZİ İÇİN OPTİMİZASYONU

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ÖZET

Aracın yol ile temasını sağlayan en önemli bileşenlerden biri olan jantlar, statik ve dinamik yükler altında çalışan kritik öneme sahip elemanlardır. Alüminyum alaşımlı binek araç jantları araca kattıkları görsel etkiler ile ön plana çıkmış olsa da jantların en önemli özellikleri önemli birer güvenlik parçaları olmalarıdır; kullanım süreleri boyunca farklı türlerde yüklere maruz kalan bu parçaların hasara uğramaması temel beklentidir. Bu beklenti ise tasarım aşamasında yapılan çeşitli sonlu elemanlar analizleri ile sağlanmakta olup, ürün geliştirme adımında hem zaman hem de maliyet kazanımı amaçlanmaktadır. Genel kullanım koşulları yorulma analizi ile incelenip test ile doğrulanırken, kaza senaryoları gibi özel durumlar da darbe analizleri ve testleri ile incelenmektedir. Jantlar kullanım esnasında aracın hızlanması ve yavaşlaması sebebiyle burulma yüklerine maruz kalmaktadır. Çalışma kapsamında tasarlanan 12 parametrik ölçüye sahip jantın burulma rijitliğinin maksimize edilmesi adına Minitab istatistik programı kullanılarak deney tasarımı oluşturulmuştur. Parametrelerin jantın dayanımı ve kütlesi üzerine etkisi belirlenmiştir.

Anahtar Kelimeler: Rijitlik, sonlu elemanlar analizi, deney tasarımı, Minitab

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PHOTOCATALYTIC AND OPTICAL PROPERTIES OF Mn-DOPED ZnS THIN FILMS DERIVED BY SOL-GEL

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ABSTRACT

Currently, photocatalysis is one of the most studied subjects due to its useful applications like H_2 production and degrading harmful organic dyes within the environment. With this aim, ZnS can be used as a photocatalyst for the mentioned applications. Therefore, in this study, ZnS and 10 % Mn-doped ZnS thin films were synthesized by sol-gel technique. The impact of Mn-doping on the photocatalytic and optical properties of the ZnS was scrutinized in detail. The x-ray diffraction analysis has shown the formation of the hexagonal ZnS phase with a predominant cubic phase. The Uv-Vis spectrophotometer was used in optical analysis as well as photocatalysis evaluation. For the photocatalysis process, ZnS/Mn-doped ZnS photocatalyst and methylene blue (MB) organic dye were degraded under UV-light radiation. The optical analysis shows an increase/decrease in the optical absorbance of ZnS when doped with 10 % Mn, while the optical band gap value decreases. Compared to the host ZnS, the photocatalytic activity of the Mn-doped ZnS has increased for degradation of methylene blue under UV-light radiation. This reduction can be connected to the synergy of the decreased crystallite size and reduced sulfur defect intensity.

Keywords : Mn-doped ZnS, Sol-gel, Mn-doping, Thin film, Photocatalysis

1. INTRODUCTION

ZnS semiconductor is a compound, belonging to the III-V periodic table and attracts great attention as a thin film. The reasons why this material has attracted so much attention can be

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listed as follows; ZnS has a wide band gap at room temperature (3.60 eV) (i), high exciton binding energy (40 meV) (ii), optical transmittance at 400-700 nm visible wavelengths and the magnitude of the polarization coefficient (iii), stable at room conditions. (iv), does not harm the environment (v) and can be used in many different industrial applications (optics, optoelectronics, electronics, photovoltaics and photocatalysis, etc.) (vi) [1-2]. The basic properties of materials (magnetic, optical, mechanical, electronic) reflect the applications in which they can be effective. Therefore, its main characteristics should be taken into consideration when producing materials. For example, if it is a material with magnetic properties, parameters such as magnetism type (diamagnetic, ferromagnetic, paramagnetic, etc.), magnetic intensity and magnetic susceptibility will come to the fore more effectively from the magnetic measurement results [3-4].

When different elements (Mn, Fe, Mg, Al, N, Se, Cu, etc.) are doped into the ZnS crystal lattice system, the morphological, structural, optical, electrical and magnetic properties of ZnS can be improved as well as photocatalytic. Recently, metal/transition element doped ZnS thin film nanostructures can generally be grown by many classical thin film growth techniques. Among the mentioned techniques, the sol-gel film production technique based on the chemical solution method is a film growth method that allows the growth of high quality and purity thin film nanostructures and is a low-cost and practical process. Due to the mentioned advantages, in the presented study, $Zn_{1-x}Mn_xS$ (x=0.10) nanostructured thin film was prepared on glass substrates to examine its optical and photocatalytic properties using sol-gel and dip-coating technique.

2. EXPERIMENTAL RESEARCH

2.1. Used Materials and Film Production

Mn transition element (doping level 10 at.%) doped ZnS thin film nanostructures were grown on glass substrates using certain solvents by using the sol-gel method. To obtain ZnS and ZnMnS thin films, Zn acetate, thiourea and Mn nitrate precursor chemical salts were taken in a certain ratio and dissolved in 2-Methoxy ethanol. Relevant solutions were prepared using a magnetic stirrer. For ZnS and 10 at. % Mn transition element doped ZnS, the pH value was adjusted to approximately 10 by using a certain amount of ethanol amine to adjust the pH of the prepared solution. The obtained solutions were mixed with a magnetic stirrer for 24 hours at room conditions. The final solutions, which were ready for coating, were stored in a vertical oven at 300 ^{o}C using the sol-gel immersion technique, on film glass substrates

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previously cleaned in acetone, methanol and ethanol bath. To crystallize the stored films, they were annealed in a vacuum environment at 600 °C for 45 min.

2.2. Characterization Techniques

Control of crystalline phases and possible foreign metallic phases of nano-structured ZnS and $Zn_{1-x}Mn_xS$ (ZMS) (x=10 at.%) thin films produced by sol-gel dipping method with XRD (Rigaku Ultima III (40 kV, 40 mA and 1.54 A◦)) diffractometer. examined. The optical and photocatalytic properties of ZnS and ZMS nanostructured thin films were examined with a UV spectrophotometer (Perkin Emler 45 UV–Vis) in the wavelength range of 300-800 nm and 200-1100 nm, respectively.

3. RESULTS AND DISCUSSION

3.2. XRD analysis

XRD analysis results of the prepared nano-structured ZnS and ZMS thin films are given in Figure-1. The results obtained indicate that nanostructured ZnS and ZMS (x=5%) thin films have a dominant hexagonal ZnS crystal structure with (002) orientation preference and a polycrystalline nature [3]. (002) preferred highly oriented crystallization in the direction of the Miller index. No possible type of metallic secondary phase or impurity was detected in the XRD analysis. It was understood that the crystallization orientation was higher in the ZnS film than that of ZMS thin film, but the crystal size calculated according to the Debye Sherrer formula was smaller [3].

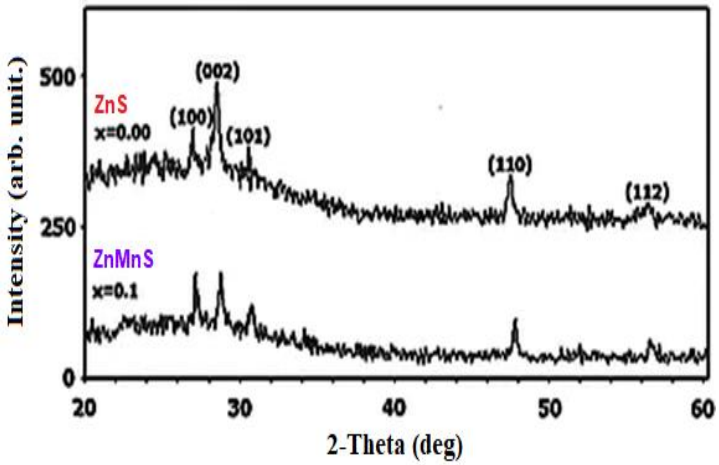

Figure-1. XRD patterns of the ZnS ve $Zn_{1-x}Mn_xS$ (x= 10 at.%) thin films.

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3.2. Optical analysis

To scrutinize the optical absorbance of the ZnS and ZMS thin films the UV–vis spectroscopy was utilized. The room temperature of optical absorbance spectrums was taken between 300 and 900 nm the ZnS and ZMS thin films as seen in Figure-2. As seen in Figure-2 ZnS has higher absorption intensity than that of ZMS film, whereas it has lower absorption intensity than that of ZMS film in the visible region. These variations are related to the crystalization of films and also reflect their usable potential in various device applications.

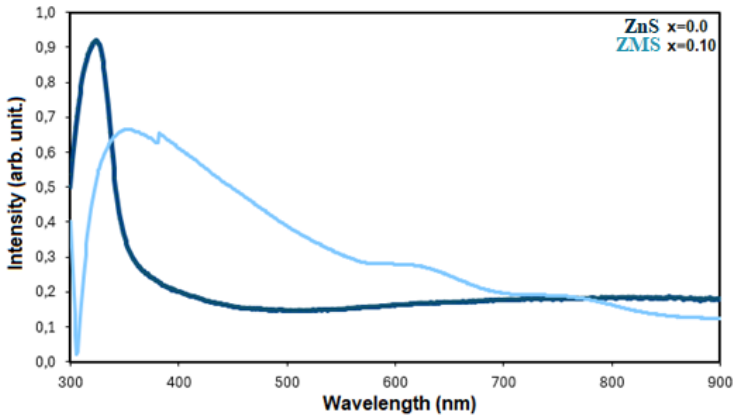

Figure-2. UV–Vis spectra of the ZnS ve $Zn_{1-x}Mn_xS$ (x= 10 at.%) thin films.

The optical energy band gap (E_g) of the ZnS and ZMS thin films was determined by using optical absorbance measurement by fitting data to the Tauc's relation [5]. The values of E_g were computed from the absorbance spectrum via plotting $(\alpha h\nu)^2$ versus $h\nu$ (Figure-3). As seen from Fig. 5, the E_g reduces by doping of the Mn content from 3.59 eV (ZnS) to 3.14 eV for the ZMS film. This reduction is likely due to formation of MnS phase since its E_g values changes between the 2.5, and 3.2 eV according to the used different film preparation methods and situations [6]. The same trend was reported in Mn-doped ZnS nanoparticles grown via chemical precipitation technique [7].

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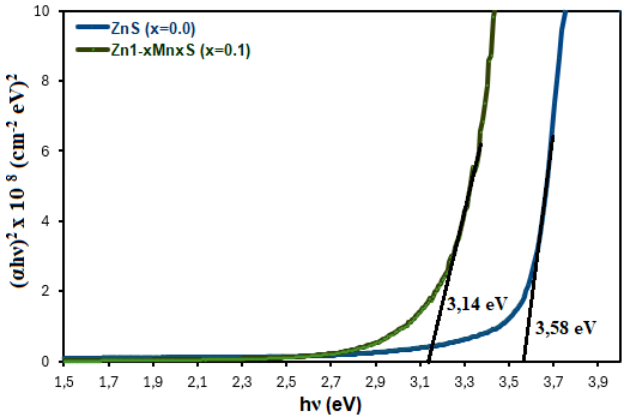
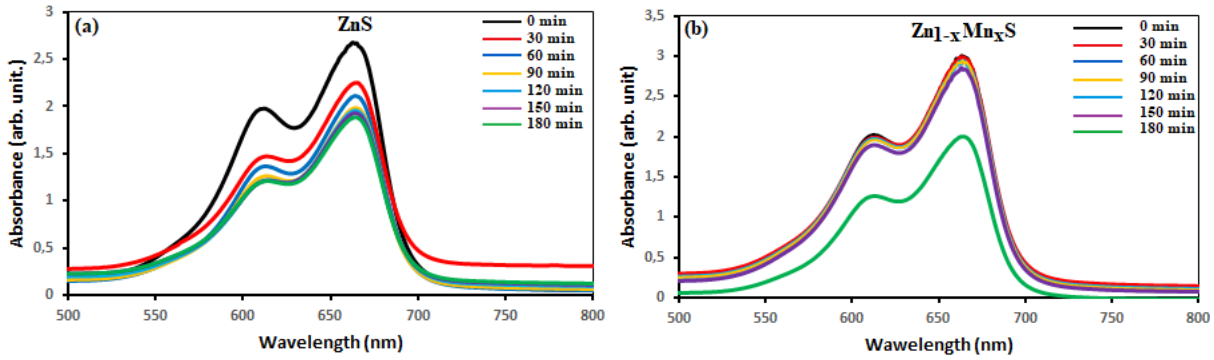


Figure-3. Estimation of the E_g for the ZMS thin films with different Mn content (x = 0.0, and 0.1)

3.3. Photocatalytic performance

To evaluate the photocatalytic performance, a certain amount of ZnS and ZMS photocatalyst thin films were regulated as ~0.4 mg/ml (catalyst dosage). The concentration and the pH methylene blue (MB) solution were adjusted to 11 by using sodium hydroxide and pure water at 10g/L. The distance of the UV lamps (4x8W) to the MB solution container was set as 3.5 cm. Additionally, the dimensions of all film-coated glasses in the solution were 6cmx1cm. During the measurements the temperature of MB solution was kept constant at room temperature. Before UV lamp light radiation, the MB solution bath containing ZnS or ZnMnS photocatalysts was meticulously mixed with a magnetic stirrer to achieve absorption-absorption balance and kept in the dark for 30 min. The activity of ZnS and ZnMnS thin film photocatalyst samples was calculated using the equation of $[(C\text{-}C_0/C_0)] \times 100$, where C_0 and C are the absorbance value of MB at the characteristic 664 nm wavelength before and after exposure to UV light radiation, respectively [8].



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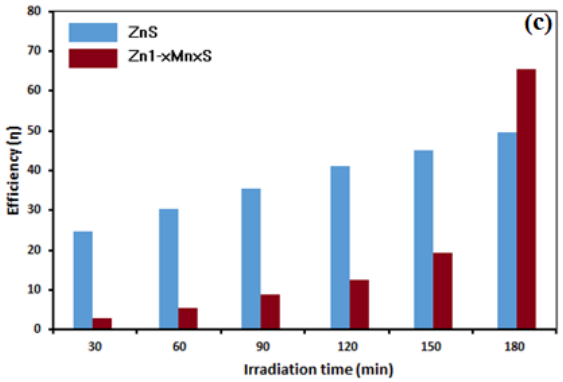

Figure-4. Time-dependent absorption spectra (a-b) and the photocatalytic efficiency of ZnS and (b) ZMS thin film photocatalysts for degradation of MB under UV-light in the presence of.

Figures-4(a-b) show the absorption curves of ZnS and ZMS photocatalyst taken at 30-min intervals. As seen from Figures-4a-b, the intensity of the methylene blue spectrum decreases rapidly over time. This is because ZnS and ZMS semiconductor photocatalysts are excited by visible UV light and electron-hole pairs are formed. Some of the excited electrons return to the valence band by recombination, while some react with O_2 and OH^- on the facet of photocatalysts, causing the formation of reactive $\cdot O2^-$ and $\cdot OH$. The organic molecule reacts with these reactive species and turns into CO_2 and H_2O [9].

According to the calculations, the degradation rates of methylene blue solution within 180 minutes were determined to be approximately 50% and 65 % for ZnS and ZMS samples, respectively (see Figure-4c). These results are compatible with the literature, but it should be noted that the amount of photocatalytic used in this study is quite less compared to other studies. Additionally, the used UV-light has low power and intensity. It is an important finding that the degradation rate is significant despite the small amount of photocatalytic material and the use of low-intensity light [10].

4. CONCLUSIONS

Nanostructured ZnS and $Zn_{1-x}Mn_xS$ (ZMS, x=10 at. %) thin films prepared using the sol-gel dipping method were produced on glass substrates in an argon environment. XRD analysis of the films revealed that they crystallized in the (002) plane oriented hexagonal ZnS structure and had a polycrystalline structure. ZnS has higher absorption intensity than that of ZMS film, whereas it has lower absorption intensity than that of the ZMS film in the visible region according to the UV-Vis spectroscopy. Additionally, the E_g of the ZnS thin films are relatively

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lower than that of 10 at. % Mn-doped ZnS thin film. Photocatalytic measurements showed that the optical absorption of MB under UV light decreased over time in the presence of ZnS and ZMS photocatalysts. In addition, photocatalytic measurement results showed that the ZnS photocatalyst exhibited lower photocatalytic performance (50 at.%)) against MB compared to the ZMS photocatalyst (68 at.%). This high performance of the ZMS photocatalyst was attributed to the smaller crystal size of ZMS, that is, it has more active surface area. The obtained results agree with the literature and ZnS photocatalyst is more suitable for photocatalytic applications.

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MOLECULARLY IMPRINTED POLYMERS (MIPS): TARGETED REMOVAL OF CARBAMAZEPINE FROM WATER

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Abstract:

The occurrence and removal of trace organic contaminants in the aquatic environment has become a focus of environmental concern. For the selective removal of carbamazepine from loaded waters molecularly imprinted polymers (MIPs) were synthesized with carbamazepine as template. Parameters varied were the type of monomer, crosslinker, and porogen, the ratio of starting materials, and the synthesis temperature. Best results were obtained with a template to crosslinker ratio of 1:20, toluene as porogen, and methacrylic acid (MAA) as monomer. MIPs were then capable to recover carbamazepine by 93% from a 10-5 M landfill leachate solution containing also caffeine and salicylic acid. By comparison, carbamazepine recoveries of 75% were achieved using a nonimprinted polymer (NIP) synthesized under the same conditions, but without template. In landfill leachate containing solutions carbamazepine was adsorbed by 93-96% compared with an uptake of 73% by activated carbon. The best solvent for desorption was acetonitrile, with which the amount of solvent necessary and dilution with water was tested. Selected MIPs were tested for their reusability and showed good results for at least five cycles. Adsorption isotherms were prepared with carbamazepine solutions in the concentration range of 0.01 M to 5*10-6 M. The heterogeneity index showed a more homogenous binding site distribution.

Keywords: Carbamazepine, landfill leachate, removal, reuse

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DUAL APPROACH FOR PENTACHLOROPHENOL REMOVAL: ADSORPTION AND BIODEGRADATION

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Abstract:

Removal of PCP by a system combining biodegradation by biofilm and adsorption was investigated here. Three studies were conducted employing batch tests, sequencing batch reactor (SBR) and continuous biofilm activated carbon column reactor (BACCOR). The combination of biofilm-GAC batch process removed about 30% more PCP than GAC adsorption alone. For the SBR processes, both the suspended and attached biomass could remove more than 90% of the PCP after acclimatisation. BACCOR was able to remove more than 98% of PCP-Na at concentrations ranging from 10 to 100 mg/L, at empty bed contact time (EBCT) ranging from 0.75 to 4 hours. Pure and mixed cultures from BACCOR were tested for use of PCP as sole carbon and energy source under aerobic conditions. The isolates were able to degrade up to 42% of PCP under aerobic conditions in pure cultures. However, mixed cultures were found able to degrade more than 99% PCP indicating interdependence of species.

Keywords: Adsorption, biodegradation, identification, isolated bacteria, pentachlorophenol.

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ENHANCED VAGINAL SUPPOSITORIES WITH LACTOBACILLUS: FORMULATION AND ASSESSMENT

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Abstract:

The objective of this study was to develop vaginal suppository containing lactobacillus. Four kinds of vaginal suppositories containing Lactobacillus paracasei HL32 were formulated: 1) a conventional suppository with Witepsol H-15 as a base, 2) a conventional suppository with mixed polyethylene glycols (PEGs) as a base, 3) a hollow-type suppository with Witepsol H-15 as a base and 4) a hollow-type suppository with mixed PEGs as a base. The release studies demonstrated that the hollow-type suppository with mixed PEGs as the base gave the highest release of L. paracasei HL32 and was microbiological stable after storage at 2- 8°C over the period of 3 months.

Keywords: Lactobacillus paracasei HL32, vaginal suppository, release study, hollow-type, viability.

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INFLUENCE OF SERICIN CONCENTRATION ON FILM PROPERTIES: A STUDY

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Abstract:

Silk sericin (SS) is a glue-like protein from silkworm cocoon. With its outstanding moisturization and activation collagen synthesis properties, silk protein is applied for wound healing. Since wound dressing in film preparation can facilitate patients- convenience and reduce risk of wound contraction, SS and polyvinyl alcohol (PVA) films were prepared with various concentrations of SS. Their physical properties such as surface density, light transmission, protein dissolution and tensile modulus were investigated. The results presented that 3% SS with 2% PVA is the best ingredient for SS film forming.

Keywords: Sericin, silk protein, film, wound healing.

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NEW RP-HPLC METHOD VALIDATION FOR NORFLOXACIN DETECTION

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Abstract:

A new reverse phase-high performance liquid chromatography (RP-HPLC) method with fluorescent detector (FLD) was developed and optimized for Norfloxacin determination in human plasma. Mobile phase specifications, extraction method and excitation and emission wavelengths were varied for optimization. HPLC system contained a reverse phase C18 (5 µm, 4.6 mm×150 mm) column with FLD operated at excitation 330 nm and emission 440 nm. The optimized mobile phase consisted of 14% acetonitrile in buffer solution. The aqueous phase was prepared by mixing 2g of citric acid, 2g sodium acetate and 1 ml of triethylamine in 1 L of Milli-Q water was run at a flow rate of 1.2 mL/min. The standard curve was linear for the range tested (0.156–20 µg/mL) and the coefficient of determination was 0.9978. Aceclofenac sodium was used as internal standard. A detection limit of 0.078 µg/mL was achieved. Run time was set at 10 minutes because retention time of norfloxacin was 0.99 min. which shows the rapidness of this method of analysis. The present assay showed good accuracy, precision and sensitivity for Norfloxacin determination in human plasma with a new internal standard and can be applied pharmacokinetic evaluation of Norfloxacin tablets after oral administration in human.

Keywords: Norfloxacin, Aceclofenac sodium, Methodoptimization, RP-HPLC method, Fluorescent detection, Calibrationcurve.

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EXPLORING ANTIBACTERIAL POTENTIAL OF PLUMERIA ALBA PETALS

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Management and Science university, Shah Alam, Selangor, Malaysia

Abstract:

Antibacterial activity of Plumeria alba (Frangipani) petals methanolic extracts were evaluated against Escherichia coli, Proteus vulgaris,Staphylococcus aureus, Klebsiella pneumoniae, Pseudomonas aeruginosa, Staphylococcus saprophyticus, Enterococcus faecalis and Serratia marcescens by using disk diffusion method. Concentration extracts (80 %) showed the highest inhibition zone towards Escherichia coli (14.3 mm). Frangipani extract also showed high antibacterial activity against Staphylococcus saprophyticus, Proteus vulgaris and Serratia marcescens, but not more than the zones of the positive control used. Comparison between two broad specrum antibiotics to frangipani extracts showed that the 80 % concentration extracts produce the same zone of inhibition as Streptomycin. Frangipani extracts showed no bacterial activity towards Klebsiella pneumoniae, Pseudomonas aeruginosa and Enterococcus faecalis. There are differences in the sensitivity of different bacteria to frangipani extracts, suggesting that frangipani-s potency varies between these bacteria. The present results indicate that frangipani showed significant antibacterial activity especially to Escherichia coli.

Keywords: Frangipani, Plumeria alba, anti microbial, Escherichia coli

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PROACTIVE DETECTION OF FALSE DRUG-DRUG INTERACTION ALERTS

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Abstract:

Researchers of drug-drug interaction alert systems have often suggested that there were high overridden rate for alerts and also too false alerts. However, research about decreasing false alerts is scant. Therefore, the aim of this article attempts to proactive identification of false alert for drug-drug interaction and provide solution to decrease false alerts. This research involved retrospective analysis prescribing database and calculated false alert rate by using MYSQL and JAVA. Results of this study showed 17% of false alerts and the false alert rate in the hospitals (37%) was more than in the clinics. To conclude, this study described the importance that drug-drug interaction alert system should not only detect drug name but also detect frequency or route, as well as in providing solution to decrease false alerts.

Keywords: drug-drug interaction, proactive identification, false alert

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COMPARATIVE ANTIBACTERIAL EFFECTS OF ETHANOL AND ISOPROPYL EXTRACTS OF ZINGIBER OFFICINALE ROSE

Ridwan Abu Djibran , Aris Syafi'i

State Islamic University K.H. Indonesia

Abstract:

In this investigation, the antibacterial effects of ethanolic and 7:3 isopropyl –hexane mixture extracts of Zingiber officinale were evaluated against three Gram positive bacteria, B. cereus, S.epidermidis, S. aureus and three Gram negative bacteria, E. coli, K.pneumonia and P.areuginosa. Utilizing paper disk diffusion and well methods in-vitro, MIC and MBC were determined by macrodilution. The results showed that ethanolic rhizome extract of ginger had significantly active than Isopropyl –hexan extract. Further work needs to be done in these extracts including fractionation to isolate active constituents and subsequent pharmacological evaluation.

Keywords: Antibacterial, Medicinal plant extract, Zingiberofficinale.

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ENHANCING SHEAR STRENGTH PARAMETERS OF LOESS WITH COMMON ADMIXTURES IN GORGAN, IRAN

Seyed Erfan Hosseini, Mohammad K. Alizadeh, Amir Mesbah

Islamic Azad University, Aghghala Branch, Aghghala, Iran

Abstract:

Non-saturated soils that while saturation greatly decrease their volume, have sudden settlement due to increasing humidity, fracture and structural crack are called loess soils. Whereas importance of civil projects including: dams, canals and constructions bearing this type of soil and thereof problems, it is required for carrying out more research and study in relation to loess soils. This research studies shear strength parameters by using grading test, Atterberg limit, compression, direct shear and consolidation and then effect of using cement and lime additives on stability of loess soils is studied. In related tests, lime and cement are separately added to mixed ratios under different percentages of soil and for different times the stabilized samples are processed and effect of aforesaid additives on shear strength parameters of soil is studied. Results show that upon passing time the effect of additives and collapsible potential is greatly decreased and upon increasing percentage of cement and lime the maximum dry density is decreased; however, optimum humidity is increased. In addition, liquid limit and plastic index is decreased; however, plastic index limit is increased. It is to be noted that results of direct shear test reveal increasing shear strength of soil due to increasing cohesion parameter and soil friction angle.

Keywords: Loess Soils, Shear Strength, Cement, Lime.

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ADVANCEMENTS IN BIM SOFTWARE DEVELOPMENT IN CLOUD COMPUTING ENVIRONMENT

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Abstract:

According as the Architecture, Engineering and Construction (AEC) Industry projects have grown more complex and larger, the number of utilization of BIM for 3D design and simulation is increasing significantly. Therefore, typical applications of BIM such as clash detection and alternative measures based on 3-dimenstional planning are expanded to process management, cost and quantity management, structural analysis, check for regulation, and various domains for virtual design and construction. Presently, commercial BIM software is operated on single-user environment, so initial cost is so high and the investment may be wasted frequently. Cloud computing that is a next-generation internet technology enables simple internet devices (such as PC, Tablet, Smart phone etc) to use services and resources of BIM software. In this paper, we suggested developing method of the BIM software based on cloud computing environment in order to expand utilization of BIM and reduce cost of BIM software. First, for the benchmarking, we surveyed successful case of BIM and cloud computing. And we analyzed needs and opportunities of BIM and cloud computing in AEC Industry. Finally, we suggested main functions of BIM software based on cloud computing environment and developed a simple prototype of cloud computing BIM software for basic BIM model viewing.

Keywords: Construction IT, BIM(Building Information Modeling), Cloud Computing, BIM Service Based Cloud Computing, Viewer Based BIM Server, 3D Design.

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FINITE ELEMENT SIMULATION AND PARAMETERIZATION OF A C-SHAPED ELECTROMAGNET FOR MAGNETIC MATERIAL CHARACTERIZATION

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Abstract:

This article presents the simulation, parameterization and optimization of an electromagnet with the C–shaped configuration, intended for the study of magnetic properties of materials. The electromagnet studied consists of a C-shaped yoke, which provides self–shielding for minimizing losses of magnetic flux density, two poles of high magnetic permeability and power coils wound on the poles. The main physical variable studied was the static magnetic flux density in a column within the gap between the poles, with 4cm2 of square cross section and a length of 5cm, seeking a suitable set of parameters that allow us to achieve a uniform magnetic flux density of 1x104 Gaussor values above this in the column, when the system operates at room temperature and with a current consumption not exceeding 5A. By means of a magnetostatic analysis by the finite element method, the magnetic flux density and the distribution of the magnetic field lines were visualized and quantified. From the results obtained by simulating an initial configuration of electromagnet, a structural optimization of the geometry of the adjustable caps for the ends of the poles was performed. The magnetic permeability effect of the soft magnetic materials used in the poles system, such as low– carbon steel (0.08% C), Permalloy (45% Ni, 54.7% Fe) and Mumetal (21.2% Fe, 78.5% Ni), was also evaluated. The intensity and uniformity of the magnetic field in the gap showed a high dependence with the factors described above. The magnetic field achieved in the column was uniform and its magnitude ranged between 1.5x104 Gauss and 1.9x104 Gauss according to the material of the pole used, with the possibility of increasing the magnetic field by choosing a suitable geometry of the cap, introducing a cooling system for the coils and adjusting the spacing between the poles. This makes the device a versatile and scalable tool to generate the magnetic field necessary to perform magnetic characterization of materials by techniques such as vibrating sample magnetometry (VSM), Hall-effect, Kerr-effect magnetometry, among others. Additionally, a CAD design of the modules of the electromagnet is presented in order to facilitate the construction and scaling of the physical device.

Keywords: Electromagnet, Finite Elements Method, Magnetostatic, Magnetometry, Modeling.

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THERMAL CONVECTION IN LIGHTWEIGHT TIMBER CONSTRUCTIONS ENHANCED WITH MINERAL WOOL

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Abstract:

The major part of light weight timber constructions consists of insulation. Mineral wool is the most commonly used insulation due to its cost efficiency and easy handling. The fiber orientation and porosity of this insulation material enables flowthrough. The air flow resistance is low. If leakage occurs in the insulated bay section, the convective flow may cause energy losses and infiltration of the exterior wall with moisture and particles. In particular the infiltrated moisture may lead to thermal bridges and growth of health endangering mould and mildew. In order to prevent this problem, different numerical calculation models have been developed. All models developed so far have a potential for completion. The implementation of the flow-through properties of mineral wool insulation may help to improve the existing models. Assuming that the real pressure difference between interior and exterior surface is larger than the prescribed pressure difference in the standard test procedure for mineral wool ISO 9053 / EN 29053, measurements were performed using the measurement setup for research on convective moisture transfer “MSRCMT". These measurements show, that structural inhomogeneities of mineral wool effect the permeability only at higher pressure differences, as applied in MSRCMT. Additional microscopic investigations show, that the location of a leak within the construction has a crucial influence on the air flow-through and the infiltration rate. The results clearly indicate that the empirical values for the acoustic resistance of mineral wool should not be used for the calculation of convective transfer mechanisms.

Keywords: convection, convective transfer, infiltration, mineralwool, permeability, resistance, leakage

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UNDERSTANDING THE CAUSES OF POOR CONSTRUCTION SITE SAFETY AND PRIORITIZING SOLUTIONS

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Abstract:

Construction site safety in China has aroused comprehensive concern all over the world. It is imperative to investigate the main causes of poor construction site safety. This paper divides all the causes into four aspects, namely the factors of workers, object, environment and management and sets up the accident causes element system based on Delphi Method. This is followed by the application of structural equation modeling to examine the importance of each aspect of causes from the standpoints of different roles related to the construction respectively. The results indicate that all the four aspects of factors are in need of improvement, and different roles have different ideas considering the priority of those factors. The paper has instructive significance for the practitioners to take measures to improve construction site safety in China accordingly.

Keywords: construction site safety, Delphi Method, structuralequation modeling, different perspective.

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OPTIMIZING STABILITY IN FUNCTIONALLY GRADED PIPES FOR FLUID CONVEYANCE

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Abstract:

This paper presents an exact analytical model for optimizing stability of thin-walled, composite, functionally graded pipes conveying fluid. The critical flow velocity at which divergence occurs is maximized for a specified total structural mass in order to ensure the economic feasibility of the attained optimum designs. The composition of the material of construction is optimized by defining the spatial distribution of volume fractions of the material constituents using piecewise variations along the pipe length. The major aim is to tailor the material distribution in the axial direction so as to avoid the occurrence of divergence instability without the penalty of increasing structural mass. Three types of boundary conditions have been examined; namely, Hinged-Hinged, Clamped- Hinged and Clamped-Clamped pipelines. The resulting optimization problem has been formulated as a nonlinear mathematical programming problem solved by invoking the MatLab optimization toolbox routines, which implement constrained function minimization routine named “fmincon" interacting with the associated eigenvalue problem routines. In fact, the proposed mathematical models have succeeded in maximizing the critical flow velocity without mass penalty and producing efficient and economic designs having enhanced stability characteristics as compared with the baseline designs.

Keywords: Functionally graded materials, pipe flow, optimumdesign, fluid- structure interaction

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DESIGN OPTIMIZATION OF LAUNCHING NOSE FOR INCREMENTAL LAUNCHING CONSTRUCTION OF SAME-SPAN CONTINUOUS BRIDGES

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State Islamic University K.H. Indonesia

Abstract:

The launching nose plays an important role in the incremental launching construction. The parameters of the launching nose essentially affect the internal forces of the girder during the construction. The appropriate parameters can decrease the internal forces in the girder and save the material and reduce the cost. The simplified structural model, which is made with displacement method according to the characteristic of incremental launching construction and the variation rule of the internal forces, calculates and analyzes the effect of the length, the rigidity and weight of launch nose on the internal forces of girder during the incremental launching construction. The method, which can calculate the launching nose parameters for the optimum incremental launching construction, is achieved. This method is simple, reliable and easy for practical use.

