5. Uluslararası Temel ve Uygulamalı Bilimlerdeki İlerlemeler Konferansı

5th International Conference on Advances in Natural and Applied Sciences

Eylül/September 21-23, 2021 | Ağrı, Turkey

BOOK of ABSTRACTS

& PROCEEDINGS

ICANAS 2021 International, Interdisciplinary, Online

5th International Conference on
ADVANCES IN NATURAL & APPLIED SCIENCES

ICANAS 2021

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ISBN: 978-605-80220-5-8

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Dear ICANAS 2021 participants!

We would like to thank you all for your interest to participate in the International Conference on Advances in Natural and Applied Sciences (ICANAS 2021) which will be held in Ağrı (İbrahim Çeçen University), Turkey, September 21-23, 2021.

Due to the extraordinary circumstances of the Covid19 coronavirus pandemic, we have decided to hold our meeting online this year.

This year we are happy to organize the 5th International Conference on Advances in Natural and Applied Sciences on the international platform in collaboration with İbrahim Çeçen University of Ağrı. Our Conference aims to provide an atmosphere for colleagues from all over the world to share expertise, experience and scientific studies and industrial experiences that describe significant advances in the following areas, but are not limited to; Chemistry, Physics and Biology, Mathematics and Statistics, Agricultural and Aquatic Sciences, Biotechnology and Nanotechnology, Engineering, Computers Sciences, Physics, Chemistry, Biology and Mathematics Education. The conference program includes invited speakers, online paper presentations, poster presentations and virtual presentation.

ICANAS 2021 is an international meeting for International Conference on Advances in Natural and Applied Sciences from all over the world working in Natural and Applied Sciences to present their latest research results, to exchange new ideas and application experiences face to face, to discuss challenging issues, to establish research relations and to find global partners for future collaboration.

This year, within the scope of the Conference, nearly 100 oral and poster abstracts accepted by the Scientific Committee and Editorial Board were presented.

Selected papers from the ICANAS2021 recommended by the scientific committee will be published in special issues of following journals: International Journal of Education, Science and Technology; Eastern Anatolian Journal of Science; International Journal of Scientific & Engineering Research.

I would like to thank honorary chairs Prof. Dr. Abdulhalik KARABULUT (The Rector of Ağrı İbrahim Çeçen University) and İbrahim ÇEÇEN (The Chairman of IC Holding) who contributed to making this conference a great success.

Also, I would like to thank all conference participants who supported the conference with their knowledge, invited speakers, session chairs, authors / presenters, colleagues, conference secretariat, technical team that contributed to the online conference, sponsors and everybody who has all contributed to this conference with great efforts for months.

I wish every success and fruitful results in their academic lives for all participants of ICANAS 2021 organized Ağrı, İbrahim Çeçen University.

Hope to see you in face at the next ICANAS conferences...

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CONTENTS

Invited Talks

Chemistry Oral Presentations

Physics Oral Presentations

Biology Oral Presentations

Mathematics Oral Presentations

Air, Soil, Water, Food, Healths Oral Presentations

Nanotechnology Oral Presentations

Engineering Oral Presentations

Materials Science Oral Presentations

Agricultural Science Oral Presentations

Education Oral Presentations

INVITED TALKS

ID:01-IOP

Some Explanations on Experimental Current-Voltage-Temperature Characteristics in Schottky Barrier Diodes

Abdulmecit TÜRÜT

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Schottky and ohmic contacts are essential parts of electronic and optoelectronic devices based on semiconductor materials. Controlling the contact/semiconductor interface properties is the key to obtaining a contact with an optimum performance. The Schottky barrier height (SBH) is one of the most important quantities of a metal/semiconductor (MS) rectifying contact since it manages the flow of carriers across MS interface and therefore it is crucial for the development of future high-functionality devices. The formation and modification mechanism of SBH in the MS Schottky contacts is still a subject of much debate. The important of zero bias and bias-dependent barrier in current-voltage characteristics under measurement temperature and the determination of the Richardson constant of the semiconductor substrate used in the fabrication of a MS Schottky contact and of some diode parameters will be explained by means of experimental findings in literature.

Keywords: Schottky Diodes, Barrier Height, Temperature mesurements,

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ID: 02-IOP

Ethical Violations and Causes Frequently Encountered in Scientific Research and Publication Process

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Ethics, which has gained more and more importance in the field of scientific research and publication in recent years, seems to remain on the agenda from now on. This is necessary in one aspect and inevitable in another aspect. Because as the fierce competition and struggle for survival in the field of science and technology continues, scientists will be under pressure to do more research and publication. With the ease of access to information/documentation, ethical violations will lead to serious problems and debates not only at the national but also at the global level. In this context, the most important way to minimize ethical violations is to ensure that scientists undergo a serious education on ethics. Since ethical violations made in the scientific research process are only noticed when they turn into publications, reader control is also of great importance. For this reason, ethical violations are more common in societies that read and write less. Ethics, which is influenced by many factors from the determination of academic promotion and appointment criteria to filling the relevant legal gap, is also a matter of rights and law. In this talk, we will try to examine the qualities that an ideal scientist should have, not only in the field of scientific research and publication, but also in almost every field of academic life, what are the common ethical violations and ways to minimize them.

Keywords:

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ID: 03-IOP

Effect of Electron Irradiation on Composites with POSS

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The purpose of this article was to study the effect of electron irradiation on polyimide track membranes-based polymer composites where Polyhedral oligomeric silsesquioxane (POSS) was used as a filler. Samples were irradiated with a 5·1015 cm^{-2} flow of electrons of energy 150 keV in a vacuum at a pressure of no more than 10–4 Pa. The curves of diffuse reflectance spectra of the initial polyimide and of the composite containing filler, both before and after irradiation with electrons, are presented. The change in the integral absorption coefficient of composites with different filler contents after electron irradiation is investigated. For pure polyimide after electron irradiation, the integral absorption coefficient of solar radiation increases by 26.7 %. For a composite with 70 % POSS content, the integral absorption coefficient increases by 15.3%.

Keywords: polymer composite, POSS, optical properties, electron irradiation, space

Introduction

Polymers and their composites are widely used in many industries [1-3]. Particular attention is paid to the development of polymer composites for space objects [4]. Polymer materials in space are actively used as thermal control coatings and are applied to the surface of the spacecraft or its individual elements in order to provide the required optical characteristics of the surface (absorption coefficient of solar radiation and the degree of blackness) [5]. By choosing a temperature-controlled coating, it is possible to change the surface temperature of the spacecraft and thereby create conditions for the supply or removal of heat from the external elements of the spacecraft.

Thermal control coatings based on polymeric materials used on the outer side of the spacecraft are exposed to a variety of aggressive factors that significantly impair their characteristics, leading to a decrease in their functional properties [6]. Aggressive cosmic conditions include: deep vacuum, solar vacuum ultraviolet radiation, charged particles (electrons, protons), extreme temperatures, impacts from micrometeorites and orbital

debris, etc [7-8]. In addition, polymer composites are exposed to atomic oxygen when in low-Earth orbit (200–1000 km above the ground) [9].

Almost all polymers are dielectrics and they are charged from the effects of electron irradiation in space. Due to the energy of absorbed electrons, the conductivity of the dielectric increases significantly and its internal structure changes irreversibly. The accumulation of a large electrical charge in polymers is a negative factor that can cause breakdown in the dielectric material. Electrical breakdowns in dielectrics not only interfere but also destroy the dielectrics themselves, impairing their performance properties. As a result of breakdowns in the dielectric, traces remain in the form of Lichtenberg figures – branchy discharge trees – therefore finding an effective way of suppressing the accumulation of charge in a polymeric insulating material for the design and safety of a space flying object is very important [10]. For thermostatic coatings, the impact of electron irradiation, in addition to electrical breakdown, can also cause a change in the functional optical characteristics of the source material [11].

Most studies on the effects of electron irradiation are devoted to the study of changes in the optical properties of pure polymers, or the study of changes in the optical properties of thermal control coating fillers. Particular attention is paid to the modification of nanoparticles of fillers with temperature-controlled coatings to increase their resistance to the effects of electron/proton irradiation in space conditions [12]. Much less research is devoted to the change in the optical properties of highly filled polymer composites that can be used as thermostatic coatings.

This article presents data on the change in optical properties (absorption coefficient of solar radiation) of polymeric composites, with on polyimide track membranes where Polyhedral oligomeric silsesquioxane (POSS) as the filler, subjected to electron irradiation under conditions simulating the influence of near-Earth space.

Materials and methods

A polyimide in the form of polyimide track (nuclear) membranes (manufactured by ION TRACK TECHNOLOGY FOR INNOVATIVE PRODUCT (it4ip), Belgium) was used as a polymer matrix. The pore diameter was 200 nm, the pore density was $5 \cdot 10^8$ cm^{-1}, and the polyimide membrane was 25 μm thick.

The tracks of the polyimide membrane were filled with organosilicon structures — POSS particles. The tracks of the nuclear polyimide membrane were filled with organosiloxane

structures by synthesizing the filler in a GSA-0.3 high-pressure reactor in the presence of polyimide membranes (autoclaving temperature 250 ° C, holding time 4 hours).
The synthesis of organosiloxane structures (POSS) under hydrothermal conditions in a high-pressure reactor is described in more detail in [13].

Irradiation of the developed polymer composites was carried out on the "Installation for technological and special tests of dielectrics by high-energy electron radiation" located at the Radiation Monitoring Center accredited to the VNIIFTRI (State Scientific Metrology Institute, Moscow) in Belgorod State Technological University named after V.G. Shukhov. A photograph of this installation is presented in Figure 1.

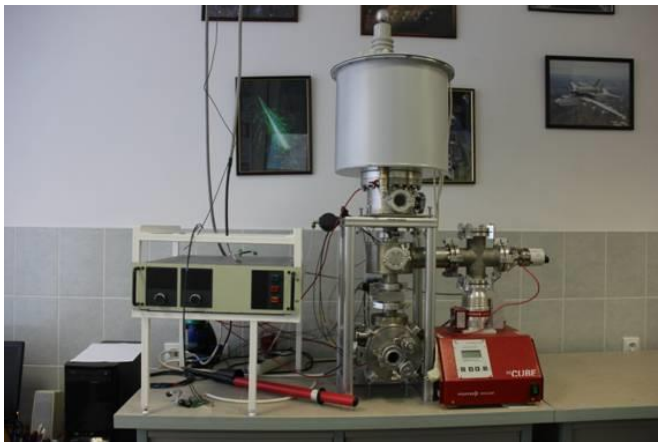

Figure 1. Installation for technological and special tests of dielectrics by high-energy electron radiation, located at the Radiation Monitoring Center in Belgorod State Technological University named after V.G. Shukhov (BSTU)

This equipment is completely safe to handle and has a high degree of radiation protection: no radioactive elements are formed during operation in the investigated 0.1–1 MeV energy range, which makes for safe operation. When used for electron irradiation it can be switched off almost instantaneously to stop the irradiation, therefore radiation protection is required only for the accelerating elements of the system during operation; in the inoperative condition it can be treated as ordinary electrical equipment with the appropriate safety standards.

The samples were irradiated with a $5 \cdot 10^{15}$ cm^{-2} flow of electrons of energy 150 keV in a vacuum at a pressure of no more than 10^{-4} Pa (exposure time 72 h and acceleration factor 10, which corresponds to 720 h of exposure in space in a geostationary orbit at radiation intensity 210^{7} cm^{-2} s^{-1}).

The integral coefficient of absorption of solar radiation was calculated from the values of the reflectance spectra of the composites at a certain wavelength. The reflectance spectra of the composites (ρλ) were recorded at points 0.5 nm apart in the range 0.24–2.02 μm using a UV-3600 spectrophotometer.

Results and discussion

Figure 2 shows the curves of the diffuse reflectance spectra of a sample of pure polyimide and a polymer composite with filler before and after irradiation with electrons.

An analysis of Figure 2 showed that the diffuse reflectance curve of the starting polyimide is well below the spectral curve of the polymer composite. Based on this, we can conclude that the polymer composite has a higher reflectivity than the pure polyalkanimide in the entire wavelength range under consideration. The polymer composite has the lowest reflectivity in the UV spectral region (the reflection coefficient reaches 76%).

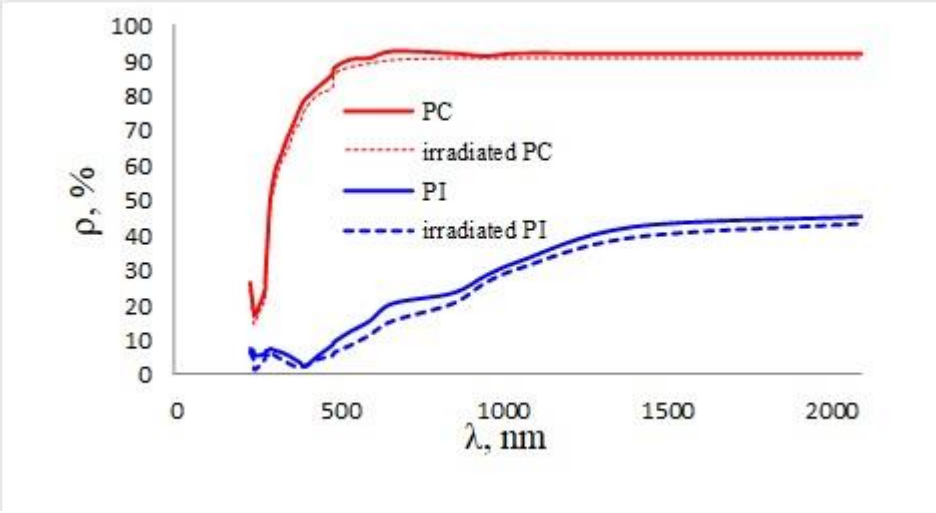

Figure 2. Diffuse reflectance spectra of polyimide (PI) and polymer composite (PC) before and after irradiation with 150 keV electrons

In the visible region of the spectrum the reflection coefficient of the polymer composite increases from 76% to 92%; in the IR region it almost does not change and its value is equal to a maximum of 92%. For pure polyimide, the maximum value of the reflection coefficient is 45% in the IR region of the spectrum whereas in the UV and visible regions it is much lower.

From the data presented in Figure 2, it is noticeable that the curves of the diffuse reflectance spectra of polyimide before and after electron irradiation are similar. It is established that the curve of the reflection spectra after irradiation with electrons is lower than the graph of the spectra taken before irradiation. It can be concluded that after electron irradiation the intensity of the reflected light decreases. A similar situation is observed with the curves of the reflection spectra of the polymer composite. Electron irradiation also leads to a decrease in reflectivity of the composite.

After irradiation, the reflection coefficient decreases mainly in the visible region. The difference in the diffuse reflectance spectra ($\Delta\rho_\lambda$) is obtained by subtracting the spectra after irradiation ($\rho_{\lambda 1}$) from the spectrum before irradiation ($\rho_{\lambda 0}$): $\Delta\rho\lambda = \rho_{\lambda 1}-\rho_{\lambda 0}$ (Figure 3).

Analysis of the diffuse reflectance difference spectra of polyimide (Figure 3) showed that the largest decrease in reflection coefficients is observed in the visible region, wavelength range 600–750 nm. The maximum increase in the reflection coefficient compared with the original is 5%, observed at a wavelength of 665 nm. In the near-IR region after electron irradiation, changes in the reflection coefficients of pure polyalkanimide do not exceed 3%. For a polymer composite, the largest changes in the diffuse reflectance spectra are observed in the UV region of the spectrum – 5.2% (Figure 3). After 480 nm, the reflectivity of the polymer composite begins to decrease. The minimum value of the difference spectrum is 0.6% at a wavelength of 950 nm.

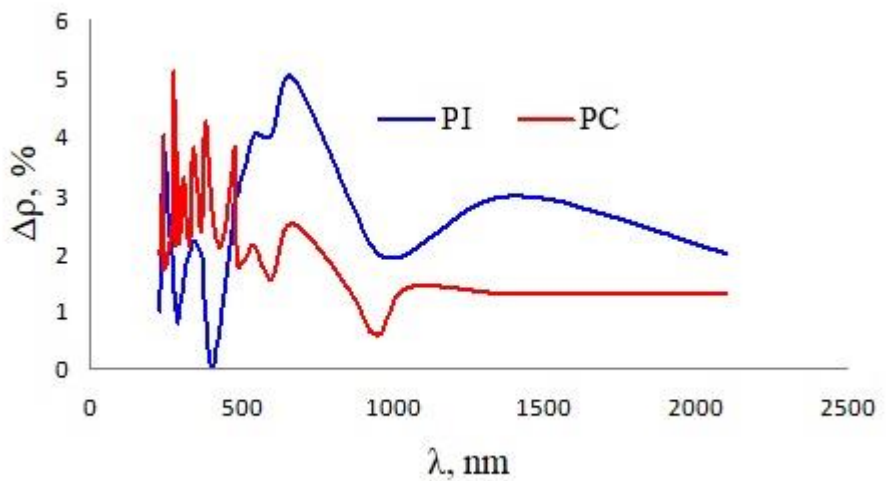

Figure 3. Diffuse reflectance difference spectra of polyimide (PI) and polymer composite (PC) after electron irradiation.

Table 1 presents the data of the integral absorption coefficients (α_s) of the developed composites before and after irradiation with electrons.

Table 1. Values of the integral absorption coefficients of the developed composites before and after irradiation with electrons

The content of the filler in the composite, wt.%	α_s	
	Before irradiation	**After irradiation**
–	0.452	0.572
10	0.337	0.421
20	0.211	0.260
30	0.159	0.194
40	0.115	0.137
50	0.101	0.118
60	0.093	0.108
70	0.090	0.104
80	0.090	0.104

For pure polyimide after electron irradiation, the integral absorption coefficient of solar radiation increases by 26.7%; for a composite with 70% filler content the integral absorption coefficient increases by 15.3%.

Conclusions

In this article, the effects of electron irradiation on the stability of polyimide-based polymer composites with POSS as filler under conditions simulating outer space are considered. It is shown that the introduction of a filler significantly increases the reflectivity of the composites over the entire considered wavelength range of 240–2020 nm.

After irradiation with electrons, the intensity of the reflected light decreases for both pure polyimide and the polymer composite under investigation. Electron irradiation leads to a decrease in the reflectivity of the composite. The greatest decrease (up to 5%) in the reflection coefficients of polyimide after irradiation is observed in the visible region, wavelength range 600–750 nm. In the near-IR region after electron irradiation, changes in the reflection coefficients of pure polyimide do not exceed 3%. For a polymer composite,

the largest changes in the spectra of diffuse reflection are observed in the UV region of the spectrum – 5.2%. The minimum value of the difference spectrum is 0.6% at a wavelength of 950 nm.

For pure polyimide after electron irradiation, the integral absorption coefficient of solar radiation increases by 26.7%; for a composite with 70% filler content, the integral absorption coefficient increases by 15.3%. The arbitrary criterion for resistance to change in the integral absorption coefficient is for an increase of no more than 25%. Thus, the developed composites fully satisfy this requirement.

Acknowledgement: This work was supported by Russian Science Foundation (№19-79-10064).

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ID: 04-IOP

The Potential of Biochar for Improving Soil and Plant Health

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Biochar is a solid product obtained by heating of biomass or organic waste in the total or partial absence of oxygen and is applied to improve soil properties, or considered a means of carbon sequestration. Several positive effects of biochar on soil chemical, physical, and biological properties have already been demonstrated. Biochar amendment has also been repeatedly discussed as an effective means to restore saline lands and increase plant tolerance to salt stress. Especially, improved soil cation exchange capacity, water holding capacity, soil nutrient retention, and increased soil enzyme activities were reported. Biochar contains a higher amount of labile carbon fractions, which may stimulate microbial activity and thereby improve soil nutrient cycling [1, 2]. Biochar amendment has also been repeatedly discussed for its disease suppressive properties. It can be assumed that the modification of plant root exudate composition, changes in soil microbial and biochemical properties and the induction of systematic plant defense mechanisms in the wake of biochar amendments are crucial factors impacting pathogen suppression. However, the underlying mechanisms of such beneficial effects provided by biochar amendment of soils are highly complex. Therefore, more in-depth studies are needed to understand biochar interactions with soil organisms under extreme environments, which will help achieve maximum benefits of biochar under saline soil conditions.

Keywords: biochar; salinity; soil; plant; microorganisms; soil enzymes

Acknowledgement: This research was supported by UZB-Ind-2021-93 grant from the Department of Science & Technology (DST), the Government of India, and the Ministry of Innovative Development of the Republic of Uzbekistan

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ID: 05-IOP

Principles of Monte Carlo Simulations for Radiation Transport and Nuclear Shielding Studies in Nuclear and Medical Physics: MCNPX Experience

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Recently, the use of Monte Carlo simulation has accelerated due to its use in a variety of areas, including nuclear technology, medical radiation, and industry. On the other hand, customers may choose from a variety of Monte Carlo Codes. In this presentation, technical details, basics of input writing, general structure of MCNPX (version 2.4.0) Monte Carlo code will be discussed. MCNPX is a general-purpose programme that is used to simulate and transport radiation in order to study the interaction of radiation with materials. It also monitors all particles at various energies. MCNPX is a completely three-dimensional program that makes use of expanded nuclear cross section libraries and particle type physics models. In addition, MCNPX has a broad range of application areas not only in different fields but also in different radiation types as well energy levels.

Keywords: MCNPX; Monte Carlo simulations; radiation

ID: 06-IOP

Synthesis of Graphene Nanoribbons and Its Application to Ammonia Gas Sensing

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Carbon nanomaterial have been employed for gas sensing application due to their exceptional electronic, thermal and mechanical characteristics. Graphene nanoribbon which is a 1D carbon material has superior characteristics in terms of high conductivity as compared with its carbon nanoubes. Different techniques including spin coating, dip coating, drop casting, dielectropheresis, direct synthesis etc have been used for coating of the sensing material onto the transducer. Amongst these techniques the direct synthesis technique or in situ have not been widely explored and it has a better advantage because with this technique, the adhesion of the sensing material to the transducer is much stronger and it is simple and economical because it is locally synthesized. Therefore, in this paper it was proposed to synthesize the sensing material epitaxially onto the substrate. The substrate employed was GaPO4 with a platinum metal. A Zirconium layer was sandwitched in between the GaPO4 and the platinum electrodes for improved adhesion. Alcohol Catalytic Chemical Vapor Deposition (ACCVD) was employed for the synthesis of Carbon Nanostructures. Novel structure of Y-branched Multiple Layered Graphene Nanoribbons were discovered for the first time and has never been reported based on the author's knowledge on this substrate. This was employed for gas sensing application in order to investigate its sensing potentialities. It was tested towards ammonia gas with different concentrations of 0.125 to 1 % at room temperature and then compared with pristine multiwalled carbon nanotubes for comparison. It was observed that the sensitivity of the direct synthesis sensor was more than that of pristine carbon nanotubes which makes it as a potential sensing material for ammonia gas. The minimum sensitivity of the sensor at 0.25% concentration is 4.3 while the maximum sensitivity for 1% gas concentration is 6. This shows that the pristine GNR based sensor. This shows that the pristine GNR based sensor has affinity towards ammonia gas as in CNT based ammonia gas sensors. In order to test the sensor for repeatability, it was tested repeatedly for 0.25 % gas concentration for four cycles which showed the same t. It could also be observed that the sensitivity increases as a result of increase in gas concentration which is in agreement with work done by other researchers.

ID:07-IOP

Turbulent Flow Modelling Using Open Source Packages OpenFOAM and Paraview

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Modeling turbulent flows by using computational fluid dynamics is an effective method for studying a wide range of scientific and technical problems of practical interest. In this paper, we consider capabilities of the OpenFOAM and Paraview open packages for numerical solution of number of computational fluid dynamics problems. It is shown results of test problems calculations available in open most informative and reliable database.

Acknowledgement: This work was supported by Ministry of Education and Sciences of Kyrgyz Republic.

Keywords: Navier-Stokes Equations, RANS Turbulence Models, volume of fluid method, ERCOFTAC Database, Open FOAM, Paraview.

ID: 08-IOP

Some Problems of Lifts

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A real modeling of Riemannian holomorphic manifold is a real smooth manifold admitting the pure Riemannian metric with respect to the integrable structure which is defined by the isomorphic representation of commutative algebras. In general, the Riemannian metric on holomorphic manifolds is not a holomorphic metric. The main purpose of this work is to study holomorphic metrics by using the Tachibana operator applied to pure tensors.

We can define the following classical numbers of order two: dual numbers (or parabolic numbers), i.e. , where is the field of real numbers. Let be a differentiable manifold and its tangent bundle. Two types of lift (extension) problems have been studied in the previous works of some authors: a) The lift of various objects (functions, vector fields, forms, tensor fields, linear connections, etc.) from the base manifold to the tangent bundle; b) The lift on the total manifold by means of a specific geometric structure on. In the present work we continue such a study by considering the structure given by the dual numbers on the tangent bundle and defining new lifts of functions, vector fields, forms, tensor fields and linear connections.

Using holomorphic extensions of functions, we also introduce so-called deformed lifts in the tangent bundle of two order being defined as the set of all higher order 2-jets and investigate some properties of these lifts. The other purpose of this work is to study the deformed lifts (i.e. so called the intermediate and complete lifts) of functions and vector fields which surprisingly appear in the context of algebraic structures in the bundle of 2-jets.

Keywords: Riemannian metric; holomorphic function; complete lift; bundle of 2-jets

ID:9-IOP

"The Face" of Biosynthesized Nanoparticles

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Based on the wide diversity of living entities, the possibilities of intracellular and extracellular bioreduction or biosorption of metal ions are continuously explored to obtain the most promising biogenic nanoparticles, with remarkable applications in various areas and industries [1]. Furthermore, the attractiveness of biogenic nanoparticles lies in the advantage of accurate planning of synthesis conditions, which facilitates stabilization, separation and purification of nanoparticles [2]. Despite the attention paid to the production and extensive use of nanoparticles, many concerns about bioactivity and cytotoxic potential still persist. Surface charge of nanoparticles is highly dependent on the presence and nature of the coating or capping agent [3]. Coated surface highly influence their stability, biocompatibility and toxicity. In an era dominated by biotechnologies and nanotechnologies, in order to enjoy a period of safe bionanotechnology, the imperative to elucidate the formation, dynamics and role of nanoparticle coating is reinforced by a multitude of important researches.

Keywords: biosynthesis, nanoparticles, coating,

Acknowledgement: This work was supported by a grant of the Ministry of Research, Innovation and Digitization, CNCS/CCCDI – UEFISCDI, project number PN-III-P4-ID-PCE-2020-0620, within PNCDI III.

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ID:10-IOP

Approximate Deconvolution with Correction - a Member of a New Class of Turbulence Models

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We propose a new family of models for fluid flows at high Reynolds numbers, Large Eddy Simulation with Correction (LES-C), that combines LES approach to turbulence modeling with defect correction methodology. We investigate, both numerically and theoretically, one of these models, based on the Approximate Deconvolution Model (ADM). The new model, Approximate Deconvolution with Correction (ADC), is shown to be stable and higher order accurate with respect to the filtering width. It is shown to outperform its most natural competitor, the ADM, on a variety of benchmark problems. These include the computation of errors (on a problem with known solution); a benchmark problem of finding maximal drag and lift coefficients; flow past the step; and the discussion on Taylor-Green vortex solutions.

Keywords: turbulence model, defect correction, approximate deconvolution

ID:11-IOP

Polymers and Glasses; Their Applications for Gamma Radiation

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Shielding against ionizing radiation is the most important and of great interest to protect people from the hazards resulted from the exposure to any type of the ionizing radiation. The ionizing radiation is broadly classified into neutrons, photons, heavy charged particles, and electrons. This radiation is characterized by their high penetration ability. In this work, an alternative materials instead of lead are examined to be used as gamma – ray shields. These materials are glasses and polymers. Several engineers and scientists have been used glasses with different compositions as radiation shielding. Therefore, the glass classification as good shielding materials must include assessing its photon and neutron shielding parameters. Neutron shield requirements simply require that the shield contain high neutron-absorbing elements such as H, B, Mg, Ca, and Cd, while effective photon shields are expected to be dense and have high mass attenuation coefficients. Thus, for glasses that are required as shields for photons and neutrons, their composition must strike a balance between light and heavy elements. Hence, the glass shield's composition would determine the type of radiation it has a potential of adequately shielding. Besides, different types of polymeric materials also investigated to be used as gamma – ray shields. The shielding effectiveness of these materials are examined via determination of the vital parameters as mass, linear attenuation coefficient, half value layer, mean free path, and buildup factors through different programs as Xcom, Phy-X/PSD, and MCNP. Finally, some physical and optical characterization of the investigated parameters is discussed.

Keywords: Polymers, Glasses

ID:12-IOP

Shielding Characteristics of Different Glass Systems for Protection Against Gamma Rays in Diverse Applications

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In the current century and with the rapid development in the technology, the utilization of gamma-rays has become an essential requirement for daily life activities. The research centers, dental as well as medical facilities and other facilities use a lot of equipment which emit different kinds of the radiation. The continuous exposure of humans to the radiation causes skin burns, cancers and other health problems. In the last two decades, scientists began to search for effective ways to reduce the negative effects of radiation. One of the most important methods is the use of materials that have the ability to absorb radiation and thus reduce the amount of radiation that reaches the human body. These materials known as radiation shieling materials. Recently, many glass systems have been prepared and developed as a novel radiation shielding materials. Glass has promising properties that distinguish it from other materials and encouraged scientists to use it as a radiation shielding material. These properties including the high transparency of the glasses, low toxicity, and the possibility of fabricating the glasses in simple technique. In this work, we will give a brief description about the radiation shielding properties of different glasses including silicate, borate, tellurite, phosphate and heavy metal oxide glasses

Keywords: Glass, heavy metal oxide, Gamma

ID:13-IOP

Chemical Biomarkers That Can Accurately Predict Honey Bee Health Factors

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Recent years have witnessed a noticeable decrease in honey bee populations worldwide. Researchers have attributed this decline to several factors, both natural and unnatural (caused by human activity). At the same time, beekeepers regularly face challenges with determining the best management practices of their bee hives because they lack the rapid diagnostic tools required for determining the cause of decline in bee health before the colony collapses. To address this, we use a systems biology approach with machine learning validation to search for chemical biomarkers and the underlying mechanisms that might be responsible for the multifactorial synergistic bee health declines by integrating hive exposome data, with the prevalence and abundance of pesticides and bee diseases, sampled from urban and suburban environments. We determined top biomarker hits for all of the 20 most common bee diseases and pesticide exposures that were found across the hives sampled. Moreover, for 9 of the 20 diseases we were able to develop a chemical biomarker library that has around 90% accuracy for predicting if a hive is infected with this disease or not. These chemical biomarkers and libraries could therefore be used in the future for rapid diagnoses of bee hives using one standardized protocol for high throughput analysis that would give the beekeeper enough warning to improve bee health and prevent honey bee colonies from collapsing.

Keywords: Honey bee, Exposome, Bee health,

CHEMISTRY
ORAL PRESENTATIONS

ID:22-COP

In Vivo Effects of Methotrexate and Zingerone on Carbonic Anhydrase, 6-Phosphogluconate Dehydrogenase and Thioredoxin Reductase Enzyme Activities in Testis Tissues of Rats

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Objectives: Methotrexate is a chemotherapy agent used in the treatment of several diseases such as cancer [1,2]. Its high-dose exposure damages seminiferous tubules, reduces sperm count, and causes genetic mutations in sperm [1]. Zingerone is a nontoxic compound with varied pharmacological activities and has several potent biological activities such as anticancer [3]. The focus of the current study is to assess the activities of carbonic anhydrase (CA), 6-phosphogluconate dehydrogenase (6PGD), and thioredoxin reductase (TrxR) enzymes in the testis tissues of the rats exposed to methotrexate and zingerone.

Material and Methods: In the current study, the Wistar albino male rats were used as experimental animals. The rats (n=21) were categorized into three groups matched for body weight, with each group consisting of seven rats. Group C consisted of healthy rats. Group Z consisted of rats that received daily oral administration of zingerone (50 mg/kg) for 20 days. Group M consisted of rats that were administered methotrexate (20 mg/kg i.p.) daily for the last 5 days of the experiment. All the rats were administered physiological saline solution during the experiment. At the end of 20 days, the activities of CA, 6PGD, and TrxR enzymes, which are the indispensable biological molecules of metabolic processes in all living organisms [4], in the testis tissues of the rats were spectrophotometrically determined.

Results: According to our results, CA and TrxR activities decreased significantly in the testis tissues of the rats in the groups M and Z compared with that of the healthy rats in the group C. Although 6PGD activities of the rats in the group M increased significantly, 6PGD activities of the rats in the group Z were close to that of the healthy rats in the group C.

Conclusion: Our findings have shown that methotrexate and zingerone, which have anticancer properties, have similar properties on the activities of CA and TrxR enzymes except for 6PGD enzyme in the testicular tissues of the rats.

Keywords: Methotrexate; Zingereone; Carbonic Anhydrase; 6-Phosphogluconate Dehydrogenase; Thioredoxin Reductase; Rat

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ID: 30-COP

Effects of Indole Derived Schiff Base Compounds on Human Carbonic Anhydrase Isoenzymes (hCAI and hCAII)

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Abstract

Carbonic anhydrase (CA) enzyme is an enzyme from the family of metalloenzymes containing zinc (Zn^{2+}) ions in its active site, and it is an enzyme that catalyzes the conversion of carbon dioxide to bicarbonate and proton, which is a slow reaction (EC4.2.1.1). It catalyzes the hydrolysis reaction of p-nitrophenylacetate to p-nitrophenol. Since p-nitrophenol absorbs at 348 nm, spectrophotometric activity measurement is made by utilizing this property.

The hCAI and hCAII isoenzymes from human erythrocytes were purified by affinity chromatography and the pure enzyme obtained was intended to be used in kinetic studies. Inhibition effects of indole derivative schiff base compounds (1a-1t) used in the study on these isoenzymes were determined and IC_{50} value at nanomolar level was calculated for each isoenzyme. It was observed that these compounds inhibited enzymes significantly. In our study, IC_{50} values for hCAI isoenzyme were determined to be in the range of 38.50-231.05 nM, respectively. The same parameter was calculated for the hCAII isoenzyme in the range of 33.01-216.28 nM. Acetazolamide (AZA) was used as a positive control for these enzymes and IC_{50} values were 61.29 nM for hCAI; It was determined as 39.48 nM for hCAII. 1k, 1l, 1p and 1t for hCAI with the best inhibitory effect relative to the control compound; for hCAII, we had 1k and 1p compounds.

Keywords: Carbonic anhydrase, enzyme, inhibition, indole derived compounds

Introduction

Human carbonic anhydrase enzyme (hCA; Carbonate hydrolyses, EC 4.2.1.1) is a member of the metalloenzyme family which are contain sixteen isoenzymes in mammals (CAI-CAXVI). Human carbonic anhydrase enzymes are catalyzed the conversion of carbon dioxide to bicarbonate and proton, which is a slow reaction. These lead to expressed as pH regulating enzyme in most tissues, especially in erythrocytes [1-6]. Many such CA isozymes which make these functions are important therapeutic targets with the potential to be inhibited/activated for the treatment of diseases such as glaucoma, edema, obesity, osteoporosis, epilepsy, and cancer [2-8]. CA inhibitors (CAIs) such as acetazolamide (AZA), zonisamide (ZNS), methazolamide (MZA) and topiramate (TPM) are utilized in clinic as diuretics and factors for glaucoma-relevant intraocular hypertension [9-10]. Acetazolamide (AZA) was used as a positive control for this study.

Many CAs inhibitors such as different metal ions [11], anions [12], phenols [13], some chalcones [14], schiff bases and their amines [15], pyrimidine-thiones [16], amides [17], sulfonamides [18], 1H-indazole molecules [19], some aminomethyl derivatives [20] have been investigated up to now. CA II inhibitors are used for various objectives like treatment of epilepsy, glucoma, antitumor agents/diagnostic tools or diuretics [5,21-23].

Novel CAIs werw found by some scientists nowadays [5, 11, 21-24]. Among them, various derivatives of phenols [5, 11], salicylic acid derivatives [25], different benzenes and bisphenols which have antioxidant properties and their various derivatives [26, 27] were found to be potential inhibitor of CA I and II isozymes.

In the current study, the inhibitory effects of some indole derivative Schiff base compounds on human erythrocyte carbonic anhydrase isoenzymes in vitro were investigated. Studies on the inhibition of the mentioned enzymes by indole-derived Schiff base compounds are not yet available in the literature. The synthesis pathway and molecular structures of the indole derivative Schiff base compounds used in the study are shown below [28].

Material And Methods

This study was designed to synthesize, characterize, and investigate the possible in vitro CA I and II enzyme inhibitory effect of the indole derivative Schiff base compounds. Here,

R is designed as mono and disubstituted halogenated phenyl, mono and disubstituted alkylphenyl ring, isonicotinic and anisic acid [28] (Fig 1.).

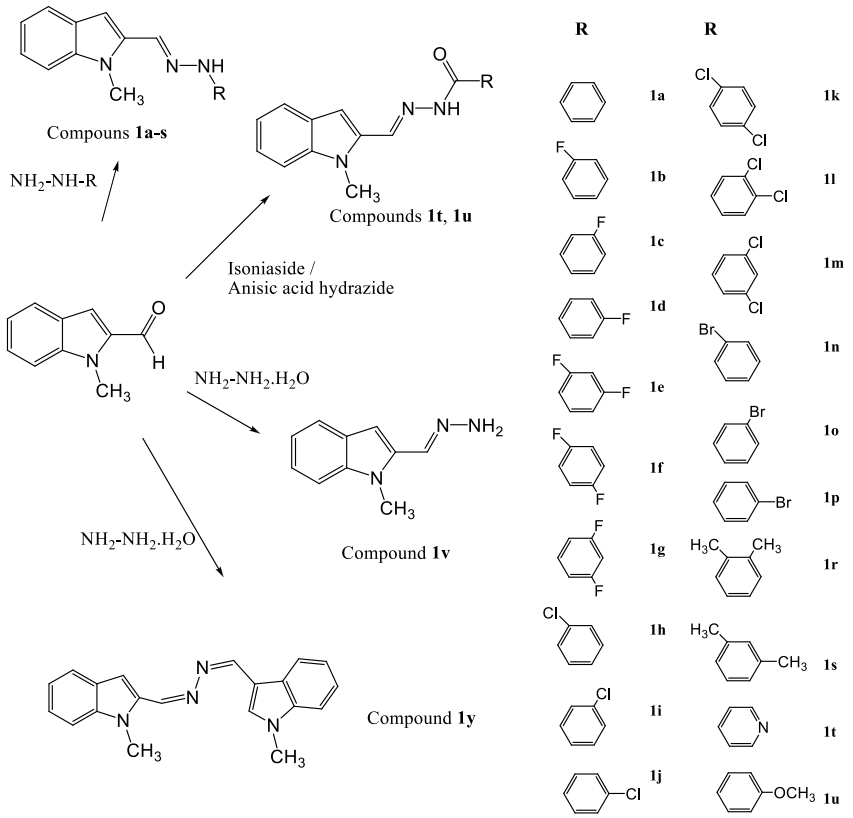

Figure 1. General synthesis pathway and molecular structures of the indole derivative Schiff base compounds

Chemistry – Experimental and Instruments

Uncorrected melting points were determined with a Stuart melting point SMP30 apparatus. The 1H and 13C NMR spectra were measured with a Varian 400 MHz spectrometer device (Palo Alto, CA) using TMS as an internal standard and DMSO-d6 as solvent. ESI mass spectra were determined by a Waters Micromass ZQ device. Elemental analyses were performed using a CHNS-932 instrument (Leco Corporation, St. Joseph, MI). All spectral analyses were performed at the Central Laboratory of the Faculty of Pharmacy at Ankara University. Chromatography was carried out using Merck silica gel 60 (230–400 mesh ASTM). Sepharose-4B, indozole molecules, and chemical substances used for electrophoresis were obtained from Sigma-Aldrich. L-tyrosine was obtained E. Merck. The chemical reagents that were used in synthesis and other chemical substances were purchased from Sigma (Germany) and Aldrich (USA).

Experimental – Biochemical Activity

Purification of Carbonic Anhydrase Isoenzymes and Inhibition Studies

The whole purification procedure was performed according to our previous studies [25-27]. The protein determination in the effluents showing activity were evaluated spectrophotometrically at 595nm using the Bradford method [29]. CA isoenzymes activities were obtained in conforming to the procedure of Verpoorte et al [30]. The increase in absorbance of the reaction medium was spectrophotometrically obtained at 348 nm. The esterase activity procedure was utilized for ascertaining the inhibition agents by CA activity (%) versus inhibitory concentration graphs were drawn.

For the designation of the inhibition efficacy of each the indole derivative Schiff base compounds (**1a-t**) on both hCA isoenzymes, a percent activity versus inhibitor concentration graph was drawn. The IC_{50} values were obtained from these graphs. In this study, they were given graphs which are drawn for the compound showing the most effective inhibition (Fig. 2-7).

Results

Studies on the synthesis of carbonic anhydrase inhibitors (CAIs) and carbonic anhydrase activators (CAAs) have increased rapidly recently. Therefore, many types of enzyme inhibitors have been synthesized and used as primary drugs for the treatment of glaucoma. In addition to glaucoma, it is still used in clinics as antitumor, analgesic, epilepsy, antiulcer, diuretic, antibiotic, and neurologic disease drugs [31].

The new compounds based on Schiff bases were synthesized and the inhibition effect on CA enzyme was observed. Schiff bases and their derivatives were investigated in many studies and established to be associated with a variety of biological activities like anticonvulsant [32] antiproliferative [33], anticancer [34], cytotoxic [35] antifungal and other activities [36]. In this study we investigated whether the inhibition effect of the indole derivative Schiff base compounds on CA I and II isoenzymes isolated from human erythrocytes. As part of our ongoing research, we were synthesized nineteen new compounds of the indole derivative Schiff base to investigate their possible in vitro CA I and II enzymes inhibitory effects.

In our study, the inhibitory effect of the indole derivative Schiff base compounds was determined by value of IC_{50}. IC_{50} were calculated by determining percent activity at various inhibitor concentrations, with substrate concentrations kept constant, and then

determining the concentration of inhibitor causing 50% inhibition graphically. For hCAI and hCAII, the obtained IC_{50} values were given in Table 1. Among the synthesized compounds, **1k, 1l, 1p** and **1t** demonstrated a potent inhibitory effect for hCA I (Fig 2.-5.) and **1k** and **1p** demonstrated a potent inhibitory effect for hCAII (Fig 6.-7.) (Table 1).

