



# CONFERENCE BOOK

30 May-01 June 2024

Adrasan-Antalya  
Türkiye

ISBN: 978-625-00-2249-8

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## Official Opening of the ICONAT-2024

30 May 2024 Meeting Salon

Akdeniz University Euro-Mediterranean Youth Education  
and Recreation Facility,  
Adrasan (Antalya)-Turkey

### PROGRAM

Google Meet: <https://calendar.app.google/Q7PdBCcB6YtB2SiXA>

08.30 The Start of Registration Process

10.00 Official Opening of the ICONAT-2024  
Welcome by Conference

Prof. Dr. Murad Omarov, Vice-Chairman Organization Committee  
Vice-Rector, NURE, (Ukraine)

Prof. Dr. Abidin Kılıç, Eskisehir Technical University, Turkey  
Chairman of Organization Committee

**10.30 Invited Speaker**

**Prof. Dr. Ali Demirsoy (Turkiye)**

**11.15 Invited Speaker**

**Dr. Maksymova Svitlana (Ukraine)**

12.00 Lunch Break

## ORAL PRESENTATIONS

### 30.05.2024 Thursday-14.00

Chairing

Prof. Dr. Nihal Kuş

Meeting Salon

Google Meet: <https://calendar.app.google/Q7PdBCcB6YtB2SiXA>

#### 01 Ahmet Sait Alali-Turkiye

Optimization of PTB7/Spiro-OMeTAD Thin-Film Photodetectors for Enhanced UV Responsivity

#### 02 Vural Avcı-Turkiye

Mission Execution Capabilities of Artificial Intelligence-Supported Ucavs Examining a Sample Scenerio

#### 03 Rudra Sheth-India

Face Detection Door Lock System

#### 04 Sema Akyil Ereenturk-Turkiye

Development of New Lead-Free Radiation Shielding Glass-Ceramics by Bariumoxide Doping in Feldspar Mineral

### 30.05.2024 Thursday -15.00

Chairing

Prof. Dr. Meryem Akbelen

Meeting Salon-15.00

Google Meet: <https://calendar.app.google/Q7PdBCcB6YtB2SiXA>

#### 05. Anna Fesenko-Ukraine

Steady-State Oscillations of An Elastic Quarter Space

#### 06. Tuğçe Pekdoğan -Turkiye

Assessing Indoor Air Quality: Empirical Measurements in A Design Studio Environment

#### 07. Nkiru E Ekechukwu-Nigeria

A New Method for Sperm Quantification in the African Malaria Mosquito Anopheles Gambiae

#### 08. Andriy Slusar-Ukraine

Innovations in Warehouse Logistics: Analysis And Prospects

### 30.05.2024 Thursday-16.00

Chairing

Prof. Dr. Abidin Kılıç

Meeting Salon-

Google Meet: <https://calendar.app.google/Q7PdBCcB6YtB2SiXA>

#### 09. Dilek Bayramin-Turkiye

Synthesis and Characterization of Thiazole Derivatives with Bis(2-Methoxyethyl) Moiety

#### 10. Nihal Kuş-Turkey

Quantum Computational Investigation of L-Quebrachitol and D-Pinitol Isomers

#### 11. Lili Arabuli-Georgia

Peripherally Substituted Phthalocyanines and Their Metal Complexes -Synthesis And Physio-Chemical Properties for Photodynamic Therapy of Cancer

#### 12. Afamefuna Moon-Nigeria

A Method of Examining the Sequencing Models of Symmetric Structures

**30.05.2024 Thursday -17.00**

Chairing

Dr. Mehmet Fidan

Meeting Salon

Google Meet: <https://calendar.app.google/Q7PdBCcB6YtB2SiXA>

**13 Mokhtar Djehiche-Algeria**

Washing of Contaminated Soil Using Thermal Energy

**14 Çağrı Yılmaz-Turkey**

Implementation of A Forced Helmholtz-Duffing Oscillator to Monitor Energy Dissipation Process under Van Der Waals Forces

**15 Burhan Engin-Turkiye**

Study of The Radiation Detection Efficiency and Resolution Properties of A Perovskite CsPbBr<sub>3</sub> Single-Crystal by Means of EGS4

**16 Seda Kın Barka-Turkiye**

Laser Spectroscopic Investigation of New Energy Levels of Atomic Holmium in the Range from 690 nm to 830 nm

**31.05.2024 Friday 09.00**

Chairing

Prof. Dr. Abidin Kılıç

Meeting Salon

Google Meet: <https://calendar.app.google/4iEuah8ge64ab7YR6>

**09.00 Invited Speaker**

**Prof. Dr. Yavuz Akbulut (Turkey)**

**31.05.2024 Friday 10.00**

Chairing

Prof. Dr. Nihal Kuş

Meeting Salon

Google Meet: <https://calendar.app.google/4iEuah8ge64ab7YR6>

**17. Meryem Akbelen-Turkey**

Ammonia Adsorption Capacities of Natural and Acid Treated Zeolite

**18. Zafer Alpaslan-Turkey**

Standard karyotype of Squalius kosswigi (Karaman, 1972)

**19. Reyhan Zoroğlu-Turkey**

Effect on The Histological Parameters of The Pelargonium Sidoides Root Extract Eps 7630 in The Methotrexate-Induced Mucositis

**20. Mykola STARODUBTSEV-Ukraine**

Control of Multinomial Production Technology Processes

**31.05.2024 Friday 11.00**

**Chairing**

**Prof. Dr. İlhan Usta**

**Meeting Salon**

**Google Meet: <https://calendar.app.google/4iEuah8ge64ab7YR6>**

**21. Nazire Burçin Hamutoğlu-Turkey**

Cloud Computing Technology Supported Method for Effective Internal Evaluation Report Writing Process is Highlighted

**22. Nazire Burçin Hamutoğlu-Turkey**

Examination of Opinions on the Web-Based System Developed within the Scope of the Planning Cycle in the Effective Structuring of Teaching Processes

**23. Şükrü Acıtaş-Turkiye**

Determination of The Effect of Thermal Conductivity, Cooking Function, and Pulsation on Oven Energy Consumption

**24. Serhii NOVOSELOV-Ukraine**

A Method of Sorting Parts in An Intelligent Factory Based on A Manipulator with A Pneumatic Gripper in Combination with A Computer Vision System

**31.05.2024 Friday 14.00**

**Chairing**

**Prof. Dr. Şükrü Acıtaş**

**Meeting Salon**

**Google Meet: <https://calendar.app.google/4iEuah8ge64ab7YR6>**

**14.00 Invited Speaker  
Prof. Dr. Cem Yüce (Turkey)**

**31.05.2024 Friday 15.00**

**Chairing**

**Prof. Dr. Şükrü Acıtaş**

**Meeting Salon**

**Google Meet: <https://calendar.app.google/4iEuah8ge64ab7YR6>**

**25. İlhan Usta-Turkiye**

On The Relationship Between Cooking Function and The Upper Heater with Oven Energy Class Labels

**26. Meliani Newal-France**

Evaluation of The Hemolytic Effect of Rhamnus Alaternus

**27. Mehmet Fidan-Turkiye**

Anomaly Detection In Railway Images Using Unsupervised Clustering of Infrared Thermography

**28. Ertan Çalmaz-Turkiye**

In Vitro Effects of Luteolin On The Toxicity of Acrylamide in Leydig

**31.05.2024 Friday 16.00**

**Chairing**

**Dr. Yeliz Mert Kantar**

**Meeting Salon**

**Google Meet: <https://calendar.app.google/4iEuah8ge64ab7YR6>**

**29. Emre Tarakçioğlu-Turkiye**

Neuronal Loss of Perineuronal Nets in Response to Microglial NLRP3 Inflammasome Activation

**30. Svitlana Maksymova -Ukraine**

Constructing an Optimal Route for a Mobile Robot Using a Wave Algorithm

**31 Svitlana Sotnik-Ukraine**

Optimization of Work: in-Depth Look at Kanban, Scrum and Lean

**32 Firas I. Syam-Indonesia**

Evaluating the Impact of Virtual Laboratories



**31.05.2024 Friday 17.00**

Chairing

Prof. Dr. Nihal Kuş

Meeting Salon

Google Meet: <https://calendar.app.google/4iEuah8ge64ab7YR6>

**33. B. Misan-Ukraine**

Features of 3D Printing of Oral Films

**34. Halit Çavuşoğlu -Turkiye**

Porous Graphene Aerogels for Photocatalysis-Assist Methylene Blue Removal From Aqueous Solutions

**35. Yeliz Mert Kantar-Turkiye**

Detection of Heteroscedasticity Using Machine Learning-Based Methods

**01.06.2024 Saturday 09.00**

Chairing

Nur Uluhan

Meeting Salon

Google Meet: <https://calendar.app.google/1crgWwMFUxfDJut59>

**36. Güldane GÖZEN TAVŞAN-Turkiye**

Standart Karyotype of *Turcichondrostoma fahirae* (Ladiges, 1960)

**37. Seçil Sevim Ünlütürk -Turkiye**

Enhancing The Electrical Conductivity of TiO<sub>2</sub> Nanoparticles by Surface Modification

**38. Olena Kovalenko -Ukraine**

Effect of Scattering on The Transmission Spectra of Crystalline P-Terphenyl

**39. Sergi Sheiko -Ukraine**

Detection and Recognition of Unmanned Aerial Vehicles by the Spectrum of Their Acoustic Signals

**01.06.2024 Saturday 10.00**

Chairing

Prof. Dr. Abidin Kılıç

Meeting Salon

Google Meet: <https://calendar.app.google/1crgWwMFUxfDJut59>

**40. Baghdad Abdulhameed Abdullah AL BADANI-Turkiye**

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**41. Abdilahi Ahmed ABDI-Turkiye**

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**42. Leman Gökçen Gerelgiz-Turkiye**

Investigation of Sputtered Co/Cu Multilayers with Different Deposition Rates and Total Film Thicknesses

**43. Izfa Riza Hazmi -Malaysia**

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## POSTERS PRESENTATIONS

01.06.2024 Saturday 11.00-12.00

Chairing

Prof. Dr. Murad Omarov

Meeting Salon

Google Meet: <https://calendar.app.google/1crgWwMFUxfDJut59>

44. Zallal Khodei-Iran

System Recommendation for Providing the Energy Requirement of Drying Systems from Solar Energy

45. Ulvuyya Yolchuyeva-Azerbaijan

Study of Biologically Active Hydrocarbons Contained in Naphthalene Oil and Their Application in Medicine

46. Burcu Denemeç-Turkiye

Determination of Monoammonium Phosphate in Dry Chemical Powder Fire Extinguishers by Icp-Oes Using Different Sample Preparation Methods

47. Amina TABET ZATLA-Algeria

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48. Gülin Aytaç-Turkiye

Development of Gluten Allergen-Free Color Products

49. Khaled Q. Shawakfeh-Jordan

Synthesis, Characterization and Anti-oxidant Activity of Diosgenin-Functionalized Graphene Oxide

50. Aycha ESSAADOUNI-Morocco

Development, Characterization of a New Low-cost Composite Membrane Composed of An Organic Ultrafiltration Layer and A Polyamide Support

51. Anissa El Absi-Morocco

Hydrodynamic Characterization of A New Ultrafiltration Membrane Synthesized Based on A Biodegradable Polymer and Fillers

52. Khairul Azreena Bakar-Malaysia

Probing The Interaction of Labetalol Hydrochloride with Human Serum Albumin and A1-Acid Glycoprotein: A Biophysical Point of View

53. Süleyman Demir-Turkiye

Reformulation of Compressible Fluid Equations in Terms of Hyperbolic Quaternion

54. Zeynep Gül HASAR-Turkiye

Solving The Flowing/Sagging Problem in Polyester Pigment Pastes Using A Rheology Agent

55. Mohammadjavad Asirad-Iran

Artificial intelligence applications in the characterization of materials

56. Ila Sandrina-Indonesia

Pressure control problem in the production of GaSb substrate

57. Candy Ranjba-Iran

Suggestions for Effective Teaching Methods for Gifted Individuals

58. Raja Sinokij-India

Effective Use of Artificial Intelligence in Solving Traffic Problems

59. Sergei Tudea-Romania

Physical Reality at High Temperatures

60. Manuela Uberi-Italy

Understanding The Origin of Cosmic Rays

61. Nur Uluhan-Turkiye

Physics Experiment Design Applications in Science Experiment Centers

62. Laura Botez-Romania

Critical Turning Points of Climate Change

**63. Zeynep H. Baykal-Turkiye**

Effect of Antioxidants on Neurodegenerative Diseases

**64. Leo Simsoyean-Indonesia**

The Effect of Climate Change on Children in Developmental Age

**65. Sajjad Sattar-Iran**

Comparison of Results Obtained According to Different Statistical Functions in HRXRD Measurements

## CONFERENCE EVALUATION MEETING AND CLOSING

**01.06.2024 Saturday 12.00**

**Chairing**

**Prof. Dr. Abidin KILIÇ**

**Meeting Salon**

**Google Meet: <https://calendar.app.google/1crgWwMFUxfDJut59>**





# ABSTRACTS

1.

## OPTIMIZATION OF PTB7/Spiro-OMeTAD THIN-FILM PHOTODETECTORS FOR ENHANCED UV RESPONSIVITY

Ahmet Sait ALALI<sup>1</sup>, Murat Oduncuoglu<sup>1</sup>

<sup>1</sup> Department of Physics Yıldız Technical University, Istanbul, Türkiye

### ABSTRACT

This study investigates the optimization of thin-film organic photodetector devices using SCAPS 1D simulations. By systematically varying the thickness of poly[[4,8-bis[(2-ethylhexyl)oxy]benzo[1,2-b:4,5-b']dithiophene-2,6-diyl][3-fluoro-2-[(2-ethylhexyl)carbonyl]thieno[3,4-b]thiophenediyl]] (PTB7) and spiro-OMeTAD layers, we aimed to enhance device responsivity across the ultraviolet (UV) spectrum. Through optimization, we identified an optimal thickness of 1000 nm for the spiro-OMeTAD layer and 1200 nm for the PTB7 layer. Additionally, we optimized the donor concentrations, setting PTB7 at  $10^{20} \text{ cm}^{-3}$  and spiro-OMeTAD at  $10^{18} \text{ cm}^{-3}$ . Our simulations reveal that these optimized parameters yield the best responsivity from 100 nm to 400 nm, making the device suitable for UV photodetection applications. These findings offer valuable insights for the design and fabrication of high-performance organic photodetectors for UV sensing applications.

**Keywords:** SCAPS 1D, PTB7, Spiro-OmeTad, Photodetector, Optimization, Responsivity

2.

## MISSION EXECUTION CAPABILITIES OF ARTIFICIAL INTELLIGENCE-SUPPORTEDUCAVs EXAMINING A SAMPLE SCENERIO

Vural AVCI<sup>1,\*</sup>

<sup>1,\*</sup>Target And Database Specialist, Turkish Aerospace Industries (TUSAŞ), Ankara, Türkiye

Today, countries' most important intelligence and operational elements are particularly Unmanned Combat Aerial Vehicles (UCAVs) developed in the context of Unmanned Aerial Vehicles (UAVs). UCAVs strategically create a great advantage over the enemy and are also successfully used against intelligence-based instant opportunity targets by providing long-term support to uninterrupted operations. The change in conventional warfare with the development of technology has caused countries and companies to make large investments in R&D activities. These developments have enabled UAVs to achieve autonomous (independent movement) capability by changing their remotely piloted structure. Developments in the field of autonomy, the Internet of Things (IoT), especially breakthroughs in 5G technology, and the rapid advancement of cloud data technology and the concept of artificial intelligence (AI) have enabled the development of the ability of UAVs to perform autonomous operations in flocks. The integration of the concept of AI in operational environments has shortened the access to intelligence information and the decision-making cycle. This situation has caused armies to react autonomously to emerging developments (target of opportunity) and a major change/transformation in their combat capabilities and strategies. These autonomous swarm UAVs offer many strategic advantages in military operations. With the development of technology, the capabilities of UCAVs enable militaries to make faster and more effective decisions and increase their operational capabilities. In a tactical scenario, in an environment where enemy targets are detected, package swarm UAVs can automatically perform predetermined tasks. These tasks include strategic activities such as surveillance, tracking, target detection, air-air defense, and target destruction. This ensures that the packet operates effectively and with coordinated communication against targets. This study aims to examine the concept of swarm UAV and the developments in this field, the tactics of a package operating as an autonomous swarm in a sample operational scenario and provide assessments on potential changes in tactics in the future.

**Keywords:** Air Operation, UCAVs, Combat Drone, COMAO's, Artificial Intelligence

3.

### FACE DETECTION DOOR LOCK SYSTEM

Aryan Salunkhe Rishika Samargade. Neha Sapkal, Shantanu Satange, Yash Shendage, Rudra Sheth  
Vishwakarma Institute Of Technology, Pune, India

#### ABSTRACT

This research paper describes a project that builds a strong door locking mechanism based on facial recognition by using computer vision and machine learning techniques. The LBPH face recognizer and Haar Cascade classifier with OpenCV and Python are used by the system for real-time face detection and recognition. By capturing images of each registered user's face, it builds a personalized dataset for them. Based on recognition outcomes, the system initiates attendance tracking and connects with an Arduino board to control a physical door lock. Unrecognized faces trigger Telegram rapid photo notifications, giving remote administrators the option to accept or reject access. Unidentified faces result in instant Telegram messages, guaranteeing comprehensive and efficient access control.

Keywords— OpenCV, Machine Learning, LBPH, Haar Cascade, Real-time face recognition

4.

### DEVELOPMENT OF NEW LEAD-FREE RADIATION SHIELDING GLASS-CERAMICS BY BARIUMOXIDE DOPING IN FELDSPAR MINERAL

Ülgenay Tan<sup>1</sup>, Abdullah Okyar<sup>1</sup>, Sema Akyil Erenturk<sup>\*,1</sup>, Sabriye Yusan<sup>2</sup>, Senem Sentürk Lule<sup>1</sup>

<sup>1</sup> Business Management, Faculty of Economics, Administration, and Social Sciences, Kadir Has University, Istanbul, Turkey

<sup>2</sup> Numerical Methods, Faculty of Economics and Administration, Bartın University, Bartın, Turkey

#### ABSTRACT

Radiation protection is very important for several reasons, primarily to protect human health and to prevent potential adverse effects associated with exposure to ionizing radiation. Ionizing radiation, such as gamma rays, can pass through a variety of materials and interact with living tissues, potentially causing damage at the cellular level. For these reasons, shielding materials are used for radiation protection. The shielding materials are of great importance in terms of protecting human health. Exposure to ionizing radiation can lead to a variety of health problems, including tissue damage, genetic mutations, and an increased risk of cancer. The severity of these effects depends on factors such as the type of radiation, duration of exposure, and dose received.

In this study, it was aimed to produce a lead-free, low-density glass-ceramic shielding material that provides sufficient gamma ray shielding performance by using feldspar and barium oxide. In this context, glass-ceramic shielding materials were prepared with different additive ratios and sintered at 1150°C. Structural characterization of the prepared glass-ceramics was investigated. Porosity of the glass-ceramics was determined. Some physical properties of the prepared Ba-doped glass-ceramics such as molar volume, oxygen packing density, Ba-ion concentration and Polaron diameter were calculated. Gamma ray attenuation performances, half value thicknesses and tenth value thicknesses were calculated for different gamma ray (<sup>241</sup>Am and <sup>60</sup>Co) energies. Gamma radiation protection properties of glass-ceramics with the XCOM program were evaluated. The results were evaluated by considering the data of different shielding materials.

**Keywords:** Gamma radiation, Shielding, Barium doped glass ceramics, Mass attenuation coefficient, Half-value layer

5.

## STEADY-STATE OSCILLATIONS OF AN ELASTIC QUARTER SPACE

Anna FESENKO

Odesa I. I. Mechnikov National University, Faculty of Mathematics, Physics and Information Technologies, Odesa, Ukraine

### ABSTRACT

Steady-state oscillations of an elastic quarter space with one fixed face and an acting harmonic compressive load distributed over a rectangular area on the other face are under consideration. The aim is to analyze the amplitude of the vertical displacements of the quarter space's edge where the load is acting, depending on the material of the medium, shape of the load section and values of the natural frequencies of the external force. New method, proposed by Popov G.Ya., which is based on the introducing two new functions, expressed through sum and difference of the displacements' derivatives, was implemented here. Motions equations are separated into the system of two equations and one independently solved equation. Boundary conditions are also separated. Integral Fourier transforms are applied sequentially to the equations and boundary conditions in contrast to the traditional approaches when integral transforms are applied to the solution's representations through harmonic functions. This leads to the one-dimensional vector inhomogeneous boundary value problem with respect to unknown displacement's transformant. The problem is solved using a matrix differential calculus. Using a method of orthogonal polynomials, a singular integral equation obtained in the process, is solved with reducing it to the infinite algebraic system of the 1<sup>st</sup> kind. The original vertical displacement is found after an application the inverse integral transforms.

**Keywords:** Elastic quarter space, integral transform, vector boundary problem, matrix differential calculus, integral equation, orthogonal polynomials

6.

## ASSESSING INDOOR AIR QUALITY: EMPIRICAL MEASUREMENTS IN A DESIGN STUDIO ENVIRONMENT

Tugce PEKDOGAN

Faculty of Architecture and Design, Department of Architecture, Adana Alparslan Turkes Science and Technology University, Adana, Turkiye

### ABSTRACT

This study aims to evaluate indoor air quality parameters during an exam in an architectural design studio. Temperature, humidity, CO<sub>2</sub>, and noise levels were recorded using a TESTO 435 multifunctional meter during the 4- hour exam with 70 students. Indoor and outdoor measurements were compared, and the classroom was analyzed on indoor quality parameters. The results show that the classroom CO<sub>2</sub> concentrations start from 1180 ppm and go up to 1220 ppm, above the maximum recommended limits. Temperatures ranged from 24.5°C to 25.8°C, relative humidity ranged from 49.7% to 52.4%, and noise levels were measured from 48 to 66 dB. Outdoor measurements showed CO<sub>2</sub> levels ranging from 440 to 532 ppm and a constant temperature of 18.9°C. The relative humidity ranged from 50.1% to 58.1%, while the noise level was recorded at 53 dB for the outdoor environment. These measurement data provide a comprehensive assessment of the air quality of the classroom environment and inform the design of learning environments. The study's findings are expected to contribute to improving ventilation systems and developing strategies to reduce the impact of learning environments on human health.

**Keywords:** Indoor Air Quality, Carbon Dioxide Concentration, Thermal Comfort, Environmental Quality

7.

## A NEW METHOD FOR SPERM QUANTIFICATION IN THE AFRICAN MALARIA MOSQUITO ANOPHELES GAMBIAE

Nakiru Ekechukwe

Faculty of Science, University of Nigeria, Nigeria

### ABSTRACT

Advancements in the field of mosquito reproduction have led to the development of a novel method for quantifying sperm in the African malaria mosquito, *Anopheles gambiae*. This study presents a refined approach that aims to enhance the accuracy and reliability of sperm enumeration, a critical component in understanding the reproductive biology of this important vector species. The proposed technique employs a combination of cutting-edge microscopy and innovative analytical procedures, enabling researchers to gain deeper insights into the factors influencing sperm production and transfer within this mosquito population. The findings of this research hold the potential to contribute to the ongoing efforts to combat malaria, by informing strategies for effective vector control and population management.

8.

## INNOVATIONS IN WAREHOUSE LOGISTICS: ANALYSIS AND PROSPECTS

Andriy SLUSAR<sup>1</sup>, Sofia KRUSTALOVA<sup>1</sup>, Kyrlo KRUSTALOV<sup>1</sup>  
Shakhin OMAROV<sup>1</sup>

<sup>1</sup>Department of Computer-Integrated Technologies, Automation and Mechatronics, Faculty of Automation and Computerized Technologies, Kharkiv National University of Radio Electronics, Kharkiv, Ukraine

### ABSTRACT

The article analyzes the progressive development of warehouse logistics and the ways to achieve it, in particular with the help of robotics, Big Data, electronic data interchange technology and additive technologies. The importance of warehouse logistics for companies and its impact on costs is emphasized. The main global trends and their impact on the financial result and quality of services are analyzed. An overview of various types of innovative development is provided, including their advantages, disadvantages, and prospects for use in warehouse infrastructure.

**Keywords:** warehouse logistics; innovative developments; automation; digital technologies.

9.

## SYNTHESIS AND CHARACTERIZATION OF THIAZOLE DERIVATIVES WITH BIS(2-METHOXYETHYL) MOIETY

Dilek BAYRAMIN<sup>1</sup>, Gülsiye ÖZTÜRK<sup>2</sup>

<sup>1</sup> Department of Chemistry, The Graduate School of Natural and Applied Science, Dokuz Eylül University, Tinaztepe Campus, Izmir, Turkey

<sup>2</sup> Department of Chemistry, Faculty of Sciences, Dokuz Eylül University, Tinaztepe Campus, Izmir, Turkey

### ABSTRACT

Thiazoles or 1,3-thiazoles form the class of 5-membered heterocyclic compounds with a nitrogen and sulfur atom and also C=N group on them. Thiazoles are found in the structure of biologically active natural compounds and they are obtained by synthesis due to their wide various applications areas. Due to its wide range of pharmacological effects and versatility in thiazole ring synthesis, it has attracted interest in medical chemistry by acting as both natural and synthetic compounds.

In this study, new thiazole compounds containing sulfonamide group as an electron withdrawing group and bis(2-methoxyethyl) group as an electron donor group were synthesized. A three-step synthesis method was optimized using methods in the literatures. Sulfonamide intermediate compounds were synthesized with disubstitue amine which is bis(2-methoxyethyl)amine and monobrominated intermediates were synthesized with the reaction of bromine. Then thiazole derivatives were obtained as a result of Hantzsch thiazole synthesis reaction with thiourea derivatives. The novel thiazole derivatives were purified by extraction and column chromatography and their molecular structure were determined by FT-IR, <sup>1</sup>H-NMR, <sup>13</sup>C-NMR and mass spectroscopy. In addition, fluorescence quantum yields were calculated by measuring the absorption and emission parameters of the synthesized novel thiazole compounds and their photophysical properties were examined in the eight different polar solvents. The remarkable fluorescent properties of the synthesized novel thiazole derivatives were determined by using the photophysical properties.

**Keywords:** Thiazoles, 1,3-thiazoles, heterocyclic compounds, sulfonamide, Hantzsch thiazole synthesis



## 10. QUANTUM COMPUTATIONAL INVESTIGATION of L-QUEBRACHITOL and D-PINITOL ISOMERS

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### ABSTRACT

L-Quebrachitol, found in high concentration in rubber trees (*Heava brasiliensis*), is a natural plant product that is easily isolated from latex wastewater. It is a compound used by diabetic patients as a sweetener and also has antioxidant properties. By protecting the body from the harmful effects of free radicals, antioxidants can reduce cellular damage and reduce the risk of various diseases. Some research shows that L-Quebrachitol has anti-inflammatory properties. The D-Pinitol compound also has properties that increase insulin sensitivity and its use in the treatment of such diseases has been proven in many studies. Also, it has anti-inflammatory and antioxidant properties. L-Quebrachitol and D-Pinitol compounds, whose structures are isomeric, are both natural sugar alcohols.

In this study, the structures of these two isomeric compounds, which contain such important information, were tried to be elucidated. Using the optimized structures of both compounds, the vibration frequencies were obtained by density functional theory (DFT) method with the DFT B3LYP/-311++G(d,p) basis set. Charges of atoms and their electronic structures were explained using the NBO method. The excited state energies were calculated using Time-Dependent Density Functional Theory (TD-DFT) calculations.

Keywords: L-Quebrachitol, D-Pinitol, DFT/TD-DFT, NBO method.

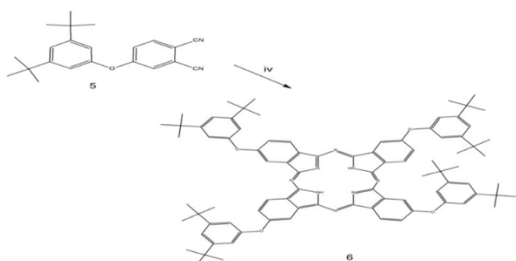
## 11. PERIPHERALLY SUBSTITUTED PHTHALOCYANINES AND THEIR METAL COMPLEXES - SYNTHESIS AND PHYSIO-CHEMICAL PROPERTIES FOR PHOTODYNAMIC THERAPY OF CANCER

Sule Yüksel<sup>1</sup>, Lili Arabuli<sup>2</sup>, Mevlude Canlica<sup>1</sup>

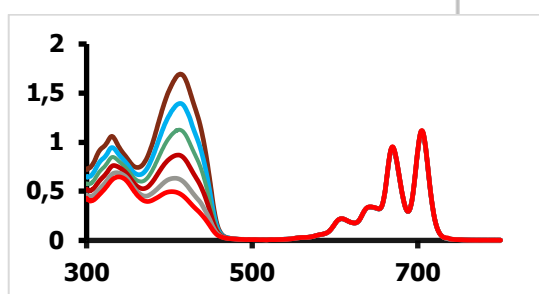
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### ABSTRACT

Photodynamic Therapy (PDT), as an alternative of traditional chemo and radiotherapy is becoming a more prospective cancer treatment method with repeated usage avoiding toxic side effects and damaging health tissues and cells [1-3]. The constituent parts of the PDT are photoactive (photosensitive) drug molecule, light absorbance at a definite wavelength (in red region) and molecular oxygen [4,5]. The mechanism of this treatment is based on the light excitation of the photosensitive molecule from its ground state to triplet state (via singlet excited state), followed by interaction with the molecular oxygen present in the tissues and finally, production of singlet oxygen (<sup>1</sup>O<sub>2</sub>) [6], a reactive specie cause cancer cell killing. Functionalization of phthalocyanines by various substituents remains one of the priorities in research, as it affects (photo)physical and chemical properties of the compounds. Phthalocyanines armed with electron-donating tert-butyl groups have attracted high interest as they found applications in photodynamic therapy and many other fields. By attaching tert-Bu groups significantly increases solubility and stability of phthalocyanines or metallo-phthalocyanines in various solvents and minimal aggregation is observed, which itself widens their application area. The properties and activities vary in localization of substituent groups and types (peripheral, non-peripheral, symmetric, asymmetric, etc), central metals and/or in combination both of them, as well as functionalized by supporting materials. Even the change of position of the same substituent group/s reflects a different picture. Early it was reported on the photophysical and photochemical properties of tetrasubstituted 3,5-di-tert-butylphenoxy containing phthalocyanines and the target precursor was 3-(3,5-di-tert-butylphenoxy)phthalonitrile (substitution in non-peripheral position). Here we present metal free and metal containing (Mg and Zn) phthalocyanines (Scheme 1) with the same substituents at peripheral location and show how it reflects in photophysico-chemical properties (scheme 2) in comparison of previous ones. Thus, 4-(3,5-di-tert-butylphenoxy)phthalonitrile has been as a starting material in the synthetic route.



Scheme 1. Preparation of new phthalocyanines



Scheme 2. Singlet oxygen production of compounds

**Keywords:** phthalocyanines, singlet oxygen, photodegradation, photodynamic therapy

12.

## A METHOD OF EXAMINING THE SEQUENCING MODELS OF SYMMETRIC STRUCTURES

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### ABSTRACT

The study of symmetric structures necessitates a rigorous examination of their sequencing models. This endeavor requires a methodical approach that encompasses the analysis of the underlying patterns and relationships within these structures. By employing a systematic framework, researchers can effectively uncover the intricate dynamics governing the sequential arrangements of symmetric architectures, paving the way for a deeper understanding of their fundamental principles and practical applications.

Keywords: Symmetric structures, Sequencing models

13.

## WASHING OF CONTAMINATED SOIL USING THERMAL ENERGY

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### ABSTRACT

The washing of contaminated soil using thermal energy is a process that involves applying heat to soil in order to remove pollutants and contaminants. This method is often used to clean up sites that have been contaminated with chemicals, oil, or other hazardous substances. By heating the soil, the contaminants are volatilized and can then be removed through various treatment methods such as vapor extraction or chemical reaction. Utilizing thermal energy for soil remediation can be an effective and efficient technique to restore contaminated sites to their original state. However, it is important to consider the potential environmental impacts of this approach, as well as the cost and energy requirements associated with the treatment process.

Keywords: Thermal energy, Contaminated soil

14.

## IMPLEMENTATION OF A FORCED HELMHOLTZ-DUFFING OSCILLATOR TO MONITOR ENERGY DISSIPATION PROCESS UNDER VAN DER WAALS FORCES

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### ABSTRACT

The present study introduces a novel theoretical framework to observe energy dissipation during the interaction of an Atomic Force Microscopy (AFM) micro-cantilever with Van der Waals forces. A forced Helmholtz-Duffing oscillator with monomodal and multimodal excitation schemes is used to predict the dynamic responses of the micro-cantilever. The energy quantities such as virial and dissipated power are calculated analytically by utilizing the deflection amplitudes, phase shifts, and other system parameters at the eigenmodes in AFM studies. As a novelty of this current work, the energy quantities for the first three vibrational modes are obtained by determining the approximate integrals using the trapezoidal method with unit spacing. In general, the virial and dissipated power variables are used to express the energy dissipation process in the presence of Van der Waals loads acting on the micro-cantilever tip. In the present work, the driving force signals to resonate the micro-cantilever are generated based on the free oscillation amplitude of 0.3 nm while obtaining deflections at the first eigenmode. The simulation results demonstrate that the trimodal excitation provides the highest deflection sensitivity (around 5 pm) to Van der Waals force for the first eigenmode. In addition to that, the resonant micro-cantilever dissipates the highest energy in the range of 0 -  $1.1 \times 10^{-12}$  W at the second resonant frequency in trimodal operations. Higher energy dissipates from the micro-cantilever driven by larger excitation forces in a multi-frequency operation. Thus, in this current study, the forced Helmholtz-Duffing oscillator is implemented to observe the energy dissipation from the resonant micro-cantilever under Van der Waals forces.