Keywords: incremental launching, launching nose, optimumanalysis, displacement method

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EVALUATING URBAN LAND DEVELOPMENT DIRECTION IN KABUL CITY, AFGHANISTAN

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Abstract:

Kabul, the capital and largest city in Afghanistan has been experiencing a massive population expansion and fast economic development in last decade, in which urban land has increasingly expanded and formed a high informal development territory in the city. This paper investigates the urban land development direction based on the integrated urbanization trends in Kabul city since the last and the fastest ever urban land growth period (1999-2008), which is parallel with the establishment of the new government in Afghanistan. Considering the existing challenges in terms of informal settlements, squatter settlements, the population expansion of the city, and fast economic development, as well as the huge influx of returning refugees from neighboring countries, and the sprawl direction of urbanization of the Kabul city urban fringes, this research focuses on the possible urban land development direction and trends for the city. The paper studies the feasible future land development direction of Kabul city in the northern part called Shamali basin, in which district 17 is the gateway for future development. The area has much developable area including eight districts of Kabul province, and the vast area of Parwan and Kapisa provinces. The northern area of the Kabul city generally has favorable conditions for further urbanization from the city. It is a large and relatively flat area of area in the northern part of Kabul city, with ample water resources available from the Panjshir basin as a base principle of land development direction in the area.

Keywords: Kabul city, land development trends, urban land development, urbanization.

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EXPLORING PLACE IDENTITY INFLUENCE ON WALKABILITY: A COMPARATIVE STUDY OF MIXED-USE STREETS IN ISFAHAN, IRAN, AND LEFKOŞA, NORTH CYPRUS

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Reihaneh Rafiemanzelat is with the Department of Architecture, Eastern Mediterranean University, Famagusta, North Cyprus

Abstract:

One of the most recent fields of investigation in urban issues focuses on the walkability in urban spaces. Considering the importance of walkability apart from pedestrian transportation, increasing walkability will help to reduce the congestion and environmental impact. This subject also matters as it has a social life, experiential quality and economical sustainability value. This study focused on the effects of walkability and place identity on each other in urban public spaces, streets in particular, as a major indicator of their success. The theoretical aspects which examine for this purpose consist of two parts: The first will evaluate the essential components of place identity in the streets and the second one will discuss the concept of walkability and its development theories which have been derived from walkable spaces. Finally, research investigates place identity and walkability and their determinants in two major streets in different cities. The streets are Chaharbagh Street in Isfahan/Iran and Dereboyu Street in Lefkosa/North Cyprus. This study has a qualitative approach with the research method of walkability studies. The qualitative method is combined with the collection of data relating to walking behavior and place identity through an observational field study. The result will show a relationship between pedestrian-friendly spaces and identity by related variables which has obtained.

Keywords: Place identity, walkability, urban public space, streets, pedestrian-friendly.

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CORRELATIONAL ANALYSIS BETWEEN BRAIN DOMINANCES AND MULTIPLE INTELLIGENCES

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Teaching Learning Centre, Indian Institute of Technology Madras, Chennai, India

Abstract:

Aim of this research study is to investigate and establish the characteristics of brain dominances (BD) and multiple intelligences (MI). This experimentation has been conducted for the sample size of 552 undergraduate computer-engineering students. In addition, mathematical formulation has been established to exhibit the relation between thinking and intelligence, and its correlation has been analyzed. Correlation analysis has been statistically measured using Pearson's coefficient. Analysis of the results proves that there is a strong relational existence between thinking and intelligence. This research is carried to improve the didactic methods in engineering learning and also to improve e-learning strategies.

Keywords: Thinking style assessment, correlational analysis, mathematical model, data analysis, dynamic equilibrium.

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AWARENESS OF STUDENTS AND TEACHERS TOWARDS AIDS AND AIDS EDUCATION

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Abstract:

600 schools going adolescents and 100 teachers from 16 schools of Dhemaji and Lakhimpur district of Assam, India were surveyed to assess and compare their awareness regarding AIDS and AIDS Education. An awareness test was administered containing 38 items for adolescents and 40 items for teachers in the test. Observations revealed that the majority of school-going adolescents are poor in their HIV/AIDS and AIDS education awareness. It shows that the school going adolescents of Dhemaji district are better in HIV/AIDS and AIDS education awareness than the school going adolescents of Lakhimpur district while comparing the gender, settlement, steam and district wise variables.

Keywords: Awareness, HIV, AIDS, AIDS education.

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APPLICATION OF SINGLE SUBJECT EXPERIMENTAL DESIGNS IN ADAPTED PHYSICAL ACTIVITY RESEARCH: A DESCRIPTIVE ANALYSIS

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Abstract:

The purpose of this study was to develop a descriptive profile of the adapted physical activity research using single subject experimental designs. All research articles using single subject experimental designs published in the journal of Adapted Physical Activity Quarterly from 1984 to 2013 were employed as the data source. Each of the articles was coded in a subcategory of seven categories: (a) the size of sample; (b) the age of participants; (c) the type of disabilities; (d) the type of data analysis; (e) the type of designs, (f) the independent variable, and (g) the dependent variable. Frequencies, percentages, and trend inspection were used to analyze the data and develop a profile. The profile developed characterizes a small portion of research articles used single subject designs, in which most researchers used a small sample size, recruited children as subjects, emphasized learning and behavior impairments, selected visual inspection with descriptive statistics, preferred a multiple baseline design, focused on effects of therapy, inclusion, and strategy, and measured desired behaviors more often, with a decreasing trend over years.

Keywords: Adapted physical activity research, single subject experimental designs.

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THE CLASSIFICATION PERFORMANCE IN PARAMETRIC AND NONPARAMETRIC DISCRIMINANT ANALYSIS FOR A CLASS- UNBALANCED DATA OF DIABETES RISK GROUPS

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Abstract:

The problems arising from unbalanced data sets generally appear in real world applications. Due to unequal class distribution, many researchers have found that the performance of existing classifiers tends to be biased towards the majority class. The k-nearest neighbors' nonparametric discriminant analysis is a method that was proposed for classifying unbalanced classes with good performance. In this study, the methods of discriminant analysis are of interest in investigating misclassification error rates for classimbalanced data of three diabetes risk groups. The purpose of this study was to compare the classification performance between parametric discriminant analysis and nonparametric discriminant analysis in a three-class classification of class-imbalanced data of diabetes risk groups. Data from a project maintaining healthy conditions for 599 employees of a government hospital in Bangkok were obtained for the classification problem. The employees were divided into three diabetes risk groups: non-risk (90%), risk (5%), and diabetic (5%). The original data including the variables of diabetes risk group, age, gender, blood glucose, and BMI were analyzed and bootstrapped for 50 and 100 samples, 599 observations per sample, for additional estimation of the misclassification error rate. Each data set was explored for the departure of multivariate normality and the equality of covariance matrices of the three risk groups. Both the original data and the bootstrap samples showed nonnormality and unequal covariance matrices. The parametric linear discriminant function, quadratic discriminant function, and the nonparametric k-nearest neighbors' discriminant function were performed over 50 and 100 bootstrap samples and applied to the original data. Searching the optimal classification rule, the choices of prior probabilities were set up for both equal proportions (0.33: 0.33: 0.33) and unequal proportions of (0.90:0.05:0.05), (0.80: 0.10: 0.10) and (0.70, 0.15, 0.15). The results from 50 and 100 bootstrap samples indicated that the k-nearest neighbors approach when k=3 or k=4 and the defined prior probabilities of non-risk: risk: diabetic as 0.90: 0.05:0.05 or 0.80:0.10:0.10 gave the smallest error rate of misclassification. The k-nearest neighbors approach would be suggested for classifying a three-class-imbalanced data of diabetes risk groups.

Keywords: Bootstrap, diabetes risk groups, error rate, k-nearest neighbors.

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VALIDATION OF AN ACUITY MEASUREMENT TOOL FOR MATERNITY SERVICES

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Abstract:

Background - The TrendCare Patient Dependency System is currently used by a large number of maternity Services across Australia, New Zealand and Singapore. In 2012, 2013 and 2014 validation studies were initiated in all three countries to validate the acuity tools used for women in labour, and postnatal mothers and babies. This paper will present the findings of the validation study. Aim - The aim of this study was to; identify if the care hours provided by the TrendCare acuity system was an accurate reflection of the care required by women and babies; obtain evidence of changes required to acuity indicators and/or category timings to ensure the TrendCare acuity system remains reliable and valid across a range of maternity care models in three countries. Method - A non-experimental action research methodology was used across maternity services in four District Health Boards in New Zealand, a large tertiary and a large secondary maternity service in Singapore and a large public maternity service in Australia. Standardised data collection forms and timing devices were used to collect midwife contact times, with women and babies included in the study. Rejection processes excluded samples when care was not completed/rationed, and contact timing forms were incomplete. The variances between actual timed midwife/mother/baby contact and the TrendCare acuity category times were identified and investigated. Results - Thirty two (88.9%) of the 36 TrendCare acuity category timings, fell within the variance tolerance levels when compared to the actual timings recorded for midwifery care. Four (11.1%) TrendCare categories provided less minutes of care than the actual timings and exceeded the variance tolerance level. These were all night shift category timings. Nine postnatal categories were not able to be compared as the sample size for these categories was statistically insignificant. 100% of labour ward TrendCare categories matched actual timings for midwifery care, all falling within the variance tolerance levels. The actual time provided by core midwifery staff to assist lead maternity carer (LMC) midwives in New Zealand labour wards showed a significant deviation to previous studies. The findings of the study demonstrated the need for additional time allocations in TrendCare to accommodate an increased level of assistance given to LMC midwives. Conclusion - The results demonstrated the importance of regularly validating the TrendCare category timings with actual timings of the care hours provided. It was evident from the findings that variances to models of care and length of stay in maternity units have increased midwifery workloads on the night shift. The level of assistance provided by the core labour ward staff to the LMC midwife has increased substantially. Outcomes - As a consequence of this study, changes were made to the night duty TrendCare maternity categories, additional acuity indicators were developed and times for assisting LMC midwives in labour ward increased. The updated TrendCare version was delivered to maternity services in 2014.

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Keywords: Maternity, acuity, midwifery research, midwifery workloads.

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A COMPREHENSIVE METHOD OF FAULT DETECTION AND ISOLATION BASED ON TESTABILITY MODELING DATA

Junyou Shi, Weiwei Cui

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Abstract:

Testability modeling is a commonly used method in testability design and analysis of system. A dependency matrix will be obtained from testability modeling, and we will give a quantitative evaluation about fault detection and isolation. Based on the dependency matrix, we can obtain the diagnosis tree. The tree provides the procedures of the fault detection and isolation. But the dependency matrix usually includes built-in test (BIT) and manual test in fact. BIT runs the test automatically and is not limited by the procedures. The method above cannot give a more efficient diagnosis and use the advantages of the BIT. A Comprehensive method of fault detection and isolation is proposed. This method combines the advantages of the BIT and Manual test by splitting the matrix. The result of the case study shows that the method is effective.

Keywords: BIT, fault detection, fault isolation, testability modeling.

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YAWNING AND CORTISOL AS A POTENTIAL BIOMARKER FOR EARLY DETECTION OF MULTIPLE SCLEROSIS

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Abstract:

Cortisol is essential to the regulation of the immune system and yawning is a pathological symptom of multiple sclerosis (MS). Electromyography activity (EMG) in the jaw muscles typically rises when the muscles are moved and with yawning is highly correlated with cortisol levels in healthy people. Saliva samples from 59 participants were collected at the start and after yawning, or at the end of the presentation of yawning-provoking stimuli, in the absence of a yawn, together with EMG data and questionnaire data: Hospital Anxiety and Depression Scale, Yawning Susceptibility Scale, General Health Questionnaire, demographic, health details. Exclusion criteria: chronic fatigue, diabetes, fibromyalgia, heart condition, high blood pressure, hormone replacement therapy, multiple sclerosis, stroke. Significant differences were found between the saliva cortisol samples for the yawners, $t(23) = -4.263$, $p = 0.000$, as compared with the non-yawners between rest and post-stimuli, which was nonsignificant. Significant evidence was found to support the Thompson Cortisol Hypothesis suggesting that rises in cortisol levels are associated with yawning. Further research is exploring the use of cortisol as an early diagnostic tool for MS. Ethics approval granted and professional code of conduct, confidentiality, and safety issues are approved therein.

Keywords: Cortisol, Multiple Sclerosis, Yawning, Thompson's Cortisol Hypothesis.

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AN APPLICATION OF SELF-HEALTH RISK ASSESSMENT AMONG POPULATIONS LIVING IN THE VICINITY OF A FIBER-CEMENT ROOFING FACTORY

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Abstract:

The objective of this study was to assess whether living in proximity to a roofing fiber cement factory in southern Thailand was associated with physical, mental, social, and spiritual health domains measured in a self-reported health risk assessment (HRA) questionnaire. A cross-sectional study was conducted among community members divided into two groups: near population (living within 0-2km of factory) and far population (living within 2-5km of factory) (N=198). A greater proportion of those living far from the factory (65.34%) reported physical health problems than the near group (51.04%) (p =0.032). This study has demonstrated that the near population group had higher proportion of participants with positive ratings on mental assessment (30.34%) and social health impacts (28.42%) than far population group (10.59% and 16.67%, respectively) (p <0.001). The near population group (29.79%) had similar proportion of participants with positive ratings in spiritual health impacts compared with far population group (27.08%). Among females, but not males, this study demonstrated that a higher proportion of the near population had a positive summative score for the self-HRA, which included all four health domain, compared to the far population (p<0.001 for females; p = 0.154 for males). In conclusion, this self-HRA of physical, mental, social, and spiritual health domains reflected the risk perceptions of populations living in the vicinity of the roofing fiber cement factory. This type of tool can bring attention to population concerns and complaints in the factory's surrounding community. Our findings may contribute to future development of self-HRA for HIA development procedure in Thailand.

Keywords: Cement dust, health impact assessment, risk assessment, walk-though survey.

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REVITALIZING URBAN WATERFRONTS: SPATIAL DYNAMICS OF CONTEMPORARY URBAN SPACES

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Abstract:

The formerly industrially or militarily used Urban Waterfront is a potential area for urban development. Extensive interventions in the urban space come along with the development of these previously inaccessible areas in the city. The development of the Urban Waterfront in the European City is not subject to any recognizable urban paradigm. In this study, the development of the Urban Waterfront as a new urban space typology is analyzed by case studies of Urban Waterfront developments in European Cities. For humans, perceptible spatial conditions are categorized and it is identified whether the themed Urban Waterfront Developments are congruent or incongruent urban design interventions and which deviations the Urban Waterfront itself induce. As congruent urban design, a design is understood, which fits in the urban fabric regarding its similar spatial conditions to the surrounding. Incongruent urban design, however, shows significantly different conditions in its shape. Finally, the spatial relationship of the themed Urban Waterfront developments and their associated environment are compared in order to identify contrasts between new and old urban space. In this way, conclusions about urban design paradigms of the new urban space typology are tried to be drawn.

Keywords: Composition, congruence, identity, paradigm, spatial condition, urban design, urban development, urban waterfront.

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UNDERSTANDING URBAN ECOLOGICAL INTERACTION: AIR, WATER, AND LIGHT IN BARCELONA'S SUPERILLES

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Abstract:

As everyday transit options are shifting from autocentric to pedestrian and bicycle oriented modes for healthy living, downtown streets are becoming more attractive places to live. However, tools and methods to measure the natural environment at the small scale of streets do not exist. Fortunately, a combination of mobile data collection technology and parametric urban design software now allows an interface to relate urban ecological conditions. This paper describes creation of an interactive tool to measure urban phenomena of air, water, and heat/light at the scale of new three-by-three block pedestrianized areas in Barcelona called Superilles. Each Superilla limits transit to the exterior of the blocks and to create more walkable and bikeable interior streets for healthy living. The research will describe the integration of data collection, analysis, and design output via a live interface using parametric software Rhino Grasshopper and the Human User Interface (UI) plugin.

Keywords: Transit, urban design, GIS, parametric design, Superilles, Barcelona, urban ecology.

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ASSESSING PERFORMANCE: TRANSITIONING FROM 'PRIORITY-CONTROLLED' TO SIGNAL-CONTROLLED INTERSECTIONS

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Abstract:

There is a call to ensure that the issues of safety and efficient throughput are considered during design; the solutions to these issues can also be retrofitted at locations where they were not captured during design, but have become problems to road users over time. This paper adopts several methods to analyze the performance of an intersection which was formerly a 'priority-controlled' intersection, but has now been converted to a 'signal-controlled' intersection. Extensive review of literature helped form the basis for result analysis and discussion. The Ikot-Ekpene/Anagha-Ezikpe intersection, located at the heart of Umuahia was adopted as case study; considering the high traffic volume on the route. Anecdotal evidence revealed that traffic signals imposed enormous delays at the intersection, especially for traffic on the major road. The major road has arrival flow which surpasses the saturation flow obtained from modelling of the isolated signalized intersection. Similarly, there were several geometric elements that did not agree with the specific function of the road. A roundabout, particularly flower roundabout was recommended as a better traffic control measure.

Keywords: Highway function, level of service, roundabout, traffic delays, Umuahia.

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EXAMINING THE EVOLVING LANDSCAPE OF URBAN MASTER PLANNING IN CHINA: A CASE STUDY OF CHANGSHOU DISTRICT, CHONGQING CITY

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Abstract:

Since the reform and opening, the urbanization process of China has entered a rapid development period. In recent years, the authors participated in some projects of urban master planning in China and found a phenomenon that the rapid urbanization area of China is experiencing frequent adjustment process of urban master planning. This phenomenon is not the natural process of urbanization development. It may be caused by different government roles from different levels. Through the methods of investigation, data comparison and case study, this paper aims to explore the reason why the rapid urbanization area is experiencing frequent adjustment of master planning and give some solution strategies. Firstly, taking Changshou district of Chongqing city as an example, this paper wants to introduce the phenomenon about frequent adjustment process in China. And then, discuss distinct roles in the process between national government, provincial government and local government of China. At last, put forward preliminary solutions strategies for this area in China from the aspects of land use, intergovernmental cooperation and so on.

Keywords: Urban master planning, frequent adjustment, urbanization development, problems and strategies, China.

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HYBRID LIVING: NAVIGATING CRISES AND DIVISIONS IN URBAN ENVIRONMENTS

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Abstract:

The paper will focus on the hybrid living typologies which are brought about due to the Global Crisis. Mixing of the generations and the groups of people, mingling the functions of living with working and socializing, merging the act of living in synergy with the urban realm and its constituent elements will be the springboard of proposing an essential sustainable housing approach and the respective urban development. The thematic will be based on methodologies developed both on the academic, educational environment including participation of students' research and on the practical aspect of architecture including case studies executed by the author in the island of Cyprus. Both paths of the research will deal with the explorative understanding of the hybrid ways of living, testing the limits of its autonomy. The evolution of the living typologies into substantial hybrid entities, will deal with the understanding of new ways of living which include among others: re-introduction of natural phenomena, accommodation of the activity of work and services in the living realm, interchange of public and private, injections of communal events into the individual living territories. The issues and the binary questions raised by what is natural and artificial, what is private and what public, what is ephemeral and what permanent and all the in-between conditions are eloquently traced in the everyday life in the island. Additionally, given the situation of Cyprus with the eminent scar of the dividing 'Green line' and the waiting of the 'ghost city' of Famagusta to be resurrected, the conventional way of understanding the limits and the definitions of the properties is irreversibly shaken. The situation is further aggravated by the unprecedented phenomenon of the crisis on the island. All these observations set the premises of reexamining the urban development and the respective sustainable housing in a synergy where their characteristics start exchanging positions, merge into each other, contemporarily emerge and vanish, changing from permanent to ephemeral. This fluidity of conditions will attempt to render a future of the built- and unbuilt realm where the main focusing point will be redirected to the human and the social. Weather and social ritual scenographies together with 'spontaneous urban landscapes' of 'momentary relationships' will suggest a recipe for emerging urban environments and sustainable living. Thus, the paper will aim at opening a discourse on the future of the sustainable living merged in a sustainable urban development in relation to the imminent solution of the division of island, where the issue of property became the main obstacle to be overcome. At the same time, it will attempt to link this approach to the global need for a sustainable evolution of the urban and living realms.

Keywords: Social ritual scenographies, spontaneous urban landscapes, substantial hybrid entities, re-introduction of natural phenomena.

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IMPACT OF URBANIZATION ON LAND USE, LAND COVER, AND STREAM FLOW IN A SUB-TROPICAL RIVER BASIN OF INDIA

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Abstract:

Rapid urbanization changes the land use/land cover pattern of a developing region. Due to these land surface changes, stream flow of the rivers also changes. It is important to investigate the factors affecting hydrological characteristics of the river basin for better river basin management planning. This study is aimed to understand the effect of Land Use/Land Cover (LU/LC) changes on stream flow of Upper Bhima River basin which is highly stressed in terms of water resources. In this study, Upper Bhima River basin is divided into two adjacent sub-watersheds: Mula-Mutha (urbanized) sub-watershed and Bhima (non-urbanized) sub-watershed. First of all, LU/LC changes were estimated over 1980, 2002, and 2009 for both Mula-Mutha and Bhima sub-watersheds. Further, stream flow simulations were done using Soil and Water Assessment Tool (SWAT) for the streams draining both watersheds. Results revealed that stream flow was relatively higher for urbanized sub-watershed. Through Sensitivity Analysis it was observed that out of all the parameters used, base flow was the most sensitive parameter towards LU/LC changes.

Keywords: Land Use/Land Cover, remote sensing, stream flow, urbanization.

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ANGIOGRAPHIC EVALUATION OF ETT (TREADMILL) POSITIVE PATIENTS IN A TERTIARY CARE HOSPITAL OF BANGLADESH

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Associate Professor Dr. Saidur Rahman Khan is with the Department ofCardiology, Ibrahim Cardiac Hospital & Research Institute, Dhaka
Dr. Farzana Islam is with the Department of Pediatric Hemato-Oncology,BangaBandhu Sheikh Mujib Medical University (BSMMU)

Abstract:

To evaluate the factors which predetermine the coronary artery disease in patients having positive Exercise Tolerance Test (ETT) that is treadmill results and coronary artery findings. This descriptive study was conducted at Department of Cardiology, Ibrahim Cardiac Hospital & Research Institute, Dhaka, Bangladesh from 1st January, 2014 to 31st August, 2014. All patients who had done ETT (treadmill) for chest pain diagnosis were studied. One hundred and four patients underwent coronary angiogram after positive treadmill result. Patients were divided into two groups depending upon the angiographic findings, i.e. true positive and false positive. Positive treadmill test patients who have coronary artery involvement these are called true positive and who have no involvement they are called false positive group. Both groups were compared with each other. Out of 104 patients, 81 (77.9%) patients had true positive ETT and 23 (22.1%) patients had false positive ETT. The mean age of patients in positive ETT was 53.46± 8.06 years and male mean age was 53.63±8.36 years and female was 52.87±7.0 years. Sixty nine (85.19%) male patients and twelve (14.81%) female patients had true positive ETT, whereas 15 (65.21%) males and 8 (34.79%) females had false positive ETT, this was statistically significant ($p<0.032$) in the two groups (sex) in comparison of true and false positive ETT. The risk factors of these patients like diabetes mellitus, hypertension, dyslipidemia, family history and smoking were seen among these patients. Hypertensive patients having true positive which were statistically significant ($p<0.004$) and diabetic, dyslipidemic patients having true positive which were statistically significant ($p<0.032$ & 0.030).True positive patients had family history were 68(83.95%) and smoking were 52 (64.20%), where family history patients had statistically significant ($p<0.017$) between two groups of patients and smokers were significant ($p<0.012$). 46 true positive patients achieved THR which was not statistically significant ($P<0.138$) and 79 true patients had abnormal resting ECG whether it was significant ($p<0.036$). Amongst the vessels involvement the most common was LAD 55 (67.90 %) followed by LCX 42 (51.85%), RCA 36 (44.44%), and the LMCA was 9 (11.11%). 40 patients (49.38%) had SVD, 26 (30.10%) had DVD, 15(18.52%) had TVD and 23 had normal coronary arteries. It can be concluded that among the female patients who have positive ETT with normal resting ECG, who had achieved target heart rate are likely to have a false positive test result. Conversely male patients, resting abnormal ECG who had not achieved THR, symptom limited ETT, have a hypertension, diabetes, dyslipidemia, family history and smoking are likely to have a true positive treadmill test result.

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Keywords: Exercise tolerance test, Coronary artery disease, Coronary angiography, True positive, False positive.

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PROTECTİVE EFFECT OF SAPONİN EXTRACT FROM THE ROOT OF GARCİNİA KOLA (BİTTER KOLA) AGAİNST PARACETAMOL- INDUCED HEPATOTOXİCİTY İN ALBİNO RATS

Yemisi Rufina Alli Smith, Isaac Gbadura Adanlawo

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Abstract:

Liver disorders are one of the major problems of the world. Despite its frequent occurrence, high morbidity and high mortality, its medical management is currently inadequate. This study was designed to evaluate the hepatoprotective effect of saponin extract of the root of Garcinia kola on the integrity of the liver of paracetamol induced wistar albino rats. Twenty five (25) male adult wistar albino rats were divided into five (5) groups. Group I was the Control group that received distilled water only, group II was the negative control that received 2 g/kg of paracetamol on the 13th day, and group III, IV and V were pre-treated with 100, 200 and 400mg/kg of the saponin extract before inducing the liver damage on the 13th day with 2 g/kg of paracetamol. Twenty four (24) h after administration, the rats were sacrificed and blood samples were collected. The serum Alanine Transaminase (ALT), Aspartate Transaminase (AST), Alkaline Phosphatase (ALP) activities, Bilirubin and conjugated bilirubin, glucose and protein concentrations were evaluated. The liver was fixed immediately in Formalin and was processed and stained in Haematoxylin and Eosin (H&E). Administration of saponin extract from the root of Garcinia kola significantly decreased paracetamol induced elevated enzymes in the test group. Also histological observations showed that saponin extract of the root of Garcinia kola exhibited a significant liver protection against the toxicant as evident by the cells trying to return to normal. Saponin extract from the root of Garcinia kola indicated a protection of structural integrity of the hepatocytic cell membrane and regeneration of the damaged liver.

Keywords: Garcinia kola, Hepatoprotective, paracetamol, Saponin

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EVALUATION OF SALIVARY NICKEL LEVEL DURING ORTHODONTIC TREATMENT

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Abstract:

Since nickel is a known toxic and carcinogenic metal, the present study was designed to evaluate the level of nickel released into the saliva of orthodontic patients. Non-stimulated saliva was collected from 18 patients attending The Orthodontic Clinic of Dental Faculty of Benghazi University. Patients were divided into two groups and level of nickel was determined by atomic absorption spectrophotometry. Nickel concentration value (mg/L) in first group prior to starting treatment was 0.097± 0.071. An increase in level of nickel was followed by decrease 4 and 8 weeks after applying the arch wire (0.208± 0.112) and (0.077±0.056 mg/L) respectively. Nickel levels in saliva of the second group were showed minimal variation and ranged from 0.061± 0.044mg/L to 0.083±0.054 throughout period of study. It may be concluded that there could be a release of nickel from the appliances used in first group but it doesn't reach toxic level in saliva.

Keywords: Atomic absorption spectrophotometry, nickel, orthodontic treatment, saliva, toxicity.

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A STUDY OF CARDIO PULMONARY CHANGES DURING UPPER GASTROINTESTINAL ENDOSCOPY

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Abstract:

Upper gastrointestinal endoscopy is a commonly performed diagnostic and therapeutic procedure and has many adverse effects like cardiopulmonary complications, complications related to sedation, infectious complications, bleeding and perforation. So this study was undertaken to evaluate important variables like patient's age, gender and stage of the procedure in relation to the cardiopulmonary changes during diagnostic upper gastrointestinal endoscopy by monitoring oxygen saturation, blood pressure, heart rate and electrocardiogram. This is a prospective longitudinal hospital based study involving a total of 140 consecutive patients, at Sri. B. M. Patil Medical College, Hospital and Research Centre. Cardiopulmonary changes during upper gastrointestinal endoscopy are more common in the age groups of 51-60 years, with equal frequency in both male and female. Oxygen saturation levels decreased by about 4% in both sexes during introduction of endoscopy. Mild to moderate hypoxia was found in 32% of the study group. Severe hypoxia was found in 5% of the patients, mostly in those patients who are above 50 years of age. Tachycardia was noted in 88% of the study group patients. Blood pressure increased to hypertension levels in 22 patients (15.7%) which returned to normal within few minutes after the procedure. S-T depression was noticed in 4% of patients and T wave inversion in 8% of patients during upper gastrointestinal endoscopy. All these changes disappeared after 10 minutes after the endoscopy. Cardiopulmonary changes are common during upper gastrointestinal endoscopy. Maximum changes in oxygen saturation, heart rate and blood pressure occurred immediately after the introduction of endoscope. The cardiopulmonary changes did not manifest into any identifiable clinical symptoms. The rate of recovery was faster in younger age groups and women.

Keywords: Blood Pressure, Cardio-Pulmonary, Heart Rate, Oxygen Saturation, Upper Gastrointestinal Endoscopy.

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THE ROLE OF IDENTIFICATIONS IN WOMEN PSYCHOPATHOLOGY

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Abstract:

Family identification has the potential to play a very decisive role in psychopathology. In this study we aimed to investigate the impact of family identifications on female psychopathology. A community sample of 101 women (mean age 20.81 years, SD = 0.91 ranged 20-25) participated to the present study. The girls completed a) the Symptom Check-List Revised (SCL-90) and b) questionnaire concerning socio-demographic information and questions for family identifications. The majority of women reported that they matched to the father in terms of identifications (47.1%). Age and birth order were not contributed on family identifications ($F(5) = 2.188$, $p = .062$ and $F(3) = 1.244$, $p = .299$ respectively). Multivariate analysis by using MANCOVA found statistical significant associations between family identifications and domains of psychopathology as provided by SCL-90 ($P < 05$). Our results highlight the role of identifications especially on father and female psychopathology as well as replicate the Freudian perception about the female Oedipus complex.

Keywords: Family Identification, Psychoanalysis, Psychopathology, Women.

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A REVIEW OF PHARMACOLOGICAL PREVENTION OF PERI-AND POST-PROCEDURAL MYOCARDIAL INJURY AFTER PERCUTANEOUS CORONARY INTERVENTION

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Abstract:

The concept of myocardial injury, although first recognized from animal studies, is now recognized as a clinical phenomenon that may result in microvascular damage, no-reflow phenomenon, myocardial stunning, myocardial hibernation and ischemic preconditioning. The final consequence of this event is left ventricular (LV) systolic dysfunction leading to increased morbidity and mortality. The typical clinical case of reperfusion injury occurs in acute myocardial infarction (MI) with ST segment elevation in which an occlusion of a major epicardial coronary artery is followed by recanalization of the artery. This may occur spontaneously or by means of thrombolysis and/or by primary percutaneous coronary intervention (PCI) with efficient platelet inhibition by aspirin (acetylsalicylic acid), clopidogrel and glycoprotein IIb/IIIa inhibitors. In recent years, percutaneous coronary intervention (PCI) has become a well-established technique for the treatment of coronary artery disease. PCI improves symptoms in patients with coronary artery disease and it has been increasing safety of procedures. However, peri- and post-procedural myocardial injury, including angiographical slow coronary flow, microvascular embolization, and elevated levels of cardiac enzyme, such as creatine kinase and troponin-T and -I, has also been reported even in elective cases. Furthermore, myocardial reperfusion injury at the beginning of myocardial reperfusion, which causes tissue damage and cardiac dysfunction, may occur in cases of acute coronary syndrome. Because patients with myocardial injury is related to larger myocardial infarction and have a worse long-term prognosis than those without myocardial injury, it is important to prevent myocardial injury during and/or after PCI in patients with coronary artery disease. To date, many studies have demonstrated that adjunctive pharmacological treatment suppresses myocardial injury and increases coronary blood flow during PCI procedures. In this review, we highlight the usefulness of pharmacological treatment in combination with PCI in attenuating myocardial injury in patients with coronary artery disease.

Keywords: Coronary artery disease, Percutaneous coronary intervention, Myocardial injury, Pharmacology

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AN EMPIRICAL MODE DECOMPOSITION BASED METHOD FOR ACTION POTENTIAL DETECTION IN NEURAL RAW DATA

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Abstract:

Information in the nervous system is coded as firing patterns of electrical signals called action potential or spike so an essential step in analysis of neural mechanism is detection of action potentials embedded in the neural data. There are several methods proposed in the literature for such a purpose. In this paper a novel method based on empirical mode decomposition (EMD) has been developed. EMD is a decomposition method that extracts oscillations with different frequency range in a waveform. The method is adaptive and no a-priori knowledge about data or parameter adjusting is needed in it. The results for simulated data indicate that proposed method is comparable with wavelet based methods for spike detection. For neural signals with signal-to-noise ratio near 3 proposed methods is capable to detect more than 95% of action potentials accurately.