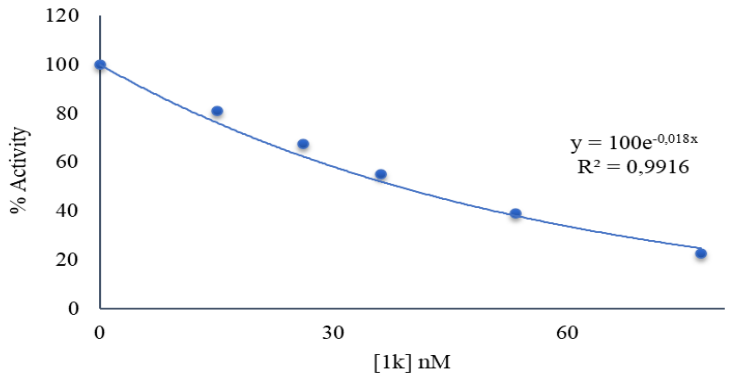

Figure 2. Determination of % Activity/[**1k**] curve for excellent inhibitor of hCA I isoenzyme.

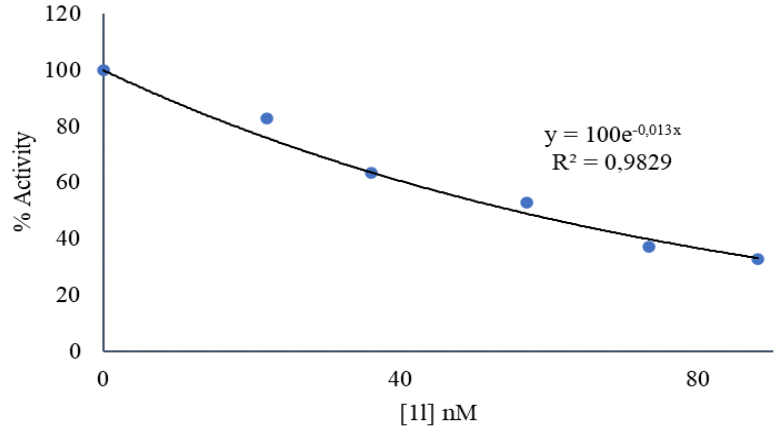

Figure 3. Determination of % Activity/[**1l**] curve for excellent inhibitor of hCA I isoenzyme.

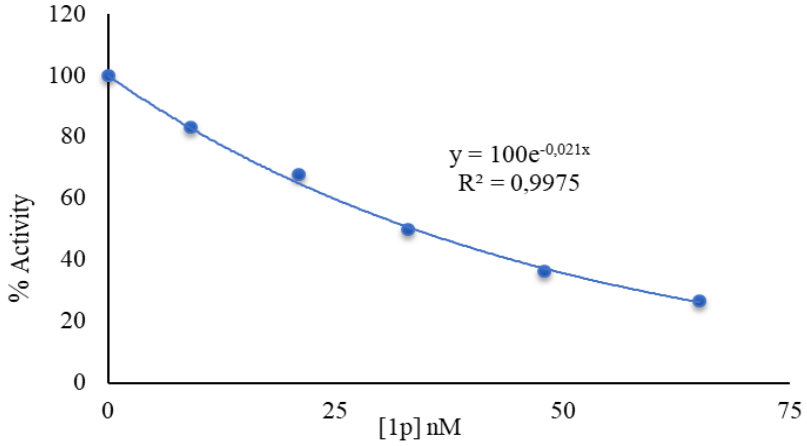

Figure 4. Determination of % Activity/[**1p**] curve for excellent inhibitor of hCA I isoenzyme.

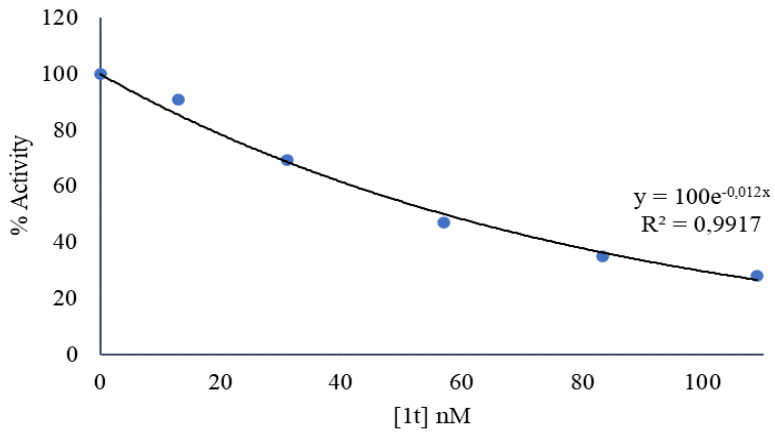

Figure 5. Determination of % Activity/[**1t**] curve for excellent inhibitor of hCA I isoenzyme.

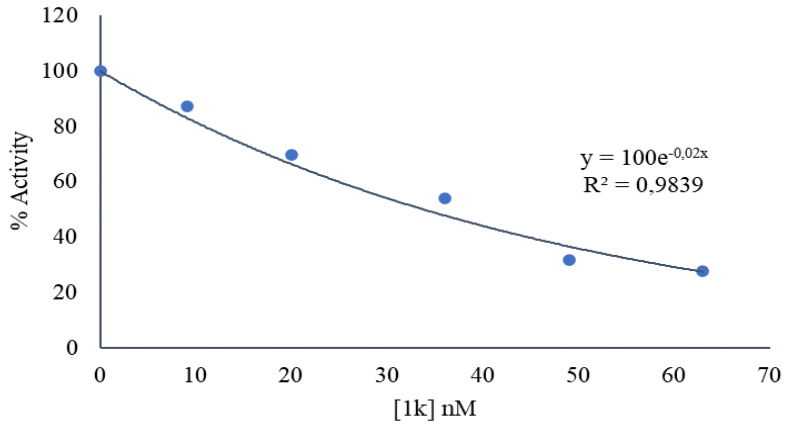

Figure 6. Determination of % Activity/[**1k**] curve for excellent inhibitor of hCA II isoenzyme.

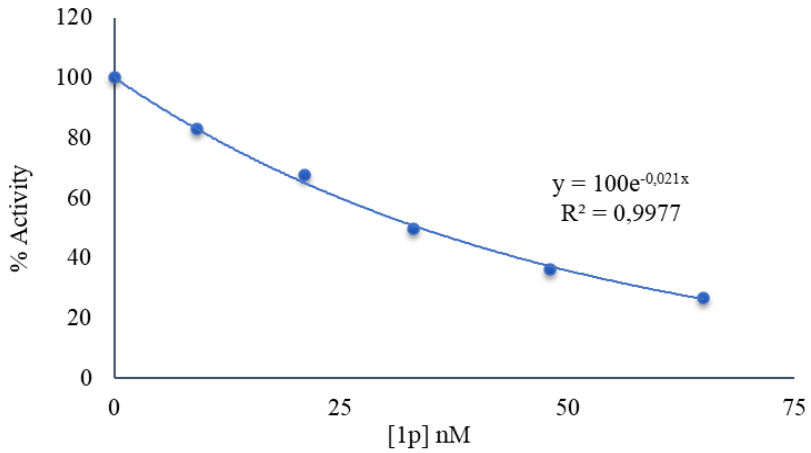

Figure 7. Determination of % Activity/[**1p**] curve for excellent inhibitor of hCA II isoenzyme.

Table 1. IC_{50} of hCA I and hCA II with compounds and AZA, by an esterase assay.

Compounds	IC_{50} (nM)			
	hCA I	R^2	hCA II	R^2
1a	77.02	0.970	62,25	0.987
1b	73.14	0.981	52,05	0.985
1c	69.31	0.986	58,26	0.989
1d	80.37	0.997	67,43	0.994
1e	173.29	0.969	152,17	0.981
1f	89.55	0.996	78,80	0.987
1g	115.52	0.988	94,20	0.993
1h	81.78	0.989	74,50	0.986
1i	86.64	0.998	82.26	0.984
1j	69.32	0.973	54.63	0.987
1k	38.50	0.986	35.32	0.983
1l	53.32	0.980	41.29	0.969
1m	99.02	0.972	83.46	0.975
1n	63.01	0.967	49.68	0.987
1p	40.77	0.978	33.01	0.998
1q	167.53	0.974	143.69	0.968
1r	202.67	0.981	185.39	0.979
1s	231.05	0.983	216.28	0.968
1t	57.76	0.991	51.29	0.981
Acetazolamide (AZA)	61.29	0.982	39.48	0.972

Conclusions

Our synthesized indole derivative Schiff base compounds inhibited the hCA I and hCA II activities at more low concentrations. The investigated compounds exhibited more effective inhibitory profiles compared to AZA used as standard drug. We think that the results we obtained in this study will make an important contribution to the potential of to be used for therapeutic purposes and to their pharmacological applications. Although our results are promising, to obtain a perfect and reliable hCA I and II enzyme inhibitor, we intend to undertake advanced studies to explain the cytotoxicity and action mechanism of these compounds.

Acknowledgement: This work was supported by the Scientific Research Council of Erzincan Binali Yildirim University (Project No: TSA-2020-663).

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Inhibition of Acetylcholinesterase Enzyme (AChE) by Indole Derived Schiff Base Compounds

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Abstract

Alzheimer's is a very common dementia disease recently and there is no definite cure. In this disease, which causes a decrease in neurotransmitters in the brain, the neurotransmitter that shows the most decrease is acetylcholine. To treat or prevent the disease, the degradation of acetylcholine should be reduced, and this is only possible with the inhibition of acetylcholinesterase (AChE), which breaks down acetylcholine.
To investigate the *in vitro* effect of indole derivative Schiff base compounds on AChE enzyme, first, pure enzyme was supplied ready. Acetylthiocholine iodate (AChI) was used as substrate. The yellow colored 5-thio-2-nitrobenzoate anion, which is formed because of hydrolysis of the substrates and then the reaction of DTNB with thiocholine, gives maximum absorbance at 412 nm wavelength.

The inhibition effects of the indole derivative Schiff base compounds (**1a-1t**) used in the study on the AChE enzyme were determined and the IC_{50} value at the nanomolar level was calculated. It was observed that these compounds inhibited the enzyme significantly. In our study, IC_{50} values were determined to be in the range of 9.90-135.90 nM. Compared to the control compound Tacrine, **1s** compound showed the best inhibitory effect.

Keywords: Acetylcholinesterase, enzyme, inhibition, indole derived compounds

Introduction

The enzyme acetylcholinesterase (AChE, acetylcholine acetylhydrolase, EC 3.1.1.7) is synthesized in the liver, and plays a role in the communication between synapses in the nervous system and hydrolyzes the acetylcholine compound. It is a member of the family of carboxylesterase enzymes, although it is usually found in synapses associated with muscle and brain nerves [1]. Acetylcholinesterase enzyme plays an important role in Alzheimer's disease. Although the exact cause of the disease is not known yet, it is known that this disease increases as acetylcholine deficiency increases. Because of this situation, it has been associated with cholinesterase enzymes. Making acetylcholine stay longer in the synaptic gap is one of the methods used in Alzheimer's treatment. For this purpose, cholinesterase enzyme inhibitors are used [2].

AChE is an enzyme from the hydrolase group that hydrolyzes the neurotransmitter acetylcholine (ACh) [3]. ACh is the ester of acetic acid and choline. It was first described by the British scientist Henry Hallet Dale in 1914. Australian scientist Otto Lewi confirmed that ACh is a neurotransmitter because of his studies with frog hearts in 1921. ACh has been found to be effective in the metabolism of Parkinson's and Alzheimer's diseases [4]. The AChE enzyme, which has a very high activity, breaks down approximately 25,000 ACh molecules per second [5].

The only known symptomatic treatment of Alzheimer's disease is the use of cholinesterase inhibitors to increase cholinergic activity [6]. In addition to the known role of cholinergic neurotransmission, the increase of acetylcholine effect because of inhibition of cholinesterase enzymes has led to the hypothesis that it will reduce Alzheimer's symptoms. Since the etiology and precise pathogenesis of Alzheimer's are unclear, this hypothesis became the rationale for the symptomatic treatment of Alzheimer's aimed at enhancing central cholinergic function in the hope that it would improve cognitive function. For this purpose, AChE activity, which changes with the use of cholinesterase inhibitors, is thought to be associated with the course of the disease. Studies have shown that rivastigmine reduces AChE activities in the cerebrospinal fluid (CSF) by 43%, galantamine has no significant effect on AChE activity, and donepezil significantly increases CSF AChE activity by 12% [7].

An acetylcholinesterase inhibitor inhibits the AChE enzyme, preventing the breakdown of acetylcholine. Thus, it increases the concentration and duration of action of the neurotransmitter acetylcholine. AChE inhibitors act reversibly, semi-reversibly and irreversibly [8]. Competitive and non-competitive reversible AChE inhibitors are mostly used for therapeutic purposes [9].

Many AChE inhibitors such as aryl methanesulfonate derivatives [8], benzoicasid derivates [10], thiazolyl-pyrazoline derivatives [11], sulfonamides [12] are among those that have been studied recently. These are used clinically in diseases such as Myasthenia Gravis, Alzheimer's, and Glaucoma Disease [13].

In the current study, the inhibitory effects of some indole derivative Schiff base compounds on the AChE enzyme *in vitro* were investigated. Studies on the inhibition of the mentioned enzymes by indole-derived Schiff base compounds are not yet available in the literature. The synthesis pathway and molecular structures of the indole derivative Schiff base compounds used in the study are shown below [14].

Material And Methods

This study was designed to synthesize, characterize, and investigate the possible *in vitro* the AChE enzyme inhibitory effect of the indole derivative Schiff base compounds. Here, R is designed as mono and disubstituted halogenated phenyl, mono and disubstituted alkylphenyl ring, isonicotinic and anisic acid [14] (Fig 1.).

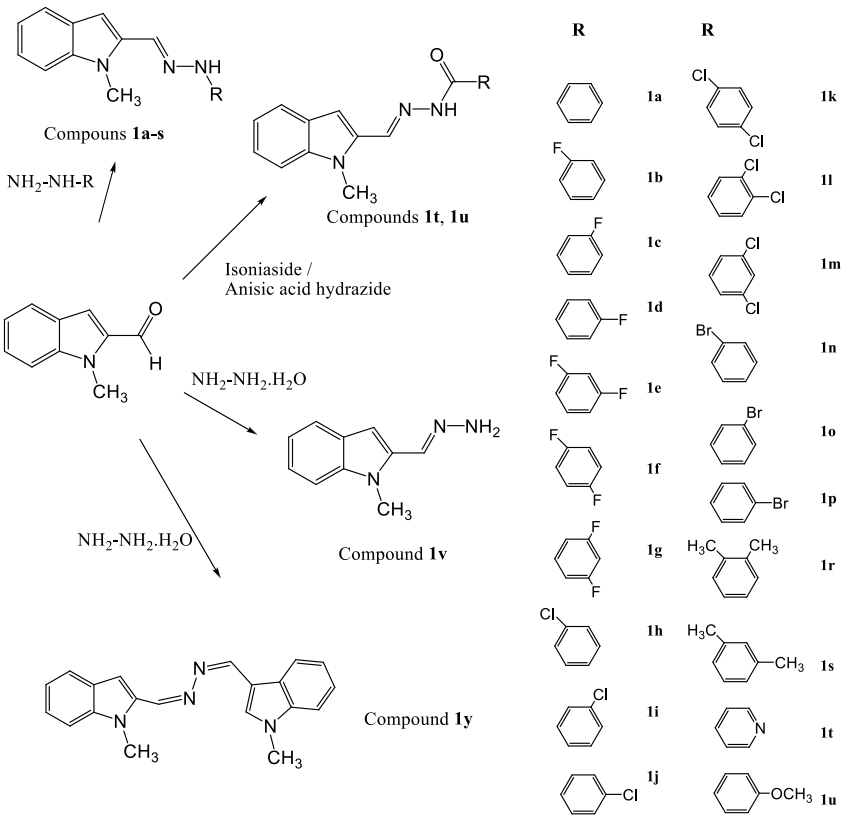

Figure 1. General synthesis pathway and molecular structures of the indole derivative Schiff base compounds

Chemistry – Experimental and Instruments

Uncorrected melting points were determined with a Stuart melting point SMP30 apparatus. The 1H and 13C NMR spectra were measured with a Varian 400 MHz spectrometer device (Palo Alto, CA) using TMS as an internal standard and DMSO-d6 as solvent. ESI mass spectra were determined by a Waters Micromass ZQ device. Elemental analyses were performed using a CHNS-932 instrument (Leco Corporation, St. Joseph, MI). All spectral analyses were performed at the Central Laboratory of the Faculty of Pharmacy at Ankara University. Chromatography was carried out using Merck silica gel 60 (230–400 mesh ASTM). Electrophorus electricus AChE enzyme, indozole molecules, and other chemical substances were obtained from Sigma-Aldrich. The chemical reagents that were used in synthesis and other chemical substances were purchased from Sigma (Germany) and Aldrich (USA).

Experimental – Biochemical Activity

Acetylcholinesterase (AChE) Enzyme Inhibition Studies

AChE enzyme was supplied ready. AChE enzyme activity was determined according to the method performed by Ellman et al. [15]. The AChE enzyme has two substrates, DTNB and acetylcholiniodate. Thiocholine is formed because of the hydrolysis of the substrates. The thiocholine formed reacts with DTNB and forms the yellow 5-thio-2-nitrobenzoate anion. This molecule gives maximum absorbance at 412 nm wavelength [16].

For the designation of the inhibition efficacy of each the indole derivative Schiff base compounds (**1a-t**) on the AChE enzyme, a percent activity versus inhibitor concentration graph was drawn. IC_{50} values were calculated with the help of these graphs. In these processes, the activity measurement at different concentrations was made for Tacrine, the standard inhibitor of AChE enzyme, and the graphs were drawn and the IC_{50} values were calculated. In this study, they were given graphs which are drawn for the compound showing the most effective inhibition (Fig. 2.).

Results

In our study, the inhibitory effect of the indole derivative Schiff base compounds was determined by value of IC_{50}. IC_{50} were calculated by determining percent activity at various inhibitor concentrations, with substrate concentrations kept constant, and then determining the concentration of inhibitor causing 50% inhibition graphically. For AChE enzyme, the obtained IC_{50} values were given in Table 1. IC_{50} values were determined to be

in the range of 9.90-135.90 nM. Among the synthesized compounds, **1s** demonstrated a potent inhibitory effect for AChE (Fig 2.).

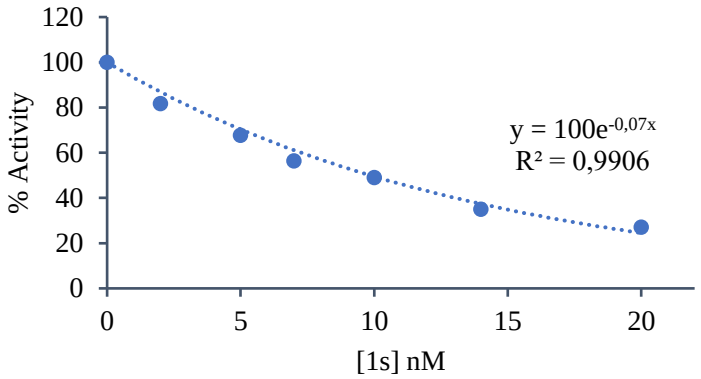

Figure 2. Determination of % Activity/[**1s**] curve for excellent inhibitor of AChE enzyme.

Discussions

Most of the biochemical research consists of enzyme studies. Therefore, enzyme studies are of great practical importance. Enzyme activities are used in the diagnosis of certain diseases in blood plasma, erythrocytes, or tissue samples. Some diseases, especially inherited disorders, can be caused by the deficiency or absence of one or more enzymes, while another group of diseases can be caused by excessive enzyme activity. Many drugs exert their biological effects by interacting with enzymes. Acetylcholinesterase (AChE), a membrane-bound enzyme, plays an important role in the regulation of several physical events by hydrolyzing the neurotransmitter acetylcholine in the cholinergic synapse [17].

With the onset of Alzheimer's disease, the loss of neurons and axons causes lower levels of acetylcholine release. At lower concentrations of neurotransmitters, it becomes more difficult to maintain the continuity of nerve impulses and, as a result, to transmit information. One of the methods to be applied to correct this situation is the administration of substances like acetylcholine, which is currently impossible. Another method to be applied to increase acetylcholine levels is to suppress the AChE enzyme, which breaks down acetylcholine. Studies have shown that acetylcholine level increases due to AChE inhibition can improve cognitive deficit in the early stages of Alzheimer's disease. Due to the close relationship of cholinergic deficiency with the clinical picture, the aim of keeping acetylcholine in the synaptic gap longer is the most used strategy in the symptomatic treatment of the disease today. For this purpose, mostly cholinesterase enzyme inhibitors are used [18].

Table 1. IC_{50} of AChE enzyme with compounds and Tacrine*

Compounds	IC_{50} (nM)	
	AChE	R^2
1a	46.02	0.995
1b	35.14	0.983
1c	31.31	0.992
1d	34.37	0.974
1e	78.29	0.998
1f	133.55	0.993
1g	45.42	0.988
1h	135.90	0.989
1i	31.84	0.980
1j	27.42	0.988
1k	19.50	0.982
1l	36.72	0.994
1m	94.62	0.985
1n	31.71	0.993
1p	16.17	0.988
1q	41.33	0.984
1r	74.87	0.983
1s	9.90	0.991
1t	31.16	0.987
Tacrine	14.29	0.995

*Note: Tacrine was used as the substrate of the AChE enzyme.

Discussions

Most of the biochemical research consists of enzyme studies. Therefore, enzyme studies are of great practical importance. Enzyme activities are used in the diagnosis of certain diseases in blood plasma, erythrocytes, or tissue samples. Some diseases, especially inherited disorders, can be caused by the deficiency or absence of one or more enzymes, while another group of diseases can be caused by excessive enzyme activity. Many drugs exert their biological effects by interacting with enzymes. Acetylcholinesterase (AChE), a membrane-bound enzyme, plays an important role in the regulation of several physical events by hydrolyzing the neurotransmitter acetylcholine in the cholinergic synapse [17].

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Based on the relationship between the deterioration of the cholinergic system in the brain and memory, acetylcholinesterase inhibitors (anticholinesterases) are used as the most effective drug group in treatment. Anticholinesterase hydrolyzes acetylcholine, an important neuromodulator of the central nervous system. Acetylcholinesterase inhibitors, on the other hand, inhibit the acetylcholinesterase enzyme, causing a decrease in the amount of acetylcholine and providing a significant regression in the patient's behavioral disorders [19-20].

Alzheimer's disease is a type of dementia. Although there is no definitive treatment for Alzheimer's disease, some negative symptoms can be reduced. One of the most important causes of Alzheimer's disease is a significant decrease in the neurotransmitter acetylcholine [21]. Accumulation of acetylcholine by inhibition of acetylcholine esterase increases activation at synapses and neuromuscular spaces and intensifies cholinergic system stimulation [22-24].

Studies on the synthesis of acetylcholinesterase inhibitors have increased rapidly recently. Therefore, many types of enzyme inhibitors have been synthesized and used as primary drugs for the treatment of Parkinson's, Alzheimer's, and glaucoma diseases [4,13]. The new compounds based on Schiff bases were synthesized and the inhibition effect on AChE enzyme was observed. Schiff bases and their derivatives were investigated in many studies and established to be associated with a variety of biological activities like anticonvulsant [25] antiproliferative [26], anticancer [27], cytotoxic [28] antifungal and other activities [29]. In this study we investigated whether the inhibition effect of the indole derivative Schiff base compounds on pure AChE enzyme. As part of our ongoing research, we were synthesized nineteen new compounds of the indole derivative Schiff base to investigate their possible in vitro AChE enzyme inhibitory effects.

Conclusions

Our synthesized indole derivative Schiff base compounds inhibited the AChE enzyme activity at more low concentrations. The investigated compounds exhibited more effective

inhibitory profiles compared to Tacrine used as standard drug. We think that the results we obtained in this study will make an important contribution to the potential of to be used for therapeutic purposes and to their pharmacological applications. Although our results are promising, to obtain a perfect and reliable AChE enzyme inhibitor, we intend to undertake advanced studies to explain the cytotoxicity and action mechanism of these compounds.

Acknowledgement: This work was supported by the Scientific Research Council of Erzincan Binali Yildirim University (Project No: TSA-2020-663).

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ID:35-COP

Investigation of Physical, Chemical and Technological Properties of Clays of The Tash-Kumyr Deposit

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This article examines the raw materials of clay deposits in the southern region of the Kyrgyz Republic. Relevance research is driven by the need to study the properties of white-burning clay deposits in the southern region to produce cost-effective, meeting all the requirements of ceramic materials.

Clay raw materials were used as research objects two Tash-Kumyr deposits. As a result of the study, granulometric, chemical and mineralogical compositions were determined, water-soluble salt content in clay rocks of two deposits Kaala, Kara-Tyt.

X-ray, thermographic, and chemical methods of analysis were used to determine the mineralogical composition of the clay under study. Testing of ceramic-technological properties was carried out according to the procedure described in GOST 21216-2014. And ceramic – technological parameters such as molding humidity, ductility, air, fire and complete shrinkage, clay sensitivity to drying, and water absorption of burnt samples at various temperatures were studied.

It is established that the clay rocks of the studied deposits are representatives of kaolinite-hydromica clays, and the non-plastic part is composed of minerals of the silicon oxide group (quartz, cristobalite, and chalcedony). According to the results of X-ray phase analysis of clay powders, the enriched sample of the Kalaa deposit had the highest content of kaolinite, while the Kara - Tyt clay had the highest content of quartz.
The studied samples are coarse-grained, differ in plasticity, air and complete shrinkage, and drying properties.

Based on the results of the study, a conclusion is made about the possibility of using the studied clays in the production of ceramic products of the national economy.
Keywords: Natural clay, kaolinite, water-soluble salts,

ID:42-COP

Case-Based Learning Approach and Technologies to Advance Teaching Biochemistry in the University

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Abstract

Due to COVID-19 pandemics, limitation of the cooperative active learning and hands –on labs, we have been searching for new methodologies of teaching. Using of various achievements of technology such as a virtual lab, interactive remote- teaching tools and animations that facilitate deep learning by enhancing the understanding of the importance and application of the material, motivates students for deep learning by increasing their interest in Biochemistry. We will describe how we have been using the CBL, Pear Deck and virtual lab in teaching Biochemistry. Our analysis has showed that the combination of above-mentioned tools results in higher learning outcome and increases knowledge retention.

Keywords: COVID-19; biochemistry education; case-based learning; online teaching; remote-teaching, virtual laboratory tool

Acknowledgement: This work was supported by International Medical Faculty, Osh State University

Introduction

A case-based approach in teaching **biochemistry** [1] has been proved a successful tool that engages students in discussion of specific scenarios creating a real-life atmosphere. It facilitates a chance to closer interaction among the students promoting a cooperative work among the learners [2]. Discussion of students may facilitate deep learning by increasing student engagement and interest. Abundant literature on CBL exists but clear guidance on how to design and implement case studies is not readily available. A case-based approach engages students in discussion of specific scenarios that resemble or typically are real-

world examples. This method is learner-centered with intense interaction between participants as they build their knowledge and work together as a group to examine the case. The instructor's role is that of a facilitator while the students collaboratively analyze and address problems and resolve questions that have no single right answer. We will demonstrate how we are practicing this method in teaching Biochemistry. We create a small groups of the students on zoom and show them a concise case which may include the results of the medical investigations and clinical symptoms of a patient, and require the students to give a probable diagnosis and explanation of the underlying biochemical defects of the metabolic disorder. These groups discuss the case among themselves, formulate their answer and submit in a written form by WhatsApp [3, 4] chat or Telegram, email or discuss with an instructor orally on zoom. Such case studies we take from the scientific research websites or from the laboratory of the clinic, which belongs to our faculty. Here is an example of website from which case study represented:

https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5508465/

Case Report

A 39-year-old male patient was referred to our outpatient department for ophthalmic evaluation. His chief complaint was blackish discoloration of both eyes for the past 6 months. The patient gave a history of knee joint pains and stiffness of metacarpal joints for the past 10 months.

Figure 1 Bluish-black discoloration of palms.

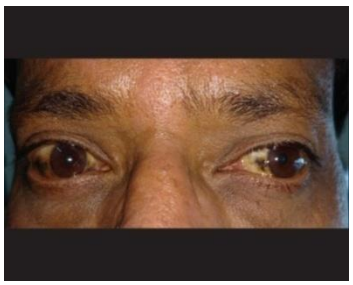

Figure 2 Bluish-black discoloration of conjunctiva and sclera of the both eyes.

Figure 3. Color of the urine turned dark on exposure to atmosphere.

On general examination, there was bluish-black discoloration of palms, (Fig.1 and Fig. 2), feet, and cartilage of ear pinna. On slit lamp examination, there was bluish-black discoloration of conjunctiva and sclera in the inter palpebral area both the eyes (Fig. 2). Complete blood picture was within normal limits. Erythrocyte sedimentation rate was 24 mm/1st h, complete urine examination was normal, but the color of the urine turned dark on exposure to atmosphere (Fig. 3).

Which amino acid metabolism is implicated in this phenomenon?
What is the cause of darkening of the urine?
How can this defect be treated?

Such case studies improve the correlation of the topic with their future practice and enhance the students' interest in the subject.

The second main tool we want to describe how we have been practicing is a virtual laboratory. This tool became extremely important during distant learning. Even the combination of traditional and remote learning systems gives better result due to overcoming such problems as lack of time, reagents or equipment. For this reason at our faculty, the computer rooms provided for teaching Biochemistry and Physics.

We have been using the open website [5]. As demonstration of it we have taken the qualitative analysis of amino acids. First students learn the instructions of how to conduct online lab work, the differences between the real lab and virtual lab in the given procedures. Then the instructor can demonstrate it, or they can conduct on his or her own and send the result to the instructor using the convenient or required method. We conducted classes to two groups with 30 students in each and demonstrated them the topic online using different tools such as PPTs to the first group and the virtual simulation –based lab to the second one. Afterwards we conducted MCQs for assessment of the result

Table 1. The result of the comparison of the two methods of teaching.

Parameters	Power point presentation based class	Virtual laboratory based class	Results
Attained knowledge	75%	77%	almost equal
Class performance	30-50%	80-90%	improved
Knowledge retention	30-40%	55-65%	improved

Material and Methods

In this work we used Case Based Learning, group work, online platforms such as Zoom, Whats Up, Google classroom, virtual laboratory program on teaching biochemistry.

Results And Discussion

In this class we used VALUE @ Amrita online laboratory tool programm for teaching students biochemistry subject (Figure 4 and 5). This tool is very illustative and colorful, attracting students attention and interests. Each inorganic and organic substances were classified and labeled for easy learning and memorizing.

Figure 4. Amrita virtual laboratory ised in teaching biochemistry subject.

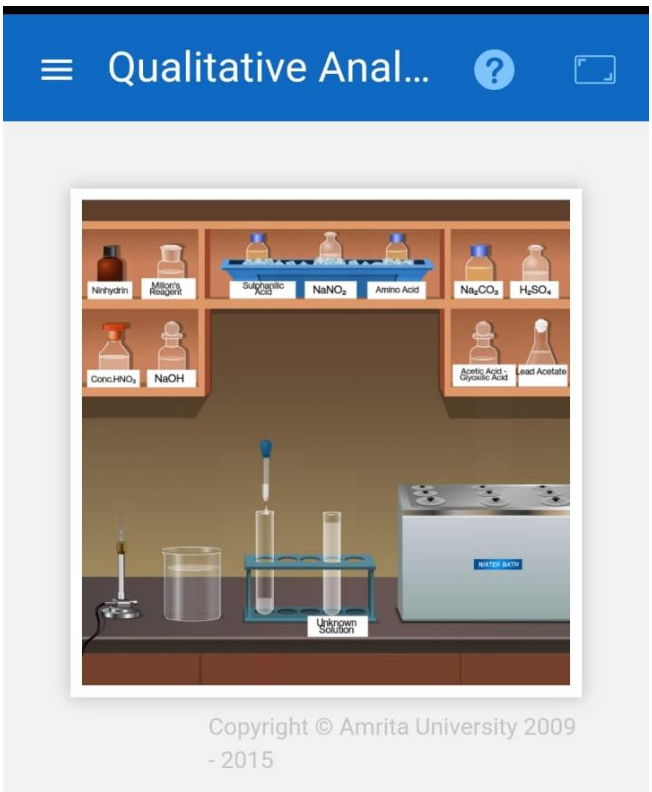

Figure 5. Qialitative analysis can be performed in Amrita virtual laboratory.

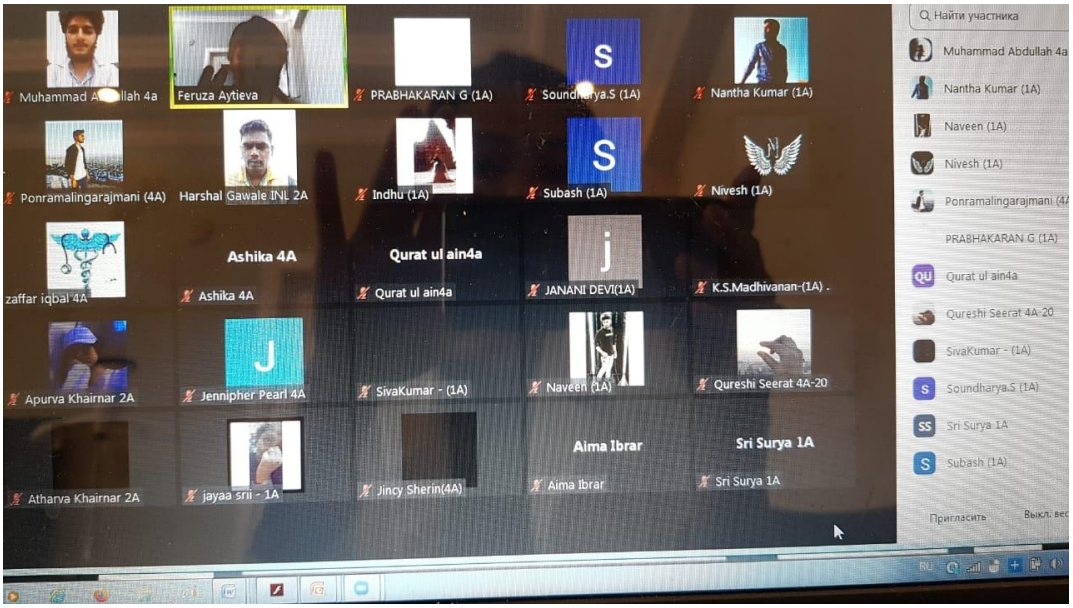

Figure 6. Zoom online platform in teaching biochemistry.

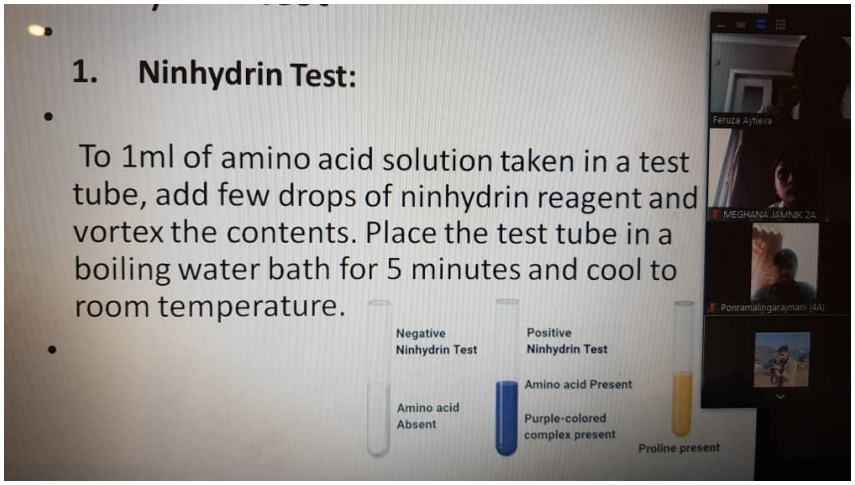

Figure 7. Case study on Ninhydrin test used in this class.

Conclusions

In conclusion we agreed that these methods like case study approach and virtual labs are proved to be more efficient tools of teaching during online classes. We will review our assessment tool and search for more objective methods for evaluation of achieved knowledge of students.

Based on above research results, we made the following conclusions:

1) The attained knowledge during the classic method using PPTs and students-engaged virtual laboratory class was almost the same, approximately 75percent, with very minute difference of 2 percent. However, this could be due the lack of objective way of assessment tool of online classes as well, which will be further worked on;

2) Students were eager to work on the virtual labs individually and showed huge excitement;

3) They retain the knowledge better;

4) We will further work on adding more virtual lab works during distant learning or combination of it to achieve the utmost result we can achieve, and distant learning assessment ways have to be improved;

5) Using case studies is always more fun and creating real-life atmosphere engages students more, develops their critical thinking, and teaches the application of the science.

Acknowledgements

First of all we are grateful to the administration of Osh State University for technical support and making the virtual labs available to the students at the campus.
Special thanks to the p.h.d professor Kurbanaliev Abdikerim Yrysbaevich for his immense support and guiding through all this complicated pandemic time to improve the teaching methodology.
We also express our gratitude to the administration and the technicians of the laboratory of the university clinic for helping us to improve our teaching methods providing the biochemical analysis.

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Purification of Azeotrope Methylal/Methanol Mixtures by Pervaporation Process Using BTEE Doped PVA/PVP Hybrid Membranes

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Methylal (CH_3-O-CH_2-O-CH_3), also called as dimethoxymethane, is accepted as a "green" solvent in the industry. It is an important intermediate used in various applications such as polymers, resins, adhesives, diesel fuel additives, insecticides. Methylal is usually obtained by the reaction of methanol and formaldehyde. During synthesis, azeotropic mixture of methylal and methanol was achieved. Azeotropic mixtures cannot be separated by simple distillation. Conventional methods, which are used to separate these mixtures, are generally very costly, energy-intensive processes and require additional chemicals. At this point, the pervaporation process is an important alternative. Recently, pervaporation has attracted great attention due to its low energy consumption, easy usage, low cost, and high selectivity. The aim of this study is to separate the azeotropic methylal/methanol mixture and to obtain the methylal as pure. For this purpose, the separation performance of the methylal/methanol mixture by pervaporation process was studied by using 1,2-Bis(triethoxysilyl)ethane (BTEE) doped PVA/PVP hybrid membranes. The synthesized membranes was characterized by SEM, FT-IR and TGA. The effect of BTEE content on the separation performance of pervaporation was investigated. It was observed that as the BTEE content increased, the methanol flux decreased. The highest flux is obtained as 0.01385 g/cm^2.hby the using %0.25 BTEE doped hybrid membrane. The obtained results show that BTEE doped membrane is a promising candidate for the separation of azeotropic methylal/methanol mixture.

Keywords: methylal, methanol, azeotrope, pervaporation, hybrid membranes

Introduction

Recently, there has been an increase in gas-to-liquid (GTL) projects around the world, in many cases to exploit remote natural gas reserves, avoiding gas explosion or re-injection. Gas-to-liquid catalytic conversion technologies offer hope for releasing trapped natural

gas reserves and enabling energy diversification around the world. Some gas-liquid products are used as fuel additives in the improvement of crude fuels and crude-derived fuels [1].

Methylal, also known as dimethoxymethane (CH_3-O-CH_2-O-CH_3) is a gas-liquid chemical. It can be 100% miscible in diesel fuel. Studies have shown that methylal can be utilized oxygenate additive for diesel fuel and provides significant particulate matter reduction with various diesel engines [2]. Methylal is also known in the industry as a "green" solvent and has a wide range of uses. It is an important intermediate used in a variety of applications, such as cleaning and degreasing solvents, pharmaceuticals, chemical syntheses, polymers, resins, adhesives, insecticides. Due to the wide usage areas, industrial applications were used to different purity methylal and alternative purification processes are investigated.

Methylal is usually produced by the reaction of methanol and formaldehyde. Since it is a reversible reaction (Equation 1), methylal production is limited by chemical equilibrium. During synthesis, methylal and methanol form an azeotropic mixture with a minimum boiling point.

$$HCHO + 2\ CH_3OH \leftrightarrow CH_2(OCH_3)_2 + H_2O \quad (1)$$

Azeotropic mixtures such as methylal/methanol with close boiling points are not separated by simple distillation. These mixtures are usually purified by conventional methods such as reactive distillation, extraction distillation, pressure exchange distillation, and azeotropic distillation[3,4,5,6]. However, these processes are generally very costly, energy-intensive processes and require additional chemicals. Pervaporation, which is an example of membrane separation compared to these processes, is a very advantageous and innovative process due to its economic, energy and environment-friendly nature.

Pervaporation (PV); It is a separation process that does not require high temperature and pressure when compared to conventional separation methods. It is a membrane process with low operating temperature, low energy consumption and physical separation mechanism. It separates the organic or aqueous components that are released as a result of the reaction with high selectivity and high efficiency. Non-porous membranes are used in pervaporation, so there is no pore-clogging problem. Does not require additional chemicals. For this reason, it is considered a promising, economical, environmentally friendly process [7].

In the pervaporation technique, the azeotrope liquid mixture is kept in direct contact with the upper surface of a selective and permeable dense homogeneous membrane. In the

pervaporation technique, the azeotrope liquid mixture is kept in direct contact with the upper surface of a selective and permeable dense homogeneous membrane. The passing vapor stream passes into the condenser and the solution is condensed. The schematic representation of the pervaporation process is given in Fig. 1.

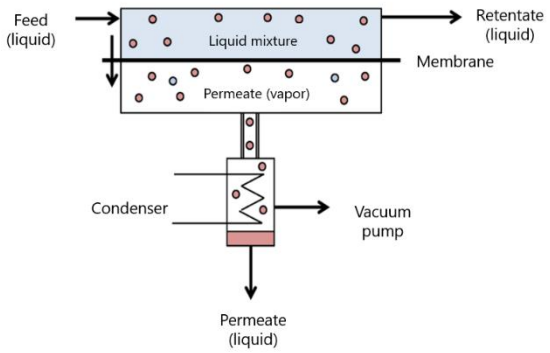

Figure 1. Schematic illustration of the pervaporation process

The driving force in the pervaporation process is the concentration gradient and is created by the pressure difference. Generally, the driving force in convection is provided by creating a partial pressure difference between the liquid feed and the steam product. The partial pressure difference is also realized by applying vacuum to the membrane outlet [8].

The performance of the pervaporation process is determined by the flux. Equation 2 is the formula used to find the flux value.

$$J = \frac{m}{S.t} \tag{2}$$

In Equation 2, J is the flux, m is the amount of mass passing through the membrane, S is the surface area of the membrane, and t is the time.

Experimental Section

Materials

In this study, Hydrophilic non-porous polymeric membranes were prepared for the purification of methylal from methylal/methanol azeotropic liquid mixture. Polyvinyl alcohol also known PVA ($(CH_2CHOH)_x$) and polyvinylpyrrolidone also known PVP ($(C_6H_9NO)_x$) polymers with hydrophilic properties were used as membrane materials. Hybrid membranes were made by adding 1,2-Bis(triethoxysilyl)ethane (BTEE ($C_{14}H_{34}O_6Si_2$))

additive to improve the flux and selectivity values of the prepared membranes. All chemicals used were obtained from Sigma Aldrich.