**Keywords:** Energy dissipation process, Helmholtz-Duffing oscillator, AFM micro-cantilever, Van der Waals force

## STUDY OF THE RADIATION DETECTION EFFICIENCY AND RESOLUTION PROPERTIES OF A PEROVSKITE CsPbBr<sub>3</sub> SINGLE-CRYSTAL BY MEANS OF EGS4

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### ABSTRACT

In this study, the efficiency and resolution behavior of the perovskite CsPbBr<sub>3</sub> single-crystal was studied for 59.5 keV X-ray and 122, 300 and 662 keV gamma-ray detection. An acid (HBr) based temperature lowering method was used for the production of the perovskite single-crystal as it produces purer and less defective crystals. As a result of the crystal growth synthesis, a CsPbBr<sub>3</sub> material with a length of 10 mm and a thickness of 2 mm was obtained. The density of the synthesized sample was determined to be 4.84 g cm<sup>-3</sup> by the Archimedes method in water. The perovskite single-crystal showed single-crystal direct band gap semiconductor behavior as was concluded by XRD, DR-UV-Vis-NIR and DSC measurements and, hence, was concluded to be a candidate X- and gamma-ray detector. The material's detector efficiency and resolution were calculated using the EGS4 Monte Carlo simulation method for different single-crystal sizes. Calculations were based on one million photons in the energy range of 10 keV to 1 MeV. Resolution values were calculated from the efficiency-energy plot by dividing the full width at half maximum (FWHM) by the corresponding energy value. As a result of the calculations, resolution values for a 10x10x5 mm crystal were determined to be 4.4%, 4.7% and 6.0% for 300, 122 and 59.5 keV, respectively. The efficiency behavior of the produced crystal was compared with the performance of detectors currently widely used for X-ray and gamma-ray detection. The resolution values obtained agree with the results of experimental studies available in literature for low energies. However for higher incident photon energies (662 keV), it was concluded that the crystal size needed to be increased in order to obtain similar and/or higher efficiency values.

**Keywords:** Radiation Detector, Perovskite Single-crystal, CsPbBr<sub>3</sub>, Efficiency, Resolution, and EGS4

## LASER SPECTROSCOPIC INVESTIGATION OF NEW ENERGY LEVELS OF ATOMIC HOLMIUM IN THE RANGE FROM 690 nm TO 830 nm

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### ABSTRACT

Accurate experimental data on the structure of complex atoms are in high demand in physics, especially in astrophysics. Holmium is a rare earth metal belonging to the lanthanides. It has only one stable isotope, <sup>165</sup>Ho. This isotope has a nuclear spin of  $I = 7/2$  and relatively large nuclear magnetic dipole and electric quadrupole moments. With an unfilled 4f electron shell Ho has very complex spectra. These properties make it a good candidate for the search for new energy levels as well as for the analysis of the hyperfine structure (hfs) and the determination of the corresponding magnetic dipole and electric quadrupole hfs constants,  $A$  and  $B$ , respectively. The atomic database of Ho has been significantly expanded since the 1970s. In the past six years, several publications have reported the discovery and investigation of new energy levels of Ho I [1-6]. Despite numerous publications, experimental data is still missing for many theoretically predicted levels.

We present the investigation of the Ho I spectrum in the wavelength range from 690 nm to 830 nm using laser induced fluorescence and optogalvanic spectroscopic methods. The outcome of the investigation of 35 spectral lines led to the discovery of a total of 16 new energy levels with 11 levels of odd and 5 levels of even parity. The hfs 'fingerprints', two examples of which can be seen in Figure 1, were very helpful in the discovery process. The hfs constants  $A$  and  $B$  were determined for all newly discovered energy levels. Confirmation and the accuracy of the identification of newly discovered levels were achieved by carefully analysing 60 lines from previously measured Fourier transform spectra.

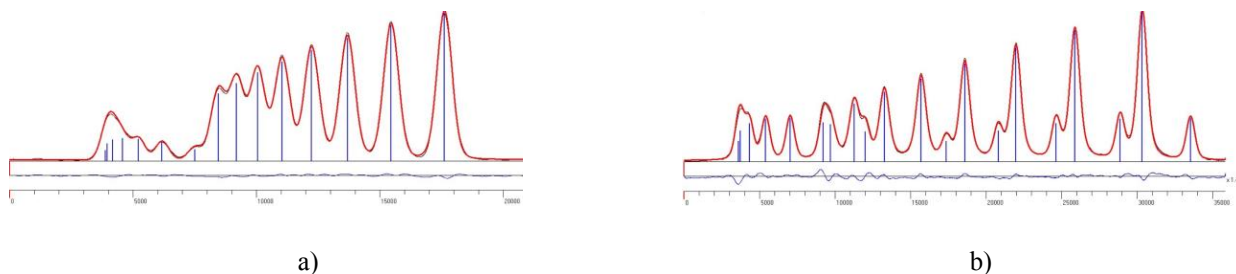


Figure 1: Examples of hyperfine structure 'fingerprints'; lines at a)  $\lambda_{\text{air}} = 721.864 \text{ nm}$ ; b)  $\lambda_{\text{air}} = 767.574 \text{ nm}$ .

**Keywords:** Atomic data, laser spectroscopy, fine structure, new energy levels

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## 17. AMMONIA ADSORPTION CAPACITIES OF NATURAL AND ACID TREATED ZEOLITE

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### ABSTRACT

In this study, ammonia ( $\text{NH}_3$ ) adsorption capacities of clinoptilolite-mordenite-rich tuff (Z) obtained from Turkey and their acid-treated forms (Z-H, Z-N and Z-S) were investigated.  $\text{NH}_3$  adsorption capacities of all samples were determined using Micromeritics 3Flex volumetric instrument at 298 K up to 100 kPa. Zeolites are hydrated aluminosilicates with three-dimensional framework constructed from  $\text{SiO}_4$  or  $\text{AlO}_4$  tetrahedra joined by sharing common oxygen atoms. The net negative charge due to the substitution of  $\text{Si}^{4+}$  by  $\text{Al}^{3+}$  in tetrahedral positions is balanced by the exchangeable  $\text{K}^+$ ,  $\text{Na}^+$  and  $\text{Ca}^{2+}$  cations within these pores. Silica rich and relatively acid-stable zeolites such as mordenite and clinoptilolite can be directly treated with acid solutions ( $\text{HCl}$ ,  $\text{H}_2\text{SO}_4$  and  $\text{HNO}_3$ ) to improve the characteristics of natural zeolites. Natural clinoptilolite-mordenite-rich zeolite was treated with 1 M acid solutions of  $\text{HCl}$ ,  $\text{H}_2\text{SO}_4$  and  $\text{HNO}_3$  at 70 °C for 4 h. The zeolite samples were characterized using Fourier transform infrared spectroscopy (FT-IR), scanning electron microscopy with detector x-ray energy dispersive (SEM-EDX) and nitrogen adsorption methods.  $\text{N}_2$  adsorption isotherms at -196 °C were obtained on Micromeritics 3Flex adsorption instrument. The acid treatment of natural zeolite leads to increase of the micropore volume and specific surface area thus increasing the adsorption capacities of acid treated zeolites. Specific surface area of the samples was measured from the adsorption isotherms according to the Brunauer – Emmett – Teller (BET) method. The micropore area and volume was determined using  $t$ -plot method. It was found that the adsorption capacity and the affinity of  $\text{NH}_3$  with zeolite samples increased as  $\text{S-Z} < \text{N-Z} < \text{H-Z} < \text{Nat.-Z}$  for 298 K. Capacity of zeolites for  $\text{NH}_3$  ranged from 4.985 mmol  $\text{g}^{-1}$  to 5.305 mmol  $\text{g}^{-1}$ .

**Keywords:** Natural zeolite, Ammonia, Nitrogen, FT-IR, SEM-EDX

18.

## STANDARD KARYOTYPE OF *SQUALIUS KOSSWIGI* (KARAMAN, 1972)

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### ABSTRACT

There are Twenty-three *Squalius* species distributed in Türkiye. *S. kosswigi* (Karaman, 1972) is an endemic species distributed in Gümüldür, Şaşal and Bulgurca streams in the Küçük Menderes River Basin. In this study, samples were collected from Gümüldür and Şaşal streams. The karyological preparation was prepared. Standard giemsa staining was applied to the resulting slides. At least 10 well-spread metaphase plates were analysed. Chromosomes were classified. The diploid chromosome number (2n) of *S. kosswigi* is 50 and the number of chromosome arms (FN) is 92. Its karyotype consists of eight metacentric, nine submetacentric, four subtelocentric and four acrocentric autosome pairs (2n=8m+9sm+4st+4a). No heteromorphic sex chromosomes were detected in the samples studied. The chromosome morphology of *S. kosswigi* is similar to the results of other *Squalius* species studied in Anatolia. We believe that the standard karyotype results of *S. kosswigi*, which was revealed for the first time in this study, will contribute to the cytotaxonomy of other *Squalius* species in Anatolia and Europe.

**Keywords:** Chromosome, Cytogenetic, Striped Chub, Türkiye

19.

## EFFECT ON THE HISTOLOGICAL PARAMETERS OF THE *PELARGONIUM SIDOIDES* ROOT EXTRACT EPs 7630 IN THE METHOTREXATE-INDUCED MUCOSITIS\*

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### ABSTRACT

Cancer is the term for the disease in which abnormal cells divide uncontrollably and can invade nearby tissues. These extra cells can divide constantly and form growths called tumors. Mucositis is an important acute clinical problem resulting from the cytotoxic effects of cancer chemotherapy and radiotherapy. This condition can affect the mucosa of the entire digestive tract, causing mouth and throat pain, ulceration, abdominal pain, bloating, vomiting and diarrhea, depending on the target tissue. Mucositis is extremely common, occurring in approximately 40% of all patients following standard doses of chemotherapy. Chemotherapeutic drugs rapidly affect the dividing cells and epithelium of the target tumor, as well as affecting inflammation and healing responses. Mucositis is a complex pathology. Mucositis most commonly develops after the use of methotrexate, 5-fluorouracil, doxorubicin and daunorubicin. Mucositis is not only an epithelial change but also a process in which apoptosis is triggered by reactive oxygen radicals, transcription factor activations and an increase in cytokines such as TNF- $\alpha$  and IL-6. *Pelargonium sidoides* a member of the family Geraniaceae, is native to coastal areas of southern Africa. *Pelargonium sidoides* has a long-standing tradition in the treatment of diseases. In the first half of the 20th century, a product made from the root (Umckaloabo) was used successfully in Europe to treat tuberculosis. Various metabolites, including phenolic and cinnamic acids, tannins, flavonoids and coumarins, have been identified in *Pelargonium sidoides*. EPs 7630 (Umckaloabo), an ethanolic root extract of *Pelargonium sidoides* roots, has known antibacterial, antiviral and immunomodulatory properties. In this study, the effect of *P. sidoides* on histopathological parameters in the MTX-induced mucositis model was investigated. For this purpose, the experimental groups were designed as Control, Methotrexate (MTX) group, *Pelargonium sidoides* root extract group and Methotrexate (MTX) + *Pelargonium sidoides* root extract group. To create a mucositis model in the experimental groups, MTX was administered at 20 mg/kg i.p. for single dose and *P. sidoides* was administered at the dose of 4.5 mg/kg for 7 days by gavage. Stomach, intestine and colon tissues were taken from all experimental groups, stained with appropriate methods and scored histopathologically. In the MTX group, histopathological changes which significant granular degeneration in the intestine such as leukocyte infiltration, crypt abscess, and crypt epithelial damage in the mucosa were noted. Resolution of the damage of the small intestine in the MTX+PS treatment groups was observed. We observed that in the MTX+PS group, microscopic colon sections showed an improvement in epithelial structure and minimal cellular damage compared to the MTX group. Gastric tissue samples from the MTX group showed epithelial degeneration and infiltration with leukocytes, primarily lymphocytes. Moderate epithelial degeneration and partial disruption of gastric gland regulation were observed in the MTX+PS group.

In conclusion, it has been demonstrated that *P. sidoides* causes improvements in histopathological scores in the MTX-induced mucositis model.

**Keywords:** *Pelargonium sidoides*, methotrexate, mucositis, histopathology.

\*This study was supported by Erciyes University, Scientific Research Projects Unit (Project No: FDK-2019-9280). This proceeding is derived from Reyhan ZOROĞLU's PhD dissertation entitled "Effect of *Pelargonium sidoides* Root Extract EPS 7630 in Methotrexate-Induced Models", conducted under the supervision of Nusret AYYILDIZ and Abdulkadir TAŞDEMİR.

## CONTROL OF MULTINOMIUM PRODUCTION TECHNOLOGY PROCESSES

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### ABSTRACT

Technological processes (TP) serve as the material basis to produce new equipment, and therefore one of the ways to increase production efficiency is to develop and improve methods and means of TP control.

The constant complexity of products, the tendency to switch to small-scale, multi-nomenclature production under conditions of strict restrictions on costs and terms of development and re-adjustment of the equipment leads to the fact that the equipment is usually managed in conditions of a priori insufficiency. Uncertainty in the control process is also introduced by errors and incompleteness of measurement information, noise, heterogeneity of materials used, and drift of process equipment parameters.

In these conditions, qualitative information in the form of intuitive knowledge and experience of the technologist becomes important in the management of the manufacturing process. The role of such information at the stage of development of the product manufacturing process and in the conditions of small-scale production can hardly be overestimated. The use of qualitative information allows the management model to take into account the complex internal interrelations of the technological object under study. Thus, a new type of uncertainty arises in the tasks of managing the manufacturing process, which requires formalization - fuzzy information.

The main content of the TP control algorithm is a mathematical model of the process, so under conditions of uncertainty, the issue of building adequate mathematical models is particularly acute.

A model of phase-trajectory control of the TP to produce new equipment has been developed, which allows adjusting the TP modes depending on the current state of the technological object. The developed model of phase-trajectory control is adaptive to changes in operating conditions and process characteristics and works under a priori insufficiency and/or fuzziness of information.

The proposed model for constructing a family of trajectories allows for real-time control of the vehicle. If the base trajectory is known, and for some reason (external disturbances) the state of the system is different from the expected one, a new trajectory is chosen that will lead our system to the goal or its vicinity. The control algorithm is reduced to a step-by-step correction of the TP modes by minimizing the difference between the current state and the acceptable solution at this stage.

The peculiarity of the proposed model of phase-trajectory control of the TP is the fundamental possibility of designing control strategies for several potentially possible groups of products at once, which makes it possible to identify the process stages common to all groups in conditions of multi-nomenclature production. The use of the model makes it possible to reduce the number of control decisions, as well as to decide on the feasibility of adjusting the modes of certain operations.

**Keywords:** phase-trajectory control, technological process, multi-assembly production, fuzzy information.

## CLOUD COMPUTING TECHNOLOGY SUPPORTED METHOD RECOMMENDATION FOR EFFECTIVE CORPORATE INTERNAL EVALUATION REPORT WRITING PROCESS

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### ABSTRACT

Higher education institutions are obliged to submit periodic reports to the Higher Education Council and the Higher Education Quality Board, to which they are affiliated and responsible, within the framework of the determined criteria. One of these reports is the Institutional Internal Evaluation Report. The internal evaluation report writing process of the institution is considered as an important opportunity to spread the quality culture to the base. In the process, it is very important to embrace the report along with the dynamics that use the institution's own possibilities and capabilities in order to be inclusive and integrated. The relevant study aims to integrate cloud computing technologies into the learning process regarding the effective internal evaluation report writing process. In line with this purpose, an application with a strong pedagogical infrastructure integrated with a method based on the dissemination of the institutional quality culture with the design of a technology-supported and intensely interactive learning environment is put to work. The results obtained indicate that quality assurance processes provide effective reporting skills about the proposed method.

**Keywords:** Cloud computing technologies, training, integration, quality assurance system, internal evaluation report.

22.

**EFFECTIVE STRUCTURING OF TEACHING PROCESSES  
DEVELOPED WITHIN THE SCOPE OF THE PLANNING CYCLE IN THE PROCESSES  
REVIEW OF OPINIONS TOWARDS WEB-BASED SYSTEM**

Aslı KAYA-KARAKÜTÜK<sup>1</sup>, Fatih FIRAT<sup>2</sup>, Emre ÇAM<sup>3</sup>, Nazire Burçin HAMUTOĞLU<sup>4,\*</sup>  
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**ABSTRACT**

This study aims to examine the opinions of faculty members about the web-based system developed within the scope of the Planning stage of the PUKÖ cycle, which is operated to ensure quality assurance in the effective structuring of teaching processes. The participants of the study consist of Eskişehir Technical University Quality Commission Members and faculty members who have earned the right to receive a certificate by participating in the Teaching Competency Program operating within the scope of Learning and Teaching Development. The web-based system developed within the framework of the Rapid Prototyping Model consists of 2 modules: Event Process Management and Course Process Management module. By contributing to the planning of the learning and teaching process; By operating the quality assurance system in the execution, reporting and dissemination of activities and courses to be carried out in line with the objectives, targets and performance indicators within the scope of the Strategic Plan to which the activities are related; This study, which aims to contribute to reporting processes at the national level within the framework of YÖK and YÖKAK criteria by creating institutional memory in evaluation and improvement processes, is the output of the research project no. 23ADP032. Based on the importance of the concept of "data" today; effective planning of the activities carried out; It is envisaged that effective reporting of corporate processes will support creating a competency mechanism that also frames the individual on the axis of quality.

Keywords: Competence in teaching, total quality management, PDCA, quality assurance

23.

**DETERMINATION OF THE EFFECT OF THERMAL CONDUCTIVITY, COOKING FUNCTION, AND  
PULSATION ON OVEN ENERGY CONSUMPTION**

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**ABSTRACT**

There are various factors that influence the energy consumption of a built in oven. In this study, the aim is to statistically analyze the effect of thermal conductivity, the cooking function and the pulsation on the oven's energy consumption among the factors. In this context, an experimental design is employed in collaboration with an R&D center of a company in Eskişehir within the TÜBİTAK 1505 project, and the necessary data is obtained from these experiments. Since each of the main factors has two levels, the statistical analysis was performed using a 2x2x2 factorial design. The analysis results are shown that some main factors and interactions are statistically significant. This result indicates that instead of considering a component for energy consumption alone, the interaction of multiple components should also be taken into account simultaneously.

Keywords: Built in oven, Energy consumption, Factorial design.

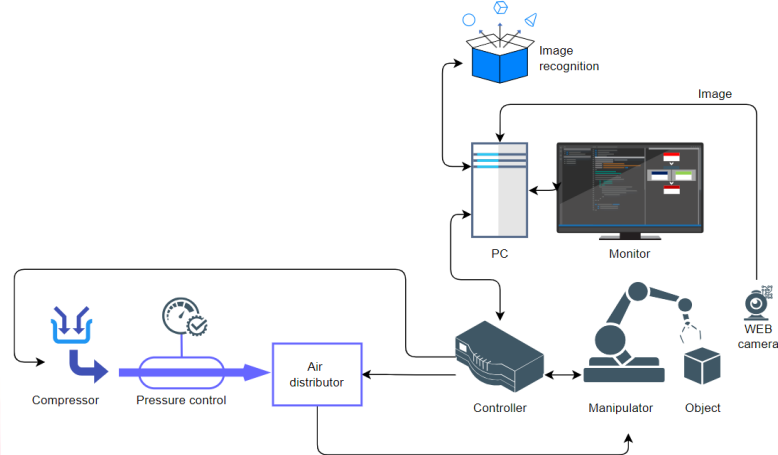
24. **A METHOD OF SORTING PARTS IN AN INTELLIGENT FACTORY BASED ON A MANIPULATOR WITH A PNEUMATIC GRIPPER IN COMBINATION WITH A COMPUTER VISION SYSTEM**

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**ABSTRACT**

This work presents the results of research in the field of automation of technological processes at a modern intelligent factory. A solution for improving the method of sorting parts on a production line using a manipulator with a pneumatic gripper in combination with a computer vision system is described. An analysis of the pneumatic scheme of the parts distribution station is carried out, the main pneumatic units of the production line are shown. Selected components for building a layout of an automated system for sorting parts on a production conveyor. Experimental studies were conducted to confirm the correctness of theoretical solutions. The model uses a manipulator with three degrees of freedom and a vacuum grip. The program uses the OpenCV library to perform the task of recognizing parts on the assembly line. Experimental studies have shown the correctness of the developed layout and program.



**Figure 1.** Automated system for sorting parts on the production line

**Keywords:** Computer vision, conveyor, pneumatic gripper, Industry 4.0, Open CV.

25. **ON THE RELATIONSHIP BETWEEN COOKING FUNCTION AND THE UPPER HEATER WITH OVEN ENERGY CLASS LABELS**

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**ABSTRACT**

Ovens produced in the household oven manufacturing sector are classified according to certain energy labels based on European Union standards. One of the main aims in oven manufacturing is to develop new oven models that consume minimal energy. Therefore, one of the most important objectives of an R&D center is to select the components used to make the best use of built in ovens and to ensure optimum efficiency from the components used in the ovens. This study aims to reveal the effect of different cooking functions used in ovens and the upper heater on oven energy class labels through a statistical analysis. The data used in the statistical analysis process is obtained from experiments conducted within the scope of the TÜBİTAK 1505 project carried out in collaboration with an R&D center of a company in Eskişehir. Since the variables included in the analysis are categorical, a three-way Chi-square test is conducted. The findings indicate a relationship between the upper heater and oven energy class labels for different cooking functions.

**Keywords:** Built in oven, Energy class label, 3-way chi-square test.



26.

## EVALUATION OF THE HEMOLYTIC EFFECT OF *RHAMNUS ALATERNUS*

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### ABSTRACT

Our work focused on the phytochemical and biological study of three extracts and essential oil from the aerial parts of an Algerian medicinal plant, *Rhamnus alaternus*. The phytochemical study, carried out on the three extracts using solvents of different polarities (aqueous, ethanolic, and hydroalcoholic) prepared under reflux, highlighted the richness of this plant in secondary metabolites, particularly tannins, flavonoids, saponins, alkaloids, and heterosides.

Based on these findings, we were interested in the biological study and evaluation of two biological activities of this plant. Firstly, we studied the antioxidant activity of *Rhamnus alaternus*, using two methods, namely the DPPH free radical scavenging assay and the FRAP iron-reducing capacity assay, which showed that all the plant extracts and its essential oil have antioxidant activity and iron-reducing capacity. Secondly, we studied the cytotoxicity of this plant by evaluating the hemolytic activity of the extracts in vitro against human red blood cells. The results showed that this plant has low toxic effects on human erythrocytes. The maximum hemolytic effect was obtained with the aqueous extract (6.38%) and the essential oil (10.52%).

**Key word:** *Rhamnus alaternus*, antioxidant activity, DPPH, FRAP, secondary metabolites, hemolytic activity

27.

## ANOMALY DETECTION IN RAILWAY IMAGES USING UNSUPERVISED CLUSTERING OF INFRARED THERMOGRAPHY

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### ABSTRACT

This paper presents a novel system for the unsupervised detection of anomalies in railway images using infrared thermography. The system comprises three main stages: image preprocessing, feature extraction, and clustering. In the image preprocessing stage, the infrared images are enhanced and normalized to improve the subsequent feature extraction. In the feature extraction stage, a set of relevant features is extracted from the preprocessed images. Finally, in the clustering stage, unsupervised clustering algorithms are employed to group the extracted features into different clusters, each representing a specific anomaly type. The proposed system is evaluated on a real-world dataset of railway images captured by a thermal camera. The experimental results demonstrate the effectiveness of the proposed system in detecting various types of anomalies with high accuracy.

**Keywords:** Anomaly detection, Infrared thermography, Railway images, Unsupervised clustering.

## IN VITRO EFFECTS OF LUTEOLIN ON THE TOXICITY OF ACRYLAMIDE IN LEYDIG CELLS

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### ABSTRACT

Acrylamide, one of the heat-induced food contaminants, is a white, odorless, and crystalline compound. Acrylamide is formed as a result of the Maillard reaction, which occurs in carbohydrate-rich foods at temperatures of 120 °C and above, such as frying, baking, and roasting. In addition, acrylamide is widely used industrially in areas such as paper production, dye synthesis, and wastewater treatment. Exposure to acrylamide is inevitable due to the frequent consumption of acrylamide-containing foods such as french fries, potato chips, bread, coffee, biscuits, and pastries around the world. Recent years have seen an increase in the number of studies examining the potential health effects of acrylamide. As a result of these studies, it has been shown that acrylamide exposure causes neurotoxicity, hepatotoxicity, and genotoxicity and also negatively affects the reproductive system. To eliminate the detrimental effects of acrylamide produced during food processing, it is preferable to use dietary supplements with a high antioxidant capacity. Antioxidants play a crucial role in mitigating oxidative stress, cytotoxicity, genotoxicity, and carcinogenicity stemming from toxic substances in cells. Luteolin is a member of the flavone group of flavonoids with antioxidant properties found in various plant species. Studies have found that luteolin prevents carcinogenicity, reduces oxidative damage by increasing the activity of enzymatic antioxidants, prevents genotoxicity by reducing DNA damage, and inhibits apoptosis. The study examined the therapeutic properties of luteolin in counteracting the detrimental effects of acrylamide on TM3 Leydig cells, which are crucial components of the male reproductive system. In this study, a single concentration of acrylamide (1 mM) and/or two concentrations of luteolin (1 µM and 5 µM) were applied to TM3 Leydig cells for 24 hours. To determine the potential protective effects of luteolin against the damage caused by acrylamide on Leydig cells, cytotoxicity, oxidative damage parameters, apoptotic cell rates, and expression levels of genes related to apoptosis were examined. The findings indicate that acrylamide was found to enhance cytotoxicity, reduce the activity of enzymatic antioxidants, and trigger apoptosis. However, it was observed that luteolin exhibited therapeutic effects at the cellular level, neutralizing the damage produced by acrylamide. Thus, it was concluded that luteolin could be used as a powerful antioxidant against the toxicity caused by acrylamide in TM3 Leydig cells.

**Keywords:** Acrylamide, apoptosis, cytotoxicity, Leydig cells, luteolin, oxidative damage.

## NEURONAL LOSS OF PERINEURONAL NETS IN RESPONSE TO MICROGLIAL NLRP3 INFLAMMASOME ACTIVATION

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### ABSTRACT

Microglia have a central role in the upkeep of the central nervous system (CNS), providing support and sustenance to neurons. Their functions range from pruning synapses to clearing debris and eliminating pathogens, ensuring a healthy neuronal environment. However, chronic inflammation can disrupt this balance, leading to sustained microglial activation and potential damage to neuronal structures. Inflammasomes, particularly the well-studied NLRP3 inflammasome, play a significant role in triggering inflammatory responses in various CNS disorders and injuries. These multiprotein complexes respond to damaging or pathogenic molecular cues, initiating inflammatory pathways. In the CNS, perineuronal nets (PNNs) surround the somas of neurons and act as guardians of neuronal integrity, shielding neurons from oxidative stress and stabilizing synaptic connections. Inflammatory microglia have been shown to degrade PNNs, however the extent of the role of inflammasomes in this degradation has not been elucidated. Investigating the interplay between microglial inflammasome activation and PNN degradation holds promise for understanding and treating inflammation-associated CNS diseases. By coculturing murine neuronal and NLRP3-activated microglial cells with and without an NLRP3 inhibitor, we aimed to understand whether NLRP3 activation also has a significant role in PNN degradation. To this end, we differentiated the mouse neuroblastoma cell line N2a into mature neurons using retinoic acid; activated the NLRP3 inflammasome in the mouse microglial cell line N9 using lipopolysaccharide and adenosine triphosphate, with or without the NLRP3 inhibitor MCC950; cocultured the cells for 24 hours and analyzed changes to neuronal PNNs via immunofluorescence microscopy. We found that culturing neurons with NLRP3-activated microglia lead to a decrease in PNN-positive neuron number and that this decrease was reversed when NLRP3 activation was inhibited. Thus, our results indicate that NLRP3 activation could be a major player in inflammation-related degradation of PNNs.

**Keywords:** neuron, microglia, perineuronal nets, inflammation, inflammasome, NLRP3

### 30. CONSTRUCTING AN OPTIMAL ROUTE FOR A MOBILE ROBOT USING A WAVE ALGORITHM

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#### ABSTRACT

The article proposes the construction of an optimal route for a mobile robot using a wave algorithm. A mathematical description of the use of the wave algorithm is presented. The development of a program in Python is described. The authors describe the developed prototype of a mobile robot. Experiments have been carried out. The analyzed results show a fairly good speed of completion of the developed route.

**Keywords:** Mobile Robot, Route Construction, Wave Algorithm, Python, Manufacturing Innovation, Industrial Innovation.

### 31. OPTIMIZATION OF WORK: IN-DEPTH LOOK AT KANBAN, SCRUM AND LEAN

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#### ABSTRACT

This work examines three leading methodologies for optimizing production flows: Kanban, Scrum and Lean. Their key principles, practices, strengths, and areas of application are explored. A comparative analysis of these methods is carried out with focus on optimizing workflows, increasing productivity and quality. The features of Agile and Lean concepts, as well as their differences and common features, are studied. Recommendations are given on how to choose most appropriate methodology depending on production characteristics, production scale, production values and standards. The importance of continuous monitoring, adaptation and optimization of chosen approach throughout product life cycle is emphasized. General statistics on use of Kanban, Scrum and Lean in companies in period from 2019 to 2024 are presented. The work reveals practical aspects of effective use of these methodologies to achieve high competitiveness of production in market.

**Keywords:** Kanban, Scrum, Lean, method, comparison, analysis.

### 32. EVALUATING THE IMPACT OF VIRTUAL LABORATORIES

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Virtual laboratories have become an increasingly popular tool in the field of education, allowing students to conduct experiments and simulations in a digital environment. The impact of virtual laboratories on learning outcomes and student engagement is a topic of ongoing research and evaluation. Studies have shown that virtual laboratories can enhance students' understanding of complex scientific concepts and improve their technical skills. Additionally, virtual laboratories provide a flexible and interactive learning experience that accommodates different learning styles and preferences. However, it is important to continue evaluating the effectiveness of virtual laboratories in order to ensure that they are meeting the educational objectives and needs of students. By analyzing data on student performance and feedback, educators can make informed decisions about the integration of virtual laboratories into their curriculum.

33.

## FEATURES OF 3D PRINTING OF ORAL FILMS

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3D printing technology is revolutionizing the medical industry by offering personalized and efficient solutions for the production of medical devices, implants, and prostheses. This technology enables the creation of complex geometric shapes that were previously unachievable or impractical with traditional manufacturing methods, significantly enhancing the personalization of treatment while reducing both cost and production time. The development of new polymer materials is expanding the capabilities of this technology, improving the biocompatibility, mechanical properties, and biodegradability of materials. Techniques such as Stereolithography (SLA), Selective Laser Sintering (SLS), Digital Light Processing (DLP), Fused Deposition Modeling (FDM), and MultiJet Printing (MJP) are increasingly used to produce accurate medical prototypes. Despite the vast opportunities 3D printing technology offers for personalized treatment and medical device production, several critical challenges remain. Material safety is of paramount concern, as not all materials used are adequately tested for biocompatibility and compliance with medical standards. Ensuring high accuracy and quality in 3D printed products also presents significant challenges, particularly when scaling up production. Additionally, regulatory issues concerning the classification and certification of 3D-printed medical devices need more standardized and unified approaches. Another significant issue is the high cost associated with 3D printing technologies and materials, which can restrict their accessibility, especially in developing countries. However, ongoing software development and improvements in technological processes hold the potential to overcome these barriers, significantly expanding the role of 3D printing in healthcare.

34.

## POROUS GRAPHENE AEROGELS FOR PHOTOCATALYSIS-ASSIST METHYLENE BLUE REMOVAL FROM AQUEOUS SOLUTIONS

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### ABSTRACT

In the past few decades, organic and inorganic pollution due to immense discharge from anthropogenic activities is discharged into the soil and water environment. As one of the priority pollutants in the urban and industrial wastewater, methylene blue is widely present in printing and dyeing, textile, leather, paper, plastics, and other industries wastewater, usually difficult to be degraded and has unstable properties because of many polycyclic aromatic hydrocarbons in molecular structure. Wastewater containing methylene blue is discharged into the lake, which is very difficult to purify and highly likely to cause serious pollution. Catalysts are essential components for the treatment of air and water pollutants on the way to a sustainable and clean environment. As active heterogeneous catalysts for several catalytic and photocatalytic environmental remediation processes, aerogels made from diverse molecular precursors are well known. Because of this, aerogels have been viewed as a bridge bridging the nano and macroworlds, where the building blocks can both maintain their original features and develop new ones through their 3D interaction. Aerogels are particularly promising for photocatalytic applications due to their specific qualities. Aerogels have an incredibly high surface area, which provides many active sites for photocatalytic reactions to occur. This increased surface aerogel materials like graphene has encouraged the search for more mechanically stable and versatile aerogel photocatalysts. Aerogels have been explored and applied in various catalytic processes due to their unique properties and larger surface area. In this presented work, pure porous graphene aerogel materials were prepared via a supercritical-drying method. The structural, morphological, and physicochemical characteristics of the graphene aerogels were characterized by scanning electron microscopy (SEM), Fourier transform infrared (FTIR) spectroscopy, and Brunauer–Emmett–Teller (BET) analysis. The photocatalytic performance of the graphene aerogels was also analyzed by UV–visible spectrophotometer using ultraviolet light.