Keywords: EMD, neural data processing, spike detection, wavelet decomposition

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THE ORIGIN, DIFFUSION AND A COMPARISON OF ORDINARY DIFFERENTIAL EQUATIONS NUMERICAL SOLUTIONS USED BY SIR MODEL IN ORDER TO PREDICT SARS-COV-2 IN NORDIC COUNTRIES

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Abstract:

SARS-CoV-2 virus is currently one of the most infectious pathogens for humans. It started in China at the end of 2019 and now it is spread in all over the world. The origin and diffusion of the SARS-CoV-2 epidemic, is analysed based on the discussion of viral phylogeny theory. With the aim of understanding the spread of infection in the affected countries, it is crucial to modelize the spread of the virus and simulate its activity. In this paper, the prediction of coronavirus outbreak is done by using SIR model without vital dynamics, applying different numerical technique solving ordinary differential equations (ODEs). We find out that ABM and MRT methods perform better than other techniques and that the activity of the virus will decrease in April but it never cease (for some time the activity will remain low) and the next cycle will start in the middle July 2020 for Norway and Denmark, and October 2020 for Sweden, and September for Finland.

Keywords: Forecasting, ordinary differential equations, SARS-CoV-2 epidemic, SIR model

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EXAMINATION OF LANDSCAPE DESIGN PRINCIPLES AND APPLICATION EXAMPLES IN SOME URBAN SQUARES

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ABSTRACT

People living in cities need areas to realise their recreational activities outside their daily lives. Open green areas are the areas where urbanites can breathe, outside the buildings and enjoy their lives. Open spaces cover all kinds of social, physical and recreational needs of people. One of the important design elements used in landscape areas is lighting elements. Lighting is of great importance in terms of the use and perception of these areas where people spend time at night as well as during the day. Landscape architects are a professional discipline that effectively uses lighting elements as well as plant material and water elements, and creates impressive landscapes in terms of light and colour with new design styles such as water-lighting element, plant-lighting element. The aim of this study is to examine the effect of light and colour in landscape design in terms of lighting elements and to reveal the importance of lighting in landscape. In this context, the study examines the effect of light and colour in landscape design in terms of lighting elements and different usage styles. Landscape design is not only limited to spatial arrangements, but also plays an important role in determining the atmosphere of living spaces with the effect of visual elements such as light and colour. The study analyses how the use of light and colour in landscape design affects spatial perception and how various lighting elements enhance this effect. It also explains how combinations of light and colour in landscape design serve various aesthetic and functional purposes by giving examples of different styles of use. In conclusion, this study highlights the importance of the use of light and colour in landscape design and aims to inspire designers to explore different combinations and styles of use.

Keywords: Landscape light, colour, lighting elements

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INTRADUCTION

City squares are public spaces, usually located in the centres of cities. They are used by city dwellers on special occasions for social, cultural, political and commercial purposes. The gathering of city dwellers for religious, political, cultural and commercial reasons is as old as urban life. From past to present, city squares have been named in different ways such as agora, forum, plaza, campo, piaza, grand place. The most common usage area of urban life from history to the present day is urban open spaces. City squares are the most effectively used elements of urban open spaces. The city square is an important public space which is used by the citizens for social, cultural, political and commercial purposes on special occasions (Özer and Ayten, 2005).

According to Kaftancı (2000), he evaluated the squares from a historical perspective and put forward the following view: 'Throughout history, squares have gained various characteristics according to the political, social, spatial and artistic understanding of the period in which they are located. The most functional use of squares is seen in Greek and Roman cities. Greeks and Romans used city squares as places where they would gather and discuss together. For this reason, there was a dais in the squares where a high-ranking official or public spokesperson could make a speech.

The Importance of City Squares

City squares, which are historically and socially significant, have an important place in urban life in terms of enabling the realisation of personal and social needs and actions. Such places have an important place in the urban landscape with their elements that contribute to open green areas and landscape value.

City squares have a very important role in social life and are always the subject of physical, economic, social, political and cultural transformations of cities. Squares keep public communication and participation alive in the city and provide the necessary environment for social interaction. In addition, squares have an important place in the functioning mechanism of the city. City squares not only fulfil people's political and cultural needs, but also their physical and mental needs. City squares have many effects on the daily lives of individuals. While squares cause individuals to socialise and feel different emotions, they also serve as meeting and gathering places where individuals with different cultural backgrounds come together. All these directly appeal to the perception of individuals and make them feel psychologically well (Jabbarıhagh, 2015).

Thousands of years of historical and cultural accumulation of societies have led to the formation of urban spaces, and the urban spaces where these accumulations are exhibited and expressed in the best way are considered as city squares. At the same time, when the interaction between urban identity and city squares is examined; Both the identity of the city affected the space and the development of the space was effective in the development of the urban identity (Durak, 2018).

From past to present, city squares are one of the most effectively used urban open spaces in urban areas. Squares are important public spaces used by city users for social, cultural, political

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and commercial purposes, in short, where urban life takes place. At the same time, they are the most important focal points of urban life, shaped by the influence of the period and culture they belong to, in terms of the role they undertake (Ektiren, 2017).

Squares are places where circulation in the city is ensured, as gathering and dispersing areas in the city. (Altay et al., 2022)

Since the squares are one of the most important places of the city, they enable those who live in the city and those who visit the city to establish relationships with each other and with the city. A connection should be established between the squares in cities and different parts of the urban fabric. At the same time, there should be harmony, integrity, diversity, balance and order among the elements that make up the square. Basic design elements such as color, shape, form and texture play an important role in giving meaning to squares. The use of design principles such as scale, continuity and unity in the relationship between the square and the environment can also increase the quality of the square (Moughtin, 1992; Plane, 2000).

Its location, order, liveliness and diversity, transportation network, carrying capacity, ease of use, plant types and urban furniture used, iconic sculptures, etc. objects, historical ruins, color and form features, design and structure, suitability for use in four seasons, harmony with the environment and structures, compliance with landscape and design principles, characteristics of the plant species used, adaptation and contribution to a sustainable environment, positive effect on urban heat island and air pollution. A city square that incorporates design approaches that minimize noise will create a strong identity for that city. Therefore, city squares and their features are very important as they increase the livability of the city.

City squares, which have a unifying effect in social and cultural terms, also have psychological healing effects, thanks to their ability to reduce the gloom and grayness of urban life.

Considering that it is the place most visited by local and foreign tourists in a city and that the square's compliance with landscape principles and its design is shaped by functionality, all these leave a good impression on the visitors and make them want to visit again. These elements create an identity by adding a special quality to the city square. This identity is of great importance in terms of recognition and demand of cities.

In this section, which includes literature reviews and thoughts about the definition and importance of city squares, the stereotypical concept of city square has been evaluated in different frameworks. The aim of the study is to identify all aspects of city squares, which are the common places of our lives, as they develop and change from past to present, and to raise awareness in order to add value to their overlooked importance and existence. In order to contribute to the study, some important city squares in the world and in our country were evaluated in the findings section by determining both their positive and negative characteristics. Design and planning suggestions are included to serve as examples for old city squares trying to maintain their existence or new square designs in cities that are constantly growing and changing.

MATERIALS AND METHODS

The concept of city square, which is the main element of the study, is explained using the opinions of various authors. In order to contribute to the content of the study; Interpretations

and evaluations have been made with the help of many sources, emphasizing the importance of city squares, their development from ancient times to the present day, general characteristics and design principles of squares, urban design elements affecting the qualities of squares, and the relationship between landscape and city square. In addition, the design and different application criteria of some important city squares in Turkey and the world were examined and evaluated and supported with visuals. The conclusion part is enriched with evaluations and suggestions based on the findings of the study and literature review.

FINDINGS

Development of Squares in Historical Process

City squares appear over time in all urban areas where there is public life. There are opinions of many authors in the sources evaluating the concept of square from ancient times to the present. In the study, (Bilgihan, 2006), (Pirene, 2003), (Dağıstanlı, 1997), (Gündem,1999), (Aslanoğlu, 2000), (Cerasi, 2001), (Aslan, 2014). The opinions of (Demir and Sesli, 2007), (Akman, 2020) and (Önder and Aklanoğlu, 2002) contributed to the creation of the historical process.

Antiquity and the 19th century. Squares Among: A real square in the historical process, only in Ancient Greece, B.C. It was developed after 500. At first, the gathering area was the acropolis, but with the development of cities, this function was transferred to the agora. Agora is usually located in the center, which is the focal point of the city. In the agora, there were structures such as stoa, which were closed commercial buildings, bouleuterion, where the city council met, and temples. In addition, the gymnasium was located close to the agora. Additionally, agoras may differ in terms of their functions: Agoras that are closer to the port and where trade is intense, and agoras that have political, philosophical and religious functions (Bilgihan, 2006).

Social life in the city took place in the agora, and these spaces were the carriers of publicity. While the most up-to-date information was received here, current political debates were discussed both in the parliament building and in various corners of the square (İbid, 2006).

In the Middle Ages, we see that cities became smaller and trade began to come to the fore. Therefore, this period is notable for the development of market squares. It can be said that the regular closed square type is based only on the buildings that represent the heritage of Ancient Rome in spatial perception or the newly established settlements of the 13th and 14th centuries. In other cities, the market area had an irregular structure like the city. (Ibid, 2006).

Certain types of squares can be listed for the Middle Ages. The first of these is the street used as a market area. Another type is the market square with laterally expanding streets. The growth of vehicular and pedestrian traffic led to the interruption of market activities and local traffic, and it was possible to expand the main streets sideways by demolishing the buildings in both directions (Pirene, 2003).

Another type is the square located at the entrance to the city. These types of squares, located in front of the city gate and inside the city walls, are generally triangular in shape and form the starting point of two or three streets. (Bilgihan, 2006).

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Another type, the medieval parvis, defines the square in front of the church building. The parvis is dominated by a single building that is part of the structural scheme. All architectural elements in the square refer to the dominant large structure. Parvis is the area where people gather before and after religious meetings, listen to sermons held outside and watch parades. It generally has a closed character with residences in three directions and the dominant western façade of the church in the other direction. Another type of square that can be mentioned is group squares. The separation of the market square from the church square was achieved by the parvis, or the open area surrounding the church. These types of formations resulted in the development of group squares. (Ibid, 2006).

In the Middle Ages; While supporting architectural additions such as fountains, small monuments, arcades and stairs create a unifying, separating, highlighting or equalizing effect on the visual impression, they can rarely be effective in creating a space with defined boundaries. The most important factor is the location of buildings such as the town hall, palace and church. (Ibid, 2006).

From the Middle Ages to the 20th Century In the development process of cities, the most important difference between the Middle Ages and the Renaissance is the city planning studies, both theoretical and practical, in this period. An Italian Renaissance square and a Northern European Renaissance square are very similar in spatial concept. However, in the Gothic period, this is not the case (Dağistanlı, 1997).

With the Renaissance, roadsides gave perspectives leading to a single vanishing point with their straight building alignments. The squares are decorated with symmetrical and magnificent plastics. The dimensions of buildings and squares have moved away from the human dimension. (Bilgihan, 2006).

Aesthetics and beauty gained importance during the Baroque period. Parks, gardens and large squares are arranged in the city center. Magnificence and symmetry were used to symbolize the powers of single-ruler social rule. It is aimed for smooth and symmetrical road axes to intersect at the executive residence (Bilgihan, 2006, Gündem, 1999).

17th and 18th centuries. When we look at French squares, we see that landscape architecture has also gained importance. In addition, instead of the small and closed typical Renaissance squares, it is seen that squares called place royals have developed, reflecting the spirit of the Baroque period in France in size and proportions. “17. and 18th century. place royal spatial and architectural form, like the great Roman squares of these centuries; The philosophy of this period directly reflects the political, social systems and cultural structure. "Just as the power of the pope was effective in Rome, so in France the dominant power of the absolute monarchy has gone to the formation of the most orderly form possible, in the background of which the royal majesty and the power of the country and the influential social classes are reflected." (Dagestanli, 1997).

The Industrial Revolution, which started in England, reshaped European cities with the change in economic and social conditions (Aslanoğlu, 2000).

19th century From the beginning, with the development of neo-classicism, grandeur was replaced in architectural expression.

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Squares in the Ottoman Period: When we look at the Ottoman Empire, we encounter an inconclusive debate about squares. There are those who say that there was no real square in the Ottoman Empire and those who emphasize that there were squares, albeit with different structures. When we look at the cities of the Ottoman and Turkey, we see that there are no urban squares in the usual sense. Many of the places called urban squares today are large intersections or undefined clearings. (Bilgihan, 2006).

In Ottoman society, women were not included in the public sphere, and men's public presence took place in mosque courtyards and coffeehouses. When we look at it as a market place, we generally encounter market places such as the Grand Bazaar and Bedesten. Apart from this, as another form of bazaar, there are urban textures with a certain group of tradesmen on every street. (Ibid, 2006).

It is also mentioned that in Ottoman cities, the functions of the square were divided into different spaces. Mosque courtyards and social complexes, bazaars and recreation areas are the places where these functions are divided (Cerasi, 2001).

In the traditional Turkish urban fabric, the concept that comes to mind when talking about square is neighborhood square. The relatively large area that emerged as a result of the road lines breaking or diverging from each other within the neighborhood has functioned as a neighborhood square. Other spatial features that give this area its square identity are fountains, mosques, monumental trees or coffeehouses. In addition, the commercial function of the neighborhood unit is also located in this place. These spaces also indicate a publicity within the neighborhood. However, this publicity is a publicity that women are deprived of. Moreover, it is out of the question to attribute a political meaning to these areas (Bilgihan, 2006).

According to another very common view, the lack of squares arises because the tradition of self-governance of Turkish cities does not date back to very old times. Squares were formed in many European cities with the existence of administrative buildings (İbid, 2006).

Squares After the Transition to the Republic: With the Republic, squares were created, especially in front of administrative buildings. Typical places from the early republican period are Istasyon Streets and Ataturk Boulevards, as well as the provincial mansions and the provincial squares in front of them. Ceremonies take place here, and the public provides the flow of political information here. In this sense, we can say that squares and streets emerged as a state project. In other words, the squares constructed as places of power were designed as constituent parts of state power in space as a top-down process. In Lefebvre's words, an abstract and state-centered spatial structure can be mentioned here (Bilgihan, 2006).

Development of City Squares in Turkey

When the development of squares in Turkey is examined, it is not possible to say that a square structure remained from the Ottoman Empire to the Republic of Turkey. The main reason for this situation is that the Ottoman administrative and social structure did not have the features that would form a city square. Because the main element of the Ottoman city is the mosque. For this reason, social life concentrated around the mosque and there was no need for a separate gathering area. On the other hand, in the Ottoman city, places such as bazaars, bazaars and long

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bazaars are important public spaces as well as areas where basic economic activities take place. For this reason, the social and political functions carried by the squares were reflected in places such as mosques and covered bazaars in the Ottoman social structure (Aslan, 2014).

The main reason for the lack of a functional square structure in Turkey is the understanding of public space in urban life. Public spaces, which are open to all citizens and create a representation area for those in them, were tried to be built by the state after the establishment of the republic. Public space discussions in Turkey are carried out on two axes. The first of these is the public space approach, which develops independently of the state and is a space of freedom. While the public space, evaluated with a freedom approach, has a more decentralized structure; It aims for a democratic goal that is open to differences. Another perspective is to design public space as areas directly related to the state and where the rules of the state are applied. These areas, which have been organized according to the basic principles and rules of the republic for a long time, have developed in the form of preserving the unitary structure rather than gaining a democratic character. (Demir and Sesli, 2007).

Among these two different approaches to public space in Turkey, there have been changes in the understanding of a public space regulated by the state, especially in the era of neo-liberal policies and globalization (Akman, 2020).

Although a square shape specific to Turkey has not developed, Beyazıt Square and Taksim Square in Istanbul, Kızılay Square and Tandoğan Square in Ankara, Konak Square and Cumhuriyet Square in Izmir have hosted important social and political events (Önder and Aklanoğlu, 2002).

General Characteristics and Design Principles of Squares

Squares; It is one of the first areas that stand out when it comes to promoting and choosing a city. These areas, which are aesthetic and functional, are the heart of the city. It is very important that such important city squares are designed correctly. When designing a square, all the features that should be present in a square should be taken into consideration. In order to add value to the city, it must have strong visuals, correct construction and usability, and must have qualities that will meet all the social demands of the city's people.

Since it is the most used point of the city, it must have a solid construction and sustainable quality. In this way, it should give the square an experience identity by fitting a strip of history into its usage period. Having a size and feature that meets personal and individual needs is an important factor for users as it provides comfort in many aspects.

Each city has its own climatic conditions specific to the region in which it is located. These conditions are a very important factor in the growth of plants, which are the main stone of the landscape. For this reason, it is very important for the plants in the area to be planted to adapt to the climatic conditions of that city for that plant to survive. In an area that needs plants, such as a city square, a green appearance is sought throughout all seasons. There should be plants with large crowns that provide shade, evergreen coniferous species, species such as flowering trees, shrubs, ground cover and seasonal flowers that will create visual appeal, and naturally growing species should be selected to add a reflection of nature to the area. Because correctly and beautifully designed open spaces have positive effects in terms of psychological, social

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and cultural improvement of routine problems and urban problems in human life. Since city squares witness all political and social events that add meaning to the joy, sadness, unity and solidarity of the society, their positive soothing properties are very important for the society and the city.

Issues to be taken into consideration during the square design process; Establishing the relationship of the square with its surroundings, establishing a solution-oriented transportation system for the main arteries related to the location of the square and its immediate surroundings, ensuring that the square design bears the characteristics of that region, connecting different parts of the city, being compatible with the human scale, ensuring the safety and vitality of the square, giving positive meaning to the square, It can be used in different climatic conditions and the sustainable design approach that can ensure the survival of the square is transferred to the square design process (Altay et al., 2022).

There are also some elements to consider in city square design. These; image and identity, recreational activity, attraction and route, flexible design, seasonal strategies, inner circle-outer circle design, octopus-like wrapping, administration control (trust) and funding sources (Sağır, 2019).

The function and structure of the squares in the city are likened to the courtyards of houses. Particularly, similarities are drawn between the urban square type, which manifests itself with a closed form, and the atrium type houses (Camillo, 2004). However, when we look at it from the perspective of publicity discussions, we see that it is stated that the living room (guest room) represents the publicity of the home (Habermas, 1995).

Paul Zucker identified five different square forms by looking at the general macro form characteristics of squares (Zucker, 1966).

Urban Design Elements Affecting the Qualities of Squares: The qualities that should be in the squares determined by Altınçekiç and Kart (2000) are stated below by making use of the comments of (Çolak, 2020).

Flooring: Floorings are elements that facilitate the solution of urban space requirements such as spatial or semantic definitions, orientation and direction creation with changes in material in different spaces. Thanks to the texture created together with the coating elements, different points such as axes, focal points, centres can be defined and messages can be given to users through perception. Pavements should be arranged in a formal or informal way, from large or small sized material, according to the place to be used, land shape, purpose, plant material and the way other objects in the environment are used.

Plastic: Sculptures, fountains and various plastic elements make the most sense in squares. One of the biggest effects of plastic elements is to break the monotony and create emphasis. As with the flooring, the dimensions of plastic elements should be suitable for the space. The use of plastic elements with water is very effective. Plastic elements should also reveal the social and cultural meaning of the square. The elements should always be open to the contact of the users.

Colour: In the use of colour in squares; the light received by the square, the comfort of the users, the climate of the area, the cultural background should be taken into consideration. Since

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the individual experiences and psychology of individuals will vary, colours should be chosen according to the psychology of the society. The use of colours should be measured and compatible with each other. The colours at the entrances of the square or in the areas with special features should contrast with the colours in other areas and attract attention. Colours can also be used for framing the square. Colour can also be used to create separate spaces within the square. The effect of colour can make an element feel heavier or lighter, closer or further away.

Plant: People look for interesting features in plants to be used in squares. Using trees and shrubs of different colors and varieties can be beneficial in this regard. Since plants are living materials, it is an important feature that they create different aesthetic appearances according to seasonal changes. Plants should not only affect aesthetics but also be a solution to problems such as air pollution in the square. Plants should create an image suitable for all seasons by establishing a balance between deciduous and evergreen plants, with trees that have the feature of shading at a height of at least 1.50-1.80 m above the ground, breaking the effect of hard ground. Planting can also emphasize areas of the square where the historical texture of the city is wanted to be highlighted. Since plants are materials that will last for many years, they must adapt to the temperature, climate, humidity and wind balance of the area.

Light: When it comes to light, sunlight usually comes to mind. But moonlight and artificial lighting are also examples of light. Lighting in the landscape has two purposes; security and aesthetics. While historical buildings create a focal point in the squares and provide an aesthetic appearance when there is daylight, they can add a spooky atmosphere in the dark. Therefore, artificial lighting application is necessary. The quality, direction and quantity of light play an important role. At the same time, the effect of the shadow created by the light should not be forgotten. The places in the square that need to be illuminated the most are primarily the entrances and exits. Then the pool, statues and city equipment should be illuminated. Square lighting makes users feel safer and extends the usage time of the square.

Time: If time is considered as the duration of the people who will use the square in the square, it contributes to the existence of the square and the duration of its perception. In other words, as long as the person perceives the square, the square remains alive. The way people perceive the square and their duration also vary depending on the activities they do in the square. After a certain period of perception, some impressions about the square remain in their minds after the change of place.

Measurement: In order for the users of the square to feel peaceful, the width of the square and the height of the buildings around the median must be in a certain ratio. If the buildings are high compared to the width of the square, the user will feel crushed. If it is low, he feels helpless. The ratio between the square width and the height of the buildings should be at most 1/4.

Landscape and Town Square Relationship

Plants are a very important element in improving the perception of space. Their rich diversity also contributes to the selection according to climatic conditions because there are species in nature that will adapt to every climatic condition and environmental pollution. In this way, there are plants that will find a place in every environment.

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As people are exposed to concrete in today's conditions, they attach importance to the prominence of green perception in recreational areas. In a recreational and social area such as city squares, the positive effects created by the green perception are revealed thanks to the plants used. Trees, shrubs, flowers and ground cover plants add vitality to city squares. Seasonal changes and adaptation of plants give a sign of vitality to the structural facades. For this reason, people build a bridge between them and natural life with the correct use of plants, which are the reflection of nature, in their living spaces.

Landscape, in terms of meaning, includes living and non-living objects that bring aesthetics to a field of view. It is possible to come across this even in compositions where structures and plants are used harmoniously. Because when there is a use that appeals to the eye, it is seen that the plants do not do this alone, but create a unity due to their relationship with the surrounding objects. The importance of this harmony is better understood in open spaces such as squares. Because the strong relationship between the landscape and the square is proportional to the correct use of plants and structures.

Evaluation of Some Important City Squares in the World and Turkey within the Framework of Design and Different Application Criteria

There are many squares in the world and in our country. Despite the large number of squares, it is seen that the elements that bring fame and identity to a square are witnessing history and reaching to the present day, being integrated with the surrounding structures, being at an important rotation point for the city, adding emphasis to the square with its structural and cultural features as well as its landscape features, and gaining value and fame with similar qualities.

With the study of some important city squares in Turkey and the world compiled by (Bayhan, 2013) and the compilation of some important city squares in Turkey by (Yılmaz, 2021), some important examples of city squares in Turkey and the world were identified.

The general characteristics and visuals of the squares were tabulated in Table 1 and Table 2, evaluated in terms of landscape design and application criteria.

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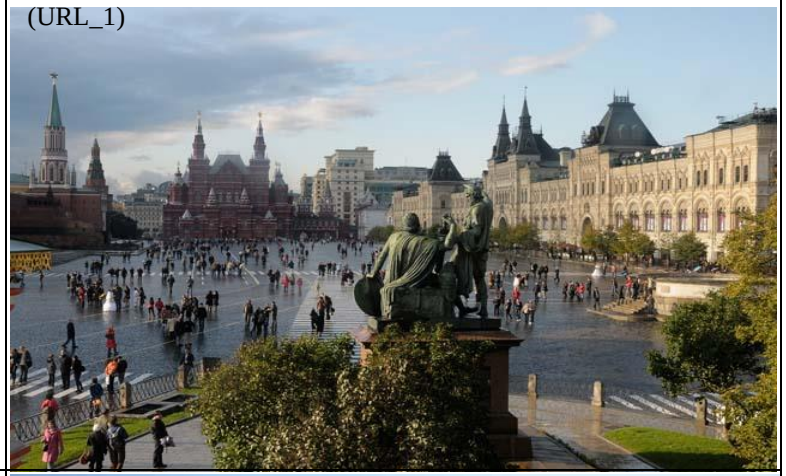
Table 1. General characteristics of important city squares around the world

SQUARE	HIGHLIGHT POINT	FEATURES	İMAGE
Red Square (Moscow, Russia)	It has been home to historical, cultural and political features. It is characterized by a large area, historic facades, sculptures and plants. The modern pavements of the square, which is a courtyard in the middle of the historical facades, stand out with their conformity to the historical silhouette. Only green plants are used in this square with majestic and colorful buildings.	Covering an area of 73,000 m², Krasnaya Ploshchad, which also means "beautiful" in Russian, Red Square is surrounded by the 20 m high walls of the Kremlin Palace, the Lenin Mausoleum, completed in 1930, and St. Basil's Cathedral with its striking onion domes. Built in the 15th century after the Kremlin walls were completed, the square has been the scene of executions, demonstrations, parades and rallies since its construction and is a UNESCO World Heritage Site (URL_1).	(URL_1) 
Palace Square (Saint Petersburg, Russia)	It is characterized by a column in the center and an original paving design within a large area. Plants and recreational elements were avoided so as not to detract attention from the important buildings around the square.	Palace Square takes its name from the Winter Palace built in the 18th century in Saint Petersburg, the center of the former Russian Empire, where the Hermitage Museum, one of the most important museums in the world, houses about 3 million works of art. The square, with a 47.5 m high column in its center, was the scene of the October Revolution - Bolshevik Revolution on October 25, 1917 and Bloody Sunday on February 22, 1905 (URL_1).	(URL_1) 

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Tiananmen Square (Beijing, China)	It covers a very large area. It is usually designed for demonstration use. It contains social and political content. Being at the center of vehicular and pedestrian transportation, it has a great social quality for the city. No plants are used inside the square, but there are ornamental plants and landscape designs dominated by color compositions made with topiary art.	Built in the 15th century, Tiananmen Square, meaning "Gate of Divine Peace", was built to separate the Forbidden City from the rest of the city. With an area of 440,000 m² that can accommodate 1 million people, it is the largest open space in the world. The square has suffered two fires and was reorganized in 1615. Starting on April 15th, 1989 and lasting until June 5th, it witnessed the so-called Tiananmen Square Events, which resulted in the deaths of hundreds of people, with intense participation from different segments of society (URL_1).	(URL_1) 
Times Square (New York, USA)	It is a square that attracts attention and is famous for its illuminated advertising signs. The high buildings narrowing the square are turned into opportunities for communication, advertising and various promotions. In this respect, it has become a brand for both the newspaper it is named after and the city. It has the characteristics of a square that is	Named after the New York Times newspaper, which moved to its new building on the square in 1904 with a fireworks celebration, Times Square is remembered for its illuminated advertising signs. The fireworks celebrations, which have become a tradition started by the newspaper, bring thousands of people together at the beginning of each year. The square is both a symbol of New York City and a global	URL_1) 

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	far from vegetative design and contains dense construction.	landmark. The square was pedestrianized in 2009 (URL_1).	
Trafalgar Square (London, England)	It is characterized by a granite column sculpture, ornamental pools with water shows and a simple landscape. The slope in the square has been transformed into amphitheater seating areas with the help of reinforced concrete and the lower ground is again offered for recreational use with a smooth grass area. In this way, the phenomenon of landscape is added to the water shows and the granite symbol. Trees with wide crowns and rounded forms are located solitary in the square.	Named after Admiral Horatio Nelson, who died at the Battle of Trafalgar in 1805, where the French and Spanish navies were defeated, Trafalgar Square is located on the main entrance gate of the National Art Gallery. In the center of the square is a 46 m high granite column with a 5.5 m tall statue of Nelson. Organized in 1820 with the demolition of many buildings, the square is often the scene of political demonstrations (URL_1).	(URL_1) 

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Place de la Concorde (Paris, France)	The fountain and sculptures, the water show and the fact that it is next to the Tuileries-style gardens give the square a different meaning. Water shows are also enriched with sculptures. In the square, lighting units are used both for light and to mark the boundary between the square and the roadway. The trees around the square are seen in the square as a silhouette.	Built in 1975, the square has an octagonal shape and is filled with fountains and sculptures. Located between the Champs Elysees and the 250,000 m² Tuileries Gardens, the square was renamed the Place de la Revolution for a while during the French Revolution. The guillotining of more than 1,000 people, including Louis XIV and Marie Antoinette, took place in this square (URL_1).	(URL_1) 
St. Michel Square (Paris, France)	The harmony of the large crowned trees with the historical buildings around the square is striking. The most important element that draws attention in the square, which does not include recreational and landscaping areas, is a fountain designed together with the sculpture.	The demonstrations and strikes, known as Bloody Monday, organized by university students on May 6, 1968 against Charles de Gaulle's government, which was criticized for its too harsh and conservative rule, started at the Sorbonne University and continued to St. Michel Square. The square is known for the fountain with two dragons on it, built in 1855 (URL_1).	(URL_1) 
Potsdam Square (Berlin, Germany)	This large square between skyscrapers attracts attention with its night lighting. Landscape design is done with lawn areas in the form of green parcels and scattered round shaped tree species.	Potsdam Square, which was the border checkpoint between the American and Soviet sectors during the Second World War, is the symbol of the new Berlin, which became the capital for the fourth time in its history. Today, the square is the center of the city, which suffered heavy damage during both world wars. Potsdam Square hosts shopping, cultural and entertainment activities (URL_1).	(URL_1) 

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Paris Square (Berlin, Germany)	It has a formal and simple landscape design. Pruned plants are used in small numbers in the area. There is a moving water surface. There is the same vegetative design on both sides of the square. Dwarf plants and ornamental plants are used. Benches are preferred as seating areas.	After the completion of the Brandenburg Gate in 1790, it was named Paris Square to symbolize the victory over Napoleon in 1814. The Brandenburg Gate was badly damaged during World War II and was rebuilt in 1898. One of the most prestigious squares in Europe, the Place de Paris today hosts many demonstrations and celebrations (URL_1).	(URL_1) 
St. Peter's Square (Rome, Italy)	It is an example of a beautiful symmetrical design with roads and buildings meeting each other. The color harmony of the buildings in the square and the patterns on the floors provide integrity. There is a column and two ornamental pools in the center. Recreational elements and plants are not included.	St. Peter's Square, located in front of St. Peter's Basilica in Vatican City, was designed by Gian Lorenzo Bernini between 1656 and 1667. The square, which has a 25.5 m high Egyptian obelisk in its center, is of great importance for Catholics (URL_1).	(URL_1) 

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Piazza San Marco (Venice, Italy)	It is a prominent square that hosts important landmarks of the city such as the Basilica of San Marco, the Bell Tower of San Marco, Torre dell'Orologion and the Ducale Palace. There are no plants in this square, which is reinforced concrete all around. Only formal striped patterns are used as ornaments on the pavements, the rest is simply integrated with the buildings.	San Marco Square, which hosts the Venetian Carnival 40 days before Easter every year, was the center of the Venetians' maritime trade with the inn surrounding it. Named after the Church of San Marco, the square is the transportation, trade and entertainment center of Venice and is one of the most beautiful squares in the world (URL_1).	(URL_3) 
Mayo Square (Buenos Aires, Argentina)	It is surrounded by monumental buildings. It has a remarkable appearance with its formal landscape design. There is a monumental sculpture in the center and a landscape design surrounding it. There are different landscape compositions made with a rich variety of plants, including ornamental plants, wide-crowned trees and palm trees.	The famous Mayo Square in Buenos Aires, the capital of Argentina, was named after the May Revolution of 1810. Built in the 16th century, the square has been the scene of political life since day one. Every Thursday, the Mothers of Mayo Square, known as the Thursday Madmen by the military as they search for the 30,000 missing people disappeared by the military junta in 1976, continue to gather in the square (URL_1).	(URL_1) 

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Puerta del Sol Square (Madrid,Spain)	It is a very large square surrounded by buildings. There are two ornamental pools and sculptures in the square. Seasonal flowers were preferred as plants in the perimeter around the ornamental pool. No trees or shrubs were used.	Puerta del Sol, known as the Gate of the Sun in Madrid, is one of the most famous squares in Spain. Once the gateway to the city, the square later became an important meeting place. Today, it has become a place where people gather for various events. Since 1962, the square has been the site of New Year's celebrations and welcomes thousands of people every year. Puerta del Sol is located in the very center of Madrid, the capital of Spain, with avenues surrounding it on all sides. This famous square dates back to the 1400s, when Madrid developed as a small suburb. However, the square did not become famous until the city grew. But since the 17th century it has been a meeting place for all important events and activities in Madrid (URL_1).	
Freedom Square (Tehran, Iran)	The square attracts attention with its magnificent Azadi Tower. In addition, the design of grass plots with a symmetrical design as a landscape is another striking element of the square. The connected roads passing through the grass plots have created a different design example. Only grass and a few dwarf plants are used as vegetation.	The Shahyaad Tower was built in the square in 1971 to symbolize the entrance to the city in honor of the 2,500th anniversary of the Persian Empire. The name Shahyaad, which means "Remembrance of the Shahs", was changed to the Freedom Monument after the 1979 Iranian Revolution. The name of the square was changed to Freedom Square in parallel with these developments. The square was the scene of violent clashes during the demonstrations against the rule of Shah Reza Pahlavi during the establishment of the Islamic Republic of Iran (URL_1).	(URL_1) 

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Tablo 2. Türkiye'deki Önemli Kent Meydanlarının Özellikleri

SQUARE	HIGHLIGHT POINT	FEATURES	İMAGE

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Taksim Square (Istanbul, Turkey)	It is a small area surrounded by the monument of the republic and the surrounding green parcels and roads divided into quadrants within a circular area. The grass plots in the square have seen different landscape designs over the years. In all designs, seasonal ornamental plants are used around a few existing coniferous trees. There are no recreational elements.	The square was named after the Taksim Maxim, where Galata-Beyoğlu water used to be distributed. The Republic Monument in the center of the square was commissioned by Italian sculptor Pietro Canonica and placed in its place in 1928. Taksim Square, located at the entrance of Istiklal Street, which is also a cultural, entertainment and major shopping center, has been the scene of many events, such as the Bloody Sunday on May 1, 1977, when dozens of people were killed. The square also hosts various festivals and celebrations (URL_1).	