Preparation of BTEE Doped PVA /PVP Hybrid Membranes

Non-porous membranes were prepared by casting evaporation method. PVA and PVP (5% w/w) were dissolved in water separately. After mixing the prepared solutions in equal volumes, a homogeneous solution was obtained. Certain amounts of BTEE were added to the solution and mixed for 8 hours at 60°C by adding HCl as acid catalyst for the hydrolysis of BTEE. The resulting homogeneous solution was poured onto a clean poly(methyl methacrylate) plate. The membranes were dried at 30 °C for 36 hours, then peeled from the surface and dried again at 80 °C for another 6 hours.

Characterization of Membranes

The morphologic structures of BTEE loaded hybrid membranes were characterized by a scanning electron microscope (SEM) instrument. The membrane samples were broken in liquid nitrogen and covered by gold under a vacuum before SEM analysis.

The FTIR analysis of the prepared membranes was carried out by Thermo Scientific Nicolet iS50 FTIR spectroscopy in the band range of 4000-450 cm^{-1}.

The thermal stability of membranes was investigated in temperatures ranging from 25 °C to 600 °C in the heating rate of 10 °C/min under nitrogen flow.

Purification Experiments by Pervaporation

The separation success of membranes was investigated in pervaporation experiments. The experimental setup was given in Fig. 2.

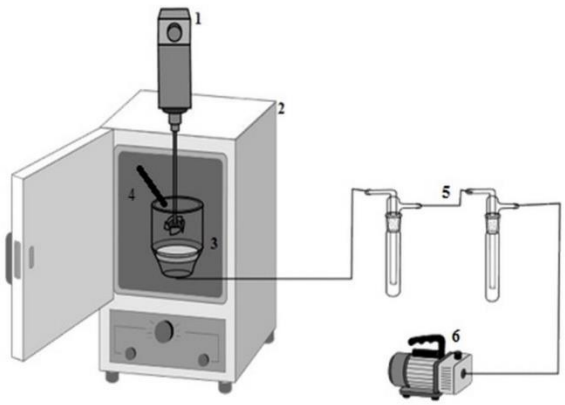

Figure 2. Schema of pervaporation (1) mechanical mixer, (2)oven, (3) membrane, (4) membrane cell, (5) cold traps and (6) vacuum pump

A stainless steel membrane cell was utilized in pervaporation experiments. Firstly, the hydrophilic membrane, which is selective for methanol was placed in the membrane cell. The membrane cell was filled in a feed azeotrope liquid mixture (96.04% methylal and %3.96 methanol). By creating a pressure difference with a vacuum pump from the bottom of the cell, the components were transported across the membrane. The feed side of the membrane cell was under atmospheric pressure. The permeate flux collected in the trap in the vapor phase was condensed with liquid nitrogen and obtained in the liquid phase. The volume of the feed mixture and the effective membrane surface area was 40 mL and 9.62 cm^2 respectively. Experiments were carried out in room temperature and realized for six hours.

Results

Membrane Characterization

SEM

The cross section images of hydrophilic PVA/PVP blend membrane and BTEE doped PVA/PVP hybrid membrane are shown in Figure 3. The SEM cross-sectional image of the PVA/PVP blend membrane (Fig. 3a) showed a smooth cross-sectional image. This is about compatibility between polymers used in the membrane. As seen in 1%(w/w) BTEE doped PVA/PVP hybrid membrane (Fig. 3b), BTEE is homogeneously distributed in every region of the membrane. BTEE is compatible with polymers and did not form any voids or pores.

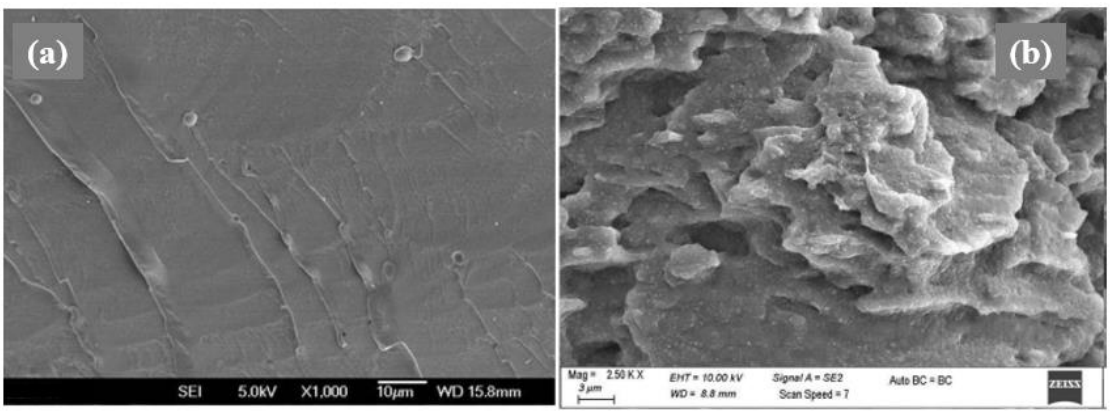

Figure 3. Cross-section images of membranes: **(a)** PVA/PVP, **(b)** BTEE doped PVA/PVP

FTIR

The chemical structure of the membranes were determined by FTIR analysis. Figure 4 shows the FTIR spectrum of the pristine and BTEE doped hybrid membranes.

Si-OH bonds formed by the addition of BTEE to the PVA/PVP blend membrane correspond to the peak seen at 915 cm^{-1}. The point at 1050 cm^{-1} caused by the stretching of the Si-O-C bonds confirms the formation of Si-O-C groups between PVA and BTEE. The presence of Si-O-Si bonds corresponds to the peak at 1084 cm^{-1}. The peak around 1200 cm^{-1} is related to the ether bonds formed by PVA and PVP to form the polymer mixture. The sharp peak at 1648 cm^{-1} indicates the presence of a free C=O group. In addition, this peak indicates the formation of hydrogen bonds between the C=O bond of the PVP membrane and the O–H bond of the PVA membrane. Other peaks at 3370 and 2900–2800 cm^{-1} correspond to –OH and C–H groups in the PVA / PVP blend membrane.

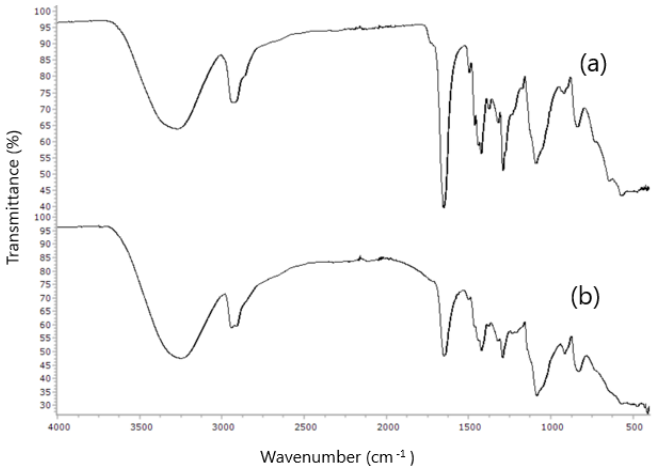

Figure 4. FTIR spectra of membranes: **(a)** PVA/PVP, **(b)** BTEE doped PVA/PVP

TGA

The thermal degradation of pristine PVA membrane, PVA/PVP blend membrane and BTEE doped PVA/PVP hybrid membranes with temperature is shown in Figure 5. With the evaporation of small molecules such as water in the BTEE-doped PVA/PVP hybrid membrane, approximately 15% weight loss occurs between 100-200°C. Membranes show extensive weight loss between 200 and 400 °C. This degradation is related to the degradation temperatures of pure PVA (about 250 °C) and PVP (about 400 °C). When we look at the total weight loss, it is seen that the addition of BTEE increases the thermal resistance of the membrane.

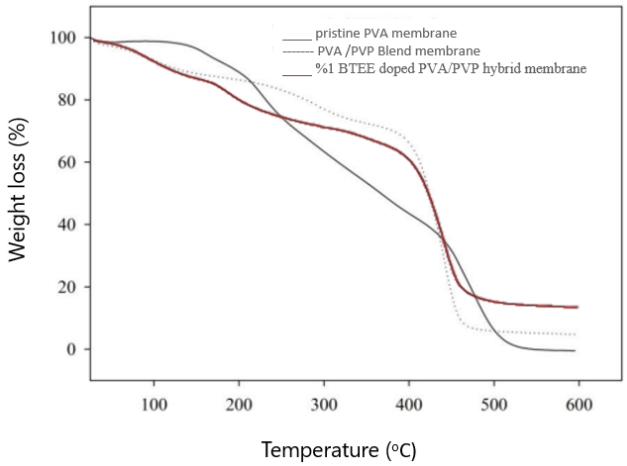

Figure 5. TGA curves of membranes
(pristine PVA, PVA/PVP, BTEE doped PVA/PVP)

Effect of BTEE Loading on Separation Performance of the Membrane

The BTEE loading ratio is a significant parameter that affects the separation behavior of the blend membranes. In order to investigate the influence of BTEE loading ratios on the separation performance of the membranes, hybrid membranes were obtained by adding BTEE to the PVA and PVP solution prepared at a ratio of 1/1 mole. Experiments were carried out with a feed mixture containing 96% methylal-4% methanol by weight at 25 ˚C for 6 hours.

Table 1. Effect of BTEE content on flux

BTEE content ratio (wt. %)	**Flux (10^{-3}) ($g/cm^2.h$)**
0	2.85
0.25	14
0.50	5.34

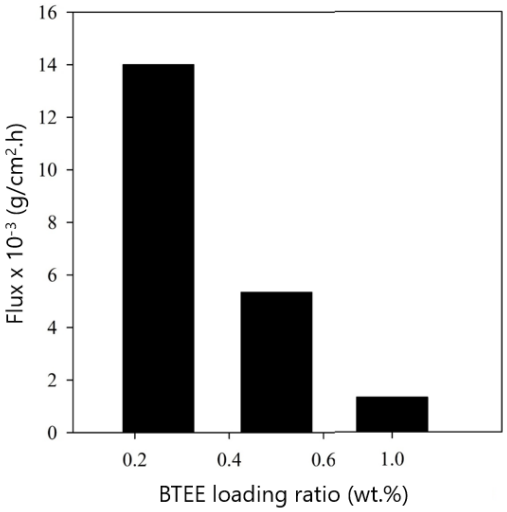

Figure 6. Effect of BTEE loading on flux

Conclusions

The pristine PVA/PVP blend membranes, and BTEE loaded PVA/PVP hybrid membranes were developed for use purification of methylal with pervaporation. In the literature, there is only one study conducted for the membrane-assisted purification of methylal and also commercial membranes were used [9]. In addition, the membranes used showed poor separation performance and low chemical and mechanical strength. With this work, functional membranes that exhibit strong chemical, thermal and mechanical strength and excellent separation performance were synthesized. At the end of the study, it was seen that BTEE additive with two triethoxysilyl groups that can be easily cross-linked with PVA chains improves the PVA/PVP pervaporation process. The fact that the functional membranes produced in this study are used for the first time for the purification of methylal makes the study quite unique.

Acknowledgement: This work was supported by Bursa Technical University Scientific Research Projects Unit (Project No. 200Y009).

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ID:65-COP

Removal of Humic Acids Through PVDF/PVP Blend Membrane by Filtration Process

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ABSTRACT

Organic substances in water resources cause undesirable problems. The most important one of these problems is the formation of by-products, which are harmful to human health, by the reaction of humic substances or other compounds after the chlorination process for disinfection. For this reason, various methods have been used in the process of processing water resources into drinking water. Membrane technology studies increase for the removal of humic acid from surface waters due to the economical and environmentally friendly properties. In this study, porous blend membranes were synthesized by phase transformation method using polyvinylidene fluoride (PVDF) as base polymer and polyvinylpyrrolidone (PVP) as pore-forming. The synthesized membranes was used to purification of aqueous humic acid solution by applying the filtration process. The effect of PVP ratio in PVDF/PVP blend membrane on humic acid removal was investigated. 10 % by mass of PVDF and 2%, 5% and 10% by mass of PVP solutions were prepared. The blend membrane which has 5% PVP gave the best performance in removal of humic acid. PVDF/PVP blend membranes were prepared as 90/10, 80/20, 70/30 and 60/40 ratios by mass. The removal ratios of humic acid by 5% PVP loaded PVDF/PVP blend membrane with different PVDF/PVP ratios were 22.07%, 24.81%, 41.84% and 27.5%. The different ratios of PVDF/PVP blend membranes, the best removal results were observed in a ratio of 70/30 PVDF/PVP as 41.84%. The obtained results show that the best separation performance was obtained in a ratio of 70/30 PVDF/PVP by 5 wt.% PVP loaded membrane.

Keywords: Filtration, Humic acid, Membrane, Polyvinylidene fluoride, Polyvinylpyrrolidone

INTRODUCTION

Organic matter in water is one of the best organic substances that can help. Organic substances naturally found in surface and underground water resources cause undesirable

problems in many cases. More than 50% of these organic substances are humic substances and are among the most critical pollutants. Humic and fulvic acids form some of the humic substances. [3][9]. Although humic acid is not directly toxic, it can produce undesirable color, taste and odor. However, the most important problem is that the chlorine added to the water for disinfection reacts with the humic substances in the water to form trihalomethane compounds and other halogenated organic compounds, which are by-products. The most important effect of these by-products is that they are carcinogenic substances that can cause long-term problems in human health [5][6].

Among the methods used for the removal of humic acids from drinking water, ozonation, biofiltration, adsorption and the advantageous membrane filtration technology used in recent years are used. Types of membranes used to purify water; They are classified as microfiltration membranes (MF), ultrafiltration (UF), nanofiltration (NF) and reverse osmosis (RO) membranes. In principle, the membrane acts as a special filter that will allow water to flow while capturing suspended solids and other substances. That is, it can be defined as an intermediate phase separating the components [7].

With the developed membrane processes, it has been proven that it is possible to use low quality water reliably, safely and economically [3]. There are many advantages to using membrane technology. The most important advantages can be listed as the good quality of the effluent, it can be applied in high concentrations, it is a continuous process, the process takes up little area, it is easy to operate, less chemicals are needed in the process, does not affect the form and chemistry of the pollutant, and the cost decreases as the processes are developed [1].

In the membrane method, the membrane filter allows the desired flux to pass by keeping the unwanted substance to be attached. A membrane filter is a structure with pores small enough to trap microorganisms. The sample is passed through a membrane filter placed in a special filter apparatus in a suction bottle. Membranes with pore sizes ranging from 0.1 to 1.4 µm are used in this system where the driving force is pressure [7].

There are important parameters that affect the separation performance of the membranes to be used in the filtration system and that will affect the removal depending on the membrane structure. These; The type of material to be used in membrane synthesis is the pore size and distribution of the membrane, surface charge, hydrophobic or hydrophilic property, and membrane thickness. It is important to obtain high adhesion efficiency and high flux values in determining the pore size. The narrow pore size distribution also provides good separation efficiency [2]. There are many chemical materials commonly used

in membrane synthesis. Material selection; separation rate, membrane morphology and system conditions should be considered. However, attention should be paid to chemical, mechanical and thermal resistance, and high permeability and selectivity should ideally be expected properties. With the hydrophobic property of PVDF, the penetration of aqueous solution into the membrane pores can be prevented. Therefore, it is expected that the membrane with high permeate flux under a high rejection will have higher hydrophobicity and larger pore volume [4]. PVDF/PVP blend membranes were synthesized using polyvinylpyrrolidone (PVP) as a pore-forming reagent.

In this study, it was aimed to synthesize porous membranes by phase transformation method using PVDF and PVP polymers and to remove humic acid from surface waters by filtration method with these synthesized membranes. The separation performance of the membrane was tested at different PVDF/PVP concentrations. The effects of different ratios of polymer solutions in the solutions prepared while the membranes were synthesized were investigated.

MATERIALS AND METHOD

Polyvinylidene fluoride used in membrane synthesis was obtained from Solvay. Dimethylformamide, polyvinylpyrrolidone and humic acid were obtained from Sigma Aldrich. Distilled water was also used in experimental studies.

PVDF Solution Synthesis

10 wt % PVDF was dissolved in dimethylformamide for preparation solution. In order to formation a homogeneous structure, dissolving was carried out in a magnetic stirrer at room temperature.

PVP Solution Synthesis

2, 5 and 10 wt % PVP was dissolved in dimethylformamide for preparation membrane solution. In order to formation a homogeneous structure, dissolving was carried out in a magnetic stirrer at room temperature.

PVDF/PVP Membrane Synthesis

PVDF solution and PVP solution were prepared separately and mixed at the determined ratios to obtain membrane solution PVDF/PVP membrane solution ratios in percent by mass, respectively; 90/10, 80/20, 70/30 and 60/40. With 10% PVDF solution, respectively; PVP solution prepared as 2, 5 and 10% was mixed at the determined ratios and membrane solutions were obtained. The prepared solution was thinly coated on the nonwoven surface and immersed in a water bath to achieve phase change. The solution-coated

membranes were kept in a water bath for 30 minutes. After the water bath, the membranes were left to dry at room temperature.

Preparation of Humic Acid Solution

Humic acid solution to be used for removal was prepared in 2 ppm concentration and the effect of feed concentration on humic acid removal was investigated.

Separation Studies With Membrane Filtration System

Membrane filtration experiments have been carried out for the removal of humic acid from water sources. The experimental setup used is shown in Figure 1.

Figure 1. Membrane filtration system

In the membrane filtration system, humic acid cannot pass through the filter and is retained on the filter surface. The filtering of the feed mixture over the membrane filter paper with vacuum support is carried out by the membrane filtration system. Therefore, the element humic acid to be removed is retained on the humic acid membrane filter. In this study, the membranes produced are expected to retain humic acid. As a result of this filtration process, organic matter is removed from surface waters. The humic acid concentration in the permeate was determined using a UV-Vis spectrophotometer at 254 nm. As a result of this analysis, the percentage calculation of humic acid rejection was made with the help of equation (1) below. In Equation 1, R is the humic acid rejection, C_f is the humic acid concentration on the feed stream side, and C_p is the humic acid concentration on the permeate side.

$$\boldsymbol{R = \frac{C_f - C_p}{C_f} \times 100} \quad (1)$$

RESULTS and DISCUSSION

Membrane Morphology

FTIR analysis was performed on the membrane layers before and after the filtration process. The analysis result report is shown in Figure 2. For the clean and dirty layer, we can say that the peaks seen in 1709 and 1654 are in the carbonyl stress vibration region.

It refers to the C=0 bond, which is the strongest peak in the spectrum. The region of 1550-650 cm-1, called fingerprint, detects the same one and unknown substances are determined in this way. The 1550-650 cm^{-1} region, called the tensile region, has C-O, N=O and C-X bonds. The region of 1000-650 cm^{-1}, which we call the outer bending region, represents =C-H vibrations. The only peak where the bonds are different is the peak seen at 719 on the dirty surface and represents the C-H or -HC=CH- bond.

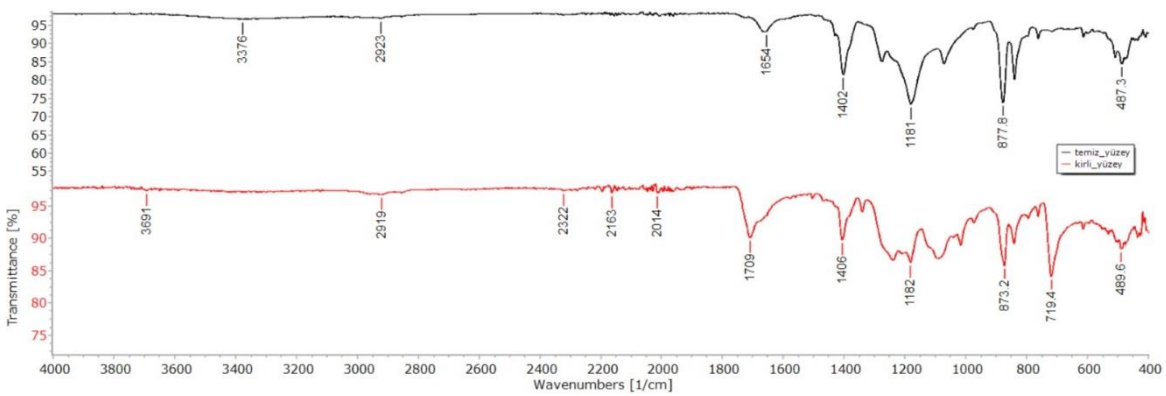

Figure 2. FTIR analysis report

Membrane Filtration Results

In the separation process for humic acid removal from surface waters, the variation of PVDF/PVP ratios and different concentrations of PVP solution for the blend membrane consisting of PVDF/PVP solutions were studied. Filtration processes were carried out by preparing humic acid solution.

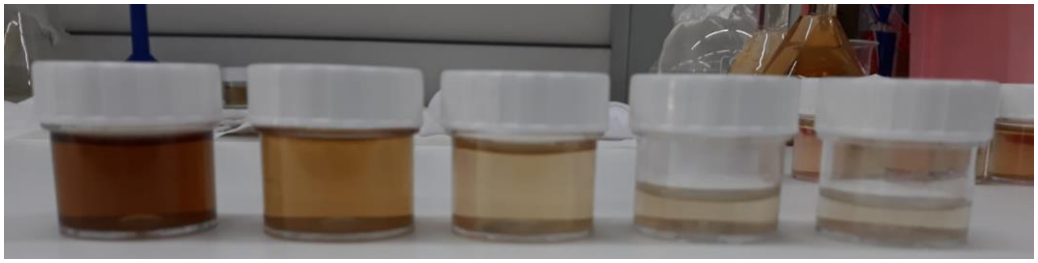

Figure 3. Feed and flow samples of humic acid solutions

When the samples taken after the membrane filtration process are examined, a visible color difference was observed as seen in Figure 3. With this observation, it can be said that the pure water permeability performance is high in the separation performance of PVDF/PVP blend membranes.

The current through filtration is one of the most important factors for evaluating membrane performance. The antifouling properties of membranes can be directly measured by flux permeability. The current through each PVDF/PVP membrane filtration decreased rapidly during the first 15 minutes and then decreased slowly. While humic acid is retained during filtration, the accumulation on the surface is visibly noticed. The deposition on the membrane surface is shown in Figure 4. From the difference before and after filtration, it is seen that humic acid accumulates on the membrane surface. As a result of this accumulation, the flow rate of the flow during filtration decreases due to the layer formed over time.

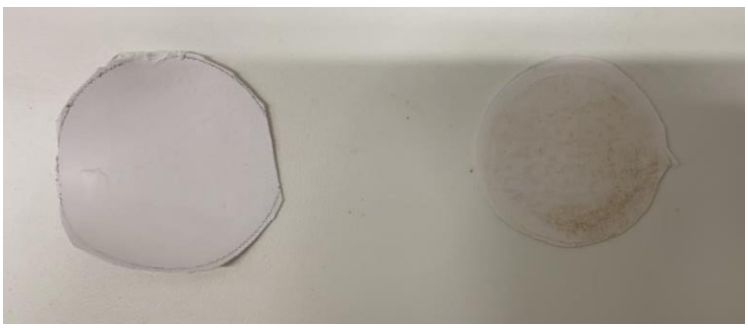

Figure 4. Membrane surfaces; a) before filtration b) after filtration

It can be said that the flux decrease in filtration is mainly related to membrane fouling due to membrane fouling, cake formation and concentration polarization.

For the evaluation of humic acid removal using the prepared blend membranes, samples were taken from the feed solution and the flowing stream for UV254 analysis. Samples taken were analyzed at 254 nm. UV254 generally represents humic-like fractions, which is a type of organic matter with aromatic structure, carbonyls or olefins. The percentages of humic acid removal obtained as a result of this analysis were calculated.

Table 1. Filtration removal results of membranes synthesized with 10% PVDF and 10% PVP solutions

Sample Number	PVDF/PVP Ratio (w/w)	Humic Acid Removal (%)
1	90/10	6.21
2	80/20	3.48
3	70/30	12.34
4	60/40	8.13

The percentages of removal after filtration of membranes synthesized with 10% PVDF and 10% PVP solutions are given in Table 1. In the preparation of PVDF/PVP membrane solutions, the effects of the solutions were observed by using different weight ratios. Among the 4 membrane samples, the most successful removal performance is seen in the membrane synthesized at a ratio of 70/30 by weight.

Table 2. Filtration removal results of membranes synthesized with 10% PVDF and 5% PVP solutions

Sample Number	PVDF/PVP Ratio (w/w)	Humic Acid Removal (%)
1	90/10	22.07
2	80/20	24.81
3	70/30	41.84
4	60/40	27.50

The percentages of removal after filtration of membranes synthesized with 10% PVDF and 5% PVP solutions are given in Table 2. In the preparation of PVDF/PVP membrane solutions, the effects of the solutions were observed by using different weight ratios. Among the 4 membrane samples, the most successful removal performance is seen in the membrane synthesized at a ratio of 70/30 by weight.

Table 3. Filtration removal results of membranes synthesized with 10% PVDF and 2% PVP solutions

Sample Number	PVDF/PVP Ratio (w/w)	Humic Acid Removal (%)
1	90/10	24.14
2	80/20	16.91
3	70/30	15.48
4	60/40	21.82

The percentages of removal after filtration of membranes synthesized with 10% PVDF and 5% PVP solutions are given in Table 3. In the preparation of PVDF/PVP membrane solutions, the effects of the solutions were observed by using different weight ratios. The filtration performances of membranes synthesized with 10% PVDF and 2% PVP solutions

are very close to each other. Among the 4 membrane samples, the most successful removal performance is seen in the membrane synthesized at a ratio of 90/10 by weight.

When the filtration results of the membranes synthesized with the solution prepared by mixing the PVP solution prepared in different ratios with 10% PVDF solution at a ratio of 70/30 are compared, it is seen that the best removal performance belongs to the membrane synthesized with 10% PVDF and 5% PVP solutions.

The removal performances of these 3 different membranes as a result of filtration are shown in Figure 4. Sample number 1 shown in Figure 5. belongs to the membrane synthesized with 10% PVDF-10% PVP solution. Sample number 2 belongs to the membrane synthesized with 10% PVDF-10% PVP solution, and sample number 3 belongs to the membrane synthesized with 10% PVDF-2% PVP solution.

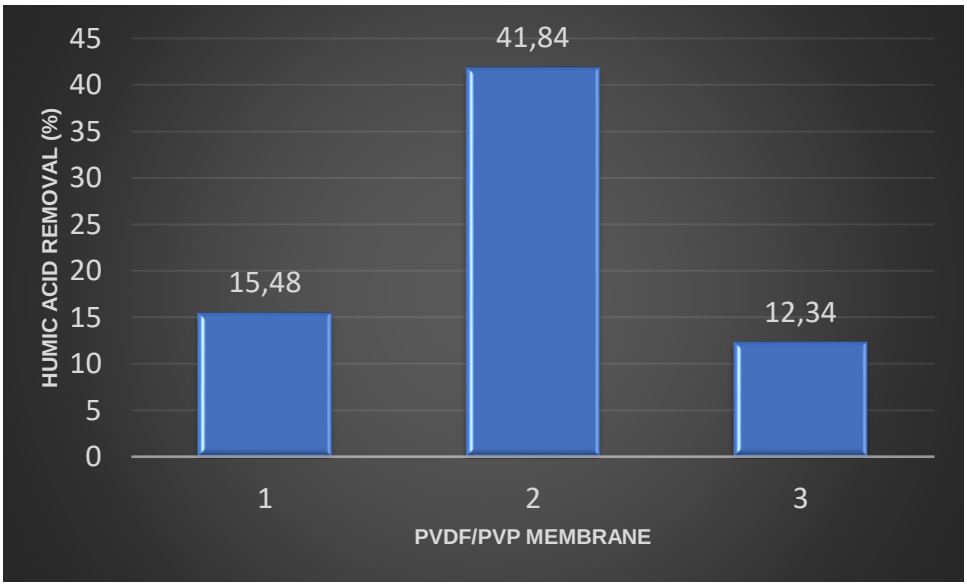

Figure 5. Effect of membrane solution with different PVP ratios on removal performance

CONCLUSION

According to the results obtained, the concentrations of the solutions prepared for the synthesis of membranes used in humic acid removal and their ratios in the solution are effective. According to the pore forming function, the best removal result was seen in membrane synthesis where the PVP solution was studied at 5% by weight. Since the

number and size of the pores will increase as the PVP concentration increases, the passage of humic acid in the filtration was also observed and it was observed that the adhesion performance of the humic acid on the membrane surface was low. Membrane filtration using 5% PVP solution prepared at a ratio of 70/30 by weight has also been observed to have the best results in membranes synthesized from solutions prepared at different ratios. The removal of this membrane was calculated as 41.84%.

It has been predicted that it can be more effective by optimizing the conditions in the synthesis of membranes. According to the results of the studies, it is thought that more successful results will be obtained by aiming to examine the effects of the changes in different operation parameters.

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ID:76-COP

Isolation of Protease from Tragopogon Reticulatus (yemlik) and Identification of Some Characteristics

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Protease enzymes that constitute 60% of the enzyme market in the world are widely used in food, detergent, pharmaceutical and leather industries. Its wide range of uses have encouraged researchers to search for new protease sources that can be used commercially. Commercial proteases are produced from plants, animals and microbial sources. The aim of this study is to isolate of protease from *Tragopogon reticulatus* and determination of some characteristics. The plants were collected at the beginning of June with leaves and roots. The protease was isolated by ammonium sulphate precipitation and ion-exchange (DEAE-Sepharose) chromatography. Protease activity was determined by the casein digestion method. Optimum pH and temperature were determined. The value of Km was also determined using casein as a substrate. The effects of some effectors on the activity of the protease enzyme were investigated. The optimum pH and temperature of enzyme was 8,0 and 45 °C, respectively. The enzyme retained its activity 70% at pH 5-10 and 20-90 °C. The purified protease exhibits activity at wide range pH and temperature indicates that this enzyme may be suitable for different industries.

Keywords: Protease, Identification, Tragopogon reticulatus,

ID:95-COP

Antibacterial, Mechanical, Water Vapor Barrier and Optical Properties of Crosslinked Starch-Polyvinyl Alcohol Films Containing Thymol

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In this study, potato starch/polyvinyl alcohol blend films containing thymol were successfully prepared by solution-casting method using (3-Aminopropyl) trimethoxysilane (0%, 5% and 10%) with different amounts as crosslinker and glycerol as plasticizer. Physicomechanical properties of the films such as mechanical, water vapor permeability, opacity and color were determined. The tensile strength of the films increased with increasing crosslinking, but the elongation at break decreased. The tensile strength of films without crosslinker was 7.05 MPa and films with 5% and 10% were 7.33 and 8.11 MPa, respectively. The elongation at break decreased by 84.44%, 60.43% and 34.42%, respectively. The water vapor permeability of the films was 2.15×10^{-6} g s^{-1} m^{-1} Pa^{-1}, 2.27×10^{-6} g s^{-1} m^{-1} Pa^{-1} and 1.89×10^{-6} g s^{-1} m^{-1} Pa^{-1} for films with and without crosslinker, respectively. The films became more opaque with increasing content of (3-Aminopropyl) trimethoxysilane. The color properties of the films were examined on the L*, a* and b* scales. As the amount of crosslinker increased, the L* and a* values of starc/polyvinyl alcohol films decreased, the b* value increased and the films observed yellowish. For the antimicrobial activities of thymol-containing films, standard pathogen strains *E. coli* ATCC and *S. aureus* ATCC were also tested.

Keywords: Crosslinker, polyvinyl alcohol, starch.

ID:103-COP

Synthesis of 2-[(Aryl)methylidene]-2,3-dihydro 1H-inden-1-ones as Potential MAO Inhibitors

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The monoaminergic system has a critical role in the modulation of mood and emotion, as well as in the regulation of motor and cognitive functions. The normal functioning of synaptic neurotransmission is achieved by the effective degradation of monoamine neurotransmitters such as noradrenaline, dopamine, and serotonin [1] Such degradation includes the oxidative deamination of monoamines and is catalyzed by monoamine oxidase enzymes (MAOs) [2-4] Hence, MAO inhibitors are used in the treatment of depression and also in neurodegenerative disorders such as Parkinson's and Alzheimer's disease [5]. MAOs contain flavin adenine dinucleotide (FAD) and are found in the outer membranes of mitochondria throughout the brain [6]. Two isoforms, MAO-A and MAO-B, have been identified based on inhibitor sensitivity and substrate selectivity [7,8]. It is important that MAO-B is the major isoform in the human brain [9]. The activity of dopamine can be prolonged by MAO-B selective inhibitors and thus MAO-B inhibitors have clinical use in the treatment of Parkinson's disease. In addition to monotherapy in early Parkinson's disease, they can also be used as adjunctive therapy with levodopa [5].
Chalcones (1,3-diphenyl-2-propen-1-ones) are open chain flavonoids that are ubiquitous in edible plants and have a broad range of reported biological activities [6,7] which include anti-inflammatory and neuroprotective effects [8,9]. At the end of the eighties, chalcones have been discovered as potential MAO inhibitors. Isoliquiritigenin was the first chalcone derivative used in the kinetic studies to determine the MAO inhibitory activity. Afterwards, some studies indicated that synthetic and natural chalcones are inhibitors of MAO enzymes [10-13]. It has been reported that chemical structure consisting of two aromatic rings linked through a three-carbon, α, β-unsaturated carbonyl system enables them to possess essential structural features for selective binding to human MAO-B [10,14].
Prompoted from above observations, in the present study, a series of 1-indanone based chalcone derivatives were synthesized and will screen for inhibitory potencies against hMAO enzymes.

Synthesis of the compounds (IG 7, IG 10, IG 11, IG 17, IG 21, IG 23, IG 25, IG26) The compounds designed were synthesized by Claisen–Schmidt condensation under basic condition. To the mixtures of 1-indanone and suitable benzaldehyde in 1:1 mol ratios in ethanol (6 ml), aqueous solution of NaOH (10%, 10 ml) was added. Reaction content was stirred at room temperature (r.t) for 24 hours. Reactions were followed by TLC [CHCl3: MeOH (98:2)]. When the reaction finished, the content of the reaction flask was poured on ice-water and neutralized by HCl (10%). The solid precipitated was filtered and washed with cold ethanol. The crude compounds were purified by crystallization with EtOH. Synthetic pathway was summarized in Scheme 1.

Scheme 1. Synthesis of the compounds

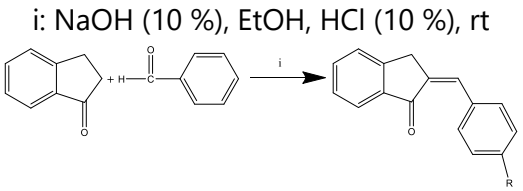
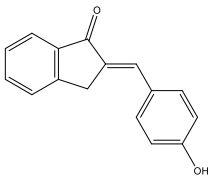
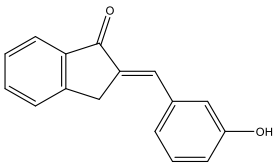
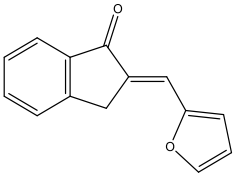
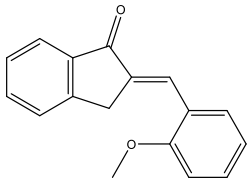


Table 1. Chemical structures of the compounds

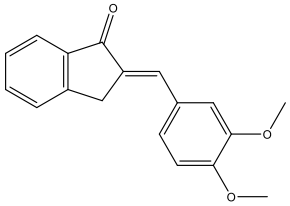
IG 7  2-[(4-Hydroxyphenyl)methylidene]-2,3-dihydro-1H-inden-1-one
IG 10  2-[(3-Hydroxyphenyl)methylidene]-2,3-dihydro-1H-inden-1-one
IG11  2-[(Furan-2-yl)methylidene]-2,3-dihydro-1H-inden-1-one

IG 17



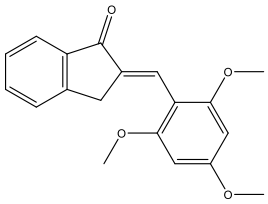
2-[(2-Methoxyphenyl)methylidene]-2,3-dihydro-1H-inden-1-one

IG 21



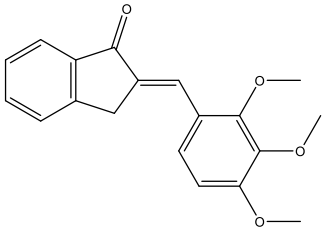
2-[(3,4-Dimethoxyphenyl)methylidene]-2,3-dihydro-1H-inden-1-one

IG 23



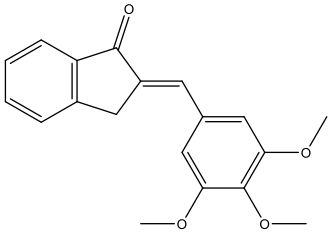
2-[(2,4,6-Trimethoxyphenyl)methylidene]-2,3-dihydro-1H-inden-1-one

IG 25



2-[(2,3,4-Trimethoxyphenyl)methylidene]-2,3-dihydro-1H-inden-1-one

IG 26



2-[(3,4,5-Trimethoxyphenyl)methylidene]-2,3-dihydro-1H-inden-1-on

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ID:123-COP

Synthesis of Sesamol-Based Sulfonate Esters and Their Biological Activities

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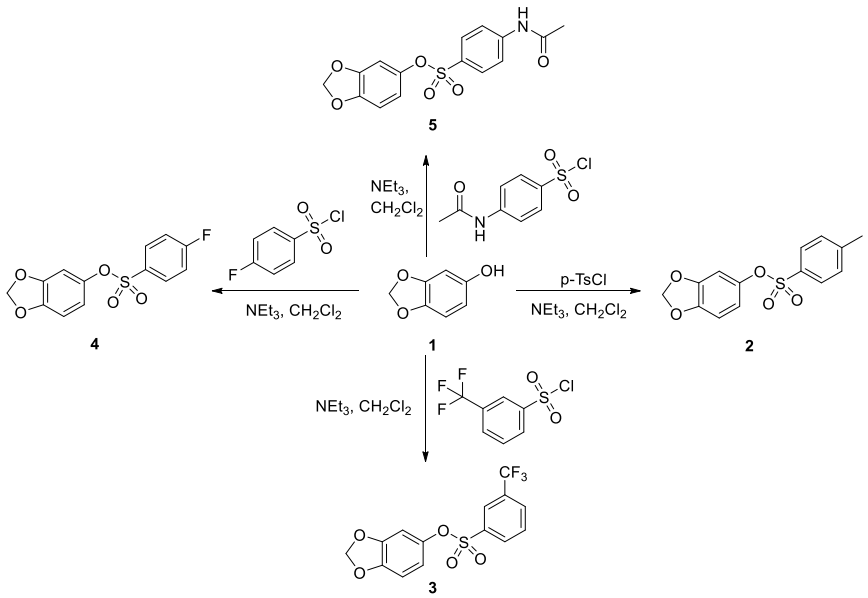
In this study our aim is to obtain some novel sesamol-based sulfonate esters starting from sesamol and the investigation of their in vitro biological activities. For this purpose commercially available sesamol (**1**) was subject to direct sulfonylation at the OH position with p-TsCl, 4-fluorobenzenesulfonyl chloride, 3-(Trifluoromethyl) benzenesulfonyl chloride, 4-acetamidobenzenesulfonyl chloride in the presence of NEt_3 in CH_2Cl_2 to yield desired sülfonate esters (Scheme 1). Their biological activities are under investigation [1,2].



Scheme 1. The synthetic route of sesomol-based sulfonate esters

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ID:127-COP

Inhibition Effects of *Polygonatum Multiflorum* (Solomon's Seal) Roots on Some Enzymes

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The most common name for the *Polygonatum* (Asparagaceae) species is "Soloman's seal" and it means the seal of Solomon. *Polygonatum multiflorum* is a plant species known as "Mührüsüleyman otu" in Turkey and used for various purposes in folk medicine (Seberg et al. 2012; Yesil and Ozhatay 2013). In this study, water, ethanol (EtOH), acetone, $CHCl_3$ and n-hexane extracts were prepared from the underground parts of the *P. multiflorum*. Inhibition effects of *P. multiflorum* were investigated on α-glucosidase, acetylcholinesterase (AChE), butyrylcholinesterase (BChE), human carbonic anhydrase (hCA) I and II enzymes. For that purpose, *P. multiflorum* collected by the local people from Kütahya, Turkey (Gediz, Murat Mountain, Çukuroren locality) was procured, then dried and ground. Different extracts of *P. multiflorum* were prepared with water, EtOH, acetone, $CHCl_3$ and n-hexane organic solvents. After the inhibition effects of the extracts on α-glucosidase, AChE, BChE, hCA I and II enzymes were determined by spectrophotometer, 50% enzyme inhibitor concentrations (IC_{50}) values were calculated. According to these results, IC_{50} values of extracts were found to be in the range of 3.48-13.89 mg/mL for α-glucosidase, 68.61-99 mg/mL for AChE, 18.43-37.05 mg/mL for BChE, 78.75-123.75 mg/mL for hCAI and 99-126 mg/mL for hCA II enzymes. The water extract of *P. multiflorum* showed no inhibition on any enzyme.

In this study, it was revealed for the first time that *P. multiflorum* showed a very strong inhibition effect, especially on the α-glucosidase enzyme. It also showed a strong effect on the BChE, while it was found to be weakly effective for AChE, hCA I and II enzymes.

Keywords: *Polygonatum multiflorum*, *α*-glucosidase, inhibition

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PHYSICS
ORAL PRESENTATIONS

ID:26-POP

Investigation of the Change of Ground State Properties of N-Electron Quantum Dot Structures Interacting in Morse Potential Depending on Confinement Intensity

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In this study, the ground state properties (such else electron density, chemical potential, kinetic energy and Hartree Energy etc.) of quantum dot system including large number of interacting electrons in Morse potential ($(r) = V_0(1 - e - br)$ 2 , V_0 and b are constants) has been investigated by changing V_0 and b parameters. For this purpose; primarily, the electron density for two-dimensional electron gas which interacting with Coulomb Potential (r) has been expressed by using Fermi - Dirac functions. In next stage, Thomas-Fermi equation has been obtained for the system interacting by combining the density expression and Poisson equation. Thomas-Fermi equation has been solved numerically. The effect of electron interaction on the base properties of the system has been determined by taking $Ve = 0$ in numerical operation. The results showed that the strength of electron interaction and hence the system properties changed with depth and curvature of confining potential

Keywords: Quantum dot structures, Electron gaz, Morse potential.