**Keywords:** Graphene Aerogel, photocatalysis, supercritical-drying, methylene blue

35.

## DETECTION OF HETEROSCEDASTICITY USING MACHINE LEARNING-BASED METHODS

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### ABSTRACT

Detecting the presence of changing variance in regression analysis is an important issue and is typically determined using graphical methods and/or statistical tests. In this study, the feasibility of using machine learning approaches as an alternative to traditional statistical methods for testing changing variance is investigated.

A framework is developed for testing changing variance using a machine learning-based approach. Features are extracted from the dataset and modeling is performed using machine learning algorithms to identify changing variance. Specifically, algorithms such as support vector regression, decision trees, and gradient boosting are employed.

Results obtained from traditional statistical tests are compared with the effectiveness of the machine learning-based approach. Comparisons indicate that machine learning-based methods provide more accurate results for testing changing variance compared to traditional methods. It is suggested that machine learning-based methods could serve as a powerful alternative for testing changing variance in regression analysis. The advantages and disadvantages of this approach are discussed, and recommendations for future research are provided.

**Keywords:** Heteroscedasticity, Machine learning, simulation

36.

## STANDART KARYOTYPE OF *TURCICHONDROSTOMA FAHIRAE* (LADIGES, 1960)

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### ABSTRACT

Kababurun fish species, which consist of seven sub-lineages, were grouped into 6 genera in a study conducted in 2007. With a molecular and morphometric study conducted in 2021, *Chondrostoma fahirae* was included in the new genus *Turcichondrostoma*. *T. fahirae* is a local endemic distributed in Başpınar (Kırkpınar) spring and Değirmendere stream, Karamanlı Lake and Karataş lake. So far, no karyological studies have been conducted on this species. The slides obtained in the karyological preparation were stained with standard giemsa staining and 20 metaphases were photographed and analyzed. According to the karyotype obtained, the diploid chromosome number (2n) of *T. fahirae* is 50. The chromosome set includes 6 metacentric, 11 submetacentric, 5 subtelocentric and 3 acrocentric chromosome pairs. The fundamental chromosome arm number (NF) is 94. No heteromorphic sex chromosome has been detected. The karyomorphology of *T. fahirae* is similar to other leuciscin species in Anatolia.

**Keywords:** Chromosome, Cytogenetic, Tefenni Nase, Türkiye

•This study is summarized from a part of Güldane GÖZEN TAVŞAN's Master's thesis. Also S.Ü. It was supported by BAP with project number 22201041.

37.

## ENHANCING THE ELECTRICAL CONDUCTIVITY OF TiO<sub>2</sub> NANOPARTICLES BY SURFACE MODIFICATION

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### ABSTRACT

Conductive pigments have a multitude of applications across various sectors. In the automotive industry, which represents a significant market, conductive pigments are employed in the production of conductive primers. While carbon black, a widely used pigment in the black conductive primers, is highly effective, it is not suitable for obtaining the white conductive primers, as even small quantities fall outside the desired color range. In such instances, conductive TiO<sub>2</sub> pigments can be utilized. The synthesis and characterization of conductive TiO<sub>2</sub> particles, which are commercially available, are the subject of current research. This study will therefore focus on the synthesis and scale-up production of particles with low-cost and high-performance characteristics.

A variety of characterization methods are employed to gain insight into these effects. To assess the impact of TiO<sub>2</sub> structure and surface morphology, it is necessary to separate and examine the samples individually at both the pre- and post-modification stages. This was achieved using an X-Ray Diffractometer (XRD), which was employed to determine the crystal structure, Dynamic Light Scattering (DLS) Measurements and Scanning Electron Microscopy (SEM) analyses, which were used to ascertain the particle size. Elemental analyses were conducted using the scanning electron microscope with energy dispersive spectroscopy (SEM-EDS) technique to determine the Sn/Sb, Sn/Ti and Sb/Ti ratios in the surface coating. Conductivity (or resistance) measurements were planned as one of the most decisive characterization methods. For this purpose, four-probe, or voltmeter techniques were employed.

**Keywords:** Conductive pigments, TiO<sub>2</sub> nanoparticles, surface modification, conductivity

38.

## EFFECT OF SCATTERING ON THE TRANSMISSION SPECTRA OF CRYSTALLINE P- TERPHENYL.

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### ABSTRACT

Interest in studying the transmission spectra of crystalline p-terphenyl is due to the possibility of creating effective scintillators based on it. The samples of large volume or large area are used for this purpose. The transmission spectra of crystalline p-terphenyl samples with a thickness of 2 and 4 mm and a diameter of 18 mm are studied in this work. Sufficiently strong light scattering appears in such samples, which has a significant effect on their transmission spectra.

Two broad electronic absorption bands are observed at 315 nm and 341 nm in the short-wavelength region of the spectrum of p-terphenyl with a thickness of 2 mm. And in a sample with a thickness of 4 mm these absorption bands are observed at 306 nm and 340 nm, respectively. It is known that light scattering leads to a short-wavelength shift of absorption bands and their weakening, which is observed in p-terphenyl samples of different thicknesses.

The transmittance  $T(\lambda)$  increases from 10% to 35% in a sample 2 mm thick and from 9% to 30% in a sample 4 mm thick in the transparency region of crystalline p-terphenyl (370 nm – 1100 nm). Such a significant increase of  $T(\lambda)$  in the transparency region is associated with the presence of a grid of small microcracks with a thickness  $t \ll \lambda$  in the near-surface layer of crystals, which arise during mechanical polishing of their surface. The presence of small microcracks leads to the tunneling effect, which determines the increase of  $T(\lambda)$ .

This work was supported by the National Research Foundation of Ukraine (project No. 2021.01/0042, “Development of effective detection systems for the most harmful ionizing radiation for humans, for radioecology tasks”).

**Keywords:** transmission spectrum, light scattering, organic crystals, scintillation materials

39.

## DETECTION AND RECOGNITION OF UNMANNED AERIAL VEHICLES BY THE SPECTRUM OF THEIR ACOUSTIC SIGNAL

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### ABSTRACT

When solving the urgent problem of detecting unmanned aerial vehicles (UAVs) from their own acoustic radiation, posing a potential threat to various areas of human activity, it becomes necessary to separate its signal from all other acoustic noises. Application of the autoregressive model widely used in practice for this purpose is complicated by the need to use significant orders of the model, since the distinctive features of the acoustic signal of the UAV, which distinguish it from other signals, are located in the low-frequency region of the spectrum. The report proposes to use a composite autoregressive model, which adequately describes the correlation properties of the signal at significant time intervals, and provides an increase in the spectral resolution in the low frequency region. Experimental studies were carried out using the proposed mathematical model, which showed significant differences in the power spectral density (PSD) of the UAV's AR from the PSD of noise from various sources, which made it possible to improve the qualitative characteristics of solving the UAV detection-recognition problem. A simplified procedure is proposed for determining the PSD peaks frequencies of a long-term autoregressive model without calculating the spectrum, which is advisable to use when working in real time.

Keywords: unmanned aerial vehicle, acoustic signal, autoregressive model, recognition, power spectral density

40.

## AN INVESTIGATION OF THE KINETIC ENERGY OPERATOR OF A POLYATOMIC MOLECULE WITH GEOMETRIC ALGEBRA

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### ABSTRACT

Physics concepts require mathematical frameworks to be understood and supported as an algebraic expression. Mathematicians and physicists have introduced and explored a variety of algebras throughout history. One of these is Clifford Algebra, often known as geometric algebra.

This work developed a general and useful method for deriving the operators of the kinetic energy of polyatomic molecules using Geometric Algebra. The kinetic energy operator of a polyatomic molecule contains the vibrational and rotational kinetic energy operators.

The gradients of vibrational coordinates form the exact vibrational kinetic energy operator of a polyatomic molecule. The conventional methods utilized for obtaining these gradients can often be extremely laborious. However, the gradients for any vibrational coordinate can be readily computed using geometric algebraic techniques. These gradients are the measuring vectors. so, the components of the reciprocal metric tensor  $g^{ij}$  readily form that emerges in the exact internal kinetic energy operators of polyatomic molecules.

On the other hand, Finding the measuring vectors for the rotational degrees of freedom is more difficult because the components of the total angular momentum operator are not conjugated to any rotational coordinates. Nonetheless, using geometric algebraic methods without restrictions on the number of particles in the system, rotational measuring vectors for any geometrically defined body frame may be easily computed. This is what we show in this paper.

**Keywords:** Geometric Algebra, kinetic energy of polyatomic molecules, measuring vectors, vibrational kinetic energy operator, rotational kinetic energy operators.

41.

## FUTURE TRENDS AND EMERGING TECHNOLOGIES IN DC-DC CONVERTERS: A REVIEW

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### ABSTRACT

DC-DC converters play a pivotal role in various electronic systems, ranging from portable devices to renewable energy applications. As the demand for higher efficiency, smaller form factors, and enhanced performance continues to grow, researchers and engineers are constantly exploring new technologies and trends to meet these evolving requirements. This comprehensive review article delves into the future trends and emerging technologies in DC-DC converters. Beginning with an overview of the current state-of-the-art, the review explores recent advancements in wide bandgap semiconductors, advanced packaging techniques, and novel converter topologies. It discusses the potential impact of these technologies on improving efficiency, power density, and reliability, while also addressing challenges and opportunities in their implementation. Furthermore, the article speculates on the future directions of DC-DC converter design and highlights promising research areas for further exploration. By providing a thorough analysis of emerging trends, this review aims to inform researchers, engineers, and industry stakeholders about the latest developments shaping the future of DC-DC converters.

**Keywords:** DC-DC converters, Future trends, Emerging technologies, Wide bandgap semiconductors

42.

## INVESTIGATION of SPUTTERED Co/Cu MULTILAYERS with DIFFERENT DEPOSITION RATES and TOTAL FILM THICKNESSES

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### ABSTRACT

In this study, the effects of different total thicknesses and deposition rates of Co layers on the microstructural and magnetic properties of the Co/Cu multilayer films were investigated. The Co/Cu multilayers were produced using the magnetron sputtering technique. For thickness investigation, the total thickness was changed as 120, 140 and 160 nm and the deposition rate of Co and Cu was kept constant at 0.04 nm/s. For different deposition rates, while the deposition rate of Co was systematically changed as 0.02, 0.05 and 0.08 nm/s, the total thickness was kept constant as 90 nm and the Cu deposition rate as 0.04 nm/s. It was detected that when the total thickness was gradually increased from 120 nm to 160 nm, the surface roughness increased while the film content (13±2 % at. Co) and crystal structure (face centered cubic) remained almost the same. Coercivity ( $H_c$ ) values for the films with a total thickness of 120 nm, 140 nm and 160 nm were found to be 43 Oe, 52 Oe and 63 Oe, respectively. The gradual increase of  $H_c$  values can be attributed to the increase in surface roughness as the thickness increases. For deposition rates, the atomic Co content gradually increased from 19 % to 26 % as the deposition rate of Co layers increased from 0.02 nm/s to 0.08 nm/s. The changes in the X-ray diffraction peak intensities are compatible with the change of Co content. The size of grains and roughness decreased on the surfaces of the films produced with relatively high deposition rates. For magnetic properties, as the deposition rate of ferromagnetic layer increased, the saturation magnetization value also increased in accordance with the atomic content. The considerable decrease in surface roughness, and therefore stress and deformation on the surface, may have caused the  $H_c$  values to decrease.

**Keywords:** Co/Cu multilayers, deposition rates, film thickness, sputtered films



43.

## SPECIES COMPOSITION OF HOUSEHOLD ANTS (FORMICIDAE: HYMENOPTERA) IN HULU LANGAT, MALAYSIA

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### ABSTRACT

Studies on household ants (Formicidae: Hymenoptera) have not yet been widely conducted in urban areas, especially in residential areas in Hulu Langat, Malaysia. Therefore, the objectives of this study are to determine the composition of household ants and the most effective food baits for household ant sampling. The ant sampling was carried out in April 2021 by using different types of food bait trap methods such as ready-made products of honey and peanut butter. Ants were sampled based on two types of house perimeters, namely indoors (domestic) and outdoors (peridomestic). Household ant specimens were identified down to the subfamily levels and the species dominating the sampling location. A total of 3861 ant individuals from three main subfamilies of Formicidae (Dolichoderinae, Myrmicinae and Formicinae) were successfully collected. Dolichoderinae was the most dominant subfamily in the indoor area with 1047 ant individuals while Myrmicinae subfamily was the most dominant in the outdoor area with 1174 ant individuals. *Tapinoma melanocephalum* was the most dominant species in the residential area with 1947 individuals (49%). Honey bait was more effective at attracting more ants (2902 individuals) compared to peanut butter (959 individual) at the study site. The t-test analysis for subfamilies in the two perimeter types (outdoors and indoors) showed no significant difference ( $p > 0.05$ ). Meanwhile, there was a significant difference in the selection of ants on the two types of baits (honey and peanut butter) ( $p < 0.05$ ). Scientific information from this study can provide information on the composition of household ants and the effectiveness of bait traps in urban areas and provide information to the community in overcoming the infestation of household ants as pests in Malaysia.

**Keywords:** Household ants, Malaysia, Dolichoderinae, Myrmicinae, Formicinae

44.

## STUDY OF BIOLOGICALLY ACTIVE HYDROCARBONS CONTAINED IN NAPHTHALANE OIL AND THEIR APPLICATION IN MEDICINE

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### ABSTRACT

The development of pharmaceutical technology requires the discovery of new medicinal substances and a new innovative approach to their application, which is related to the discovery and increase of the number and quantity of new chemical compounds with potential pharmacological activity. In this regard, oil also attracts the attention of researchers because it is a potential source of natural compounds with biological activity. For this reason, the study of the hydrocarbon composition of the unique Azerbaijani oils, which are rich in biologically active chemical compounds, and the precise determination and investigation of the characteristic features of their components are one of the main perspective issues facing our scientists and can play an important role in the preparation of new medicinal substances. This approach is also favorable from an environmental and economic point of view, and plays an important role in the development of new medicinal substances.

Even in the last century, our famous scientist Y.H. Mammadaliyev showed that the unique therapeutic character of Naftalan oil is related to polycyclic naphthenic hydrocarbons with short side chains. However, the role of individual hydrocarbons of this unique oil, which is used in the treatment of various diseases (rheumatism, osteochondrosis, gynecological diseases, etc.) in the treatment processes, has not yet been studied in detail. From this point of view, the hydrocarbon composition of 50<sup>0</sup> (115-150<sup>0</sup>C, 150-200<sup>0</sup>C, 200-250<sup>0</sup>C and 250<sup>0</sup>C - 300<sup>0</sup>C) fractions of Naftalan oil was studied using a "Thermo Electron GMS Trace DSO" chromato-mass spectrometer with software, and the content of this oil was found to be rich in bioactive bicyclic substances (decalin, coumarin, indene, etc.): 150-200<sup>0</sup>C (38.453%) > 200-250<sup>0</sup>C (29.305%) > 250-300<sup>0</sup>C (27.415%) > 115-150<sup>0</sup>C (17.265%). 7.681% of its 200-250<sup>0</sup>C fraction consists of diene, aldehyde and ketones, 38.807% of its 250-300<sup>0</sup>C fraction consists of diol, aldehyde, diene, ketone, alcohol, ether, anhydride, oxide compounds. The total amount of bicyclic (C<sub>10-13,15</sub>) hydrocarbons at 200-250<sup>0</sup>C is 29.305%, among which 37 bicyclic decane, undecane, dodecane, heptane, octane, nonane compounds were found: C<sub>10</sub>, C<sub>12</sub>, C<sub>13</sub>, C<sub>15</sub> (C<sub>n</sub>H<sub>2n-2</sub>) and C<sub>11</sub> (C<sub>n</sub>H<sub>2n-4</sub>) and oxygen-containing C<sub>10</sub>, C<sub>11</sub> and C<sub>13</sub> compounds. The number (19) and amount (17.579%) of spiroundecane compounds in the indicated fraction is slightly higher than in the 150-200<sup>0</sup>C fraction. 18.032% of the compounds recorded in the 200-250<sup>0</sup>C fraction are bicyclic spiro [5.5] undecane compounds. Currently, spiro compounds, which are of great interest in medicinal chemistry, are applied as antioxidants, and they prevent processes related to neurogenerative diseases, metabolic syndromes, infections, and cancer by absorbing free radicals and inhibiting oxidation and degradation. On the other hand, the bioactive substances found in the hydrocarbon contents of the studied fractions are used in medicine, pharmaceutical and food industries, in the preparation of new types of jet fuels, etc. can be used.

**Keywords:** naphthalane oil, biologically active hydrocarbons, chromato-mass spectrometer

## DETERMINATION OF MONOAMMONIUM PHOSPHATE IN DRY CHEMICAL POWDER FIRE EXTINGUISHERS BY ICP-OES USING DIFFERENT SAMPLE PREPARATION METHODS

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### ABSTRACT

Analysis of chemical content of the powder fire extinguishers has been an issue for the producers and the users. There is a standard for the analyses of different physical and chemical properties of powder fire extinguishers called EN 615. The standard requires the reporting of concentrations representing 10% or more of the total content. Different types of fire extinguishing powders designed for different fire types (class A, class B, class C, class ABC, etc.) may contain different chemicals and additives. Main chemicals used in dry chemical extinguishers can be siliconized sodium bicarbonate, monoammonium phosphate (MAP), ammonium sulfate. Monoammonium phosphate is a critical parameter in ABC class fire extinguishers. The analysis method for these chemicals is left open-ended in the standard and different alternative methods can be used such as ED-XRF, spectrophotometric methods and ICP- OES. This research suggest a comparison between two sample preparation methods for analysis of phosphorus (for monoammonium phosphate) by ICP-OES. The method where the sample (MAP) is digested at 190°C by H<sub>2</sub>SO<sub>4</sub> on a heating table showed a recovery rate 106% and the second method which is very simple, the sample (MAP) is solved in a falcon tube with H<sub>2</sub>SO<sub>4</sub> and distilled water, vortexed for 3 minutes showed a recovery rate 105%. A simple alternative method has been showed with the same recovery efficiencies rather than using different kind of acids and their mixtures, and instead of consuming time by heating and preparation of the sample.

Keywords: Monoammonium Phosphate (MAP), Dry Chemical Fire Extinguisher Powder, ICP-OES

## SYNERGISTIC EFFECTS OF TWO ESSENTIAL OILS OF *ROSMARINUS OFFICINALIS* AND *CARTHAMUS CAERULEUS* AGAINST PATHOGENIC MICROORGANISMS

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### ABSTRACT

Antibiotic resistance is one of the most serious threats to global health, food security and development today. As the number of infections increases, treatment becomes more difficult, if not impossible, due to the loss of antibiotic efficacy.

In the present study, the chemical composition of the essential oils of *Rosmarinus officinalis* and *Carthamus caeruleus* and their synergistic effects on antimicrobial activities were investigated.

The chemical composition of the essential oil was analysed by gas chromatography (GC) and gas chromatography-mass spectroscopy (GC/MS). The antimicrobial activity of the essential oils was evaluated using the dilution agar method against nine bacterial strains, three gram-negative *Escherichia coli* (ATCC 25922), *Pseudomonas aeruginosa* (ATCC 27853) and *Salmonella typhi* (ATCC 14028) and six gram-positive: *Staphylococcus aureus* (ATCC 43300), *Clostridium sporogenes* (ATCC 19404), *Bacillus subtilis* (ATCC 6633), *Enterococcus faecalis* (ATCC 7314), *Lactobacillus rhamnosus* (ATCC 53103) and *Bacillus cereus* (ATCC 14579).

The essential oil of *R. officinalis* was characterised mainly by 1,8-cineol (20.4%) and camphor (16.1%). The identified constituents of the essential oil of *C. caeruleus* were mainly acetylenic compounds represented by carlina oxide (90.4%). *C. caeruleus* essential oil had good antimicrobial activity against four bacterial strains (*Escherichia coli*, *Salmonella typhi*, *Lactobacillus rhamnosus* and *Bacillus cereus*) with MIC and MBC values between 0.2-0.4 µl/ml and 0.2-6.2 µl/ml, respectively. Whereas, *R. officinalis* essential oil had moderate antimicrobial activities against all strains with MIC and MBC values between 1.6-7.1 µl/ml and 6.1-12.3 µl/ml, respectively. The antimicrobial activity results of the essential oil blend showed higher antimicrobial activity against all bacteria tested with MIC and MBC values between 0.2-1.6 µl/ml and 0.5-6.1 µl/ml, respectively.

The blend of essential oils showed high antimicrobial activity compared to virgin oils. This activity may be due to the association of active compounds such as 1,8-cineol and carlina oxide. These findings provide a new source of drugs that may help in therapy, leading to the development of a new treatment based on a combination of these essential oils against gram-negative and gram-positive bacteria, which continue to pose a threat to public health.

Keywords: *C. caeruleus*, *R. officinalis*, essential oils blend, synergistic effects, antimicrobial activity,

## DEVELOPMENT OF GLUTEN ALLERGEN-FREE COLOR PRODUCTS

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### ABSTRACT

Nowadays, it is known that gluten sensitivity is between 4% and 6% in the population. Due to the gluten content originating from malt, alternative products are being developed sectorally for users with gluten sensitivity. In this project, it is aimed to benefit from the availability of grain cultivation in Türkiye, to provide diversity in the product portfolio by improving the process conditions from roasted gluten-free raw materials. By optimizing the production conditions, color extract products in liquid and powder form will be obtained and will be used as a natural brown color material in different application areas such as bakery, confectionery, dairy products and beverage group products. In order to develop a gluten-free extract product, alternative products such as rice, chickpeas, palm kernel, lentils and corn have been tried. By applying different roasting processes on the raw materials, the most suitable raw material was selected in terms of cost, supply and roasting process. Extract trials using roasted gluten-free raw materials were primarily carried out on laboratory scales; The most suitable process parameters were determined by performing enzyme, mash temperatures and times, filtration and liquidity studies. It is planned that the raw material will go through the stages of grinding, mashing, pulp separation, cooking, sedimentation and concentration. In these stages, the parameters were optimized and in the concentration stage, products were studied in the range of 55-70 Brix. The natural brown color products obtained within the scope of the project are important in terms of ensuring product diversity as they can be used in the gluten-free field in the food and beverage industry.

**Keywords:** Gluten-free, roasted, brown, color

## SYNTHESIS, CHARACTERIZATION AND ANTI-OXIDANT ACTIVITY OF DIOSGENIN-FUNCTIONALIZED GRAPHENE OXIDE AND ITS COMPOSITE INTO CYCLODEXTRINS

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### ABSTRACT

This study reports the synthesis and characterization of diosgenin-functionalized graphene oxide and its potential application as a drug delivery platform. Diosgenin, a naturally occurring steroid sapogenin, was functionalized onto graphene oxide (GO) via a simple chemical reaction. The resulting diosgenin-functionalized graphene oxide (Dio- GO) was characterized using Fourier-transform infrared spectroscopy (FTIR), Raman spectroscopy, X-ray diffraction (XRD), scanning electron microscopy (SEM), and X-Ray diffraction (XRD). In addition, we intend to make inclusion of Diosgenin, nanocomposite contains Diosgenin, Graphene oxide with Fe<sub>3</sub>O<sub>4</sub> into several types of cyclodextrins, then we will test their solubility and bioactivity and ant-oxidant activity. **Keywords:** Diosgenin, ant-oxidant, Graphene, Cyclodextrin.

## DEVELOPMENT, CHARACTERIZATION OF A NEW LOW-COST COMPOSITE MEMBRANE COMPOSED OF AN ORGANIC ULTRAFILTRATION LAYER AND A POLYAMIDE SUPPORT

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### ABSTRACT

This research examines the development and study of advanced composite ultrafiltration (UF) membranes, which are specifically designed for use in water treatment and dye removal. Composite UF membranes were made by combining two polymers with polypropylene-TiO<sub>2</sub> (PP-TiO<sub>2</sub>) to create the active layer, while the support unit is made of a flat polyamide and prepared by the casting method followed by solvent evaporation. The characteristics of these membranes were studied using various techniques, such as nuclear magnetic resonance, electron microscopic scanning, infrared spectroscopy, contact angle measurements and mechanical testing. The performance evaluation process involved filtering colored solutions through prepared composite membranes at a pressure of 1 bar. The first study of this type investigates the influence of PP-TiO<sub>2</sub> on membrane characteristics. The performance of the optimized composite UF membrane is outstanding in terms of water permeability and dye rejection, making it a promising candidate for water treatment and decolorization applications.

**Keywords:** Casting method, Dyes, Polypropylene-TiO<sub>2</sub>, Textiles, Ultrafiltration membranes,

## HYDRODYNAMIC CHARACTERIZATION OF A NEW ULTRAFILTRATION MEMBRANE SYNTHESIZED BASED ON A BIODEGRADABLE POLYMER AND FILLERS

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### ABSTRACT

In this research, we study the synthesis and characterization of composite ultrafiltration (UF) membranes made from a biodegradable organic polymer. On the one hand, our membrane was elaborated by the casting method. The bonding collodion used to prepare the active layer of composite membranes was made from a biodegradable polymer containing different percentages of fillers. This is then cast onto a support that ensures the membrane's exceptional mechanical and chemical performance. In order to examine the influence of filler incorporation in the bonding collodion, various techniques were used, including Fourier transform infrared (FTIR), nuclear magnetic resonance (NMR), and scanning electron microscopy (SEM) morphology to verify these characteristics, as well as contact angle measurements. To assess the efficiency of the synthesized membranes, permeability and selectivity tests were carried out. The experimental results showed us that the water permeability and rejection rate of the composite UF membrane are remarkable and moderate, prompting us to evaluate the performance of our membrane in terms of wastewater treatment at a later date.

**Keywords:** Active layer, Biodegradable polymer, Permeability, Selectivity.

## PROBING THE INTERACTION OF LABETALOL HYDROCHLORIDE WITH HUMAN SERUM ALBUMIN AND $\alpha_1$ -ACID GLYCOPROTEIN: A BIOPHYSICAL POINT OF VIEW

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### ABSTRACT

Labetalol hydrochloride (LAH), an  $\alpha$ - $\beta$  adrenergic blocking agent, is prescribed for the treatment of persistent hypertension. The pharmacokinetic features of a drug, which determine its effectiveness, are influenced by its binding to plasma proteins. The molecular interaction profile of LAH with the two principal human transport proteins, human serum albumin (HSA) and  $\alpha_1$ -acid glycoprotein (AAG), is still largely uncharacterized. Hence, this study employed spectroscopic, microscopic, and structural analysis approaches to comprehensively analyze the interaction between LAH and HSA/AAG. Analysis of fluorescence spectroscopic data revealed that both HSA/AAG–LAH interactions are reversible and of intermediate affinity. Nevertheless, LAH exhibited greater affinity for AAG than HSA. These results were corroborated by the alterations observed in the UV absorption spectrum of the protein. Furthermore, atomic force microscopic images revealed that the dimensions of the proteins increased in the presence of LAH. Based on structural analysis of LAH, the protein–LAH complexes were predicted to be stabilized via hydrogen bonding as well as hydrophobic and ionic interactions. Competitive drug displacement assays determined that HSA site II serves as the main binding site of LAH, with site I acting as a secondary binding site. The information gained from this study may facilitate the development of LAH-based drugs that are safer and more effective.

**Keywords:** human serum albumin;  $\alpha_1$ -acid glycoprotein; drug–protein interaction; labetalol hydrochloride, hypertension

## REFORMULATION OF COMPRESSIBLE FLUID EQUATIONS IN TERMS OF HYPERBOLIC QUATERNIONS

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### ABSTRACT

In the relevant literature, it has been shown that there exist similarities between electromagnetism and fluid mechanics. Furthermore, the correspondence between them permits the formulation of a set of fluid Maxwell equations. However, the reformulation of Maxwell-type equations of compressible fluids in terms of hyperbolic quaternions has not yet been presented. In this work, an alternative formulation has been developed by taking advantage of the similarity between the Maxwell equations of classical electromagnetism and their corresponding equations for compressible fluids. The derived expressions in this work can summarize the well-known equations of compressible fluid compactly and elegantly.

**Keywords:** Maxwell Equations, Field Equations, Compressible Fluids, Hyperbolic Quaternion

**Acknowledgement:** This study is supported by Eskişehir Technical University Scientific Research Projects Commission under the grant no: 23LÖP227

## **SOLVING THE FLOWING/SAGGING PROBLEM IN POLYESTER PIGMENT PASTES USING A RHEOLOGY AGENT**

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### **ABSTRACT**

Polyester pigment pastes consist of pigments dispersed in solvent-free reactive polyester resin. The pigments used are carefully selected to have minimal impact on color fastness, opacity, heat stability, and curing properties of the final system. The viscosity of pigment pastes can be adjusted to be suitable for spray applications and is particularly used as a coloring agent in composite applications. If the applied paint does not have the required thixotropic structure, it cannot adhere to the surface beyond a certain micron and begins to flow/droop due to gravity.

In this study, the regulation of the rheology of pigment paste with new formulations using different agents in varying proportions aimed to provide a solution to the flow/sagging problem. Considering the industry's requirements, two different agents were used in our formulations. One of the thixotropic agents used is based on "amide wax," while the other is a rheology and thixotropic agent based on the composition of "phyllosilicates." First, the solid components were mixed with each other (pre-dispersion), and then the resulting mixture was mixed at high speed until a good dispersion was obtained using a basket-mille. The crushing, flow/droop properties, and viscosity values of the pigment paste obtained as a result of this process were determined. The data obtained showed that the pigment paste formulations developed with phyllosilicates stabilized thixotropy and exhibited superior performance, eliminating the flow/droop problem in standard pigment pastes.

**Keywords:** Rheology agent, Pigment Paste, Thixotropy, Dispersion, Flow/Sagging

## **ARTIFICIAL INTELLIGENCE APPLICATIONS IN THE CHARACTERIZATION OF MATERIALS**

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### **ABSTRACT**

Artificial intelligence has revolutionized the field of material characterization by offering innovative solutions to complex challenges. Through advanced algorithms and machine learning techniques, AI has enabled researchers to analyze and predict the properties of materials with unprecedented accuracy and efficiency. By leveraging vast amounts of data and automating the process of identifying patterns and correlations, AI has significantly expedited the characterization of materials, leading to the development of new materials with enhanced properties and functionalities. Furthermore, AI has opened up new avenues for research and discovery, allowing scientists to explore novel materials and technologies that were previously unattainable. As AI continues to evolve and expand its capabilities, the possibilities for further advancements in material characterization are virtually limitless.

## **PRESSURE CONTROL PROBLEM IN THE PRODUCTION OF GASB SUBSTRATE**

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### **ABSTRACT**

One of the key challenges faced in the production of GaSb substrate is the control of pressure during the manufacturing process. Maintaining the appropriate pressure levels is crucial for ensuring the quality and uniformity of the substrate. Variations in pressure can have significant impact on the structural and electrical properties of the material, leading to defects and inconsistencies in the final product. Effective pressure control mechanisms must be implemented to minimize these issues and optimize the production process. This may involve the use of precise monitoring equipment, automated systems, and periodic adjustments to ensure that the pressure remains within the desired range throughout the production cycle. By addressing the pressure control problem effectively, manufacturers can enhance the overall quality and performance of GaSb substrates, ultimately leading to greater success in the semiconductor industry.

## SUGGESTIONS FOR EFFECTIVE TEACHING METHODS FOR GIFTED INDIVIDUALS

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### ABSTRACT

When it comes to teaching gifted individuals, it is essential to utilize effective methods that cater to their unique needs and abilities. One suggestion is to provide opportunities for independent study and research projects, allowing them to delve deeper into topics of interest at their own pace. Additionally, incorporating hands-on activities, creative projects, and real-world application of concepts can help keep gifted students engaged and motivated. Encouraging collaboration and discussion among peers can also foster a stimulating learning environment. Regularly assessing and adjusting teaching strategies based on the individual needs and progress of the gifted students is crucial for their continued growth and development. By implementing these suggestions, educators can create a more enriching and fulfilling learning experience for gifted individuals.

## EFFECTIVE USE OF ARTIFICIAL INTELLIGENCE IN SOLVING TRAFFIC PROBLEMS

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### ABSTRACT

In today's fast-paced world, traffic congestion has become a major issue in urban areas. To address this problem, the use of artificial intelligence (AI) has proven to be an effective solution. By leveraging AI technology, traffic management systems can be optimized to improve traffic flow, reduce congestion, and enhance overall transportation efficiency.

One of the key ways AI can be leveraged to solve traffic problems is through predictive analytics. By analyzing historical traffic data and real-time information, AI algorithms can accurately predict traffic patterns, identify congestion hotspots, and recommend optimal routes for drivers. This can help reduce travel times, alleviate congestion, and improve overall traffic flow.

Additionally, AI-powered traffic signals can adapt in real-time to changing traffic conditions. These intelligent traffic management systems can optimize signal timings based on traffic volumes, pedestrian patterns, and environmental factors, leading to smoother traffic flow and reduced waiting times at intersections.

Furthermore, AI can also be used to optimize public transportation systems. By analyzing ridership data, traffic patterns, and commuter preferences, AI algorithms can recommend efficient routes, schedules, and modes of transportation. This can encourage more people to use public transportation, leading to reduced traffic congestion and improved air quality in cities.