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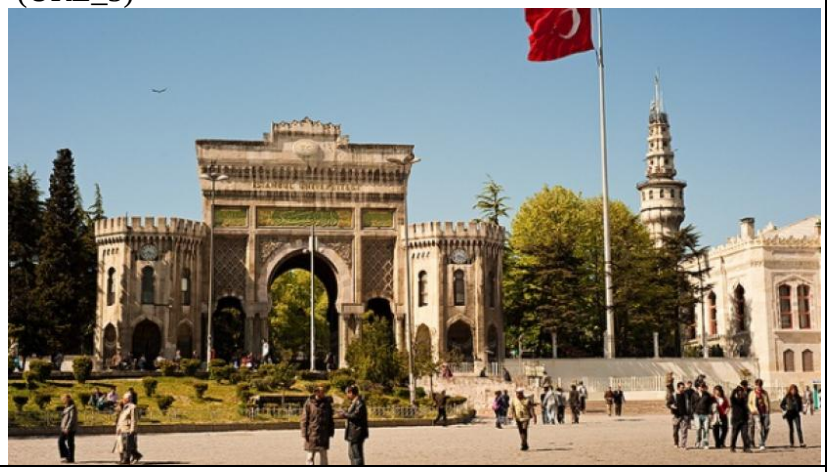
Beyazit Square (Istanbul)	This area between the university and the mosque was used as a parking lot, but thanks to a project, it became a square. Seating areas and plant parterres were created by terracing. Generally, tree species with large crowns and dwarf plants were used. Simple grass parcels are also included. Surrounding the existing trees in the square were utilized as seating areas and plant boxes were frequently used.	Beyazıt Square, which was the largest forum of the city during the Byzantine period and a palace square during the Ottoman period, and located in the center of the Historical Peninsula, has been the site of many demonstrations and protests throughout the history of the Republic. One of the most important of these was the rally on February 16, 1969 in protest against the US 6th fleet anchored in the Bosphorus (URL_1).	(URL_5) 
Kızılay Square (Ankara)	The square is surrounded by transportation routes on all four sides and covers an area with high vehicle and human circulation. There is a shopping center and various restaurants and cafes in the square. There are advertising signs in the square, an illuminated object in the central refuge and a moving water surface on the ground. In terms of vegetation, grass, large trees and seasonal flowers are preferred in the central refuges.	Kızılay Square is located at the intersection of Atatürk Boulevard, one of the busiest streets of Ankara, with Ziya Gökalp Street and Gazi Mustafa Kemal Boulevard. Named after the Kizilay institution, the square has both Metro and Ankaray connections. The square is crowded and lively every day of the week and witnesses celebrations and demonstrations (URL_1).	(URL_6) 

Konak Square (Izmir)	The clock tower in the center of the square and the surrounding palm trees are the symbolic elements of the square. There are wide walking paths and recreational areas around it. In addition, the large grass surfaces and various plant species used add the comfort of an open green area to the square. At certain points, ornamental plants such as seasonal flowers are used to emphasize.	Kemeraltı Bazaar is an open space with historical and symbolic elements such as the government mansion, clock tower and the first bullet monument. In the historical process, it is seen that the concept of square in the real sense has not been developed in Turkish cities (URL_1).	(URL_7) 
Sultanahmet Square, Istanbul	It is a square that covers a very large area and attracts attention with its many historical buildings and rich landscaping. The moving water surface in the square and the walking paths connected to each other have created many green parcels. In these plots, there are pruned tree species and ornamental plants with various patterns. The design of the square in accordance with the historical silhouette and the rich landscaping of the recreational areas within it have created a peaceful environment.	Sultanahmet is the historical heart of both Istanbul and Turkey with its historical texture, architecture and crowds where different cultures come together. As it is today, it was the most important square of the city during the Roman, Byzantine and Ottoman periods. The square, which was the Horse Square of the Ottoman period and the hippodrome of the Byzantine period, is located on one of the hills of the city with seven hills. Topkapi Palace, Hagia Sophia, Blue Mosque, Basilica Cistern are located in the historical atmosphere of the square (URL_2).	(URL_8) 

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Cumhuriyet Square, Antalya	It is a large area between the surrounding buildings and a square with an Atatürk monument. There is a simple landscaping around the monument and large crowned trees around the square. The square has a moving water surface and seating units.	Cumhuriyet Square in the city center has a view where history and the sea are intertwined. The most magnificent structure seen from the square is the Yivli Minaret, one of the symbols of the city. It used to be called Tophane Square because the cannons that protected the city were located in the area. The most popular place in the square is the Tophane Tea Garden (URL_2).	(URL_9) 
Mevlana Square, Konya	Important buildings around the square led to its recognition. The patterns of the tiles on the floor give the surrounding buildings an aesthetic appearance. There are walking paths and green parcels that connect to each other around the square. Within these plots, a simple landscape and solitary trees are preferred.	It is the most visited square in Konya. Mevlana Cultural Center and Selimiye Mosque, one of the most beautiful examples of Ottoman architecture, built by Selim II and the work of Mimar Sinan, and Mevlana Museum, also known as Mevlana's lodge and tomb, are located within the borders of the square (URL_2).	(URL_10) 

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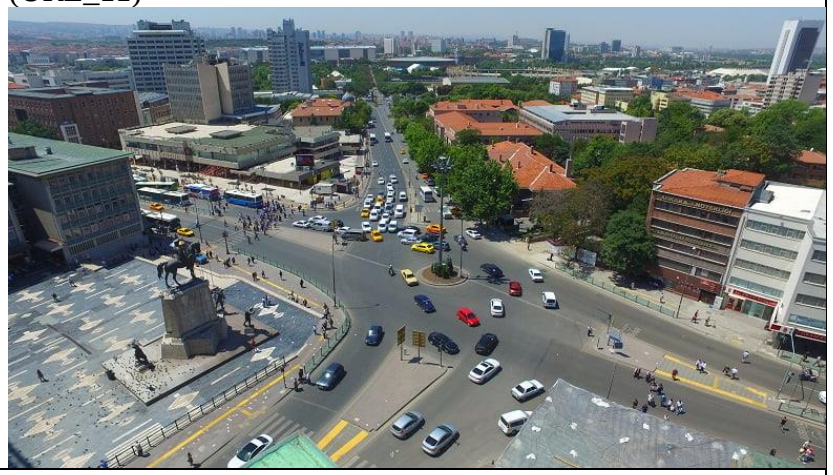
Ulus Square, Ankara	It is a square that takes its importance from the historical places around it and draws attention with the Atatürk monument inside. It is small in area and is not planted. Only the monument and pavements stand out visually. There is a project for the renovation of the square.	The square where the Atatürk monument is located is surrounded by many historical places. The Old Grand National Assembly of Turkey, Ankara Palas, Ankara Governor's Office, Ziraat Bank, State Theaters General Directorate Building, İş Bank Building, Garanti Bank Building, etc. are prominent here. Adjacent to the square, there are shops selling antiques in Samanpazarı and At Pazarı (URL_2).	(URL_11) 
Cumhuriyet Square, Samsun	The square covers a large area. It is named after the statue of Atatürk. There are a few scattered trees with wide crowns. There is no recreational element. Formal patterns are preferred on the floors, but there is no other arrangement.	The square in İlkadım, which is described as the center of Samsun, is one of the main stops of Samsun tram. Also standing in the Municipality Park near the square is the 'Monument of Honor', a statue of Atatürk, which is considered one of the rare structures in the world (URL_2).	(URL_12) 

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Yakutiye City Square, Erzurum	The square is shaped by the use of a pavement compatible with the historical structure and green parcels. Due to the climatic conditions, coniferous tree species were used more around the square.	In the city square of approximately 20 thousand square meters, there are two symbolic historical monuments identified with Erzurum such as Lala Pasha Mosque and Yakutiye Madrasa. The square, where social events are organized, is one of the most visited spots in the city with its public buildings built in 18th and 19th century architecture, landscape and environmental beauty (URL_2).	(URL_13) 
Balıklıgöl and Dergâh Platform Square, Urfa	There are cultural and historical sites within the square. In some places, a simple landscape is used and in other places, arrangements with dense afforestation are used. There are also areas for recreational activities.	Organized by the Şanlıurfa Governorship in 1999, the project implementation of the square was carried out by the Şanlıurfa Culture, Art and Research Foundation. Within the borders of the square are Şanlıurfa Castle, the cave where Prophet Abraham is believed to have been born, the place where he was thrown into the fire, Balıklıgöl, Ayn-ı Zeliha Lake, mosques, madrasas, bazaars and inns belonging to the Ayyübi, Akkoyunlu and Ottoman periods (URL_2).	(URL_14)

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Saburhane Square, Mugla	It is a nostalgic square with cultural and historical buildings. The fact that the structures that have been preserved to this day have survived has added meaning to the square. There are recreational arrangements suitable for the buildings. The existing plane trees in the area were preserved, and new tree species were used in recreational arrangements.	Muğla's Saburhane Square, which smells of history with its old inns, baths, fountains, arastas, mosques and unique coffeehouses, has a history of 500 years. The square, shaded by large plane trees, still preserves its original architectural identity. The houses in the square, where Turks and Greeks used to live together, have the architectural features of Muğla houses. It keeps its history alive with its two-storey whitewashed houses on Daracık streets (URL_2).	(URL_16) 

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City Square, Eskisehir	It stands out as a modern city square with its use of space, aesthetic structure and rich landscaping arrangements. Transforming the river passing through the square and the surrounding areas into both social and recreational opportunities increases the attractiveness of the square.	The old hay market, which was used as a parking lot for large tonnage vehicles, was transformed into a modern square with the Metropolitan project. Even though it is new, the area is very popular and has become a modern square where walking is done, where everyone from 7 to 70 can cycle and skate (URL_2).	(URL_16) 

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CONCLUSION AND SUGGESTIONS

The concept of square appears in various features and forms from past to present. In all areas where human life is intense, there is a need for a square, no matter how small or large, and square formations arising from this need. When the characteristics of important squares in the world and in Turkey are examined, the criteria that make that square important are; It has been observed that the society gains an identity in proportion to its suitability for recreational, cultural, social, aesthetic and functional elements.

In addition, some squares have an identity by preserving their historical structure or witnessing historical events. It is not easy to make a square famous with its identity. Because although there are many city squares around the world, the basis for recognition of only those with an identity are elements such as correct design, social and cultural activity, functional fiction, strong landscape design, sustainable and harmonious environment. These elements are one of the basic needs of every society and city. However, if a city square containing these elements is surrounded by inappropriate building facades in its environment, it is reflected in the identity of the square as a negative feature since it does not create integrity in terms of design. Integrity and harmony, which are one of the principles that make the design strong, if they are inadequate in the construction around the square, it creates an ugly appearance in the background, which is negatively reflected in the square.

When squares in Türkiye and the world are examined, the importance of the effect of environmental structures on the square is seen. The most important qualities are that the most important squares are in harmony with their surroundings and that they have transferred the historical elements of the city they are located in to the future without being damaged. These qualities add value to the squares as they add a sense of lived experience to the spaces.

Squares that meet the needs of urban people and provide circulation provide opportunities for socialization and cultural transfer within the society. Squares that allow the society to socialize and engage in recreational activities are generally preferred. It is seen that the squares that have hosted historical, cultural, monumental and important events in or around them have become famous and recognized.

Squares have a mutual interaction with the city people that cannot be ignored. These effects were sometimes in the form of hosting, and sometimes they were both a breakthrough into sociality and personal escape points. It has found a place in the life of the society, sometimes with demonstrations of joy, sometimes with total calmness, and sometimes with an intensity that is problematic. In every age and society, city squares have been shaped by both cliché and unique characteristics. In other words, the elements that shape the squares were born with the inherent desires and needs of the people. Because they are the people living within the essence of a city. All the positive and negative aspects of the people are embodied in the city square.

The past ruins of the squares must keep up with developing technology. It should be able to keep up with innovation both in terms of modernity and functionality, and should be free of problems that disrupt public service. It should continue its existence without the need for urban transformation, which is one of the main issues of today. Because only in this way is it possible to transfer past knowledge to the future.

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Every square keeps the culture it has accumulated alive. The squares that undergo change become a diminishing puzzle by losing their integrity. Each piece that changes and succumbs to time causes a disharmony that does not overlap with each other over time. In all transformations where history and modernity conflict, history is usually the defeated side. The reason for this is the phenomenon of urban heritage that is not instilled in future generations. Squares are areas that keep the city's heritage and identity alive. For this reason, it should be designed in a way that will not stand the test of time.

Existing squares should be preserved intact and the public's contribution to social needs should be increased. The new squares to be built are:

- Compatible with the city and surrounding structures,
- Compliant with basic design and comfort principles,
- Can be used in all seasons,
- Contains sufficient recreational elements
- Includes sustainable use,
- Contributing to the urban landscape,
- Having historical and social meaning,
- Provides image and prestige to the city,
- Suitable for all kinds of social activities,
- It should have features that provide comfort to pedestrians and vehicles in terms of transportation.

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EVALUATION OF THE EFFECT OF LIGHT AND COLOR IN LANDSCAPE STUDIES IN TERMS OF LIGHTING ELEMENTS AND DIFFERENT STYLES OF USE

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ABSTRACT

People living in cities need areas to realize their recreational activities outside their daily lives. Open green spaces are the areas where urban dwellers can breathe, outside the buildings, where they enjoy living their lives. Open spaces cover all kinds of social, physical and recreational needs of people. One of the important design elements used in landscape areas is lighting elements. Lighting is of great importance in order for these areas where people spend time to be used and perceived at night as well as during the day. Landscape architects are a professional discipline that effectively uses lighting elements as well as plant material and water elements, and creates impressive landscapes in terms of light and color with new design styles such as water-lighting element, plant-lighting element. This study was conducted to examine the effect of light and color in landscape studies in terms of lighting elements and to reveal the importance of lighting in landscape. In this context, the study examines the effect of light and color in landscape design in terms of lighting elements and different usage styles. Landscape design is not only limited to spatial arrangements, but also plays an important role in determining the atmosphere of living spaces with the effect of visual elements such as light and color. The study analyzes how the use of light and color in landscape design affects spatial perception and how various lighting elements enhance this effect. It also explains how combinations of light and color in landscape design serve various aesthetic and functional purposes by giving examples of different styles of use. In conclusion, this study highlights the importance of the use of light and color in landscape design and aims to inspire designers to explore different combinations and styles of use.

Keywords: Landscape light, colour, lighting elements

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INTRODUCTION

When the activities that people perform in their daily lives come together, they constitute urban life. What is important for cities is to increase the quality of life by making outdoor spaces usable. For people living in urban areas, outdoor recreation areas are the most important areas where they can breathe, outside the buildings and enjoy their lives. These areas meet all kinds of social, physical and recreational needs of people.

Lighting elements have become indispensable elements of urban landscape design. Especially the visuality of the landscape can be made very attractive at night. With the lighting works to be carried out, the landscape project can be turned into a corner of paradise with different wavelengths of light and creative light color choices according to the selection of landscape elements. Factors such as achieving a beautiful appearance in the dark, focusing on favorite objects, highlighting structures such as sculptures, walls, pools, trees, fountains, and safe use of open spaces in the dark can summarize the aesthetic aspect and practical benefits of landscape lighting. In the area to be illuminated, not only visuality but also functionality and safety are among the issues to be considered.

The purpose of landscape lighting occupies an important place in our lives. The main ones of these purposes are lighting for the security needs of cities, lighting for comfortable transportation, lighting for the road-direction-finding needs of urbanites, lighting for the social activity needs of urbanites and lighting to emphasize the special areas of the city.

One of the biggest concerns of landscape architecture is visual concerns in spaces. Since the space is perceived primarily with the sense of sight, the direction and quality of the light illuminating that space is an important factor in creating the quality of the space. Light clarifies or obscures boundaries, emphasizes form or texture, conceals or reveals a feature, reduces or enlarges distances (Kıran, 1992). It should not be forgotten that light is effective together with shadow in these changes. It is also impossible to examine the phenomena of light and color by separating them from each other. Distinguishing objects in the field of vision from each other depends on some color contrasts. For this reason, while illuminating the building surfaces, a certain color contrast should be created with the immediate environment and background (Tuna, 1994). Textures and forms can be perceived in different ways according to the direction and effect of light. Thus, a separate possibility is added to the effect of the building through light-shadow play. This new possibility creates an interesting and plastic appearance as it breaks the monotony (Güngör, 1972).

One of the most important factors affecting visuality and visual perception is color. Color, which serves aesthetic purposes, determines the quality of the space and is a part of our perception system, adds a different depth and dimension to the space by revealing the material, design and equipment elements used in the arrangements made in urban spaces (Kıran, 1986). Color, in connection with the level of illumination of the space, helps to impose some features such as large, small, warm, cold, reassuring, cheering, suffocating, relaxing according to the

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actions to be performed in it (Sağocak, 2005). Warm colors generally have the effect of vitality, joy, excitement and movement, while cool colors have the effect of calmness, comfort and relaxation (Altınçekiç, 1994). Surfaces composed of warm and dark colors are perceived closer than they are, while surfaces composed of cold and light colors are perceived farther than they are (Danby, 1964). It has also been found that light colored surfaces are perceived to be larger in size than dark colored surfaces (Işıngör et al., 1986).

In this study, the effect of light and color in landscape design is evaluated in terms of lighting elements and different usage styles are examined. Light and color are important elements in landscape design and can enhance environmental aesthetics when used correctly. The study discusses how to optimize the use of light and color in landscape design by focusing on various lighting elements and color options. In addition, different styles of use and their impact on landscape design are also discussed. As a result, this study highlights the importance of light and color effects in landscape design, providing designers with different options and guidance to enhance environmental aesthetics. In addition, the aim of this study is to reveal the effects of lighting elements used in the landscape on people with the effect of light and color and to reveal the different ways of using light and color in designs.

MATERIALS AND METHODS

This study was carried out to evaluate the lighting elements used in the designs in the landscape architecture profession group in terms of light and color effects, to determine new approaches to the use of light and color and to evaluate the general perspective of these approaches in terms of landscape architecture. For this purpose, the information obtained as a result of domestic and foreign sources, articles, theses, literatures and internet scans on the subject constitute the basic data and main material of the study. Within the scope of the study, the characteristics of light and color, their usage areas in the landscape and different design styles constitute the other auxiliary materials of the study.

These data were generally evaluated under some sub-headings and concepts, and as a result of the study, new design approaches for the use of light and color in lighting in terms of landscape architecture were evaluated. In this context, the effect of light and color in landscape design was evaluated in terms of lighting elements and different usage styles were discussed. In addition, literature research on the importance of light and color effect in landscape design was conducted, and then, different usage styles of lighting elements and the effects of these styles on landscape design were discussed. As a result of the study, suggestions were made for the aesthetic and functional effects of lighting elements used in the world and in our country in landscape studies.

RESEARCH FINDINGS

In terms of landscape architecture, the effects of lighting elements and the effects of light and color in designs and new design approaches are discussed in a broad framework in this section, and the properties of light and color, the properties of lighting, and the usage techniques of lighting in landscape are examined under different headings.

Concept of Light

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Light is an important phenomenon that meets the visual needs of human beings and responds to shaping and aesthetics in line with their emotional, mental and physiological needs. To perceive any object formally and colorfully and to place it in memory can only be realized with light. Atalay (2004) defined light as follows: "Since the human eye is sensitive to radiations consisting of electromagnetic waves with wavelengths between 380-780 nanometers, the radiations between these wavelengths are called LIGHT. The reasons why the wavelengths are not very precise are the slight differences from person to person in the organ of vision, which is the basis for the definition of light, and the effect of the light force on the visual limit."

Light is divided into two according to its source; 'natural light' and 'artificial light'. Natural light is the light formed by the combination of daylight, sky light and sunlight existing in nature at different times and amounts (Atalay 2004).

Physical Properties of Light: When the physical properties of light are examined, it is seen that it attracts attention with its different properties. Erim (1999) explained the wave propagation of light as follows: "Light is an energy quantum. That is, an energy particle. It propagates with wavy motion. The length from one crest to the other crest of this wave is called the wave length. Rays of various wavelengths are refracted at different angles in a prism and this is how the spectrum is formed. The wavelengths that affect the human eye vary between 380 nm and 760 nm. The wavelengths we can see are the light rays between these two limits." Light is also made up of particles called photons. Object surfaces reflect these particles with certain wavelengths in certain ways depending on their material and whether they are flat or not. Refraction is the change in the direction of light as it passes from one transparent medium to another transparent medium (Yıldırım 2004).

Apart from these three properties of light, it can be said that light also has "intensity", "color", "spectrum" and "shadow" properties. According to Kanbur (2006), one of the properties of light is the decrease in intensity depending on the distance it travels; another is the color of light depending on the source from which it is produced. Color is the expression of light and affects both our physiological and psychological state with the energy it contains. Our eyes perceive light with wavelengths between 380 and 780 nm as color, red, orange and yellow between 780-565 nm are called warm colored light, while blue, green and purple between 565-380 nm are called cold colored light". The color properties of light affect the perception of the essence of the color of the illuminated objects and surfaces. In defining the color properties of light, numerical determinations such as color temperature and color rendering class/index (Ra) as well as designations such as warm-warm-cold are used (Ünver 2000). While surfaces appear more gray in "cold colored" light, they become less gray in "warm colored" light (Fitoz et al. 2007).

The spectrum is the state of infinite change of color, sound and electromagnetic waves within a certain value, one after another in continuity. The color section of the light spectrum consists of the colors in which the light is separated by passing through a special prism (Oğuz and Işık 2003).The shadow is also a light source reality and is formed if the path and direction followed by the light is obstructed. In other words, everything that is perceived visually is an obstacle to the path of light. An object becomes perceptible by being revealed through light. But it is the shadow that determines the actual form, dimensions and spatial position of the object. Thanks

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to the shadow, it is possible to perceive the atmosphere and give depth to objects (Yıldırım 2004).

Effects of Light

It is known that light causes some positive / negative effects on all living and non-living objects. There are many studies conducted on this subject today.

Gürel (2001) stated that in line with the researches conducted in the 20th century, light has many positive / negative effects on the eye systems, especially on the act of seeing. For example; bright light sources within the visual fields of users can cause some parts of the space to be brighter, causing discomfort such as glare, vision difficulties and distraction. Light coming towards the eye from lighting fixtures or windows creates a "direct glare" effect, while light reflected from shiny surfaces creates a "reflected glare" effect. There is information that colored lights produced using various devices can have negative consequences for eye health and are therefore not recommended by experts. In experiments on the effectiveness of vision conducted under light beams of equal intensity but of various colors, the decreases in the speed of seeing clearly and distinguishing objects followed the following order: Yellow, greenish yellow, greenish orange, red, greenish blue and blue. However, there are also opinions that colored lights can give positive results when used for special purposes.

Based on research on light and health, it should be noted that light not only affects the eye system, but also the hormone and nervous system, and that these effects on the hormone and nervous system have an impact on the "biological system", "biological clock", "performance", "psychological state" and "perception mechanism" (Atalay 2004).

It is also possible to create positive effects on psychological state and general health by using light as a therapy method. According to Ekerbiçer (2007), the treatment of winter depression caused by the decrease in the amount of daylight in autumn and winter with artificial bright light applications is known as a treatment method applied by many psychiatric doctors.

In addition to the mentioned effects of light, it is also known to have some effects on object appearances. As stated by Kazanazmaz (2003), light defines space, reveals surface textures, shows form, determines scale and differentiates functions by creating various effects such as sharpening, highlighting and softening on elements such as line, color and texture. Light is also known to have positive and negative effects on plants. According to Atalay (2004), short wavelength (ultraviolet) rays prevent color formation and growth in plants and cause dwarfism. The effect of medium wavelength rays (purple, blue, green, yellow, orange, red lights) on plant development varies according to the wavelength. While blue light increases the height of plants, the absence of red light delays or inhibits seed germination and development, green light negatively affects plant growth. The effect of long wavelength (infrared) rays is more on heating than on photosynthesis. Depending on the characteristics of the light lighting system, light pollution can cause serious damage. Light pollution is caused by the wrong amount, direction and timing of the lighting system, with light illuminating where it is not wanted or needed, and at the same time sending too much light into the sky. At the same time, too much light may not provide better vision and may not prevent crime, while insufficient lighting may cause glare and adversely affect good visual conditions. Light pollution is defined as the use of light in the

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wrong place, in the wrong amount, in the wrong direction and at the wrong time (Bostancı, 2002).

Color Concept

Color is one of the most effective factors on visual perception among the design elements. It is an element that appeals to the senses more closely and effectively. Color is not only a property of animate and inanimate materials and objects or an element that evokes psychological effects. People determine and perceive the color of surfaces and objects according to the color of the reflected light. Therefore, color is an integral part and property of light and is defined subjectively as an element of sensation and objectively as the light stimulus that gives rise to this sensation. Indeed, in the process of visual perception, in addition to the color of the material and object, the color of the illuminating light and the color perception system of the visual organ are also effective (Ünver, 2000).

Effects of Color

Erim (1999) divided color effects into biological, visual and psychological. Apart from these, it can also be said that color has physical and economic effects. The physical effects of color are mentioned together with its biological effects. Among the visual effects, contrasting colors (opposite colors) increase the strength of each other when they come side by side, making the highest visual contrast effect by seeing vivid and bright. Objects have different color effects according to the environments they are in. The effect of a yellow object on an orange object is less than the effect of the same object on a purple object. This is because yellow and purple colors create maximum contrast with each other. These visual effects are accompanied by psychological effects. As for the biological and physical effects, it is a known fact that the iris shrinks under bright light and grows under dim light conditions. Less well known is the fact that the retina's sensitivity to light increases in dim light and decreases in bright light. In this way, within certain limits, a certain quality of vision can be achieved both in dim light and in bright light. This is known as "brightness adaptation". Colors can affect the physical movements of the human body such as orientation, attraction, acceleration and deceleration in relation to its biological state.

Danger (1987) stated that people's physical reactions to colors are similar to psychological ones. Reactions to the saturation of color are reactions to the purity of color. Highly saturated color conditions the human body for muscular activities but inhibits mental tasks; the body directs its attention outward. In environments with very high brightness colors, the level of concentration will be very low. In environments with low saturation and brightness, the body turns away from the environment and turns towards itself. Since there will be less distraction, people will concentrate better on visual and mental tasks (Başoğlu 2007). Looking at the psychological effects of color, the effect of colors on people varies according to the psychological state, age and cultural level of the person, as well as the experiences of nations in different periods are also a criterion in color selection. However, there is a difference in the general psychological effects of colors on people in design studies (Öztan 1969).

Lighting Concept

Light, the data of visual perception, is the main material of lighting. The International Commission on Illumination (CIE) defines lighting as "the application of light to make objects and their surroundings visible" (CIE, 2000). The main purpose of lighting is not to achieve a certain level of illuminance, but to provide visual comfort. Inadequately illuminated environments may lead to a decrease in visual performance, discomfort, illusions, insecurity, inappropriateness in terms of aesthetic and architectural features (Ünver, 2001).

Lighting is a system that allows us to see spaces and objects with their real size and natural colors by sending light with natural and artificial sources. Lighting also allows us to create different atmospheres for objects and spaces. Erdem (1995) defined lighting as "light per unit area". Lighting is divided into three in terms of its purpose in various sources. These are "physiological lighting", "decorative lighting" and "emphasizing lighting". If there is a physiological purpose in lighting, such as seeing and perceiving all the objects in the environment in the shortest time, with all their details (such as form, surface, color features), the lighting to be done is "physiological lighting".

Lighting that aims to see a space or living and non-living objects in desired details other than physiological purposes is "decorative lighting". In this way, it is tried to make these places or objects more attractive, different, memorable and beautiful.

The lighting used to draw people's attention to an object or event is called "accent lighting". The places where attention is wanted to be drawn can be a historical building, an artistic object or a tree. It can also be used for advertising purposes. In this case, it may be the purpose of lighting to promote a product or organization, to ensure that a brand is in the minds.

Types of Lighting

Lighting is divided into two as natural and artificial light lighting. In natural light illumination, light sources are sources that produce light spontaneously (sun, stars, etc.). Artificial light illumination is the sources (light bulbs, candles, torches, lanterns, etc.) produced by humans to be used in the dark (Şahin et al., 2014).

According to various sources, lighting with artificial light can be realized in five ways (Akyıldız, 2019; Özkum, 2011; Zeytinoğlu, 2015; Yıldırım & Erikli, 2021):

Direct Illumination; It is a form of illumination made by sending 90-100% of the light flow from the lighting element directly to the surface to be illuminated.

Semi-Direct Lighting is a form of lighting in which 60-90% of the light flow is sent directly to the surface to be illuminated.

Mixed Lighting; It is a form of lighting made by sending 40-60% of the light flow from the lighting element directly to the surface to be illuminated.

Semi-indirect lighting; It is a form of lighting made by sending a part of the light streams between 10-40% to the surface to be illuminated.

Indirect Lighting; It is a form of lighting made by sending a ratio of 0-10% of light streams to the surface to be illuminated.

Lighting Design in Landscape Architecture

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The physical environment, which is closer than the boundaries of the space where people live, refers to an environment that directly affects them. The physical environment is a determining factor in the lives of individuals. The physical environment is affected by light, color, sound, heat and humidity, which are factors that affect people. Light, which is one of the elements of the physical environment, gains great importance because approximately 95% of the information that people acquire through different ways of perception about the environment they live in is visual perception (Tokay, 2019).

In order for cities to have different uses after dark, lighting should be used for different purposes. Among these objectives are lighting to meet the security needs of cities, lighting to provide comfortable intercity and intra-city transportation, lighting to facilitate people living in the city to find the road-direction-location, lighting for the social activity needs of people living in the city, and lighting to highlight some special areas that have become symbols of the city (Demir, 2012).

In order to enable the use of open green areas at night, lighting techniques and design principles should be used in landscape design so that these areas can be used even when it gets dark. Lighting applications that provide functional use of the area also help to add aesthetic visual richness to the area. Lighting applications belonging to the comfort, security and comfort area, as well as the use of space, should focus on the areas and objects you want to draw attention to in the area. Different light colors, light intensities and lighting can be used to achieve this (Tokyay, 2019). Landscape application is a process that starts with architectural design, emerges with implementation and continues with use. In order for lighting projects to be unique, environmentally friendly and sustainable, it is necessary to have a good understanding of lighting planning processes and to manage the processes carefully. It is also of great importance to define the right professional fields correctly. In this way, lighting projects can be designed and implemented more effectively (Bektaş et al., 2018).

Lighting Techniques in Landscape Design

In landscape architecture, lighting forms serve two purposes: aesthetic and functional. Aesthetic lighting is designed to reveal the visual impact of interesting objects and outdoor areas with some illumination. In functional lighting, the aim is to emphasize the functional aspects of outdoor spaces while ensuring their safety. Lighting styles are influenced by the position and direction of light sources. Lighting schemes depend on the location and type of object used. In this context, there are many lighting methods. These are accent lighting, wash technique, texture technique, cross lighting, silhouette lighting, moonlight and shadow technique (Yılmaz & Alper, 2006).

Accent Lighting: Accent lighting means illuminating a plant or groups of plants, an object or an area to make it brighter than its surroundings, to make it the center of the area, to increase attractiveness and attention (Candan, 2010; Yavuz, 2016). Accent lighting requires careful placement of luminaires to avoid shadow fall (Figure 1).

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Figure 1. An example of illumination of plants and plant groups (Url -1, 2024)

Washing lighting: Washing lighting can be defined as a light that covers a specific area. When a flat wall surface is illuminated with the washing technique, it can leave its ordinary appearance and become more impressive and meaningful (Figure 2). Using this technique, the color of the surface can be highlighted with different bright colors or an interesting look can be achieved. This type of lighting can be provided by point or linear lights mounted on the surface or floor, providing wide-angle light distribution. It is important to place the lights correctly to avoid unwanted images (Yenioğlu, 2010; Demir, 2012).

Figure 2. An example of a villa garden wall with wall lighting (Url-2, 2024)

Texture technique (grazing): Texture technique refers to surface lighting used to show texture and make it interesting (Figure 3). Although texture lighting is generally preferred for illuminating brick and stone walls, this technique can be used to illuminate any facade, object or plant body with textured features. To achieve the texture technique, recessed lighting fixtures

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can be used on the surface or on the ground to provide top-down or bottom-up lighting with narrow or wide-angle light distribution (Yavuz, 2016).

Figure 3. An example of stone wall lighting (Url-3, 2024)

Cross lighting: It involves the location of the luminaire and the direction of illumination rather than the lighting effect. The texture and shape of illuminated objects or plants are emphasized by cross lighting, which allows them to be recognized (Figure 4). Landscape lighting, especially plant and sculpture lighting, can be achieved by using diagonally positioned and surface-mounted spotlights or recessed luminaires, which typically offer underground lighting (Candan, 2010; Yılmaz and Alper, 2006).