ID:66-POP

Calculating Energy Absorption and Exposure Buildup Factors of Some Psychoactive Substances

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Psychoactive substances are chemical substances that especially effective in the central nervous system and cause temporary changes in perception, mood, consciousness and behavior by changing the functions of the brain. In addition, psychoactive substances are also used for the purpose of anesthesia and against pain problems. In recent years, the buildup factors of some psychoactive substances, the use of which has increased excessively despite many negative consequences and risks, were calculated using the EpiXS. In the present study, energy absorption buildup factor (EABF) and exposure buildup factor (EBF) values of amphetamine, caffeine, cocaine, diazepam, morphine, nicotine and phenobarbital (long-acting) selected from psychoactive substances that are widely used in daily life, have been computed for 0.015-15 MeV energy region up to 40 mfp (mean free path) penetration depths. In addition, the effective atomic number and electron density of the chosen substances were computed for photon energy 1 keV to 100 GeV. The results show EABF and EBF values of amphetamine are most and are least in diazepam. This study should be useful in estimating the dose for patients using psychoactive substances and also receiving radiation therapy.

Keywords: Buildup Factors, Psychoactive Substances, Radiation,

ID:69-POP

Growth And Characterization Of NiO Thin Films Grown By Spray Pyrolysis Method

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In this study, the growth of NiO thin films was carried out by spray pyrolysis method on glass substrate. Different base temperatures were used for growth, and it was investigated how these temperatures affected the structural, morphological, and optical effects of the samples. The structural properties of the samples were examined by X-ray diffraction (XRD), morphological properties by scanning electron microscopy (SEM) and optical properties by UV–Vis spectroscopy. In the examinations made, it was observed that the NiO thin films were grown successfully, and the structural morphological and optical properties were changed with the change of the substrate temperature.

Keywords: Thin film, Spray pyrolysis, XRD,

ID:70-POP

Cd Dopant Effect on NiO Thin Films Grown by Spray Pyrolysis Method

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In this study, Cd doped NiO thin films were carried out by spray pyrolysis method on glass substrate. The structural, morphological and optical effects of Cd dopant on NiO samples were investigated. Firstly, the structural properties of the samples were examined by X-ray diffraction (XRD). Then, the morphological properties of the produced thin films were asserted by scanning electron microscopy (SEM). And, lastly the optical properties of the grown nanostructures were analyzed by UV–Vis spectroscopy. It was observed that the XRD peaks of the samples shifted, and their intensities changed with the Cd dopant. Also, it was clear that there were changes in the SEM photographs of the samples after the Cd dopants introduced to the NiO lattices. And, the absorption measurements showed that modifications were also occurred in the band gaps of the samples due to the doping the thin films with varied concentrations of Cd ions.

Keywords: Metal-doping, Semiconductors, Uv-vis spectroscopy,

ID:96-POP

Investigation of Fast Neutron Attenuation for Ferrovanadium

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In this study, it was aimed to show ferrovanadium, as alternative shielding materials aganist fast neutrons with Monte Carlo Smilation and to determine the shielding performances of these ferrovanadium. Ferrovanadium and other vanadium alloys are used in carbon steels, high-strength steels and alloy steels to increase temperature and torsion resistance. These steels are used in industry, especially in the production of automotive parts, high strength tools and durable pipes. The aim of this study is to investigate whether ferrovadiniums containing four different rates of vanadinium can be an alternative shielding material against fast neutrons. To do this, some important shielding parameters such as half-value layer, effective removal sections, mean free path, and number of particles passing through the material were determined using a quasi-experimental Monte Carlo simulation (GEANT4) code. The results were compared with 316LN nuclear steel. All samples were found to absorb fast neutrons. But it was found that the sample containing 85% vanadinium had the best absorption. As a result, it has been shown that these samples can be shielding materials against neutrons in nuclear applications.

Keywords: Geant4, Neutron, Geant4,

ID:105-POP

Research on Protective Drug Effect Ingredients in Boron Neutron Capture Therapy

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Boron Neutron Capture Therapy (BNCT) is a method of intravenously administering a non-radioactive boron compound (bearing ^{10}B) to tumor cells, bombarding this tumor cell with epithermal neutrons. During the bombardment, neutrons are captured by 10B, as a result of this capture, ^{10}B decays to release high-energy charged particles [Helium-4 (^{4}He) (ie particle α) and Lithium-7 (^{7}Li)]. The energy released during this time both kills the tumor cells and damages the DNA of tumor cells, thus preventing the proliferation of tumor cells. During this treatment, intact cells must be protected from the lethal energy that will emerge from the 10B (n, α) reaction. Therefore, there is a need for good neutron-absorbing agents. These agents will absorb excess neutrons and prevent possible nuclear reactions. In this study, neutron absorption capacities were investigated of some drug effect ingredients (Lithium carbonate, Chromium chloride, Chromium nicotinate, Lanthanum carbonate, Zinc gluconate, Titanium dioxide) which are commonly used in some diseases. Neutron reduction parameters such as mass removal cross-section, half-value layer, mean free path, and transmission number were determined using Monte Carlo Simülation GEANT4 code. Chromium chloride, Chromium chloride, Titanium dioxide, drugs with the best neutron absorption were determined. These cells will be protected from harmful effects by injecting these drugs into healthy cells before boron neutron treatment and allowing them to stay there, by absorbing the excess neutrons scattered during the treatment.

Keywords: BCNT, Neutron, Therapy,

BIOLOGY
ORAL PRESENTATIONS

ID:43-BOP

Determination of the Genotoxic Potential of Haplophyllum Vulcanicum Boiss. & Heldr.

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Haplophyllum genus, which is in the Rutaceae family known as 'Citrus' in Turkey, are perennial and fragrant plants. The genus *Haplophyllum*, which has a wide geographical distribution from the Mediterranean region to Eastern Siberia, is represented by about 70 species in the world. Turkey has an important gene center for the genus *Haplophyllum* with an endemism rate of 58%.[1] *Haplophyllum* species are used in skin diseases, warts and herpes, stomach, and toothaches in folk medicine in Sudan and other African countries and Mongolia.[2] In addition, some types are used in the treatment of nervous system, fever, infertility, and testicular cancer. *Haplophyllum* species show important biological activities including antioxidant, antimicrobial and anti-inflammatory, cardiovascular effects, malaria, and anti-ulcer.[2] In previous literature, it has been reported that *Haplophyllum* species contain alkaloids, lignans, coumarins, flavonoids, essential and essential oils.[2] In this study, it was aimed to determine the genotoxic potential of *Haplophyllum vulcanicum Boiss. & Heldr*., since *Haplophyllum* has the stated biological activities, its use in complementary medicine and there is not enough research in the literature about its genotoxic potential. For this purpose, the genotoxic potential of methanol extracts of *Haplophyllum vulcanicum Boiss. & Heldr*. (HVm) in human lymphocyte cells was investigated by micronuclei test. As a result of the study, it was observed that HVm had no genotoxic effect at the concentrations used (10, 25, 50, 75 and 100 µL). In addition, it was determined that HVm exhibited antigenotoxic properties against sodium azide, which was used as a mutagen, at 50 and 75 µL concentrations.

Keywords: Haplophyllum vulcanicum, micronuclei, genotoxicity,

ID:45-BOP

Cold Active Amylase Producing Yeasts from a Cryoconite Hole in Palandöken Mountain

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Cold active amylases are one the most important groups of commercially produced enzymes and their importance is increasing due to the fact that they require less energy in many industrial processes, especially production of cold active detergents and food processing applications. This situation leads scientific research to the discovery of new microbial sources that produce cold active amylases. Hence, the present study was conducted to isolate new microbial cold adapted amylase sources from the Palandöken Mountain, one of the coldest ecosystems of Turkey. For this aim, soil samples were taken from a cryoconite hole in January 2020. The microbial isolation steps were performed according to previous studies in the literature. The pure cultures were inoculated on starch agar plates and incubated at +4 °C for three weeks. Then, active isolates were determined by the treatment of Gram's iodine solution. The molecular identification of the isolates were done by using Sanger sequencing of the particular PCR amplicons produced by the universal ITS 1-4 primer set. The sequence data was deposited at NCBI – GenBank with unique accession numbers.

According to the results, 65 yeast isolates were obtained from a cryoconite hole in Palandöken Mountain. Among them, four isolates were determined as cold active amylase producers and they were identified as *Vishniacozyma tephrensis* SAY-1, *Vishniacozyma victoriae* SAY-2, *Dioszegia hungarica* SAY-3 and *Rhodosporidiobolus colostri* SAY-4. The accession numbers were MW922829.1, MW922830.1, MW922831.1 and MW922832.1, respectively.

In conclusion, these results of the present study are valuable for the development of cold active amylase production strategies. Moreover, these isolates will be studied for the optimization of the yield in the near future.

Keywords: Cold active amylase, Cryoconite, Palandöken Mountain,

Acknowledgement: This work was supported by Research Fund of the Ataturk University. Project Number: FYL-2021-9054

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ID:48-BOP

Determinatıon of Expression Levels and DNA Methylation Rates of Some Genes Affecting Cadmium Stress Responses in Triticum Aestivum

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The accumulation of cadmium (Cd) heavy metal in the soil origaneted from increasing of factors such as changing climatic conditions, incorrect irrigation techniques and chemical fertilizers used in recent years [1]. Therefore, our study was aimed to determine of the molecular level changes caused by Cd accumulation in Triticum aestivum (bread wheat) plant. In this context, the wheat plants applied in 0, 100, 250 and 500 µM Cd doses were determined both root and stem the expression levels and DNA methylation rates of UGT-3, LTP-4 and PIP-1 genes. DNA methylation rates were determined by applying the restriction enzyme-based qAMP technique, which is a new technique used in plants, and the obtained results were compared with the gene expression analysis. When the UGT-3, LTP-4 and PIP-1 genes were analyzed, the highest methylation percentage of all three genes was observed at 250 µM concentration. In gene expression analysis, the highest expression ratio of the UGT-3 gene was observed at dose of 250 µM in the stem, while the LTP-4 gene occurred in the root at a concentration of 250 µM. On the other hand, it was observed that the PIP-1 gene was downregulated at the expression level in the plant stem and was consistent with the methylation results. In addition, 6 and 14-fold upregulation of the PIP-1 gene occurred in the plant root at concentrations of 250 and 500 µM, respectively. Consequently, changes in methylation ratios of UGT-3, LTP-4 and PIP-1 genes under Cd stress were investigated for the first time in our study. In addition, the qAMP technique, which is generally used in mammalian cells, was used for the first time in plant cells and was successfully concluded. As expected, a significant correlation was observed between the expression levels of genes and their methylation status. On the other hand, the fact that the gene expression and DNA methylation ratios observed at some doses of the genes are not inversely proportional has revealed the necessity of explaining the results in more detail by investigating other mechanisms involved in the regulation of gene expression.

Keywords: Cadmium, qAMP, gen expression,

Acknowledgement: This work was supported by Research Fund of the Ataturk University

ID:71-BOP

A Newly Synthesized 4-Thiazolidinone Derivative with Antimutagenic Effect against NPD-Induced Mutagenesis

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4-Thiazolidinone derivatives have been the subject of research in many scientific disciplines, especially medicine and pharmacy, with their diverse bioactivities such as antimicrobial, antiviral, anticancer, anti-inflammatory and antidiabetic activities [1]. In this study, it was aimed to investigate the potential genotoxic and antigenotoxic effects of the newly synthesized 4-thiazolidinone compound, (2*Z*,5*Z*)-3-phenyl-2-[(pyridin-2-yl)imino]-5-[(thiophen-2-yl)methylidene]-1,3-thiazolidin-4-one (**C1**), using AMES/*Salmonella* test system. For this purpose, the safety of **C1** and its leading role in the development of novel antigenotoxic agents were determined. In the genotoxicity assessment, *Salmonella typhimurium* TA98 tester strain was exposed to 0.2, 0.4, 0.6, 0.8 and 1.0 mM/plate concentrations of **C1**. At the same concentrations, **C1** was treated with 2.5 µg/plate dose of 4-nitro-*o*-phenylenediamine (4NPD) to assess antigenotoxicity. According to the results, **C1** did not show mutagenic activity on the TA98 strain at the concentrations tested. However, **C1** was found to have antigenotoxic activity in the 0.2-1.0 mM/plate concentration range and significantly inhibited the number of 4NPD-induced revertant colonies (inhibition$_{max}$ = 38.8% for 1 mM/plate). As a result, it was determined that this newly synthesized 4-thiazolidinone derivative is a genotoxically safe compound and has a protective effect against DNA damage caused by 4NPD.

Keywords: 4-Thiazolidinone, Synthesis, Antigenotoxicity,

Acknowledgement: This work was supported by Research Fund of the Ağrı İbrahim Çeçen University. Project Number: FEF.20.003

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ID:73-BOP

Nanotechnological Applications in the Food Industry the Use of Nanomaterials and Their Evaluation for the Food Safety

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Nanotechnology, one of the important science and technology fields of our age, is a branch of science responsible for the examination, design, processing and control of materials in very small nanoscales. Nanotechnological studies are carried out in many fields such as physics, chemistry, biology, medicine and engineering, and produced nano materials are used. One of the latest trends in the scientific world is the studies on the use of nanomaterials in the food industry. Nanotechnology and nanomaterials, which are a developing technology today, have the power to revolutionize the field of food processing and packaging, if used correctly in the food industry. The widespread use of nanotechnology in the food industry and the use of nanomaterials in many areas of the food industry such as production, processing and protection have brought up the debates on whether the use of these materials is safe for consumers. It is not possible to say anything definite about the effects of nanotechnological applications and nanomaterial use in the food industry on consumer health due to the fact that nanotechnology is a developing science and there are few studies in this field. In this study, nanotechnological applications in the food industry and the use of nanomaterials are evaluated in terms of food safety.

Keywords: Nanotechnological, Nanomaterials, Food safety,

Introduction

Nanotechnology, which emerged as a result of multidisciplinary studies of disciplines such as physics, chemistry, biology, engineering and biotechnology; It deals with materials of 1-100 nm size. Nanotechnology, which originates from the Greek word "nanos" "dwarf"; It aims to give a completely new feature to the substance in terms of physical, chemical and biological by carrying out studies such as the processing, measurement, design, modelling,

regulation and control of structures, devices and materials smaller than 100 nm, literally. As a result of rapidly increasing nanotechnological studies in the last decade, nanostructures and nanomaterials have been used in many fields. Medicine, pharmacy, computers, electronics, materials, environment, energy, food, agriculture and textiles are among these fields. Various institutions and organizations around the world; They use nanotechnology in the treatment and diagnosis of medicine, in the research and control of pests and diseases in agriculture, in fertilizer and pesticide studies, in the production of substance and materials in the fields of engineering. Compared to the nanotechnological studies in other fields, the number of studies in the field of food is quite low. Nevertheless nowadays, nanotechnology is used to a certain extent in improving flavour and texture, packaging, detecting contamination, antimicrobial studies, encapsulating nutrients to extend the shelf life of food or reducing fat content.

According to 2008 data, more than 15 million dollars were demanded for nanotechnological innovations in the world market and this demand is expected to reach 3 trillion dollars in 2020. Although its real financial capacity is not fully known today, it is obvious that nanotechnological studies will have a very important value in the future as a result of both global trends and the need to meet consumer preferences. However, since it is a new concept, there is little information in this field, causing consumers to have safety concerns regarding the use of nanomaterials. In addition, the fact that the effects of the use of nanomaterials and nanostructures on human health and the environment are not fully known limits the production and use of nanomaterials, so every study in the field of nanotechnology is of great importance. In this review, nanotechnological studies that have developed rapidly in the food industry in recent years, the nanomaterials used are compiled and these studies are evaluated in terms of food safety.

1. Development of Nanotechnology

Although the naming is new, nanotechnology is quite an old science. According to Roman sources, dichroic glasses containing colloidal gold and silver nanoparticles in their structures 1500 years ago were used in the production of a special glass called "Lycurgus Cup", which turns green with the light coming from the outside and red with the light coming from the inside. According to the sources, unconsciously developed nanomaterials were used in the production of hair dyes used in Egypt, in the production of damask steel swords used by Islamic armies, and in the manufacture of fabrics containing nano-sized pores [6,18].

For the first time in 1925, chemist Richard Zsigmondy used the concept of nano meter when describing the particle size and was recorded as the first person to measure the size

of gold colloid particles with the help of a microscope. The beginning of nanotechnology in the history of science is considered to be the speech given by Nobel Prize-winning scientist Richard Feyman in 1959, in a lecture called "There Is Enough Room at the Bottom", on the possibility of going down to smaller scales. By 1974, a scientist named Norio Taniguchi was the first person to use the name "nanotechnology" to describe semiconductor processes [15,21].

The golden age of nanotechnology began in the 1980s; With the discovery of the Scanning Tunnel Microscope in 1981, nanotechnology began to develop. Eric Drexler, a scientist at the Massachusetts Institute of Technology during these years, was very impressed by Feynman's ideas and frequently mentioned the term nanotechnology by writing the book "Engines of Creating: The Coming Era of Nanotechnology". In the same years, Richard Smalley, Harold Kroto and Robert Curl discovered for the first time that the carbon atoms, which they evaporated with the graphite laser method, were in the form of ball-shaped cages. These developments were followed by the discovery of carbon nanotubes in 1986, and with this discovery, practical industrial applications began to emerge in the science of nanotechnology. The first nanotechnology program of the National Science Fund, created by the United States of America in 1991, was implemented and in 2000, nanotechnological studies were invested from this fund. Also, the approval of the National Nanotechnology Initiative (NNI) by the President of the United States in 2001 and the designation of nanotechnology as a priority field of study for the USA, led to the start of nanotechnological studies that continue today throughout the world [7,15, 17, 18].

2. Nanotechnological Applications in the Food Industry

Today, nanotechnology, which is a rapidly developing branch of science, has started to be used in many industrial areas as a result of studies and new inventions. In the food industry, one of these, nanotechnology has been started to be used for purposes such as monitoring of pollutants and microorganisms in foods, increasing shelf life, storing foods more effectively and for a longer time, adding food additives and preservatives to their structure [1,18, 19].

The food formed by the use of nanotechnology during the production, processing and packaging of foods is called nanofood. Today, the biggest problem we face in the field of food is the formation of diseases as a result of nutritional deficiencies caused by the low quality of available water and food, and the inadequacy of food supply. According to scientists, the solution to these problems lies in nanotechnological studies. It is predicted that with each nanotechnological invention to be made for the purification and improvement of water, increasing agricultural productivity, food processing, storage and

packaging, significant progress will be made in the fight against hunger and poverty [5,18, 22].

Nanotechnological applications in the field of food are basically grouped under four main headings. These are food processing and functional product development, which will be detailed below, transport and controlled release of bioactive substances, detection of pathogens and increasing food safety, is the development of packaging systems that will positively affect product quality and shelf life [2,10, 19].

2.1. Food Processing and Functional Product Development

By adding flavor, color and nutritional elements to foods through nanoemulsions and nanocapsules created as a result of nanotechnological studies, new functional foods developed in sensory and technological terms can be designed and produced [10,19].

Nanoencapsulation

It is a biological active packaging method that uses techniques such as nanoemulsification, nanocomposite and nanostructuralization to package very small, miniature size materials. Nanoencapsulation is frequently used in the production of functional foods in the food industry. These methods preserve the structure of antioxidants, vitamins, lipids and proteins, while at the same time increasing functionality and stability. With the nanocapsulation technique, protection against oxidation of foods, which is an important problem in the food industry, can be provided, the retention of volatile substances can be increased, taste and aroma can be improved, moisture-triggered controlled release and pH triggered controlled release can be achieved. In addition, important benefits can be obtained such as the continuous delivery of multiple active substances to food, increasing its stability and maintaining organoleptic properties for a long time [16,18, 23, 24].

Nanoemulsions

The mixture that is formed by the dispersion of two immiscible liquid substances in the form of droplets in one of the other is called an emulsion. Nanoemulsions, on the other hand, are emulsions formed by the dispersion of oil droplets between 10 and 100 nm, ie nono size, each surrounded by surfactant molecules in an aqueous continuous phase. Nanoemulsions are prepared using techniques such as emulsification-diffusion, emulsification-evaporation, solvent displacement and precipitation. To stabilize it, techniques involving emulsifier and their combination are required. Nanoemulsions in foods; They act as carrier systems of lipophilic compounds such as drugs, antioxidants,

flavorings, nutraceuticals and antimicrobial agents. In addition, nanoemulsions increase the bioavailability of encapsulated compounds. Generally, nanoemulsions are used in the production of salad dressings, aroma oils and sweeteners [4, 8,13, 18].

Apart from functional food production with nanoemulsion and nanoencapsulation techniques, nanotechnology; It is used in the development of nano-sized plant formulations in powder or emulsion form from traditional plants, removal of monovalent cations from food in liquid form, partial purification, disinfection and toxification of liquid food products [2,3, 9, 10, 11, 19, 20].

2.2. Transport and Controlled Release of Bioactive Substances

They are effective in using nanocapsules as carriers for nutrients such as protein, vitamins, minerals, essential fatty acids and antioxidants, and in transporting these nutrients to the necessary places in the body by protecting them against adverse environmental conditions. They prevent the conversion of bioactive substances into harmful components under the influence of environmental conditions during the processing, transportation and storage of foods. In addition, hydrophobic substances are soluble in water; they make hydrophilic substances soluble in oil [2, 9, 19, 20].

2.3. Detection of Pathogens and Increasing Food Safety

Sensitive food-borne nano-biosensors, produced by the use of various nano-structured materials and biological receptors by an integrated system, have been developed for the rapid detection of pathogens and food spoilers developing in foods. Silver nano colloids, magnetic beads, graphene oxide, plasmonic gold, carbon nanotubes and silver nanoparticles are widely used for detection of foodborne pathogens. In addition, synthetic DNA molecules are used to determine toxins and chemicals, marked with color-coded probes in the diagnosis of food pathogens under the nano-barcode name [2,3, 9, 11, 19, 20].

2.4. Development of Packaging Systems Positively Affecting Product Quality and Shelf Life

With nanotechnological studies to be done to extend the shelf life of the food and increase the quality of food; Nanoparticles can be added to the packaging materials such as titanium oxide (ti02) and silver. This increases the physical properties of both food and material. In addition, a structure adsorbing oxygen to the surface of the package, which is contacting the food is gained. Thus, antifungal and antimicrobial protection of food can

be achieved by creating an anaerobic media. Oxygen and carbon dioxide permeabilities can be limited by using various nanocomposite structures in packaging materials. Thus, the bad odors that may occur in food products are blocked, product freshness is protected and the shelf life can be extended [2, 9, 19, 20].

3. Nanotechnological Foods and Food Safety

It useful and harmful effects of products produced with nanotechnological materials designed as engineering product are not fully known because there is not enough research today. It is only possible to say something about the toxicity of nanotechnological materials. For this reason, there are many concerns about the possible negative effects of nanotechnology, whose applications in the food field are rapidly developing. Regulatory authorities of the United States, including the Food and Drug Administration (FDA), Environmental Protection Agency (EPA), European Health and Consumer Protection Agency, and safety assessment agencies, have published guidelines on the use and potential health risks of nanomaterials. Most of these risks are related to toxicity and have been identified by nanotoxicologists [12, 14, 18, 19].

CONCLUSION

Nanotechnology, which is one of the important discoveries in the field of science of the century we live in, shows rapid development in the field of food, as in all other fields. Today, nanotechnological applications in the food industry; It is used in many areas such as packaging, food control, food processing and development, and important developments are promised for the future with the studies carried out. From an economic point of view, it is predicted that the nano-food market, which was worth 30 billion US dollars in 2016, will reach an important numerical value in the world economy in the coming years. Increasing the number of researches on the production and consumption of nanotechnological foods and making the necessary national and international legal regulations will ensure that the nanotechnological food market will come to a much better place in the future.

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ID:74-BOP

Investigation of Production Potentials of Various Commercially Important Enzymes in Bacillus Species Isolated from Magnesite Mines

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Enzymes, which are a very important protein for living organisms, are widely used in many industrial areas, especially in the food, textile, paint, detergent and pharmaceutical sectors. Enzymes used for commercial purposes are generally obtained from microorganisms because their production is easier, faster, more economical, more environmentally friendly, and they can be produced in high amounts and purity by creating very few by-products. Every year, approximately 41% of protease enzyme, 10% of renin enzyme, 3% of lipase enzyme, 10% of cellulase and xylanase enzymes are obtained from microorganisms for industrial use. In this study, microorganisms isolated from magnesite mine, which is one of the important mines of our country in terms of reserve richness and diversity of usage areas, were used; 14 *Bacillus* species identified by conventional and molecular methods were qualitatively investigated in terms of their ability to produce industrially important amylase, lipase, xylanase, protease, cellulase pectinase and chitinase. As a result, it has been determined that many enzymes of industrial importance can be produced by *Bacillus* species obtained from the natural flora of magnesite mine.

Keywords: Magnesite, Enzyme, Bacillus,

ID:84-BOP

The Effect of Luteolin on the Elimination of Hydrogen Peroxide-Induced Oxidative Damage in Human Erythrocytes

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The aim of this study was to evaluate the capacity of the flavonoid derivative luteolin to alleviate the oxidative damage created in human erythrocytes exposed to hydrogen peroxide. Oxidative damage caused by free oxygen radicals causes lipid peroxidation in living cells, dragging the cell to apoptosis or necrosis, causing the cell to eventually lose its viability. Antioxidants produced by the body or taken exogenously are used to prevent oxidative damage in tissues, to eliminate or minimize damage. Flavonoids are among the radical scavenging agents taken exogenously. In this study, in order to determine the antioxidant effect / capacity of flavonoid derivative luteolin, it has high amount of unsaturated fat and haemoglobin and frequently exposed to oxidative damage. Erythrocyte cells were studied in ex vivo environment. Hydrogen peroxide (H_2O_2) was used as oxidant to expose erythrocyte cells to oxidative damage. To determine how oxidative damage in erythrocytes replaces luteolin, DMSO and H_2O_2 used only to dissolve the erythrocytes in the RPMI 1640 cell culture medium. Three different concentrations of luteolin were applied in combination with DMSO. After the experimental samples were incubated at 37 °C for 24 hours to simulate the body environment, lipid peroxidation levels were measured to determine the change in oxidative damage levels. The results showed that H_2O_2 significantly increased damage in cell upstream, causing oxidative damage. In groups where luteolin was added only with DMSO and DMSO, a significant and clear decrease in MDA levels was observed compared to the H_2O_2 group. The lowest levels of destruction in the cell membranes were measured in groups with flavonoid derivative.

Keywords: Oxidative damage, flavonoid, erythrocyte,

ID:85-BOP

The Effect of Flavonoid Derivative 6-Fluoroflavone on Mitigation of Hydrogen Peroxide Induced Oxidative Damage in Erythrocyte Cells

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Flavonoids that have a polyphenolic structure are considered as natural antioxidant substances. In addition, it is known that not only flavonoids, but also flavonoid derivatives formed by binding groups such as sugar, methyl, which bind to flavonoids, have antioxidant properties and even their activity increases. In the current study, it has been investigated whether the erythrocytes, which are damaged by oxidative damage by the use of flavonoid derivative 6-fluoroflavone, with hydrogen peroxide (H_2O_2), have an effect on the destruction of the cell membranes. Human erythrocytes were subjected to three concentrations of 6-fluoroflavone along with H_2O_2 and H_2O_2 in RPMI 1640 cell culture medium for 24 hours at 37˚C and then lipid peroxidation levels were determined. Dimethylsulfoxide (DMSO) used to dissolve 6-fluoroflavone in the working setup was also tested separately. H_2O_2 significantly increased the lipid peroxidation level of erythrocytes. All 6-fluoroflavone applications administered with H_2O_2 significantly reduced membrane damage. In the DMSO group, while lipid peroxidation was only lower than the H_2O_2 group, there was no decrease in 6-fluoroflavone applications. This shows that 6-fluoroflavone alleviates damage to membranes independently of DMSO.

Keywords: Flavonoid species, lipid peroxidation, erythrocyte,

ID:98-BOP

Hormonal Control of Osmoregulation in The Lake Van Fish (Alburnus tarichi, Güldenstädt, 1814)

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Lake Van is Turkey's largest alkaline lake. Lake Van fish (Alburnus tarichi Güldenstädt, 1814) is a vertebrate species living in the lake. During the breeding period (April-July), fish migrate from the lake to fresh waters while spending time in water areas with different physico-chemical properties. After completing its breeding migration, the fish returns to the hyper-alkaline and salt water environment of the lake [1].

Adaptation and regulation to the aquatic environment in fish is under the control of the endocrine system. Hormones increase or decrease the amount of water and ions taken into the body by the osmoregulatory organs [2].

Thyroid and cortisol hormones are the most important hormones controlling osmoregulation in fish. In this study, thyroid and cortisol hormone levels were investigated in fish in aquatic areas with different chemical properties during the reproductive migration of fish from Lake Van. As a result, it has been observed that the studied hormones are effective in the adaptation of the Van Lake fish to water.

Keywords: Van fish, Thyroid hormones, Cortisol, Reproductive migration.

Acknowledgements: This study was supported by YYU Scientific Research Projects Presidency with project number FYL-2019-7890.

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ID:125-BOP

Investigation of Siderophore-Producing Bacteria Isolated from Sainfoin (*Onobrychis sativa* L.)

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Sainfoin (*Onobrychis sativa* L.) is one of the most well-known forage crop in all over the world. Especially, this forage plant is grown in Central and Eastern Anatolia in Turkey. It is well adapted to cold and drought land conditions [1]. In this regard; most of the farmers have prefer to cultivation of this plant in our region Ağrı/Turkey, because of its beneficial nutrient content and growing under extreme climate conditions. However, in past decades, numerous detrimental effects have caused to decreasing of plantation of sainfoin such as soil born diseases, pesticisides and over usage of chemical fertilizers. Hence, as alternative approaches have been used to increase yield of agricultural products. Among these approaches, Plant growth promoting rhizobacteria (PGPR) are tried to fill this gap with its eco-friendly feature from last past decades. These microorganisms can be situated in the rhizosphere and rhizoplane which enhance plant growth promotion in the deficience of pathogens or decrease the hazardous effects of pathogens on crop yield by HCN production, antibiosis, induced systemic resistance and siderophore production.

Siderophore production by PGPRs have been attracted intensive attention with their beneficial properties and aproaches in various type of agriculture areas as struggling with plant diseases which caused by microorganisms, soil science *etc*. [2, 3]. In this perspective, soil samples for PGPR isolation studies were provided 5 different regions from sainfoin rhizosphere in Ağrı region. Then, dilution series (10^{-1}-10^{-7}) were spread on Luria-Bertani (LB) agar plates and single colonies were chosen further purification studies. And then, each isolate was inoculated onto Chrome azurol S (CAS) agar plates, the plates were incubated at 28 °C for 2-7 days. According to the colour alteration, colour from blue to orange around the bacterila colonies were determined as siderophore-producing bacteria. Finally, the molecular characterization of the potential PGPRs which have siderophore pruduction capabilities was carried out the 16S ribosomal RNA gene region sequence analysis method. The results were demonstrated that 5 isolates (*Bacillus* sp., *Bacillus pumilus*, *Arthrobacter* sp., *Enterobacter ludwigii* and *Pseudomonas* sp.) were isolated from sainfoin have huge potential to use for as biocontrol agents sainfoin agricultural applications.

Keywords: Sainfoin, siderophore production, 16S rRNA, PGPR

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ID:126-BOP

Soil Salinity and the Associated Effects in Mingbulak District, Fergana Valley in Uzbekistan

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Uzbekistan has a harsh continental climate with large daily and seasonal changes in temperature. Total agricultural land occupies 25.2 million hectares. Hence 4.3 million hectares of irrigated land. Soil salinity is one of the major soil constraint which can affect plant growth and the survival of soil organisms. The study aims to identify the soil salinity in Fergana valley and its relationship with the measured soil properties like humus, soil texture and silt content. The samples were air dried and the following soil properties were analyzed in the laboratory. Soil humus was determined using Tyurin Method, soil salinity by total soluble salts by evaporation of a soil water extract (TSS), and the soil texture using aerometric method. The soil salinity of the collected soil samples varied from 0.1% to 1.69 %. Based on salinity, the soils were included in non-saline , low saline and medium saline categories. The humus content of the soils varied from 0.36% to 1.45%. These were ranked as very low, medium and high categories. The soil texture included silt clay (11.11% of total samples), sandy clay (33.33% of the samples), sandy clay loam (33.33% of the samples) and sand loam (22.22% of the samples). The silt content of the soils varied from 10.3% to 53.3%. A significant positive correlation was observed between humus content and soil silt(r=0.57). Salinity and humus showed a negative relationship but it was not statistically significant(r=-0.38). Soil salinity in the region is a major problem and proper management measures need to be adopted. The monitoring of the salinity of the affected soils at regular intervals on a seasonal basis is very important and primary step. Scientific crop management also can be put forward as an efficient method for the management of saline soils.

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Acknowledgement: This work was supported by Ministry of Innovative Development of the Republic of Uzbekistan (Grant UZB-Ind-2021-93)

ID:128-BOP

The Endophytic Bacteria Associated with *Tetragonia tetragonioides* (Pall.) Kuntze Improves Salt Tolerance of Plants

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The diversity of cultivable endophytic bacteria associated with the halophyte New Zealand spinach (*Tetragonia tetragonioides* (Pall.) Kuntze) was studied and their plant beneficil properties were evaluated. The diversity of bacteria isolated from the leaves and roots showed that the isolates belonged to the genera *Agrobacterium, Stenotrophomonas, Bacillus, Brevibacterium, Pseudomonas, Streptomyces, Pseudarthrobacter, Raoultella, Curtobacterium,* and *Pantoea*. All bacterial isolates were salt-tolerant and grew in a nutrient medium supplemented with 4% NaCl. Isolates exhib-ited plant growth-promoting traits including the production of a phytohormone (indole-3-acetic-acid), cell wall degrading enzymes, hydrogen cyanide production. Furthermore, antag-onistic activity against plant pathogenic fungi *Fusarium solani, F. oxysporum, Botrytis cinerea, Pythium ultimum, Rhizoctonia solani* and *Alternaria alternate* was detected. Ten out of twenty bacterial isolates were able to synthesize ACC deaminase, which plays a vital role in decreasing ethylene levels in plants. Regardless isolated origin of bacteria, root or shoot tissue, they stimulated plant root and shoot growth under 200 mM NaCl condition. Our study suggests that halophytes such as New Zealand spinach are a promising source for the isolation of halotolerant plant beneficial bacteria that can be used to enhance the productivity of saline soil and support its remediation.

Acknowledgement: This research was supported by a Georg Forster Research Fellowship (HERMES), Alexander von Humboldt Foundation.

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MATHEMATICS
ORAL PRESENTATIONS

ID:39-MOP

One of the Cornerstones in Stem Approach

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Abstract

Unfortunately, students have less creative, innovative spirit needed to succeed in today's society as its more important than ever before outside of the workplace, too. How can we help young people develop as creative thinkers so that they're prepared for life in constant changed world? That's the central question of this research. There is extensive evidence that active learning works better than a completely passive lecture. STEM-based education teaches children more than science and mathematics concepts. Being STEM ambassadors 2021 in Kyrgyzstan we try to create active learning environments that foster student engagement. We test 1 year students' activity on "Medical biology, genetics, parasitology" subject. The focus on hands-on learning with authentic problems helps develop softs skills which sets them to be successful. The ability to think critically and challenge standards is the basis of innovation. In this work, we offer one tool to help faculty members implement active learning. This tool on the process of implementation elements that have been shown to increase student outcomes related to achievement, logic development, or other relevant learning goals with college-age students. This pedagogical approaches to transforming educational practice that seem better suited as it shown approximately 15% more activity then classical teaching lesson. Results are taken from not completed work's first topic: "Vaccine distribution challenge" for the 1st year medical students of IMF, Osh State University.

Keywords: STEM, teaching approach, inquiry, activity of students.

Introduction

There are no problems with deficiency of information, there is problem with curiosity of readers. These problems aren't visible by looking at students' grades and exam scores. In fact, many students are performing well according to traditional measures. Receiving excellent grades from elementary school through high school shows that despite their high

grades and test scores, didn't have the creative, innovative spirit needed to succeed in today's society.

There are no problems with deficiency of information, there is problem with curiosity of readers. Many students are performing well according to traditional measures. Receiving excellent grades from elementary school through high school shows that despite their high grades and test scores, didn't have the creative, innovative spirit. Creative thinking is needed outside of the workplace, too. The pace of change continues to accelerate in all types of activities, in all aspects of our lives. How can we help young people develop as creative thinkers so that they're prepared for life in this ever-changing world? That's the central question of this research.

Science, technology, engineering and mathematics (STEM) education puts an emphasis on preparing future generations to be successful in their careers. STEM-based education teaches children more than science and mathematics concepts. The focus on hands-on learning with real-world applications helps develop a variety of skill sets, including creativity and 21st-century skills.

The skills gained from STEM education extend beyond those needed to be successful in STEM fields, preparing children with varied interests who move into any industry to have valuable skill sets that allow them to be successful. The ability to think critically and challenge standards is the basis of innovation. Innovation is a critical component of economic growth. Innovative thinkers are the movers and shakers that have the potential to change the world.

Preparing today's children to become the innovators and inventors of tomorrow begins with STEM education programs. Being STEM ambassadors 2021 in Kyrgyzstan we try to create active learning environments that foster student engagement. We test 1 year students' activity on "Medical biology, genetics, parasitology" subject. There is extensive evidence that active learning works better than a completely passive lecture. Despite this evidence, adoption of these evidence-based teaching practices remains low. In this work, we offer one tool to help faculty members implement active learning. This tool on the process of implementation elements that have been shown to increase student outcomes related to achievement, logic development, or other relevant learning goals with college-age students. Thus, this tool both clarifies the research-supported elements of best practices for instructor implementation of active learning in the classroom setting and measures instructors' alignment with these practices. This tool is inquiry-based learning. It is an approach to teaching and learning that places students' questions, ideas and observations at the center of the learning experience. As Kuklthau, Maniotes and Caspari

said: "Inquiry ... requires more than simply answering questions or getting a right answer. It espouses investigation, exploration, search, quest, research, pursuit, and study. It is enhanced by involvement with a community of learners, each learning from the other in social interaction." Educators play an active role throughout the process by establishing a culture where ideas are respectfully challenged, tested, redefined and viewed as improvable, moving children from a position of wondering to a position of enacted understanding and further questioning.

From intuitive understandings and natural curiosity to knowledge creation – to a space where ideas can be transformed into formalized understanding and further questioning. As educators we are charged with the great challenge and responsibility of engaging students in learning so that they develop the skills and knowledge they need to function in today's world. Questions and concerns abound. How do we instill the skills and the values necessary to experience success in biology?

Authentic inquiry begins with questions and problems that students want to find out more about. Sometimes inquiry begins not with a question or problem, but with a shared experience – a social event, a field trip, a blog, a YouTube clip and a book – that elicits student curiosity and helps establish a common starting place of wonder for all class members. Whether inquiry begins with the student, teacher or a shared classroom experience, what matters most is that the initial query sparks student interest and provides the opportunity and resources for in-depth student investigations. Teacher can use a mystery box, video, great thinking question, task, diagram or graphic. As example given mystery box where shown five sides of box with a diamond, blue print, a cell, a virus, a banknote embedded in the boxes sides as an inquiry. There are the consequences of pictures, where students should guess what is possibly next, or between the line. Students should find out what is in mystery box. The Mystery box.docx Other examples you may see in following document. (full Lesson Plans).

Moreover, key characteristics of inquiry-based learning that offer promise in supporting students to become thoughtful, motivated, collaborative and innovative learners capable of engaging in their own inquiries and thriving in a world of constant change. Thus, this pedagogical approach to transforming educational practice that seem better suited as it shown approximately 15% more activity then classical teaching lesson. Results are taken from not completed work's first topic: "Vaccine distribution challenge" for the 1st year medical students of IMF, Osh State University. We try to do a rubric of assessments to compare effects of two approaches. Inquiry-based learning concerns itself with the creative approach of combining the best approaches to instruction, including explicit instruction and small-group and guided learning, in an attempt to build on students' interests and

ideas, ultimately moving students forward in their paths of intellectual curiosity and understanding. It provokes initiatives and real interests of students fostering them become problem solvers and enthusiastic in our changed world.

Conclusions

Continue to implement STEM tool as pedagogical approach to transforming educational practice.

Results are shown comparison as 15% more activity then classical teaching lesson.

To test the rubric of assessments to compare effects of two approaches.

To share inquiry-based learning concept with small-groups and guided learning, in an attempt to build on students' interests and ideas, ultimately moving students forward in their paths of intellectual curiosity and understanding.

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ID:46-MOP

Improving Regularization Techniques for Incompressible Fluid Flows via Defect Correction: Detailed Version

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We propose and investigate two regularization models for fluid flows at higher Reynolds numbers. Both models are based on the reduced ADM regularization (RADM) of [1]. One model, which we call DC-RADM (deferred correction for reduced approximate deconvolution model), aims to improve the temporal accuracy of the RADM. The second model, denoted by RADC (reduced approximate deconvolution with correction), is created with a more systemic approach of [6]. We treat the RADM regularization as a defect in approximating the true solution of the Navier-Stokes equations (NSE), and then correct for this defect, using the defect correction algorithm, introduced in [6]. Thus, the resulting RADC model can be viewed as a first member of the class that we call "LESC-Reduced", where one starts with a regularization that resembles a Large Eddy Simulation turbulence model, and then improves it with a defect correction technique. Both models are investigated theoretically and numerically, and the RADC is shown to outperform the DC-RADM model both in terms of convergence rates, and in terms of the quality of the produced solution.

Keywords: defect correction, regularization, large eddy simulation

ID:60-MOP

On Adjoint Curve of a Curve in Three Dimensional Weyl Space

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In this study, we defined the adjoint curve of a curve in three dimensional Weyl space. We also compared the Frenet apparatuses of these two curves. Then, we investigated the conditions to be general helix, slant helix for the adjoint curve and we expressed that the considered curve and its adjoint curve created Bertrand pair. Finally, we showed that the geodesic curvature vector field of the net which is occured by the Frenet vector fields of the considered curve is equal to the negative of product of the second curvature and the principal normal vector field of the adjoint curve and also the tendency of the principal normal vector field of the adjoint curve is equal to the second curvature of the adjoint curve.

Keywords: Weyl space, Prolonged covariant derivative, Adjoint curve,

ID:62-MOP

Higher Temporal Accuracy for LES-C Turbulent Models

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Large Eddy Simulations(LES) are widely used in modeling turbulent flows. In Labovsky(2020), a method called Large Eddy Simulation with Correction (LES-C) was proposed to reduce the modeling error. However, there was a need to reduce the Time discretization error of the LES-C models. Therefore, we propose a method that uses a predictor-corrector scheme called Deferred correction to reduce the Time discretization error. The method was obtained by adding extra terms to the LES-C model and there we can obtain extra accuracy with no additional computational cost. The method is tested for the ADC model (a member of the LES-C family) and the full numerical test is carried out where a clear reduction of errors can be observed. We also performed the full numerical analysis of the method.