In conclusion, the effective use of artificial intelligence in solving traffic problems holds great potential for improving transportation systems in urban areas. By harnessing the power of AI technology, we can create smarter, more efficient traffic management systems that benefit both drivers and the environment. As cities continue to grow and traffic congestion worsens, it is essential to leverage AI solutions to address these challenges and create a more sustainable and efficient transportation infrastructure.

## PHYSICAL REALITY AT HIGH TEMPERATURES

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### ABSTRACT

Physical reality at high temperatures has fascinated scientists for centuries. As materials are heated to extreme temperatures, their properties and behaviors can change dramatically. From the expansion of gases to the melting of solids and the ionization of atoms, high temperatures bring about profound transformations in the world around us.

At high temperatures, the kinetic energy of particles increases, causing them to move faster and collide more frequently. This results in changes in the physical state of matter, such as the transition from solid to liquid or gas. For example, as a solid is heated, its atoms gain enough energy to overcome the forces holding them in a fixed position, leading to melting.

Furthermore, at high temperatures, atoms can lose or gain electrons, becoming ions. This process, known as ionization, can create highly energetic particles that interact in unique ways. This phenomenon is essential in fields such as plasma physics, where high temperatures are used to generate and manipulate ionized gases.

In conclusion, the study of physical reality at high temperatures is crucial for understanding the behavior of matter under extreme conditions. By exploring the properties of materials at elevated temperatures, scientists can unlock new insights into the nature of energy, matter, and the universe as a whole.

## UNDERSTANDING THE ORIGIN OF COSMIS RAYS

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### ABSTRACT

Cosmic rays are high-energy particles that originate from outer space and bombard Earth's atmosphere at incredible speeds. These particles, which include protons, electrons, and other atomic nuclei, have puzzled scientists for decades as they seek to understand their origins.

One of the leading theories behind the origin of cosmic rays is that they are produced by supernova explosions. When a massive star reaches the end of its lifecycle and explodes in a supernova, it releases enormous amounts of energy and accelerates particles to high speeds. These accelerated particles then travel through space and eventually reach Earth as cosmic rays.

Another possible source of cosmic rays is the supermassive black holes that lurk at the center of galaxies. These black holes have incredibly strong magnetic fields that can accelerate particles to tremendous speeds. These accelerated particles can then be ejected from the black hole and travel through space as cosmic rays.

In addition to supernovae and black holes, other sources of cosmic rays may include pulsars, gamma-ray bursts, and even the remnants of the Big Bang. Scientists continue to study these high-energy particles in order to unravel the mysteries of the universe and better understand the forces at work in the cosmos.

In conclusion, while the origin of cosmic rays remains a complex and still unresolved question, scientists have made significant progress in identifying potential sources for these high-energy particles. By studying cosmic rays, we gain valuable insights into the nature of the universe and the powerful forces that govern it.



## PHYSICS EXPERIMENT DESIGN APPLICATIONS IN SCIENCE EXPERIMENT CENTERS

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### ABSTRACT

Physics experiment design plays a crucial role in shaping the educational experiences of students in science experiment centers. These centers are where students engage in hands-on activities to foster their understanding of fundamental principles in physics. By applying appropriate experiment design, students can not only gain practical experience but also develop critical thinking and problem-solving skills.

Experiment centers utilize physics experiment design to create interactive and engaging activities for students. These designs are carefully crafted to align with specific learning objectives and to provide students with meaningful experiences that complement theoretical knowledge. Experiment centers often incorporate various types of experiments, such as demonstrations, investigations, and projects, to offer a well-rounded learning experience for students.

One of the key applications of physics experiment design in science experiment centers is the emphasis on the scientific method. Through well-designed experiments, students learn how to formulate hypotheses, design experiments, collect and analyze data, and draw conclusions. These activities help students develop a deeper understanding of the scientific process and cultivate a scientific mindset.

Furthermore, experiment design in these centers also focuses on safety considerations and ethical practices. This ensures that students can participate in experiments with confidence and provides a foundation for responsible scientific conduct.

In conclusion, physics experiment design applications in science experiment centers are instrumental in providing students with meaningful and engaging learning experiences. By utilizing well-crafted experiment designs, science centers can effectively help students develop vital skills and a deeper understanding of fundamental physics concepts.

## CRITICAL TURNING POINTS OF CLIMATE CHANGE

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### ABSTRACT

The phenomenon of climate change is a complex and multifaceted issue that has far-reaching consequences for our planet. Throughout history, there have been several critical turning points that have shaped our understanding of this pressing crisis.

One such turning point was the publication of the Intergovernmental Panel on Climate Change (IPCC) reports in the late 20th century. These reports provided definitive scientific evidence that human activities were significantly contributing to global warming and climate change. This served as a wake-up call to world leaders and the public, leading to increased awareness and calls for action.

Another crucial turning point was the signing of the Paris Agreement in 2015, where nearly 200 countries committed to reducing greenhouse gas emissions and limiting global warming to well below 2 degrees Celsius. This historic agreement marked a significant milestone in international efforts to combat climate change and emphasized the importance of collaborative action on a global scale.

Additionally, the increasing frequency and severity of natural disasters such as hurricanes, wildfires, and droughts have also served as critical turning points in raising awareness about the impacts of climate change. These events have highlighted the urgent need for adaptation and resilience measures to mitigate the effects of a changing climate.

In conclusion, the critical turning points of climate change have played a pivotal role in shaping our understanding of the crisis and spurring action at both the international and local levels. As we continue to face the challenges of a warming planet, it is imperative that we heed the lessons of these turning points and work together to address this urgent threat to our environment and future generations.

## EFFECTS OF ANTIOXIDANTS ON NEURODEGENERATIVE DISEASES

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### ABSTRACT

Neurodegenerative diseases are diseases that affect the nervous system and are characterized by the loss of function and death of nerve cells. These diseases pose a great threat to human health, and the most common is Alzheimer's Disease (AD), followed by Parkinson's Disease. Many diseases such as Huntington's Disease, Dementia with Lewy Bodies, Multiple Sclerosis, Amyotrophic Lateral Sclerosis, which are less common but cause significant discomfort in patients, are included in the group of neurodegenerative diseases. Antioxidants have positive effects in the treatment of these diseases. Within the scope of this seminar, the effects of some plants, vitamins and nutrients with good antioxidant values on neurodegenerative diseases were compiled.

## THE EFFECT OF CLIMATE CHANGE ON CHILDREN IN DEVELOPMENTAL AGE

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### ABSTRACT

Climate change poses a significant threat to the health and development of children in their formative years. The impacts of climate change, such as extreme weather events, air pollution, and water scarcity, have far-reaching consequences on the physical, mental, and emotional well-being of children.

Children are more vulnerable to the effects of climate change due to their developing immune systems, smaller bodies, and reliance on adults for their care and protection. Exposure to extreme heat can lead to heat-related illnesses, such as heat exhaustion and heat stroke, while poor air quality can exacerbate respiratory conditions like asthma.

In addition, natural disasters caused by climate change, such as hurricanes, wildfires, and flooding, can result in displacement, injury, and trauma for children. Disrupted access to clean water and food can also have long-term effects on their growth and development.

It is essential for policymakers, healthcare providers, and communities to prioritize the well-being of children in the face of climate change. By implementing strategies to reduce greenhouse gas emissions, improve air quality, and build resilience to extreme weather events, we can protect the most vulnerable members of our society. Only by taking action now can we ensure a healthy and sustainable future for children in their developmental age.

## **COMPARISON OF RESULTS OBTAINED ACCORDING TO DIFFERENT STATISTICAL FUNCTIONS IN HRXRD MEASUREMENTS**

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### **ABSTRACT**

HRXRD (high-resolution X-ray diffraction) measurements are commonly used in material science research to analyze the crystallographic properties of thin films and semiconductor devices. In this essay, we will discuss the comparison of results obtained using different statistical functions in HRXRD measurements.

When analyzing HRXRD data, researchers often use statistical functions such as peak fitting, Fourier analysis, and rocking curve analysis to extract valuable information about the material under investigation. Each of these functions has its own advantages and limitations, and the choice of which one to use depends on the specific properties of the material being studied. Peak fitting, for example, is a commonly used statistical function in HRXRD measurements that allows researchers to determine the position, width, and intensity of diffraction peaks. This information can be used to calculate lattice parameters, strain, and crystallite size in the material. However, peak fitting is sensitive to noise in the data and may not always provide accurate results.

On the other hand, Fourier analysis is a powerful technique that can be used to decompose the HRXRD data into its frequency components. This allows researchers to identify trends and patterns in the data that may not be easily visible using other statistical functions. Fourier analysis is particularly useful for studying complex systems with multiple crystallographic phases. Rocking curve analysis, another statistical function commonly used in HRXRD measurements, provides information about the crystal orientation and strain in the material. By measuring the intensity of diffraction peaks as a function of the azimuthal angle, researchers can determine the alignment of crystal planes and the presence of defects in the material.

In conclusion, the choice of statistical function in HRXRD measurements should be based on the specific research goals and properties of the material being studied. Each function has its own strengths and weaknesses, and researchers should carefully consider which one is most appropriate for their study. By comparing the results obtained using different statistical functions, researchers can gain a better understanding of the crystallographic properties of the material and make informed decisions about its future applications.

65.

## **SYSTEM RECOMMENDATION FOR PROVIDING THE ENERGY REQUIREMENT OF DRYING SYSTEMS FROM SOLAR ENERGY**

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### **ABSTRACT**

In order to meet the energy requirements of drying systems efficiently and sustainably, it is recommended to implement a system that utilizes solar energy. Solar energy is a renewable and environmentally friendly source of power that can provide ample energy for drying processes.

One approach to utilizing solar energy for drying systems is through the installation of solar panels. These panels convert sunlight into electricity, which can then be used to power the drying system. By harnessing the power of the sun, businesses can reduce their reliance on traditional energy sources and lower their carbon footprint.

Another option is to utilize solar thermal technology, which uses the heat from the sun to directly power the drying process. This method can be especially effective for drying applications that require high temperatures, such as industrial drying of grains or wood.

In conclusion, implementing a system that uses solar energy to meet the energy requirements of drying systems is a sustainable and efficient solution. By harnessing the power of the sun, businesses can reduce their energy costs, lower their environmental impact, and ensure a reliable source of energy for their drying processes.



**FULL TEXTS**

# STEADY-STATE OSCILLATIONS OF AN ELASTIC QUARTER SPACE

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## ABSTRACT

Steady-state oscillations of an elastic quarter space with one fixed face and an acting harmonic compressive load distributed over a rectangular area on the other face are under consideration. The aim is to analyze the amplitude of the vertical displacements of the quarter space's edge where the load is acting, depending on the material of the medium, shape of the load section and values of the natural frequencies of the external force. New method, proposed by Popov G.Ya., which is based on the introducing two new functions, expressed through sum and difference of the displacements' derivatives, was implemented here. Motions equations are separated into the system of two equations and one independently solved equation. Boundary conditions are also separated. Integral Fourier transforms are applied sequentially to the equations and boundary conditions in contrast to the traditional approaches when integral transforms are applied to the solution's representations through harmonic functions. This leads to the one-dimensional vector inhomogeneous boundary value problem with respect to unknown displacement's transformant. The problem is solved using a matrix differential calculus. Using a method of orthogonal polynomials, a singular integral equation obtained in the process, is solved with reducing it to the infinite algebraic system of the 1<sup>st</sup> kind. The original vertical displacement is found after an application the inverse integral transforms.

**Keywords:** Steady-state oscillations, quarter space, integral transforms, vector boundary problem, singular integral equation.

## 1. INTRODUCTION

An elastic quarter space can be considered as a model object for elasticity problems before moving on to objects with more complex geometry, such as layers and plates. Traditional solving methods for the problems in the elasticity theory are based on the representation of unknown functions through harmonic functions, potential theory or numerical methods.

A new method is applied here, developed by Popov G.Ya. [1], based on introduction two new functions, expressed through derivatives of displacements. Using this method, the problem was solved in a static statement in [2]. This method gives opportunity to divide the motion equations into the system of two equations and separate solvable equation. Subsequent application of integral transforms reduces the problem to a one-dimensional vector boundary value problem, to which the theory of solving vector boundary value problems is applicable [4]. In contrast to the static formulation, in the problem of oscillations one has to deal with multivalued functions included in the solution, and therefore apply the theory of contour integration. In the [4] solution to this problem was obtained under some restrictions, here the assumptions have been removed and the problem is considered without any additional conditions, so an approximate solution was constructed.

The aim of the work is to analyze the movement of the quarter space's edge depend on material of the medium, shape of acting load section, oscillation frequencies.

## 2. STATEMENT OF THE PROBLEM

An elastic quarter space  $0 \leq x, z < \infty, -\infty < y < \infty$  with  $\mu$  – Poisson ratio,  $G$  – shear modulus is under consideration. Normal compressive load is acting on a medium's boundary  $z = 0$ , changes according a harmonic low  $P(t) = Pe^{i\omega t}$ ,  $P$  is a constant intensity of the load,  $\omega$  is a natural frequency of oscillations and concentrated at the point with coordinates  $(a, b)$ , while a boundary  $x = 0$  is rigidly fixed.

Corresponding wavenumbers are introduced  $k_i = \omega / c_i, i = 1, 2$ . Where  $c_2 = \sqrt{G / \rho}$  – propagation speed of transverse waves,  $c_1 = \sqrt{\frac{2G(1-\mu)}{\rho(1-2\mu)}} = \sqrt{G / \rho} \sqrt{\frac{\kappa+1}{\kappa-1}} = c_2 \sqrt{\frac{\kappa+1}{\kappa-1}}$  – speed of longitudinal waves,  $\kappa = 3 - 4\mu$ ,  $\rho$  – density of the elastic medium.

Displacements  $u_x(x, y, z) = u(x, y, z)$ ,  $u_y(x, y, z) = v(x, y, z)$ ,  $u_z(x, y, z) = w(x, y, z)$ , which appear in the quarter space are in the interest of investigation.

The statement leads to the following boundary conditions

$$\begin{aligned} \sigma_z|_{z=0} &= P\delta(x-a)\delta(y-b), \tau_{zy}|_{z=0} = 0, \tau_{zx}|_{z=0} = 0, \\ u|_{x=0} &= 0, v|_{x=0} = 0, w|_{x=0} = 0. \end{aligned} \quad (1)$$

Here  $\delta(x)$  is the Dirac delta function.

Unknown displacements satisfy the motion equations, written in a vector form

$$\Delta(u, v, w) + \frac{2}{\kappa-1} \left( \frac{\partial \Theta}{\partial x}, \frac{\partial \Theta}{\partial y}, \frac{\partial \Theta}{\partial z} \right) + k_2^2 (u, v, w) = 0. \quad (2)$$

Here  $\Delta$  – Laplace operator,  $\Theta = \frac{\partial u}{\partial x} + \frac{\partial v}{\partial y} + \frac{\partial w}{\partial z}$  – volume expansion.

### 3. SOLVING METHOD

Introduction two new functions [1]

$$Z(x, y, z) = \frac{\partial}{\partial x} u(x, y, z) + \frac{\partial}{\partial y} v(x, y, z), \quad Z^*(x, y, z) = \frac{\partial}{\partial x} v(x, y, z) - \frac{\partial}{\partial y} u(x, y, z) \quad (3)$$

reduces the system (2) into a system of two equations

$$\Delta w + \frac{2}{\kappa-1} \frac{\partial}{\partial z} \left( Z + \frac{\partial w}{\partial z} \right) + k_2^2 w = 0, \quad \Delta Z + \frac{2}{\kappa-1} \nabla_{xy} \left( Z + \frac{\partial w}{\partial z} \right) + k_2^2 Z = 0, \quad (4)$$

here  $\nabla_{xy} = \frac{\partial^2}{\partial x^2} + \frac{\partial^2}{\partial y^2}$ , and separate equation for function  $Z^*(x, y, z)$

$$\Delta Z^* + k_2^2 Z^* = 0. \quad (5)$$

At the same time boundary conditions (1) are also separated

$$\begin{aligned} \mu Z(x, y, 0) + (1 - \mu) \frac{\partial}{\partial z} w(x, y, 0) &= \frac{\kappa-1}{4Ga} P \delta(x-1) \delta(y), \\ \nabla_{xy} w(x, y, 0) + \frac{\partial}{\partial z} Z(x, y, 0) &= 0, \quad \frac{\partial}{\partial z} Z^*(x, y, 0) = 0, \end{aligned} \quad (6)$$

$$u(0, y, z) = 0, \quad v(0, y, z) = 0, \quad w(0, y, z) = 0.$$

To reduce the given problem (4)-(6) to the one-dimensional problem, integral transforms are applied: sin-Furrier – with respect to a variable  $x$ , Furrier – with respect to a variable  $y$

$$\begin{bmatrix} w_{\alpha\beta}(z) \\ Z_{\alpha\beta}(z) \\ Z^*_{\alpha\beta}(z) \end{bmatrix} = \int_0^\infty \int_{-\infty}^\infty \begin{bmatrix} w(x, y, z) \\ Z(x, y, z) \\ Z^*(x, y, z) \end{bmatrix} \sin \alpha x e^{i\beta y} dx dy.$$

System (4) and boundary conditions (6) take a form

$$\begin{cases} w''_{\alpha\beta}(z) + \frac{2}{\kappa+1} Z'_{\alpha\beta}(z) - N^2 \frac{\kappa-1}{\kappa+1} w_{\alpha\beta}(z) + k_1^2 w_{\alpha\beta}(z) = 0, \\ Z''_{\alpha\beta}(z) - \frac{2}{\kappa-1} N^2 w'_{\alpha\beta}(z) - N^2 \frac{\kappa+1}{\kappa-1} Z_{\alpha\beta}(z) + k_2^2 Z_{\alpha\beta}(z) = -\frac{\kappa+1}{\kappa-1} \alpha \chi_\beta(z), \end{cases} \quad 0 < z < \infty. \quad (7)$$

$$-N^2 w_{\alpha\beta}(0) + Z'_{\alpha\beta}(0) = 0, \quad \mu Z_{\alpha\beta}(0) + (1 - \mu) w'_{\alpha\beta}(0) = \frac{\kappa-1}{4Ga} P \sin \alpha, \quad N^2 = \alpha^2 + \beta^2. \quad (8)$$

The problem for function  $Z^*_{\alpha\beta}(z)$  has a following form

$$Z^{**}_{\alpha\beta}(z) - (N^2 - k_2^2) Z^*_{\alpha\beta}(z) = -\alpha \psi_\beta(z), \quad 0 < z < \infty, \quad Z^*_{\alpha\beta}(0) = 0. \quad (9)$$

Here the unknown functions  $\chi_\beta(z)$ ,  $\psi_\beta(z)$

$$Z(0, y, z) = \chi(y, z), \quad Z^*(0, y, z) = \psi(y, z), \quad Z_\beta(0, z) = \chi_\beta(z), \quad Z^*_\beta(0, z) = \psi_\beta(z), \quad (10)$$

were introduced. They should be found from condition, that motion equations (2) after differentiation (3) have to be satisfied [2].

The problem (9) was solved using the integral Furrier transform and solution took a form

$$Z_\beta(x, z) = -\frac{1}{\pi} \frac{\partial}{\partial x} \int_{-\infty}^\infty \psi_\beta(\xi) K_0 \left( \sqrt{\beta^2 - k_2^2} \sqrt{x^2 + (z - \xi)^2} \right) d\xi.$$

$K_0(z)$  – Macdonald function.

The system (7) can be written in a vector form, using the differential operator of the 2d kind

$$L_2 \mathbf{y}(z) = \mathbf{I} \mathbf{y}''(z) + 2\mathbf{Q} \mathbf{y}'(z) - N^2 \mathbf{P} \mathbf{y}(z) + k_2^2 \mathbf{T} \mathbf{y}(z) = \mathbf{f}(z), \quad 0 < z < \infty \quad (11)$$

here unknown vector of transformants and the vector of right part

$$\mathbf{y}(z) = \begin{pmatrix} w_{\alpha\beta}(z) \\ Z_{\alpha\beta}(z) \end{pmatrix}, \quad \mathbf{f}(z) = \begin{pmatrix} 0 \\ -\frac{\kappa+1}{\kappa-1} \alpha \chi_\beta(z) \end{pmatrix},$$

and so as constant matrices

$$\mathbf{I} = \begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}, \mathbf{Q} = \begin{pmatrix} 0 & \frac{1}{\kappa+1} \\ -\frac{1}{\kappa-1}N^2 & 0 \end{pmatrix}, \mathbf{P} = \begin{pmatrix} \frac{\kappa-1}{\kappa+1} & 0 \\ 0 & \frac{\kappa+1}{\kappa-1} \end{pmatrix}, \mathbf{T} = \begin{pmatrix} \frac{\kappa-1}{\kappa+1} & 0 \\ 0 & 1 \end{pmatrix},$$

were introduced.

Solution to the vector problem (11), (8) was constructed in a form [4]

$$\mathbf{y}(z) = \int_0^{\infty} \mathbf{\Phi}(z - \xi) \mathbf{f}(\xi) d\xi + \mathbf{Y}_-(z) \mathbf{C},$$

where  $\mathbf{\Phi}(z - \xi)$  – fundamental matrix,  $\mathbf{C} = (C_0 \ C_1)^T$  – constant vector, should be found from the boundary conditions (8),

$\mathbf{Y}_-(z)$  – general decreasing, when  $z \rightarrow \infty$ , solution to a matrix equation  $L_2 \mathbf{Y}(z) = 0$ , related to (11). Using Jordan lemma and the main theorem on residues needed matrices were found.

As a result, the transformants can be written in a form of composition

$$w_{\alpha\beta}(z) = w_{\alpha\beta}^0(z) + w_{\alpha\beta}^1(z), \quad Z_{\alpha\beta}(z) = Z_{\alpha\beta}^0(z) + Z_{\alpha\beta}^1(z),$$

where  $w_{\alpha\beta}^0(z)$ ,  $Z_{\alpha\beta}^0(z)$  correspond to the solution of the problem under the assumption that unknown functions (10) are equal to zero and were constructed in [3] components with index “1” include unknown function.

The integral equations were obtained under assumption that motion equations (2) have to be satisfied after operation of differentiation (3). Relations that connects unknown functions were obtained in the process. They coincide with ones for problem in a static statement [2]

$$\frac{\partial \Omega_{\beta}(0, z)}{\partial x} + i\beta Z_{\beta}^*(0, z) = 0, \quad \frac{\partial Z_{\beta}^*(0, z)}{\partial x} - i\beta \frac{\kappa+1}{\kappa-1} Z_{\beta}(0, z) = 0,$$

where  $\Omega(x, y, z) = \frac{\kappa+1}{\kappa-1} Z(x, y, z) + \frac{2}{\kappa-1} \frac{\partial}{\partial z} w(x, y, z)$ .

After simplifications the final form for singular integral equation is

$$\begin{aligned} & \left( \gamma_1^2 - \frac{\partial^2}{\partial z^2} \right) \int_0^{\infty} \chi_{\beta}(\xi) \left[ \gamma_1^2 K_0(\gamma_1 |z - \xi|) - \frac{1}{z - \xi} \frac{\partial}{\partial z} K_0(\gamma_1 |z - \xi|) - \frac{\kappa+1}{\kappa-1} k_1^2 K_0(\gamma_1 |z - \xi|) \right] d\xi - \\ & - \left( \gamma_2^2 - \frac{\partial^2}{\partial z^2} \right) \int_0^{\infty} \chi_{\beta}(\xi) \left[ \gamma_2^2 K_0(\gamma_2 |z - \xi|) - \frac{1}{z - \xi} \frac{\partial}{\partial z} K_0(\gamma_2 |z - \xi|) \right] d\xi - \\ & - \beta^2 k_2^2 \int_0^{\infty} \chi_{\beta}(\xi) \left[ K_0(\gamma_2 |z - \xi|) + K_0(\gamma_2 |z + \xi|) \right] d\xi + \int_0^{\infty} \chi_{\beta}(\xi) \left( \int_0^{\infty} \frac{\alpha^2}{\Delta_{\omega} \delta_1} F(N, z, \xi, \omega) d\alpha \right) d\xi = \\ & = \frac{\kappa-1}{\kappa+1} \frac{2k_2^2 P}{Ga} \int_0^{\infty} \frac{\alpha \sin \alpha}{\Delta_{\omega}} \left[ -2N^2 \delta_1 \delta_2 e^{-\delta_2 z} + \left\{ 2N^4 - \frac{\kappa-3}{\kappa+1} N^2 k_2^2 - \frac{2}{\kappa+1} k_2^4 \right\} e^{-\delta_1 z} \right] d\alpha. \end{aligned} \quad (12)$$

Where

$$\Delta_{\omega} = 4N^4 - 4N^2 k_2^2 + k_2^4 - 4N^2 \delta_1 \delta_2 = (2N^2 - k_2^2)^2 - 4N^2 \delta_1 \delta_2, \quad (13)$$

$$F(N, z, \xi, \omega) = \left( N^2 + \frac{2}{\kappa+1} k_2^2 \right) g_1 e^{-\delta_1(z+\xi)} + \delta_1 \delta_2 \left( g_1 e^{-\delta_2(z+\xi)} - N^2 g_2 e^{-\delta_2 z} e^{-\delta_1 \xi} - g_2 \left( N^2 + \frac{2}{\kappa+1} k_2^2 \right) e^{-\delta_1 z} e^{-\delta_2 \xi} \right).$$

$$g_1 = 4N^4 - 4N^2 k_2^2 + k_2^4 + 4N^2 \delta_1 \delta_2, \quad g_2 = 8N^2 - 4k_2^2.$$

Presented in the equation (12) multivalued function

$$\delta_1 = \sqrt{N^2 - k_1^2}, \quad \delta_2 = \sqrt{N^2 - k_2^2}, \quad \gamma_1 = \sqrt{\beta^2 - k_1^2}, \quad \gamma_2 = \sqrt{\beta^2 - k_2^2}$$

have to be fixed in order to implement the methods of contour integration. It is necessary that the energy is carried away to infinity by each of two types of possible waves leaving the boundary, energy's flow must be directed away from the place where the load is applied. The introduction of attenuation into the medium makes the wave numbers complex and shift them to the 1st and 3rd quadrants of the complex plane. Also the presence of the root, which is a pole of a simple kind,  $\xi = \pm k_R$  – wave number related to the propagation velocity of the Rayleigh wave in the denominator of the integrand in (12), defined as  $\Delta_{\omega}$  in (13), was taken into account.

After highlighting the mechanical sense of the unknown function in the integral equation, it was represented as series

$$\chi_\beta(\xi) = Z_\beta(0, \xi) = \sum_{n=1}^{\infty} x_n(\beta) e^{-\xi} \xi^{-\gamma} L_n^{(-\gamma)}(2\xi), \quad (14)$$

where  $L_n^{(-\gamma)}(2\xi)$  – Laguerre polynomials,  $x_n(\beta)$  – unknowns. The correspondence (14) is substituted into the equation (12) and the method of orthogonal polynomials is utilized, which reduces the equation to the infinite system of linear algebraic equations of the first kind, which was solved with the help of the reduction method.

After simplifications formula for vertical displacement was obtained

$$\begin{aligned} w(x, y, 0; \omega) = & \frac{(\kappa+1)^2}{\kappa-1} \frac{1}{\pi^2 k_2^2} \sum_{n=0}^{\infty} x_n \int_0^{\infty} e^{-\xi} \xi^{-\gamma} L_n^{(-\gamma)}(2\xi) \frac{x\xi}{x^2 + \xi^2} \left[ \right. \\ & -i \frac{\pi}{2} \int_0^{k_1} \sqrt{k_1^2 - \beta^2} Y_2\left(\sqrt{k_1^2 - \beta^2} \sqrt{x^2 + \xi^2}\right) + i \frac{\pi}{2} \int_0^{k_2} \sqrt{k_2^2 - \beta^2} Y_2\left(\sqrt{k_2^2 - \beta^2} \sqrt{x^2 + \xi^2}\right) + \\ & \left. + \int_{k_1}^{\infty} \sqrt{\beta^2 - k_1^2} K_2\left(\sqrt{\beta^2 - k_1^2} \sqrt{x^2 + \xi^2}\right) - \int_{k_2}^{\infty} \sqrt{\beta^2 - k_2^2} K_2\left(\sqrt{\beta^2 - k_2^2} \sqrt{x^2 + \xi^2}\right) \right] \beta \cos(\beta y) d\beta d\xi + \\ & + \frac{(\kappa+1)^2}{\kappa-1} \frac{2}{\pi k_2^2} \sum_{n=0}^{\infty} x_n \left[ \pi \frac{k_R \Psi(k_R)}{F'(k_R)} J(k_R, x, y) - \int_0^{k_1} \frac{s \Psi_1(s) J(s, x, y)}{(2s^2 - k_2^2)^2 + 4s^2 \sqrt{k_1^2 - s^2} \sqrt{k_2^2 - s^2}} ds - \right. \\ & \left. - \int_{k_1}^{k_2} \frac{4s^2 \sqrt{s^2 - k_1^2} \sqrt{k_2^2 - s^2} \Psi_2(s) J(s, x, y)}{(2s^2 - k_2^2)^4 + 16s^4 (s^2 - k_1^2)(k_2^2 - s^2)} ds \right] + w_0(x, y, 0; \omega). \end{aligned} \quad (15)$$

Here  $Y_2(z)$  – Neumann function,  $J(s, x, y)$  connects Bessel functions,  $\Psi_i(s)$  are known functions,  $w_0(x, y, 0; \omega)$  – vertical displacement related to zero unknown functions, obtained in [3].

Derived displacement (15), that appears in the elastic quarter space under the action of concentrated at the point  $(a, b)$  on the boundary  $z=0$  harmonic load, can be used to investigate a displacement under distributed across rectangular area  $0 < x < A, -B < y < B$  load [2].

#### 4. NUMERICAL RESULTS

For numerical implementation, the displacement (15) should be multiplied by  $e^{i\omega t}$  and the real and imaginary parts should be separated. The load of constant intensity was supposed to be equal  $P=1$ . The Poisson ratio  $\mu=1/3$ , which relates to steel with the shear modulus  $G=82$  GPa, the density  $\rho=7.86 \cdot 10^3$  kg/m<sup>3</sup>, speed of the secondary waves  $c_2=3210$  m/s. Natural frequencies' values of the load are  $\omega=0.3, 0.5, 1, 2$ . Three types of load distributed sections are considered: 1)  $B=A/2$  – over the square; 2)  $B=A$  – over rectangle, elongated along the  $Oy$  axis; 3)  $B=A/4$  – a rectangle extended along the  $Ox$ ; The graphs are given for the  $\text{Im } w^{AB}(x, y, 0; \omega)$ .

The Fig.1. illustrates the oscillation process of the boundary  $z=0$  when the load is distributed along a square area  $B=A/2$  with an increasing the frequency of an external force from  $\omega=0.5$  to  $\omega=2$  in Fig.2. The fulfillment of the rigidly fastening of the face  $x=0$  is obvious. The maximum deflection is achieved under the area of action the force with attenuation while moving away from the load section. At the distance of approximately  $1.5A$  there is a zone of negative displacements for  $\omega=2$ , which means that the face  $z=0$  is raised. With increasing the oscillation frequency of the external force, the amplitude of the face's vibration grows approximately 1.5 times. Maximum amplitude achieves when the load is distributed over rectangle, elongated along the  $Oy$  axis and minimal amplitudes are achieved when a load is applied over a rectangle extended along the  $Ox$ . At low frequencies, which in the limit corresponds to the static problem [2], only deflection of the edge  $z=0$  is observed. For the frequencies starting from  $\omega=1$ , zones of edge  $z=0$  elevation are observed at a distance of approximately 1.5 times further from the zone of action the distributed load. The most significant contribution to the oscillatory process is made by the term corresponding to the wave number, related to the Rayleigh wave.



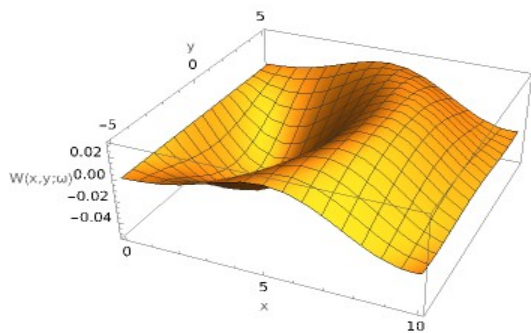


Figure 1.  $w^{AB}(x, y, 0; \omega)$  for  $\omega = 0.5$

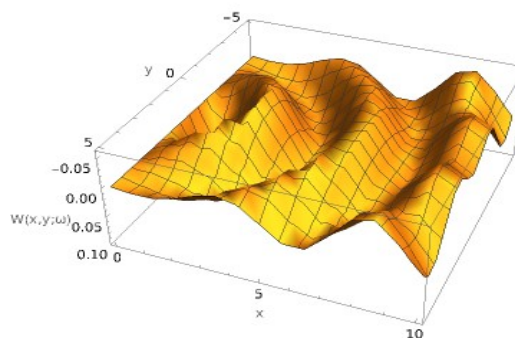


Figure 2.  $w^{AB}(x, y, 0; \omega)$  for  $\omega = 2$

## 5. CONCLUSION

The steady-state oscillations of the elastic quarter space were analyzed, when one face is rigidly fixed and a normal harmonic compressive load is acting on another. Implementation of the method, proposed by Popov G.Ya., give opportunity to divide the system of three equations into the system of two equations and independently solved equation. The boundary conditions are separated too. The application of the integral transforms leads to the one-dimensional inhomogeneous vector boundary problem, which was solved with the matrix differential calculus. The integral equations were derived under assumption that two equations from motion equations, which were subjected to the operation of differentiation, must be satisfied. A singular integral equation was resolved using the method of orthogonal polynomials, with reduction to an infinite algebraic system of the 1<sup>st</sup> kind. The amplitude of the vertical displacement of the quarter space's edge was investigated depending on oscillation frequency, the shape of the acting load's section and a material of the medium.