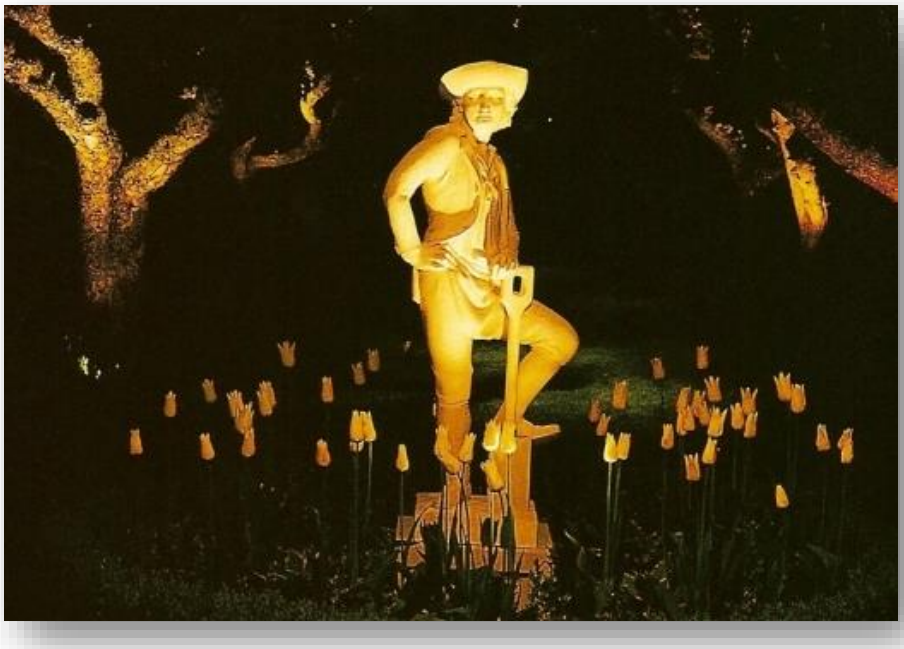

Figure 4. An example of a sculpture illuminated with spotlights (Url-4, 2024)

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Silhouette lighting (silhouetting): This technique is achieved by illuminating a wall or other vertical surface behind the subject to make it appear darker. The technique involves illuminating a wall or other vertical surface behind the subject to make it appear darker. The texture and color of the object is not obvious, but its distinct boundaries create an interesting focal point. The desired effect requires factors such as the distance from the light source to the object and the direction of light propagation. If the distance between the illuminated surface and the object is too great, the silhouette effect will be lost as the contrast between light and dark is blurred. The silhouette lighting effect can be achieved by using luminaires that emit diffused light concentrated in a certain volume (Candan, 2010; Yavuz, 2016).

Moon lighting: In the moonlight method, a light source is created by placing it diagonally between the branches and leaves of a tree. This style of light, which has a soft character, penetrates the leaves and creates a beautiful atmosphere (Yılmaz & Alper, 2006).

The shadowing technique (shadowing): This is a technique that can be likened to the silhouette technique, but is used as a technique that provides the opposite lighting. The shadowing technique differs from the silhouette technique in that it requires lighting to illuminate plants or objects from the front and create shadows on the surface behind them. The lighting fixtures to be used should be wide angle. The size of the shadow varies and can have different effects depending on the distance between the luminaire and the illuminated object or plant. Spot lighting fixtures or low power lighting fixtures are acceptable (Yavuz, 2016).

Illumination of Space and Elements in Landscape Designs

Cities should provide people with opportunities for various uses after dark. Therefore, lighting should be done in cities with different purposes in mind. For this reason, certain design principles should be followed and lighting elements should be used in landscape designs (Demir, 2012).

Entrance Lighting: Entrance lighting is related to the lighting layout around and within the park. Although the primary purpose of entrance lighting is to ensure safety, architectural space and aesthetic lighting needs should also be considered (Figure 5). A well-lit park entrance attracts the attention of visitors and directs them towards that space. Devices embedded in the ground to be used in entrance lighting illuminate the park entrance, while at the same time creating a focal point for anyone who wants to enter the park, helping to guide park users safely inside (Raine 2001, Dedeoğlu 2006).

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Figure 5. Aksaray Municipality Makas City Park entrance (Url-5, 2024)

Tree and Shrub Lighting: In tree lighting, the type, location, lamp selection and power of the device are very important in the area to be illuminated. The size, cover density, structure, shape, color, texture and location of the tree also play an important role in lighting design. Tree color plays an important role in the choice of lighting device (Figure, 6). If the leaves, bark or flowers of the trees are light colored, they will stand out mostly with low-power lighting. In the autumn season, the same technique applies, especially for trees with red and orange colored transparent leaves (Raine 2001, Dedeoğlu 2006). It is the biggest mistake to illuminate every tree in the illumination of wooded areas. Illumination should be done for tree groups in places and unilluminated tree groups should be left. Trees should be removed from the ground by placing the light source high and leaving the trunk of the trees in the dark (Alper 2002).

Figure 6. Example of tree lighting (Url-6, 2024)

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Flower Parterres and Lawn Area Lighting: The illumination of flower parterres is done in different ways according to their size and shape. Since flowers show frequent closure, it is not correct to bury the spotlights in the ground. This type of use emits a beam of light downward from eye level. As a result, this light is reflected on a nearby garden path, terrace or stairs. Since this reflection is closer to the flowers, a 15-25 watt bulb should be used to eliminate this negative effect (Çelik and Koç 1992).

When illuminating ground covers such as grass, light sources should be placed in such a way that they do not cause glare. The light from the devices should be directed only on grass areas. The size of the grass area to be illuminated also affects the lighting scheme. When the area is small, a uniform illumination over the whole area gives a good effect. If the grass area is large, it is sufficient to illuminate the edges of the area and the roads within the area (Acar 2008).

Sculpture and Focal Point Lighting: Sculptures and monumental objects in the park make important contributions to the landscape of the park. These objects create a focal point both during the day and at night. They take an important place in creating a composition in park lighting. In order to provide the necessary emphasis and shadow to reveal the shape and structure of the sculpture, the sculpture should be illuminated from more than one direction (Raine 2001, Dedeoğlu 2006).

If the luminosity of sculptures and focal points is high enough, they can be easily perceived in their surroundings. Illuminating the plants around the sculpture and focal points with a lower level of illumination than the sculpture and focal points better emphasizes the importance of the sculpture and focal points. A beam of light is directed at the sculpture and focal points to be illuminated from specific and appropriate points. Projectors that create light and shadow plays and lamps that give white light are used (Çelik and Koç 1992).

Illumination of Historical Artifacts and Plastic Elements: A good lighting design in historical artifacts provides the desired display of contrasts, materials, colors, volumes and reliefs in the structure. Thanks to the application of a correct lighting technique, historical buildings can become more interesting (Dalkılıç and Halifeoğlu 2003). It is necessary to illuminate buildings and monuments of high artistic importance in order to ensure that they can be seen at night and to reveal their features (Yalçın 1998).

The illumination of plastic elements is handled in two sections as two-dimensional elements (paintings, posters, panels, etc.) and three-dimensional elements (monuments, sculptures, etc.). In order for the colors to be perceived correctly in the illumination of colored objects, white light sources with high color rendering should be used and placed in locations that will not cause glare (Figure 7). The size and darkness of the details and shapes of objects are important in indicating luminance. As the detail becomes smaller or darker, the illuminance level on the surface should be increased (Dedeoğlu 2006).

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Figure 7. Erzurum Castle lighting (Url-8, 2024)

Lighting of Gazebos and Pergolas: When lighting the pergolas, the devices should be placed in such a way that they do not create glare. Lighting the pergolas from bottom to top or with the moonlight technique is a better solution than edge lighting. Top-down illumination of the interior is used to emphasize decorative base details. Pergolas can be illuminated with halogen light sources, needle-pointed devices, devices embedded in the ground or spotlights (Figure 8). Pergolas are illuminated by devices directed from bottom to top, placed in the vines around the columns, or by devices directed from top to bottom, placed on opposite columns, beams and columns. Depending on the function of the pergola, a combination of these two lighting techniques is usually the best solution.

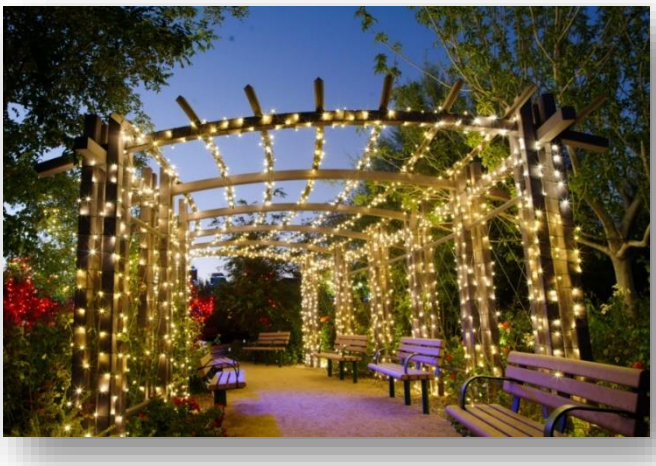

Figure 8. An example of lighting a pergola (Url-9, 2024)

Pedestrian Path, Bike Path and Stairway Lighting: Pedestrian paths, bicycle paths and stairs are the areas where transportation and circulation are directed and carried out in a landscape area. When parks are used at night, these places need to be illuminated. In pedestrian path lighting; adequate illumination level, safe movement of people, properties of the surface coating

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material used and device selection are the criteria to be considered (Raine 2001, Dedeoğlu 2006).

Stair lighting is a functional requirement rather than a lighting technique. Stair lighting should provide sufficient illumination to determine the appearance of the staircase and to distinguish between the depth of the landing and the depth of the steps. The ease of seeing the steps depends on the material used for the stairs and also on the shape of the staircase. Dark colored materials require a higher level of illumination. The depth of the landing and step can be made more easily perceived by changing the color of the material used (Raine 2001, Dedeoğlu 2006).

Each stair tread should benefit from the direct illumination provided by the shielded light sources within the devices and should not be shaded by the step above. This eliminates glare problems for pedestrians and the difficulty of perceiving the stairs (Raine 2001, Dedeoğlu 2006).

The ability of pedestrians to see the stairs and obstacles on the stairs is a basic requirement for these areas. Stairs should be illuminated with light sources with spectral distribution suitable for the material used. The desired level of illumination can be achieved on the steps with devices with a linear light field (Figure 9). In addition, lighting devices should be aesthetically compatible with the stair design and positioned (CIE 2000).

Figure 9. Sinop Aşıklar Street (Url-10, 2024)

Illumination of Water Elements: The movement of light in water is refraction, reflection and dispersion. Light refracts as it enters water from air or vice versa. This is why the location of an object under water appears different. Refraction also causes brightness or rainbows in wavy

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water. In uniform reflection, water reflects the light coming to its surface like a mirror, the angle of incidence and the angle of reflected light are equal to each other. Some of the light incident on the water surface is scattered by hitting particles and air bubbles in the water (IESNA 2000).

In lighting over water, since the water surface is generally flat, it gives a smooth and dark image with very aesthetic and interesting reflections (Çelik and Koç 1992).

The water element is used for many purposes in urban spaces. In landscape studies, water is a visual element and an indispensable object for human beings. By using the water element in urban spaces in arrangements suitable for both functional and aesthetic purposes, different and interesting views are provided in these spaces. Water can be used as a focal point or for security purposes by directing or blocking pedestrian circulation (Haris and Dinnes 1988, Dedeoğlu 2006).

Fountain Lighting: In fountain lighting, it is first necessary to decide which part of the fountain, water or structure, is to be illuminated, the lighting technique to be used and the effect to be created (IESNA, 2000).

Fiber optic systems are widely used in a lighting system where light is carried into the water. Lenses of various colors can be used to create different effects. However, the wide variety of these lenses creates confusion (Figure 10). Different types of water jets can be illuminated by placing spots of different beam widths close to the jets to create the best effect. Fiber optics also means convenient maintenance. (Raine 2001, Dedeoglu 2006).

Figure 10. Example of fountain lighting (Url-11, 2024)

Ornamental Pool Lighting: Pools are illuminated by devices placed under or around the water surface. Devices placed on the side walls of the pool are an effective way to reveal the geometric form of the pool. A dramatic effect is achieved by illuminating the pool from underwater. The

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colors of the light sources to be used in pool lighting should be cold colored and especially emphasize the blue color (Raine 2001, Dedeoğlu 2006).

In order to get the best results in lighting ornamental pools, lighting should be done with isolated sources from the bottom of the pool upwards. When this lighting system is placed in the pool, the pool should be empty and leaks in the pool should be checked (Çelik and Koç 1992).

Purplish blue or greenish blue color can be chosen for pool lighting. In both colors, the water effect in the pool is not disturbed and an aesthetic appearance is obtained (Öztürk 1992).

If the pool is not illuminated, it is appropriate to illuminate the trees around the pool. Because the image of the illuminated trees on the water surface allows the pool to be perceived (Öztürk 1992).

Artificial Lake Lighting: It is not possible to illuminate artificial lakes from the inside as in pools. For this reason, it is possible to perceive the water by illuminating objects such as trees, grass, etc. on the edge of the artificial lake and their images on the water surface.

In artificial lake lighting, strong point light sources should be used to create a remarkable image. A lighting scheme that allows the formation of images of light sources on water particles should be established by taking advantage of the glossy surface of water particles, which are transparent and glossy surfaces, which are important in the illumination of water elements. In order for these images to be perceptible, the background should be as low-lighted as possible (Figure 11). In the illumination of such water elements, the use of colored light sources should be avoided (Acar 2007).

Figure 11. An example of artificial lake lighting (Url-12, 2024)

Children's Playground Lighting: Lighting is done according to the game activity. Direct light on children's faces should be prevented. In addition, seating areas prepared for parents should

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also be illuminated. Interesting and active environments for children can be created in a very beautiful way with light games (Çelik and Koç 1992).

The amount of light should be at a level where children can play comfortably. Lighting should be done according to the activity of the game. Light should be prevented from shining directly into the eyes. Interesting and moving environments should be created (Alper 2002).

Lighting in Sports Areas: In the illumination of sports fields, it is not correct to illuminate only the field. At the same time, it is necessary to make objects moving in different places and at different speeds visible (Çelik and Koç 1992).

Lighting should be in such a way that the players can best see the playing field. According to the changing background, the balls that need to be seen should be sufficiently illuminated, and the general background should be illuminated accordingly to minimize excessive contrast and glare problems (Çelik and Koç 1992).

The most important factor in the lighting of playgrounds is the presence of a light intensity that will not disturb the players during the game. The amount of light and the type of lighting will be different for different games. Another important issue is that the light should not shine directly on the player's face. This also applies to the spectators (Çelik and Koç 1992).

It is a mistake to illuminate only the playing fields in sports and playgrounds. Objects moving in different places and at different speeds should be made visible in sports fields. The lighting should not tire the eyes of the spectators and should show the game at a sufficient level. Objects should not be seen as flatly illuminated, but as shaped by light and shadow (Alper 2002).

Square Lighting: Squares are a central point where people or vehicles come together within certain boundaries. In order for squares to become attractive, first of all, their visual comfort and aesthetic design must be complete. Elements such as fountains, stairs, etc. around the squares should be emphasized by illuminating them. Squares can be built for a wide variety of purposes. Squares are needed around historical and social structures that allow people to gather, facilitate entry and exit, and emphasize the structure (Öztürk 1992).

The functions of the squares and the nature of the lighting to be done are determined by the function and configuration of the buildings around the square. Depending on the architecture and functions of the buildings around the squares, the square is either illuminated or remarkable elements such as fountains and stairs in the square are emphasized by illuminating them (Öztürk 1992).

The purpose of illuminating the areas within the squares, which are partially or completely open to pedestrians and used by people for sitting, resting, strolling, shopping, exhibitions, meetings, etc., is primarily to provide visibility and to create safety and security for pedestrians (Arifoğlu and Sözen 2000).

In order for the square to have a gathering and attractive feature, the structures and elements that border it should be illuminated in accordance with human nature. In order for the entrances and exits of the square to be easily perceived, a lighting scheme should be established at a much higher level than the surrounding area (Figure 12). The interesting objects in the square (pools,

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lakes, monuments, fountains, etc.) should be illuminated in a way to reveal their features and emphasize the space. Lighting should be installed to ensure safety on pedestrian roads in the square (Alper 2002).

Figure 12. Sivas Historical City Square (Url-13, 2024)

Building Surface Lighting: By emphasizing the architectural and functional features of the buildings with a good lighting scheme, it is possible to ensure that the night view of the city is remembered more than the daytime and that it takes place in people's memories. Thus, people can perceive many buildings that they do not pay attention to or even perceive due to the hustle and bustle during daytime business hours (Acar 2008).

DISCUSSION AND CONCLUSION

Outdoor lighting has been an indispensable requirement for humans since the early ages and has been developing day by day. Especially for people who spend most of the day working, it is necessary to make appropriate lighting arrangements that will enable them to get away from the fatigue and stress of the day and participate in various activities. Artificial lighting is of great importance for people to benefit from outdoor activities at night and to increase the duration of use of these spaces.

Artificial lighting not only makes outdoor spaces safe, but also adds aesthetic beauty. The appearance of the outdoor space and architecture can be revealed again at night with a mysterious effect by using various methods with lighting suitable for architectural design. Landscape spaces, plant arrangements, rock gardens, pools, etc., which do not attract enough

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attention during the day or which are seen differently in daylight, can be seen from a completely different angle with artificial lighting and can be made more interesting and flashy.

In order to create the most ideal visual effect in lighting designs, an inter-professional work such as landscape architects, lighting designers and experts is required.

Landscape architecture takes part in ecological planning, land use planning, protection of water, soil and visual values, nature restoration, creating areas for recreational use in urban and rural environments and creating functional and aesthetic living spaces sensitive to the environment with living and non-living materials at the design application stage by investigating the characteristics of the natural factors that make up the landscape and its structure. As a matter of fact, Alper (2002) also reached results that support this view in his study. As a result, ensuring the correct use of color and light in creating usage areas increases the importance given to human beings and ensures the integration of the relationship between the environment and human beings.

Today, the importance of outdoor spaces is increasing day by day. People living in houses and similar places can use the gardens they use during the day with the same comfort and safety at night. Apart from this, lighting is also used in parks, streets and sports fields to provide different usage opportunities at night (Çelik and Koç 1992). Lighting studies in landscape architecture should be evaluated especially when designing areas. In this way, integrity can be ensured and incompatibilities and light pollution that may occur later will be prevented.

Historical and contemporary buildings and artistic values reflecting the city's past and cultural accumulation are visible in all their splendor during the daytime. These values, which determine the level of culture and civilization of the people living in the city, turn dark when it gets dark and deprive the city of all its beauty. For this reason, urban values that symbolize the character of the city should be illuminated to increase the time when people can see the presence of these values (Öztürk 1992). In the illumination of a very important value in cities, the issue should not only be understood as making it visible, but the quantity and quality of the illumination on the surface of the value, its function, formation, facial texture, color and similar features should be revealed.

Lighting elements used in urban parks should not be very functional, large, exaggerated and overly striking, but should be more aesthetic, functional and less striking.

However, lighting elements should be used in different colors, shapes, forms and features in outdoor applications. The shape and aesthetic appearance of the luminaires used to illuminate urban parks should be in accordance with the environmental architecture. In addition, the construction, installation, maintenance and repair of lighting elements should be easy and protected against external influences (Çelik and Koç 1992). In lighting designs used in urban parks, the quantity and quality characteristics of light should be determined accurately. For this reason, park lighting should be handled within a certain plan and a method should be determined to create a suitable environment for the illuminated place. Two important points should be addressed in urban lighting. These are lighting for safety and aesthetic purposes.

In today's plant lighting applications, it is seen that the characteristic features of plants are not taken into account in terms of lighting. In such lighting applications, plants should be

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illuminated in accordance with lighting techniques (Acar 2008). Creating successive bright and dark areas on the roads tires the eyes and endangers traffic. This situation can be eliminated by installing lighting elements at the appropriate height and appropriate clearance.

Special lighting for plastic elements is not found in most places. Making these elements suitable for urban life and bringing different expressions to the city will be positive for urban aesthetics. It is more appropriate to pass the tools and cables used in the installation of lighting elements under the ground in order not to cause visual pollution.

Even though certain steps have been taken in the field of lighting in recent years, it is seen that the process of globalization and international relations have increased (Sözen 2003). As a matter of fact, it is an undeniable fact that it is necessary to approach the issue of lighting in a scientific and technical manner as in many other issues in today's conditions.

As a result, in the areas designed for people where lighting elements are used, especially in urban parks, in order to serve people in every aspect and to get away from the living conditions they are in during the day, the light and color image that emerges by using lighting elements in the designs to be made should be used in a way that is sustainable 24/7, without disturbing the environment, especially light pollution. Lighting elements should be selected according to the region to be illuminated, and these elements selected in terms of aesthetics and safety should be in harmony with the region they illuminate.

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THE USE OF WATER IN LANDSCAPE ARCHITECTURE NEW APPROACHES

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ABSTRACT

Water has been indispensable for living life from the moment the world has existed until today and will continue to be indispensable in the future. This resource, which is valuable for all living life, has shaped the history of civilisation from past to present in many ways. For this reason, the first settlements were established on the waterfronts, and human beings living in a nomadic state started agricultural activities with water and established settled living spaces. This study examines and discusses new approaches to the use of water in landscape architecture. Water is an important element in landscape design and can be used in various ways to enhance the aesthetic and functional qualities of spaces. However, traditional water feature design is limited and confined to conventional forms. This study explores the potential for landscape architects to utilise the water element in more creative and diversified ways and considers innovative approaches in this area. **Keywords:** Landscape light, colour, lighting elements. New trends and technological developments are enabling water to play a more dynamic role in landscape design. This study focuses on different uses of water and various design principles and shows how these approaches are applied through sample projects. As a result of this study, innovative approaches that encourage landscape architects to develop more innovative and environmentally sustainable approaches to the use of the water element by breaking out of traditional boundaries have been investigated in detail and various evaluations and recommendations have been made.

Keywords: Landscape, water, innovative approaches

INTRODUCTION

Water is one of the most important natural resources that should be preserved and passed on to future generations, but its consumption is increasing day by day. Rapidly growing urban populations and the effects of climate change are increasing the pressure on water resources and emerging as the biggest risk to sustainability. In addition, the impermeable surfaces brought about by dense urbanization cause rainwater to pass into surface runoff without infiltrating underground, thus causing flood events.

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In addition to being an indispensable resource for the survival of all living things on earth, water has also been the determinant of cultures and lifestyles for people throughout history. The fact that life depends on water and that natural water resources are decisive in site selection decisions has led to the shaping of agriculture and living spaces in this direction. Over time, water has become not only a source of life but also a source of inspiration for people, and with the use of water with artistic and deep spiritual meanings, water has also shaped the history of civilization (Akın & Akın, 2007).

Water, the most important source of life for human beings, is an important element that can be included in landscape design. Especially as a result of intense urbanization, the longing for the presence of water is increasing. It is known that the use of water as a design element in urban parks provides many benefits such as visual, auditory, psychological, cooling, recreational, etc. to park users.

With its therapeutic properties, water has the effect of relaxing people and relieving stress (Kürkçüpğlu, 2009). In addition to their visual and psychological effects on people, water elements bring vitality to the space, become a unifier between the elements of the space and provide the emergence of architectural elements around the space. Water provides coolness, humidity, radiance, lightness, depth and tranquility, while at the same time providing a living environment for in-water flora and fauna and contributing to recreation (Taner, 2010). Due to these features, it is very important that water, which is an important element in landscape design, is versatile and compatible with the environment in which it is designed in order to give the desired effect in designs.

Water used in landscape design is an excellent element that allows the dimensions and forms of the area to be perceived differently from the real one. Water offers new perspectives, movement, light, sound and ever-changing reflections (Rees and May 2002). Water also contributes to the emergence of architectural element details around the space. For this reason, water has been used in different sizes and shapes in all known historical periods with its aesthetic and functional properties.

While calmness and a sense of the third dimension in the landscape can be achieved with a calm and wide water surface, effects such as liveliness, joy and coolness can also be created with moving water and water shows that can be created with music systems. Lighting, one of the important elements of landscape design, is also an important design element that can support the effects of water uses.

Day and moonlight, raindrops, a flowering tree or a dark cloud cluster give meaning to the water surface. Water is a landscape element that most clearly expresses the power of gravity to create balance (Uzun 1999).

Landscape architecture is an art and science where nature and the man-made environment merge in harmony. This field is constantly evolving over time and adapting to changing needs. Water is one of the most fundamental and influential elements at the center of landscape design. However, factors such as climate change, diminishing water resources and urbanization require us to rethink the use of water. This study explores new perspectives on the use of water in landscape architecture that transcend traditional approaches. The importance of water in

landscape studies is listed below (Muratoğlu, 2010; Bayramoğlu et al., 2012; Çorbacı and Özyavuz, 2011; Taner 2010):

Water Conservation and Sustainability: In traditional landscape designs, water was often wasted and sustainability was ignored. However, today, the utilization and conservation of water resources has become an important issue. In this context, landscape architects are developing design approaches that encourage the rational use of water. For example, rainwater harvesting and recycling, the use of smart technologies in landscape irrigation systems and the preference for vegetation that provides natural filtration of water are important steps towards sustainable water management.

Interaction and Experience with Water: While in traditional landscape design water is often used only as a decorative element, new approaches aim to make water more interactive with people. Design elements such as walkways around the water feature, seating areas, and areas that can be freely navigated in or around the water allow people to experience the water more closely. In addition, sensory features such as the sound and movement of water enrich the atmosphere of the landscape, enhancing the users' experience.

Biodiversity and Ecosystem Services: Water is the source of life for many biological species and it is important that landscape design supports the natural ecosystem services of water. New approaches emphasize the creation of natural habitats around the water feature and the promotion of biodiversity. Design elements that capitalize on the natural filtering and habitat-providing capabilities of water, such as ponds, wetlands and rain gardens, enhance the ecological value of the landscape and contribute to local ecosystems.

Water Use in Social and Cultural Context: Water is not only a natural resource, but also has cultural and social significance. New approaches address the use and meaning of water in a social and cultural context, encouraging a more sensitive approach to water as part of local communities and cultural heritage. For example, the integration of traditional water features and water-related rituals into modern landscape design contributes to preserving local identity and strengthening social bonds.

The aim of this study is to examine the use of water element in designs within the scope of landscape architecture profession discipline, to determine new design approaches that can be made to create spaces for users in terms of both psychological and health by using water effectively, and to explain the importance of water used in every branch of architecture from history to the present day.

1-MATERIAL AND METHOD

This study was conducted in order to determine new approaches to the use of water element in the landscape architecture profession group and to evaluate the general perspective of these approaches in terms of landscape architecture. For this purpose, the information obtained as a result of domestic and foreign sources, articles, theses, literatures and internet scans on the subject constitute the basic data and main material of the study. New design approaches emerging for the use of decreasing water resources in designs due to changing climate and environmental conditions as a result of global warming, the usage areas of water from history

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to the present day, the importance of water in terms of landscape architecture, the effects of water on landscape designs constitute the other main material of our study.

These data were evaluated and discussed in general terms within some sub-headings and concepts, and as a result of the study, new design approaches for the use of water element in designs in terms of landscape architecture were evaluated. As a result of the study, with the change in the climate in the world and in our country, suggestions were made for the effective use of water and its aesthetic and functional effects in landscape studies.

2-STUDY FINDINGS

In this chapter, the water element and new design approaches in terms of landscape architecture are discussed in a broad framework, water and water properties, the use of water throughout history, the purposes of water use, the role of water use in landscape studies are examined under different headings.

Water and its properties: Water is one of the most interesting substances of our world due to its various properties. It is the only element that can be found in different states in nature as solid, liquid and gas. It is colorless, odorless and tasteless. Water has a volume and a shape when it is solid. In its liquid state, it has a volume but no form. Therefore, it takes the shape of the container it is placed in. In its gaseous state, it is homogeneously distributed in the container in which it is placed, because in this state it does not have a certain volume and shape.

Historical Use of Water

Human beings, who spent their early periods in caves, opened up to the environment with the change of conditions and needs, used water for protection from all kinds of external factors and built their dwellings on the banks of water bodies or on stakes driven into the water. However, with the change in the way of life, socialization and the development of technology, people retreated further inland from the shores of the water and adopted settlement on land over time. As a result of the need to organize the land as a living environment apart from its economic function, it started to create gardens in an artistic sense. As one of the most important elements of nature, water has always taken place in settlements and gardens throughout historical periods (Akkan 1994).

Water, as a landscape design element for the eye and mind, has been found at different scales in almost all historical gardens (Uzun 1999). The use of water for parks and gardens has a history dating back to ancient times. Probably the oldest and most interesting examples of this tradition can be found in the Hanging Gardens of Babylon (Öztan 2004).

The Element of Water in Ancient Gardens: In the early ages, the use of water was mostly functional for economic reasons. In Egypt, where the climate was very hot and arid, large canals were opened from the Nile River to irrigate agricultural areas and to meet the water needs of residential areas. Some of these canals were wide and deep enough for a ship to pass through, while others were only narrow enough to deliver water to pools and wells (Okutan 2003).

Water Elements in Ancient Egypt : Egyptian civilization was strongly influenced by the geological structure and climatic conditions of the Nile valley where it was born and developed;

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the Nile played a very influential role not only in the gardens but also in the whole life of Egypt and especially in its economy. The overflowing of the Nile at certain times, leaving a fertile sediment over a large area of land, was considered as a gift of nature to Egypt. The water was brought to the villas in this vast land, which was generally outside the flood boundary of the Nile, by canals dug from the river. These T-shaped or rectangular water reservoirs, which were initially built to irrigate vegetables, fruits and flower beds, were later transformed into pools, which were also decorative elements of the garden (Akdoğan 1974).

Water Elements in Ancient Iran (Persia): The irregular and insufficient rainfall in most parts of Iran necessitated the transportation of water to the cities through underground canals from distant high snowy mountains. The water delivered to the cities could then be used as a show in open channels and pools. In the palace gardens, gradually rising terraces were connected to each other by steps. There are many sculptures around the palaces. Water is the common feature of all gardens in Persian gardens, which developed based on courtyard system plans (Figure 1). Water was used for demonstration purposes in open canals and pools (Karahan 2002). The pool form in Persian gardens is architectonic. It had a dominant design effect. At its center is a very fine and skillfully detailed fountain. It is seen that the cooling and reflecting properties of water were meticulously evaluated (Öztan 1970).

Figure 1. A view of the Finnish Garden of Kashan, Iran, included in the UNESCO World Heritage Sites list in 2011 (Url-1, 2024)

Water Elements in Mesopotamia : The warrior tribes settled in Mesopotamia created gardens with favorable ecological conditions and public parks in Mesopotamia, which was poor in forests, established large gardens on artificial hills and decorated these gardens with artificial lakes (Pamay 1978).

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The most famous gardens among ancient civilizations are the "Hanging Gardens of Babylon" built by Nabuchodonosor for his Persian wife and known as one of the seven wonders of the world. In these terrace gardens, which usually show a formal plan, there are cool corners reserved for entertainment, fountain pools with moving water, shade trees and decorative flowers.

Water Elements in Ancient Greece : Ancient Greek gardens were originally useful places with fruit trees and vineyards. There are fountains, pools, vegetable and fruit trees and useful plants for irrigation purposes. In the ancient Greek civilization, garden works, which started with religious beliefs, later became green and water play gardens. In the Hellenistic period, fountains were activated by ingenious hydraulics; water power was used to animate human and animal figures. The gardens of this period later became public parks and incorporated qualities to integrate with the classical landscape. These features include fountains, fountain structures irrigated by streams, grottoes or nymphs, shaded porticoes and tree-lined pedestrian paths (Cendere 1998).

Ancient Roman Water Elements: The Romans had a special interest in water, cared about fountains in the form of monuments and considered fountains as a symbol of the power of a city. This respect and love for water from ancient times continued during the Middle Ages and monumental fountains were built. The importance the Romans attached to water is clearly seen in the engineering achievements of aqueducts and monumental spas (Cendere 1998). Spread over three continents, the Great Roman Empire's contribution to the art of gardening was large green areas and villa gardens. In the large green areas they created, they created public facilities and artificial lakes on which water games were held to entertain the public (Akdoğan 1974).

Water Elements in Medieval Gardens : The Middle Ages is a millennium in which great social, political, cultural and artistic changes slowly accumulated. This age was a purely religious art world in an environment influenced by Christianity, which developed in Rome. Two movements were observed in Europe during the Middle Ages. These are Roman Art and Gothic Art. Romanesque architecture was formed around monasteries and overlord castles. Although the distinctive building type of Gothic art was cathedrals, official buildings, palaces, castles and city walls were also realized in this architecture. In the Middle Ages, garden art works were carried out around monasteries and castles where overlords ruled (Nurlu and Erdem 1994).

Monastery and Castle Gardens: Monastery gardens are gardens that are planned mainly for function rather than beauty. Generally, each monastery has a courtyard, which is divided into four parts by two perpendicular roads. In the center of the courtyard there is a well, a pool or a fountain and a tank for watering the plants (Akdoğan 1974). In medieval castle gardens, where a strong idea of protection was formed, the use of water is different. Here, water is primarily a protection element and was used in the form of water channels called "Moads" surrounding the castles (Bekiroğlu 1992). In addition to its functional use, water was used as wells, small pools and water bowls in various forms for pleasure between the castle walls. Some of these were in gothic style, some in the form of large marble bowls, and some were simple square, rectangular, stone pools (Akdoğan 1974).