Keywords: LES, LES-C, LES-C Turbulent Models

ID:79-MOP

Note on the Effect of Grad-Div Stabilization on Calculating Drag and Lift Coefficients

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In recent years, grad-div stabilization has become a popular technique for improving the mass conservation of a solution to the incompressible Navier-Stokes equations (NSE). Grad-div stabilization can be easily implemented in any code that already uses the very common Taylor-Hood finite elements. In this work we do a close review of the grad-div stabilized and modular grad-div stabilized NSE applied to a well-known benchmark problem: 2D flow around a cylindrical obstacle. We show that using large grad-div stabilization parameters can change the calculated drag and lift coefficients. We will then suggest a remedy for the given test problem and verify our results by comparing with Scott-Vogelius finite elements.

Keywords: Navier-Stokes Equations, Grad-Div Stabilization, Scott-Vogelius Finite Elements,

ID:108-MOP

Some New Fractional Order Integral Inequalities for Logarithmically Convex Functions

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In this presentation, firstly, we will give some historical backgorunds and further information about geometrically convexity, Riemann-Liouville fractional integral operators and general forms of proportional fractional integral operators. In the second part, we will use the general forms of proportional fractional integral operators to prove some new integral inequalities for integrable m-logarithmically convex mappings.

Keywords: fractional integral operators, integral inequalities, logarithmically convex functions,

AIR, SOIL, WATER, FOOD, HEALTHS
ORAL PRESENTATIONS

ID:56-BOP

Determination of Some Antioxidant Enzyme Levels in Hairdressing Workers in Van Province.

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Since the profession of hairdressing requires the use of a number of cosmetic products, hairdressers are professionally exposed to many dangerous chemicals. These chemicals act as free radicals in the body that damage compounds such as protein and DNA. When it comes to continuous exposure to chemicals, free radicals increase in humans and damage healthy cells over time. The increase in free radicals in the body slows down the antioxidant defense systems and leads to oxidative stress. In this case, dysfunction in body cells and tissues and various related diseases occur. These products can cause allergic dermatitis, asthma, rhinitis and even cancer when taken by skin or respiratory tract. Hairdressing-related cancers include lung, breast, ovarian, cervical, lymphoma, bladder, pancreatic, and salivary gland cancers. At the same time, hairdressers are exposed to electromagnetic fields as they constantly use blow dryers/hair dryers, which adversely affect health [1-4].

In line with this information, it was aimed to determine the levels of malondialdehyde acid (MDA), which is an indicator of oxidative stress level and the end product of lipid peroxidation, and superoxide dismutase (SOD), catalase (CAT) and reduced glutathione (GSH), which are known as some important antioxidants, in hairdresser workers in Van.
After obtaining the ethics committee approval for the study, 33 female hairdressers working in the central districts of Van (Edremit, Tusba and İpekyolu) were included in the study as subjects. Volunteer participants benefiting from hairdressing services were determined as the control group. Venous blood was taken from those who accepted the study, examined in the laboratory, and the results were statistically analyzed. Descriptive statistics and comparison results of the groups are summarized in Table 1. When Table 1 was examined, the difference between group averages for MDA, CAT, SOD and GSH was statistically significant ($p < 0.05$).

Table 1: Descriptive statistics and comparison results in the Hairdresser Staff and control groups

	Group	n	Mean±Std. Deviation	p
MDA	Hairdresser Staff	30	0,658632±0,0537978	0,001
	Control	33	0,270515±0,0555822	
CAT	Hairdresser Staff	30	0,13219±0,14007	0,001
	Control	33	0,254±0,01928	
SOD	Hairdresser Staff	30	41,732±18,942544	0,001
	Control	33	77,6904±9,870398	
GSH	Hairdresser Staff	30	0,0011868±0,00063783	0,001
	Control	33	0,0254815±0,01233310	

As a result, it can be said that hairdressers, whose professional lives will last for many years, are in the potential risk group in the formation of diseases such as eczema, asthma, cardiovascular diseases, cancer, in which reactive oxygen derivatives also play a role since they are constantly exposed to physical and chemical factors. Hairdresser employees should be encouraged to reduce risks.

Keywords: Antioxidant, Hairdresser, Van Province

Acknowledgement: The authors are grateful to the hairdresser employees and volunteer participants who participated in the study.

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ID:57-BOP

Frequency of Lung Cancer in Van Central Districts

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Lung cancer (Ca) is the second most common type of cancer after prostate cancer in men and breast cancer in women. The average 5-year survival for all stages is around 15%. The median age at diagnosis of lung cancer for both sexes is 70 (3,4). Cigarette is in the first place in its etiology, and Radon gas, which is a radioactive substance, is in the second place. In addition, asbestos, atmospheric carcinogens, passive smoking, previous lung infections, positive family history, dietary factors, occupational exposures are among the causes of lung cancer (5,1,6). Lung Ca consists of two main histological subtypes, non-small cell (NSCLC) and small cell (SCLC). Approximately 85% of all lung cancers are NSCLC and 15% are SCLC. As a treatment, surgery, chemotherapy (KT), radiotherapy (RT), immunotherapy and supportive treatments are applied alone or in combination (2,4,7).

In this study, our aim is to investigate the incidence of lung cancer in the central districts of Van (Ipekyolu, Tusba, Edremit). For this purpose, 162 patients in central districts who applied to Van Yüzüncü Yıl University Dursun Odabaş Medical Center between February 2014 and July 2021 and were diagnosed with Lung Ca were included in the study. File information (age, gender, histological sub-main type, smoking history, family history, treatment given) of 62 recent applicants was analyzed. SPSS statistical package program was used for statistical calculations.

When the data is evaluated; 43.2% of 162 patients reside in İpekyolu, 42.6% in Tusba and 14.2% in Edremit. The lowest mean age was found in İpekyolu (59.0857±12,48622) and the highest in Tusba (64.1594±12,66029). There was no significant difference between the districts in terms of gender. NSCLC in Ipekyolu district is 52.8%, SCLC in Edremit district is 36.8%, and most of the patients not identified histologically reside in Tusba district (60%). While there was no significant relationship between the districts in terms of smoking and family history, it was determined that there was a significant correlation in comparison with the histological type ($p<0.05$). When the type of treatment received was examined, the patients in İpekyolu district received the most KT, RT and Combined treatments

(40.9%, 50.0, 58.8%, respectively), which was statistically significant ($p<0.05$). In addition, it was observed that most of the patients who underwent surgical resection were in Tusba (57.1%).

It can be said that the current results in this study are compatible with the literature. Such retrospective studies support the prospective studies needed. Thus, regional risk factors can be determined and some preventive measures can be taken to reduce the incidence of Lung Ca and mortality trends.

Keywords: Lung Cancer, Statistics, Rate, Van Province

Introduction

Lung cancer (Ca) is the second most common type of cancer after prostate cancer in men and breast cancer in women. It is estimated that there are an estimated 1.6 million deaths from lung cancer each year in the world [10,11]. Asian countries closest to Eastern Europe, such as Armenia, Turkey and Kazakhstan, have the highest rates of lung cancer in the world [5]. In 2020, it ranks first with 41.264 (17.6%) out of 233,834 new cancer cases in our country. Of these, 34,207 (25.8%) are male and 7057 (7%) are female [1]. The median age of lung cancer diagnosis for both men and women is 70. About 53% of cases occur in individuals between the ages of 55 and 74, and 37% over the age of 75. The remaining 10% are under the age of 55. Since more than half of the patients have distant metastases at the time of diagnosis, overall survival in lung cancer is quite low despite standard treatments. It even has one of the lowest survival rates with liver and pancreatic cancer [10]. When the disease is limited to the lung, the 5-year survival rate is 45%, while the average 5-year survival for all stages is around 15% [12].

Smoking is responsible for about 85-90% of lung cancer. In our country, 90% of lung cancers occur due to smoking. Radon gas is the radioactive substance that plays a role in the etiology of lung cancer and takes the second place. The degradation products of this isotope emit alpha particles, which cause malignancy as these particles cause cell damage [20,2]. Concurrent tobacco smoking increases the risk of radon-induced lung Ca[10]. In addition, asbestos, outdoor atmospheric carcinogens, passive smoking, lung damage caused by inflammation and infection, a positive family history, dietary factors, occupational exposures (tire production, stone flooring, roofing, chimney sweep etc.) are also among the causes of lung cancer. Apart from these, infections such as human immunodeficiency virus (HIV) and human papilloma virus (HPV), Chronic Obstructive Pulmonary Disease (COPD), idiopathic pulmonary fibrosis and a history of tuberculosis have also been found to be associated with high risk [2,21].

Lung Ca consists of two main histological subtypes, non-small cell lung cancer (NSCLC) and small cell lung cancer (SCLC). Approximately 85% of all lung cancers are NSCLC and 15% are SCLC [15,12]. NSCLC among themselves; It is subdivided into adenocarcinoma, squamous cell carcinoma, and large cell carcinoma. Adenocarcinoma is the most common histology in non-smokers and is a heterogeneous peripheral mass with early metastasis. On the other hand, SCLC was determined as a persistent malignancy by the US National Cancer Institute due to the difficult pathophysiology of the disease, its aggressive clinical course, the poor prognosis of patients, and minimal improvement in the effectiveness of treatments in the last decade, and it has a strong relationship with smoking history [4,5,21].

The most common symptoms in patients with lung cancer (which may vary depending on the type of tumor and the extent of metastases); cough, weight loss, dyspnea, chest pain, hemoptysis, bone pain, clubbing, fever, fatigue, superior vena cava syndrome (VCSS), dysphagia, hypercalcemia, Cushing's syndrome, antidiuretic hormone syndrome, confusion, wheezing, stridor, etc. [20,21].

Among the diagnostic methods; anamnesis, physical examination, chest X-ray, Computed Tomography (CT), Magnetic Resonance (MR), Positron-Emission Tomography (PET-CT), Bone Scintigraphy, Bronchoscopy, tissue biopsy, sputum cytology, laboratory tests, etc. takes place [18,21].

In patients diagnosed with lung cancer, tumor-lymph node-distant metastasis (TNM) staging is used to determine individualized treatment options and to predict patient prognosis. Since lung Ca is a type that cannot be evaluated in cancer screening programs, it is rarely detected at the initial stage and the probability of early diagnosis is around 15% [18,1].
Surgery, Chemotherapy (CT), Radiotherapy (RT), İmmunotherapy and supportive treatments are applied alone or in combination in the treatment of lung Ca. In addition to factors such as age, performance status, gender, weight loss, the type of treatment to be chosen; It is preferred depending on different parameters such as the histopathological type and stage of the cancer [9, 23].

Although the incidence of lung Ca is increasing all over the world, morbidity and mortality have been improved for early stage lung cancer thanks to the application of effective targeted therapies and technological developments in the field of surgery and radiation. Surgical resection is preferred for Stage I, Stage II and IIIA NSCLC. Advanced NSCLC is treated with a multimodality approach that may include radiotherapy, chemotherapy, and palliative care. In SCLC, clinical examination of SCLC is difficult because the diagnostic biopsy specimens taken from the tumor are usually small and necrotic. Therefore, there are limited improvements in SCLC treatment with chemotherapy and radiotherapy [3,11, 4, 21,19].

In this study, we examined the incidence of lung cancer in the central districts of Van (İpekyolu, Tusba, Edremit) by including some parameters (age, gender, histological subtype, smoking, genetic characteristics).

Materials and Methods

The study area covers the borders of the central district of Van. Van province is located between 42° 40' and 44° 30' east longitudes and 37° 43' and 39° 26' north latitudes. On Turkey, Van, located in the closed basin of Lake Van in the Upper Murat-Van Section of the Eastern Anatolia Region, is Turkey's 6th largest province with a surface area of 19,069 km^2. The altitude is about 1725 m. Lake Van, Turkey's largest lake, is in a depression in the middle of high mountains [6]. Volcanic mountains such as Nemrut in the west, Süphan and Girekol in the north, Tendürek in the northeast and İncekaya in the southwest are located in the basin [14].

Between February 2014 and July 2021, 162 patients who applied to Van Yüzüncü Yıl University Dursun Odabaş Medical Center and were diagnosed with lung cancer and residing in the central districts of Van (İpekyolu, Tusba, Edremit) were included in the study. However, file information of a total of 62 patients could be accessed and analyzed (age, gender, histological sub-main type, smoking history, family history, treatment given).

In the study, project data supported by Van Yüzüncü Yıl University Scientific Research Projects Coordination Unit (BAP) was used (Project ID: 8412). Since it is a retrospective study, an informed consent form was not required.

Statistical Analysis:

Descriptive statistics for the features emphasized, for categorical variables; as numbers and percentages, for continuous variables; expressed as mean, standard deviation, minimum and maximum values. One-Way Analysis of Variance was used for comparisons. Principal Components Analysis was performed for the three-dimensional configuration of the variables thought to be effective on lung cancer. The statistical significance level was taken as 5% in the calculations and the SPSS statistical package program was used for the calculations.

Results

When the data is evaluated; Of 162 patients, 43.2% resided in İpekyolu, 42.6% in Tusba, and 14.2% in Edremit (Figure 1). The lowest mean age was found in İpekyolu

(59.0857±12,48622) and the highest in Tusba (64.1594±12,66029). There was no significant difference between the districts in terms of gender. NSCLC in Ipekyolu district with a rate of 52.8%, SCLC in Edremit district with a rate of 36.8% are the most commonly diagnosed species, and most of the patients who are not histologically identified reside in Tusba district (60%). While there was no significant relationship between districts in terms of smoking and family history, it was determined that there was a significant correlation in comparisons with histological type ($p<0.05$). For both diagnosis types, the rate of smokers is higher than non-smokers. While 75% of patients with NSCLC have a positive family history, 37.8% of patients with SCLC have a negative family history. When the type of treatment received was examined, most of the patients in İpekyolu district received combined treatment (58.8%), and most of the patients (36.4%) in Edremit district received KT, which is statistically significant ($p<0.05$). In addition, it was seen that most of the patients with surgical resection indication were in Tusba (57.1%). When the relationship between the diagnosis type and the treatment received was examined, most of the patients with NSCLC were treated with combined therapy (70.6%), most of the patients with SCLC (45.5%), and most of the patients with unspecified diagnosis were operated or recommended (42.9%).

The configuration of the variables thought to be associated with lung cancer in the study in three-dimensional space is given in Figure 2. As seen in Figure 2, it is seen that the gender variable, which is thought to be associated with lung cancer, has no effect on lung Ca, while other variables have an effect on lung Ca.

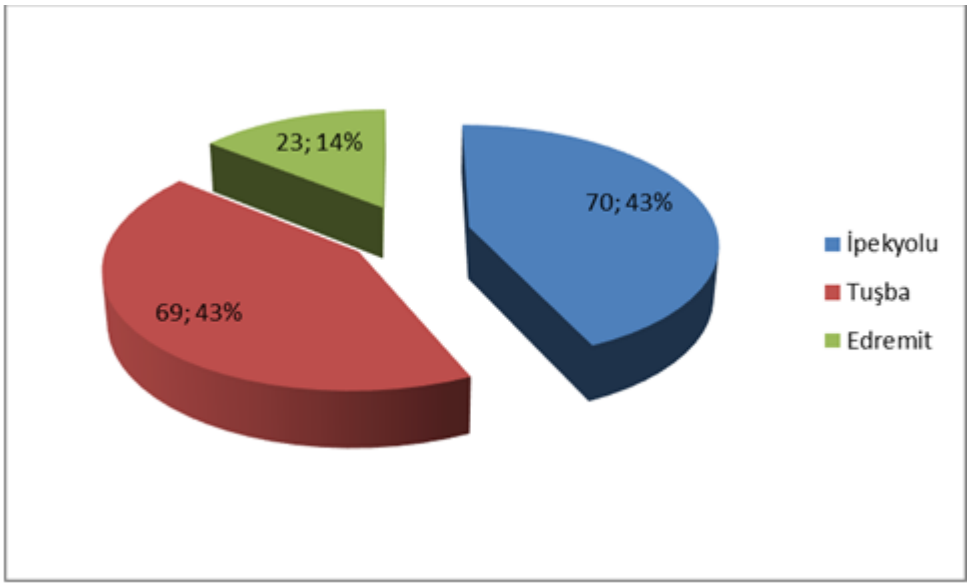

Figure1. Number and rate in districts

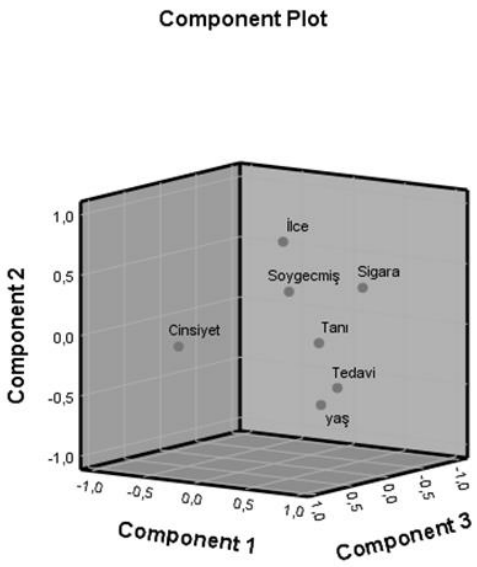

Figure 2. View of variables in three-dimensional space

Discussion

Compared to other organ cancers, lung Ca is not a cured type of cancer, but life expectancy is significantly longer when diagnosed in the early stages. It is reported that more than half of the patients with lung cancer consult a physician in advanced stages (stages 3b and 4). The standard treatment in early-stage NSCLC cases is surgery. It is stated that the combination of RT and CT is superior to RT alone in patients with NSCLC who are not suitable for resection in locally advanced stages. Due to the lack of information in the files in our study, the stage of the disease could not be determined. 70.6% of patients with NSCLC received combined treatment and reside in İpekyolu district. This suggests that the patients in the district may have applied to a physician in an advanced stage. SCLC, unlike other types, is highly sensitive to KT. In this study, 45.5% of patients with SCLC received KT and reside in Edremit. In the study of Öztuna et al., it was found that most of the patients with SCLC were given KT [23]. In addition, most of the patients in Tusba district were not diagnosed histologically or follow-up was recommended after surgical resection. The files of the patients whose treatment method was unknown for various reasons, or who applied to other centers at the diagnosis stage, were referred, and did not want to receive treatment, were not examined.

In the study of Chen et al. on lung cancer, it was determined that both incidence and mortality rates are in the first place in China, and these rates are higher in men than in women [16]. It is also in the first place in our country and is more common in men than in women [1]. Again, Jemal et al. found a higher incidence of lung Ca in young women, and stated that one of the reasons for this was that women were more likely to smoke menthol cigarettes and further studies were needed for other reasons. Menthol produces increased

dependency and decreased ability to quit in the person[8,10]. Although men were diagnosed more often than women in our study, no significant difference was found between the districts.

In a study investigating the incidence of lung Ca over 43 years, it was stated that female patients with lung cancer had a better survival rate than male patients, due to the fact that female patients underwent surgery more often than men [7]. It is known that surgery is the best chance for long-term survival in patients with lung cancer. Most of the patients who underwent surgery or were recommended in this study live in Tusba. Since it was not written whether the patients were alive or not in the hospital records, no finding related to survival could be determined.

Lung Ca incidence is inversely proportional to education level. It has also been shown that there is a correlation between low socioeconomic status and the incidence of lung cancer, suggesting the contribution of other environmental factors, including housing and occupational exposures[10]. In our study, because the profession and income level of the person were not written in the patient files, it could not be evaluated in this respect.

Since the province of Van is located in the eastern Anatolia region of Turkey, people living here mostly consume bread, rice, red meat, dairy products, vegetable and animal fats, and these foods are possible risk factors for the development of lung cancer [10]. Recently, vitamin E and selenium have been found to show promise in lung cancer prevention [24]. It has been proven that vitamin E protects the cell against lipid peroxidation and contributes to the prevention of cancer [13].

The incidence of cancer is higher in patients with Diabetes Mellitus (DM) than in the healthy population. One study reported that DM is an independent risk factor for lung cancer, but the increased risk is only in women [17]. Apart from this, it is associated with high risk in diseases such as HIV, HPV, COPD, Tuberculosis. In the current study, 3 out of 62 patients were diagnosed with COPD and 8 with Diabetes. Since uncontrolled diabetes negatively affects the prognosis of cancer patients, care should be taken in the treatment of diabetes in patients with cancer.

In a study investigating familial cancer history; A positive family history was found in 40% of 1500 patients with lung cancer, but it was found that there was no relationship between family history and histology[22]. In our study, most of the patients with NSCLC had a positive family history, while most of the patients with SCLC had a negative family history, but there was no significant relationship between the districts.

The median age at diagnosis of lung Ca for both men and women is 70. Approximately 53% of cases occur in individuals between the ages of 55 and 74[10]. In our study, the mean age was calculated as 61.3765±12.25912 for all districts.

Smoking is responsible for about 85-90% of lung cancers. In a study conducted in the USA, it was stated that the incidence of lung Ca decreased as a result of determined tobacco control policies[10]. In our study, the rate of smokers was found to be higher than non-smokers for both SCLC and NSCLC diagnosis types, but there was no significant difference between districts. It has been reported that approximately 110,000 deaths, including lung cancers, can be prevented each year when effective tobacco control is provided[2].

Radon gas is responsible for the development in 8-15% of patients with lung cancer, and it stands out as the main factor in certain regions [2]. Using the data of this study, we planned to carry out indoor radon gas measurements in the homes of patients with lung cancer residing in the central districts of Van.

Conclusions

NSCLC in İpekyolu district and SCLC in Edremit district are the most commonly diagnosed species, and most of the histologically unidentified patients reside in Tusba district. The rate of patients who received combined treatment in İpekyolu, the rate of patients who received KT in Edremit district, and the rate of patients who underwent or recommended surgical resection in Tusba district were found to be high. On the other hand, no significant difference was found between the districts in terms of gender, smoking and family history.

Suggestions

Lung cancer is a common type of cancer that is usually diagnosed in the metastatic stage and has a poor prognosis. In the global struggle, measures should be taken to prevent or reduce the use of all tobacco-related products, and information should be given to increase awareness in the society. Since early diagnosis of lung cancer positively affects survival, regular health screenings will reduce mortality, especially in populations at risk. In addition, some measures such as increasing the ambient air quality, avoiding passive smoking, healthy eating, airing the houses frequently to reduce indoor radon, early treatment in lung infections, use of personal protective equipment in occupational exposures will reduce the incidence of lung Ca.

Recording the patient's information completely (profession, income level, education level, passive smoking, disease stage, etc.) and adding it to the records after hospitals reach the patient's relatives at regular intervals and find out whether the patient is alive or not will create a better data source for expanding such studies.

Acknowledgement: The study was supported by Van Yüzüncü Yıl University Scientific Research Projects Coordination Unit (BAP) (Project ID: 8412).

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ID:124-BOP

Chlorophyl Analysis in Determination of the Lipoic Acid Effects in Bread Wheat Plants Applied Heavy Metal

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It is known that have become an environmental problem for all organisms from plants to humans of heavy metals, which have recently started to accumulate in ecosystems due to industrial activities, pesticides and fertilization in agriculture. This problem against is used to various materials especially protect plants. Lipoic acid (LA) is an important cofactor for energy metabolism, naturally synthesized in almost all living things. Due to lipoic acid properties such as removing free radicals and chelating metals in living beings under environmental stress, it is called the antioxidant of antioxidants by interacting with antioxidants [1]. In our study, Copper (Cu), Lead (Pb) and Aluminum (Al) heavy metals were applied to bread wheat plants and the protective properties of lipoic acid were analyzed by chlorophyll analysis. For each application, the SPAD value of the chlorophyll amount was created with the SPAD-502 Plus instrument from the middle parts of the 5 repetition selected plants in each replication, so that they do not come into the middle vein of the uppermost leaf. As a result, an increase in SPAD value was observed in parallel with the dose increase of LA application. It was also determined that heavy metal stress increase (30.733), the SPAD value compared to the control and lipoic acid applied under heavy metal stress caused decreased (13,063) an in SPAD values depending on varying concentrations.

Acknowledgement: This work was supported by Research Fund of the Bayburt University

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ID:131-BOP

Important Biological Values of Birecik - Karkamış Districts and Their Contribution to Biotourism

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In this study, the important species that need to be protected in Birecik and Karkamış districts and their effects on tourism are emphasized. In scientific sources, it is stated that the first agricultural activities in the world begins in southeast Turkey. For this reason, the oldest civilization remains are expected to come from this region. There is a lot of evidence in the region to support this idea. Göbeklitepe and Zeugma are the main these works.

The fact that the first agricultural and domestication activities started in this region after the last ice age gives an idea about the nature of the region. It is understood that the natural living conditions of the region are suitable for these activities. This situation also provides information on the richness of biodiversity in the area. As a matter of fact, there are many figures of wild animals in the historical artifacts in the region. Based on these data, we can say that the region is an exceptional place for living things.

The richness of species in the region is also reflected today. Some species seen in Anatolia continue to live only in this region today. Birecik and Karkamış districts on both shores of the Fırat River are the leading areas in the region with regard to living things. The bald ibis (Geronticus eremita), which is endangered worldwide, lives in this area as a semi-wild. The population of the Fırat turtle (Rafetus euphraticus) is increased density in these sections. Pallid Scops-owl (Otus brucei) lives in old tree cavities in a small woodland in Birecik district center. Desert monitör (Varanus griseus), one of the giant lizards, and the striped hyena (Hyaena hyaena), whose numbers are very low, are the creatures seen in the area. The region has a rich fauna with these species. The bald ibis station is one of the leading point in Turkey biyoturizm. Many tourists come to see the species. In order for tourism to become widespread in the region, other species should also be introduced. The sustainability of tourism will only be possible with strict protection of the species in the area.

Keywords: Bald ibis, Birecik, Fırat turtle, Karkamış, Pallid Scops-owl

NANOTECHNOLOGY
ORAL PRESENTATIONS

ID:32-NOP

Electrochemical Synthesis of Pd Particles Decorated Cu_2S Nanobelts as Novel Electrocatalysts for Hydrogen Evolution Reaction

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Abstract

Increasing need for energy around the world, decrease in fossil fuel reserves that meet this need, and problems such as global warming necessitate the searches for renewable, cheap and clean energy resources. Hydrogen is basically formed by the decomposition of water and is a good alternative to fossil fuels in terms of both its manufacturability and not releasing harmful gases into the atmosphere after its usage. Herein, we present electrochemical synthesis of palladium decorated copper(I) sulfide nanobelts (Pd/Cu_2S NBs) as novel catalysts for hydrogen evolution reaction (HER). The X-ray powder diffraction spectroscopy, X-ray photoelectron spectroscopy and field emission scanning electron microscopy were used for the analytical and morphological characterizations. The reported electrocatalysts properties of Pd/Cu_2S NBs were obtained via linear sweep voltammetry in an aqueous 0.5 M H_2SO_4 electrolyte. The HER potential at 10 mA cm^{-2} was established to be −205 mV which is attributed a good electrocatalytic activity for hydrogen production in acidic solution.

Keywords: Hydrogen Energy, Electrocatalyst, Electrochemical Synthesis, Palladium, Copper(I) sulfide

Introduction

Among the existing fossil fuels such as coal and petroleum, hydrogen stands out as a reliable, accessible, clean and inexhaustible fuel source. The most common method used for hydrogen production is the electrolysis of water [1]. Hydrogen production from water by electrolysis is a cheap, sustainable and eco-friendly method [2]. The energy required for

the electrolysis of water is tried to be reduced with the usage of electrocatalyst in scientific research. The main factors determining the performance of the electrocatalysts are stability and high efficiently. In the literature, using electrocatalysts of the Pt-group metals (such as Pt, Au, and Pd) was achieved excellent performance for HER [3,4]. Pd is widely used as an easily re-separated electrocatalyst in chemical reactions, especially organic. It has been reported that catalyst can be recycled and used several times with an excellent activity [5]. Metal sulfides (Cu_2S, CdS, ZnS, etc.) composed of S elements have less positive valence band occupied by S 3p orbital and small effective mass carriers leading to appropriate energy band structure and fast charge carrier dynamics [6]. Copper-rich (Cu_2S) with a unique p-type semiconducting and nontoxic nature has excellent thermoelectric and optoelectronic properties which allow it to use in many promising applications like biomedical and energy. Hydrothermal, solvothermal, microwave irradiation, thermolysis and template assisted approaches are the synthetic methods previously reported for Cu_2S nanostructures [7].

In this study, we report an electrochemical synthesis route to fabricate Pd/Cu_2S NBs. The analytically and morphologically characterized material was used as an electrocatalyst for HER.

Material and Methods

All electrochemical syntheses were actualized in a three electrode cell (the working electrode fluorine doped tin oxide (FTO) coated glass, the counter electrode Pt wire (approximately 99.95% purity, 0.5 mm diameter) and reference electrode Ag/AgCl). X-ray diffractometer (Cu-Kα (λ=15.405 Å) (XRD) and X-ray photoelectron spectroscopy (XPS) (with an Al Kα X-ray (1486.6 eV) source) were used for structural analyzes. Morphological structures of the materials were determined by using Scanning electron microscope (SEM).

Electrochemical Synthesis of Cu_2S Nanobelts

The FTO electrodes were cleaned before all electrochemical processes via ethanol and distilled water, respectively. A mixture solution containing 50 mM $CuCl_2$, 50 mM thiourea and 0.1 M NaCl was used for electrochemical synthesis of Cu_2S nanobelts. Figure 1 shows a typical cyclic voltammogram (CV) obtained in this aqueous solution at a scan rate of 100 mV s^{-1}. Electrodeposition was ensured by cyclic voltammetry via stepping the potential from 0.2 to -1 V with 20 cycles.

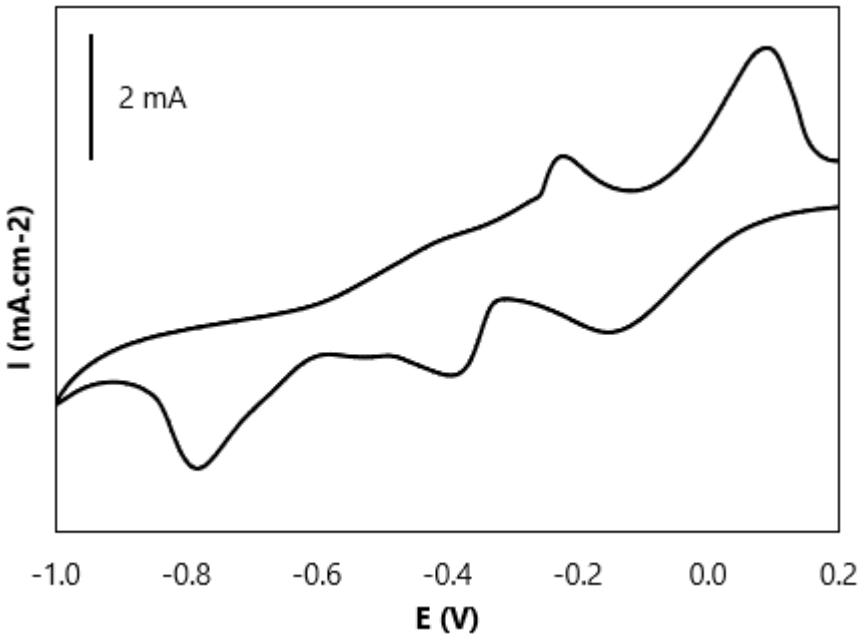

Figure 1. CV of FTO electrode in mixture solution at a scan rate of 100 mV s^{-1}.

Pd Particles Decoration

The electrochemical deposition method was used for this process, also. A solution containing 2 mM $Pd(NO_3)_2$ and 0.1 M HCl was used for the decoration of Cu_2S nanobelts with Pd particles. Pd decoration was performed at a constant potential of −0.2 V for 15 min.

Results And Discussion

Characterization of Pd Particles Decorated Cu_2S Nanobelts

The surface morphology of the electrochemically synthesized materials were determined by SEM. SEM images of Cu_2S NBs and Pd/Cu_2S NBs are shown in Figure 2 and Figure 3. Before decoration, a homogeneous morphology was observed whose has nanobelts structures, clearly (Figure 2). Figure 3 shows the Pd/Cu_2S NBs. The images exposes the Pd particles grew as clusters formed by the integration of nanoparticles.

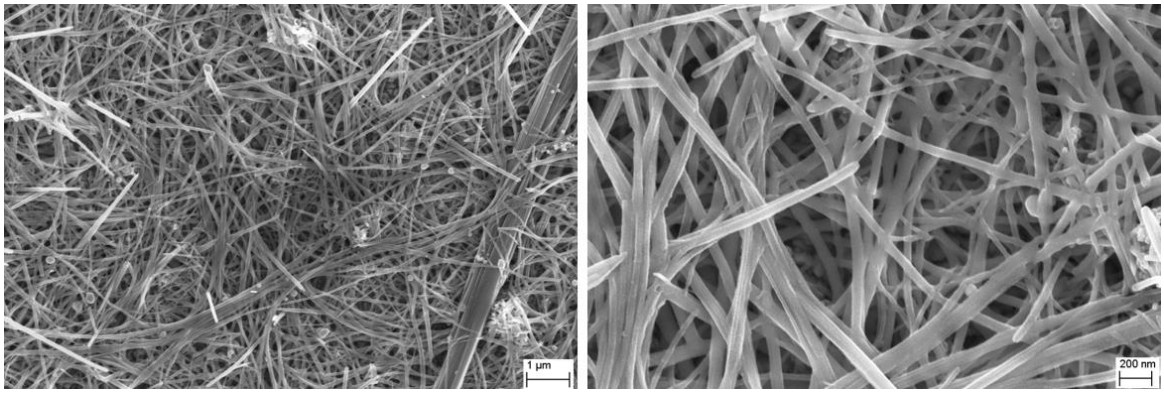

Figure 2. SEM images of Cu_2S NBs.

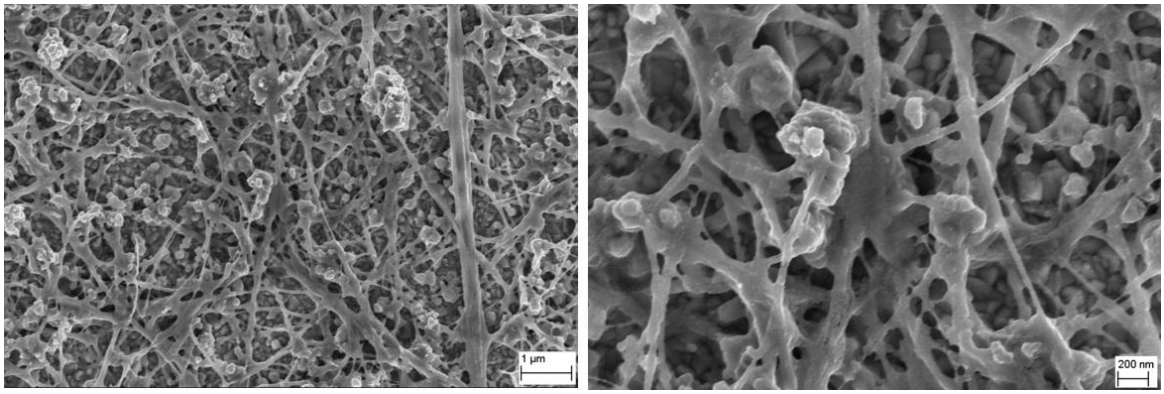

Figure 3. SEM images of Pd/Cu_2S NBs.

XRD spectroscopy was utilized to examine the crystalline structure of Pd/Cu_2S NBs (Figure 4). The observed peaks at 2θ=26.4° and 54.6° corresponds to Cu_2S (JCPDS No. 36-1451), while 2θ=42.9° corresponds to the (200) plane of Pd (JCPDS No. 05–0681). There are no other diffraction peaks except for assigned to FTO, were detected in the XRD spectra.

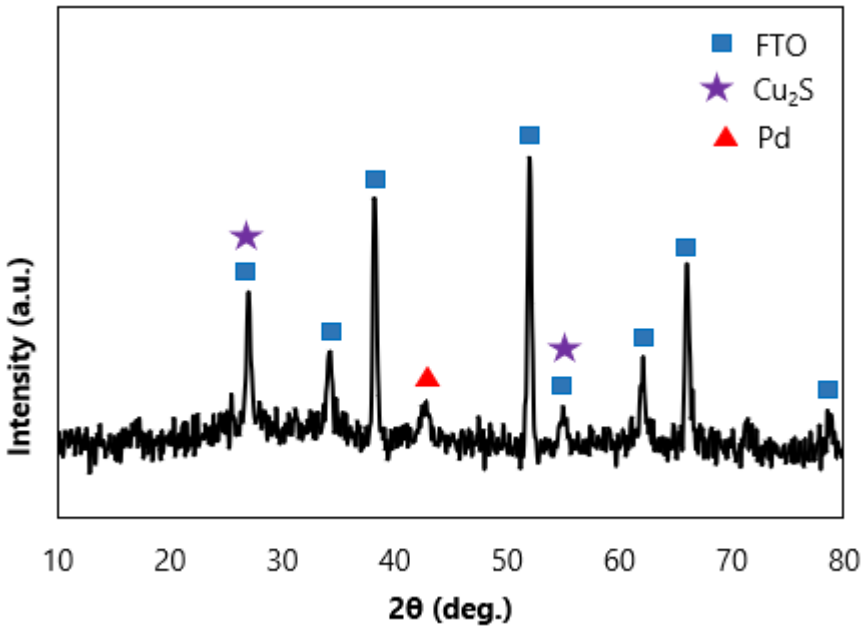

Figure 4. XRD patterns of Pd/Cu_2S NBs.

XPS measurements were used to analyze the surface composition of Pd/Cu_2S NBs (Figure 5). The position of the XPS peaks were calibrated with reference C 1s binding energy (BE) (284.8 eV). The detected photoelectrons at 932.5, 952.3 and 161.9 eV are related as Cu 2p1/2, Cu 2p3/2 and S 2p3/2 valence states of Cu_2S, respectively [8]. Two main peaks of Pd 3d5/2 (at 334.9 eV) and Pd 3d3/2 (at 340.1 eV) are related to the metallic state of Pd 3d [9]. This binding energy levels are consistent with previous studies and promotes the formation of the Pd/Cu_2S NBs.

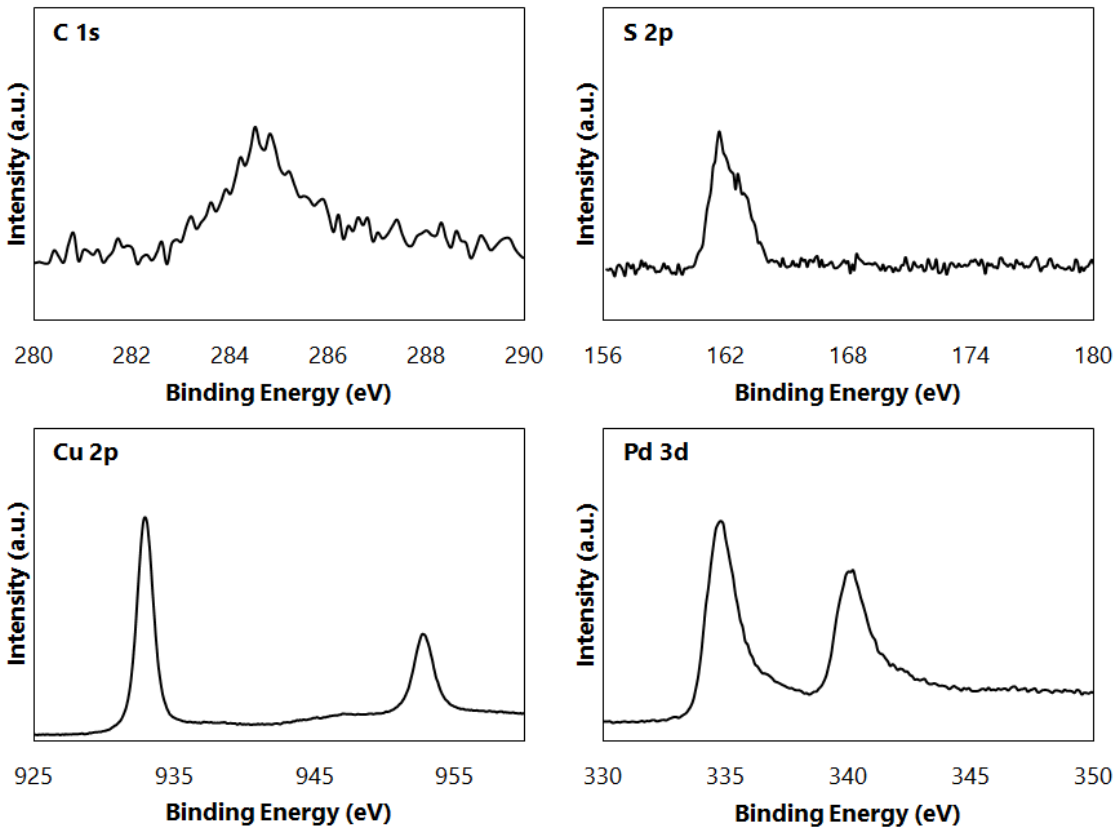

Figure 5. Core level XPS spectrums of Pd/Cu_2S NBs.

HER Activity

Figure 6 shows the linear sweep voltammetry (LSV) results obtained in 0.5 M H_2SO_4 at a scan rate of 10 mV s^{-1} for Pd/Cu_2S NBs, Cu_2S NBs and Pt (as reference) electrodes, respectively. LSV result indicates that, Pd/Cu_2S NBs exhibit a good HER potential at 10 mA cm^{-2} current density (-205 mV), whereas the HER activity of the reference Pt electrode was -82 mV. The obtained potentials show that Pd particles decoration increases the electrocatalytic activity of Cu_2S NBs and Pd/Cu_2S NBs display a good electrocatalytic activity as novel electrocatalysts for hydrogen production in acidic solution.