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# QUANTUM COMPUTATIONAL INVESTIGATION of L-QUEBRACHITOL and D-PINITOL ISOMERS

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## ABSTRACT

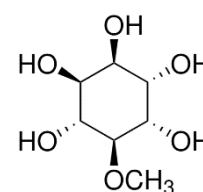
L-Quebrachitol, found in high concentration in rubber trees (*Heava brasiliensis*), is a natural plant product that is easily isolated from latex wastewater. It is a compound used by diabetic patients as a sweetener and also has antioxidant properties. By protecting the body from the harmful effects of free radicals, antioxidants can reduce cellular damage and reduce the risk of various diseases. Some research shows that L-Quebrachitol has anti-inflammatory properties. The D-Pinitol compound also has properties that increase insulin sensitivity and its use in the treatment of such diseases has been proven in many studies. Also, it has anti-inflammatory and antioxidant properties. L-Quebrachitol and D-Pinitol compounds, whose structures are isomeric, are both natural sugar alcohols.

In this study, the structures of these two isomeric compounds, which contain such important information, were tried to be elucidated. Using the optimized structures of both compounds, the vibration frequencies were obtained by density functional theory (DFT) method with the DFT/B3LYP/6-311++G(d,p) basis set. Charges of atoms and their electronic structures were explained using the NBO method. The excited state energies were calculated using Time-Dependent Density Functional Theory (TD-DFT) calculations.

**Keywords:** L-Quebrachitol, D-Pinitol, DFT/TD-DFT, NBO method.

## 1. INTRODUCTION

L-Quebrachitol is a member of cyclohexanols, found in high concentration in rubber trees (*Heava brasiliensis*). It is a natural plant product that is easily isolated from latex wastewater. used by diabetic patients as a sweetener and also has antioxidant properties. By body from the harmful effects of free radicals, antioxidants can reduce cellular damage and reduce the risk of various diseases. Some research shows that L-Quebrachitol has anti-inflammatory properties. The D-Pinitol compound also has properties that increase insulin use in the treatment of such diseases has been proven in many studies. Also, it has anti-inflammatory and antioxidant properties. L-Quebrachitol and D-Pinitol compounds, are isomeric, are both natural sugar alcohols [1-10].



trees (*Heava*  
It is a compound  
protecting the  
damage and  
inflammatory  
sensitivity and its  
anti-  
whose structures

### D-Pinitol

Carob is one of the main food trees for people in the Mediterranean basin, but it has also been used traditionally for medicinal purposes. Carob contains many nutrients and active natural products, and D-Pinitol is one of the most important of them. D-Pinitol has been reported to have potent activities as a natural antidiabetic and insulin regulator, as well as being an active anti-Alzheimer, anticancer, antioxidant, and anti-inflammatory, as well as being immune and hepatoprotective.

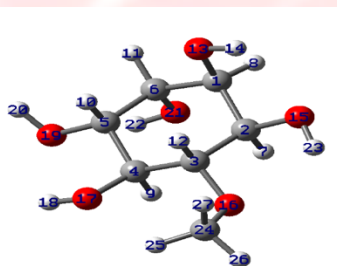
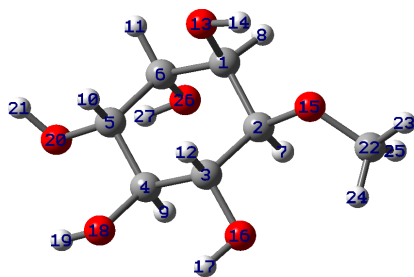


Figure 1. Molecular scheme of D-P with adopted atom numbers

### L-Quebrachitol

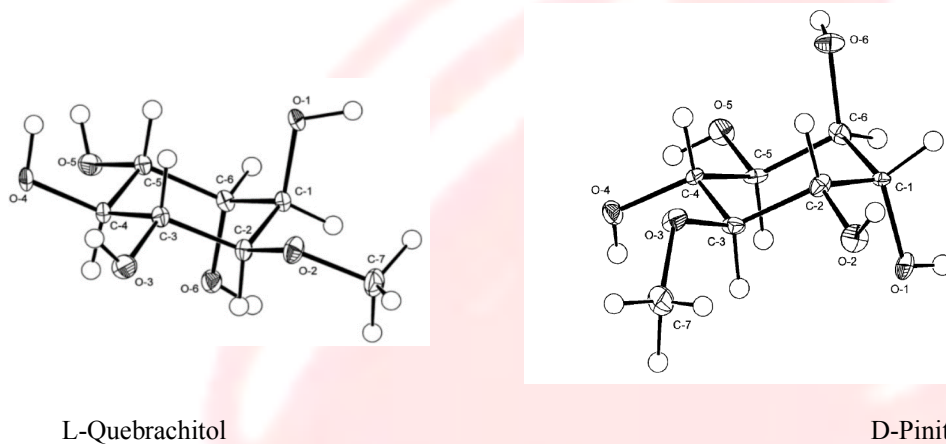
The compound L-Quebrachitol is a natural plant product. It is found in high concentration in rubber trees (*Heava brasiliensis*) and is easily isolated from latex effluent. L-Quebrachitol, is a compound used by diabetic patients as a sweetener and also has antioxidant properties [11-14].



**Figure 2.** Molecular scheme of L-Q with adopted atom numbers

## 2. STRUCTURAL ANALYSIS

There are no unusual bond lengths or valence angles in the structures. Both rings are chair-shaped and the majority of the pendulous groups are equatorially oriented (Fig.3). As with many compounds with multiple hydroxyl groups, the structures have extensive networks of hydrogen bonds. Both structures have infinite chain hydrogen bond sequences containing O-2 and O-3 methyl groups and finite chain sequences containing other hydroxyl groups [15-16].

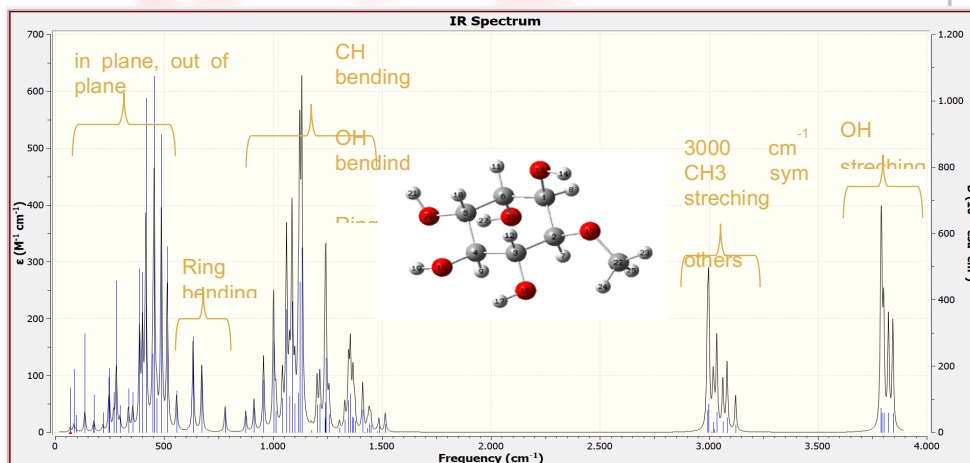


**Figure 3.** L-Q and D-P are chair-shaped and the majority of the pendulous groups are equatorially oriented.

C-O vibration are with high sensitivity and strong intensity of absorptioint moderately minor changes in its environment for L-Q and D-P.

The OH stretching vibration occurs with band spectral region 3844, 3824, 3802, 3793, 3789  $\text{cm}^{-1}$ .

C-H3 stretchings are 3122 asym, 3083 asym, 3000 sym  $\text{cm}^{-1}$  (Fig. 4).



**Figure 4.** Calculated Spectra of L-Quebrachitol

The OH stretching vibration occurs with band spectral region 3841, 3804, 3780, 3796, 3794  $\text{cm}^{-1}$ . C-H3 stretchings are 3125 asym, 3085 asym, 2996 sym  $\text{cm}^{-1}$  (Fig.5).

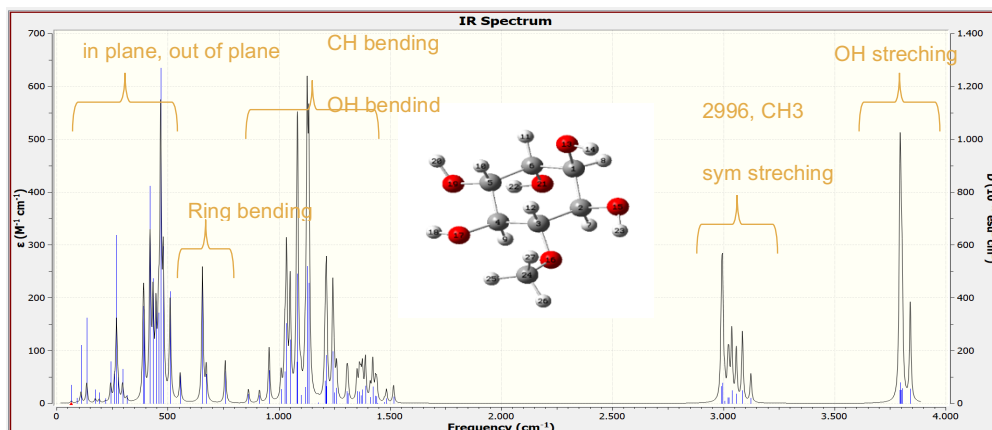


Figure 5. Calculated Spectra of D-Pinitol

### 3. HOMO-LUMO GAP ENERGIES

The highest occupied molecular orbital (HOMO) indicates the ability to donate an electron, while the lowest unoccupied molecular orbital (LUMO) indicates the ability to accept an electron. On the other hand, while the energy of HOMO is directly related to Ionization Potential, the energy of LUMO is related to Electron Affinity (Fig. 6).

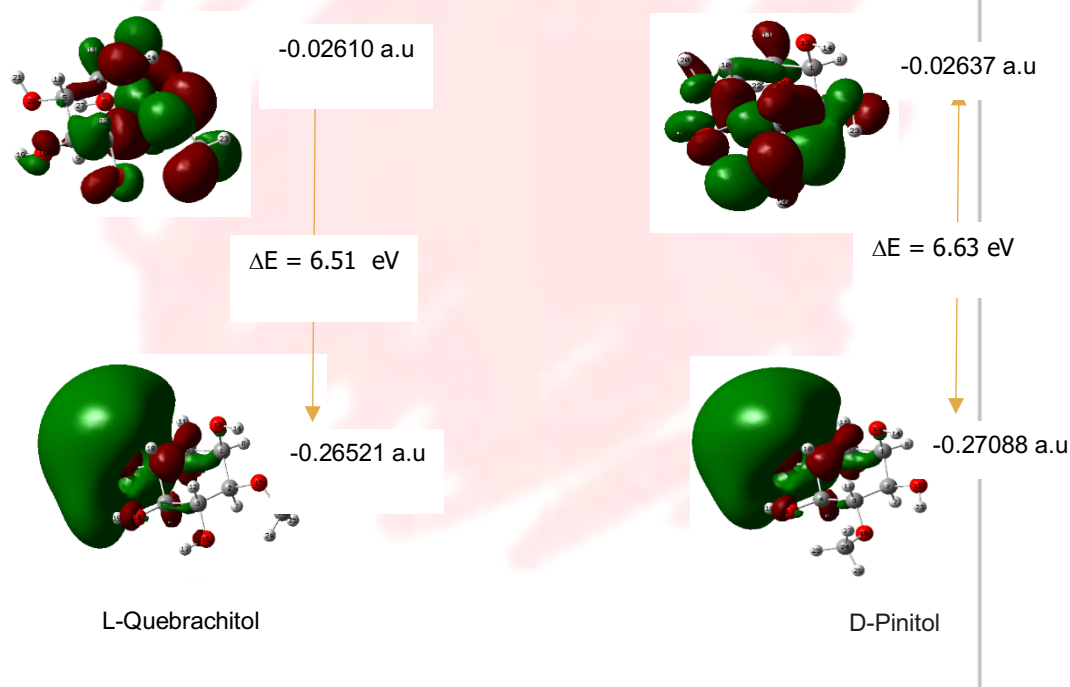


Figure 6. HOMO-LUMO energies of L-Q and D-P

The less the energy difference between these two molecular orbitals, the more polarized the molecule can be. Polarizable molecules have very high chemical reactivity and low kinetic stability. Because of these properties, they are called soft molecules. When the energy difference is large, it means that the molecule is hard, that is, its ability to react is low.

IP; Ionization Potential; - HOMO  
EA; Electron Affinity ; - LUMO

#### 4. STABILIZATION ENERGIES of L-Q and D-P

Thus, this paper presents the results of research in the field of navigation of mobile robots, the proposed technology of navigation of a group of robots using a cloud service with the use of a single server designed to collect information from sensors of robotic equipment and use it to build a map of the working space. An example of a constructed map of a room using sensors of a mobile robot is given. An example of a possible design of a mobile workplace used to build a map of the area is given. The structural diagram of the cloud data storage for the construction of the terrain map is developed [4]. The structure of the data collection server is developed and the algorithm of the mobile platform in interaction with the cloud server is proposed. The developed application performs the following functions: displaying the list of mobile devices registered on the server; displaying the room plan; generating the ground map based on the data from the cloud storage; accumulating information about the environment of the mobile platform to build a ground map.

**Table 1.** Stabilization energies of L-Q

| LQ            |                  | E(2)     | E(j)-E(i) | F(i,j) |
|---------------|------------------|----------|-----------|--------|
| Donor NBO (i) | Acceptor NBO (j) | kcal/mol | a.u.      | a.u.   |
| BD (1) C2-H7  | BD*(1) C1-O13    | 3.91     | 0.80      | 0.050  |
| BD (1) C5-H10 | BD*(1) C6-O26    | 3.98     | 0.80      | 0.051  |
| LP (2) O13    | BD*(1) C1-C2     | 4.51     | 0.67      | 0.049  |
| LP (2) O13    | BD*(1) C1-H8     | 7.74     | 0.69      | 0.065  |
| LP (2) O15    | BD*(1) C2-C3     | 7.13     | 0.67      | 0.062  |
| LP (2) O15    | BD*(1) C22-H24   | 5.82     | 0.70      | 0.058  |
| LP (2) O15    | BD*(1) C22-H25   | 5.39     | 0.68      | 0.055  |
| LP (2) O16    | BD*(1) C3-C4     | 4.96     | 0.68      | 0.052  |
| LP (2) O16    | BD*(1) C3-H12    | 6.99     | 0.68      | 0.062  |
| LP (2) O18    | BD*(1) C4-C5     | 6.22     | 0.69      | 0.058  |
| LP (2) O18    | BD*(1) C4-H9     | 5.50     | 0.70      | 0.055  |
| LP (2) O20    | BD*(1) C5-C6     | 6.45     | 0.70      | 0.060  |
| LP (2) O26    | BD*(1) C5-C6     | 4.19     | 0.67      | 0.047  |
| LP (2) O26    | BD*(1) C6-H11    | 8.17     | 0.68      | 0.067  |

**Table 2.** Stabilization energies of D-P

| DP            |                  | E(2)     | E(j)-E(i) | F(i,j) |
|---------------|------------------|----------|-----------|--------|
| Donor NBO (i) | Acceptor NBO (j) | kcal/mol | a.u.      | a.u.   |
| BD (1) C2-H7  | BD*(1) C1-O13    | 4.30     | 0.79      | 0.052  |
| BD (1) C5-H10 | BD*(1) C6-O21    | 4.05     | 0.80      | 0.051  |
| LP (2) O13    | BD*(1) C1-C2     | 4.34     | 0.68      | 0.049  |
| LP (2) O13    | BD*(1) C1-H 8    | 7.75     | 0.69      | 0.066  |
| LP (2) O15    | BD*(1) C2-C3     | 4.32     | 0.68      | 0.048  |
| LP (2) O15    | BD*(1) C2-H7     | 7.53     | 0.70      | 0.065  |
| LP (2) O15    | BD*(1) C22-H25   | 5.39     | 0.68      | 0.055  |
| LP (2) O16    | BD*(1) C3-C4     | 7.67     | 0.68      | 0.065  |
| LP (2) O16    | BD*(1) C24-H27   | 4.93     | 0.68      | 0.052  |
| LP (2) O17    | BD*(1) C4-C5     | 5.45     | 0.67      | 0.054  |
| LP (2) O17    | BD*(1) C4-H9     | 6.51     | 0.69      | 0.060  |
| LP (2) O19    | BD*(1) C5-C6     | 6.41     | 0.70      | 0.060  |
| LP (2) O21    | BD*(1) C5-C6     | 4.10     | 0.67      | 0.047  |
| LP (2) O21    | BD*(1) C6-H11    | 8.28     | 0.68      | 0.067  |

$$\Delta E_{ij} = q_i \frac{F_{ij}^2}{\varepsilon_i - \varepsilon_j} \quad (1)$$

$q_i$  is the donor orbital occupancy,  $\varepsilon_i$ ,  $\varepsilon_j$  are diagonal elements (orbital energies) and  $F_{i,j}$  is the off-diagonal NBO Fock matrix element. Total LQ stabilization energy is 392.02, DP is 318.8 kcal/mol.

### 5. ORBITAL ANALYSIS of L-Q and D-P

| (Occupancy) | Bond orbital         | Coefficients/ Hybrids (Fig.5)        |
|-------------|----------------------|--------------------------------------|
| (1.92958)   | LP (2) O15           | s(0.02%) p99.99(99.95%) d1.67(0.03%) |
| (0.03664)   | BD*(1) C1-C2         |                                      |
|             | (50.38%) 0.7098* C1  | s(28.31%) p2.53(71.64%) d0.00(0.05%) |
|             | (49.62%) -0.7044* C2 | s(27.14%) p2.68(72.82%) d0.00(0.05%) |

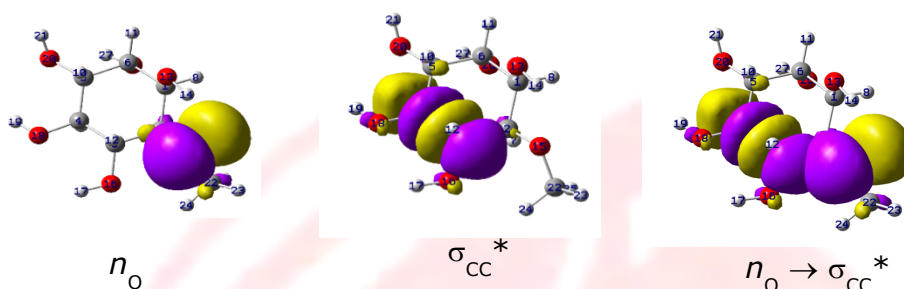


Figure 5. Orbital scheme of L-Q

| (Occupancy) | Bond orbital         | Coefficients/ Hybrids (Fig.6)         |
|-------------|----------------------|---------------------------------------|
| (1.95793)   | LP (2) O15           | s(0.00%) p1.00(99.96%) d0.00(0.04%)   |
| (0.03791)   | BD*(1) C3-C4         |                                       |
|             | (50.48%) 0.7105* C3  | s(28.64%) p2.49(71.31%) d 0.00(0.05%) |
|             | (49.52%) -0.7037* C4 | s(28.41%) p2.52(71.55%) d 0.00(0.04%) |

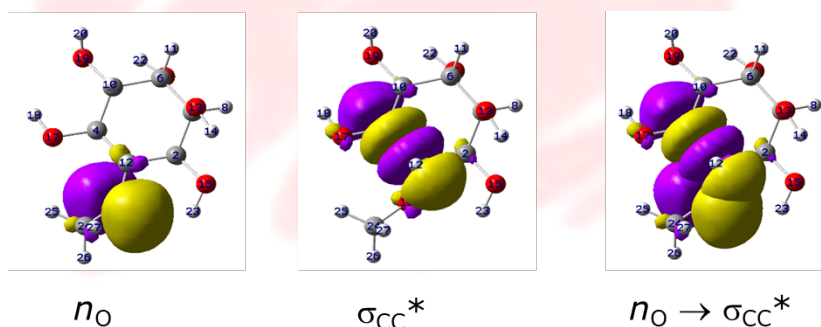


Figure 6. Orbital scheme of D-P

Occupancy (between 0 and 2 electrons) and unique label of the NBO.

Bond orbital

(LP for 1-center valence lone pair)

(BD\* for 2-center antibond)

The unstarred and starred labels corresponding to Lewis and non-Lewis NBOs

Hybrids

(percentage s-character, p-character, etc.)

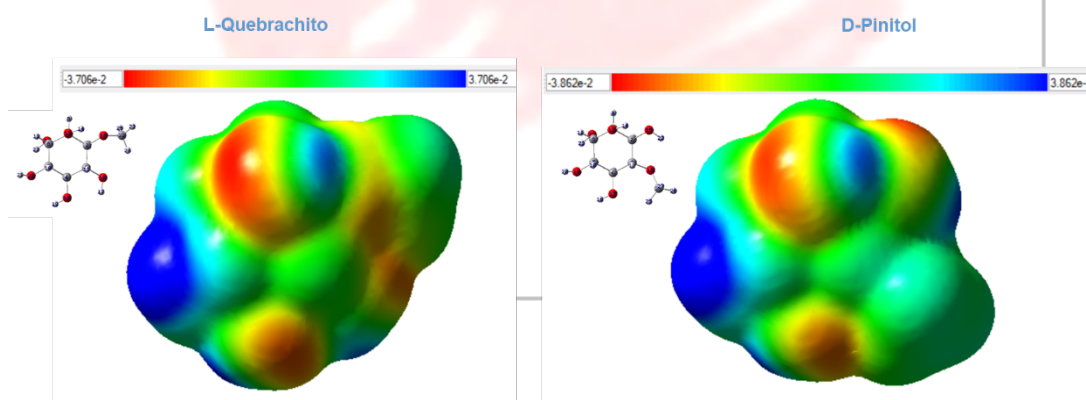
Table 3 shows the general quality of the natural Lewis structure description in terms of the percentage of the total electron density (e.g., in the above case, for D-Pinitol 99.157%, for L-Quebrachitol 99.166). The table also exhibits the relatively important role of the valence non-Lewis orbitals relative to the extra-valence orbitals in the slight departures from a localized Lewis structure model.

**Table 3.** natural Lewis structure description in terms of the percentage of the total electron density

| D-Pinitol         |                            | L-Quebrachitol    |                            |
|-------------------|----------------------------|-------------------|----------------------------|
| Core              | 25.99186 (99.969% of 26)   | Core              | 25.99185 (99.969% of 26)   |
| Valence Lewis     | 77.13124 (98.886% of 78)   | Valence Lewis     | 77.14082 (98.898% of 78)   |
| =====             |                            |                   |                            |
| Total Lewis       | 103.12310 (99.157% of 104) | Total Lewis       | 103.13267 (99.166% of 104) |
| -----             |                            |                   |                            |
| Valence non-Lewis | 0.65902 (0.634% of 104)    | Valence non-Lewis | 0.65136 (0.626% of 104)    |
| Rydberg non-Lewis | 0.21788 (0.210% of 104)    | Rydberg non-Lewis | 0.21597 (0.208% of 104)    |
| =====             |                            |                   |                            |
| Total non-Lewis   | 0.87690 (0.843% of 104)    | Total non-Lewis   | 0.86733 (0.834% of 104)    |
| -----             |                            |                   |                            |

## 6. ELECTRON DENSITY FROM TOTAL SELF-CONSISTENT FIELD DENSITY of L-Q and D-P

On the MEP map (Fig.7), the most negative potential (the region with higher electron density over the entire molecule than the nucleus) is shown in red, while blue is used to show the most positive potential (the region with partial positive charges). These values are between  $-3.706e-2$  (max. red region) and  $+3.706e-2$  (max. blue region) for L-Q and between  $-3.862e-2$  (max. red region) and  $+3.862e-2$  (max. blue region) for D-P. The map showed that the negative electrostatic potentials (red region, electrophilic attack) were intensified around the O21 and O16 atoms while the maximum electrostatic potential (blue region, nucleophilic attack) was intensified around the C5H10 group hydrogens for L-Q and D-P.



**Figure 7.** Electron density pattern from total SCF density mapped with the electrostatic potential (ESP), Isoval: 0.0004

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# EXAMINATION OF OPINIONS ON THE WEB-BASED SYSTEM DEVELOPED WITHIN THE SCOPE OF THE PLANNING CYCLE IN THE EFFECTIVE STRUCTURING OF TEACHING PROCESSES

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## ABSTRACT

This study aims to examine the views of instructors on the web-based system developed within the scope of the Planning step of the PDCA cycle, which is operated to ensure quality assurance for the effective structuring of teaching processes. The participants of the study consisted of Eskişehir Technical University Quality Commission Members and lecturers who were entitled to receive a certificate by participating in the Competence in Teaching Program operating within the Learning and Teaching Development. The web-based system developed within the framework of the Rapid Prototyping Model consists of 2 modules: Activity Process Management and Course Process Management module. Based on the importance of the concept of "data" today, it is envisaged that effective planning of the activities carried out, effective reporting of institutional processes will support the creation of a competence mechanism that also frames the individual on the quality axis.

**Keywords:** Competence in teaching, total quality management, PDCA, quality assurance

## 1. INTRODUCTION

All kinds of events in the age we live in bring educational problems along with them. Undoubtedly, the most prominent concern among educational problems is whether learning outcomes can be achieved. This issue brings with it the effective planning of the teaching process, and the basis of effective planning is related to a well-structured instructional design. With the dynamics that online learning environments contain, it is necessary to ensure the commitment of the teaching process for the learner and the learner's adaptation to the learning process. This issue has shown itself in all its dimensions in the Covid 19 pandemic as well as in the Kahramanmaraş earthquake on February 6, 2023. The crisis created in the field of education, as in every field in times of extraordinary circumstances, brings with it the opportunity to reconsider the learning-teaching processes in the context of educational technologies and to integrate these technologies into the learning process and to evolve into innovations by enriching them in the light of changing and transforming paradigms. To prevent the deepening of this crisis, planning for the realization of activities to ensure quality assurance is among the priority agendas of higher education institutions [1].

Even though educational institutions at almost every level have updated their existing systems in line with the dynamics of our age, it is an undeniable fact that there is a serious adaptation problem in managing these systems. When it comes to effective technology integration, it is seen that technology enriches education and training processes, improves learning outcomes, and ultimately, education cannot be carried out without technology. As a matter of fact, as stated by [2], the statement "it is not possible to teach the course without that technology" expresses the idea of successful technology integration. A successful technology integration study is an important indicator in dealing with adaptation problems. One of the most important steps that constitute this indicator is the "Planning" phase of the PDCA cycle, which is the basis for providing internal quality assurance. An effective planning process is the preparation phase of a successful implementation process by thoroughly observing possible variables. Education and training standards constitute an important share in providing an internal quality assurance system in a higher education institution. In this regard, based on the education-teaching standards of a higher education institution; to dominate education in general and learning situations in particular; a web-based technology for the functional structuring of teaching processes. It is important that the "Planning" stage should be structured meticulously, first and foremost, in the integration of learning-teaching processes. In revealing the effectiveness of the structuring processes; of course, the "Check" and "Take Measures" steps, which are the stages of the "Implementation" step after the implementation, are important. Evaluating and improving the realized practices is important in terms of closing the PDCA cycle and creating input for the next cycle.

The answer sought for the effective structuring of teaching processes in accordance with education and training standards The question "1-Where do we want to go?" is followed by the question "2-How do we get there?" and "3-Did we really get where we wanted to go?". In this study, it is aimed to provide structured support for planning processes to instructors who want to structure their teaching processes effectively.

This study aims to ensure internal quality assurance in accordance with the education standards of higher education institutions; It can be said that;

- It is up to date in terms of integrating the web-based environment to be developed to support the functional structuring of teaching processes,
- The web-based environment to be developed to master general education and learning situations during the integration process is unique and unique in terms of being designed to operate the Planning stage of the PDCA cycle.
- The web-based environment to be developed for structuring processes is necessary to support change management,
- It is functional in terms of planning teaching processes through the web-based environment to be developed and including supervision regarding the planning processes.

**Purpose of the study:** It aims to examine the opinions of faculty members about the web-based system developed within the scope of the Planning stage of the PUKÖ cycle, which is operated to ensure quality assurance in the effective structuring of teaching processes.

**Applications:** Web-Based System Developed for Effective Structuring of Educational Processes Opinions of Faculty Members About the Web-Based System Developed for Effective Structuring of Educational Processes

**Participants:** Eskisehir Technical University Quality Commission Members and faculty members who have earned the right to receive a certificate by participating in the Teaching Competency Program operating within the scope of Learning and Teaching Development.

## 2. WEB-BASED SYSTEM DEVELOPED FOR EFFECTIVE STRUCTURING OF EDUCATIONAL PROCESSES

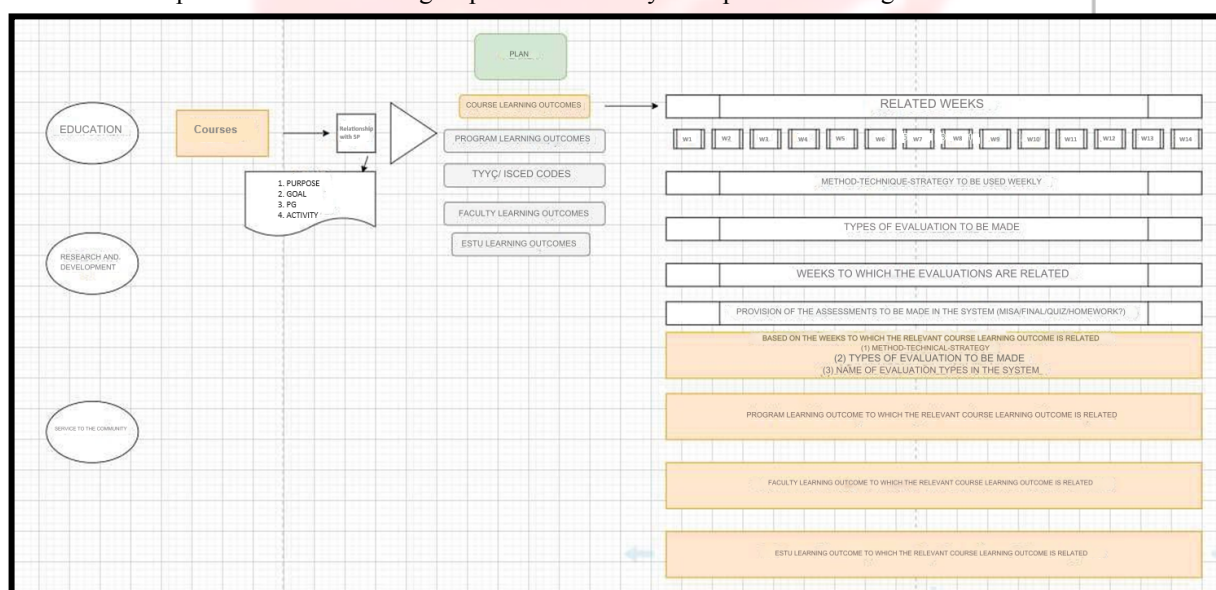
The aim of this study is to develop a web-based task, performance, and documentation system for the management of education and training standards within the framework of the Planning cycle of the PDCA cycle, which helps the internal quality assurance system in accordance with the education and training standards of higher education institutions. The web-based system is intended to manage the plans and practices of the academic staff in the field of education and training, which is the most fundamental responsibility of the academic staff, and to plan evaluation and improvement processes and effective feedback processes regarding the learning performance of their students. In addition, it will be possible to serve the understanding of institutional agility by keeping the institutional memory alive and dynamic with the documentation module aimed at creating evidence to support the quality assurance system, which is very important for higher education institutions. In this direction, the research problem sought to be answered within the scope of the study presented below:

*"What are the opinions of the lecturers about the web-based system developed for effective structuring of education and training processes?"*

The method to be used in the study is based on the observance of national and international standards for quality assurance. In this context, the variables that will form the basis of the "Institutional Internal Evaluation Report" that institutions are expected to report every year by the Higher Education Quality Council and the standards of the institution and the standards of the accreditation organizations with which the units are associated; The web-based system developed in line with the institution's strategic plan in relation to the goals, objectives, performance indicators and fields of activity;

- 1 In the planning step, the relevant academic staff will enter (a) the relationship between the course learning outcomes and the program outcomes, unit learning outcomes, institutional learning outcomes and the Turkish Higher Education Qualifications Framework and the UN Sustainable Development Goals; (b) the methods, techniques and strategies that will be the basis for achieving the course learning outcomes and the weeks related to them will be specified; (c) the types of assessment to be made and the weeks related to them will be determined and their equivalent in the system (e.g. midterm) will be marked.
- 2 The planning cycle will end with a structured feedback process. In this process, participants will receive individual supervision regarding their teaching processes and will have knowledge and awareness about the implementation, control, and prevention cycles.
- 3 Although the developed system is limited to the Planning cycle, it will be possible to integrate the Implementation, Control and Prevention cycles into the system in future studies. The documentation module of the system will also include a module that will keep the institutional memory alive and create evidence when necessary.

The flow chart for the operation of the Planning step of the PDCA cycle is presented in Figure 1.