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Byzantine Water Elements : In Byzantium, the simplicity of Roman classical art was moved away from the simplicity and colorful, bright and showy came to the fore. In the Byzantine gardens, which were smoothly shaped, water was given great importance. Especially fountains, pools, cascades and cascades were utilized. In these gardens, which were arranged in the form of large inner courtyards, water channels covered with gold and silver, colorful and geometric shapes and ornaments were used (Pamay, 1978). The great influence of the East is evident in garden art, where water structures and their ornaments were given great importance. The most typical feature is the sense of greatness in the selection and use of materials. It has become a tradition to use precious stones and metals in water facilities. Around the pools there are animal figures made of metals and water is poured from them (Bekiroğlu 1992).

Water Elements in Islamic Gardens: In the shaping of Islamic garden art, the hot and arid climatic conditions in the countries where Islam spread played a major role as well as religious philosophy. Examples of Islamic gardens that have survived to the present day can be found especially in Spain, Iran and India (Akdoğan 1970).

Spain is famous for its water gardens in terms of Islamic gardens (Figure 2). The main inspiration of water gardens is the water channels (Öztan 1970). Water takes place in the garden as a composition that can be called completely motionless. When used in this way, it is vast and illuminated in the form of water mirrors in wide and deep pools. In Spanish gardens, water was used in rectangular, polygonal, square pools surrounded by semicircles (Bekiroğlu 1992).

Figure 2. A view of the Cennett-il Arif Garden Pool in Spain (Url-2, 2024)

In Iranian gardens, it is impossible to see a garden without the use of water. Pools play an important role in garden design. They range in size from a small sea to the smallest circular or

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rectangular pool in the courtyard. These water features in the courtyards of rural and urban houses are refilled at fixed intervals by open channels running along the avenues. The water in these pools is used as cisterns. Sometimes, to create different effects on the water surface, the pool is divided into several sections by rods and different flowers float in each section (Cendere 1998).

In India, a marble pavilion is placed in the center of a lake, canal or pool and water is dispersed in all directions. These pavilions were used not only for resting but also for banquets and special meetings. The still water surface in front of the Taj Mahal, built by Shah Jahan for his deceased wife in 1631, reflects the beauty of the structure, as well as the tranquility created by death and the color and vitality of moving clouds (Öztan 1970).

In addition to the visual and musical effect of water, its softening effect on the local climate is also mentioned. The fountains in mosque courtyards, which we see beautiful examples of especially in Islamic gardens, were used both as music and as elements that reduce the negative effects of heat. Due to the climate, the use of water in Islamic gardens with pools, fountains and cascades was widely used, the shows were decorated with metal and bronze ornaments, and irrigation schemes were developed for the gardens (Uzun 1987).

Water Elements in Far Eastern Gardens: When it comes to Far Eastern gardens, Chinese, Japanese and Indo-Mongolian gardens come to mind (Figure 3). Among these gardens, especially Chinese gardens are the mother of gardens, as almost all garden art historians agree. Chinese gardens have been a source of inspiration and ideas for the changing European gardens in the eighteenth century (Gültekin 2006).

Figure 3. An example of the use of water elements in a Far Eastern garden (Url-3, 2024)

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Throughout history, traditional Chinese gardens have been a place where the emotions and soul beauties of nature can be found and developed. Mountains, rocks, lakes, rivers have been the natural assets of Chinese art and especially garden art (Kavaklı 1994). In Chinese gardens, with the influence of Taoism, water aims to reflect nature in meandering streams, waterfalls and stagnant pools. The design consists of water and rocks. Water adds softness to the environment and reflects other elements in the design with its reflective surface (Cendere 1998). In Chinese garden art, trees and flowers, curving paths and perimeter walls are details. The main elements are mountains, roads and water. Taoist philosophy recognizes water as the lifeblood of the earth. Water has a meaning in life-giving power. Water is also suitable for creating an atmosphere that catches the light and shows the mysterious caves inside with shadowy reflections (Bekiroğlu 1992).

The Chinese word for garden is "Shan Shui", a combination of the words mountain and water. The elements of Shan Shui are cascades, ponds, islands, bridges, rocks, walkways, ornaments, plants. Water is used in the form of large surfaces, complemented by large purpose-built bridges. The bridges are usually in the form of semicircular arches and reach the appearance of a full circle with the mirror effect of water (Erdal 2003).

In Japanese gardens, water is often used in the form of cascades, merging with stone, wood, grass and a calm lake. In flat gardens, water sometimes gushes from a small stone, but when used as a stream, it flows from east to south and then west. It does not appear to flow in such a way that it directly divides the garden in two. Transitions from one side of the water to the other are made by stone steps or bridges (Gültekin 2006). In Japanese gardens, water, bridges, gazebos, stones, stone lamps, garden pagodas, plants, siege elements, stepping stones and paving stones constitute Japanese garden elements. The purpose of using water is to bring peace, coolness and vitality to the environment. In addition to natural uses such as waterfalls, lakes and rivers, water is also used in bowls in various parts of the garden. In gardens without water, water is expressed with stones and pebbles (Nurlu and Erdem 1994).

The Element of Water in Turkish Gardens : The use of water in Turkish gardens has been in the form of fountains, fountains, pools and cascades. The movement of the water was brought by fountains and cascades. Pools are usually four corners or square. Pool depths are 1-1.5 m. Due to the changing geographical structure of Anatolia in the east-west and north-south directions, there have been some differences in the understanding of the garden and the use of water. However, with the influence of Islam, gardens and houses were surrounded by high walls and thus transformed into a courtyard system. Within this courtyard system, almost every house had a square or hexagonal marble or stone pool or well. These examples can be found today especially in Diyarbakır, Şanlıurfa, Gaziantep and Hatay, where summers are very hot and dry (Karahan 2005).

During the Principalities period, which is characterized as the Early Turkish Age in Anatolia, courtyards are seen in almost all mosques, madrasahs, palaces and residential buildings. Mosque and madrasa courtyards were enriched with fountains, pools and fountains (Erdoğan 1996).

The water element has an important place in the Turkish garden. Even if it is small, a pool is an indispensable element in the garden structure that varies according to the seasons (Sazak 2005). As flooring in Turkish gardens, the garden floor is left either with its natural covering or as smooth soil. There are no large areas of grass or hard paved areas to create richness of perception. The section close to the house and prominent places such as pools and fountain heads were covered with stones, mosaics, etc. (Sazak 2005).

In Turkish gardens, water has always been used as a design object and a means of recreation. Most of the time, mansions were built by the sea and streams, or water was used in gardens as pools and fountains. Moving water was always preferred to stagnant water. There was always a pool in the garden, and the fountains and cascades in the pool gave movement to the water (Kurum 1987).

Uses of Water

A water element with a fountain to be placed in a square or a pedestrian axis in an urban space can give that space a focal point and a landmark character, as well as adding value to the space as a landscape element that will provide noise control and encourage people to use that space. Water adds richness to architecture with its physical effect that adds charm to the space, its relaxing effects on people and its natural and symbolic meaning. It plays an effective role in providing both functional and aesthetic requirements of spaces. The sound of water flowing in an urban space with its acoustic, reflective, cooling, refreshing and relaxing features creates a unique structure in the space with its attractive effect. In addition, at night, various water and lighting elements such as pools and fountains provide spatial attractiveness (Gençtürk 2006).

Water adds sound and texture to the space, with ornamental details and water elements attracting attention and drawing the eye. Water can be spread over a large surface or kept in a small area in the form of a small pool partially hidden by plants. Flowing water creates a pleasant sound and a lively ambience, gushing from the source or creating water play in the fountain. It creates moving images that shimmer with each ripple and splash. On the contrary, stagnant water has a reflective characteristic that gives the design more scope for activity. The general characteristics of the purposes of using water in designs are listed below (Gençtürk 2006; Düzenli et al., 2019):

Aesthetic purposes: The aesthetic properties of water are at the forefront rather than its psychological effects and physical properties as a means of expression.

Visuality : Water plays a role as a focal point in the space with the many emotions it evokes in people. While excitement and vitality are provided by the strong vertical movements of the water that form a fast, dense mass, silence and peace can be provided by a calm stream or pools. (Erdal 2003). Visually exciting and pleasing to the ear, moving water is a dominant element that adds life to the space (Cendere 1998).

Auditory: The sounds emanating from natural streams and existing natural water elements are utilized in the designs (Cendere 1998). Moving water structures (streams, water falls) add vitality to the space and create a musical effect. Foaming and boiling water creates images that attract people's attention and affect them (Ataturay 1993). Water creates sounds by gushing and hitting the surrounding objects, moving over solid objects and flowing by itself. It is important

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to pay attention to the sound characteristic of water. Too little water sound can be annoying, such as a running faucet, and too loud water sound in enclosed spaces can be strong or mundane. Therefore, the sound of water should be well adjusted and appropriate to the function of the designed space. (Gençtürk 2006).

Psychological Impact : Still water creates an environment of meditation, contemplation, poetry and musical associations, love, laziness or discharge (Kavaklı 1994). People turn to water psychologically. In addition to the visuality of water, the sensations created by its sound, smell and contact create different effects on people (Erdal 2003).

Functional purposes : Apart from the visual appeal and aural appeal of water used for aesthetic purposes, pools, fountains and other water surfaces can serve different functions.

Noise Control : Especially in urban environments with high levels of noise from automobiles, people and industry, water is used as a buffer for noise. In this case, falling or moving water screens the noise to create a more peaceful atmosphere. (Erdal 2003).

Circulation Control : Pools are used to manage traffic patterns for security purposes or to enter between them or to provide a regular progression within the space (Cendere 1998). In addition, water plays a role in the organization of space as a limiting or closing element.(Erdal 2003)

Climatic Impact : Water is used to modify the weather and temperature outdoors. Large expanses of water on a regional scale are known to regulate air temperature in surrounding areas. In tropical and humid regions, water is used for luxury in the landscape. In dry and semi-dry regions, water is used with great care to get maximum coolness and to provide moisture from every drop (Erdal 2003).

Recreational Purposes: Another common use of water in landscaping is recreational use. Water can be used for swimming, hunting, surfing, water and ice skiing. Lakes, rivers, waterfalls, cascades, oceans are all examples of these recreational uses of water. From pools in private backyards to regional lakes and oceans, landscape architects are involved in all water activities in their plans and designs (Erdal 2003). The recreational use of the water element is very diverse. All natural or artificial water surfaces can serve many recreational uses. The water element is always a source of activity as an attractive element in the space (Gençtürk 2006).

Use of Water in Landscape Works

In landscape architecture studies, water is used in two different ways: still and moving. Moving water types are usually listed in five different ways. These are canals and streams, fountains, water curtains, cascades and cascades and finally fountains (Ataturay 1993).

Visually exciting and pleasing to the ear, moving water elements are an element that adds life to the space. The type of moving water depends on the scale and the condition of the area where it will be placed. Water surfaces can be given horizontal and vertical movement in various ways (Gençtürk 2006).

Streams and Canals : The type of horizontally flowing water that flows in natural forms is called a stream, and the type that flows along a formal reservoir is called a canal. The design of the canal or stream depends on the garden and whether there will be a natural slope where water can flow (Zaloğlu 2006).

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Cascades and Cascades : Cascades are formed by the movement of water from any object to various surfaces and forms along low elevations. Flowing water usually covers the surface and moves downwards. This movement, which starts with a drop, accelerates with the downward elevation difference and if it reaches a sudden elevation difference, this falling water becomes a cascade (Bekiroğlu 1992). Cascades are small cascades flowing from one rock block to another at various heights. Cascades are used in gardens created with architectural arrangements in the form of a series of steps over which water flows (Cendere 1998).

Fountains : Fountains are high water monuments consisting of various boats placed one on top of the other on a pedestal erected in the center of the pools, whose water gushes from a nozzle at the top and flows into the pool by pouring from one boat to the other (Erdal 2003). Fountains are an important part of water shows. The gushing water takes different shapes and creates different effects. In addition, the difference in pressure applied to the water provides stagnation and mobility in fountains, variability and diversity in movements (Cendere 1998).

Water Curtains : Water curtains can be formed by curtains controlled by free-falling twine or ribbons. The strips follow a precise path to limit the shape of the water and reduce the size required for the lower pool (Cendere 1998). A water curtain is a decorative water structure that can be applied mainly indoors and, limited by special precautions and operating conditions, outdoors (Zaloğlu 2006).

Fountains : Fountains are water facilities designed for water needs, decorations and birds. Turks have gone especially far in this regard. Historical fountains and fountains still adorn our cities today as monuments. (Kavaklı 1994). Fountains are used to easily obtain drinking, domestic and irrigation water. Some specially designed types are also used as playgrounds for children. Spring and fountain waters are clean, cold and moving waters. As well as being used by people, they are biological elements that allow wildlife to survive. Fountains are usually flowed from a height in order to have a lively and acoustic sound feature. Bowls of various forms and sizes are placed in front of them (Zaloğlu 2006).

New Approaches to the Use of Water in Landscape Architecture

Water in Roof Gardens: Water in roof gardens can be in the form of fountains and fountains, as well as stagnant water surfaces and water bowls. In these bowls, some parts of the water show or water surface can be made deeper as required by the building session plan and decorative aquatic plants such as various water lilies can be grown in it (Uzun 1996). In roof ponds, fish can be kept at a rate that will ensure biological balance in the water. In some applications, the water of the pond is drained in winter and the fish can be moved to another place (Uzun 1987). Underwater lighting systems made in accordance with the technique in roof ponds do not present any problems in roof garden ponds, unlike other normal lighting systems. The differences between the designs of seating units, shades, flower and plant boxes, flooring and water surfaces within the design of roof gardens and the designs made on the surface of the earth significantly affect the design of roof gardens (Uzun 1999).

Water Parks : Water parks are places where people of all age groups spend time having fun together and include various water activities (Figure 4). In the difficult conditions of our daily lives, people are looking for places where they can spend pleasant and quality time with their families. Water parks are very suitable places for this purpose. Water parks are recreational

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areas where basic water elements and entertainment elements can be used together, including various water activities where children and their families, in short, people of all age groups can have fun together. Water parks, which gain importance mostly in hot climate zones, can be used in summer and winter months, or they can be used mostly in summer months (Oruçkaptan, 2002).

Figure 4. View from a fun water park (Url-4, 2024)

Water gardens: These are structures that are created by designing water together with aquatic plants in an aesthetic way in accordance with the surrounding landscape, according to planning principles and application techniques, creating a complete ecological balance with flora, fauna and microorganisms. These gardens can be classified as formal and informal as well as stagnant and moving water uses. In water gardens, it is possible to create very attractive areas with ornate and effective bridge stepping stones, lighting, fountains and sculptures. Planting is also an important factor in the organization of water gardens. Natural species and plant species that can adapt to each other should be selected (Şentürk, 1990).

Play Pools : In children's playgrounds, water can be a different play tool for children together with sand. Children can especially play with water and sand at the same time. In playgrounds where it is not possible and appropriate to create a game by combining these two elements, even a small fountain, simple concrete and wooden trough can be sufficient for children. Shallow wading pools are also interesting for children. Shallow pools are reminiscent of natural conditions and thus it is appropriate to have the appearance of a beach where a material such as flat gravel connected with nature is exhibited (Şentürk, 1990).

CONCLUSION AND EVALUATION

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In successful designs from the past to the present, water has always maintained its place as one of the important design elements. Designs related to water have always attracted people and attracted attention. Water has been used as a design element for different purposes, especially with its symbolic, visual and auditory features. In addition to its many physical properties (being a noise screen, changing the climate, etc.), water has also been used in designs due to its healing psychological effects. Water can sometimes create joyful, crazy, fun feelings, sometimes it can make you feel calm and still, it can create joyful currents by creating graceful curves or bending and twisting, and sometimes it can create different forms by covering sharp surfaces. These features have been used continuously in garden and urban open space designs over the periods and have contributed to the creation of quality spaces. Today, in many urban spaces designed and planned by landscape architects, water is used by emphasizing its very different features in the past. However, it is seen in many garden examples examined in the past that water shapes the space. Today, on the contrary, it is seen that water is used only as an ornamental element by constantly attributing limited shape and function to water.

The presence of water in the environment makes people feel the richness of the landscape. The value it adds to the landscape with its color, brightness, reflection and wave play as well as its sound features is very meaningful. Water surfaces and green areas are a part of each other. As a matter of fact, water surfaces in many residential areas in our country and in developed countries are generally within green areas or organized together with green areas, let alone boulevards, squares and pedestrian zones.

Water uses in urban parks, which constitute an important part of urban green areas, are effective with their aesthetic and functional features. Especially in landscape planning and design works to be carried out in areas with continental climates, water uses are intensively included. Water is an important design element that relieves people from stress with its therapeutic properties, has a relaxing effect, adds color, movement, tranquility, sound, joy, optics, etc. to the space where it is located, and at the same time creates a cooling effect with the humidity it provides in its environment. Due to all these features, many different water uses are included in landscape designs.

While designing water shows used in landscape designs, designs that can benefit not only from the aesthetic features of water but also from its functional features (boating, fishing, water shows with games for children, etc.) should be put forward.

When designing water uses, the size and depth of the water surfaces should be determined according to the functional or aesthetic features they will carry.

In order for water uses to give clean images, water should be recirculated with fountains, pumps, etc. in accordance with the water volume.

While designing water shows, a different dimension can be added to the design by choosing the appropriate type of water show and supporting it with plastic objects as well as water lighting.

New approaches to the use of the water element in landscape architecture bring together different perspectives such as sustainability, interaction, biodiversity and social cultural context to enable a more efficient and meaningful use of water. These approaches aim to create healthier, more aesthetic and functional landscapes while maintaining a balance between the

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natural and man-made environment. In the future, as these innovative approaches to water use become more widespread and adopted, the potential of water in landscape architecture will expand even further.

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SERVO SİSTEMLERDE TRAPEZ VE S-EĞRİ HAREKET PROFİLLERİ

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ÖZET

Bu çalışmada yüksek doğruluklu konum kontrol uygulamalarında kullanılan trapez hareket profili ve S-eğri hareket profili incelemesi sunulmuştur. Robotik sistemler birçok uygulamada konum kontrolü gerçekleştirmektedir. Bu sistemlerde hızlı-hassas pozisyon tepkisi ve minimum enerji tüketimi yapılan çalışmaların temel motivasyon kaynağıdır. Bunu sağlamak için hafif parça kullanımı, kinetik ve potansiyel enerji arasındaki verimli dönüşümden yararlanmak için elastik unsurlar ekleme gibi donanımsal yöntemler yanında, yazılım tabanlı noktadan noktaya hareket, tek eksenli ve çok eksenli manipülatörlere uygulanmaktadır. Bu kapsamda polinomlar ya da parçalı polinomlar kullanılarak hareket profili oluşturulmaktadır. Hareket profilleri bir sistemin aynı zamanda sessiz, doğru ve güvenilir olmasını sağlar. Bu sistemlerde sabit hareket süresi olan noktadan noktaya hareket, doğruluk, negatif güç yenilenmesi, gerçek zamanlılık önemli kriterlerdir. Basit yapısı ve hızlı tepki vermesi nedeniyle gerçek uygulamalarda yaygın olarak kullanılan trapezoidal hız profili sabit bir hızlanmaya/yavaşlamaya ve maksimum/sınırlandırılmış bir hıza sahiptir. Bu hız profilinde sabit son süre ve hedef mesafe önceden tanımlanır. Trapez profil, ivme ve hız limitleri altında hızlı bir profil olmasına rağmen ivmedeki ani değişikliklerden olumsuz etkilenmektedir. Bölge değiştiğinde büyük bir sarsıntı, konum doğruluğunu kısıtlayan ve ek yanıt süresi gerektiren titreşimlere neden olur. Sarsıntı ivmenin değişim hızıdır ve ivme süreksizliklerinde çok yüksek değerlere çıkabilmektedir. S-eğrisi profili sarsıntıyı sonlu bir değerle sınırlandırarak hızlanma ve yavaşlama periyotlarında hız profilini s şeklinde değiştirir ve hareket eden sistemin sebep olduğu titreşimler azaltılır. Böylece ivmede ani artış/azalma yerine, trapez profildeki hız değişimine benzer şekilde rampa şeklinde artış/azalma gerçekleşir. Sarsıntı sınırı, ivme sınırı ve hızlanmadaki süreklilik harekete bağlı salınımları ve mekanik gerilmeleri sınırlandırır. S-eğrisi profilinin, trapezoidal hız profiline göre titreşimi azaltmadaki üstünlüğü birçok çalışma ile olarak doğrulanmıştır. Hareket profili seçiminde daha yumuşak bir hareket oluşturmanın fayda ve maliyet ödünleşmesi en önemli hususlardan biridir.

Anahtar Kelimeler : Konum kontrolü, Trapez hareket profili, S-eğri hareket profili

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TRAPEZE AND S-CURVE MOTION PROFILES IN SERVO SYSTEMS

ABSTRACT

In this study, the general features of the trapezoidal motion profile and S-curve motion profile used in high-accuracy position control applications are presented. Robotic systems perform position control in many applications. In these systems, fast-precise position response and minimum energy consumption are the main motivation for the studies on this subject. To achieve this, software-based point-to-point motion is applied to single-axis and multi-axis manipulators, as well as hardware methods such as using lightweight parts and adding elastic elements to benefit from the efficient conversion between kinetic and potential energy. In this context, a motion profile is created using polynomials or piecewise polynomials. Motion profiles ensure that a system is quiet, accurate and reliable at the same time. In these systems, point-to-point movement with a fixed movement time, accuracy, negative power regeneration and real-time are important criteria. The trapezoidal speed profile, which is widely used in real applications due to its simple structure and fast response, has a constant acceleration/deceleration and a maximum/limited speed. In this speed profile, a fixed final time and target distance are predefined. Although the trapezoidal profile is a fast profile under acceleration and speed limits, it is negatively affected by sudden changes in acceleration. A large shake when the area changes causes vibrations that limit location accuracy and require additional response time. Shake is the rate of change of acceleration and can reach very high values in acceleration discontinuities. By limiting the vibration to a finite value, the S-curve profile changes the velocity profile to an s-shape during acceleration and deceleration periods, and the vibrations caused by the moving system are reduced. Thus, instead of a sudden increase/decrease in acceleration, a ramp-shaped increase/decrease occurs, similar to the speed change in a trapezoidal profile. Jerk limit, acceleration limit and continuity in acceleration limit motion-related oscillations and mechanical stresses. The superiority of the S-curve profile in reducing vibration compared to the trapezoidal velocity profile has been confirmed by many studies. The trade-off between the benefits and costs of creating a smoother motion is one of the most important considerations in motion profile selection.

Keywords: Position control, Trapezoidal motion profile, S-curve motion profile

Anahtar Kelimeler: En Az 3 Anahtar Kelime yazılması gerekmektedir.

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1. GİRİŞ

Yörünge planlaması, robotik alanında ve daha genel olarak otomasyon alanında çok önemli bir konudur. Robotlar ve otomatik makineler için eğilim, daha kısa üretim süreleri elde etmek için giderek daha yüksek hızda çalışmaktır. Yüksek çalışma hızı, aktüatörler ve kontrol sisteminden aşırı performans beklendiğinden robot hareketinin doğruluğunu ve tekrarlanabilirliğini engelleyebilir. Bu nedenle, yüksek hızda gerçekleştirilebilecek ancak aynı zamanda aktüatörlerin aşırı hızlanmasını ve mekanik yapıdaki titreşimleri önlemek açısından robot için zararsız bir yörünge oluşturmaya özellikle dikkat edilmektedir. Bu gibi nedenlerden dolayı yörünge planlama algoritmaları robotikte giderek artan bir önem kazanmaktadır. Yörünge planlama algoritmaları zaman bilgisi ile birlikte belirli bir geometrik yol alır. Yörünge planlama algoritmaları robotikte çok önemlidir, çünkü geçiş noktalarında geçiş sürelerinin tanımlanması yalnızca hareketin kinematik özelliklerini değil aynı zamanda dinamik özelliklerini de etkiler. Yani robotun maruz kaldığı atalet kuvvetleri (ve torklar) yörünge boyunca ivmelere bağlıdır, mekanik yapısının titreşimleri ise temel olarak sarsıntı değerleri (yani ivmenin türevi) tarafından belirlenir. Ayrıca artan enerji maliyetleri ve çevresel kaygılar enerji tüketimini önemli bir konu haline getirdiğinden, enerji optimal hareket profili üretimi günümüz robotik tasarımı ve işletiminde önemli bir husus haline gelmiştir. İmalat endüstrilerindeki enerji tasarrufu çözümleri çeşitlidir ve optimum üretim karı sağlarken enerji tüketimini en aza indirmek amacıyla robotların hareket profillerini optimize etmek için etkili stratejiler tasarlamaya ihtiyaç vardır. Hareket profili oluşturma aynı zamanda enerji tasarrufu sağlar. Noktadan noktaya hareket için hareket profillerinin optimizasyonu iyi araştırılmış bir alandır ve enerji tüketimini en aza indirmek için çeşitli teknikler önerilmiştir. Hareket profili oluşturma, bir hareket kontrol sisteminin takip etmesi için bir dizi hız ve konum komutu oluşturma işlemidir. Hareket profili oluşturmanın amacı, düzgün ve hassas hareket sağlamak için hareketli bir nesnenin hızlanmasını, hızını ve yavaşlamasını kontrol etmektir. Çeşitli otomatik makinelerde, bir nesnenin hareketi bir yörünge tarafından belirlenir ve daha karmaşık görevler için düz bir yönde hareket eden bir eksen veya birçok eksenin koordineli hareketi gerekebilir. Bir eksenin bir yerden diğerine hareket etmesi gerektiğinde, yumuşak hızlanma, sabit çalışma hızı ve uç noktaya doğru yavaşlama sağlamak için bir yol veya hareket profili oluşturulur. Hareket kontrolü, performansı ve üretkenliği artırmak için çeşitli endüstrilerde yaygın olarak benimsenen önemli bir çalışma alanıdır. Örneğin robotik de, otomatik montaj makinelerinde,

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mekanik kontrol sistemlerinde ve cerrahi robotlarda hareket profilleri kritik öneme sahiptir. Hareket profili otomatik üretim makinelerinde doğruluğu, performansı ve enerji tasarrufunu artırmaya yönelik etkili bir yaklaşımdır[1]. Endüstriyel süreçlerde enerji tüketiminin en aza indirilmesi, mühendislik tasarım sürecinin önemli bir hedeflerinden biridir. Bunu gerçekleştirmek için donanımsal ve yazılımsal yaklaşımlar kullanılmaktadır. Donanım yaklaşımları, enerji açısından daha verimli mekatronik cihazlar oluşturmak için mevcut sistemlerin parçalarının değiştirilmesini veya yenilerinin tasarlanmasını dikkate almaktadır. Özellikle yeni, daha hafif ve dayanıklı malzemelerin bulunması, daha hafif robotik kolların ve bileşenlerin tasarlanmasını mümkün kılmaktadır. Hafif yapılar, hareketli kütlelerin azaltılmasıyla da elde edilir. Donanım yaklaşımları aynı zamanda bileşenlerin verimliliğini artırmaya ve enerji geri kazanımı ve dağıtım stratejilerini uygulamaya yönelik teknolojileri de içerir. Bunlar, enerji tüketiminin azalmasına ve dolayısıyla çevresel etkinin azalmasına yönelik yeni senaryolara olanak tanır. Yazılım yaklaşımı ise tersine, hareket planlama aşamasını optimize etmenin yanı sıra operasyonları planlayarak enerji tüketimini azaltır. Makineler ve robotlar genellikle üretim çıktılarını en üst düzeye çıkarmak (yani zamanı en aza indirmek) için çalıştırılır; bu durum hem yüksek hızlarda yüksek enerji kayıplarına hem de yavaşlamada fazlalıklara neden olur. Bu nedenle, daha az enerji kullanmak amacıyla bir noktadan noktaya hareket işlemindeki hız hareket profili ile değiştirilebilir. Literatürde, noktadan noktaya harekete odaklanan, trapezoidal hız profili gibi endüstriyel uygulamalarda en yaygın olanlardan S eğri gibi daha karmaşık olanlara kadar, farklı yörünge profilleri konusunda bir çok çalışma bulunmaktadır[2]. Robotlar, yüksek hassasiyetleri, doğrulukları ve tekrarlanabilirlikleri nedeniyle al ve yerleştir, montaj hatları ve malzeme taşıma sistemleri gibi çeşitli endüstrilerde yaygın olarak kullanılmaktadır[3]. Bu gibi mekatronik sistemlerde birçok parçanın hareketi noktadan noktaya harekettir. Noktadan noktaya harekette, aktüatör bir konumdan başka bir konuma hareketsiz durumdan başlayacak ve sonunda tam bir duruşu tamamlayacak şekilde hareket eder. Hareket öteleme veya dönme olabilir[4]. Konum (pozisyon) kontrolü genellikle bir pozisyon kontrolörü ve bir profil oluşturucu kullanılarak gerçekleştirilir. Profil oluşturucu, konum referansından ve önceden tanımlanmış profillerden istenen konum yörüngesini üretir[5]. Pozisyon kontrolünde önemli bir konu, hızlı ve hassas pozisyon tepkisinin nasıl elde edileceğidir[6]. Noktadan noktaya yöntemini kullanarak, robotlar gerekli hareket yörüngesini korurken optimum enerji tüketimi elde etmeye çalışmaktadır. Yörüngeler aynı zamanda minimum enerji tüketimi faydası sağlar. Konum kontrolündeki sorun her zaman, minimum titreşim ve hem konum hem de hız aşımı ile hassas hareketin nasıl elde edileceğidir. Donanım

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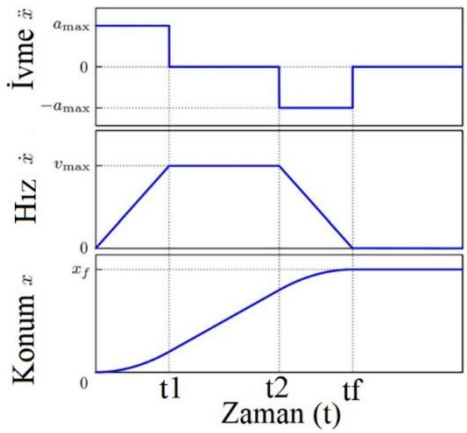
yöntemleriyle konum kontrolü kolaylıkla titreşime ve gürültüye neden olduğundan, konum denetimi mekanizması donanım yöntemlerinden yazılım yöntemlerine doğru değişmiştir[7]. Trapez hareket profili ve S-eğrisi hareket profili hareket kontrolünde en yaygın iki hareket profili türüdür. Bu iki hareket profilleri her türlü hareket kontrolü için kullanılır. S-eğrisi hareket profili daha yumuşak hareket üretse de basitliği nedeniyle trapez hareket profili tercih edilmektedir.

2. TRAPEZ HAREKET PROFİLİ

Trapezoidal hız profili sabit bir hızlanma, hız ve yavaşlama bölgelerine sahiptir. Bölge değiştiğinde büyük bir sarsıntı, konum doğruluğunu kısıtlayan ve ek yanıt süresi gerektiren titreşimlere neden olur. trapez hız profili basit yapısı ve hızlı tepki vermesi nedeniyle popüler profillerden biridir. Profilin dezavantajlarının giderilmesine yönelik çalışmalar halen devam etmektedir. Trapez hız profili sabit bir hızlanma, hız ve yavaşlamaya sahiptir. Görsel 1'de gösterildiği gibi, sabit ivme bölgesinde, hız maksimum değere (ωmmax) ulaşana kadar ivme maksimum pozitif değerdir (ammax). İvmenin ve hızın sırasıyla sıfır ve maksimum değer olduğu sabit hız bölgesinden sonra, hız maksimum yavaşlamayla - ammax ile sıfıra düşer [6].



Görsel 1. Trapez hareket profili notasyonları

Trapez (Yamuk, Trapezoidal) hız profili en basit olanıdır ve gerçek uygulamalarda yaygın olarak kullanılmaktadır. Trapezoidal hız profili aşağıdaki dört temel parametreyle benzersiz bir şekilde belirlenebilir: sabit son zaman tf, hedef mesafe xf, maksimum ivmelenme amax ve maksimum hız vmaks. Önceki iki parametre olan tf ve xf genellikle noktadan noktaya harekette önceden tanımlanır [8,9]. Trapezoidal hız profili aşağıdaki dört parametre ile analitik olarak hesaplanabilir [8].

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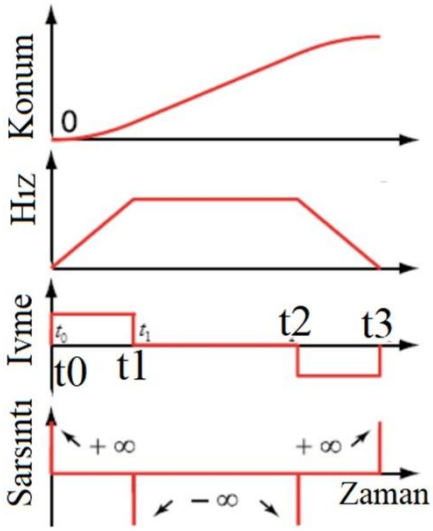
Uygulanan maksimum ivmelenme amax ve uygulanan maksimum hız vmax, aktüatör kapasiteleri tarafından güçlü bir şekilde sınırlanmalıdır. Maksimum ivmelenme amax ve maksimum hız vmax, enerji tasarrufu için iki ayar parametresi olarak benimsenmiştir [8]. Görsel 2'de gösterildiği gibi hız profili, yukarı rampa kısmı, sabit kısım ve aşağı rampa kısmından oluşan yamuk şekle sahiptir. Hız t1 anında maksimum değere ulaştığında ivme sabit değerinden sıfıra atlar. Sıçramalar aynı zamanda hızın yönelimini değiştirdiği diğer t0, t2 ve t3 anlarında da meydana gelir. İvmedeki bu süreksizlikler sarsıntının sonsuz değerler sergilemesine neden olur. Bu nedenle trapezoidal hız profili, aşmalara neden olma eğilimindedir ve makinenin istenen hassasiyetle son konuma ulaşması için zaman gerektiren artık titreşimleri harekete geçirir. Bu hassas sistem için potansiyel bir sorun olabilir. Ancak hız profilinin köşelerindeki ivme tutarsızlıklarından dolayı sarsıntı veya sarsıntı, hareket profilinin dört noktasında sonsuzdur. Sonuç olarak, sistem titreşimini uyarma eğilimini azaltmak için s-eğrisi hız profili önerilmiştir [7].