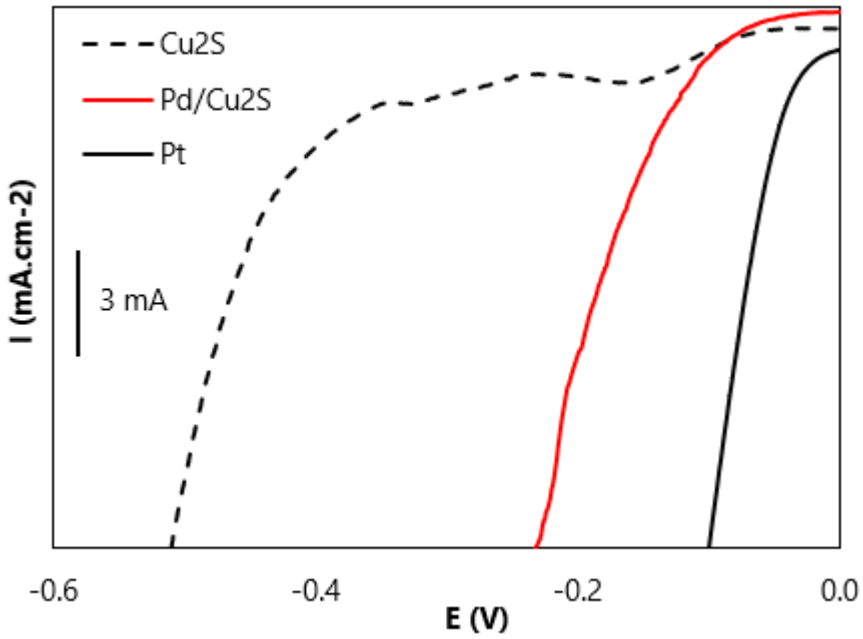

Figure 6. LSVs of Pd/Cu_2S NBs, Cu_2S NBs and Pt electrodes

Conclusions

In this study, a facile electrochemical synthesis route was proposed to fabricate Pd/Cu_2S NBs. The synthesized materials were characterized by using XRD, XPS and SEM techniques. The formation of composition was successfully demonstrated. HER potentials obtained with the usage of LSV showed that Pd/Cu_2S NBs display a good electrocatalytic activity (-205 mV at 10 mA cm^{-2} current density). Hence, this study presents new evidences for the synthesis of promising novel electrocatalysts for HER.

Acknowledgement: This research was financially supported by Atatürk University.

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ID:67-NOP

Purification of Carbonic Anhydrase Enzyme with Sulfanilamide Bonded Magnetic Nanoparticles

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Enzymes are widely used in industrial processes and scientific research. Therefore, high purity purification of enzymes in a fast and inexpensive way is very important economically. The aim of this study is to develop a new, cheap, reusable and magnetic based material to purify the carbonic anhydrase (CA) enzyme in a short time with high efficiency. In the first part of the study, Fe_3O_4 magnetic nanoparticles (MNP) was first synthesized. MNPs were coated with silica using the tetraethyl orthosilicate (TEOS) in the second step and $Fe_3O_4@SiO_2$ was obtained. In the third step, -NH_2 group was added to the surface of $Fe_3O_4@SiO_2$ by the APTES ((3-Aminopropyl) triethoxysilane) and $Fe_3O_4@SiO_2$-NH_2 was produced. In the fourth step, -NH_2 of $Fe_3O_4@SiO_2$-NH_2 and -COOH group of Phloretic acid (PA, 3-(4-hydroxyphenyl) propionic acid) were covalently bounded using EDC (N-(3-Dimethylaminopropyl)-N′-ethylcarbodiimide hydrochloride) and NHS (N-hydroxysuccinimide) activators and $Fe_3O_4@SiO_2$-PA were obtained. Finally, the diazonium salt of the sulfonamide (SA) in which the carbonic anhydrase enzyme has affinity is bound to the aromatic ring of phloretic acid found in $Fe_3O_4@SiO_2$-PA to synthesize $Fe_3O_4@SiO_2$-PA-SA. The final particle ($Fe_3O_4@SiO_2$-PA-SA) was characterized by SEM, TEM, XRD and FT-IR. In the second part of the study, carbonic anhydrase (CA) enzyme from erythrocytes was purified by using $Fe_3O_4@SiO_2$-PA-SA. The obtained CA was checked for purity by SDS-PAGE and the enzyme was found to be of high purity.

Acknowledgement: This work was supported by TÜBİTAK. Kübra Solak has a scholarship for her PhD from 100/2000 program of Turkish Higher Education Council (YÖK).

Keywords: Purification, Magnetic Nanoparticles, Carbonic Anhydrase,

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ENGINEERING
ORAL PRESENTATIONS

ID:13-EOP

Effect on Heat Transfer of Al2O3-water Nanofluid in a Zigzag Channel with Baffles

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Abstract

In this study, the effects on heat transfer and friction factor of Al_2O_3-water nanofluid in a zigzag channel with baffles were numerically investigated. In simulations, mass, momentum and energy equations are discretized with finite volume approach and iterations are solved with SIMPLE algorithm. In the study, Reynolds number ($200 \leq Re \leq 1600$), and nanoparticle volume ratio ($0.01 \leq \varphi \leq 0.03$) were changed, and other parameters kept constant. The lower and upper zigzag walls of the channel were kept at constant temperature, and the Nusselt number and friction factor along the channel were calculated. In order to observe the effects of the parameters examined, contours of velocity and temperature in the channel were obtained. The numerical results show that the nanofluids contribute significantly to the heat transfer improvement, especially the increasing nanoparticle volume fractions at high Reynolds numbers significantly improve the heat transfer, while the friction factor increases slightly.

Keywords: zigzag channel, baffle, nanofluid, heat transfer, friction factor.

Introduction

In engineering applications, heat transfer improvement is an important research area as it contributes to the efficiency of thermal devices. Passive and active methods are widely used to increase heat transfer without reducing the overall efficiency of these devices. Passive methods are applications such as in-channel baffles, bent band, vortex generators and special surface geometries. These applications, which do not require an external power, are preferred in evaporators, condensers, gas turbine cooling, nuclear reactors, heat exchangers, solar air heaters. This method is economical and reliable compared to other techniques as it has no moving parts and does not require any external energy [1-8]. Promvonge et al. [9] experimentally investigated the heat transfer performance in a channel where inclined horseshoe baffles were used and reported that the heat transfer

increased by approximately 92-208% and the friction factor increased by 1.76-6.37 compared to straight channels. Kumar et al. [10] experimentally studied the heat transfer behavior of the solar air channel using multiple V-type baffles. Sahel et al. [11] reported that the different baffle design in a rectangular channel improved heat transfer by 65%.

In order to improve heat transfer, corrugated channels of different geometries have been studied experimentally and numerically by many researchers. The corrugated surfaces have a significant effect on heat transfer enhancemet as they both increase the surface area and provide self-flow oscillation, but these channels increase the pressure drop compared to straight channels [12-14].

Fluids containing water, ethylene glycol, and oil, widely used in industrial applications, have low thermal properties. New technologies are used to improve the thermophysical properties of such conventional coolants. One of these techniques is the addition of nano-sized solid particles with high thermal conductivity to the base fluid. Some researchers have used nanofluids together with other passive techniques [15-17]. Manca et al. [18] examined the heat transfer for the $20.000 \leq Re \leq 60.000$ of Al_2O_3-water nanofluid at different rib heights, at 0% to 4% nanoparticle volume ratios in a channel where homogeneous heat flux was applied to the walls. As a result, they reported that as the Reynolds number and particle volume ratio increased, the heat transfer improved and at the same time an increase was observed in the pumping power. Heshmati et al. [19] numerically studied the mixed convective heat transfer in the $50 \leq Re \leq 400$ with the baffles of different geometries at varying particle volume ratios ($0.01 \leq \phi \leq 0.04$) of different nanofluids. As a result, it has been shown that nanofluids with high particle volume ratios and small nanoparticle diameter significantly improve heat transfer. Ajeel et al. [20] numerically studied the flow and heat transfer properties of ZnO-water nanofluid for turbulent flow with L-shaped baffles in a curved corrugated channel and reported that baffles and nanofluids increase heat transfer. Menni et al. [21] carried out the dynamic and thermal behaviors of nanofluids in turbulent flow conditions by using baffles at different angles in the channel and reported that the highest thermal improvement was obtained when vertical baffles were used at high Reynolds numbers.

There are many studies in the literature examining the combined effect of passive heat transfer applications. However, the high number of parameters used has increased the efforts to find the optimum parameters and new studies are needed on this subject. Therefore, in this study, the effects on heat transfer and friction factor of Al_2O_3-water nanofluid in a zigzag channel with baffles was numerically investigated.

Numerical Study

In Figure 1, the geometry of the zigzag channel with baffle used in this study is given. At the entrance and exit of the channel, there is an unheated flat section L_1 = 0.2 m. The height of the channel (H) is 19 mm and the total length of the zigzag channel is L_2 = 0.229 m. The length of zigzag section is considered as S = 1.5H and the thickness as t = 3 mm. The lengths of the baffles are t_2 =6 mm, t = 3 mm and the thickness of the baffles is t_1 = 0.5 mm. Other geometric parameters were kept constant in the studies.

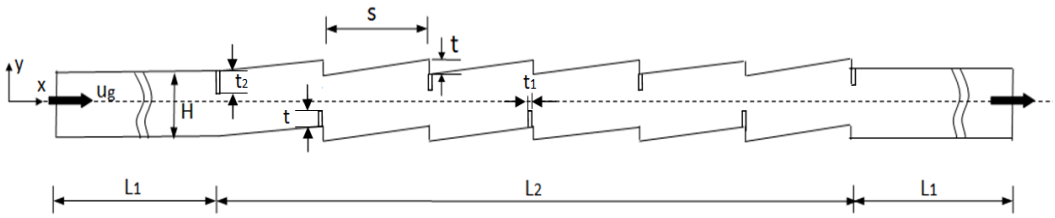

Figure 1. Geometry of the numerical model

Al_2O_3-water suspension was considered as the nanofluid, and three different nanoparticle volume fractions (φ= 1%, 2% and 3%) were used. Simulations were applied for a certain range of Reynolds number (200 ≤ Re ≤ 1600) under laminar flow conditions.

The flow in the channel was considered to be fully developed, laminar, incompressible, two-dimensional, steady, Newtonian type and single-phase. The heat transfer with gravity and radiation has been neglected. The equations used according to these assumptions are given below;

$$\frac{\partial u_i}{\partial t} + \nabla(\rho u) = 0 \tag{1}$$

$$\frac{\partial u_i}{\partial t} + \frac{\partial (u_i u_j)}{\partial x_i} = -\frac{\partial p}{\partial x_i} + \frac{1}{\mathrm{Re}} \nabla^2 u_j \tag{2}$$

$$\frac{\partial T}{\partial t} + u_i \frac{\partial T}{\partial x_i} = \frac{1}{\mathrm{Re}\,\mathrm{Pr}} \nabla^2 T \tag{3}$$

Computational Fluid Dynamics (CFD) based Fluent 15. 0 [22] program was used for numerical solution. The equations were solved using the SIMPLE algorithm and the terms

convection and diffusion were discriminated using a second order forward difference scheme. The convergence criterion was taken as 10^{-6} for all equations. Various tests were applied for grid independence at cell numbers of 38.624, 55.346, 76.409, 98.114, 122.793 and 76.409 cell number was used in this study.

The thermo-physical properties of nanofluids were obtained as follow (density by Eq. (4) and specific heat by Eq. (5) [23], thermal conductivity by Eq. (6) and viscosity by Eq. (7) [24].)

$$\rho_{nf} = (1-\varphi)\rho_{bf} + \varphi\rho_{pt} \tag{4}$$

$$c_{nf} = (1-\varphi)c_{bf} + \varphi c_{pt} \tag{5}$$

$$k_{nf} = k_{bf}\frac{[k_{pt} + 2k_{bf} - 2\varphi(k_{bf} - k_{pt})]}{[k_{pt} + 2k_{bf} + \varphi(k_{bf} - k_{pt})]} \tag{6}$$

$$\mu_{nf} = \mu_{bf}[123\varphi^2 + 7.3\varphi + 1) \tag{7}$$

The water was used as the base fluid. Thermo-physical properties of Al_2O_3 nanoparticle and water were given in Table 1.

Table 1. Thermo-physical Properties of Al_2O_3 Nanoparticle and Water

	ρ [kg/m³]	**c [j/kgK]**	**k [W/mK]**	**μ [kg/ms]**
water	998	4182	0.613	0.001003
Al_2O_3	3970	765	37	-

The fluid temperature at the channel inlet is T_o = 293 K. At the channel entrance, the "velocity inlet" boundary condition is defined. Fully developed flow was accepted at the outlet and "outflow" boundary condition was applied. The lower and upper surfaces of the zigzag channel were preserved at an constant temperature of T_w = 340 K and the non-slip boundary condition for the channel walls was defined. A non-slip and adiabatic boundary conditions were applied for the straight section at the entrance and exit of the channel.

Results and Discussion

For the validity of the numerical solution, the this study was compared with the experimental result of Meyer and Abolarin [25]. A straight channel with a diameter of 19 mm was used and a constant heat flux of 2 kW was applied to the channel surfacies. The heat transfer coefficient was calculated with x / D distances along the channel for Re = 1331. The agreement between the results of both studies was shown in Figure 2.

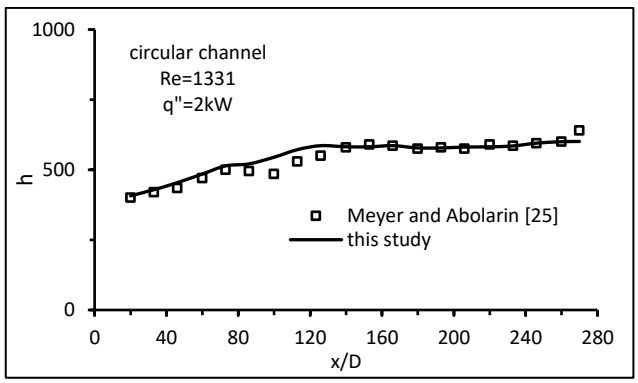

Figure 2. The validity of the numerical solution

In this section, the velocity and temperature and vortex structures are obtained in the channel to explain the flow and heat transfer mechanism. In Figure 3, the temperature, velocity and vortex structures are given for Re = 200 (Fig.3a) and Re = 1600 (Fig.3b) at a constant particle volume fraction (φ=0.02). It can be seen that the zigzag channel structure and baffles significantly affect the flow and temperature fields depending on the Reynolds number. It is shown that the baffles cause flow oscillation within the channel. Increasing Reynolds number leads to heat transfer enhancement by increasing seconder flow structures in the channel.

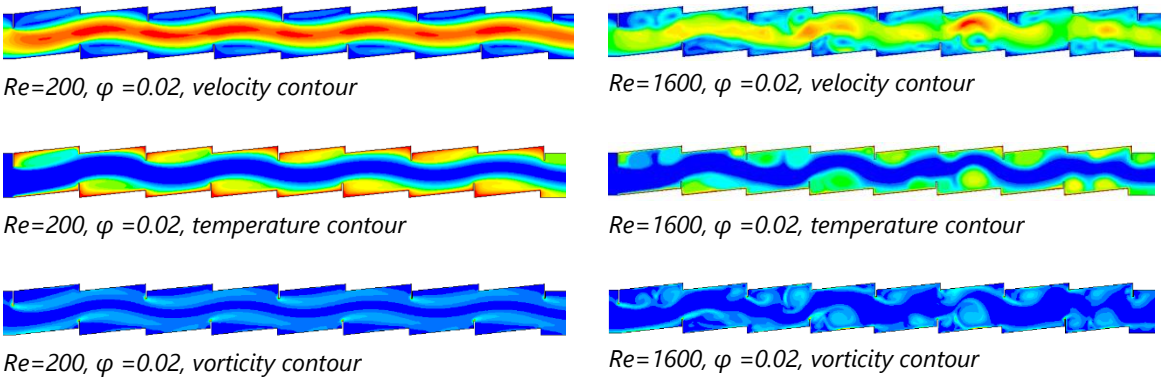

Figure 3. The velocity, temperature and vortex structures at a constant particle volume fraction (φ=0.02), **a-**Re = 200, **b-** Re = 1600

In Figure 4, the velocity structures (Fig. 4a) and temperature structures (Fig. 4b) were given for Re = 1400 at different particle volume fraction. The particle volume fraction was not significantly change the flow structure, but it was seen that the temperature in the channel surfaces decreased with the increase of the particle volume fraction.

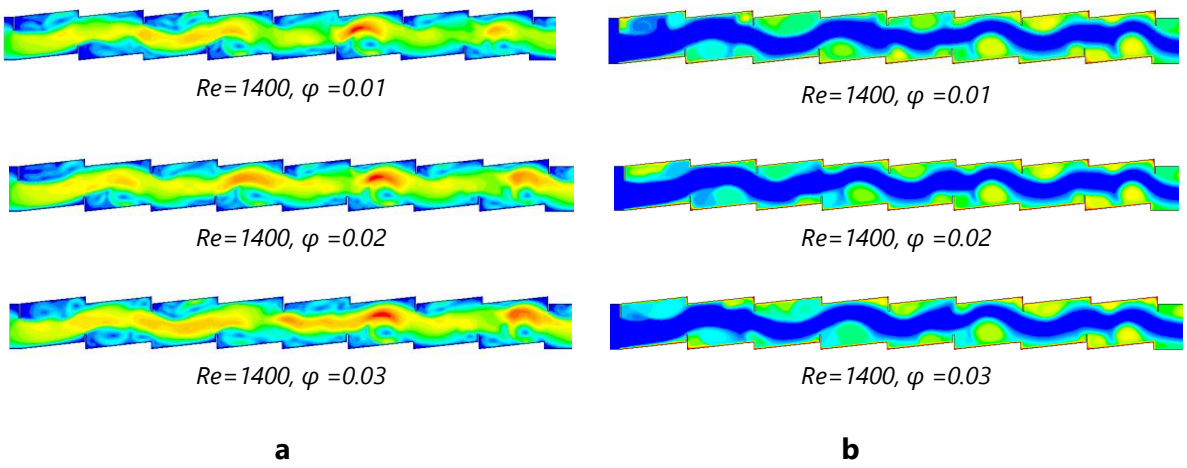

Figure 4. At Re = 1400 for different nanoparticle volume fractions, **a-**the velocity structures **b-** the temperature structures

Equations

In this study, Nusselt number is defined by Equations (8-9) to calculate the local and average heat transfer in the channel:

$$Nu_x = \frac{q'' D_h}{k(\bar{T}_{w,x} - \bar{T}_{b,x})} \tag{8}$$

$$Nu = \frac{1}{L}\int_0^L Nu_x dx \tag{9}$$

where, k is the thermal conductivity coefficient of the nanofluid, D_h is the hydraulic diameter of the channel, L is the total channel length, T_w is the surface temperature of the channel. The film temperature of the nanofluid is calculated as $T_b = (T_{in} + T_{out}) / 2$. The heat transfer performance calculated based on the Nusselt number is defined as η and shown in Equation (10).

$$\eta = \frac{Nu_b}{Nu_s} \tag{10}$$

where, Nu_b is the average Nusselt number calculated for the nanofluid, and Nu_s is the Nusselt number calculated for the base fluid.

On the other hand, depending on the particle volume fraction and fluid velocity, a significant pressure drop occurs in the wall and fluid. Due to the high viscosity of nanofluids compared to the base fluid, the pressure drop should also be evaluated in heat transfer improvement studies. In this study, the dimensionless friction factor $r = f_b / f_s$ is defined to determine the pressure drop of the nanofluid. Where, f_b shows the surface friction for the nanofluid flow and f_s is the surface friction for the base flow. Thermo hydraulic performance is achieved by the ratio of heat transfer performance to friction factor and is defined by Eq. (11):

$$THP = \frac{(Nu_b / Nu_s)}{(f_b / f_s)^{1/3}} = \frac{\eta}{r^{1/3}} \tag{11}$$

The variation of the heat transfer performance with the Reynolds number for different particle volume fractions in Figure 5a, the dimensionless friction factor in Figure 5b, and the thermo-hydraulic performance in Figure 5c were given. From the figures, it was seen that the heat transfer performance and friction factor increased with the increase of particle volume fraction and Reynolds number. The dashed line represents the base fluid for the same geometry. The frictions in the channel increased with the effect of the baffles at zigzag channel and the increase in the particle volume fraction.

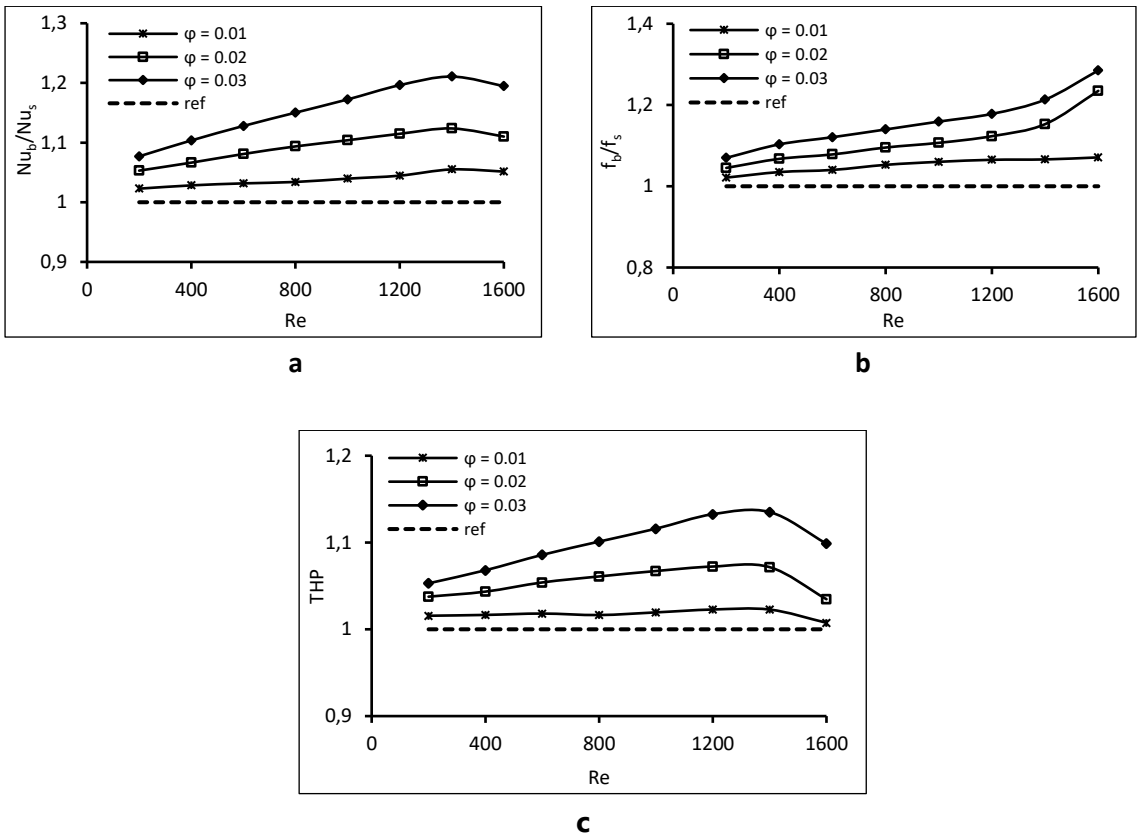

Figure 5. At different Reynolds numbers ve particle volume fractions **a-**The heat transfer performance, **b-** the dimensionless friction factor, **c-** Thermo-hydraulic performance

The highest heat transfer performance was obtained as η=1.21 at Re = 1400 and φ = 0.03. The baffles and nanofluids in the zigzag channel provided significant heat transfer improvement, while an acceptable increase in friction factor was observed. The highest friction factor was found to be r=1.28 at Re = 1600 and φ = 0.03. In Figure 5c, Thermo-hydraulic performance values were obtained above the reference value for all Reynolds numbers and particle volume fractions because the heat transfer improvement was greater than the friction in the channel. The highest thermo-hydraulic performance was obtained at φ = 0.03 and Re = 1400 as approximately THP = 1.13.

Conclusions

In this study, the effects on flow and heat transfer of Al_2O_3-water nanofluid in a zigzag channel with baffles were numerically investigated. The effects of particle volume fraction and Reynolds number on flow and heat transfer were analyzed. In numerical simulations, it was observed that the flow and temperature fields were significantly affected by the Re and channel structure. It was determined that particle volume fraction have an important role in heat transfer improvement under laminar steady flow conditions. The results shown

that the heat transfer performance increased with the increase of Reynolds number and particle volume fraction. The best thermo-hydraulic performance was obtained at Re = 1400 and φ = 3% as approximately THP=1.15.

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ID:15-EOP

Indoor Thermal Comfort; Definition, Applications and Turkey Cases

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Abstract

The concept of thermal comfort has long been a topic introduced since the beginning of the last century and studied extensively in the world especially in the fields of architecture and engineering. In its broadest sense, according to ASHRAE-55 standards, its definition is the ambient where people can feel comfortable. This concept was initially used only for indoor for a long time and has been adapted for outdoor use for the last 40 to 50 years. The fact that thermal comfort qualities affect the preferences of the users indoor shows that this concept has dimensions related to social, economic, health, energy, environmental and many other issues. The provision of thermal comfort requires a number of adaptations of the human body. In this sense, in the first studies, heat transfer process and heat balance of human body are studied and equations, calculation indices and models are developed. In Turkey thermal comfort was seen initially as indoor engineering knowledge, especially in recent years and later considered in outdoor environment and architecture and design. This study, corresponding general definitions and information related to the concept of thermal comfort will address some of the studies conducted over the last decade in Turkey and will have some basic conclusions from the results. In this sense, the main findings of the study are the effects of thermal comfort on the interior dimensions of the users, it is determined that the effects are tried to be determined in the common use areas, calculations are made according to various indexes, and consequently, the structures provide suggestions for controlling the energy consumption and increase the comfort levels of the users.

Keywords: indoor, thermal comfort, thermal comfort indices,

Introduction

Thermal comfort, in its broadest sense, may be described as the environmental conditions that make individuals feel their best. Thermal comfort is defined by the international standards ASHRAE Standard 55 and ISO 7730 as "the state that describes contentment with the thermal environment.'' In the Occupational Health and Regulation Draft for thermal comfort, "to provide a healthy and safe working environment in the workplaces; Indoor air temperature, relative humidity, air velocity and average radiation temperature values of the space will be controlled to be within acceptable limits. The systems to be used to provide suitable thermal comfort conditions in the workplace will be suitable for the work done and will not pose any danger to the health and safety of the employees [1]. Thermal comfort is essential for an individual to live a healthy lifestyle, perform more productive work in the workplace, and feel mentally at ease [2].

In order to provide thermal comfort, the space we interact with must also provide some values. These values vary according to individuals due to different age, gender, metabolic rate, subcutaneous fat ratio and clothing values, the areas where the values accepted as average are provided are considered as comfort areas [2]. Although it depends on many parameters such as human height, age, and gender, the parameters that affect thermal comfort in the most general sense can be classified as personal and environmental parameters [3].

According to Fanger, the most important variables affecting the thermal comfort condition are listed as follows [4,5]:

- Activity level (metabolic rate)
- Clothing thermal resistance (clo-value)
- Temperature
- Average radiation temperature
- Air velocity
- Relative humidity

Thermal Comfort Models

The topic of thermal comfort, which has been studied since the 1930s, is also an extremely important issue in the field of architecture. While Mahoney model offers the most design options, Fanger and Harmony model has the most comprehensive definition of comfort zone. In terms of input data, the Fanger model performs the most detailed calculations [2]. In this research, 5 thermal comfort model definitions are included. These models are;

- *Fanger Model (PMV/PPD):*

The Fanger model is the most commonly employed in thermal comfort research. In this model, air temperature, air flow velocity, average radiant temperature, metabolic rate and clothing were taken into account. Fanger studied ambient variables, metabolic rate, and clothing conditions based on individuals living in stable settings at university age when developing the thermal comfort equation. He devised a formula that explains how the settings he studied produce a heat exchange in the human body, which adapts to its surroundings to achieve thermal comfort [2].

Fanger defined two different values while evaluating the formula as a result of his observations; PMV (Predicted Mean Vote) called thermal sensation and PPD (Predicted Percentage of Dissatisfied) called thermal dissatisfaction. The PMV value is the positive or negative evaluation of the conditions of the individuals it observes, and the PPD is the percentage of dissatisfaction among these evaluations [2].

- *Olgyay Model:*

Olgyay described the thermal comfort model using bioclimatic graphs. These graphs are a method that shows the effect of the relationship between temperature, humidity and air flow velocity on the comfort area according to the climatic characteristics of a selected area. Bioclimatic comfort is expressed as a situation where a person can live in harmony with his environment with minimum energy [2].

- *Mahoney Model:*

The Mahoney model calculates comfort levels based on annual average temperatures, humidity, wind, and precipitation. Mahoney model is a model that consists of three stages and can present ideas to the designer to reach comfort conditions during the design phase. The three stages that the model mentions are; It is the phase of design, plan development and sketching [2].

- *Givoni Model:*

Givoni had tried to predict the comfort situation that will occur in the interior according to the outdoor conditions with the bioclimatic graphic method. In his studies, he had examined the direct relationship between temperature and absolute humidity [2].

- *Adapted Comfort Level Model:*

Humphreys and Aucliciemes discovered the thermal neutrality of the human body after their studies. This thermal state, which they define as neutral, is actually the state in which the individual feels comfortable. Humphreys and Aucliciemes carried out studies with individuals with different thermal characteristics in the laboratory environment and in their living spaces [6,7].

Purpose of the Study

The aim of this study is to reveal the general definitions and information about the concept of thermal comfort and to make various inferences from the results by considering some of the studies done in the last ten years in Turkey.

Material and Method

In this research, it is essential to aim to make general inferences from the results by making a compilation study. For this reason, first of all, a wide literature review on indoor thermal comfort was made. Then, among the studies carried out in the last 10 years in Turkey, those related to indoor thermal comfort were examined. As a result of this examination, inferences about indoor thermal comfort were made in the light of studies.

Turkey Cases

The internal physical environment quality of the Architecture Department building on Uludağ University Görükle Campus was analyzed using user views in a research named "Evaluation of User Satisfaction in Terms of Comfort Conditions: An Example of an Educational Building" performed by Sezer in 2015. The purpose of this evaluation is to determine the criteria that are important for students and instructors in the use of space and to allow the building to meet the required performance requirements. The data obtained within the scope of this study will not only open the horizon for the newly designed buildings in the campus, but also will help the practitioners in the architectural arrangements related to the existing buildings [8].

Salur (2016), in her research, examines the impact of Fanger's comfort models on PMV and PPD values in the moderate-dry climate characteristics of the courtyard, which is one of the most basic and prevalent space typologies in the link between architectural space and thermal comfort. On study, among the simulation studies made by entering the meteorological data of Kayseri, SketchUp was used for shadow analysis, ECOTECT V5.6 for

radiation analysis, and ENVI-met V4 program for microclimate and thermal comfort analysis. As a result of the thesis, PMV and PPD values for indoor and outdoor environments in the Köşk Madrasa sample were compared, and it was discovered that the courtyard typology's spatial microclimate conditions provide an effective balancing factor for thermal comfort in summer and winter periods in moderate-dry climate [2].

Another study in Izmit, Turkey, had looked into the measures and techniques that could be used to improve energy efficiency and thermal comfort in the Izmit Ulugazi Primary School, which is made up of different blocks with no historical or historical characteristics. These strategies are discussed separately in the context of existing historical and non-historical structures. Invoices for the years 2014-2015 were obtained in order to determine the monthly natural gas and electricity energy consumption amounts. Measurements were carried out in May 2014 to determine the values obtained by the climatic and visual parameters in order to determine the thermal and visual comfort conditions in the classrooms in both blocks. The strategies determined in line with the data obtained from the measurements and surveys, including the improvements to be made in the building envelope and the improvements that can be applied in the electrical and mechanical systems, are handled separately for both buildings [9].

In this study carried out in 2017, the indoor comfort conditions (indoor temperature, relative humidity, average radiant temperature, air flow rate) of the naturally ventilated and central heating systems in the higher education (Trakya University Faculty of Architecture) structure in Edirne. “Satisfaction with the thermal environment” (PMV) and “Dissatisfaction with the thermal environment” (PPD) indices were investigated. The measurements were determined simultaneously with the measuring device during the usage period of the classrooms (weekdays) in winter (November-December) months. The measurement results were analyzed statistically and the results obtained were compared according to the relevant standards (Ashrae 55, ISO 7730). It is seen that the measurement results obtained in the sample higher education structure generally do not exceed the values in the relevant standards. By providing thermal comfort in educational buildings, students will be productive, as well as gains in terms of energy consumption and environmental effects of buildings [10].

Another study conducted by Özdamar (2017); It is based on experimental measurements as well as theoretical information. Within the scope of the thesis, office buildings were taken as a sample from the working spaces where an important period of daily life passes. In the selected sample office building, comfort conditions and indoor air quality were investigated in similar office units facing different directions. In the months of December-January 2015-2016, measurements were taken in each office unit and outside in a one-

month period. The data obtained were evaluated by considering the ASHRAE Standard 55 limit values. In addition, evaluation was made with PMV sensation scale and PPD dissatisfaction percentage. When the data is examined, the building envelope, office space, heating system, number of users, available equipment, etc. it is seen that the effects of factors on comfort conditions and indoor air quality are high. In line with the results obtained, measures that can be taken to protect indoor air quality are stated [11].

The indoor environment quality and related energy consumption of Sapphire Residence Tower, which is the tallest residential building in Turkey, were examined another study. The characteristics of the building according to the physical outdoor and indoor conditions were analyzed and the energy consumption depending on the indoor quality of the building was calculated with the help of the simulation program "DesignBuilder". In addition, as a result of the interviews with the building residents, their perception of indoor quality was tried to be determined. According to the information obtained as a result of the interview and the simulation program calculations, the relationship between the indoor quality of the building and the energy consumption has been established. As a result of the data obtained, it has been determined that the building is 25-30% more energy efficient than the high-rise buildings of its own scale and the indoor quality is suitable for user comfort [12].

In a study conducted by Ranjbar, experimental and subjective measurements were made both in the studio and in the classroom at Bilkent University, Department of Interior Architecture and Environmental Design. CO2 concentration, indoor temperature and humidity values were collected in three ventilation conditions in winter and summer seasons:
1) condition without opening doors and windows;
2) natural ventilation condition and
3) the condition in which the mechanical TROX school-air device is used.

In the end of the study, both experimental and subjective results showed that the mechanical TROX school-air device condition was the classroom indoor environment where the highest values of students' concentration and attention were achieved [13].

A study on mosques, which is a religious worship structure, was carried out by Atmaca. Within the scope of this thesis, in order to determine the comfort levels of the people who come to the mosque, the thermal comfort of the indoor environmental conditions of the mosques with different heating and cooling systems were measured and evaluated. (One Mosques is with natural ventilation and the other one with mechanical ventilation.) Thermal comfort measurements and survey data in sample mosques are presented. The energy

consumption in the mosque, which has an air-conditioning system, has been analyzed and interpreted within the scope of the thesis. As a result, some suggestions were presented in the light of the findings within the scope of the study [14].

In another study, two indoor shopping malls, one of which is at the forefront of energy efficient design, rated from green building rating systems were determined within the scope of the study. A measurement study was carried out to evaluate the thermal comfort conditions in the clothing store of the same brand, with the same concept, located in the designated shopping centers, and a survey study was carried out to determine the user perception. The field studies were handled together with the user density and energy consumption data obtained from shopping centers, and their effects on thermal comfort were evaluated and the availability of optimum conditions was emphasized. Various suggestions have been presented according to the data obtained [15].

In another study conducted on courtyard buildings, it was aimed to evaluate the effects of the orientation of the building, ventilation time and ventilation options on the comfort conditions in buildings in buildings with different courtyard sizes. As a result of the study; It has been emphasized that the dimensions of the courtyard, the volume orientation and ventilation options, the operative temperature, relative humidity, solar radiation gain values and airflow velocity, thus the indoor comfort conditions, have changed significantly. So, desired comfort conditions in the volumes can be achieved with the right decisions regarding these variables at the design stage [16].

In a study carried out in the city of Konya, the thermal comfort properties of the Ali Gav madrasah were evaluated in the context of the data obtained from the measurements. As a result of the study, it was seen that the thermal comfort conditions were insufficient for all the places within the Madrasa. However, it has been observed that this situation is not directly related to the restoration/reconstruction, and suggestions have been made to carry out the necessary feasibility studies and to produce the necessary solutions and architectural details before such applications are made for the future historical buildings [17].

In the city of Mardin, another research was conducted with the goal of evaluating local communities in the hot, dry climatic region in terms of thermal comfort. In the first stage of the study, streets classified as open spaces were evaluated in terms of thermal comfort. Evaluation was done with ENVI-met simulation model. As a result of the analyses, the air temperature in the streets, the average radiative temperature, the wind speed and the physiological equivalent temperature (PET) values were calculated. In the second stage; Courtyards classified as semi-open spaces were evaluated in terms of thermal comfort. In

the third stage, the results obtained in the first two stages were evaluated in terms of their effects on indoor thermal comfort. Settlement pattern alternatives were created by matching the parameter values for streets and courtyards. In the fourth stage, in order to complete the results obtained, the settlement model that provides the highest comfort level in the outdoor environment was evaluated in terms of indoor and outdoor comfort using two different simulation models. At the last stage of the study, the results obtained for indoor and outdoor thermal comfort were discussed and design proposals for application were developed [18].

Another thermal comfort study for mosques was carried out in 2019. Thermal comfort study was carried out by using Fanger's PMV model in Trabzon Çarşı Mosque, which is located in Ortahisar district of Trabzon province and is the largest mosque in the region. Different scenarios have been evaluated in order to improve thermal comfort conditions in historical stone mosques. These scenarios are the creation of different types of glass, roof insulation, internal wall insulation and natural ventilation scenarios for the cooling period. The data obtained from the alternative scenarios were compared with the existing data and the change in the thermal performance and energy consumption of the mosque was analyzed [19].

In another study conducted in 2021, the thermal effect of a wind tower designed to ventilate a classroom space was investigated. 11 wind tower models within the scope of the study were designed and simulated with the ANSYS program. The results were analyzed to determine the performance of the wind towers and the level of thermal comfort for users in a sitting position. In addition, the effects of different physical properties of the wind tower on air flow and thermal comfort of users were also investigated. The best results were obtained with the unidirectional wind tower model with 0.5 m span and the wind tower with internal span at ground level. Within the framework of the study, it is proposed that the research conducted in August using August's meteorological circumstances be replicated in other summer months. It is suggested that this approach should be combined with contemporary systems and, as a result of the results to be obtained, it should be used in architectural design processes of the buildings in Trabzon [20].

Conclusions and Inferences

The conclusions made as a result of the studies examined can be listed as follows;

• It has been concluded that the comfort conditions of working environments affect people's physical and mental production rates.

• It is clear that perception, understanding, attention, efficiency and performance will be high in a comfortable environment suitable for thermal comfort conditions.
• While providing comfort conditions, minimum energy consumption (buildings with high energy efficiency) should be ensured without sacrificing comfort conditions.
• By providing thermal comfort in educational buildings, students can be productive as well as gain in terms of energy consumption and environmental effects of buildings.
• The ventilation options of buildings that are not suitable for thermal comfort conditions need to be reviewed and improved.
• Space dimensions and setups should be designed in accordance with thermal comfort conditions.
• Space design elements that can come to the fore with their materials such as insulation and ventilation should be developed.

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ID:17-EOP

Springback Analysis in the Forming of Oven Panels

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In this study, the springback (material distortion) behavior of furnace catalytic side panel sheet materials, which occurs as a result of forming operations, was investigated. In this study, the distribution of the final part geometry between the lower and upper limits of the desired tolerance values was analyzed by using the MINITAB statistical software program. As the material type, 0.60 mm thick DC04 cold rolled sheet material was used. The surfaces of the molds of the original model were prepared in SOLIDWORKS software. Forming operation was performed using two different mold as two operations. First operation is cutting process and the second operation is the forming process. The data obtained from the analyzes for the first final product were far from the tolerance values according to the technical drawing. The part was out of tolerance due to the effect of springback. In order to bring the geometry to the desired tolerance range, in addition to the operations applied to the part, a third mold was produced and the final forming process was carried out. The geometry obtained for the second final product is visually smoother than the first geometry. As a result of the measurements made, it remained within the acceptable tolerance values according to the technical drawing.

Keywords: sheet forming, springback, MINITAB,

ID:19-EOP

Effects of Welding Joining Methods Applied to AISI 430 Ferritic Stainless Stells on Surface Polishing

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In this study, the effects of different welding methods used in joining AISI 430 Ferritic stainless steels on surface polishing were investigated. In this study, 0.9mm AISI 430 ferritic stainless sheet was used as the material. TIG (Argon welding, Micro plasma welding and Laser welding were used as the welding method. PTX polishing machine and ceramic-based abrasives were used in the surface polishing process. By using the TIME TR-200 surface roughness measuring device, the lower and upper limits of the desired surface roughness tolerance values of the sample parts were used. The distribution of the sample sheet materials used in the application was prepared in SOLIDWORKS software. The cutting process of the sample sheet materials was carried out precisely on the laser cutting machine. According to the data obtained after the trial studies, it was found that the surface polishing ability of the parts to which the laser welding and micro plasma welding method was applied was higher. It has been determined that the surface polishing capabilities of the sheet metal parts applied with TIG welding method are lower. The welding method and application method are effective in determining the surface polishing quality.

Keywords: AISI 430, ferritic stainless steel, TIG,

ID:36-EOP

The Effect of Welding Parameters on Mechanical Properties in Joining Materials with Different Properties with Mig Method

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In this study, in joining low carbon steel and stainless steel with MIG welding; the effects of welding current, welding voltage and welding time on mechanical properties were investigated. Mechanical properties and microstructures were investigated by taking samples from the materials that joined at three different welding current values. In addition, penetration analyzes were made according to the welding current changes. As a result of the study, according to the results of the tensile test, it was observed that the strength of the joining at high amperage in MIG welding of low carbon steel was higher. However, the elongation value was higher in the welded sample at low amperage. It has been observed that the tensile strength of the joint with lower amperage value is higher in MIG welding of stainless steel. According to the results of bending test, we can see that many test pieces are broken from the weld area. According to the hardness test results, the highest hardness values in all welding methods were measured from the weld metal, followed by ITAB and base material, respectively. When microstructures are evaluated as a whole, starting from the melting line of the grains in all joints, it was determined that they were directed towards the heat flow direction and towards the solidification point.

Keywords: MIG welding method, welding current, mechanical properties, ITAB

ID:64-EOP

Battle Royale Optimization based PID Controller Design for Vehicle Cruise Control System

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In this paper, a novel meta-heuristic algorithm for vehicle cruise control (VCC) system, battle royale optimization algorithm based BRO/PID controller is proposed. This algorithm, known as the battle royale and inspired by the digital game, is represented by each individual soldier/player. This algorithm is based on the struggle for survival of each soldier/player to move toward the safest (best) place. In order to tune the parameter values of the PID controller through the battle royale optimization algorithm, the Zwee Lee Gaing's (ZLG) objective function, which is one of the performance criteria frequently used in the literature, is used. In order to demonstrate the efficiency and superiority of the proposed battle royale optimization algorithm based PID controller, convergence profile, transient and frequency responses analysis were performed via the MATLAB program. When the results obtained are examined, it is observed that the BRO-based PID controller gives better results than the other approaches PID controllers proposed in the literature.