**Figure 1.** Event Process Management Module

In this framework, the system was developed based on the "Rapid Prototyping Model". According to Tripp and Bichelmeyer [2], this model has been successfully used in software engineering, and given the similarities between software design and instructional

design, rapid prototyping is particularly suitable for computer-based/web-based teaching and instructional design. The most important feature of the model is the continuous improvement of design tests during the process of creating the final product. The superiority of this method over other design models is that it saves time, labor, and cost without sacrificing quality [4]. Figure 2 shows the implementation process of the rapid prototyping model to be used as a basis for the project.

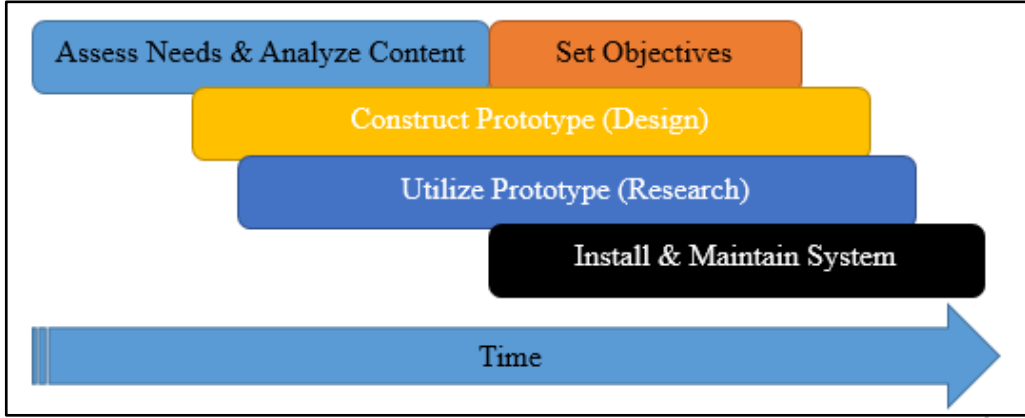


Figure 2. Rapid Prototyping Model

The interfaces of the developed software are presented in Figure [3-10]:

Figure 3. Event Process Management and Course Process Management Module.

| ID | Başlık  | Durum | İşlemler            |
|----|---|-------|---------------------|
| 1  | deneme etkinlik 1   | Aktif | <a href="#">Gör</a> |
| 2  | F1.1.1: Fakültelerde ve MYO'larında mezunlara yönelik bir komisyon kurulacak ve koordinatörler belirlenecek (Öğrenci Dekanlığı)                 | Aktif | <a href="#">Gör</a> |
| 3  | F1.1.2: Mezunlara yönelik çevrimiçi portal ortamı oluşturulacak   | Aktif | <a href="#">Gör</a> |
| 4  | F1.1.3 .Mezulan olan öğrencilerin mevcut kariyer durumlarının tespit edilmesine yönelik bilgi sağlanacak (Öğrenci Dekanlığı)                    | Pasif | <a href="#">Gör</a> |
| 5  | F1.1.4: Fakülteler ve MYO'larına yönelik mezunlar ve son sınıf öğrencilerinin katılımıyla çevrimiçi buluşmalar düzenlenecek (Öğrenci Dekanlığı) | Aktif | <a href="#">Gör</a> |
| 6  | Birim içi iletişimin güçlendirilmesi  | Aktif | <a href="#">Gör</a> |

Figure 4. Event Process Management Module.

The screenshot shows the 'Tanımlı Dersler' (Defined Courses) page in the ESTÜ system. The left sidebar has 'Tanımlı Dersler' highlighted. The main content area shows a table of courses with the following data:

| ID | Başlık  | Kredi | Sıra | Durum | İşlemler              |
|----|---|-------|------|-------|-----------------------|
| 19 | IST412.Bulanık Mantık   | 3     | 1    | On    | [İçerik] [Ekle] [Sil] |
| 20 | ENM317. Mühendislik İstatistiği                                       | 4.5   | 1    | On    | [İçerik] [Ekle] [Sil] |
| 21 | ENM320 - Production and Operations Planning II(Üretim ve Ope. Pla.II) | 5     | 1    | On    | [İçerik] [Ekle] [Sil] |
| 22 | ENM426 - Ergonomi   | 5     | 1    | On    | [İçerik] [Ekle] [Sil] |

Figure 5. Course Process Management Module-Defined Courses.

The screenshot shows the 'Tanımlı Dersler' (Defined Courses) page with a 'Yeni Kayıt Ekle' (Add New Record) modal form open. The form fields are:

- Başlık: Lütfen Başlık Giriniz
- Kredi: 1
- Sıra: 1
- Durum: Aktif

Figure 6. Course Process Management Module- Defined Courses.

The screenshot shows the 'Tanımlı Dersler' (Defined Courses) page in the ESTÜ system. The left sidebar has 'Ö. Yöntem ve Teknikleri' highlighted. The main content area shows a table of courses with the following data:

| ID | Başlık  | Kredi | Sıra | Durum | İşlemler              |
|----|---|-------|------|-------|-----------------------|
| 19 | IST412.Bulanık Mantık   | 3     | 1    | On    | [İçerik] [Ekle] [Sil] |
| 20 | ENM317. Mühendislik İstatistiği                                       | 4.5   | 1    | On    | [İçerik] [Ekle] [Sil] |
| 21 | ENM320 - Production and Operations Planning II(Üretim ve Ope. Pla.II) | 5     | 1    | On    | [İçerik] [Ekle] [Sil] |
| 22 | ENM426 - Ergonomi   | 5     | 1    | On    | [İçerik] [Ekle] [Sil] |

Figure 7. Course Process Management Module-Teaching Methods and Techniques.

The screenshot shows the 'Amaçlar' (Goals) section of the ESTÜ Course Process Management Module. The left sidebar has a menu with 'Stratejik Plan' highlighted in red. The main area shows a table of goals with the following data:

| ID | Başlık  | Sıra | Durum | İşlemler     |
|----|---|------|-------|--------------|
| 12 | Ön lisans, lisans ve lisansüstü programlarda öğrenme ortamlarını sürekli geliştirmek, verimliliğini ve etkililiğini artırarak küresel boyutta tercih edilen mezunlar yetiştirmek. | 1    | On    | [Ekle] [Sil] |
| 14 | Toplum için sürdürülebilir değer yaratmak   | 2    | Off   | [Ekle] [Sil] |
| 15 | Uluslararasılaşmayı tüm boyutlarıyla bütünlük, verimli ve sürdürülebilir olarak yönetmek  | 1    | On    | [Ekle] [Sil] |
| 16 | Doğa ve insan odaklı, yenilikçi, yaratıcı, sürekli öğrenen, sürdürülebilir ve bütünlük bir yönetim ekosistemi geliştirmek   | 1    | On    | [Ekle] [Sil] |
| 17 | Araştırma unsurlarını etkinleştirmek ve değer yaratan araştırma çıktıları üretmek   | 1    | On    | [Ekle] [Sil] |

Figure 8. Course Process Management Module-Strategic Plan.

The screenshot shows the 'Amaçlar' (Goals) section of the ESTÜ Course Process Management Module. The left sidebar has a menu with 'Kriterler' highlighted in red. The main area shows a table of criteria with the following data:

| ID | Başlık  | Sıra | Durum | İşlemler     |
|----|---|------|-------|--------------|
| 12 | Ön lisans, lisans ve lisansüstü programlarda öğrenme ortamlarını sürekli geliştirmek, verimliliğini ve etkililiğini artırarak küresel boyutta tercih edilen mezunlar yetiştirmek. | 1    | On    | [Ekle] [Sil] |
| 14 | Toplum için sürdürülebilir değer yaratmak   | 2    | Off   | [Ekle] [Sil] |
| 15 | Uluslararasılaşmayı tüm boyutlarıyla bütünlük, verimli ve sürdürülebilir olarak yönetmek  | 1    | On    | [Ekle] [Sil] |
| 16 | Doğa ve insan odaklı, yenilikçi, yaratıcı, sürekli öğrenen, sürdürülebilir ve bütünlük bir yönetim ekosistemi geliştirmek   | 1    | On    | [Ekle] [Sil] |
| 17 | Araştırma unsurlarını etkinleştirmek ve değer yaratan araştırma çıktıları üretmek   | 1    | On    | [Ekle] [Sil] |

Figure 9. Course Process Management Module- Criteria.

The screenshot shows the 'Amaçlar' (Goals) section of the ESTÜ Course Process Management Module. The left sidebar has a menu with 'Çıktılar' highlighted in red. The main area shows a table of outputs with the following data:

| ID | Başlık  | Sıra | Durum | İşlemler     |
|----|---|------|-------|--------------|
| 12 | Ön lisans, lisans ve lisansüstü programlarda öğrenme ortamlarını sürekli geliştirmek, verimliliğini ve etkililiğini artırarak küresel boyutta tercih edilen mezunlar yetiştirmek. | 1    | On    | [Ekle] [Sil] |
| 14 | Toplum için sürdürülebilir değer yaratmak   | 2    | Off   | [Ekle] [Sil] |
| 15 | Uluslararasılaşmayı tüm boyutlarıyla bütünlük, verimli ve sürdürülebilir olarak yönetmek  | 1    | On    | [Ekle] [Sil] |
| 16 | Doğa ve insan odaklı, yenilikçi, yaratıcı, sürekli öğrenen, sürdürülebilir ve bütünlük bir yönetim ekosistemi geliştirmek   | 1    | On    | [Ekle] [Sil] |
| 17 | Araştırma unsurlarını etkinleştirmek ve değer yaratan araştırma çıktıları üretmek   | 1    | On    | [Ekle] [Sil] |

Figure 10. Course Process Management Module-Outputs.

During the design evaluation phase, the data collection process was carried out through a survey on the selected sample to receive opinions and suggestions about the interfaces prepared. The interfaces were evaluated according to the parameters of effectiveness, efficiency, usefulness, functionality, originality, and necessity. The results of the opinions and suggestions obtained from the pilot study are presented Figure [11-15].

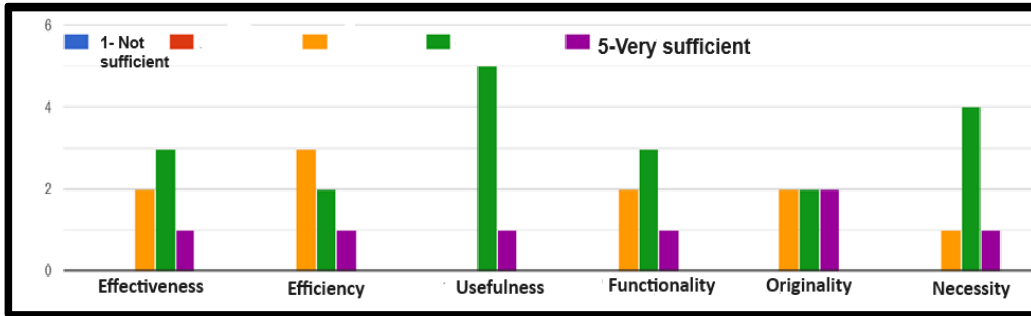


Figure 11. Distribution of Opinions about the Planning Interface

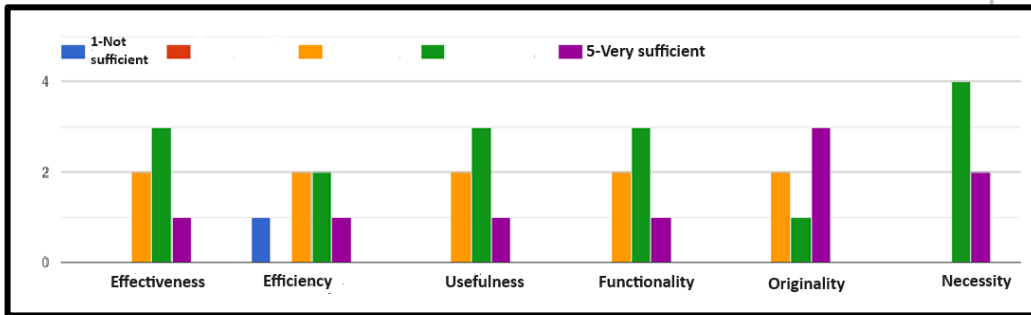


Figure 12. Distribution of Opinions about the Implementation Interface 1.

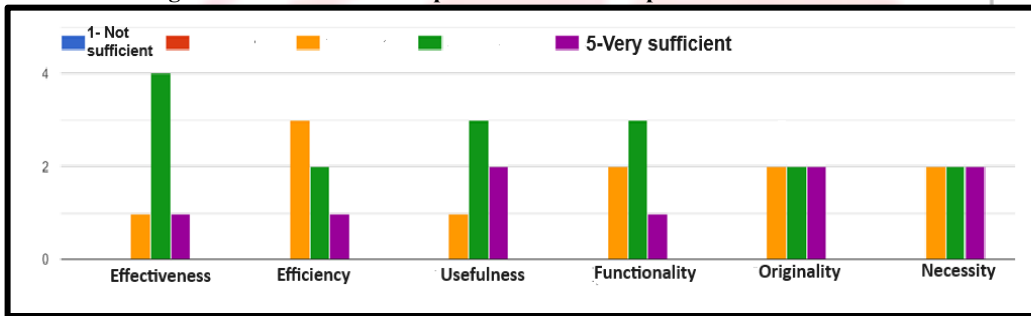


Figure 13. Distribution of Opinions about the Implementation Interface 2.

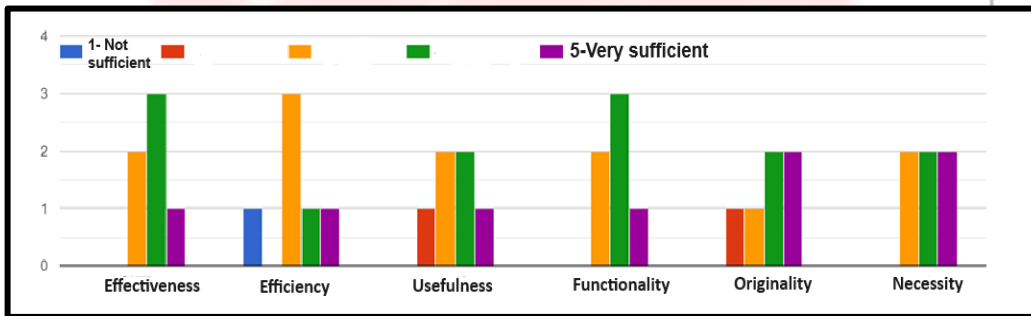


Figure 14. Distribution of Opinions about the Check Interface.

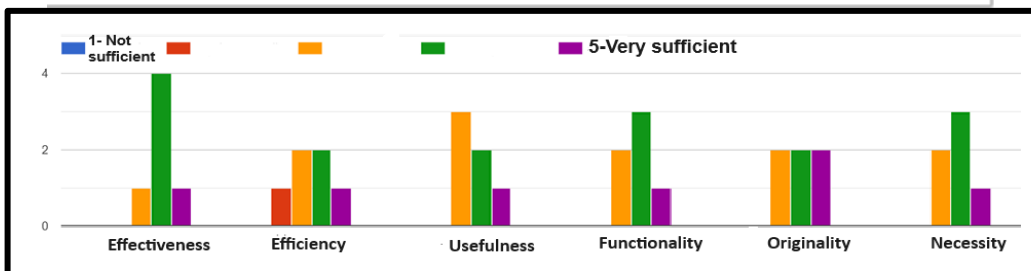


Figure 15. Distribution of Opinions about the Act Interface.

The respondents were also asked to rate the level of contribution of the web-based system developed for effective structuring of teaching processes to the monitoring and evaluation of the Strategic Plan (SP). The participants stated that the developed application could be used effectively in the SP process. The results obtained are presented in Figure 16.

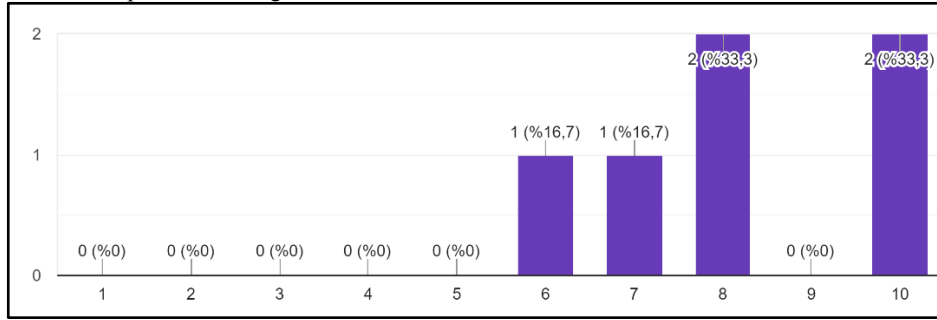


Figure 16. Distribution of Opinions about the Strategic Plan Interface.

### 3. CONCLUSION

Effective structuring of teaching processes is directly related to internal quality mechanisms in education. While ensuring the proper functioning of the system, The PDCA cycle, which enables the missing aspects to be recognized and improved, forms the basis of quality processes. With the system developed in this study, it is aimed to support the Planning phase within the scope of structuring the teaching processes effectively. The web-based system developed within the framework of the Rapid Prototyping Model consists of 2 modules. Opinions and suggestions were received through a questionnaire about the interfaces related to these two modules. By contributing to the planning of the learning and teaching process; by operating the quality assurance system in the execution, reporting and dissemination of the activities and courses to be carried out in line with the goals, objectives and performance indicators within the scope of the Strategic Plan to which the activities carried out are related; This study, which aims to contribute to the institutional memory in the evaluation and improvement processes and to contribute to the reporting processes at national level within the framework of YÖK and YÖKAK criteria, is the output of the research project numbered 23ADP032; It is also an input to the project numbered 23ADP225 in terms of examining the opinions and controlling the process.

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# CLOUD COMPUTING TECHNOLOGY SUPPORTED METHOD FOR EFFECTIVE INTERNAL EVALUATION REPORT WRITING PROCESS

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## ABSTRACT

The Institutional Development and Planning Coordination Office conducted a training session to enhance the effectiveness of writing the Institutional Internal Self-Evaluation Report (ISER). This training is aligned with the Higher Education Law and the Higher Education Quality Assurance and Higher Education Quality Board Regulation. The purpose is to support the university's management, specifically the Institutional Quality Commission Members and Unit Internal Self-Evaluation officers, in aligning with the vision, mission, and policies of the university. The training goals of the session were as follows: (1) to effectively report quality assurance processes and (2) to train members on the updated ISER Preparation Guide Version 3.2. Addition to this, achievements expected from the training were identified as (a) Analyze documents related to the quality assurance system (b) Apply knowledge in writing the internal evaluation report (c) Understand relevant sub-criteria (d) Evaluate mistakes in texts based on internal evaluation criteria (e) Create evaluation reports based on specified sub-criteria (f) Recognize the importance of the quality assurance system (g) Be motivated to write internal evaluation reports. The training was structured in two phases. The first phase of the training was focused on an interactive applications for theoretical knowledge and awareness while the second phase was handled with the practical applications to develop skills, including individual evaluations and team-based writing activities. The planned and implemented training was focused inline the ISER Preparation Guide Version 3.2. The need for training was highlighted by the similarity between the ISER reports of 2022, 2021, and 2020. The training included theoretical sessions and practical activities using tools like Google Drive for collaboration and Zoom for online participation. Findings to the followed method was showed that high satisfaction rates among participants, with training content and meeting expectations scoring 90-97%. Addition to this, participants appreciated hands-on activities and practical exercises, suggesting more widespread and frequent training, especially the use of interactive tools like Mentimeter for engagement was informed effectively. As a conclusion, the followed method with the basis of cloud computing technology supported in the training successfully increased participants' knowledge, skills, and awareness regarding quality assurance reporting. Future training sessions will incorporate feedback to ensure broader dissemination and continuous improvement of quality assurance processes.

**Keywords:** Cloud computing technology in teaching, effective writing of ISER, PDCA, quality assurance.

## 1. INTRODUCTION

Institutional Development and Planning Coordination Office *Article 12, Additional Article 35* [1] of the Higher Education Law, which supports the Rector, known as the highest authority responsible for the management of the university, in the processes of institutional structuring of the University, managing its performance and monitoring its development in line with the vision, mission, core values and policies of the University. and Higher Education Quality Assurance and Higher Education Quality Board Regulation. In this regard, in accordance with the matters specified among the activity areas and duties of the unit; "Effective Institutional Internal Self-Evaluation Report (EISER) Writing Training" has been planned in line with the possibilities and capabilities of the research team. The most important factor and need in the implementation of this planning is the ISER Preparation Guide Version 3.2, which is requested by the Higher Education Quality Board and is obliged to prepare every year. It is important to convey the updates to all individuals who provide direct and indirect support to the management processes of the university, especially the Institutional Quality Commission Members who are responsible for writing the ISER. In this study, the aim of this study is to train the Institutional Quality Commission Members and the Unit Internal Self-Evaluation (USER) from the units. It is responsible for bringing together and managing the reports. For this reason, in line with the emerging need, it is aimed for the Institution Quality Commission Members at the top of the institution to be trained by their sub-commissions in disseminating the quality culture through the updated guide. Within the scope of the main target of this study; there is a method proposal for activities that can be carried out to disseminate the quality culture. It was held in two stages, with sessions presented separately to the "Leadership, Governance and Quality", "Education-Training", "Research-Development" and "Community Service" sub-commissions, which include the Institutional Quality Commission Members of our University, and interactive applications. The first phase progressed through interactive applications aimed at providing more theoretical knowledge and awareness. The second stage is designed to gain skills. In the second stage, the planned activities were implemented with two different applications in the context of the criteria and sub-criteria for which the sub-commissions were responsible. In the first implementation, while the members were expected to reflect on the section in the ISER section of the Fictional Venus University by individually evaluating it in the context of the relevant sub-criterion in the "Evaluator Role". In the second application, members examine the reports of the University which the training is handled. They were enabled to complete the writing and reflection activities of the relevant ISER section as a team within the context of the given sub-criteria. Although the trainings are planned face to face in four different sessions; by utilizing the dynamics of the Google Drive collaborative learning environment in providing structured feedback, evaluation and reflection activities in individual and team work; significant efforts have been made to ensure effective technology integration [2,3,4,5]. At this stage, upon request from different units to participate in the interactive and intensive technology-supported face-to-face training planned only for the Institution Quality Commission Members. The Zoom online conferencing platform is flexibly integrated into the process. At the end of the two-day training, the Satisfaction and Self-Evaluation Form was delivered to the participants online. This study is important in terms of the continuity and sustainability of the activities within the Institutional Development and Planning Coordinatorship, evaluating the data obtained from individuals participating in the training and reflecting the necessary improvements and measures taken as input for the next cycle. The purpose and achievements of the planned and implemented training were effective in creating the report. According to this,

**Purpose of the training:** To effectively report quality assurance processes.



## Acquisitions:

### Cognitive Domain:

**Analyze:** Compares documents related to the quality assurance system

**Apply:** The institution examines the basic documents for writing the internal evaluation report

**Understand:** Understands the relevant sub-criteria of the institution's internal evaluation report

**Evaluate:** The institution evaluates the mistakes made in a given text in line with internal evaluation criteria

### Psycho-motor Domain:

**Guided Response:** It creates an evaluation report within the scope of the relevant sub-criterion determined

### Affective Domain:

**Receive:** Becomes aware of the importance of the quality assurance system

**Respond:** The institution is willing to write an internal evaluation report

In summary, in accordance with the duties of the unit, "Effective Institutional Internal Self-Evaluation Report (EISER) Writing Training" was planned, leveraging the research team's resources and capabilities. The primary factor for this planning is the ISER Preparation Guide Version 3.2, mandated by the Higher Education Quality Board, which requires annual preparation. It's crucial to communicate updates to all individuals supporting the university's management processes, particularly the Institutional Quality Commission Members responsible for writing the ISER. This study aims to train the Institutional Quality Commission Members and the Unit Internal Self-Evaluation (USER) officers. It focuses on managing and compiling the reports, ensuring these members are well-versed in the updated guide. The training promotes the dissemination of a quality culture through a two-stage approach:

**Interactive Applications for Theoretical Knowledge and Awareness:** The first stage includes sessions for "Leadership, Governance and Quality," "Education-Training," "Research-Development," and "Community Service" sub-commissions.

**Skills Development Activities:** The second stage involves practical applications within the context of specific criteria and sub-criteria for the sub-commissions. Members evaluate and reflect on sections of a fictional university's ISER and then collaborate to complete the writing and reflection activities for their university.

Despite the initial face-to-face planning, the training utilized Google Drive for collaborative learning and integrated Zoom for online conferencing. At the end of the two-day training, participants completed an online Satisfaction and Self-Evaluation Form in order to achieve the above-mentioned achievements, the knowledge and skills regarding the more effective writing of the "Institutional Internal Evaluation Report (ISER)", which is prepared every year by the ESTU Quality Commission Sub-Groups and prepared by the Institutional Development and Planning Coordination Office and submitted to YÖKAK. and gained awareness.

### 1.1. Planning Cycle

"Effective Institutional Internal Evaluation Report Writing Training" planning is based on YÖKAK's "Institutional Internal Evaluation Report Preparation Guide (Version 3.2)" dated 27.12.2023. In addition, the similarity rates of the ISER 2022 report with the ISER 2021 and ISER 2020 reports reveal the necessity of this training. The training was planned in two stages:

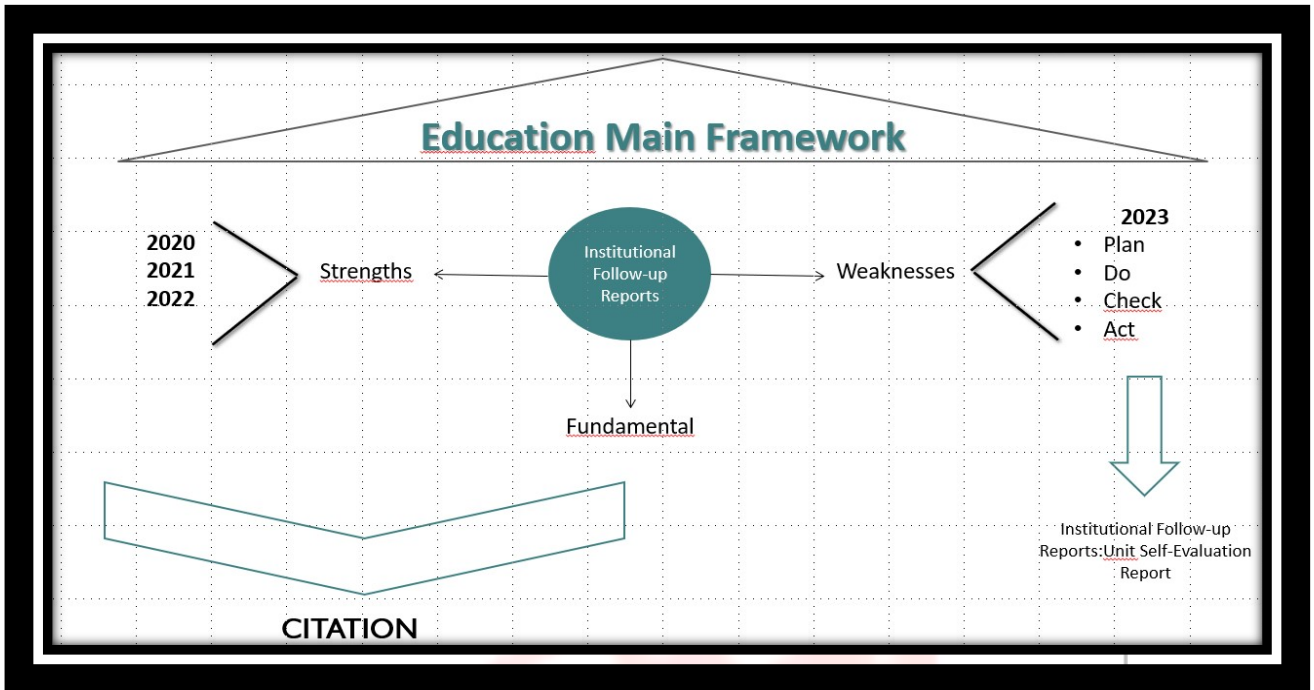
**Knowledge and Awareness Stage:** The first phase includes theoretical and interactive short activities, comparing similarity rates of ISER reports and discussing the framework of education.

**Application and Reflection Stage:** The second phase involves practical activities, split into two parts, focusing on application and reflection skills. Participants engage in interactive exercises and evaluations.

The first phase includes theoretical and interactive short activities aimed at providing knowledge and awareness. The second stage includes activities in which application and reflection skills are active in the process. In terms of providing knowledge and awareness in the first stage of the training; Comparison of similarity rates of 2022, 2021 and 2022 ISE reports, elements showing the framework of education and interactive short applications are included. Thus, the basis of the effective reporting of quality processes aimed at Effective ISER Writing Processes Training is presented interactively from a theoretical framework.

| Plagiarism Detection                           | Plagiarism Detection                           |
|--|--|
| <b>Matching Type</b>                           | <b>Matching Type</b>                           |
| Identical: 16.8% (6563 words)                  | Identical: 28.8% (11247 words)                 |
| Minor Changes: 17.5% (6817 words)              | Minor Changes: 23.9% (9337 words)              |
| Paraphrased: 10.8% (4225 words)                | Paraphrased: 11.8% (4618 words)                |
| <b>Total Similarity Rate: 45.1%</b>            | <b>Total Similarity Rate: 64.5%</b>            |
| <b>ISER 2022 and ISER 2020 Similarity Rate</b> | <b>ISER 2022 and ISER 2021 Similarity Rate</b> |

Figure 1. ISER Similarity rates by years



**Figure 2. Training Content**

A training was planned within the scope of the "Institutional Internal Evaluation Report Preparation Guide (Version 3.2)" to inform the ISER sub-heading officers about the changes. In this context, training programs have been organized for each sub-heading. The program prepared and implemented is as follows.

| Subgroups                           | Participants               | Training Date/Time and Place   | Contents  |
|-------------------------------------|----------------------------|--|---|
| Leadership, Governance, and Quality | Quality Commission Members | 14.02.2024 14:00-16:30<br>Rectorate Building B entrance (ground floor) Senate Hall | *Documents for Institutional Self Evaluation Report (ISER)<br>*List of Abbreviations<br>*Purpose/Scope of Sub-criteria<br>*Use of Evidence<br>*Common Mistakes<br>*A Case Study |
| Education                           |                            | 15.02.2024 10:00-12:30<br>Rectorate Building B entrance (ground floor) Senate Hall |   |
| Research and Development            |                            | 14.02.2024 10:00-12:30<br>Rectorate Building B entrance (ground floor) Senate Hall |   |
| Community Service                   |                            | 15.02.2024 12:45-15:00<br>Rectorate Building B entrance (ground floor) Senate Hall |   |

**Figure 3. ISER Sub-Title Officers Training Program**

Within the scope of planning, participants responsible for the Sub-Heading were informed about the work schedule of ISER studies, as seen in Figure 4 below. In this calendar, the process of ISER studies is briefly summarized.

| Packages  | 16.01.2024 | 17.01.2024 | 24.01.2024 | 7.02.2024 | 13.02.2024 | 15.02.2024 | 18.02.2024 | 1.03.2024 | 10.03.2024 | 20.03.2024 | 25.03.2024 | Sorumlu Birimler   |
|---|------------|------------|------------|-----------|------------|------------|------------|-----------|------------|------------|------------|--|
| APPENDIX 4: Preparation of Performance Indicators   |            |            |            |           |            |            |            |           |            |            |            | Institutional Development and Planning Coordination                                |
| Establishment of Quality Commission Sub-teams (QCS)   |            |            |            |           |            |            |            |           |            |            |            | Vice Rector (Responsible for Quality Assurance)                                    |
| Determining the report format and scope to be requested from Unit Quality Commissions (UQC) and Unit Quality Embassies (UQE), and receiving feedback by sending it to the Quality Commission (QC) |            |            |            |           |            |            |            |           |            |            |            | Institutional Development and Planning Coordination                                |
| Finalizing the Draft Unit Internal Evaluation Report format and sharing it with UQC and UQEs  |            |            |            |           |            |            |            |           |            |            |            | Institution Quality Commission&Institutional Development and Planning Coordination |
| Higher Education Quality Commissions training meeting   |            |            |            |           |            |            |            |           |            |            |            | YÖKAK  |
| Institutional Quality Commission information meeting  |            |            |            |           |            |            |            |           |            |            |            | Institutional Development and Planning Coordination                                |
| Training on improving ISER preparation processes  |            |            |            |           |            |            |            |           |            |            |            | Institutional Development and Planning Coordination                                |
| Preparation of the Unit Internal Evaluation Report (UIER) by the UQC/UQE  |            |            |            |           |            |            |            |           |            |            |            | UQC/UCS  |
| Completion of the preliminary work for the sub-headings of the KIDR by the relevant sub-teams of the Quality Commission   |            |            |            |           |            |            |            |           |            |            |            | Quality Commission Sub Teams   |
| Consolidation of the UIER from the units and the reports prepared by the Quality Commission Sub-Teams   |            |            |            |           |            |            |            |           |            |            |            | Institution Quality Commission&Kurumsal Gelişim ve Planlama Koordinatörlüğü        |
| Reviewing the ISER together with the evidence documents   |            |            |            |           |            |            |            |           |            |            |            | Institutional Development and Planning Coordination                                |
| Review of the ISER by the Quality Commission Chair (Rector) and submission to the Senate  |            |            |            |           |            |            |            |           |            |            |            | Rector   |
| Entering the report into the Quality Assurance Management Information System  |            |            |            |           |            |            |            |           |            |            |            | Institutional Development and Planning Coordination                                |

**Figure 4. 2023 ISER Working Calendar**

Various abbreviations were mentioned in the information provided within the scope of the training. Some of these abbreviations are as follows.