Görsel 2. Trapez hareket profilinde sarsıntı

Trapezoidal hareket profilinin hesaplanması kolaydır, ancak keskin köşeler gibi önemli bir dezavantajı vardır, çünkü ivmedeki ani değişiklikler genel harekette büyük sarsıntılara neden olabilir. Bu sorunu hafifletmek için kenarlar, bir S-eğrisi hız profili oluşturmak için polinomlar kullanılarak kavisler elde edilir.

3. S-EĞRİ HAREKET PROFİLİ

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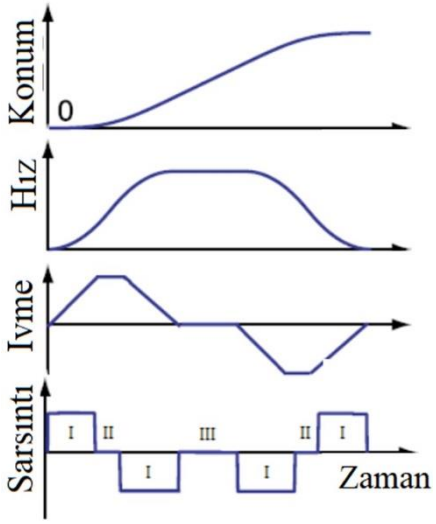
S-eğrisi profili pozitif, sıfır ve negatif hızlanma aşamaları arasındaki geçişleri yumuşatarak kuvvet veya torktaki ve motorun akım gereksinimlerindeki ani değişiklikleri etkili bir şekilde ortadan kaldırır. Bu aynı zamanda yüksek frekanslı salınım hareketlerini de en aza indirerek hareket kontrolü uygulamalarının doğruluğunu ve ömrünü artırır. S-eğrisi profili yedi faz içerir; bunlardan dördü ikinci dereceden denklemlerle elde edilen kavisli bölümler ve üçü pozitif, sıfır ve negatif eğime sahip kesintisiz çizgilerdir. Saf S-eğrisi hız profili, doğrusal bölümlerin çıkarılmasıyla elde edilir. Görsel 3'te s-eğrisi hareket profilinin bir örneği gösterilmektedir; burada Görsel 2 ile karşılaştırıldığında hızlanma ve sarsıntı tasarımından dolayı hız profilinin düzgün olduğu fark edilmektedir[10]. S-eğrisi profili pozitif, sıfır ve negatif hızlanma aşamaları arasındaki geçişleri yumuşatarak kuvvet veya torktaki ve motorun akım gereksinimlerindeki ani değişiklikleri etkili bir şekilde ortadan kaldırır. Bu aynı zamanda yüksek frekanslı salınım hareketlerini de en aza indirerek hareket kontrolü uygulamalarının doğruluğunu ve ömrünü artırır. S-eğrisi profili yedi faz içerir; bunlardan dördü ikinci dereceden denklemlerle elde edilen kavisli bölümler ve üçü pozitif, sıfır ve negatif eğime sahip kesintisiz çizgilerdir. Saf S-eğrisi hız profili, doğrusal bölümlerin çıkarılmasıyla elde edilir[11].



Görsel 3. S-eğri hareket profili

S eğri hareket profili hızlanma ve yavaşlama sürekli değişmektedir. Trapez hareket profilinde hızlanma ve yavaşlama çok hızlı değişimlere sahiptir. Bu durumda sarsıntı üstel halde artar. Burada sarsıntı (jerk) geçiş aşamaları sırasında hızlanmadaki değişimle ilişkili hareket karakteristiğini tanımlar. S-eğrisi profilindeki sarsıntı sabit kalarak ivme değişimini süre boyunca dağıtır. İvme değişimi daha hızlı hale geldikçe üretilen titreşimlerde daha güçlü hale gelir. Bu titreşimler, kontrollü mekanik sistemin rezonans frekanslarıyla eşleşirse, sistem mekaniği titreşim enerjisini emer ve bu da potansiyel olarak daha uzun bir yerleşme süresine

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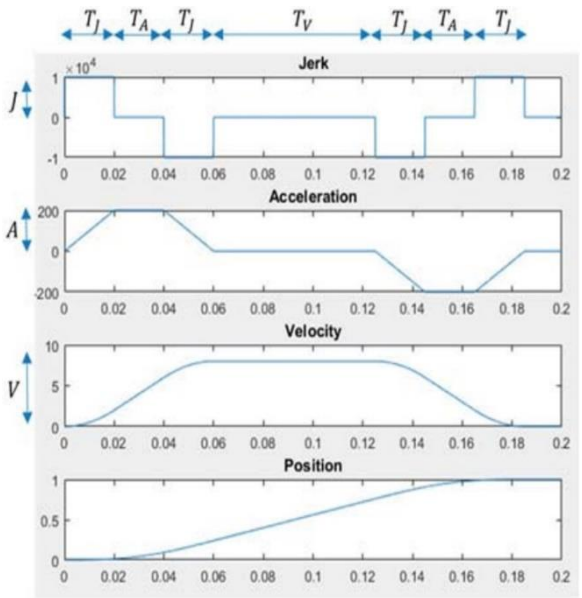
veya daha düşük doğrulukla sonuçlanır[10,11]. Robotlarda kötü tasarlanmış yörüngeler, hız veya ivmede ani değişikliklere yol açarak parça deformasyonuna ve artan mekanik gerilime neden olabilir. Bu tür deformasyonlar sistem bileşenlerinde hasara neden olabilir ve bu hem maliyetli hem de çevresel açıdan önemli bir etkiye sahiptir. Bu nedenle, bu sorunları azaltmak ve sistem bütünlüğünü korumak için doğru yörünge tasarımının sağlanması çok önemlidir[10]. Sarsıntı sınırını getirerek bunu engellemeye yönelik girişimler, S-eğrisi profilinin geliştirilmesine yol açmıştır. S-eğrisi hareket profili, ivmedeki her ani artışın ve azalışın yerini sırasıyla bir artış ve yavaşlama ile değiştiren trapez profilin modifikasyonudur. Bu rampa çıkışlarının ve rampa inişlerinin eğimleri sabit sarsıntı değerlerine karşılık gelir. Genel bir S-eğrisi profili, Görsel 4'de gösterildiği gibi 7 bölümden oluşur[4].



Görsel 4. S-eğri hareket profili bölümleri

Hızlanmanın yukarı/aşağı rampa süresine "sabit sarsıntı süresi" TJ denir ve açıkçası TJ>0'dır çünkü değilse profil trapez profil haline gelir. Hızlanmanın değişmeden kaldığı süreye “sabit hızlanma süresi” TA adı verilir. Hızın değişmeden kaldığı zaman aralığına “sabit hız zamanı” TV adı verilir. Transfer süresi bu zaman aralıklarıyla ilişkilidir:

T=4TJ+2TA+TV

Görsel 3' ve 5’de de gösterildiği gibi S-eğrisi profilinin belirli bir süreye yayılmış sonlu sarsıntı göstermektedir. S-eğrisi profili için daha düşük titreşime katkıda bulunan öncelikle bu kalitedir. Bölüm I maksimum sarsıntının süresini, bölüm II maksimum hızlanmanın süresini ve bölüm III maksimum hızın süresini belirtir. Verilen sınırlar ve istenen son konum değiştirilerek çeşitli

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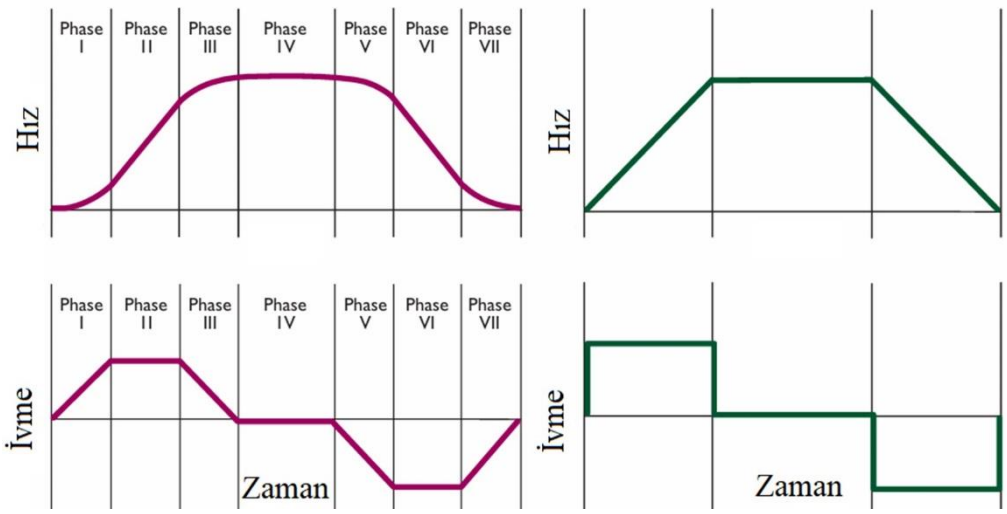
profiller oluşturulabilir. S-eğrisi profilleri için ana sınırlar maksimum sarsıntı, maksimum ivme ve maksimum hızdır. Karşılık gelen zaman aralığının hesaplanmasına yönelik bu sınırlar, pratik sistemin özellikleriyle verilmektedir. İstenilen son pozisyona göre bölüm II ve bölüm III'ün zaman aralığını değiştirilerek bir profil elde edilebilir.



Görsel 5. S-eğri ve trapez hareket profilleri karşılaştırması[11]

Noktadan noktaya hareket bağlamında, tam bir S eğrisi hareket profili 7 farklı hareket aşamasından oluşur (Görsel 5). Aşama I, maksimum ivmeye ulaşana kadar yükü doğrusal olarak artan bir ivmeyle hareketsiz durumdan hareket ettirmeye başlar. Aşama II'de profil, maksimum hıza yaklaştıkça azalmaya başlaması gerekene kadar maksimum hızlanma oranında hızlanır. Bu, Faz III'te ivme sıfıra ulaşana kadar doğrusal olarak azaldığında meydana gelir. Aşama IV'te, yavaşlama başlayana kadar kontrol hızı sabittir; bu noktada profiller Aşama I, II ve III'e simetrik bir şekilde yavaşlar.

Görsel 5'de görüldüğü gibi trapez profil ise 3 fazdan oluşur. Bu, bir S-eğrisi profilinin bir alt kümesidir ve yalnızca S-eğrisi profilinin sabit hızlanma, sabit hız ve sabit yavaşlama)karşılık gelen fazlara sahiptir. Bu azaltılmış faz sayısı, bu iki profil arasındaki farkın altını çizmektedir: S-eğrisi profili, hızlanma dönemleri ile hızlanmama dönemleri arasında geçiş yapan ekstra hareket aşamalarına sahiptir. Trapez profil bu fazlar arasında anlık geçişlere sahiptir. Bu, bu iki profil tipi için karşılık gelen hız profillerinin ivme grafiklerinde görülebilir (Görsel 5). İvmedeki değişimi veya geçiş periyodunu tanımlayan hareket karakteristiği sarsıntı olarak bilinir. Sarsıntı, ivmenin zamanla değişim oranı olarak tanımlanır. Trapez profilde, faz geçişlerinde sarsıntı (ivme değişimi) sonsuzdur, S-eğrisi profilinde ise "sarsıntı" sabit bir değerdir; ivmedeki

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değişimi belirli bir süreye yayar. S-eğrisi profilinin trapez profilden daha düzgün olduğu yukarıdaki grafiklerden açıkça görülmektedir. Ancak S-eğrisi profili neden daha az yük salınımına neden oluyor? Bunun cevabı, belirli bir yük için sarsıntı ne kadar yüksek olursa, istenmeyen titreşim enerjisi miktarının da o kadar büyük olacağı ve titreşim enerjisinin frekans spektrumunun o kadar geniş olacağı gerçeğiyle ilgilidir. Bu, ivmedeki değişim ne kadar hızlı olursa, titreşimlerin o kadar güçlü olacağı ve titreşim modlarının sayısının da o kadar fazla olacağı anlamına gelir. Titreşim enerjisi sistem mekaniğinde emildiği için, titreşim frekansının mekanik ve kontrol sistemindeki rezonanslarla eşleşmesi halinde, yerleşme süresinin artmasına veya doğruluğun azalmasına neden olabilir.

S-eğrisi hareket profili daha yumuşak hareket üretse de basitliği nedeniyle trapez hareket profili tercih edilmektedir S-eğrisi ve sarsıntı sınırlı profil gibi çeşitli düzgün hız profillerini uygulayarak robotlardaki titreşimleri azaltmaya çalışmıştır. Yüksek dereceli polinom hareket profilleri robotun düzgün hareket etmesini sağlar. Bir polinom denkleminin emirleri olarak robotun konumu ve hızı düzgün şekillere sahiptir. Artık titreşimler daha sonra düzgün hareketle azaltılabilir, ancak zamanın bir fonksiyonu olarak katsayıların sayısındaki artışa bağlı olarak polinom denkleminin sırası arttığı için ek hesaplama gereklidir. Harekete trapezoidal bir hareket profili uygulandığında aynı mesafeyi hareket ettirmek için büyük bir ivme ve torka da ihtiyaç vardır. Aynı yer değiştirmeyi elde etmek için aynı büyüklükte maksimum hız uygulandığında, trapezoidal hareket profili ve konumdaki üçüncü dereceden hareket profili Görsel 6'da karşılaştırılmıştır. Trapezoidal hareket uygulandığında aynı yer değiştirme için hareket süresi daha kısadır. Görsel 6'da polinom fonksiyonunun sırasına göre hız profillerindeki değişim gösterilebilmektedir. Hareket süresi aynı olduğunda maksimum hız ve ivme fonksiyonun sırasına göre artar. Dolayısıyla trapezoidal hareket profilinin polinom hareket profillerine göre hız ve ivme büyüklüğü üzerinde etkili olduğu sonucuna varılabilir[12].

Son yıllarda çok sayıda yörünge oluşturma yöntemi araştırılmıştır. Endüstriyel alanda ekonomik verimliliği artırmak için verimliliğin artırılmasına ihtiyaç duyulduğundan, zaman optimalliği dikkate alınması gereken önemli bir faktördür. Bu arada, gerçek zamanlı olarak uygulanabilme yeteneği, hareketi mümkün olduğu kadar az aksama süresiyle yürütmedeki gecikmeyi en aza indirecek bir yöntem için düşük hesaplama çabası gerektirir[13]. Yüksek dereceli yörüngeler için, hesaplamadaki karmaşıklık nedeniyle kontrolörün yükünün oldukça yüksek olabileceği de belirtilmektedir. Ancak hesaplama yükü nedeniyle bu yöntemin gerçek zamanlı olarak uygulanması zordur[14]. trapez profil (2. dereceden polinom), S-eğri (3. dereceden polinom) ve S-eğri (4. dereceden polinom) Görsel 6 da görülmektedir [15]. Yüksek

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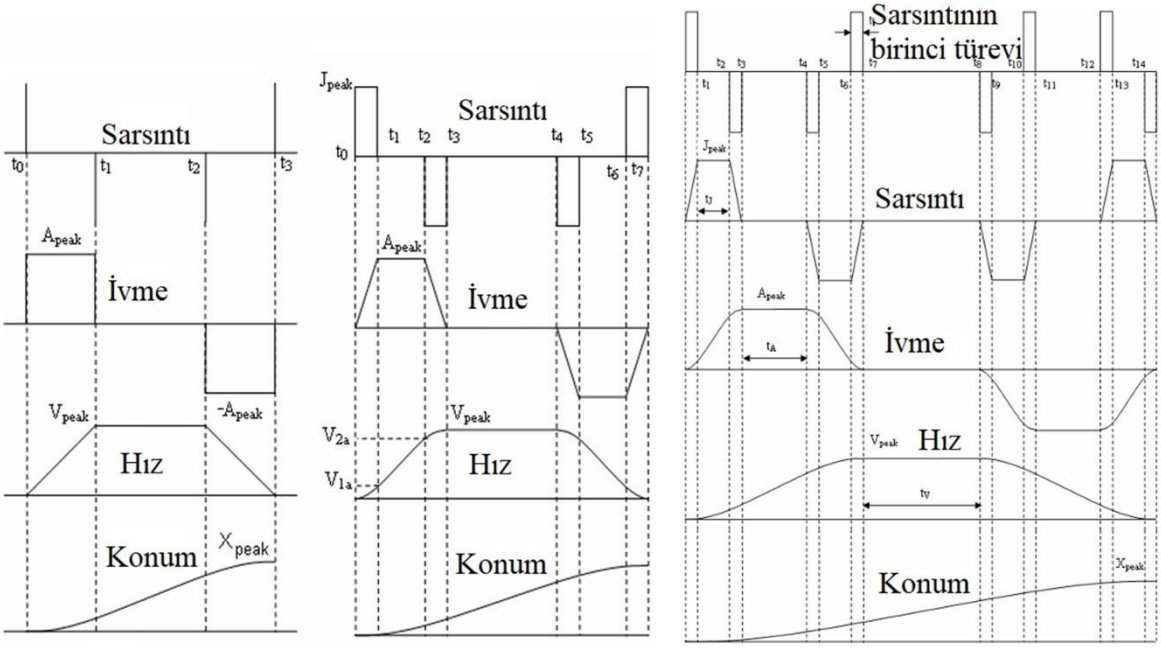
dereceli yörüngelerde hesaplama yükü daha fazla olduğundan gerçek zamanlı uygulamalarda yüksek hızlı sayısal işlemci gerektirirler.



Görsel 6. Trapez, s-eğri ve 4. dereceden s-eğri hareket profilleri

4. SONUÇ

- Robotikte ve takım tezgahlarında noktadan noktaya harekette yüksek hız, sarsıntısız çalışma, hatasız konumlandırma ve minimum enerji tüketimi beklenmektedir.
- Konum hareketi için hareket profilleri kullanılarak maksimum hız, maksimum ivme ve maksimum sarsıntı limitleri ile hareket gerçekleştirilebilmektedir.
- Trapez hareket profili basit yapısı nedeniyle yaygın olarak kullanılmaktadır. Ancak trapez hareket profilinde ani büyük ivme değişimleri büyük sarsıntı üretmektedir.
- S-eğri hareket profilinde ivmenin hızlanma ve yavaşlama bölgelerinde sürekli değişmesi ile sarsıntı sınırlandırılmaktadır.

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TEK FAZLI GÜÇ KAYNAĞINDA AKTİF GÜÇ FAKTÖRÜ DÜZELTME DEVRELERİ

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ÖZET

Bu çalışma da, tek fazlı güç kaynağı beslemesi DC-DC dönüşüm aşamasında uygulanan yüksek frekanslı güç faktörü düzeltme (PFC) tekniklerine genel bir bakış sunulmaktadır. Anahtarlamalı mod topolojisine dayalı düşük ve orta güçteki DC-DC dönüştürücü topolojileri verilmiştir. Toplam harmonik distorsiyonu (THD), güç faktörü (PF), pasif ve aktif PFC temel devre topolojilerinin bazıları açıklanmıştır. Ayrıca sürekli, süreksiz ve kritik iletim modu gibi aktif PFC'lerin kontrol stratejileri ele alınmıştır. Evsel ve endüstriyel uygulamalarda geniş bir kullanım alanı bulan anahtarlamalı güç kaynakları doğrusal güç kaynaklarına göre üstün ve verimli olmalarına rağmen doğrusal olmayan davranışları nedeniyle şebekeden bozuk akım çekerler ve düşük PF'ye sebep olurlar. PF, güç kullanımının ne kadar etkili olduğunun ve akım ile gerilim arasındaki faz kaymasının bir ölçüsüdür. Eğer güç sistemi saf sinüs dalga biçiminde bir voltaj sağlıyorsa ve yük doğrusal ise PF, anlık akım ile anlık voltaj arasındaki faz kayma açısının kosinüsüne eşittir. PE devrelerinde anahtarlama sistemleri doğrusal olmayan davranış sergilediğinden sadece faz açısı gösterimi PF hesaplanması için yeterli değildir. Bozuk akım ve gerilim dalga şekillerinden PF hesaplanması, sinüzoidal akım ve gerilim dalga biçimlerine göre daha karmaşıktır. Bir PFC ünitesinden istenen, PF değerini mümkün olduğunca 1'e yaklaştırmasıdır. Geliştirilen standartlar ve PFC alanında yapılan çalışmalar sonucu pasif ve aktif devre topolojileri geliştirilmiştir. Pasif topoloji, bakımı kolay ve yüksek güç işleme kapasitesi gibi özellikleri ile daha çok yüksek güçlü uygulamalarda kullanılırken, aktif topoloji yüksek performansı ve düzeltme yeteneği sayesinde düşük ve orta güç uygulamalarında yaygındır. Aktif sistemlerde giriş akımını başarılı bir şekilde şekillendirmek için Buck, Boost, Buck-Boost, Cuk, Sepic, Zeta, Flyback, Forward, Forward-Flyback, Single-Stage Quasi Z-Source gibi yüksek frekanslı anahtarlama yapan temel PE dönüştürücü topolojileri veya bunların geliştirilmiş versiyonları kullanılmaktadır. PFC devreleri basitlik, kontrol kolaylığı, yüksek anahtarlama frekansı gibi istenen özelliklere karşın sırasıyla doğruluk, güç işleme kapasitesi ve verimlilik gibi kısıtlar çerçevesinde optimize edilmektedir.

Anahtar Kelimeler: Güç faktörü düzeltme, DC-DC dönüştürücü, Tek fazlı güç kaynağı

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ACTIVE POWER FACTOR CORRECTION CIRCUITS IN SINGLE PHASE POWER SUPPLY

In this study, an overview of high-frequency power factor correction (PFC) techniques applied in the DC-DC conversion stage of single-phase power supply supply is presented. Low and medium power DC-DC converter topologies based on switched mode topology are given. Some of the basic circuit topologies of total harmonic distortion (THD), power factor (PF), passive and active PFC are explained. Additionally, control strategies of active PFCs such as continuous, discontinuous and critical conduction mode are discussed. Although switching power supplies, which are widely used in domestic and industrial applications, are superior and efficient compared to linear power supplies, they draw distorted current from the network and cause low PF due to their non-linear behavior. PF is a measure of how effective power handling is and the phase shift between current and voltage. If the power system supplies a voltage in pure sine waveform and the load is linear, PF is equal to the cosine of the phase shift angle between the instantaneous current and the instantaneous voltage. Since switching systems in PE circuits exhibit nonlinear behavior, phase angle representation alone is not sufficient for PF calculation. Calculating PF from distorted current and voltage waveforms is more complex than sinusoidal current and voltage waveforms. What is required from a PFC unit is to bring the PF value as close to 1 as possible. Passive and active circuit topologies have been developed as a result of developed standards and studies in the field of PFC. While passive topology is mostly used in high power applications with its features such as easy maintenance and high power processing capacity, active topology is common in low and medium power applications thanks to its high performance and correction ability. In order to successfully shape the input current in active systems, basic PE converter topologies that perform high-frequency switching such as Buck, Boost, Buck-Boost, Cuk, Sepic, Zeta, Flyback, Forward, Forward-Flyback, Single-Stage Quasi Z-Source or their improved versions are used. PFC circuits are optimized within the framework of constraints such as accuracy, power processing capacity and efficiency, respectively, despite the desired features such as simplicity, ease of control and high switching frequency.

Keywords: Power factor correction, DC-DC converter, Single phase power supply

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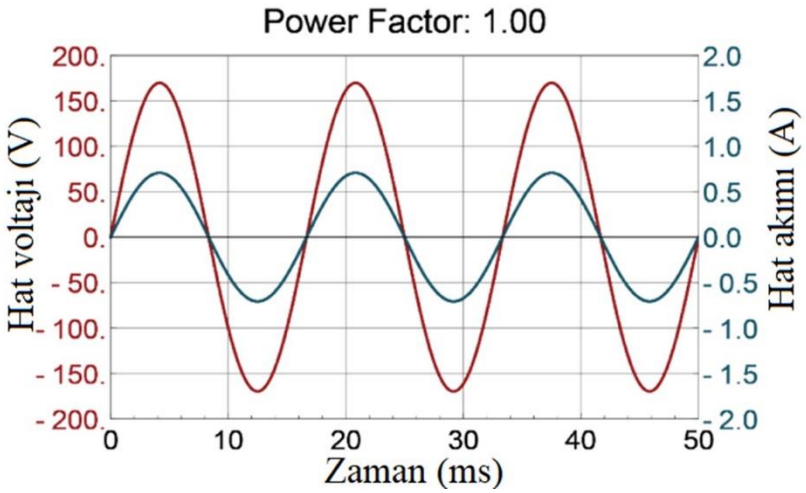
1. GİRİŞ

AC enerji sağladığı avantajlar nedeniyle üretim, iletim ve dağıtım sistemlerinde en uygun enerji biçimidir. Ancak endüstri ve konut uygulamalarında tüketicilere ihtiyaç duyulan dönüştürülmüş DC ya da AC enerjinin sağlanması için güç dönüşüm gereklidir. Bu nedenle güç elektroniği dönüştürücüleri güç kaynakları ve besleme devreleri olarak önemli parçalardır. Tüm güç seviyelerinde güç dönüşümü sağlamayabilmeleri nedeniyle, endüstriyel ve evsel uygulamalarda adaptör ve besleme devresi olarak güç elektroniği dönüştürücüleri yaygın olarak kullanılmaktadır. Ancak bu dönüştürücüler, doğrusal olmayan bir davranışa sahip olduklarından akım ve gerilim dalga şeklinin bozulmasına ve güç faktörünün bozulmasına neden olmaktadır[1, 2].

AC elektrik şebekesine yük olarak PF=1 olan omik bir yük (direnç) bağlanırsa bu yükün şebekeden çektiği voltaj ve akım aralarında faz farkı yoktur (Görsel 1). Bu durumda yük sadece aktif güç çekmektedir. Ya da diyot doğrultuculu elektronik devrede PF=1 yapılırsa akım faz gecikmesi olmadan voltajı takip eder. Güç faktörü 1 olduğunda, şebeke tarafından üretilen gücün tamamı şebekeye bağlı yük tarafından kullanılır [3].



Görsel 1. PF=1 için giriş voltajı ve akımı

Yük eğer endüktif karekterli olursa (indüktaslı, elektrik motoru gibi) bu yükün şebekeden çektiği voltaj ve akım aralarında faz farkı vardır. Bu durumda yük aktif ve reaktif güç çekmektedir. Güç katsayısı PF<1 olur. Voltaj ve akım sinüsoidal şekildedir (Görsel 2). Güç katsayısı azaldığında aktif güç sabitken görünür güç artar, şebekeden daha fazla akım çekilir. 0,4 güç faktörü için üretilen güç yük tarafından etkin bir şekilde kullanılmamakta ve üretilen gücün önemli bir kısmı yük tarafından tüketilmek yerine sistemde dolaşmaktadır. Yükün zayıf

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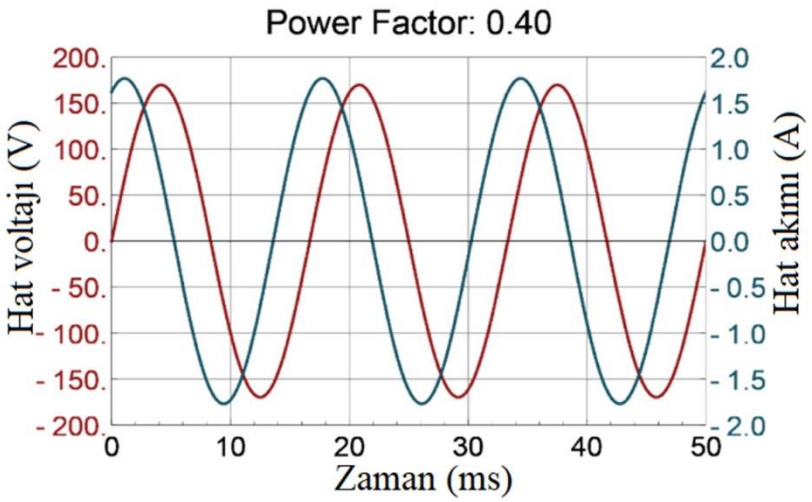
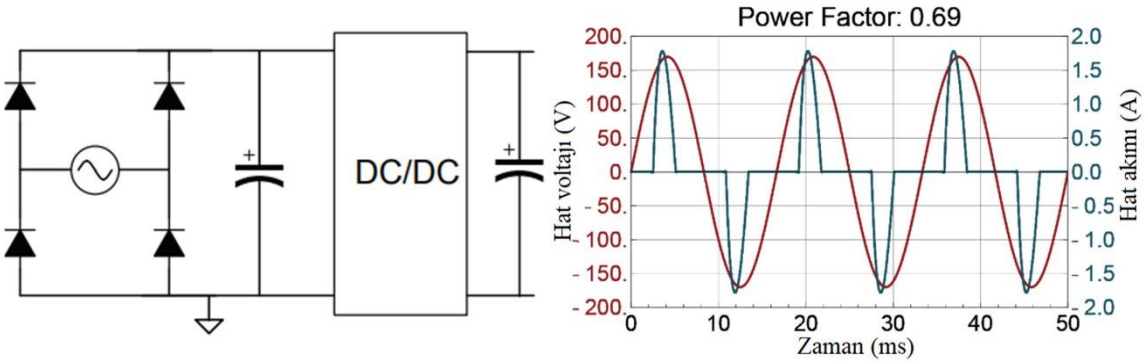
güç kullanımı nedeniyle gerekli görünen güç miktarının boyutu artar[3]. Burada köpüklü yayık ayranı örnek verilebilir. Bardak, üretilen güç, içindeki ayran talep edilen güç, köpük ise kullanılmayan güçtür. Yüksek güç faktörü az köpük anlamına gelirken, zayıf güç faktörü ise çok köpük az ayran demektir.



Görsel 2. PF=0,4 için giriş voltajı ve akımı

Teknolojisinin hızlı gelişmeyle birlikte güç yarı iletkenleri bir çok sektörde uygulama alanı bulmuştur. Anahtarlamalı güç kaynakları (SMPS) gibi güç elektroniği dönüştürcülerinin geleneksel doğrusal güç kaynaklarına göre daha üstün olması güç sistemlerinde bu sistemlerin giderek daha fazla geçmesine neden olur. SMPS'ler oldukça verimli olmalarına rağmen doğrusal olmayan davranışları nedeniyle hattan bozuk akım çekerler (Görsel 3), bu da yüksek toplam harmonik bozulma (THD) ve düşük PF ile sonuçlanır. Daha küçük bir çıkış voltajı dalgalanması elde etmek için pratik SMPS'ler, tek fazlı doğrultucunun çıkış tarafında büyük bir elektrolitik kapasitör kullanılır. Doğrultucu diyotlar yalnızca hat voltajı kondansatör voltajından yüksek olduğunda iletim yaptığından, güç kaynağı yüksek rms darbeli hat akımı çeker. Sonuç olarak, bu tür güç sistemlerinde yüksek THD ve zayıf PF (genellikle 0,67'den az) mevcuttur. Harmonik azaltma ve PFC üzerine araştırmalar 1990'ların başında yoğunlaşmıştır[1,4,5,3].



Görsel 3. AC/DC güç kaynağı giriş voltajı ve akımı

Her cihaz ayrı ayrı harmonik akım açısından çok ciddi bir sorun teşkil etmese de, bu tür sistemlerin yoğun kullanımı şebeke durumunu kötüleştirebilir. Son yıllarda güç kalitesinin düşmesi önemli bir konu haline gelmiştir. IEC1000-3-2 gibi zorunlu ve daha sıkı teknik standartların getirilmesiyle birlikte giderek daha fazla araştırmacı, harmonik azaltma ve PFC alanına odaklanmıştır ve bunun sonucunda çok sayıda devre topolojisi ve kontrol stratejisi ortaya çıkmıştır. Genel olarak harmonik azaltma ve PFC çözümleri pasif yaklaşım ve aktif yaklaşım olarak sınıflandırılmaktadır. Pasif yaklaşım, yüksek güvenilirlik, yüksek güç kapasitesi, tasarımı ve bakımı kolay olma avantajlarını sunabilir ancak pasif kompanzasyon sisteminin çalışması güçlü bir şekilde güç sistemine bağlıdır ve yüksek PF elde edemez. Pasif yaklaşım birçok yüksek güçlü uygulamada hala en iyi seçim olabilirken, aktif yaklaşım, 1'e yakın PF performansları sayesinde düşük-orta güç uygulamalarında kullanım alanı geniştir. Güç yarı iletken anahtarlarının güç işleme kapasitesi yüksek watt değerlerine kadar genişletilmesiyle, aktif güç elektroniği sistemleri pasif güç işleme cihazlarının çoğunun yerini almaya başlamıştır[1, 6].