Keywords: Vehicle cruise control system (VCC), Battle royale optimization algorithm, PID controller, MATLAB program.

Introduction

Cruise control system is a system that provides a comfortable and safe cruise opportunity for vehicles and drivers, especially on long-distance travels at a constant speed. Control systems are vital for a safe navigation. Recently, there have been significant developments in VCC system. These developments have led to the diversification of controller types. There are many controller types used in the VCC system in the literature such as proportional-integral-derivative controller [1-2], fractional order proportional-integral-derivative controller [1], fuzzy logic controller [3]. VCC system, the most preferred among these control techniques is the PID controller. PID controllers are a type of control mostly used in control systems because of their simple and applicable structure and their stability over a wide operating range. The parameter setting of the PID controller has become quite

easy through meta-heuristic algorithms that have become popular recently. In addition to the algorithm used in metaheuristic algorithms,
the chosen objective function is also of great importance. Objective functions, which include the transient characteristic values of the system such as maximum overshoot, steady-state error, settling time and rise time, are frequently used in the literature.

In this study, Battle royale optimization algorithm is used to tune the parameter value of the PID controller. Battle royale optimization algorithm is used to determine the parameters of decentralized PI controller in linearized quadruple tank process [4] and inverse kinematics problem of 6-DOF PUMA 560 robot arm [5].

The ZLG objective function is used to determine the optimal values of the PID parameters. It is aimed to reduce the transient characteristic values of the VCC system with BRO-PID controller. In addition, comparisons are made with the HHO-PID [1] and GA-PID [2] controllers previously designed for the VCC system in the literature.

In this paper VCC system model, PID controller scheme and description of BRO algorithm are introduced in section 2. The simulation results of the VCC system are presented in the section 3. In the last section, the obtained conclusions are evaluated.

VCC System

Vehicle cruise control is a system that adjusts the vehicle's cruise speed according to the speed value shown by the drivers as a reference. In Fig. 1, the dynamic of the vehicle cruise control system is given. As can be seen from Fig. 1, u represents the throttle input and sets the amount of gas required to produce the desired constant speed. θ adjusts the actuator on the pedal according to the slope of the road, allowing the vehicle to go at the desired constant speed. The nonlinear longitudinal dynamic equation of the vehicle is given in Eq. 1 [7].

$$F_d = M\frac{d}{dt}v + F_a + F_g \tag{1}$$

In Eq. 1, F_d represents the drive force, F_a represents the aerodynamic drag, F_g represents the downgrade force, *M* represents total mass of the passenger and the vehicle, and $M\frac{d}{dt}v$ represents the inertia force.

As shown in Fig. 1, the vehicle control system's throttle actuator is modeled with a first-order delay and a certain saturation range. $F_{d\min}$ and $F_{d\max}$ are the saturation ranges, taken as -3500 and 3500, respectively.

First, all initial values and disturbance parameters are taken as zero in order to model the cruise control system. It is assumed that there is no wind gust while the vehicle is in movement and the slope of the vehicle's movement plane is zero.

$$\dot{v} = \frac{1}{M}(F_d - C_a v^2) \tag{2}$$

$$\dot{F}_d = \frac{1}{T}(C_1 u(t-\tau) - F_d) \tag{3}$$

Since the Eq. 2 has squared term, the system is nonlinear. Therefore, in this study, the nominal operating speed of the vehicle is taken as $v_{ref} = v_0 = 30$ km/h in order to linearize the system. Its linearized form is given in Eqs. 4 and 5.

$$\delta\dot{v} = \frac{1}{M}(\delta F_d - 2C_a v_0) \tag{4}$$

$$\delta\dot{F}_d = \frac{1}{T}(-\delta F_d + C_1 \delta u(t-T)) \tag{5}$$

The linearized transfer function of the vehicle control system is given in Eq. 6.

$$\frac{\Delta V(s)}{\Delta U(s)} = \frac{\frac{C_1}{MT} e^{-\tau s}}{\left(s + 2C_a v_0\right)\left(s + \frac{1}{T}\right)} \tag{6}$$

Where term $e^{-\tau s}$ denotes the time-delay in the system. Using the power series expansion, the transfer function of the time-delay term is approximately as follows.

$$e^{-\tau s} \approx \frac{1}{1+\tau s} \tag{7}$$

$$\frac{\Delta V(s)}{\Delta U(s)} = \frac{\frac{C_1}{MT}}{(s+2C_a v_0)\left(s+\frac{1}{T}\right)(1+\tau s)} \tag{8}$$

Where C_1 is actuator constant equal to 743. C_a is aerodynamic drag coefficient is equal to 1.19 N/(m/s)^2. M is equal to 1500 kg. τ is actuator constant equal to 0.2 . T is observation time equal to 1 s.

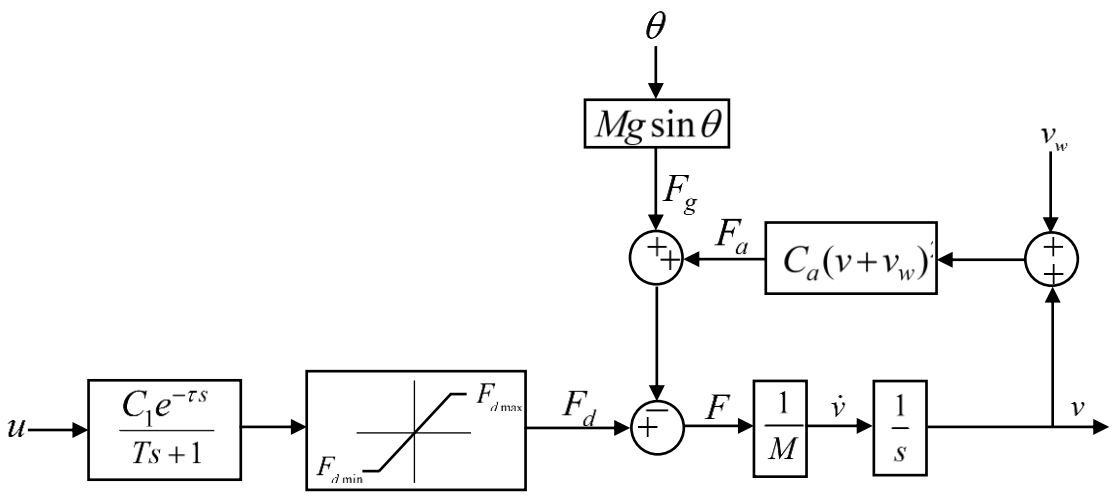

Figure 1. Dynamic model of VCC system [7].

BRO Algorithm

The BRO algorithm, inspired by the PUBG game, was proposed by Farshi in 2020 [5]. In PUBG, each individual is called a soldier or player. The game starts with the players jumping out of the plane on a randomly determined map. Each soldier aims to survive by killing enemy soldiers within a time limit or kill limit [6]. In the BRO algorithm, mathematical equations is created according to this game method. In Eq. 9, the damage level of the injured soldier is expressed mathematically.

$$x_i.damage = x_i.damage + 1 \tag{9}$$

The *r* specified in Eq. 10 represents a randomly varying number between 0 and 1, $x_{dam,d}$ the position of the injured soldier in the *d* dimension and $x_{best,d}$ the best solution found so far in the *d* dimension.

$$x_{dam,d} = x_{dam,d} + r(x_{best,d} - x_{dam,d}) \tag{10}$$

The equation specifies the lower bound and upper bound in Eq. 11 and in the *d* dimensional problem space, respectively.

$$x_{dam,d} = r(ub_d - lb_d) + lb_d \tag{11}$$

In each iteration, the search space shrinks down and tries to reach the best solution. To reach the best solution, in Eq. 12 is used. The initial value of Δ is determined as $\Delta = \log_{10}(MaxCicle)$. Where $MaxCicle$ represents the number of iterations.

$$\Delta = \Delta + round\left(\frac{\Delta}{2}\right) \tag{12}$$

lb_d and ub_d equations are updated according to the given Eqs. 13 and 14. In addition, when the lower and upper limits exceed the original limits, these parameter values take the value of the limit values. $SD(\overline{x_d})$ denotes the standard deviation of the entire population in the *d* dimensional search space.

$$lb_d = x_{best,d} - SD(\overline{x_d}) \tag{13}$$

$$ub_d = x_{best,d} + SD(\overline{x_d}) \tag{14}$$

The parameter values used for the BRO algorithm in this paper are given in Table 1.

Table 1. BRO Algorithm Parameters

Parameter	Value
Number of soldiers/players	50
Iteration number	100
Lower bounds for PID parameters	[3 0.10 3]
Upper bounds for PID parameters	[5 0.25 5]

In this study, the ZLG objective function is used in order to make a fair comparison with algorithm-based PID controllers [1-2] with different approaches previously designed for the VCC system in the literature. The equation of the objective function ZLG is given in Eq. 15. M_p E_{ss}, t_s and t_r represent the maximum overshoot, steady-state error, settling time and rise time, respectively. β is the weighting coefficient and is taken as 1.

$$ZLG = (1-e^{-\beta})\left(M_p + E_{ss}\right) + e^{-\beta}(t_s - t_r) \tag{15}$$

PID Controller Design for Vehicle Control Cruise System

In this paper, BRO algorithm based PID controller is designed to obtain a better dynamic system response for the VCC system. In Eq. 16, the transfer function of the PID controller is given, and k_p, k_i and k_d in this equation are proportional, integral and derivative gains. The closed loop block diagram of the VCC system with PID controller is given in Fig. 2.

$$G_{PID}(s) = k_p + \frac{k_i}{s} + k_d s \tag{16}$$

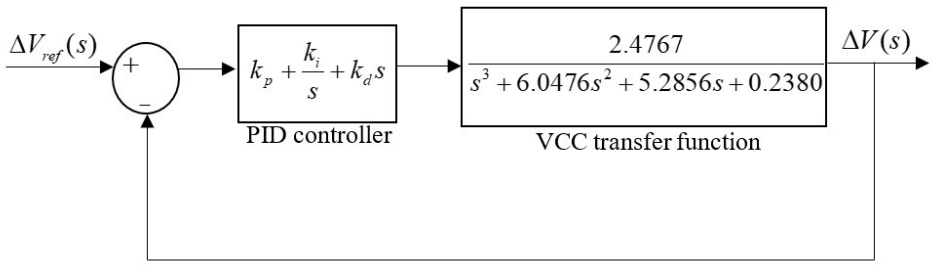

Figure 2. Closed loop of the VCC system with PID controller

Simulation Results

In this study, the convergence profile, transient response analysis and bode analysis of the BRO-PID controller proposed for the VCC system are performed using the MATLAB program, and the simulation time is taken as 4 seconds.

Convergence Profile

The convergence profile of the BRO-PID controller, which is desired to find the optimal value according to the ZLG objective function, is given in Fig. 3. In addition, the controller parameter values found at the end of the optimization process of the proposed BRO/PID controller are listed in Table 2.

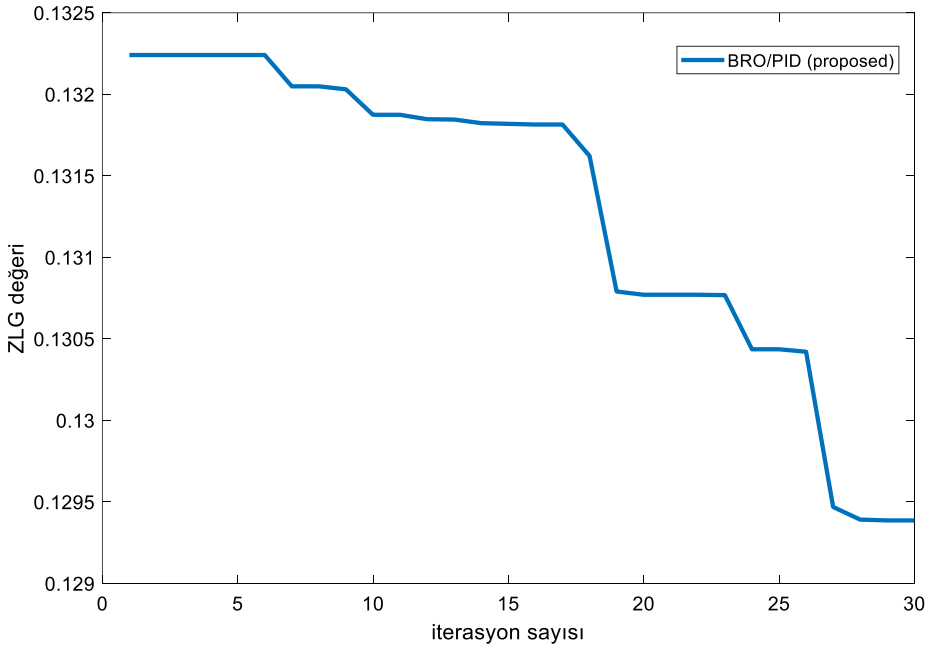

Figure 3. Convergence profile of the proposed BRO-based PID controller

Table 2. Parameters of PID obtained using different approaches algorithms for the VCC system

Controller	k_p	k_i	k_d
BRO/PID (proposed)	4.8348	0.1456	4.9970
HHO/PID [1]	4.1132	0.1714	4.2564
GA/PID [2]	3.5907	0.1630	3.3021

The closed loop transfer functions of the system obtained by using the parameter values found for the BRO/PID, HHO/PID [1] and GA/PID [2] controllers in Table 2 are given in Eqs. 17-19, respectively.

$$T_{proposed\ \mathrm{BRO/PID}} = \frac{12.38s^2 + 11.97s + 0.3606}{s^4 + 6.048s^3 + 17.66s^2 + 12.21s + 0.3606} \quad (17)$$

$$T_{HHO/PID} = \frac{10.54s^2 + 10.19s + 0.4245}{s^4 + 6.048s^3 + 15.83s^2 + 10.43s + 0.4245} \quad (18)$$

$$T_{GA/PID} = \frac{8.178s^2 + 8.893s + 0.4037}{s^4 + 6.048s^3 + 13.46s^2 + 9.131s + 0.4037} \quad (19)$$

Comparative Time-domain Analyzes

In order to show the superiority of the proposed BRO/PID controller over the HHO/PID [1] and GA/PID [2] controllers, time response analysis was used and the comparative step responses are given in Fig. 3. Using the graph in Fig. 4 obtained using MATLAB program, the transient response characteristic values for each controller are listed in Table 3. Looking at the results in Table 3, the BRO/PID controller has performed better than the other controllers in terms of settling time (t_s), rise time (t_r), peak time (t_p) and steady-state error (e_{ss}), excepting the maximum overshoot (M_p).

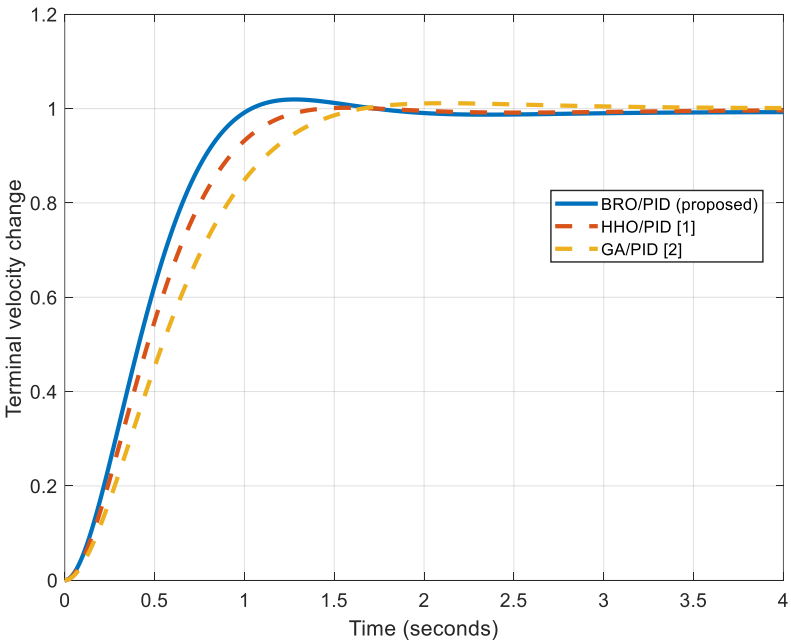

Figure 4. Terminal velocity step response comparison of VCC with different controllers

Table 3. Comparison of transient response analysis results

Controller Types	M_p (%)	t_s (seconds) %2	t_r (seconds) 0.1 → 0.9	t_p	e_{ss}	ZLG value
BRO/PID (proposed)	1.9442	**0.9570**	**0.6387**	**1.2784**	**0**	**0.1294**
HHO/PID [1]	**0.1757**	1.1962	0.7632	1.5645	**0**	0.1604
GA/PID [2]	1.1456	1.4559	0.9394	2.1166	**0**	0.1973

Comparative Bode Analyzes

Bode diagram was used to show the stability and efficiency of the proposed BRO/PID, HHO/PID [1] and GA/PID [2] controllers in the frequency domain. Comparative frequency performance analysis results of gain margin, phase margin and bandwidth calculated using bode diagram are presented in Table 4. In addition, comparative bode plots of BRO/PID, HHO/PID [1] and GA/PID [2] controllers are given in Fig. 5.

As can be seen in Table 4, it is seen that the proposed BRO/PID controller gives superior results in terms of phase margin, gain margin and bandwidth values compared to other approaches PID controllers.

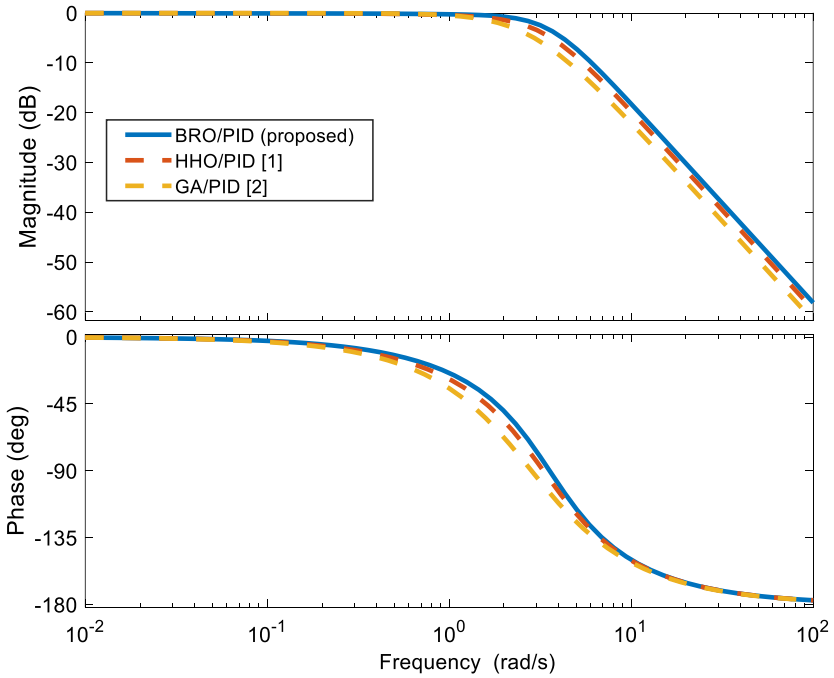

Figure 5. Bode plots obtained using different controllers

Table 4. Comparison of frequency domain performance analysis results

Controller	Gain margin (dB)	Phase margin (degree)	Bandwidth (Hz)
BRO/PID (proposed)	Infinite	180°	3.4229
HHO/PID [1]	Infinite	180°	2.8663
GA/PID [2]	Infinite	180°	2.2657

Conclusions

In this study, the application of the battle royale optimization algorithm for the tune of PID parameter values in the VCC system is presented for the first time. The proposed BRO/PID controller improves the settling time, rise time, peak time and steady-state error of terminal velocity change in the VCC system. In addition, the comparative bode analysis results of the proposed BRO/PID, HHO/PID [1], GA/PID [2] controllers are given. Considering the simulation results obtained, the superiority and efficiency of the proposed BRO/PID controller over the previously proposed HHO/PID [1] and GA/PID [2] controllers in the literature has been confirmed.

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ID:77-EOP

The Effects of Using Different Elastic Modulus Expressions on the Load-Displacement Behavior of Concrete Beams with Hybrid Steel-FRP Reinforcement

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One of the important factors affecting the flexural behavior of concrete beams with hybrid FRP-steel reinforcement is the modulus of elasticity of concrete. Various national and international reinforced concrete (RC) codes present empirical equations expressing the modulus of elasticity of concrete in terms of its compressive strength. However, these equations generate significantly different modulus of elasticity estimates (up to 44% differences), which results in significant variations between the estimated deflections of RC beams.

In this study, the effects of the use of different modulus elasticity equations in ACI 318-19 (2019), CSA S806-12 (2012), Eurocode 2 (2004) and TS500 (2000) codes on the theoretical load-displacement behavior of hybrid RC beams were investigated numerically. In this context, the experimental load-deflection curves of the related beams in the literature were compared to the numerical curves according to different modulus of elasticity expressions. The study underscores considerable differences between the analytical load-deflection curves of the beams according to different elastic modulus expressions. Differences up to 4 and 32 % were obtained between the cracking load and deflection estimates from different elastic modulus equations at the initiation of cracking. Similarly, differences up 1 and 13 % were observed in the load and deflection values at the start of tension steel yielding. Finally, ultimate loads and deflections differed up to 2 and 10 % when using different elastic modulus expressions.

Keywords: Hybrid RC beam, Flexural behavior, Elastic modulus,

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ID:80-EOP

The Designed Examples for Optimal Use of Urban Furniture in Winter Cities

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Abstract

Urban spaces which are a necessity of the life of people living in cities, are places where both social and personal needs are met. These places change over time according to the city's climate, physical structure and socio-cultural and socio-economic structure of the citizens. In order to meet the increasing needs of the citizens with the effect of urbanization in urban spaces, there are various elements called urban furniture. These elements are shaped according to the social and physical structure of the city. The needs of the citizens change according to effects such as climate, culture, physical structure, economy and different geography. As a climatic effect, harsh weather conditions such as snow, wind, ice, frost, prolonged cold and decreasing daylight in cities where the winter season is predominantly felt restrict the use of urban spaces and the access of the citizens to these spaces. In these places the use of qualified urban space and access to urban furniture are important. However, urban spaces and urban furniture that are not designed in accordance with winter climate conditions lose their accessibility.

In this study, the design criteria of urban spaces and urban furniture in winter cities with harsh winter climate conditions were examined. In addition to this, examples from world cities regarding the usage levels of urban space and urban furniture are discussed. The examination was carried out within the extent of the design criteria that should be applied in winter cities. By examining the examples in world cities such as Trondheim, Edmonton, Montreal, Toronto, Bakklandet, Ottawa, Vancouver, Bracebridge, Quebec, Denver, Harbin, Washington, conclusions were made about the optimal use of urban furniture in winter cities. The study was prepared within the extent of the completed master thesis titled " Aesthetic and Functional Evaluation of Urban Furniture within the context of Winter Cities; the Case of Erzurum City Center ".

Keywords: Winter city, Winter climate, Urban space, Urban furniture, Design criteria

Introduction

The urban spaces that the citizens use constantly are mostly the areas outside the constructions. Due to the fact that human beings are always in contact with the environment they live in, the areas where this communication is felt most strongly and intensely appear as urban spaces. In urban areas, the physical environment elements that will provide communication and the human population to be affected are more than other areas. Urban environments are areas where citizens can meet their vital needs and are shaped according to the social, economic and cultural structure of the society formed by the citizens [1]. The term of urban space has many different definitions. Bakan and Konuk (1987) defined the urban space as all the spaces that are outside the urban development and are built on the city land, where the situations related to the city take place and are used by the citizens. In another definition; it has been stated that urban spaces are places where both social and personal needs are met as a result of social life and that they change over time due to the cultural and socio-economic structure of the citizens [2,3].

Urban spaces contain various elements called urban furniture in order to respond to the increasing individual and social needs of the citizens with the effect of urbanization. These elements are shaped in connection with the social and physical structure of the city like climate, culture, physical structure, traditionality etc. Furthermore, the needs of the citizens vary according to different geographies [1]. According to Yıldırım (2001), urban furniture is defined as equipment and structures located in open areas, whose users are not certain, and suitable for outdoor activities. Urban furniture is produced to meet the various needs of users [4]. In a different definition; urban furniture that makes urban spaces useful and enables them to fulfill their functions as required; It is stated that there are elements such as illuminated showcases, electricity poles, telephone booths, street lamps, mail boxes, public transport stops, sales units. [5].

In this study, in which urban spaces and urban furniture will be evaluated in the context of winter cities, there is also various information about the winter city. In winter cities, precipitation is usually in the form of snow and the temperature is 0°C and below. Daylight is felt to be limited. Seasonal changes are harsh and all these factors occur in long time periods [6]. According to Erskine (1986), winter cities are cities that are generally located above 45° latitude and have temperatures of 0°C or below in January [7]. Köppen climate classification (Figure 1.), introduced by Köppen in the 1900s, is one of the climate classification methods that is frequently used by the whole world. According to Köppen climate classification, the D climate zone and E climate zone are the zones where winters are severe [8].

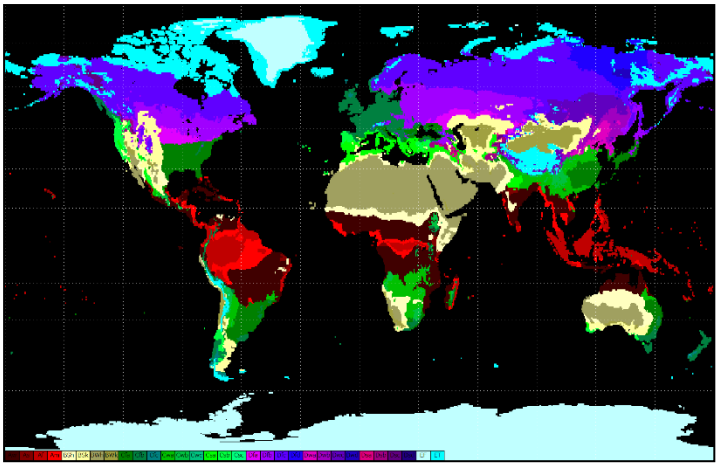

Figure 1. Köppen climate classification [8]

In cities where the winter season is predominantly felt, harsh weather conditions such as snow, wind, ice, frost, prolonged cold and decreasing daylight limit the use and access of urban spaces. The existence of qualified urban usage spaces in a city and access to these spaces are important. However, urban spaces that are not designed in accordance with the conditions of the winter season lose their accessibility [9]. Well-designed public open spaces, pedestrian and vehicle roads and structures with a correct settlement planning are important to increase the comfort of the citizens in the winter season by reducing the negative effects of the cold climate. If the streets, pedestrian roads, playgrounds, squares and parks of a winter city are planned and designed in accordance with the climate-sensitive design principles, safe and active use of the urban space can be achieved [10].

Purpose of the Study

The main purpose of this study is to consider urban spaces and urban furniture in winter cities with harsh winter climate conditions within the scope of design criteria.

Material and Method

As a method in the research; The design criteria of urban spaces and urban furniture in winter cities with winter climate conditions have been examined, and examples from world cities for their usage levels have been discussed. This analysis was made within the scope of the design criteria that should be applied in winter cities.

Design Criteria for Urban Space and Urban Furniture in Winter Cities and Examples from the World

In winter cities, the use of urban spaces is physically and psychologically restricted due to cold climatic conditions. In order for the urban structure to be socially, physically and economically livable, pedestrian ways and streets that combine the different functional areas of the city and are considered as the social spaces of the city should be designed in accordance with the climate. There are many criteria to be considered in the design of such spaces [1]. According to the Winter City Design Guidelines, there are some criteria to be applied in winter cities;

- Seamless building facades with awnings, signage and warm colors create visual interest and pedestrian scale.
- The use of seasonal lighting is one of the most effective ways to create a special winter atmosphere. Fun activities can be organized on the street by adding electrical and sound outputs to the lighting elements.
- Slightly elevated pedestrian crossings slow traffic and prevent snowmelt or ice from forming at the curb.
- Pedestrian lighting and street furniture increase comfort and safety.
- Wider curbside lanes allow for bikes in the summer and temporary snow storage in the winter [11].

There are various suggestions in the literature about sunbathing and wind effect;

- It is important to design streets and avenues in accordance with the topography of the city in order to provide sunbathing and to protect them from the cooling effect of the wind [10].
- Shaded areas, especially in cold climate regions, are considered as dead areas in the city. For this reason, pedestrian roads and urban spaces should be designed in such a way that they benefit from the sun at the maximum level. In addition, it is important to position the streets in the north direction so that high buildings do not block the sun and large shadows do not fall on pedestrians [12].
- An orientation that receives direct sunlight should be provided, and buildings should be avoided as much as possible. For this purpose, the north side of the open areas should be limited to the buildings, and the south side of the open areas should be left open for maximum benefit from the sun [13].
- Pedestrian paths should be planned in the sunlit parts of the buildings. When this situation cannot be achieved, designs should be designed in such a way that the buildings do not cast a shadow on the pedestrian paths [11].
- Winter winds make even sunny places unbearably cold. Tall buildings increase wind speed at ground level. Instead, reducing the height of buildings and grouping them

together with other buildings of similar height helps to protect them from the wind [11].

There are also various suggestions by researchers about the use of color and visual interest;

- When organizing pedestrian routes and streets, warm colors such as red, orange, and yellow should be chosen over chilly hues such as green and blue. For emphasis, pastel tones, earth tones, and vibrant colors like red, orange, and yellow can be used. Special structures such as electricity poles, bridges and urban furniture are suitable for the use of colors. Colors can be used temporarily in elements such as banners and posters, which are temporary urban elements [11]. Facade designs designed for color choices that help increase the visual interest of the citizens are found in Trondheim and Bakklandet regions of Norway (Figure 2).

Figure 2. Use of warm colors in winter cities [14,15]

In Québec, Canada, designs were designed to create lively streets using warm colors (Figure 3). In addition, Figure 4 shows the colorful urban furniture in Canada.

Figure 3. Use of warm colors in winter cities [16]

Figure 4. Use of warm colors in urban furniture (Montreal, Ottawa)

Various suggestions have also been developed on lighting;

- Due to the lack of sunlight, the citizens cannot see the ice on the pedestrian roads and some urban elements. For this reason, the streets should be illuminated well and walking safety should be ensured [17,18]. The use of lighting elements suitable for pedestrian scale also ensures walking safety.

Figure 5. Use of pedestrian-scale lighting (Edmonton) [12]

- In order to balance the darkness and monotony of the winter season, appropriate colors and lighting elements should be used in the buildings surrounding the squares and in the square [19].

Figure 6. Lighting and colors that add movement to the space (Amsterdam, Netherlands)

In winter cities, social space activities in urban spaces are very limited. The reason for this is the negative effect of cold and gloomy weather on human psychology. There are some suggestions to increase social space activities;

- Urban spaces should be designed as multifunctional to allow activities to be carried out both in winter and summer. A lake or water area that can be used as an ice rink in winter can be designed to be used as a pond in summer [11,13].

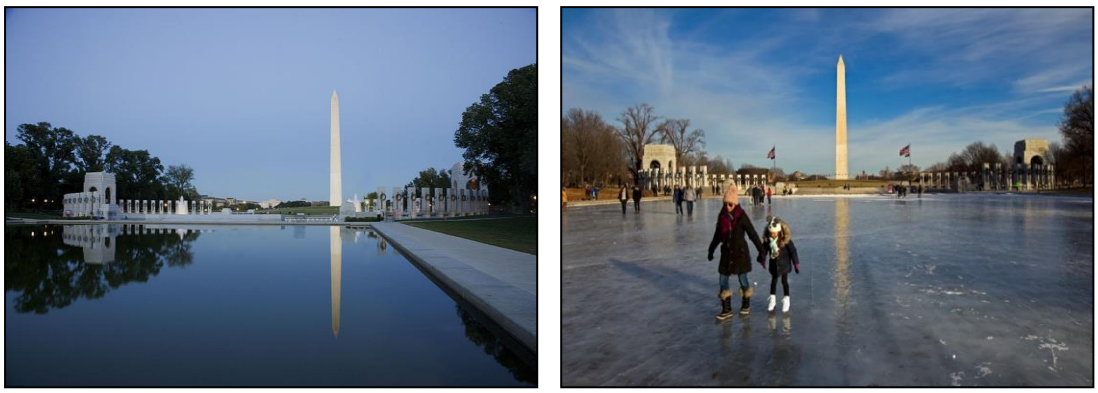

Figure 7. "Reflecting Pool", which offers both winter and summer activities (Washington)

- Open urban areas such as parks and squares should have areas for snow and ice storage. For example, mound-like areas to be created can be used as winter playgrounds for children [11]. Apart from being a playground, such areas can also be used as a basic element in a festival (Figure 8).

Figure 8. A winter festival in Bracebridge (Canada) [20]

In addition, urban elements such as plastic art elements can be constructed in order to dissipate the monotony of the cities stemming from the cold climate. The recommendations for this are as follows;

- The elements of modern art, which are used to disperse the cold and dark air in winter cities, also appear as ice sculptures. Ice sculptures, which are mostly used in festivals, create a warm atmosphere with the help of different lighting (Figure 9).

Figure 9. 29th Harbin International Ice and Snow Festival (Harbin, China)

Conclusions

Suggestions for urban space and urban furniture design in winter cities are as follows;

- With the use of small-scale lighting elements, the daily life of the citizens in urban spaces should be facilitated in the face of climatic events such as snowfall and frost, which are intense in winter.
- Besides being functionally successful, it is important to consider the lighting elements in terms of aesthetics as well. The use of products that can minimize the harsh conditions of the winter season and make them feel energetic should be

ensured. In order to obtain such products, qualities such as color and material must be chosen correctly.

- By providing semi-closed and semi-open areas in urban areas and presenting these areas to the citizens, the cold effect of winter should be transformed into a warm social space and various social activities and services should be offered to the citizens.
- Urban interior spaces should be obtained by making the seating elements and their surroundings sheltered and providing heating with various methods, and qualified attraction points should be created for the active use of the citizens.
- The cold and harsh conditions of the winter city should be improved by creating sheltered seating areas with the frequent use of top cover elements in the design.
- Only materials such as plastic and wood should not be used in the game elements. In addition to these, playgrounds should be arranged with snow accumulations obtained from snowfall. Playing elements in different forms and functions should be produced and shaped by snow, and fun and enjoyable spaces should be presented. Such places will make the winter season fun not only for children but also for adults.
- The frequent use of urban elements such as plastic art objects and water elements in urban spaces has a permanent place in the minds of the citizens. In this way, it becomes easier for the citizens to define a visual space. For this reason, while designing such elements, vivid colors, seasonal lighting elements and striking forms should be designed.

In summary, the needs in a winter city should be taken into account, and the compatibility of the products with the climate should be strengthened. Urban furniture designed as a result of the evaluation of such criteria will be adopted by the citizens and its use will develop in a positive way.

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ID:81-EOP

Friction and Wear Characteristics of Methacrylated κ-Carrageenan/Gellan Gum Based Hydrogels

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In-vitro friction and wear properties of a methacrylated κ-carrageenan/gellan gum based hydrogel proposed as a cartilage tissue engineering material were investigated as it was reciprocated against a CoCrMo femoral head using a custom pin-on-disk tribometer. Tests were carried out for 1 h at a sliding speed of 20 mm s^{-1} and the loads of 2.5 and 5 N in phosphate saline solution (PBS) and bovine calf serum (BCS) at 37±1 °C. The wear track of each sample was photographed to measure the damage area using ImageJ. Both the coefficient of friction (COF) and the damage area were found to increase at a higher load regardless of lubricant. The use of BCS rather than PBS contributed to better lubrication and reduced the COF by 29% and 38% at 2.5 and 5 N, respectively. The wear track was observed as surface fibrillation when BCS lubricant was used, and the wear track area greatly decreased. The hydrogel tested at 2.5 N in BCS showed superior tribological performance than the other test groups. This study shows how the tribological performance of the hydrogel altered under various physiological conditions.

Acknowledgement: This work was supported by the Scientific Projects Coordination Unit of Hitit University under the project number MUH19001.19.003.

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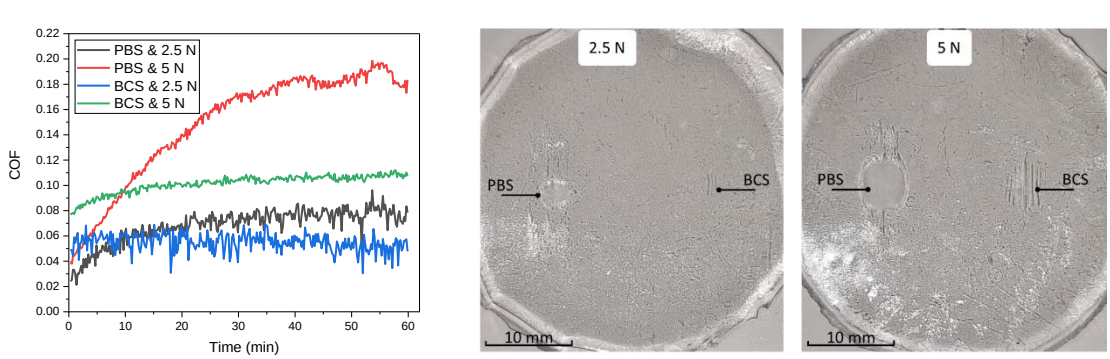

Figure. COF versus time (left) and photographs of hydrogel worn surfaces (right).

ID:91-EOP

Investigation of the Relationship Between Safety Culture Levels and Safety Performances of Employees in the Construction Sector

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The construction sector has an important place in the Turkish economy with its financial size and workforce opportunities it provides. In addition, according to the 2019 work accident statistics of the Social Security Institution in the construction sector, which is in the category of very dangerous work, 47701 accidents occurred, 368 employees lost their lives due to work accidents, and 1586 employees became permanently incapacitated as a result of work accidents. Occupational accidents are one of the most important problems faced by employees in their working lives. Many legislation and institutional arrangements have been made in order to prevent accidents that may occur during the working life of humanity and to create a healthy environment for employees. Although these regulations exist, many accidents still occur in workplaces. Recently, the concept of safety culture has been emphasized in the prevention of occupational accidents. In this study, the effect of safety culture perceptions of employees in the construction industry on safety performance was examined. The sample of the study consists of 130 people working in 5 different companies operating in the construction sector in Ankara, Istanbul, Ağrı and Sivas, determined by simple sampling method. As a data collection tool, 9 different scales adapted into Turkish by Dursun (2011) were used. IBM SPSS 22 package program was used to analyze the data in the research. It has been determined that there is a positive and significant relationship between the variables of safety culture (attitudes of managers, behaviors of managers, safety priority, safety communication, safety training, safety awareness, employee participation, fatalism and reporting culture) and employees' safe behaviors (safety compliance and safety participation). As a result of the regression analysis, it was determined that the variables of safety awareness and reporting culture were significant predictors of employees' safe behaviors (safety compliance and safety participation). It is thought that eliminating the fatalism understanding, taking measures to increase awareness and competence, and developing a reporting culture by creating a strong reporting system will contribute to the reduction of occupational accidents.

Keywords: Safety culture, safe behavior, construction industry, work accident

Introduction

The construction sector has an important place in the Turkish economy with its financial size and workforce opportunities [1]. In addition, serious hazards in the construction sector threaten the lives of workers due to the unique characteristics of this field of activity [2]. According to the 2019 occupational accident statistics of the Social Security Institution (SGK), 47701 accidents occurred in the construction sector. While approximately 11.3% of all occupational accidents in 2019 were experienced in the construction sector, 368 construction workers lost their lives due to occupational accidents in this year, and 1586 construction workers became permanently incapacitated as a result of work accidents [3]. Although many legal and institutional arrangements have been made to prevent occupational accidents from the past years to the present, occupational accident statistics show that the studies have not achieved much success. From this point of view, it is necessary to consider occupational accidents not only as a technical issue, but also to take into account the human factor [4].

The first measures taken to prevent or reduce occupational accidents mostly cover the issues of solving technical issues and eliminating physical hazards. However, when it was understood that these technical measures were not sufficient to solve the problem, researchers started to examine the human factor. According to these studies, approximately 90% of occupational accidents are caused by unsafe behaviors of people [5]. This shows that the concept of safety culture is important for the prevention of occupational accidents.

The concept of safety culture was first mentioned in the reports prepared for a nuclear accident that occurred in Chernobyl in 1986. In the future, it has been a concept that has been emphasized in the prevention of occupational accidents [6]. While Carroll (1998) defines safety culture as “shared values, beliefs, assumptions, and norms that influence individual and organizational attitudes and organizational decisions about safety” [7]. Cooper (2000) stated that “it is the level of visible efforts related to their interest and actions to increase security on a daily basis that guides all organizational members” [8]. The basic step of making the occupational safety dimension culturally entrenched with the employer and the employee in preventing occupational accidents and occupational diseases in occupational health and safety activities in workplaces is the safety culture. Employees, employers and businesses are the subjects of this culture. If a connection is established with each other in an interactive and systematic harmony, each subject can carry out what he has to do in a healthy and safe way [9].

There have been many studies on safety culture, both at the theoretical and practical level. Studies have shown that a safety culture is an important factor in creating a healthy and safe work environment [6, 10, 11, 12, 13, 14, 15, 16]. The concept of safety culture is accepted by experts because of its positive effects on reducing accident occurrences and work injuries [15]. In this study, the effect of safety culture perceptions of employees in the construction industry on safety performance was examined.

Method

Safety culture perceptions of employees in the construction industry Questionnaire technique was used to examine the effect on performance. The data were collected with the relational survey model, one of the quantitative research methods. This model is a quantitative approach involving the use of self-report measures of a carefully selected sample [17]. Karasar (2009: 81) defined the relational screening model as "a research model that aims to determine the existence and/or degree of variation between two or more variables" [18].

The universe of the research consisted of employees in 5 different construction companies in Ankara, Istanbul, Ağrı and Sivas, and the sample consisted of 130 employees determined by simple sampling method.

Nine different scales adapted into Turkish by Dursun (2011) were used to collect data [8]. Management commitment (attitudes and behaviors of managers) and employee involvement scales developed by Muniz et al. (2007) [19], Management commitment and security priority scales developed by Cox and Cheyne (2000) [20], Safety communication, safety education, and safety behavior (security compliance and safety engagement) scales developed by Neal et al. (2000) [21], Security awareness scale developed by Lin et al. (2008) [22], fatalism scale taken from Havold and Nesset (2009) study developed by Rundmo and Hale (1999), The reporting culture scale [23] developed by Havold and Nesset (2009) was used.

IBM SPSS 22 package program was used to analyze the data collected in the research. Correlation and regression analysis were performed in the evaluation of the data. The Cronbach Alpha coefficient was used to measure reliability in the study. It is suggested that a Cronbach Alpha coefficient higher than 0.70 is sufficient for the reliability of the measurement tool [24, 25, 26, 27]. When Table 1 is examined, the Cronbach Alpha coefficient of safety culture scales being greater than 0.70 indicates that the scales used are reliable.