- YÖKAK: Higher Education Quality Board
- KKK: Institutional Quality Commission
- BKK: Unit Quality Commission

- BKE: Unit Quality Embassies
- KİDR: Institution Internal Evaluation Report
- KGBR: Corporate Feedback Report
- KİP: Institutional Monitoring Program
- DIRT: Institution Monitoring Report
- KAP: Institutional Accreditation Program
- KAR: Institution Accreditation Report

The first phase of the training is based on the process of informing sub-heading officers in line with the relevant abbreviations given above. In addition, in the first part, there is a process of providing theoretical information and awareness in line with the achievements that serve the purpose of education; In the second part, the process of gaining skills for application and reflection comes into play in planning. In the first part, the "Mentimeter" application, the screenshots of which are shown below, was included in the planning in order to carry out two different interactive-short mini tests.

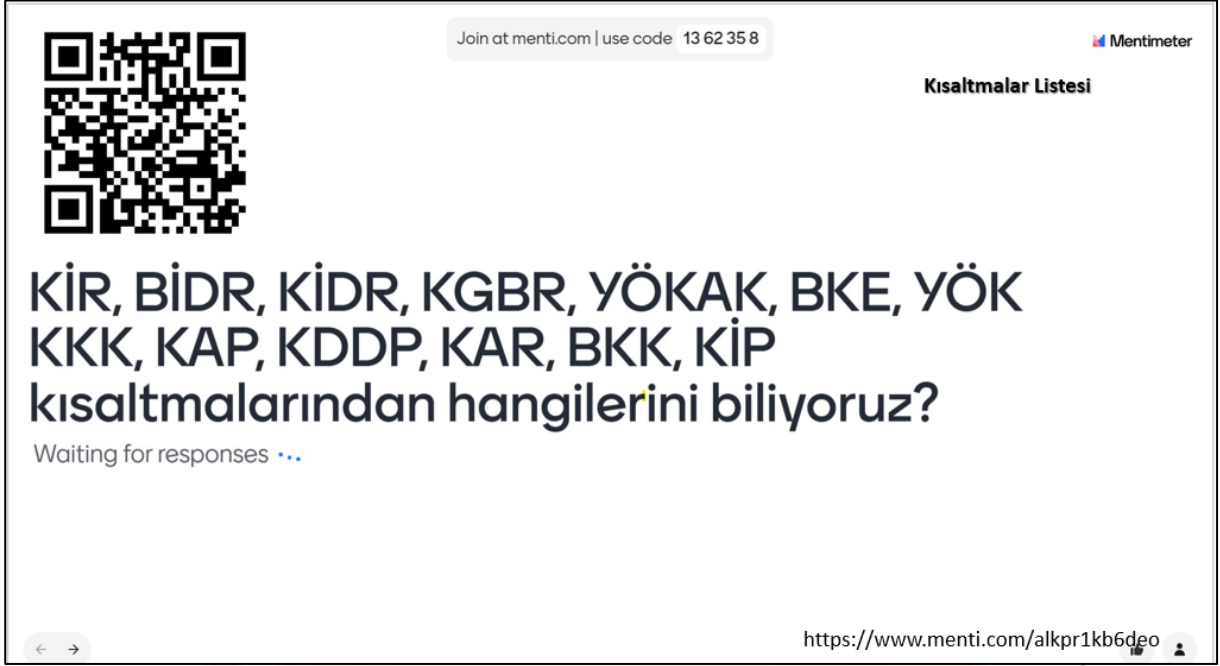


Figure 5. Mentimeter Application-1



Figure 6. Mentimeter Application-2

## 2. FINDINGS

### 2.1. Do Cycle

#### 2.1.1. Mentimeter Application Results

Results of the Research and Development Sub-Team

KİR, BİDR, KİDR, KGBR, YÖKAK, BKE, YÖK KKK, KAP, KDDP, KAR, BKK, KİP kısaltmalarından hangilerini biliyoruz?

7 responses

kurumsal geri bildirim ra  
kurumsal izleme raporu  
4 kidr bidr  
yok yokak  
birim iç degerlendirme ra

Bildiğimiz kısaltmaların açıklamalarını yazalım.

Kurumsal İzleme Raporu, Birim İç Degerlendirme Raporu, Kurum İç Degerlendirme Raporu, Kurumsal Geri Bildirim Raporu, Yüksek Öğretim Kurulu Akreditasyon Kurulu, Kurumsal Akreditasyon Raporu

Mentimeter

Results for the Leadership, Governance and Quality Sub-Team

KİR, BİDR, KİDR, KGBR, YÖKAK, BKE, YÖK KKK, KAP, KDDP, KAR, BKK, KİP kısaltmalarından hangilerini biliyoruz?

3 responses

bidr kidr yökak yök  
yök  
yökak

Mentimeter



## Bildiğimiz kısaltmaların açıklamalarını yazalım.

Kurum izleme raporu  
Birim içi değerlendirme raporu  
Kurum içi değerlendirme raporu  
Kurumsal geribildirim raporu  
Yükseköğretim kurulu  
Kurum kalite komisyonu  
Yükseköğretim kalite ve akreditasyon kurulu

### Results of the Education-Training Sub-Team

KİR, BİDR, KİDR, KGBR, YÖKAK, BKE, YÖK KKK, KAP, KDDP, KAR, BKK, KİP kısaltmalarından hangilerini biliyoruz?

9 responses

hepsi  
kidr  
bidr  
kir bidr kidr kgbr yök kk  
bke ve sonrası bidr kidr  
kir yökak yök kap bke  
bidr kidr yok yokak



## Bildiğimiz kısaltmaların açıklamalarını yazalım.

Birim içi değerlendirme raporu  
Kurum içi değerlendirme raporu

Birim içi değerlendirme raporu  
Kurum içi değerlendirme raporu  
Yükseköğretim kurumu  
Yükseköğretim kurumu kalite kurulu  
Kurumsal akreditasyon programı  
Birim kalite elcilikleri  
Kurum izleme raporu

Kurum içi rapor birim içi değerlendirme raporu  
yüksek öğretim kurumu akreditasyon kurulu

Yükseköğretim Kalite Kurulu,  
Kurumsal Dış Değerlendirme Programı,  
Birim içi değerlendirme raporu,  
Kurum içi değerlendirme raporu,  
Yükseköğretim kalite ve akreditasyon kurulu,  
Yükseköğretim kalite komisyonu,  
Yükseköğretim kalite ve akreditasyon kurulu

Birim içi değerlendirme raporu  
Kurum dışı değerlendirme raporu  
Birim kalite komisyonu  
Yükseköğretim kurulu akreditasyon kurumu  
Kurum içi değerlendirme raporu  
Kurum kalite komisyonu

### Results of the Community Service Sub-Team

KİR, BİDR, KİDR, KGBR, YÖKAK, BKE, YÖK KKK, KAP, KDDP, KAR, BKK, KİP  
kısaltmalarından hangilerini biliyoruz?

9 responses

kidr  
bidr  
yökak yök

< >

1 3  
1 3

Bildiğimiz kısaltmaların açıklamalarını yazalım.

2 responses

Yüksek öğretim kurumu Yüksek  
öğretim kalite kurumuBirim  
değerlendirme raporuKurum  
değerlendirme raporu

Yökak yök kalite kuruluBirim  
değerlendirme Kurum  
değerlendirme

The second phase of the training consists of studies that include application (part 1) and reflection (part 2) activities.

## 1. BÖLÜM

Değerli Araştırma-Geliştirme Alt Ekip Üyesi,

Bu etkinlik kapsamında öncelikle; adınıza yapılandırılan (1) aşağıda verilen alt ölçüt ve kapsamını kavramanız beklenmektedir. Daha sonra (2) ilgili alt ölçütler doğrultusunda verilen örnek metinlerden hareketle;

➤ Kurgusal Venüs Üniversitesi'nin Kurum İç Değerlendirme Raporu'nda verilen içeriğin ilgili alt ölçüt ile ilişkisini;

- Alt ölçüt açıklaması bağlamında,
- İlgili alt ölçüte gösterilen kanıtın içeriği desteklemesi bağlamında,
- Kanıtın metin içinde formata uygun gösterimi bağlamında,
- Verilen olgunluk düzeyinin metin içeriği ile örtüşmesi bağlamında,

değerlendiriniz ve (3) değerlendirme sonuçlarınızı yansıtınız.

Katılım ve katkılarınız için şimdiden teşekkür ederiz.

Kurumsal Gelişim ve Planlama Koordinatörlüğü

Figure 7. Activity First Part Directive

## 2. BÖLÜM

Değerli Araştırma-Geliştirme Alt Ekip Üyesi,  
Bu bölümde, Üniversitemiz geçmiş yıllara ait ilgili raporlardan hareketle, **C.1.1. Araştırma Süreçlerinin Yönetimi** alt ölçütüne ait bölüm raporunu (1) takım olarak yazmanız ve (2) etkinlik sonunda yansıtmanız beklenmektedir.

Katılım ve katkılarınız için şimdiden teşekkür ederiz.  
Kurumsal Gelişim ve Planlama Koordinatörlüğü

### C.1.1. Araştırma Süreçlerinin Yönetimi

#### İncelenecek Dokümanlar:

- C.1.1. Alt ölçüt açıklama ve kapsamı (bkz. Çalışma Kağıdı/Şekil 8)
- 2022 Yılı Kurumsal İç Değerlendirme Raporu (bkz. bkz. Drive/Faydalı Dokümanlar /KİDR\_2022)
- Kurum İç Değerlendirme Raporu Hazırlama Kılavuzu Sürüm 3.2 (bkz. Drive/Faydalı Dokümanlar /KİDR\_Hazırlama\_Kılavuzu\_3.2)
- 2023 Yılı Kurumsal İzleme Raporu (bkz. Drive/Faydalı Dokümanlar /KİR\_2023)
- Birim İç Değerlendirme Raporları (bkz. Drive/Faydalı Dokümanlar / BKK\_BKE\_alt\_ölçüt\_dağılımı.xlsx)
- 2021 Yılı Kurumsal Geri Bildirim Raporu (bkz. Drive/Faydalı Dokümanlar / KGBR\_2021)

Figure 8. Activity Second Part Directive

Following the mini tests applied in the first stage, in the planning; While members are expected to evaluate and reflect the section in the Institutional Internal Evaluation Report section of the Fictional Venus University individually in the context of the relevant sub-criterion in the "Evaluator Role"; In the second application, members examine the reports of the University which the training is handled; They were enabled to complete the writing and reflection activities of the relevant Institutional Internal Evaluation Report section as a team within the context of the given sub-criteria. Cross-sectional examination reports of the Fictional Venus University, which are the basis for the planning of the training, were presented to the participants by taking advantage of the sharing, storage and collaboration features of the Google Drive Collaborative Learning Platform. Participants completed their responsibilities with individual and collaborative work. Structured feedback was provided by instructors and teaching assistants during the completion of the activity.

| Etkinlik Başlıyor!  |   | A. LİDERLİK, YÖNETİM VE KALİTE  |   |  |  |   |
|---|---|---|---|--|--|---|
| A.3. Yönetim Sistemleri   |   | 1   | 2   | 3  | 4  | 5 |
| <p><b>A.3.3. Finansal yönetim</b></p> <p>Özel gelir ve gider kalemleri tasniflenmiştir ve yılın içinde izlenmektedir.</p> <p>Tasarruf Carl Bütçe (gelir) + Devlet dışı katkı (merkez bütçesinden gelen ve araştırma geliştirme kapsamındaki faaliyetlere ait olmayan tian gelirleri) + Öğrenci gelirleri (kaynak öğrenci olan tian gelirleri: 1. ve 2. öğretim, tezi, yüksek lisans, vizit ücreti, konut/daire/çocuk bakım harcı vb.) + araştırma geliri (devletten merkez bütçe içinde gelen + ulusal tahsis yansızna projeler) + ulusal yarışma araştırma destekleri + uluslararası araştırma destekleri (özel hesap, diğer sermaye, vakıflar gelen veya bakıca muhabeleleştirilen) + toplumsal katkı geliri (ip, diğlik vb.) fakülterin sağlık hizmeti geliri (öner sermaye veya bakıca muhabeleleştirilen) + mülkiyet, nispetle vb. fakülterin bilgi ve teknoloji transferi/çalıştır/uygulamalar geliri (öner sermaye veya bakıca muhabeleleştirilen) + enjün eğitim/çalışma - baya eğitim geliri + kira geliri + laboratuvar/teknoloji vb. geliri (özel hesap, diğer sermaye, vakıflar gelen veya bakıca muhabeleleştirilen) + bağışlar (devlet vb., parti veya partiler olarak ödenenler) aktarılan kaynaklı bütçesinde izlenmektedir ve kurum profiline işlenmektedir!</p> | <p>Kurumda finansal kaynakların yönetimine ilişkin tanımlı süreçler bulunmamaktadır.</p>  | <p>Kurumda finansal kaynakların yönetimine ilişkin olarak stratejik hedefler ile uygulama tanımlı süreçler bulunmaktadır.</p> | <p>Kurumun genelinde finansal kaynakların yönetimine ilişkin uygulamalar tanımlı süreçlere uygun biçimde yapılmaktadır.</p> | <p>Kurumda finansal kaynakların yönetim süreçleri izlenmekte ve iyileştirilmektedir.</p> | <p>İçselleştirilmiş, sistematik, sürdürülebilir ve örnek gösterilebilir uygulamalar bulunmaktadır.</p> |   |
|   | <p><b>Örnek Kanıtlar</b></p> <ul style="list-style-type: none"> <li>Finansal kaynakların yönetimine ilişkin tanımlı süreçler ve uygulamalar (Kaynak dağılımı, kaynakların etkin ve verimli kullanılması, kaynak çeşitliliği)</li> <li>Finansal kaynaklara planlama, kullanım ve izleme uygulamalarının kurumun stratejik plan ile uyumunu gösteren belgeler</li> <li>Finansal kaynakların yönetimi süreçlerine ilişkin izleme raporları ve analizleri ve iyileştirme kanıtları</li> <li>Standart uygulamalar ve mevzuatı yanı sıra kurumun ihtiyaçları doğrultusunda geliştirildiği özgün yaklaşımlar ve uygulamalarına ilişkin kanıtlar</li> </ul> |   |   |  |  |   |

**Şekil 1. A.3.3. Finansal yönetim (Elvin KUPA DOĞAN)**

Kurgusal Venüs Üniversitesi Kurum İç Değerlendirme Rapor Bölümü (Örnek Metin):

(Yukarıda Şekil 1’de verilen alt ölçüt kapsamında aşağıdaki içeriği değerlendiriniz.)

Venüs Üniversitesinin mali kaynakları 5018 sayılı Kamu Mali Yönetim ve Kontrol Kanunu, ilgili yıl Bütçe Kanunu ve ikinci mevzuat doğrultusunda yürütülmektedir. Üniversitemizin finansal gelirleri, kamu fonlarının yanında 5018 sayılı Kamu Mali Yönetim ve Kontrol Kanunu 2 sayılı cetvelinde belirtilen özel bütçeli kurumlardan olmanız nedeniyle öz gelirlerden oluşmaktadır. Finansal kaynakların yönetimi stratejik plan ile uyumlu program bütçe kapsamında izlenmekte ve değerlendirme yapılmaktadır. Üniversitemizin yürüttüğü program, faaliyet ve projeler ile bunların kaynak ihtiyacı, performans hedef ve göstergelerini içeren performans programı ile takip edilmektedir. (A.3.3.1). Finansal kaynakların yönetimine ilişkin kaynak dağılımı, kaynakların etkin ve verimli kullanılmasını, kaynak çeşitliliğine ilişkin uygulama sonuçları (A.3.3.2), (A.3.3.3) ile izleme ve değerlendirme yapılmaktadır. Faaliyet sonuçları ve değerlendirilmeler detaylı olarak yer alınmakta ve kamuoyu ile paylaşılmaktadır. (A.3.3.4). Üniversitemizin bütçesi; merkezi yönetim bütçe mevzuatı kapsamında Stratejik Plan ve Performans Programlarıyla uyumlu ve çok yönlü olarak, analitik bütçe sunulduğunu reberliğinde hazırlanmakta ve uygulanmaktadır. Bu kapsamda belirlenen bütçe, Üst Yönetici tarafından Yönetim Kurulu bilgisine sunulduktan sonra birimlere dağılımı yapılmaktadır. Yatırım ödenek dağılımı, Stratejik Plan doğrultusunda üst yönetim tarafından, Üniversitemizin önceliklerine göre belirlenmektedir. Bütçe işlemleri (hazırlık, uygulama ve raporlama) Strateji ve Bütçe Bağlanışının E-Bütçe (Bütçe Yönetim Enformasyon Sistemi) sistemi ile KaYa (Kamu Yatırımları Bilgi Sistemi) kullanılarak yürütülmektedir. 5018 sayılı Kamu Mali Yönetimi ve Kontrol Kanunu gereği, her yıl bir önceki yılın faaliyet sonuçlarını ve performans sonuçlarını içeren bütçe uygulama sonuçları raporlarında detaylı olarak açıklanmıştır (A.3.3.5). Venüs Üniversitesi giderlerine ilişkin süreçleri harcama birimleri tarafından Mali Yönetim Sistemi (MYS), Kamu Harcama ve Muhasebe Bilgi Sistemi (KBS) ve Temel Kurum Yönetim Sistemi (KBS-TKYS) sistemleri aracılığıyla gerçekleştirilmektedir. Muhasebe sisteminde izlenen

**İlk paragraf için stratejik plan eklenebilir.**

**2. paragraf için ilgili yıl bütçe teklifi, bütçenin yönetim kuruluna sunulmasına ilişkin yönetim kurulu kararı eklenmelidir.**

**Figure 9. Educational Environment Application Example (Individual)**

| C.3. Araştırma Performansı   |  | C. ARAŞTIRMA VE GELİŞTİRME   |   |  |  |   |
|--|--|--|---|--|--|---|
| C.3.2. Öğretim elemanı/araştırmacı performansının değerlendirilmesi  |  | 1  | 2   | 3  | 4  | 5 |
| <p><b>C.3.2. Öğretim elemanı/araştırmacı performansının değerlendirilmesi</b></p> <p>Öğretim elemanlarının araştırma performansını karşılamak için; birim düzeyinde tanımlı süreçler vardır ve bunlar ilgili paydaşlarla bilini. Araştırma performansı yıl bazında izlenir, değerlendirilir ve kurumsal politikalar doğrultusunda kullanılır. Çıktılar, grubun ortalama değerleri ve seçim şeffaflı olarak paylaşılır. Performans değerlendirme süreci sistematik ve kalıcı olarak sağlanmıştır.</p> | <p>Kurumda öğretim elemanlarının araştırma performansının izlenmesine ve değerlendirilmesine yönelik mekanizmalar bulunmamaktadır.</p>   | <p>Kurumda öğretim elemanlarının araştırma performansının izlenmesine ve değerlendirilmesine yönelik ilke, kural ve göstergeler bulunmaktadır.</p> | <p>Kurumun genelinde öğretim elemanlarının araştırma performansını izlemek ve değerlendirmek üzere oluşturulan mekanizmalar kullanılmaktadır.</p> | <p>Öğretim elemanlarının araştırma-geliştirme performansını izlenmekte ve öğretim elemanları ile ilgili değerlendirilerek iyileştirilmektedir.</p> | <p>İçselleştirilmiş, sistematik, sürdürülebilir ve örnek gösterilebilir uygulamalar bulunmaktadır.</p> |   |
|  | <p><b>Örnek Kanıtlar</b></p> <ul style="list-style-type: none"> <li>Akademik personelin araştırma-geliştirme performansını izlemek üzere geçerli olan tanımlı süreçler (Yönetmelik, yönerge, süreç tanımlı, ölçme araçları, rehber, kılavuz, fakülte-tanıtma sistemi, talep mekanizmaları vb.)</li> <li>Öğretim elemanlarının araştırma performansına yönelik analiz raporları</li> <li>Öğretim elemanlarının geri bildirimleri</li> <li>Araştırma geliştirme performansına ilişkin izleme ve iyileştirme kanıtları</li> <li>Standart uygulamalar ve mevzuatı yanı sıra kurumun ihtiyaçları doğrultusunda geliştirildiği özgün yaklaşımlar ve uygulamalarına ilişkin kanıtlar</li> </ul> |  |   |  |  |   |

**Şekil 7. C.3.2. Öğretim elemanı/araştırmacı performansının değerlendirilmesi (Dr. Öğr. Üyesi Leman Esra DOLGUN ve Dr. Öğr. Üyesi Seçkin ULUSKAN)**

Kurgusal Venüs Üniversitesi Kurum İç Değerlendirme Rapor Bölümü (Örnek Metin):

(Yukarıda Şekil 7’de verilen alt ölçüt kapsamında aşağıdaki içeriği değerlendiriniz.)

Öğretim üyelerinin araştırma ve geliştirme faaliyetleri, “Yıllık Akademik Rapor” olarak adlandırılan bir form aracılığı ile periyodik olarak değerlendirilmektedir. Her takvim yılı sonunda öğretim üyeleri tarafından doldurulması beklenen bu anket, öğretim üyesinin o yıl içinde gerçekleştirdiği eğitim ve öğretim aktiviteleri ile okula sağladığı servis hizmetlerinin yanında, araştırma ve geliştirme faaliyetleri ile bu faaliyetler sonucunda üretilen çıktılar raporlanmaktadır. Anket aracılığıyla bildirilmesi beklenen araştırma ve geliştirme faaliyetleri arasında bilimsel proje çalışmalarını, yönetilen yüksek lisans/ doktora tez çalışmaları, konferans/çalıştay düzenleme, katılma ve seminer verme faaliyetleri, gerçekleştirilen sergiler ve çeşitli sanatsal faaliyetler yer almaktadır. Öğretim Üyesi Yıllık Akademik Rapor ve Yıllık Değerlendirme Raporu ise akademik birimlerin Venüs Bilgi Sistemleri Merkezi tarafından

**Genel itibarıyla uygun bulunmuş. Olgunluk düzeyi 3 veya 4 seçilmeliydi. 5 olarak seçilmiş.**

**Figure 10. Educational Environment Application and Reflection Example (Teamwork)**

## 2.2. Control Cycle

In the survey applied to all participants at the end of the training, the training was evaluated with a 5-point and 10-point Likert-type scale and open-ended questions. As a result of the analysis of the answers to these questions, improvement opportunities will be obtained to improve the trainings to be carried out in the future. Education satisfaction and self-efficacy perception rates, which include the rates obtained after the questions and answers given in the survey, are stated specifically for the relevant question in the tables below. In addition, during the process, instant feedback is provided in the application and reflection sections of the training and structured feedback is conveyed to the participants. It was ensured that no compromise was made in the process of achieving gains, and the process was controlled.



Table 1. Opinions on Training Content and Satisfaction Rates

| Items  | Strongly Agree | Agree | Neither Agree Nor Disagree | Disagree | Strongly Disagree | Satisfaction Rate |
|--|----------------|-------|----------------------------|----------|-------------------|-------------------|
| Training time was sufficient   | 4              | 1     | 1                          |          |                   | 90%               |
| The training content was suitable for the purpose of the program     | 5              | 1     |                            |          |                   | 97%               |
| Training events were well planned                                    | 5              | 1     |                            |          |                   | 97%               |
| The training contributed positively to my professional development   | 2              | 3     | 1                          |          |                   | 83%               |
| The training provided me with knowledge and skills that I can apply. | 3              | 3     |                            |          |                   | 90%               |
| Education increased my motivation                                    | 3              | 3     |                            |          |                   | 90%               |
| The training environment was suitable to carry out the training      | 5              | 1     |                            |          |                   | 97%               |
| Education contributed positively to my personal development          | 2              | 3     | 1                          |          |                   | 83%               |

Table 2. Education Satisfaction and Expectation Rates

| Items   | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | Satisfaction and Expectation Rate |
|---|----|---|---|---|---|---|---|---|---|---|-----------------------------------|
| Your overall satisfaction level with Effective KIDR Writing Training (1-I am not at all satisfied / 10-I am very satisfied) | 3  | 2 | 1 |   |   |   |   |   |   |   | 93%                               |
| The extent to which Effective KIDR Writing Training meets your expectations (1-Did not meet at all / 10-Very met)           | 3  | 1 | 1 | 1 |   |   |   |   |   |   | 90%                               |

Table 3. Self-efficacy Perception Rates

| Items  | Strongly Agree | Agree | Neither Agree Nor Disagree | Disagree | Strongly Disagree | Perception of Self-efficacy Rate |
|--|----------------|-------|----------------------------|----------|-------------------|----------------------------------|
| In a way that contributes to KIDR; (I can compare documents related to the quality assurance system)   | 2              | 3     | 1                          |          |                   | 83%                              |
| In a way that contributes to KIDR; (I can review the basic documents for the writing of KIDR)  | 3              | 3     |                            |          |                   | 90%                              |
| In a way that contributes to KIDR; (I can use the relevant subcriteria of KIDR for its purpose)  | 2              | 4     |                            |          |                   | 87%                              |
| In a way that contributes to KIDR; (I can evaluate the mistakes made in a given text in line with the internal evaluation criteria of the institution) | 3              | 3     |                            |          |                   | 90%                              |
| In a way that contributes to KIDR; (I can create an evaluation report within the scope of the relevant sub-criterion specified)                        | 4              | 1     | 1                          |          |                   | 90%                              |

When we look at the satisfaction rates, the average satisfaction rate of the survey was measured as 90%, with the lowest being 83% and the highest being 97%. The open-ended questions asked in the survey and their answers are listed below.

Table 4. Answers to Open-Ended Questions

| QUESTION  | Answer1                        | Answer2   | Answer3  | Answer4  | Answer5  | Answer6   |
|---|--------------------------------|---|--|--|--|---|
| Could you share with us the reasons for the activities carried out within the scope of the Effective ISER Writing Training that you liked along with the aspects you liked? | Being hands-on                 | Giving an example application   | Interactive practices were very useful. Only theoretical information does not provide effective development. Practical work was useful to make some points more understandable.            | It was very productive in terms of information, experience and awareness.  | Working on an example made KIDR writing skills develop better.   | Working through an example contributed to my development of KIDR writing skills |
| Could you share with us the reasons for the activities carried out within the scope of the Effective ISER Writing Training that you liked along with the aspects you liked? | None                           | None  | Interactive practices were very useful. Only theoretical information does not provide effective development. Practical work was useful to make some points more understandable.            | Without prior preparation, the subject matter is not sufficiently understood on the spot.  | None   | I did not observe any negative points to share.                                 |
| If you were the coordinator/facilitator of this training (if you are not already), what method would you follow? Please explain.  | Same method                    | The method is quite good and adequate, but there is a need for the training to be spread to the base... | According to me, the training was very well planned. Only time is limiting. Maybe different sessions can be organized for the same groups.   | I would follow the method of giving the full text of the topic in advance, making preparations and then working together on the details.   | I think the training was quite successful.   | I think the method followed was successful.                                     |
| What could be the aspects of the conducted training that need improvement and open for development? What are your suggestions for future trainings?                         | More widespread implementation | more short trainings, reaching more audiences.  | Since the training is a comprehensive study, improvements can be made in terms of time, especially for implementation activities. Perhaps some practical repetitions could be more useful. | Depending on the importance of the topic, informing the participants in advance and ensuring that they are prepared will make it easier to understand the topic during the presentation.   | It would have been more useful if our colleagues were also involved in the training one-on-one. There were audio and video glitches in participation through the system. | I think the method followed was successful.                                     |
| Do you have any different opinions you would like to mention?   | None                           | It was an enjoyable and useful event, thank you.  | Many thanks to those who put in effort.  | I congratulate the success of our lecturers who carried out the presentation and training in terms of their knowledge, experience, mastery of the subject and their efforts. We request such trainings to be more frequent and long-term. I would like to thank you. | None   | None  |

### 2.3. Act Cycle

When the results obtained are examined, it is seen that the participants' satisfaction rates with the training content and the level of meeting their expectations are high. The feedback provided regarding the more effective reporting processes of the activities carried out in the corporate structure on the axis of quality draws attention to the common denominator of disseminating the activities. Our coordination is from bottom to top based on the results obtained; It draws attention to the participation of the Unit Quality Commission and Quality Embassies in order to ensure the continuity and sustainability of similar trainings that are widespread from top to bottom.

### 3. CONCLUSION

In light of the results obtained, it can be said that there is a high level of satisfaction with education and meeting expectations. In addition, it can be said that the desired outcomes in line with the purpose of the training were achieved with the self-efficacy perception form taken from the participants in line with the achievements of the training. Participants gained knowledge, skills and awareness that serve the purpose of effective reporting of quality assurance processes. In this regard, new inputs compatible with the evaluation results are planned with the aim of disseminating this process in future studies.

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# AMMONIA ADSORPTION CAPACITIES OF NATURAL AND ACID TREATED ZEOLITE

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## ABSTRACT

In this study, ammonia (NH<sub>3</sub>) adsorption capacities of clinoptilolite-mordenite-rich tuff (Z) obtained from Turkey and their acid-treated forms (H-Z, N-Z and S-Z) were investigated. NH<sub>3</sub> adsorption capacities of all samples were determined using Micromeritics 3Flex volumetric instrument at 298 K up to 100 kPa. Silica rich and relatively acid-stable zeolites such as mordenite and clinoptilolite can be directly treated with acid to improve the characteristics of natural zeolites. Natural clinoptilolite-mordenite-rich zeolite was treated with 1 M acid solutions of HCl, H<sub>2</sub>SO<sub>4</sub> and HNO<sub>3</sub> at 70 °C for 4 h. The zeolite samples were characterized using Fourier transform infrared spectroscopy (FT-IR), scanning electron microscopy with detector x-ray energy dispersion spectroscopy (SEM-EDX) and nitrogen adsorption methods. N<sub>2</sub> adsorption isotherms at 77 K were obtained on Micromeritics 3Flex adsorption instrument.

The acid treatment of natural zeolite led to increase of the micropore area, micropore volume and specific surface area. It was found that the adsorption capacity and the affinity of NH<sub>3</sub> with zeolite samples increased as S-Z < N-Z < H-Z < Z for 298 K. Capacity of zeolites for NH<sub>3</sub> ranged from 4.985 mmol g<sup>-1</sup> to 5.305 mmol g<sup>-1</sup>. The lower ammonia adsorption capacity of the acid-treated forms of the zeolite samples in comparison to the natural zeolite – despite having increased surface area – can be attributed to both dealumination and the partial destruction of the zeolite structure.

**Keywords:** Natural zeolite, Ammonia, Nitrogen, FT-IR, SEM-EDX.

## 1. INTRODUCTION

Zeolites are crystalline hydrated aluminosilicate minerals of alkali and earth alkali metals. The smallest structural unit of any zeolite crystal is the SiO<sub>4</sub> or AlO<sub>4</sub> tetrahedrons joined by oxygen atoms. Clinoptilolite (CLN) has a 2-dimensional structure, and the channel dimensions of this structure are 4.4×7.2 Å for channel A, 4.7×4.1 Å for channel B and 4.0×5.5 Å for channel C [1, 2]. Mordenite (MOR) is a member of the large-pore zeolite family. It has a two-dimensional structure which work as a one-dimensional channel system formed by 12-membered ring channels of pore diameters of 6.5×7.0 Å interconnected by 8-membered ring pores of 2.6×5.7 Å [3]. To improve the physical, chemical and adsorption properties of zeolite minerals, they are generally activated by using nitric, hydrochloric and sulphuric acid solutions. This treatment causes the replacement of exchangeable cations with the much smaller H<sup>+</sup>, the removal of some aluminum ions and some impurities from the structure [4].

Ammonia (NH<sub>3</sub>) is a smelly gas occurring because of the facilities for the processing of solid waste, water treatment plants, treated wastewater facilities conducted intensive animal husbandry and used agricultural crop as a raw material and waste storage space. NH<sub>3</sub> emissions emitted as pollution from various sources have extremely adverse effects on human health and the environment such as eye and throat irritation, cough, acute poisoning, pulmonary, edema, pneumonia, biological nitrification and eventually the death of aquatic living creatures. For the reasons, retention of NH<sub>3</sub> gas by adsorbents is of great importance in terms of human and environmental health. There are many studies about the adsorption of NH<sub>3</sub> [5-10] on activated carbon, silicate, natural and synthetic zeolites. However, it was determined that the studies that uses the natural and acid-treated forms of zeolite form our country which are abundant and cheap are extremely limited. Kallo et al found that the ammonia adsorption capacities of clinoptilolite and mordenite zeolites at 293 K were approximately 4.0 mmol/g and 2.3 mmol/g, respectively. Helminen et al [6, 7] showed that zeolite adsorbents (4A, 5A and 13X) have higher ammonia adsorption capacity compared to alumina and silicagel adsorbents at 298 K temperature and 0-100 kPa pressure range. The ammonia adsorption capacities of 4A, 5A and 13X zeolites were found to be 8.717 mmol/g, 7.815 mmol/g and 9.326 mmol/g, respectively. The ammonia adsorption capacity of mesoporous carbon synthesized by Saha and Deng at 298 K and up to 800 Torr pressures was found to be 63.9 mmol/g [8]. Caputo et al. [9] examined the ammonia adsorption properties of clinoptilolite zeolite at 298 K. Opalinski et al [10] determined the ammonia adsorption capacities of bentonite and halloysite clays. The aim of this study is to characterize natural and acid-treated zeolite samples using FT-IR, SEM/EDX and nitrogen adsorption methods and to determine the ammonia adsorption capacities of these samples

## 2. MATERIALS AND METHODS

### 2.1. Materials and chemicals

The zeolite used in this study was obtained from Sivas-Yavu region of Turkey. A sample was ground and sieved using ASTM standard sieves until its particle size was less than 45 µm. Acid-treated forms of zeolite (H-Z, N-Z and S-Z) were prepared by using 1 M solutions of HCl, H<sub>2</sub>SO<sub>4</sub> and HNO<sub>3</sub> at 70 °C for 4 h. The resulting acid-treated samples are referred to H-Z, N-Z and S-Z, respectively, denoting there HCl, HNO<sub>3</sub> and H<sub>2</sub>SO<sub>4</sub> treatments. The HCl, HNO<sub>3</sub> and H<sub>2</sub>SO<sub>4</sub> materials were supplied by Merck (Darmstadt, Germany), and all solutions were prepared by using deionized water.