Şebeke güç kaynağındaki güç kalitesini iyileştirmeye yönelik harmonik azaltma ve PFC teknikleri, düşük güç seviyesi, orta güç seviyesi ve yüksek güç seviyesi için farklı uygulamalarda çok önemli araştırma çalışmalarıdır. Güç kaynağı endüstrileri güç kaynaklarında giderek daha fazla PFC tekniğini kullanmaya başlamıştır[1]. Bu çalışma da, güncel açık literatürdeki çeşitli aktif harmonik azaltma ve PFC tekniklerine genel bir bakış sunulmakta, yaygın olarak kullanılan çeşitli dönüştürücü topoloji türleri incelenmektedir.

2. GÜÇ FAKTÖRÜ DÜZELTME

PF sistemdeki gerçek güç kullanımının ne kadar etkili olduğunun bir ölçüsünü verir. Aynı zamanda hat voltajındaki bozulmanın ve hat akımının ve bunlar arasındaki faz kaymasının bir

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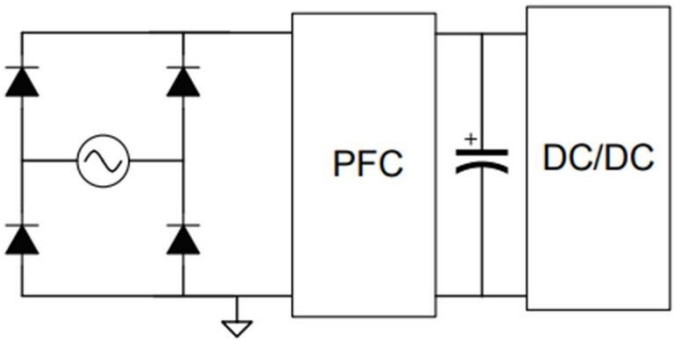
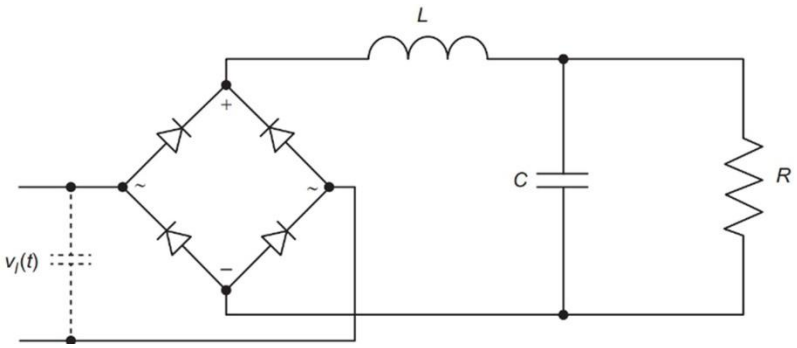
ölçüsünü de temsil eder. Bir PFC devresi, giriş akımını anlık hat voltajıyla aynı fazda olacak şekilde şekillendirir ve tüketilen toplam görünen gücü en aza indirir. Elektronik cihaz tarafından tüketilen toplam görünen gücü en aza indirmek amacıyla pasif veya aktif PFC devreleri kullanılır. Görünen güç, anlık gerilim ile anlık akım rms değerlerinin çarpımı olarak tanımlanır. Yükün doğrusal olması durumunda sinüzoidal gerilim altında tamamen sinüzoidal akım çektiği iyi bilinmektedir. Bu durumda PF yalnızca voltaj ve akım arasındaki faz kaymasıyla belirlenir. Burada güç katsayısı yükün çektiği akımın ve yüke uygulanan voltaj arasındaki açının cosinüsüdür. Aradaki açı anlık çekilen akım ile anlık uygulanan voltaj arasındaki faz kaymasıdır. Bu nedenle, eğer güç sistemi saf sinüs dalga biçiminde bir voltaj sağlıyorsa ve yük doğrusalsa, PF, anlık akım ile anlık voltaj arasındaki faz kayma açısının kosinüsüne eşittir. Ancak güç elektroniği sisteminde aktif anahtarlamalı güç cihazlarının doğrusal olmayan davranışı PF'nin hesaplanması için faz açısı gösterimi tek başına yeterli değildir. Akım ve/veya gerilimin bozuk dalga biçimleri için PF'nin hesaplanmasının, sinüzoidal akım ve gerilim dalga biçimleriyle karşılaştırıldığında daha karmaşıktır. Hem hat voltajı hem de hat akımı bozuksa bu durumda anlık çekilen akım ve anlık güç kaynağı voltajı için Fourier açılım gösterimleri verilir. Pratik olarak, güç kaynağı tarafından görülmesi beklenen anlık akım ve gerilimin iki ortalama değeri, bir periyot boyunca gerilim ve akımın pozitif ve negatif kısımlarının simetrisi nedeniyle sıfıra eşittir. Harmonik akım ve voltaj değerlerinin tamamının hesaba katılması gerekir. PFC'deki iyileşme aynı zamanda harmoniklerin, özellikle de düşük dereceli harmoniklerin azalması anlamına gelir. SMPS'ler kapasitif doğrultucular kullanır ve Görsel 3'de görülen darbeli hat akımına neden olur. Bu tür bir devre için tipik giriş akımı harmonik distorsiyonu THD genellikle %55-%65 aralığındadır ve PF yaklaşık 0,65'tir[7,8]. Bu giriş akımı karakteri, dağıtım şebekesinde çeşitli problemler yaratır ve güç kaynağının yakınındaki diğer elektrikli alıcıları etkiler. Özellikle yüksek güçte bu dezavantajların üstesinden gelmek için bazı çözümler önerilmiştir. Çıkışında DC-DC dönüştürücü bulunan tek fazlı doğrultucunun (Görsel 3) hat akımına ilişkin mevcut şeklin iyileştirilmesi için Görsel 4'de görülen PFC devresi diyot köprüsü ile DC-DC dönüştürücü arasına eklenir[1].



Görsel 4. Tek faz AC-DC güç kaynağında PFC ünitesi

2.1. Pasif Güç Faktörü Düzeltme Devreleri

Pasif PFC, güç sistemlerinde yüksek güvenilirlikleri ve yüksek güç işleme kapasiteleri nedeniyle pasif güç faktörü düzelticileri normalde yüksek güçlü hat uygulamalarında kullanılır. Güç kaynaklarında girişe bir indüktans eklemek ile pasif PFC gerçekleştirilebilir. Anahtarlama kayıplarının olmadığı bu yaklaşım minimum düzeyde karmaşıklığa ve düşük maliyete sahip olsa da etkinliği sınırlı verimi düşüktür. Ancak düşük voltajlı bir sistem için 85-265 V arasında bir AC girişi gibi genişletilmiş çalışma aralıklarında iyi güç faktörü düzeltme performansı sürdürmek zordur. Örnek bir pasif PF devresi Görsel 4'de verilmektedir. Girişteki indüktans sayesinde sürekli iletim modunda (CCM) ve kesintili iletim modunda (DCM) çalışabilir. Pasif devrelerde daha iyi PFC elde etmek için boyutlar artar. Pasif unsurlarla ilişkili zaman gecikmesi nedeniyle dinamik tepki zayıftır. Tasarımın optimizasyonu zordur, dinamik tepkisi zayıftır [1].



Görsel 4. Endüktif girişli pasif PF düzeltici.

Yüksek güvenilirlikleri ve yüksek güç işleme kapasiteleri nedeniyle pasif güç faktörü düzelticileri normalde yüksek güçlü elektrik sistemleri hat uygulamalarında kullanılır.

2.2. Aktif Güç Faktörü Düzeltme Devreleri

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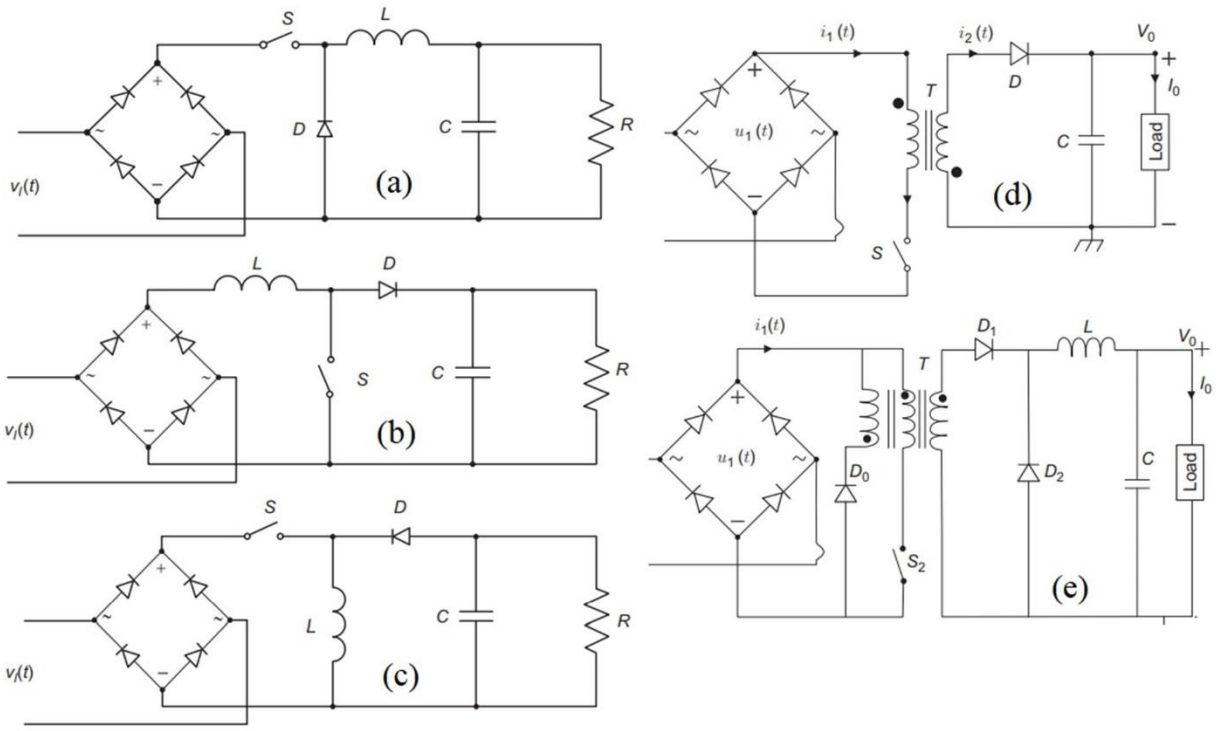
Aktif PFC devreleri, yüksek güç yoğunluğu ve enerji verimliliği açısından önemli bir rol oynamaktadır. Aktif PFCe yaklaşımı, diyot köprüsü ile izole edilmiş DC-DC dönüştürücü arasında tam güç dönüştürücü aşamasının kullanılmasını gerektirir. Aktif bir PFC, geniş bir çalışma aralığında çok az bozulmayla üstün güç faktörü performansı sunar. Son yıllarda anahtarlamalı mod topolojileri kullanılarak belirli standartlara (IEEE Std 519 ve IEC1000-3-2 gibi) uyacak şekilde birçok devre ve kontrol yöntemi güncel olarak geliştirilmiştir. Bunun sonucunda giriş akımı dalga biçimini başarılı bir şekilde şekillendirmek için yüksek frekanslı anahtarlama teknikleri kullanılmıştır. Temel olarak, tek fazlı güç kaynaklarında PFC fonksiyonunu gerçekleştirmek için kullanılan aktif PF düzelticileri, iyi bilinen temel DC-DC dönüştürücü topolojilerine veya bunların geliştirilmiş versiyonlarına dayanmaktadır. Bir PFC dönüştürücünün birincil faydası yüksek güç faktörü ve düşük THD'dir. Aktif PFC'nin dahil edilmesi nedeniyle genel AC-DC güç kaynağının sağladığı ikincil faydalar da vardır. PFC aşamasının yüksek çıkış voltajı nedeniyle, PFC çıkış kapasitansında orta miktarda enerji depolanabilir. Bu enerji, ürün tarafından, AC hattının anlık olarak beklenenden daha düşük bir voltaja düştüğü voltaj düşüklüğü koşullarını atlatmak için kullanılabilir. Bu özellik özellikle elektronik devrenin tamamen kapanmadan önce son durumunu belleğe depolamak için zamana ihtiyacı varsa kullanışlıdır. PFC'nin çıkış voltajı düzenlendiğinden bu, artık dar bir DC girişi için optimize edilebilen düşürücü izole DC-DC dönüştürücünün tasarımını büyük ölçüde basitleştirir[3]. Bazı aktif PFC devreleri Görsel 5'de verilmiştir.



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Görsel 5. Bazı PFC devreleri (a)Buck, (b)Boost, (c) Buck-Boost, (d)Flyback, (e)Forward düzeltici

Diğer yüksek frekanslı PFC devreleriyle karşılaştırıldığında buck düzeltici, hattın önündeki güç anahtarının varlığı nedeniyle ani akım sınırlama, aşırı yük veya kısa devre koruması ve dönüştürücü için aşırı gerilim koruması sağlar. Diğer bir avantaj ise çıkış voltajının hat voltajının tepe noktasından daha düşük olmasıdır ki bu genellikle normalde istenilen durumdur. Buck düzeltici kullanmanın sakıncaları şu şekilde özetlenebilir: Çıkış voltajı hat voltajından yüksek olduğunda, hat voltajının sıfıra yakın noktasında önemli hat akımı bozulmasına neden olur, giriş akımının süreksiz olması, yüksek EMI'ye yol açar, güç anahtarındaki akım ve gerilimi yüksektir[1].

Boost düzelticinin avantajları arasında daha az EMI, daha düşük anahtar akımı ve topraklanmış sürücü yer alır. Boost düzelticinin eksiklikleri şu şekilde özetlenmiştir: çıkış voltajı hat voltajının tepe noktasından yüksek olmalıdır, ani akım sınırlama, aşırı yük ve aşırı gerilim korumaları mevcut değildir[1]. Yıllar boyunca her birinin kendine özgü avantaj ve dezavantajları olan çok sayıda dönüştürücü topolojisi kullanılmış olsa da, günümüzde aktif güç faktörü düzeltmesi için kullanılan en yaygın topoloji seçeneği Boost dönüştürücüdür. Boost dönüştürücünün bugün kullanımda baskın PFC topolojisi haline gelmesinin başlıca nedenlerinden biri, güçlendirme indüktörünün dönüştürücünün giriş tarafında olmasıdır. Bu avantajlıdır çünkü giriş akımının yüksek di/dt yaşamadığı anlamına gelir, bu da topolojinin düşük giriş akımı distorsiyonunu elde etmek için daha iyi donatılmasını sağlar[3]. Bu topolojinin düşük giriş akımı distorsiyonunu elde etmek için daha iyi donatılmasını sağlar. Buck-boost düzeltici, Buck düzelticinin ve boost düzelticinin bazı avantajlarını birleştirir. Bir düşürücü düzeltici gibi, devre korumaları ve düşürücü çıkış voltajı sağlayabilir ve bir boost düzeltici gibi, giriş akımı dalga biçimi ve çıkış voltajı sıkı bir şekilde kontrol edilebilir. Bununla birlikte, Buck-Boost düzelticinin aşağıdaki dezavantajları vardır; giriş akımı güç anahtarı tarafından kesilir, bu da yüksek diferansiyel mod EMI'sine neden olur, güç anahtarındaki akım gerilimi yüksektir, çıkış voltajının polaritesi ters çevrilmiştir[1]

Flyback düzeltici, giriş akımının, giriş voltajıyla aynı fazda olan düzeltilmiş bir sinüs dalgasına dönüştürülmesine olanak tanır, böylece yüksek bir PF ve düşük harmonik içeriği elde edilir. Aslında, izole edilmiş bir ön aşamalı PFC dönüştürücü ve tek aşamalı bir PFC olarak yaygın şekilde kullanılan, en çok kullanılan aktif PFC dönüştürücülerden biridir. Giriş ve çıkış arasındaki izolasyon, düşük maliyet ve basit yapı gibi birçok avantaj sunmaktadır. Bununla birlikte, birincil anahtardaki büyük voltaj stresi ve çıkış diyotu boyunca oluşan büyük akım stresi, uygulamasını düşük güç seviyesiyle sınırlamıştır. Flyback dönüştürücüler, basit devre

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yapısı ve düşük maliyet gibi avantajlara sahip olmasına rağmen, trafonun kaçak endüktansına bağlı olarak yarı iletken elemanlar üzerinde oluşan ilave akım ve gerilim stresleri gibi dezavantajlar da barındırmaktadır[9, 10, 11, 12, 13,14]. Flyback PFC topolojisi üç modda çalışabilir: CCM, DCM ve kritik iletim modu (CRM). Çalışma modu, bir anahtar periyodunda ana anahtar kapatıldığında, ayırma transformatörünün sekonder tarafındaki serbest diyotun davranışına göre seçilir. Flyback PFC dönüştürücünün CCM işlemi iki kontrol döngüsü gerektirir. Birinci kontrol döngüsü, hat akımı dalga şeklinin ve hat voltajı ile hat akımı arasında sıfır kayma fazının, dolayısıyla bir PF'nin elde edilebilmesini sağlamak amacıyla akımı kontrol etmek için kullanılır. İkinci kontrol döngüsü, çıkış voltajını düzenleyerek kontrol etmek için kullanılır. DCM ve CRM geri dönüşlü PFC dönüştürücüler için yalnızca voltaj kontrol döngüsüne ihtiyaç duyulması, CCM geri dönüşlü PFC dönüştürücüden daha basit devrelerin elde edilmesine olanak sağlar, bu da DCM ve CRM geri dönüşlü PFC dönüştürücülerin daha yaygın olarak kullanılmasını sağlar[15, 16].

Forward dönüştürücülerde ise çıkış geriliminin giriş geriliminden yüksek olduğu aralıklarda AC girişten enerji çekilememesi nedeniyle PFC kalitesi bozulmaktadır. Forward dönüştürücü topolojisinin kullanımı çeşitli dezavantajları içerir: (1) Tipik tek uçlu forward dönüştürücü, transformatör enerjisini sağlamak için üçüncü bir ek yardımcı sargı gerektirir. Manyetikliği gidermeyi sıfırlama buck PFC dönüştürücünün temel topolojisinin aynı dezavantajlarına ve sınırlarına sahiptir. Çıkış voltajı, giriş doğrultulmuş voltajından daha büyüktür, giriş akımı dalga formlarında PF'yi düşürebilen ve harmonik içeriğinin artmasına katkıda bulunabilen ölü bölgeler görünür. Bu ana dezavantajlar, forward PFC topolojisinin PFC uygulamalarında kullanılmasını zorlaştırır. Bununla birlikte, birçok çalışma, giriş akımı harmonik bozulmasının azaltılması ve daha yüksek PF gereksinimini karşılamak için bu tür bir dönüştürücünün geliştirilmiş topolojilerini sunmuştur. Forward dönüştürücünün temel topolojisinin ana dezavantajlarının üstesinden gelmek için önerilen böyle bir topoloji, temel forward topolojiyi ve temel flyback topolojisini birleştiren forward-flyback PFC topolojisidir; burada yalnızca bir ortak anahtar ve bir ortak transfer kullanılır. Bu topolojide giriş voltajı forward çalışmayı sağlayacak kadar büyük olmadığında flyback güç aktarımına katkıda bulunur. Bu topolojinin ana avantajları şunlardır: Konvansiyon forward PFC topolojisinde mevcut ölü bölgeler ortadan kaldırılmıştır, Geri dönüş dönüştürücünün çalışması sırasında transformatör sıfırlanır, forward için ek sıfırlama sargısına artık gerek yoktur[17, 18].

2.3. PFC Güç Kaynağı Sistem Yapılandırması

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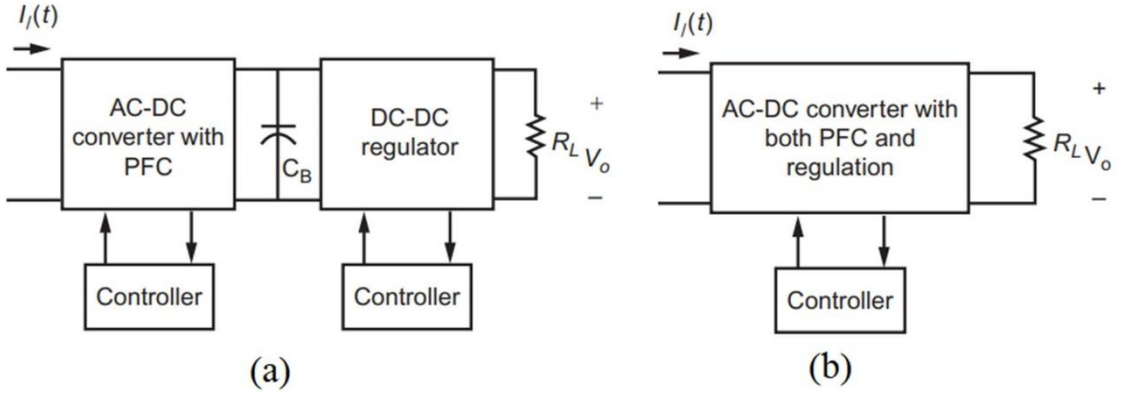
PFC'li AC-DC güç kaynağının en yaygın konfigürasyonları iki aşamalı şema ve tek aşamalı (veya tek aşamalı) şemadır. Görsel 6'da gösterildiği gibi iki aşamalı şemada, bir ara DC barası oluşturmak için hatta izole edilmemiş bir PFC AC-DC dönüştürücü bağlanır. Bu DC bara voltajı genellikle ikinci harmonik dalgalanmalarla doludur ve bunu elektrik izolasyonu ve sıkı voltaj regülasyonu sağlamak için kademeli bir DC-DC dönüştürücü takip eder. İki aşamalı yapıya sahip PFC devrelerinin avantajı, iki güç aşamasının ayrı ayrı kontrol edilebilmesi ve böylece her iki dönüştürücünün de optimize edilmesini mümkün kılmasıdır. Bu şemanın dezavantajları, giriş gücünün iki kez işlenmesi nedeniyle daha düşük verimlilik, karmaşık kontrol devrelerine yol açan iki kontrol sistemi, daha yüksek maliyet, iki aşama arasında kullanılan ara devreler nedeniyle hantallık ve düşük güvenilirliktir. İki aşamalı şema yaklaşımı çeşitli endüstriyel uygulamalarda yaygın olarak benimsenmesine rağmen, girdi aşaması ve çıktı aşaması bağımsız olarak incelenebildiğinden ortak araştırmalarda sınırlı ilgi görmüştür. Tek aşamalı şema, görsel 6 B'de gösterildiği gibi PFC devresini ve güç dönüşüm devresini tek aşamada birleştiren basitleştirilmiş bir yapıya sahiptir. Bu nedenle, bu topoloji potansiyel olarak daha verimlidir ve düşük-orta güç seviyeli özellikle maliyete duyarlı uygulamalar için uygundur. Bu nedenle tek aşamalı şema, konut ve ofis aletleri gibi ucuz güç kaynağı uygulamalarına yönelik giderek artan talep nedeniyle araştırmaların ana araştırma konularından biridir[1].



Görsel 6. PFC güç kaynağının yapılandırma: (a) iki aşamalı, (b) tek aşamalı şema

Birçok tek aşamalı PFC dönüştürücü için en önemli sorunlardan biri, hat ve yük değişimlerinde yavaş dinamik tepkidir. Hattın (120 veya 100 Hz) neden olduğu düşük frekanslı dalgalanmayı çıkıştan çıkarmak ve neredeyse sabit bir çalışma görev oranını korumak için normalde büyük hacimli bir çıkış kapasitörü kullanılır. Sonuç olarak, geri besleme döngüsüne düşük frekanslı bir kutbun (tipik olarak 20 Hz'den az) eklenmesi gerekir. Bu, sistemin dinamik tepkisinin çok yavaş olmasına neden olur[19].

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2.3. PFC devreleri iletim modları

PFC devrelerinde iletim modları ile hat akımının değişimi Görsel 7'de görülmektedir. CCM, orta ve yüksek güç seviyeleri için yüksek giriş PF'si elde etmek için kullanılan kontrol stratejilerine ve geliştirilmiş topolojilere vurgu yapar. Bu teknik sürekli bir akım akışının kontrolü için uygulandığında sabit veya değişken bir anahtarlama frekansı kullanılabilir[20]. CCM yüksek güçlü durumlarda kullanılır. Bununla birlikte, CCM'de çalışan bir dönüştürücü, doğası gereği PFC yeteneğine sahip değildir; yani, belirli bir kontrol stratejisi uygulanmadığı sürece giriş akımı, hat voltajının dalga biçimini takip etmeyecektir. Bu nedenle CCM koşullarında PF'yi iyileştirmeye yönelik araştırma faaliyetlerinin çoğu, yeni mevcut şekillendirme kontrol stratejilerinin geliştirilmesine odaklanmıştır. Kontrol edilen sistem değişkenine (akım veya voltaj) bağlı olarak, PFC kontrol teknikleri akım kontrolü ve voltaj kontrolü olarak sınıflandırılabilir. Akım kontrolü en yaygın kontrol stratejisidir çünkü PFC'nin temel amacı giriş akımını hat voltajının şeklini izlemeye zorlamaktır[1].

DCM, basitleştirilmiş kontrol devresi sayesinde düşük maliyetli güç kaynağının elde edilebilmesidir. Bununla birlikte, bir DCM dönüştürücünün tepe giriş akımı, karşılık gelen ortalama giriş akımının en az iki katı kadar yüksektir; bu, anahtarlar üzerinde bir CCM dönüştürücüdekinden daha yüksek akım stresine neden olur ve bu da kabul edilemez iletim ve anahtarlama kayıplarına ve yüksek düzeyde transformatör bakır kayıplarına neden olur. Pratikte DCM tekniği, yalnızca düşük ila orta seviyeli güç uygulamaları için uygundur.

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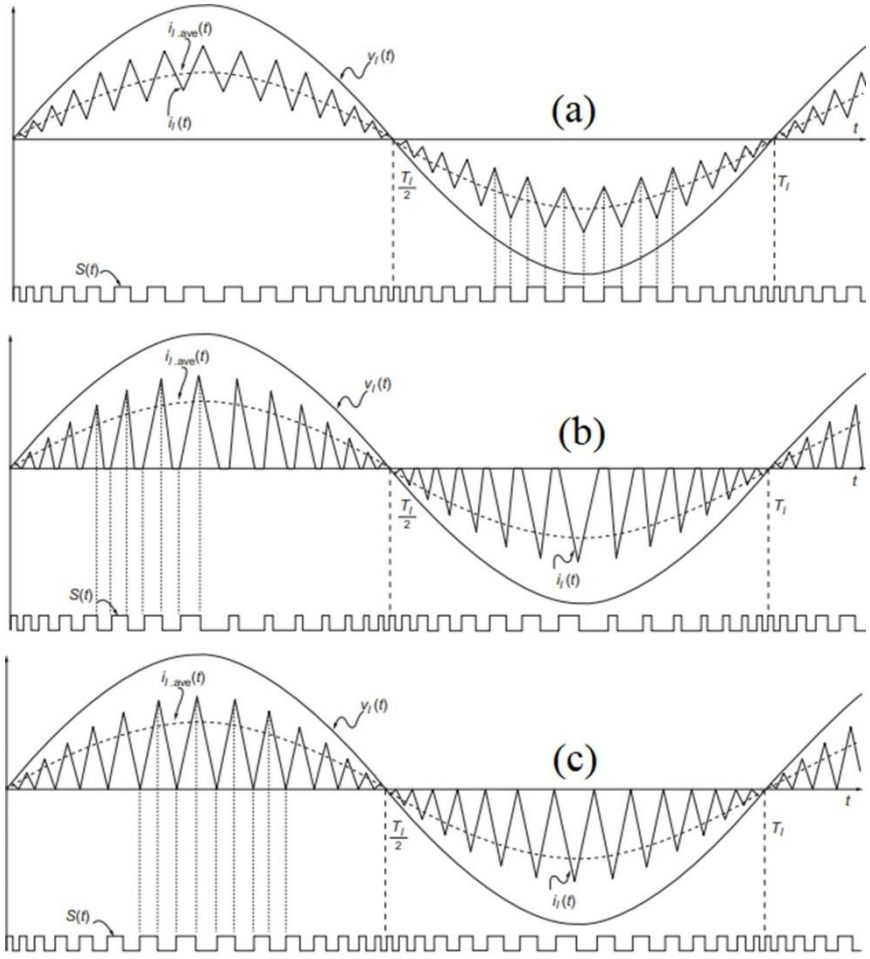

Görsel 7. İletim modları (a) CCM, (b)DCM, (c)CRM

Yüksek güçlü uygulamalarda mükemmel enerji aktarımı, düşük akım dalgalanması vb. nedenlerle sürekli akım modunda (CCM) çalışma tercih edilmektedir. Fakat CCM çalışma, diyodun ters toparlanma enerji kaybına, anahtarın akım altında iletime girmesine ve EMI'ya neden olmaktadır. Düşük güçlü uygulamalarda, diyodun ters toparlanma enerji kaybının neden olduğu problemlerden kaçınmak ve anahtarlama kayıplarını düşürmek amacıyla kesintili akım modunda (DCM) çalışma tercih edilir. DCM çalışmada, aynı güç değeri için akımın tepe değeri yükselir ve enerji aktarımı kötüleşir. Bununla birlikte CCM çalışmaya göre daha düşük THD sağlar. Buna rağmen CCM çalışma daha küçük EMI filtresi gerektirir.

Bu tekniklerin ortak sorunu, çıkıştaki sabit güç dağılımının hat frekansının iki katı ile AC güç dağılımına yansıtılmasını sağlayacak şekilde güç akışının düzgün şekilde işlenmesidir. Teknik olarak PFC teknikleri aşağıdaki ödünleşimlerle karşı karşıyadır:

Basitlik ve doğruluk: Tek aşamalı PFC devresi basit topolojiye ve basit kontrol devresine sahiptir ancak daha az kontrol doğruluğuna sahiptir, iki aşamalı PFC devresi ise tam tersi bir performansa sahiptir.

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Kontrol basitliği ve güç işleme kapasitesi: DCM giriş tekniği, giriş akımı kontrolü gerektirmez ancak daha az güç işleme kapasitesine sahiptir; CCM ise çoklu döngü kontrolüne sahiptir ve daha fazla güç işleme kapasitesine sahiptir.

Anahtarlama frekansı ve dönüşüm verimliliği: PFC dönüştürücünün ağırlığını ve boyutunu azaltmak için daha yüksek anahtarlama frekansı arzu edilir. Ancak ilgili anahtarlama kayıpları dönüşüm verimliliğinde düşüşe neden olur.

Frekans tepkisi ve bant genişliği: İyi bir dinamik tepkiye sahip olmak için daha geniş bant genişliği arzu edilir; ancak yüksek PF elde etmek için toplu depolama kapasitörü ve çıkış kapasitörünün kullanılması gerekir[1].

Geçtiğimiz yıllarda, PFC tekniklerindeki araştırmalar, yukarıdaki ödünleşimlerden ödün vermeden tasarımı optimize etmek için daha verimli devrelerin ve kontrol stratejilerinin geliştirilmesine yol açmıştır. Ayrıca, güç elektroniğindeki büyüme, yarı iletken cihazların geliştirilmesine ve son zamanlarda daha yüksek dereceli güç cihazlarının ortaya çıkmasına büyük ölçüde bağlı olduğundan, anahtarlama modlu PF düzelticilerinin, güç sistemindeki mevcut pasif reaktif kompansatörlerin tamamen yerini alacağına inanılmaktadır. Küçük boyutun ve yüksek verimliliğin son derece önem taşıdığı dağıtık güç sistemlerinde (DPS), PFC devrelerinin tasarımında yeni bir yumuşak anahtarlama tekniği kullanılmıştır. Ultra hızlı bilgisayarlara yönelik pazar talebinin sürekli artmasıyla birlikte, yüksek çıkış akımlarına ve yüksek verimli dönüştürücülere sahip düşük çıkış voltajına (tipik olarak 1 V'den az) olan ihtiyaç hiç bu kadar fazla olmamıştı. Yüksek frekanslı, yüksek verimli PFC devrelerinin geliştirilmesine yönelik araştırma çabaları artmaya devam edecek. Güç Faktörü Düzeltme devreleri, maksimum verime ulaşmak için stratejik tasarım ve ürün seçimi gerektirir. Bu PFC topolojilerinin her birinde, bu devrelerin verimliliğini etkileyen birçok bileşen vardır. Spesifik olarak, uygun kapı sürücüsü seçimi, sürücü tarafından gerçekleştirilen anahtarlama geçiş süresi sırasında meydana gelen kayıplar nedeniyle maksimum verimliliğin korunmasında anahtardır.

3. SONUÇ

Doğrusal güç kaynaklarındaki AC gücün DC güce dönüştürülmesiyle ilgili kayıpları azaltmak ve ağırlığı ve boyutu azaltmak için SMPS'ler geliştirilmiştir. Güç sistemlerine bağlanan bu tür güç elektroniği sistemlerinin yüksek doğrusal olmama özelliği, şebeke güç sistemine düşük PF ve yüksek THD sağlayarak kendi kendine engel oluşturur. Bu istenmeyen harmonikler genellikle PFC tekniğinin SMPS'ye dahil edilmesiyle düzeltilir. Aktif PFC devrelerinin

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performansı daha yüksektir. CCM, CRM ve DCM iletim modlarında çalışma ile hattan çekilen akımın ortalama değerinin hat voltajı ile aynı faza getirilerek PF değeri 1'e yaklaştırılmaya çalışılır. Boost düzeltici bazı avantajları nedeniyle en yaygın kullanılan aktif PFC topolojilerinden biridir.

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