### 2.2. Characterization

Infrared spectra of the zeolite samples were recorded using a Perkin Elmer Spectrum 100 model spectrophotometer in the region of 450–4000 cm<sup>-1</sup> with the potassium bromide (KBr) pellet technique. The morphologies and elemental compositions of zeolite samples

were determined by scanning electron microscopy (SEM) with a ZEISS ULTRAPLUS instrument equipped with a system for elemental composition analysis based on energy-dispersive x-ray (EDX) spectroscopy. Zeolite samples were coated with gold-palladium at 50 mA for 1 min to improve conductivity during an investigation by SEM. Specific surface areas of the samples were calculated at 77 K from the adsorption branch using the Brunauer–Emmett–Teller (BET) method and a Micromeritics 3Flex device under a vacuum environment at 300 °C following 12 h of degassing. High-purity (99.99%) nitrogen gas was used in N<sub>2</sub> adsorption/desorption experiments. The *t*-plot method was applied to calculate micropore area and volume using the de Boer model. NH<sub>3</sub> adsorption experiments of the natural and acid-treated zeolite samples were determined using the by a Micromeritics 3Flex volumetric equipment at 298 K up to 100 kPa pressure. High-purity (more than 99% purity) ammonia gas was used. All zeolite samples were degassed at 300 °C for 12 h prior to ammonia adsorption experiments.

### 3. RESULTS AND DISCUSSION

#### 3.1. FT-IR Analysis

FT-IR absorption spectra for natural and acid-treated zeolite samples were investigated in the region of 450 cm<sup>-1</sup>– 4000 cm<sup>-1</sup> (Fig. 1). In FT-IR spectrum of zeolite samples, the bands in the region between 1600–3700 cm<sup>-1</sup> can be related to the presence of zeolite water. The bands at 3622–3626 cm<sup>-1</sup> and 3434–3436 cm<sup>-1</sup> were assigned to the isolated OH and hydrogen bonded OH, respectively. The band at 1636–1641 cm<sup>-1</sup> was attributed to the H-O-H bending vibrations of water molecules [4, 11-13].

The strongest asymmetric stretching vibration of TO<sub>4</sub> group shifted to higher wavenumber values (1047–1079 cm<sup>-1</sup>) with loss of aluminum cations in the zeolite structure [14-18]. The band observed at ~797 cm<sup>-1</sup> appears in all spectra and can be related to quartz or amorphous SiO<sub>2</sub> [19]. This band was assigned to the symmetric stretching vibration of external tetrahedral [15, 16]. The band observed at 694-695 cm<sup>-1</sup> was attributed to the symmetric stretching vibration of internal tetrahedral T-O bonds. The second strongest band appearing at 466–467 cm<sup>-1</sup> corresponded to internal tetrahedral bending [14-16].

#### 3.2. SEM/EDS Analysis

Scanning electron microscopy (SEM) images of natural and acid-treated zeolite samples are given in Figure 2 and 3. SEM images of the natural zeolite sample showed that it mainly contained clinoptilolite and mordenite. Clinoptilolite appeared in the form of plate-like crystals. The mordenite mineral was formed of needle-like crystal structure. It was seen that the acid treatment did not have a significant influence on the morphology of zeolite samples.

The elemental compositions of the zeolite sample and its acid-treated forms were determined using EDX performed with 2 different random points. EDX analysis showed that the major elements of the natural zeolite sample were O, Si, Al, Ca, Fe in addition to small amounts of Na, K and Mg (Table 1). According to EDX results, the amount of Al, Na, Ca and Mg was greatly reduced after acid treatment (Table 1).

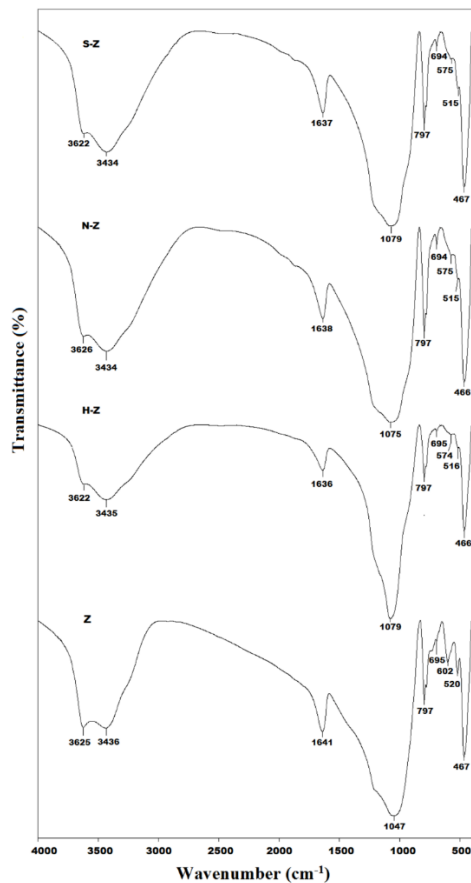


Figure 1. FT-IR spectra of natural and acid-treated zeolite samples

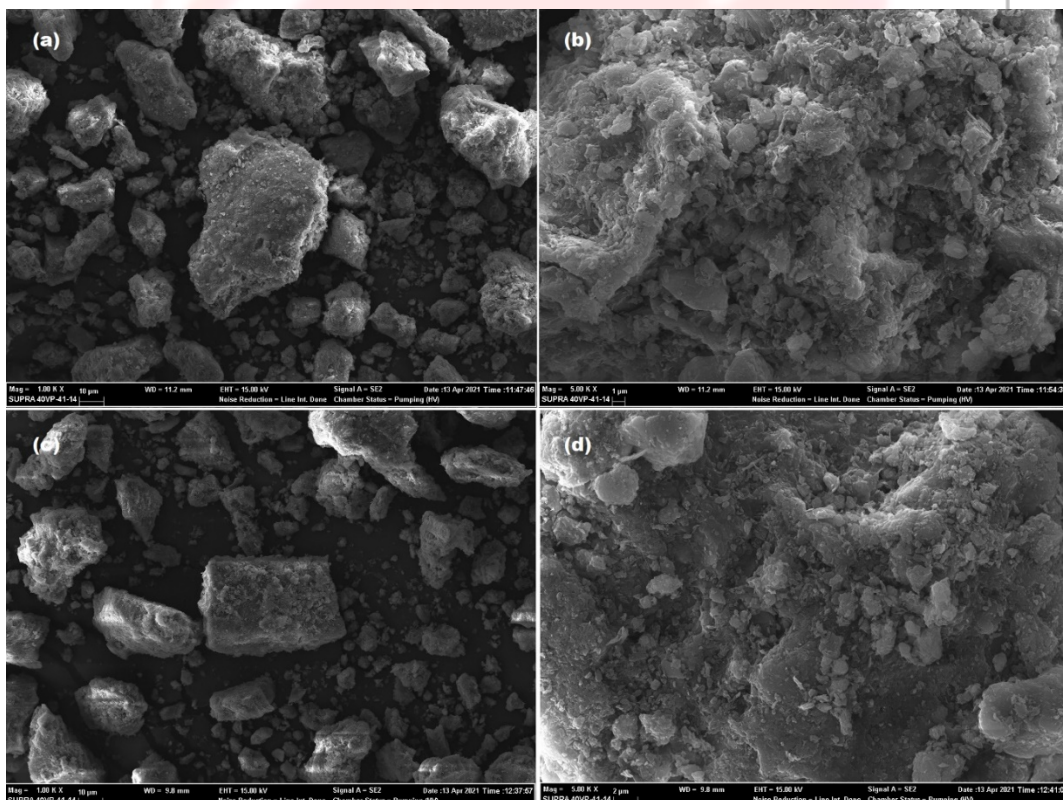
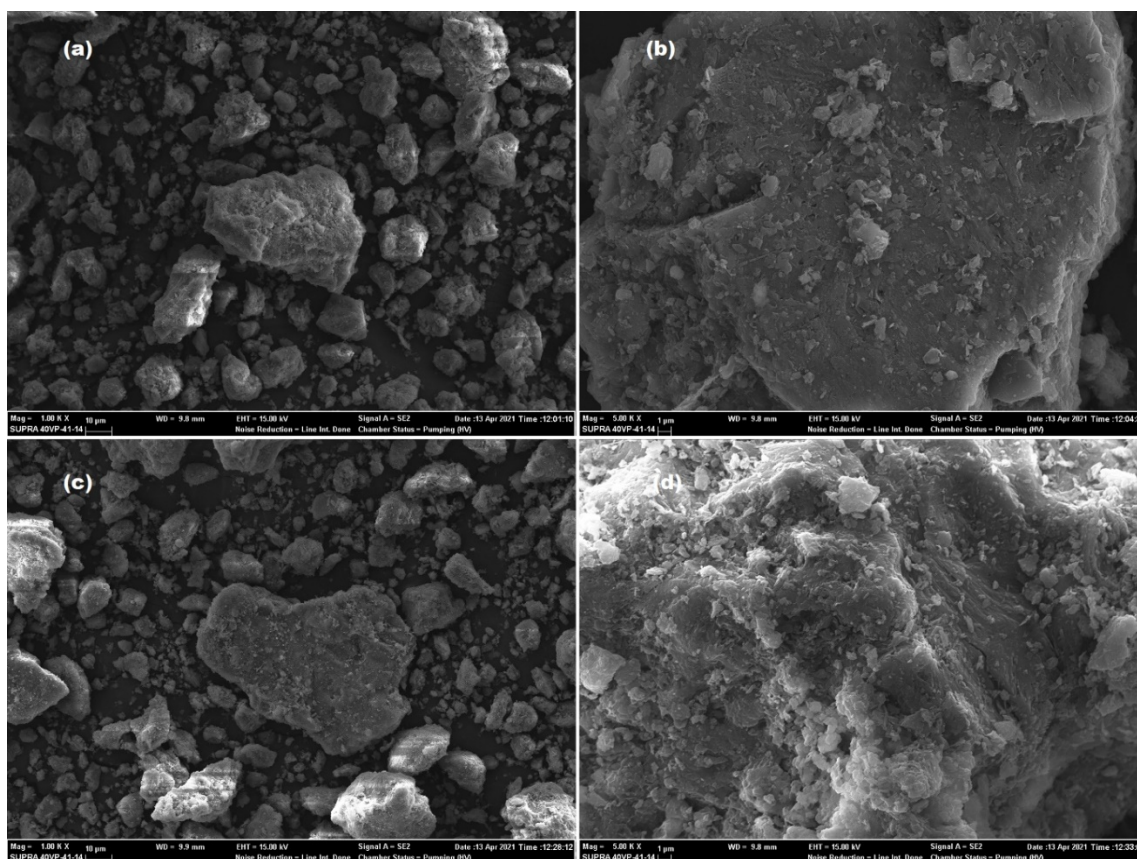


Figure 2. SEM images of (a) (b) natural (Z) and (c) (d) H-Z samples



**Figure 3.** SEM images of (a) (b) S-Z and (c) (d) N-Z samples

**Table 1.** Average elemental compositions of natural and acid treated zeolite samples

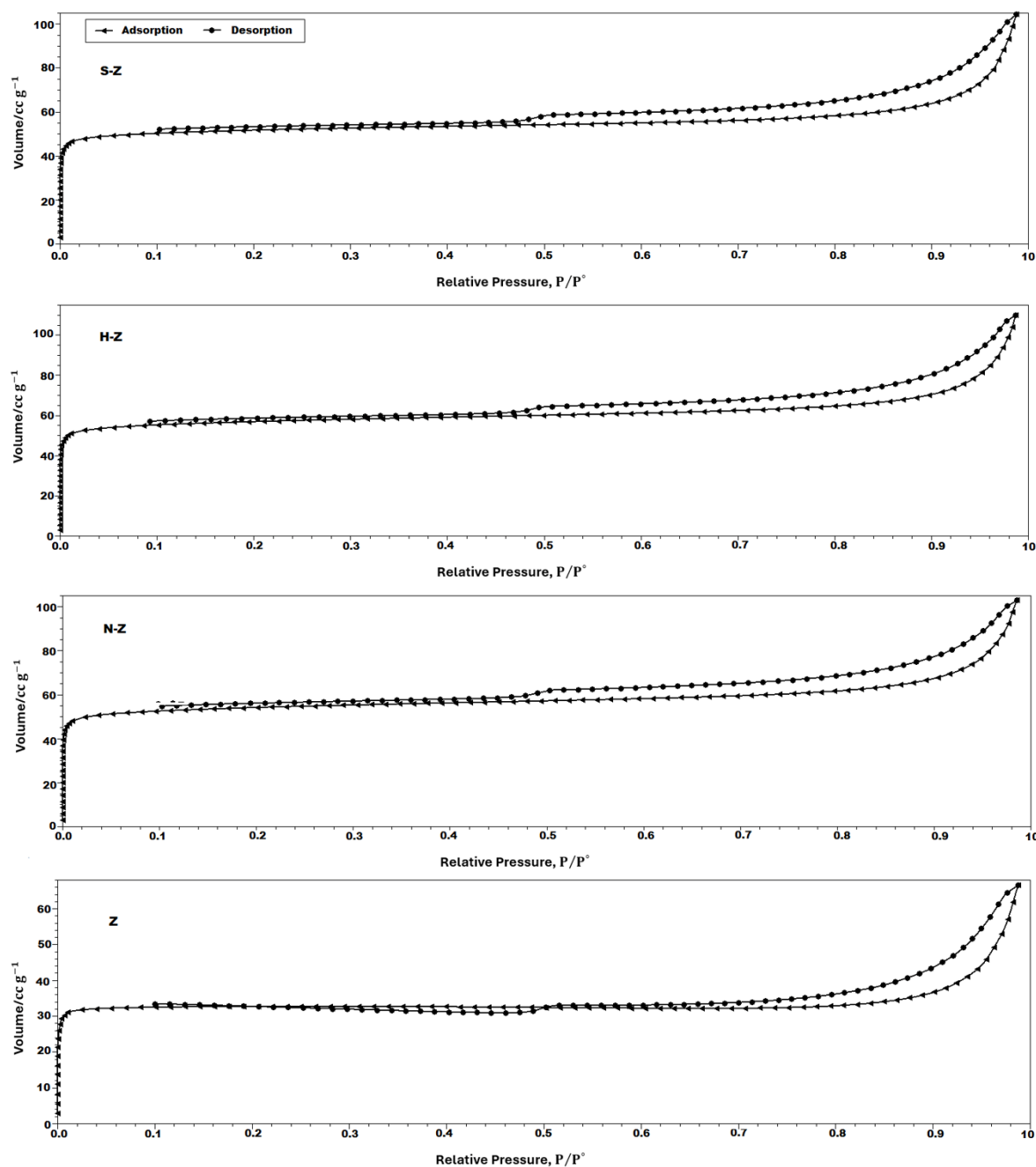
| Element, % | Z     | N-Z   | S-Z   | H-Z   |
|------------|-------|-------|-------|-------|
| O          | 62.52 | 66.30 | 64.42 | 61.96 |
| Si         | 26.83 | 28.54 | 29.99 | 31.13 |
| Al         | 6.26  | 3.60  | 3.52  | 4.43  |
| Mg         | 0.55  | 0.24  | 0.37  | 0.43  |
| Ca         | 1.85  | 0.24  | 0.46  | 0.23  |
| K          | 0.29  | 0.26  | 0.40  | 0.38  |
| Na         | 0.42  | 0.12  | 0.18  | 0.04  |
| Fe         | 1.13  | 0.49  | 0.66  | 1.14  |
| Ti         | 0.16  | 0.22  | -     | 0.25  |

### 3.3. Specific Surface Area and Porosity

The nitrogen adsorption-desorption isotherms for the natural (Z) and acid-treated zeolite samples (H-Z, N-Z and S-Z) obtained at 77 K are shown in Fig. 4, and the surface area characteristics are summarized in Table 2. Adsorption isotherms of zeolite samples are Type II with hysteresis type H4 according to IUPAC classification [20]. All zeolite samples showed hysteresis beginning from  $P/P_0$  value of about 0.47 related to the presence of mesopores as well as micropores. Specific BET surface areas were calculated according to the Brunauer-Emmet-Teller (BET) equation model.

**Table 2.** N<sub>2</sub> and NH<sub>3</sub> adsorption data of natural and acid treated zeolite samples

| Sample | NH <sub>3</sub> (mmol g <sup>-1</sup> )<br>298 K | BET surface<br>area (m <sup>2</sup> g <sup>-1</sup> ) | Micropore<br>area (m <sup>2</sup> g <sup>-1</sup> ) | Micropore<br>volume<br>(cm <sup>3</sup> g <sup>-1</sup> ) | Total pore<br>volume<br>(cm <sup>3</sup> g <sup>-1</sup> ) | Average<br>pore<br>diameter (Å) |
|--------|--|---|---|---|--|---------------------------------|
| Z      | 5.305  | 116   | 113   | 0.049   | 0.101  | 163                             |
| S-Z    | 4.985  | 181   | 152   | 0.067   | 0.158  | 139                             |
| N-Z    | 5.140  | 184   | 150   | 0.069   | 0.157  | 120                             |
| H-Z    | 5.279  | 199   | 164   | 0.073   | 0.167  | 127                             |



**Figure 4.** N<sub>2</sub> adsorption isotherms of natural and acid-treated zeolites at 77 K



It was seen that BET surface areas for natural and acid-treated zeolite samples increased, following the sequence:  $Z < S-Z < N-Z < H-Z$ . Surface area values of samples varied between  $116 \text{ m}^2/\text{g}$  and  $199 \text{ m}^2/\text{g}$ . Specific surface area, micropore area and micropore volume, and total pore volume values for acid-treated samples increased compared to those of the natural sample (Table 2). Among all the zeolite samples that acid-treated, it was found that the biggest surface area belongs to the H-Z sample. Surface area, micropore area and total pore volume values for the natural sample were  $116 \text{ m}^2/\text{g}$ ,  $113 \text{ m}^2/\text{g}$  and  $0.101 \text{ cm}^3/\text{g}$ , respectively while they increased to  $199 \text{ m}^2/\text{g}$ ,  $164 \text{ m}^2/\text{g}$  and  $0.167 \text{ cm}^3/\text{g}$  in the H-Z sample. This was probably due to cation migration and dissolution of amorphous material from the zeolite structure [21, 22].

### 3.4. $\text{NH}_3$ Adsorption

$\text{NH}_3$  adsorption isotherms for the natural and acid-treated samples obtained at 298 K up to 100 kPa are shown in Figs. 5. The ammonium molecule ( $3.62 \text{ \AA}$ ) is small enough to easily pass through the channels of the zeolite used in this study.  $\text{NH}_3$  adsorption capacities of zeolite samples 298 K increased in the following sequence:  $S-Z < N-Z < H-Z < Z$ . The capacities of the zeolites towards  $\text{NH}_3$  varied from  $4.985 \text{ mmol/g}$  to  $5.305 \text{ mmol/g}$  (Table 2).

The lower ammonia adsorption capacity of the acid-treated forms of the zeolite samples in comparison to the natural zeolite – despite having increased surface area – can be attributed to both dealumination and the partial destruction of the zeolite structure. This situation is also compatible with the XRF and XRD results obtained in the previous study [19]. The fact that the acid forms of the zeolite sample have less ammonia adsorption capacity compared to the natural sample is generally attributed to their weaker electrostatic and polarization interactions compared to the cationic forms. Acid treatment causes the formation of silanol hydroxyl groups. Although these silanol groups are polar, they cause smaller field gradients and electric fields compared to cations [21, 23].

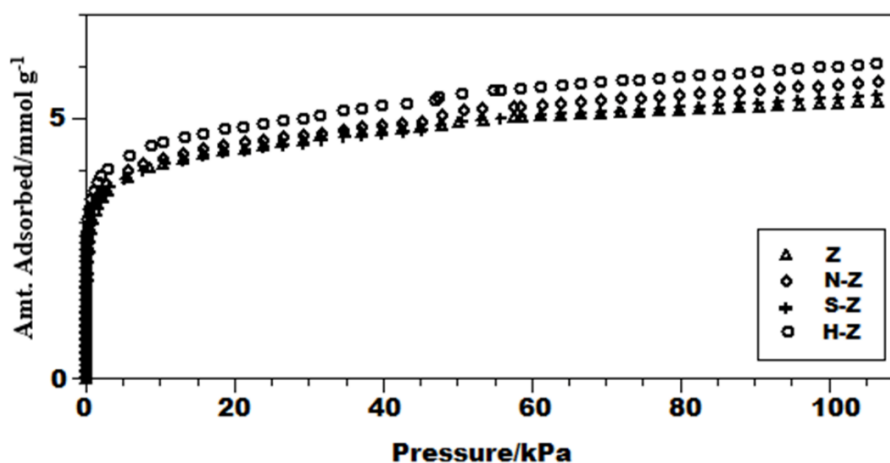


Figure 5.  $\text{NH}_3$  adsorption isotherms of natural and acid-treated zeolites at 298 K

### 3. CONCLUSION

Natural and acid-treated zeolite samples were characterized by using FT-IR, SEM-EDX and nitrogen adsorption methods. The efficiency of these samples in the removal of ammonia ( $\text{NH}_3$ ) was also investigated. Treatment of zeolite samples with 1 M solutions of  $\text{HCl}$ ,  $\text{H}_2\text{SO}_4$  and  $\text{HNO}_3$  led to increase in the BET surface area, micropore area and micropore volume, and total pore volume. It was seen that the ammonia adsorption capacities of acid-treated samples were lower than the natural sample, despite their increased surface area. It was found that the natural zeolite sample (Z) had the highest  $\text{NH}_3$  adsorption capacity at  $5.305 \text{ mmol/g}$ . Acid treatment of the zeolite caused the aluminum cations to remove from the zeolite structure and the partial destruction decreased its ammonia adsorption [4].

### ACKNOWLEDGMENT

This work was supported by Eskişehir Teknik University via Scientific Research Projects under Grant No. **23ADP033**.

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# POROUS GRAPHENE AEROGELS FOR PHOTOCATALYSIS-ASSIST METHYLENE BLUE REMOVAL FROM AQUEOUS SOLUTIONS

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## ABSTRACT

In the past few decades, organic and inorganic pollution due to immense discharge from anthropogenic activities is discharged into the soil and water environment. As one of the priority pollutants in the urban and industrial wastewater, methylene blue is widely present in printing and dyeing, textile, leather, paper, plastics, and other industries wastewater, usually difficult to be degraded and has unstable properties because of many polycyclic aromatic hydrocarbons in molecular structure. Wastewater containing methylene blue is discharged into the lake, which is very difficult to purify and highly likely to cause serious pollution. Catalysts are essential components for the treatment of air and water pollutants on the way to a sustainable and clean environment. As active heterogeneous catalysts for several catalytic and photocatalytic environmental remediation processes, aerogels made from diverse molecular precursors are well known. Because of this, aerogels have been viewed as a bridge bridging the nano and macroworlds, where the building blocks can both maintain their original features and develop new ones through their 3D interaction. Aerogels are particularly promising for photocatalytic applications due to their specific qualities. Aerogels have an incredibly high surface area, which provides many active sites for photocatalytic reactions to occur. This increased surface aerogel materials like graphene has encouraged the search for more mechanically stable and versatile aerogel photocatalysts. Aerogels have been explored and applied in various catalytic processes due to their unique properties and larger surface area. In this presented work, pure porous graphene aerogel materials were prepared via a supercritical-drying method. The structural, morphological, and physicochemical characteristics of the graphene aerogels were characterized by scanning electron microscopy (SEM), Fourier transform infrared (FTIR) spectroscopy, and Brunauer–Emmett–Teller (BET) analysis. The photocatalytic performance of the graphene aerogels was also analyzed by UV–visible spectrophotometer using ultraviolet light.

**Keywords:** Graphene Aerogel, photocatalysis, supercritical-drying, methylene blue.

## 1. INTRODUCTION

Since organic chemicals are released widely and uncontrolled in the twenty-first century, water pollution has become a major problem. This causes the issue of water scarcity and leads to the deterioration of the quality of clean water [1-3]. Many organic pollutants, including phenolic chemicals, rhodamine B (RhB), and methylene blue (MB), are widely used in textile, leather, and other production processes [4]. It has been found that there are more than 100,000 different kinds of organic dyes, and that 36,000 tons are consumed annually [5]. Unfortunately, one of the hardest issues to handle is treating wastewater that contains organic contaminants.

Up to now, several methods have been developed, including adsorption [6], coagulation [7], and photocatalysis [8], all of which have been widely used to address the problem of organic dyes in wastewater [9]. Of the several approaches, photocatalysis is notable for its advantages in particular areas, such as preserving a solution's pH at a desirable level, functioning at a moderate reaction temperature, and attaining a high level of efficiency [10].

Graphene has unique advantages over conventional materials based on carbon [11]. Though tremendous progress has been made, challenges still exist in the real-world application of photocatalysis to organic pollutant wastewater treatment, especially regarding selecting highly effective photocatalysts. One of the most important aspects of the photo-degradation process is the adsorption capacity of pollutants. With its large surface area, exceptional adsorption capacity, and intriguing photocatalytic potential, graphene is a material with great promise [12].

Three-dimensional graphene aerogel materials (3D GA) have been receiving increasing attention recently because of their remarkable inherent characteristics and porous structure [13]. Significant promise exists for addressing the breakdown of organic contaminants in wastewater due to the distinct structure of 3D GA. Notably, 3D GA has a high potential for adsorption of organic pollutants, which increases its efficiency in breaking down those pollutants [14]. To date, the synthesis of 3D GA as a low-cost photocatalyst for the removal of organic dyes in aqueous environments via hydrothermal reduction and supercritical ethanol drying remains unexplored.

## 2. SYNTHESIS METHOD OF 3D GA

Over the last ten years, the hydrothermal reduction method has proven to be a successful synthetic approach for three-dimensional graphene hydrogels (3D GH). By dehydrating 3D GH, three-dimensional graphene aerogels are produced. To produce 3D GH, cross-linking agents such metal ions and polymers were added to the graphene oxide dispersions. Supercritical drying and direct freeze-drying are two methods that can produce 3D GA. The most often used method is the freeze-drying method because of its easy conditions and straightforward operation.

Compared to freeze drying and ambient pressure drying, supercritical drying typically produces aerogels with larger surface areas, porosities, and pore volumes. The Superex F-500 apparatus was used to carry out the supercritical drying process (Biosan, Superex, Türkiye). The column of the extractor is 500 mL. The instrument has a maximum pressure and temperature rise of 34.5 MPa and 70 °C, respectively.



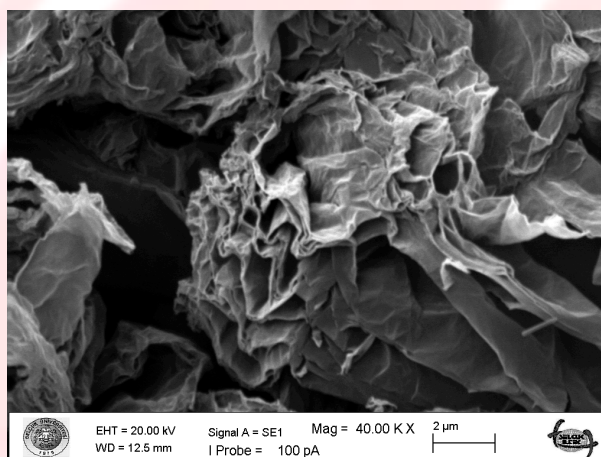
**Figure 1.** Supercritical drying system

### 3. CHARACTERIZATION OF 3D GA

The graphene aerogel's microscopic morphology was examined using a Zeiss EVO LS-10 scanning electron microscope. At 77 K, measurements of nitrogen adsorption and desorption were carried out using a Micromeritics TriStar II PLUS device. The BET (Brunauer-Emmett-Teller) method was utilized to compute surface areas, whereas the Barrete-Joynere-Halenda (BJH) approach was employed to determine the pore size distribution. Using a Bruker Vertex 70 spectrophotometer (Rheinstetten, Germany), the Fourier transform infrared (FT-IR) spectra of 3D GA was recorded at a resolution of  $4\text{ cm}^{-1}$ . The  $400\text{--}4000\text{ cm}^{-1}$  range was used to acquire the FTIR spectra. Using a UV-Vis-NIR spectrophotometer (Jasco Inc., MD, USA), heterostructure photocatalytic studies in the  $190\text{--}1100\text{ nm}$  range were examined.

### 4. RESULTS AND DISCUSSION

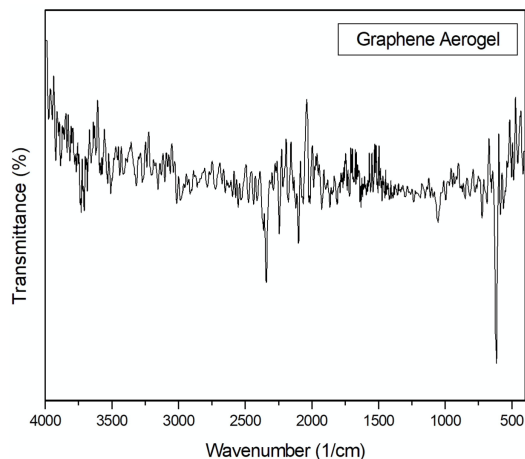
Figure 2 depicted the microscopic microstructure of 3D graphene aerogels. Homogeneously linked holes with diameters less than  $2\text{ }\mu\text{m}$  were seen in 3D GA structures. Graphene aerogels seemed to have a well-organized and fine pore structure.



**Figure 2.** SEM image of supercritical dried graphene aerogel

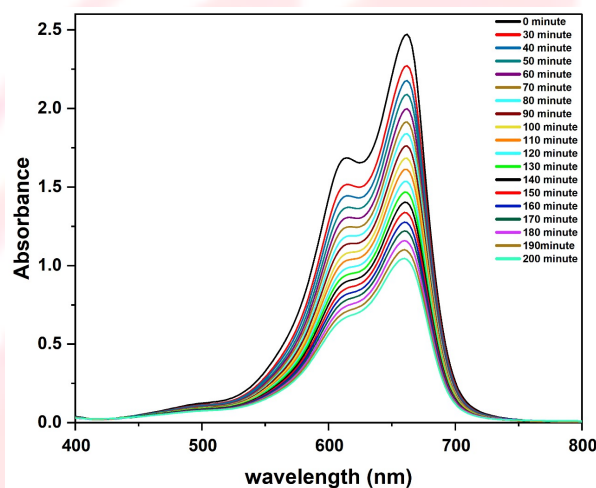
Using the Brunauer-Emmett-Teller method, the surface area, pore volume, and average pore diameter of 3D GA were determined. Because of the layering or overlaying of graphene sheets, the graphene aerogel's surface area was significantly less than  $2600\text{ m}^2\cdot\text{g}^{-1}$ , which is the predicted value for a single graphene sheet. The surface area, pore volume and average pore diameter of 3D GA at approximately  $400\text{ m}^2\cdot\text{g}^{-1}$ ,  $1.14\text{ cm}^3\cdot\text{g}^{-1}$ ,  $76,59\text{ }\text{\AA}$ , respectively.

Figure 3 displayed the 3D GA's ATR-FTIR spectrum. A broad band is typically seen in graphene oxide at approximately  $3300\text{ cm}^{-1}$ , which originates from the O–H stretching vibration in the C–OH groups. The obtained 3D GA almost had no bands at  $3300\text{ cm}^{-1}$  and  $1380\text{ cm}^{-1}$  after supercritical drying. Furthermore, there was a notable drop in the band intensity of the alkoxy (at  $1050\text{ cm}^{-1}$ ) and carbonyl (at  $1730\text{ cm}^{-1}$ ) groups.



**Figure 3.** FT-IR spectrum of supercritical dried graphene aerogel

Methylene blue (MB) degradation was used to track the photocatalytic activity of graphene aerogel, which has been produced by supercritical drying, when exposed to ultraviolet (UV) radiation. Figure 4 displayed the 3D GA absorbance spectrum. The concentration of MB was determined using the wavelength at which it absorbs light the most, which is around 663 nm. Absorbance tests were made for supercritical dry graphene aerogel every ten minutes, and the strength of the MB dye absorption peak decreased with exposure time. The illustration illustrates how the administered UV light causes the MB aqueous solution's absorption peak to diminish. The figure makes it very evident that 3D GA demonstrated exceptional photocatalytic activity.



**Figure 4.** Absorbance spectrum of supercritical dried graphene aerogel

## 5. CONCLUSION

In conclusion, this work provided an overview of current developments in the synthesis of 3D GA photocatalyst. Supercritical drying method has been exploited for the synthesis. GA is a useful material with a high adsorption capacity, big specific surface area, and typical 3D porous skeleton. GA possesses advantageous properties such as high connectivity, strong conductivity, and hydrogen bonding with  $\pi$ - $\pi$  interlaminar stacking. For the photocatalytic destruction of organic pollutants like MB, 3D GA photocatalyst has been used. Future research can significantly increase the photocatalytic activity by combining 3D GA with semiconductors.

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