Table 1. Reliability coefficients of the scales and skewness and kurtosis coefficients of the scales

	Number of Items	C.Alph	C.Alph*
Attitudes of Managers	4	0.92	0.84
Behaviors of Managers	4	0.87	0.90
Security Priority	4	0.87	0.76
Security Communication	5	0.89	0.86
Safety Training	4	0.84	0.89
Security Awareness	5	0.88	0.81
Employee Participation	4	0.86	0.80
Fatalism	6	0.87	0.82
Reporting Culture	5	0.88	0.80

*Reliability values when the scales are adapted to Turkish [8].

Findings

The results of the correlation analysis carried out to determine the relationship between the safety culture variables and the employees' safe behaviors (safety compliance and safety participation) are shown in Table 2.

Table 2. Results of correlation analysis between safety culture variables and safe behavior

	1	2	3	4	5	6	7	8	9	10
1. Attitudes of Managers										
2. Behaviors of Managers	.67**									
3. Security Priority	.71**	.78**								
4. Security Communication	.60**	.62**	.74**							
5. Safety Training	.54**	.52**	.61**	.75**						
6. Security Awareness	.41**	.38**	.31**	.30**	.47**					
7. Employee Involvement	.43**	.51**	.50**	.43**	.51**	.58**				
8. Fatalism	.10	.14	.19**	.24**	.24**	.24**	.40**			
9. Reporting Culture	.42**	.36**	.39**	.36**	.39**	.66**	.55**	.33**		
10. Security Compliance	.39**	.32**	.31**	.33**	.38**	.63**	.48**	.18**	.72**	
11. Safety Engagement	.45**	.37**	.36**	.39**	.45**	.60**	.49**	.21**	.61**	.67**

**p<.01

When Table 2 is examined, it is seen that both safety participation and safety compliance variables have a positive and significant relationship with safety culture variables. The variable with the strongest relationship between the safety engagement variable is safety awareness (r=.60; p<0.01), and the safety compliance variable is reporting culture (r=.72; p<0.01). It has been determined that the variables of safety participation and safety compliance have a weak and positive significant relationship with the fatalism variable. There is also a strong relationship between safety compliance and participation (r=.67; p<0.01).

The results of multiple regression analysis conducted to examine the effect of safety culture variables on safety compliance are shown in Table 3.

Table 3. The effects of safety culture variables on safety compliance, results of multiple regression analysis

	B	S.H.	β	t	p
Constant	,37	,32		1,17	,244
Attitudes of Managers	,06	,09	,06	0,65	,515
Behaviors of Managers	,00	,12	,00	-0,02	,988
Security Priority	-,12	,13	-,10	-0,88	,382
Security Communication	,12	,13	,10	0,87	,385
Safety Training	,02	,12	,01	0,14	,889
Security Awareness	,28	,11	,24	2,63	,010
Employee Participation	,07	,11	,06	0,66	,514
Fatalism	-,10	,08	-,09	-1,27	,207
Reporting Culture	,61	,10	,53	6,13	,000
$R=.662$, $R^2=.539$, $F_{(9\text{-}120)}=17.751$, $p=.000$					

The regression model created was found to be significant (F(9-120)=17.751, p<.001). It explains 54% of the variance regarding safety compliance of safety culture variables (R2=.539). According to the standardized regression coefficient (β), the relative order of importance of the predictor variables on safety fit; reporting culture, security, awareness, safety priority, safety communication, fatalism, attitudes of managers, employee participation, safety training, and behavior of managers. When the results regarding the significance of the regression coefficients are examined, it is seen that the variables of reporting culture (β=.53, t=6.13, p<.001) and security awareness (β=.24, t=2.63, p<.05) are significant (significant) on safety compliance. appears to be a predictor. Other safety culture variables did not have a significant effect (Table 3). The results of multiple regression analysis conducted to examine the effect of safety culture variables on safety engagement are shown in Table 4.

Table 4. The effects of safety culture variables on safety participation, results of multiple regression analysis

	B	S.H.	β	t	p
Constant	0,81	,29		2,81	,006
Attitudes of Managers	0,14	,09	,16	1,61	,110
Behaviors of Managers	-0,01	,11	-,01	-0,05	,962
Security Priority	-0,11	,12	-,12	-0,91	,366
Security Communication	0,12	,12	,12	0,98	,330
Safety Training	0,06	,11	,07	0,60	,551
Security Awareness	0,25	,10	,26	2,57	,011
Employee Participation	0,08	,10	,08	0,80	,428
Fatalism	-0,03	,07	-,03	-0,39	,696
Reporting Culture	0,31	,09	,32	3,42	,001
$R=.699$, $R^2=.450$, $F_{(9-120)}=12.748$, $p=.000$					

The regression model created was found to be significant (F(9-120)=12.748, p<.001). Safety culture variables explain 45% of the variance in safety participation (R2=.450). According to the standardized regression coefficient (β), the relative order of importance of the predictor variables on safety participation; reporting culture, security awareness, attitudes of managers, security communication, security priority, employees participation, safety training, fatalism, behavior of managers. When the results regarding the significance of the regression coefficients are examined, it is seen that the variables of reporting culture (β=.32, t=3.42, p<.001) and safety awareness (β=.26, t=2.57, p<.05) are significant (significant) on safety participation. appears to be a predictor. Other safety culture variables did not have a significant effect (Table 4).

Discussion and Conclusion

The effect of safety culture perceptions of employees in the construction industry on safety performance has been examined.

A positive and significant relationship was determined between the safe behaviors of the employees in the construction sector (safety compliance and safety participation) and the safety culture variables. In the study conducted by Yılmaz and Yılmaz (2011) on employees in the construction sector, a positive and significant relationship was found between the safe behaviors of employees and the variables of safety culture [28]. In the study conducted by Dursun (2011) on employees in the manufacturing sector, a positive and significant

relationship was found between the safe behaviors of employees and all other safety culture variables except fatalism [9].

When the effects of security culture variables on security compliance were examined, it was determined that the reporting culture and security awareness variables were important predictors of security compliance. From this point of view, increasing the awareness of the employees about the dangers and risks in the working environment and developing a reporting culture by creating a strong reporting system positively affect the behavior of complying with safety. In the study conducted by Dursun (2011) it was determined that besides the variables of security awareness and reporting culture, the variables of employee involvement and fatalism also have a significant effect on safety compliance [9]. In the study conducted by Yılmaz and Yılmaz (2016), security awareness, reporting culture, security priority, security communication and employee participation variables were found to have a significant effect on safety compliance [28].

When the effects of safety culture variables on safety engagement were examined, it was determined that reporting culture and safety awareness variables were significant predictors of safety engagement. In the study conducted by Yılmaz and Yılmaz (2016), it was determined that besides the variables of security awareness and reporting culture, the variable of security communication also has a significant effect on security participation [28]. In the study conducted by Dursun (2011) it was determined that the variables of safety awareness, employee participation, reporting culture and fatalism had a significant effect on safety participation [9]. Neal et al. (2000) in their study on hospital employees and Griffin and Neal (2000) in their study on workers in the manufacturing and mining sectors, it was determined that the safety climate directly affects safe behavior [21, 29].

Safety culture is of great importance in creating a healthy and safe working environment in the construction industry. One of the reasons for occupational accidents in the construction sector is the lack of a safety culture at the desired level. Employing highly educated employees and increasing educational activities, improving the attitudes and behaviors of the management, eliminating the fatalism approach, It is thought that taking measures to increase awareness and competence, ensuring the active participation of employees in safety, establishing effective communication, developing a reporting culture by creating a strong reporting system will contribute to the reduction of occupational accidents.

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MATERIALS SCIENCE ORAL PRESENTATIONS

ID:18-AOP

Corrosion and Wear Behavior of Fe-Cr-C-V-Mo Hardfacing Coatings

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The workpieces which experience abrasive, erosive and corrosive conditions can be protected by hardfacing coatings. Present study focused on the effect of molybdenum (Mo) on wear and corrosion resistance of Fe-Cr-C hardfacing alloys with a constant ferrovanadium addition of 8 wt.%. Increasing Mo content provided the formation of complex carbides and increased carbide volume fraction (CVF) although it caused a minor change in corrosion resistance. Owing to the increased CVF, wear loss of coatings tended to decrease. The coating with minimum Mo content exhibited the maximum corrosion rate of 0.06 mm/year whereas the other coatings showed the same corrosion rate of 0.04 mm/year. Corrosion has started in iron based matrix around the carbides which act as cathode spot.

Keywords: Hardfacing, hardness, wear, corrosion, carbide.

Introduction

Hardfacing is an economic and a simple method to extend the life of structural components exposed to severe wear conditions [1]. Due to the material loss, the components could lost their functionality and dimensional stability [2]. Hardfacing is widely applied in petrochemical, food industry , mining [2,3] by several methods such as submerged arc welding (SAW) [4], laser hardfacing [5], cold metal transfer welding [6], and arc welding [7].

Hardfacing can be defined as a kind of surfacing process which includes the deposition of a filler metal on a relatively soft base metal [8]. Hardfacing alloys can be divided into three according to the matrix material; Co-based alloys with superior galling resistance [9], Ni-based alloys with an excellent abrasion and corrosion resistance at elevated temperature [10], and high alloy Fe-based alloys which are commonly preferred due to their cost effectiveness and good performance.

Abrasion and corrosion resistance of Fe-Cr-C hardfacing alloys can be imrpoved by adding elements such as Ti [11], Mo [12], V [13], W [14], and Nb [15]. This study aims to improve the wear and corrosion resistance of Fe-Cr-C-V hardfacing alloy by molydenum addition.

Materials and Method

Fe-C-Cr-V-Mo hardfacing coatings were applied on 5 mm thick S235JR steel. A powder mixture of ferrochromium (FeCr), ferrovanadium (FeV) and ferromolybdenum (FeMo) was added to massive filler wire (Table 1) by a powder feeding unit during the arc welding process (Table 2). The coatings consist of 70 wt.% powder mixture of FeCr-FeV-FeMo and 30 wt.% of massive wire. The amount of FeV in the powder mixture was kept constant (8 wt.%). FeMo was added to powder mixture with the weight percentages of 2%, 3%, and 4%. The composition of the powder mixtures are given in Table 3.

Table 1. Chemical compositions of massive wire and ferro alloys (wt.%)

Element	V	Mo	C	Si	S	P	Cr	Mn	Fe
Massive wire	-	-	0.08	0.8	-	-	-	1.45	Rest
FeV	57.5	-	0.1	1.5	0.017	-	-	-	
FeMo	-	69.5	0.047	-	0.043	-	-	-	
FeCr	-	-	7.27	0.516	0.061	0.01	67.84	-	

Table 2. Welding parameters

Voltage (V)	28-30
Current	350
Welding Speed	140
Oscillation width	40

Table 3. Composition of powder mixtures of coatings (wt.%)

Sample code	FeCr	FeMo	FeV
FeCrCV-2 Mo	90	2	8
FeCrCV-3 Mo	89	3	
FeCrCV-4 Mo	88	4	

Metallographic Examination

Metallographic investigations of the hardfacing coatings were performed by Nikon Eclipse LV-100 optical microscope and SEM-EDX analysis. Coatings were polished and etched with Kalling's solution. The carbide volume fraction was calculated by the Clemex software (Figure 1). Chemical compositions of matrix and carbide phases were determined by SEM-EDX analysis.

Hardness Test

Macro hardness of the coatings was measured by EMCO Test Vickers hardness tester under 20 kgf loads according to ASTM: E-384 standard. In addition, Vickers microhardness test was applied to carbides and matrix/carbide eutectic under 50 gf loads.

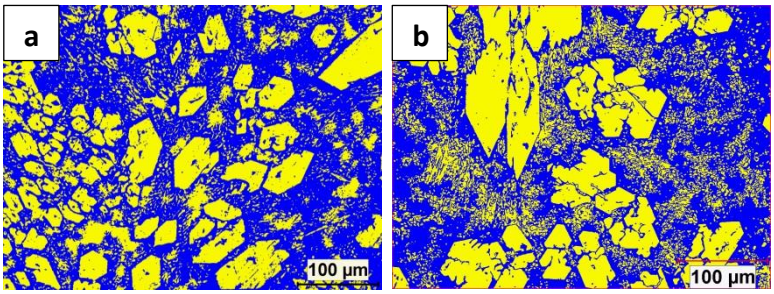

Figure 1. Carbide volume fraction measurements: a) FeCrCV-2 Mo, b) FeCrCV-3 Mo

Wear Test

Dry sliding wear behaviour of coatings was examined by ball-on-disc wear test performed at room temperature (25 ± 3) °C with CMS Instruments Tribometer. An alumina ball with a diameter of 6 mm was selected as the counterpart. The load of the wear test was adjusted as 10 N. Ball-on-disc wear test was carried out along the sliding distance of 1500 m. The radius of the wear track was adjusted as 4 mm. Volumetric material was measured with Mitutoyo profilometer.

Corrosion Test

Metrohm Dropsens µstat 400 Potentiostat/ Galvanostat corrosion test equipment was employed in an attempt to determine the corrosion rate of the coatings in 0.4 M NaCl solution. The corrosion test was carried out in 75 ml NaCl solution with a scan rate of 0.001 V/s using a Ag/AgCl reference electrode and a graphite electrode. Corroded surface of the coating was 16 mm2. Each sample was immersed in NaCl solution for 60 seconds in order

to stabilize the open circuit potential. Tafel curves were plotted between -1V and 0.3V. Corrosion rate was calculated according to Tafel extrapolation method. After corrosion test the corroded surfaces were examined under SEM.

Results and Discussion

Microstructure

SEM images of hardfacing coatings are given in Figure 2. The microstructure of coatings consists of hexagonal shaped primary M_7C_3 carbides which were also observed by [16], [17], [18], and [19], secondary carbides dispersed in iron based matrix and a complex carbide of Mo,Cr, and Fe.

Based on the SEM observations, the microstructure of coating near the substrate differs from the top surface of the coating. The coating has a hypoeutectic microstructure near the substrate whereas it evolves into hypreutectic microstructure towards the top surface (Figure 2). This microstructural evolution arises from the effect of dilution. Chemical dilution can be described as the element diffusion from the substrate toward the deposit [20]. It was observed from the SEM images taken with the same magnification that the addition of 4% FeMo and decreasing carbon and chromium content expanded the hypoeutectic structure besides dilution of coating with the substrate (Figure c). The hypoeutectic structure is followed by the eutectic and hypereutectic structure towards the upper surface of the coating.

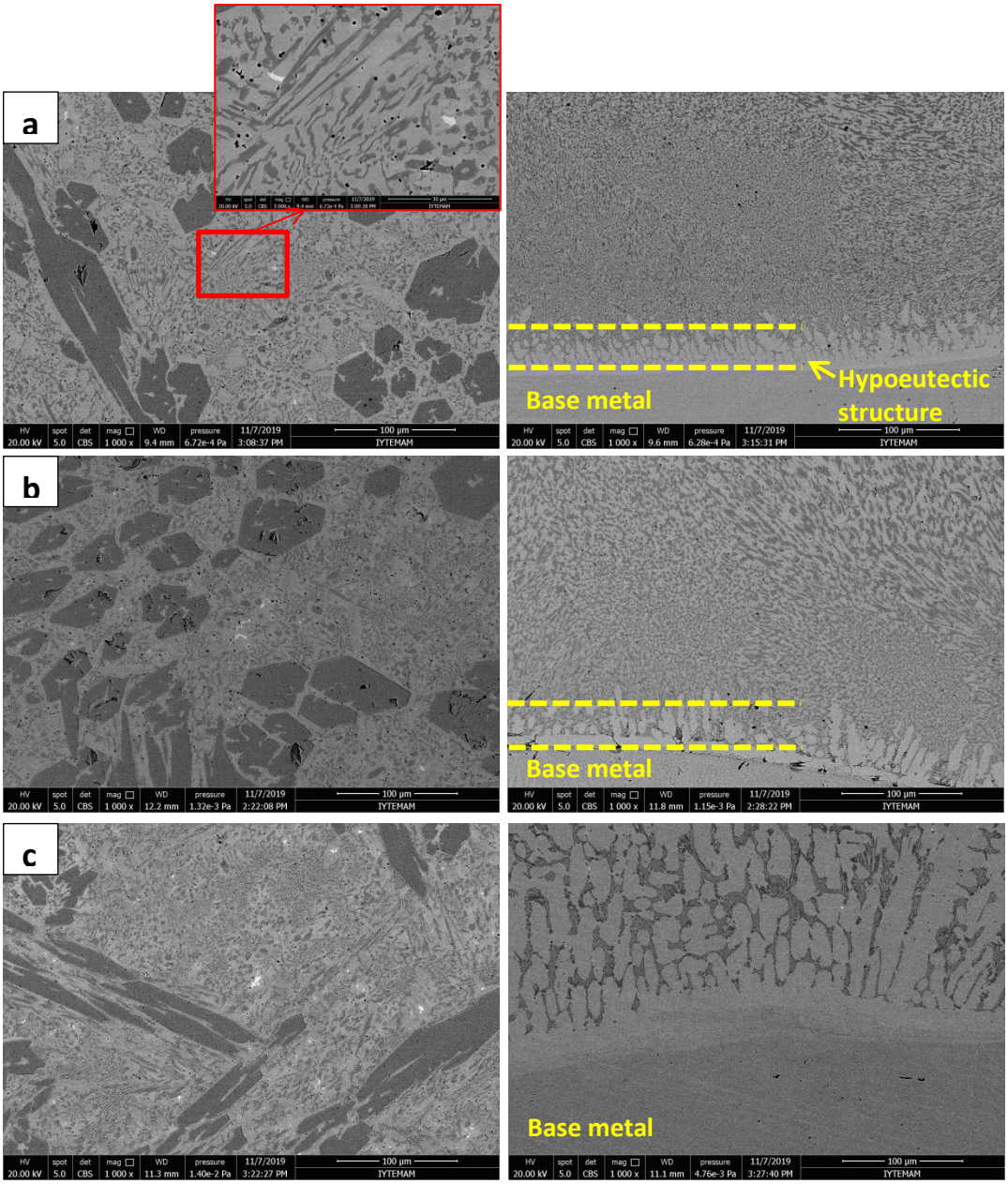

Figure 2. Microstructure of Fe-Cr-C-V-Mo hardfacing coatings: a) FeCrCV-2 Mo, b) FeCrCV-3 Mo, c) FeCrCV-4 Mo

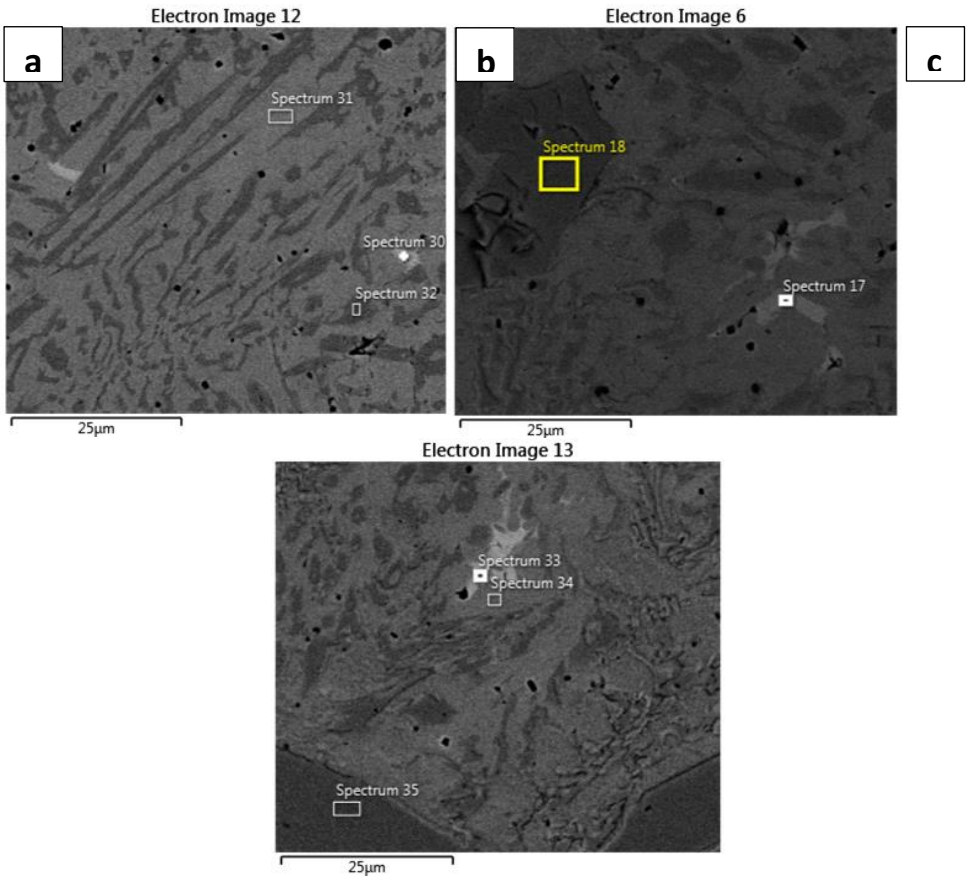

Figure 3. SEM-EDX analyses of: a) FeCrCV-2 Mo, b) FeCrCV-3 Mo, c) FeCrCV-4 Mo

Light phase			
Element	FeCrCV-2 Mo	FeCrCV-3 Mo	FeCrCV-4 Mo
C	2.60	6.41	4.99
V	**0.52**	**1.68**	**1.66**
Cr	13.97	19.69	18.64
Fe	70.97	49.28	48.19
Mo	**11.94**	**22.93**	**26.51**
Total:	100.00	100.00	100.00
Dark phase			
Element	FeCrCV-2 Mo	FeCrCV-3 Mo	FeCrCV-4 Mo
C	10.90	13.97	11.37
V	**4.35**	**4.66**	**5.97**
Cr	49.95	54.94	54.16
Fe	33.66	25.63	27.61
Mo	**1.15**	**0.81**	**0.89**
Total:	100.00	100.00	100.00

SEM-EDX analyses revealed that the hexagonal shaped carbides (dark) includes at least 50% chromium, vanadium above 4% and a trace amount of molybdenum (Figure 3 and Table 4). In contrast, the lightest phase with a complex morphology includes a significant amount of molybdenum in comparison with the hexagonal shaped primary carbides and a trace amount of vanadium. The molydenum content ot this phase increased witt increasing FeMo addition. According to the SEM-EDX findings it can be stated that the hardfacing coatings consist of M7C3 (M: Fe,Cr dominant) carbides and molybdenum carbides.

Hardness and Wear Loss

The correlation of carbide volume fraction (CVF)-hardness and wear loss is given in Figure. CVF was improved by the increasing amount of molybdenum. Although CVF has a significant effect on wear resistance, the abrasion resistance is not only depend on the amount of carbides but also the type of matrix [21] and hardness of matrix and carbides. Microhardness measurements revealed that the coating including 3 wt.% FeMo exhibited the highest matrix hardness (Figure 4b). The primary carbide hardness of FeCrCV-3 Mo was found to be approximately the average of the primary carbides of other coatings. However, owing to its high matrix hardness it is the hardest coating with the minimum wear loss although it has not the highest CVF (Figure 4a).

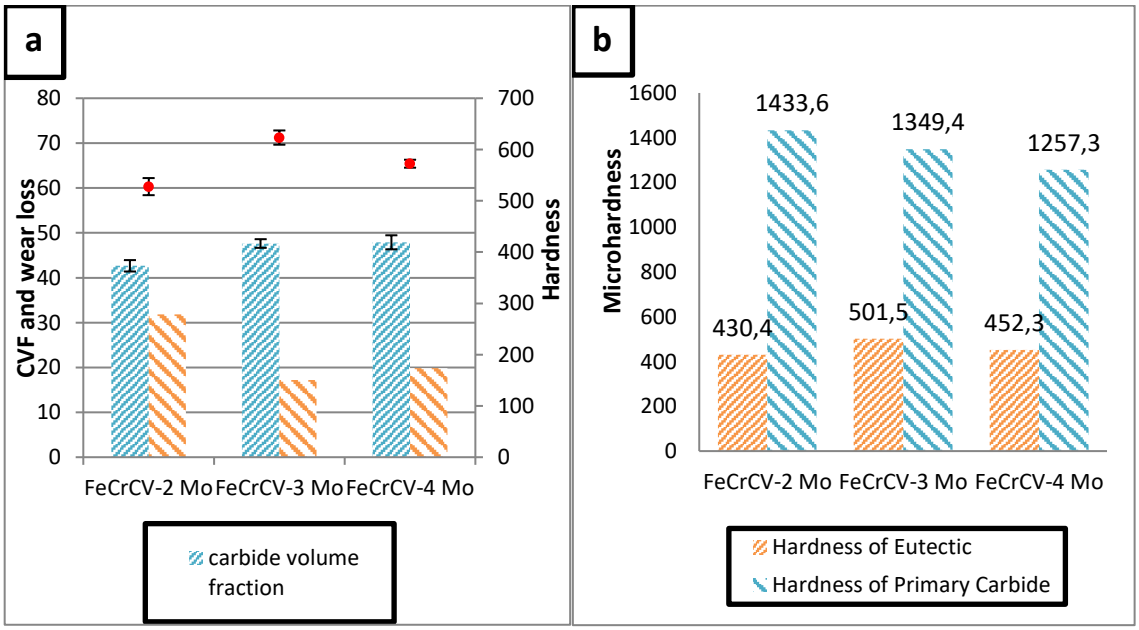

Figure 4. a)Correlation of CVF-Hardness-Wear Loss, b) Microhardness of primary carbide and eutectic

Worn surface of the coatings indicates the abrasive wear. Besides, cracks and fracture of brittle primary carbides were observed (Figure 5). Cracks were observed extensively in the coating of FeCrCV-3 Mo with the minimum wear loss probably due to its highest matrix hardness.

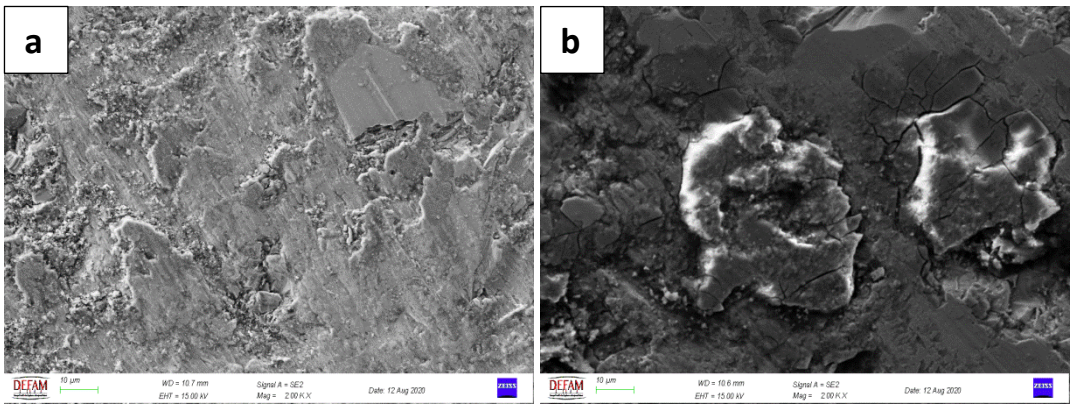

Figure 5. Worn surface of coatings: a) FeCrCV-2 Mo, b) FeCrCV-3 Mo

Corrosion Rate

Tafel curves and calculated corrosion rates are given in Figure 6. Although the increased amount of Mo has a significant effect on wear resistance, it did not result in a great difference of the corrosion rate of coatings. The coating with minimum Mo content exhibited the highest corrosion rate that can be a result of minimum amount of CVF.

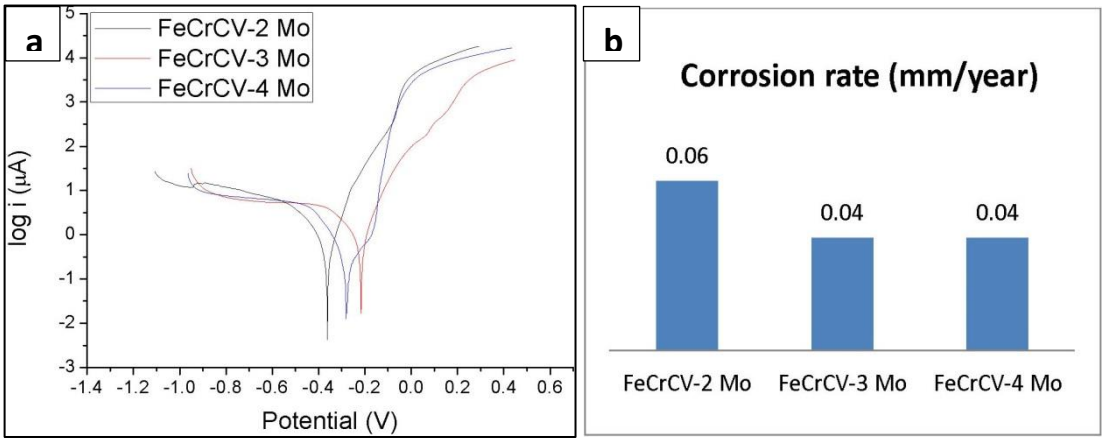

Figure 6. a) Tafel curves of coatings, b) Corrosion rate of coatings

Corroded surfaces of hardfacing coatings are given in Figure 7. It was observed that Fe-based matrix material around the primary and secondary carbides dissolved. Zhang et al.

[22] measured the free corrosion potentials of carbides higher than that of matrix. The corrosion potential difference between carbide and matrix explains the dissolution of the matrix phase. Because the material with a more negative potential tends to corrode [23]. Azimi and Shamanian [21] reported that the corrosion potential of M7C3 carbides could be higher than that of austenite matrix. Hence, the more M7C3 carbides can shift the corrosion potential of coating to a more positive state and improve its corrosion resistance.

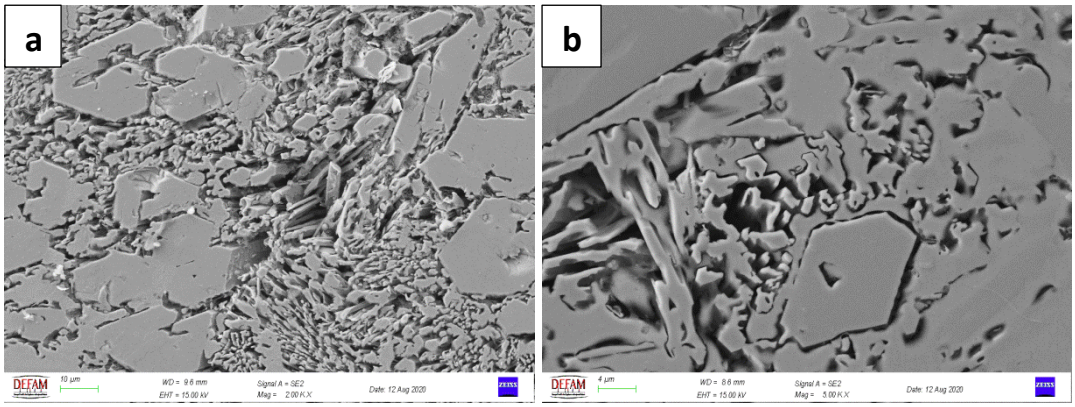

Figure 7. Corroded surfaces of coatings: a) FeCrCV-2 Mo, b) FeCrCV-4 Mo

Conclusions

Fe-Cr-C-V-Mo hardfacing coatings were produced successfully by arc welding. The performance of these coatings was examined considering their hardness, wear and corrosion resistance. The results are summarized as follows:

1. Microstructure of Fe-Cr-C-V-Mo hardfacing coatings consists of primary M7C3 carbide, a complex carbide of Mo, Cr and Fe, and secondary carbides dispersed in iron based matrix.
2. Carbide volume fraction increased with increasing amount of molybdenum. However, the hardness of the coating is not only depend on carbide voume fraction but also the chemical content of the matrix material. A decrease in carbon and chromium with increasing molybdenum resulted in a decrease in hardness of matrix/secondary carbide eutectic.
3. Increased amount of molybdenum enhanced the wear properties of the hardfacing coatings.
4. The addition of FeMo more than 2 wt.% provided a better corroson resistance. Iron based matrix material exhibited anodic characteristic and was exposed to corrosion. The dissolution of the matrix material started around carbides which acted as cathode site.

Acknowledgement: This work was supported by Scientific Research Project office of Manisa Celal Bayar University (Project number: 2019-074)

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ID:33-AOP

Flexible and Ultralight CoZn-MOF/Reduced Graphene Oxide Sponge

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Abstract

We studied the fabrication of a flexible and ultralight CoZn-Metal-organic frameworks/reduced graphene oxide (CoZn-MOF/rGO) sponge for use as a multifunctional flexible electrode material. Flexible and ultralight CoZn-MOF/rGO sponge was produced by incorporating hydrothermally synthesized CoZn-MOF into the aqueous dispersion of graphene oxide (GO) using a foaming sol-gel method. The physicochemical properties of as-prepared materials were characterized by means of scanning electron microscopy (SEM), energy-dispersive X-ray spectroscopy (EDAX), X-ray photoelectron spectroscopy (XPS), and X-ray powder diffraction (XRD) patterns. Cyclic voltammetry (CV) result showed that the flexible and ultralight CoZn-MOF/rGO sponge exhibited good electrochemical performance. This study exhibited that flexible and ultralight CoZn-MOF/rGO sponge possessing easy and non-toxic method preparation, low cost, and high flexibility, have great potential to develop high-performance flexible electrode materials.

Keywords: Cobalt zinc MOF, graphene sponge, hydrothermal synthesis, flexible electrode material

Introduction

In recent years, graphene, a material that consists of two dimensional (2D), one-atom-thick sheet of sp^2-hybridized carbon atoms has attracted tremendous interest in a variety of fields because of its outstanding electronic, thermal, and mechanical properties [1]. However, 2D graphene sheets tend to the irreversible agglomeration or restacking because of the strong van der Waals interactions. Engineer a three-dimensional (3D) macroscopic electrode material in which individual graphene sheets are bonded together to construct 3D networks is one of the effective way to solve this problem [2]. This 3D electrode materials assembled by atom-thick 2D graphene sheets with excellent mechanical,

electrical and thermal properties as well as the ease of scalable synthesis from inexpensive graphite have exceptional potential in many practical applications [3]. Another effective way is that introducing interlayer spacers between the graphene sheets. So, this way is an effective strategy to prevent the restacking and, simultaneously, increase specific surface area and electrochemical properties [4]. Recently, using Metal–organic frameworks (MOF) as spacers, the graphene−MOF showed promising properties as electrode materials for electrochemical application [5]. MOF are a new class of crystalline porous materials constructed from the combination of metal ions (or metal clusters) and organic linkers. Owing to high specific area and excellent porosity structure, MOF using magnetic metals (Fe, Co, Ni or bimetallic) as metal center can be directly pyrolyzed to design metal/C nanocomposites with porous carbon [6]. MOF have played an important role in many areas, such as supercapacitor [7] and sensing [8]. The recently developed mixed-metal approach over MOF allows for incorporation of two different metals into a same framework to form solid-solution-like mixed-metal MOF, which offers MOF with an additional degree of structural complexity and is expected to endow them with new functionalities, since their properties are dependent on the incorporated metal atoms. The bimetallic organic frameworks derived from MOF are not only more structurally complex than established MOF, but also provide new functionality due to replacement of the original metal ion with a second metal ion [9].

It has been reported that the electrochemical properties of the 3D graphene/MOF sponge material, which is formed by adding MOF to the pores of the graphene sponge structure, have been improved [10].

Herein, we report a flexible and ultralight CoZn-MOF/rGO sponge material for utility in various applications. This material was prepared by applying a foaming sol-gel method to the dispersion of GO and hydrothermal synthesized CoZn-MOF. As-prepared flexible and ultralight CoZn-MOF/rGO sponge material was used as an electrode material in cyclic voltammetry (CV) experiments.

Material and Methods

I. Synthesis of Graphene Oxide (GO)

GO was prepared by the modified Hummers' method using the procedure reported previously [11]. Go solution was prepared at optimum concentration.

II. Synthesis of CoZn-MOF

In a typical synthetic procedure of CoZn-MOF, 2.5 g $Zn(NO_3)_2{\cdot}6H_2O$ and 2.5 g $Co(NO_3)_2{\cdot}6H_2O$ were dissolved in 75 mL methanol, as well as 2-MeIM were dissolved in 75 mL methanol and then added into above solution slowly. Subsequently, the mixture was stirred for 6 h at room temperature. Finally, the obtained precipitates were collected by centrifugation and washed several times with methanol, and dried in vacuum oven at 60 °C for overnight [12].

III. Preparation of CoZn-MOF/rGO sponge material

Flexible and ultralight CoZn-MOF/rGO sponge was prepared by a foaming sol-gel method using the procedure reported previously [13]. To prepare dispersion of CoZn-MOF/GO, optimum amount of CoZn-MOF were added to the GO dispersion and ultrasonicated for 1 h. The graphene hydrogel obtained after the preparation procedure was washed with ethanol three times every 3 h, thus flexible and ultralight CoZn-MOF/rGO sponge was gained by ambient pressure drying the washed graphene hydrogel for 24 h. Finally, to obtain high-performance CoZn-MOF/rGO sponge, an annealing procedure at high temperature (300 °C) was applied to remove the residual oxygen-containing compounds.

IV. Chemicals

All the chemicals were of analytical reagent grade, purchased from Sigma-Aldrich and used without any further purification. Double distilled water was used through the experiments.

V. Apparatus

Powder XRD was carried out using a Rigaku TTR III X-ray diffractometer equipped with monochromatized Cu Kα radiation (λ=1.5406 Å). SEM images and EDAX analysis results were acquired using a Zeiss brand field emission scanning electron microscopy (FE-SEM) instrument, equipped with an EDAX detector. X-ray photoelectron spectroscopy (XPS) measurements were performed on a Spect-Flex spectrometer with standard Al X-ray source. All the electrochemical experiments were performed with Gamry (600+) potentiostat system connected to a three-electrode cell. A flexible and ultralight CoZn-MOF/rGO sponge electrode directly used as the working electrode (20 mm×5 mm). In this electrochemical cell, an Ag/AgCl (saturated KCl) and a Pt wire served as reference electrode and counter electrode, respectively.

Results And Discussion

The digital camera photograph of the purple colored CoZn-MOF is shown in Figure 1.a. It can be observed that CoZn-MOF possesses a highly compact spherical structure (Figure 1.b). The rhombic dodecahedron particles with an average size of 600 nm were observed for obtained MOF. Also, elemental analysis using EDAX for CoZn-MOF is shown in Figure 1.c, illustrating the presence of Zn and Co atoms in addition to C, O and N atoms in the structure of prepared MOF.

XPS is employed to analyze the chemical structure of the ZnCo-MOF composite powder. XPS spectra of CoZn-MOF composite powder (Figure 1.d) shows the presence of O (18%), C (28%), N (20%) Co (10 %), and Zn (24%).

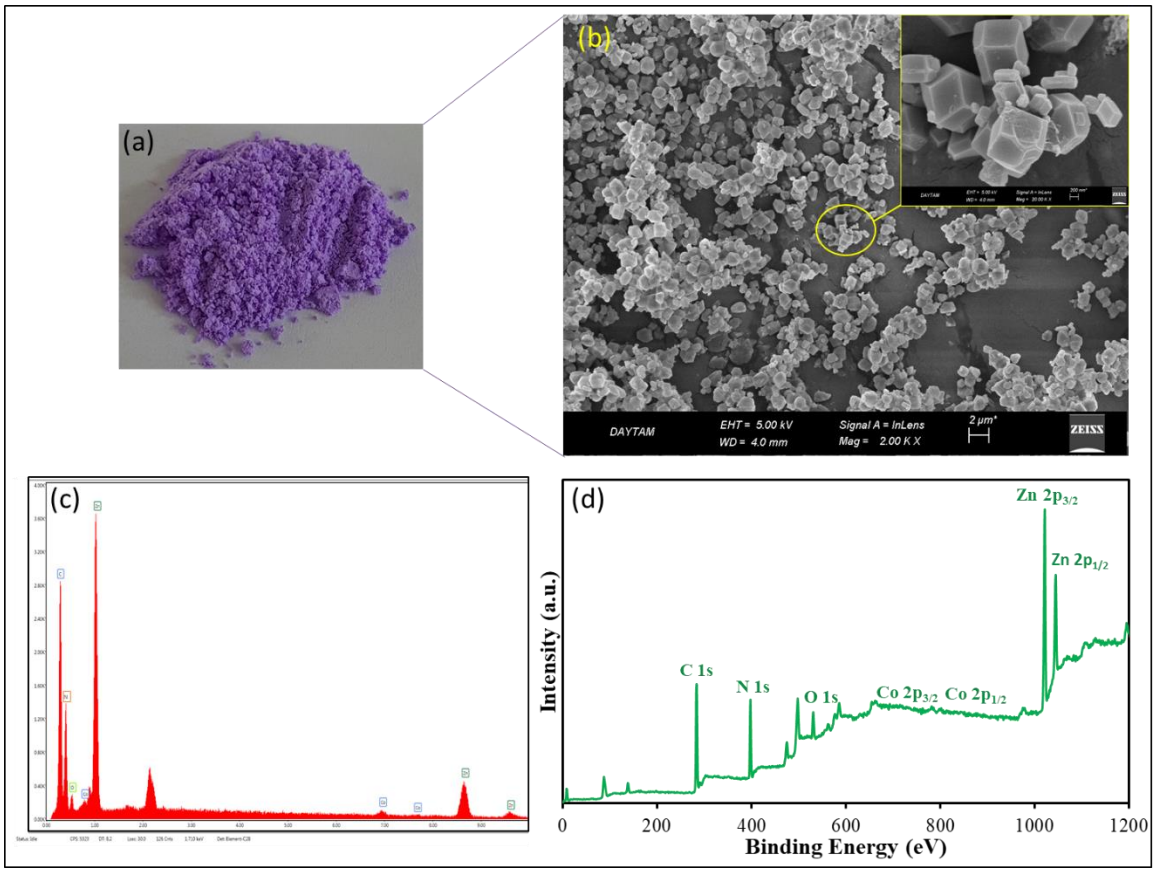

Figure 1. (a) Digital camera photograph, (b) FESEM image, (c) EDAX spectra and, (d) XPS spectra of CoZn-MOF.

Digital camera photographs of flexible and ultralight CoZn-MOF/rGO sponge are shown in Figure 2. Figure 2.a displays that sponge material was able to stand on a flower smaller than 50 times its own size without any deformation due to its low density. Figure 2.b

displays that sponge material is strong, flexible and, durable enough. This process, as shown in Figure 2.b was repeated 30 times in a row and it was observed that the sponge material was able to maintain the sponge structure after 30 cycles, demonstrating high flexibility and durability.

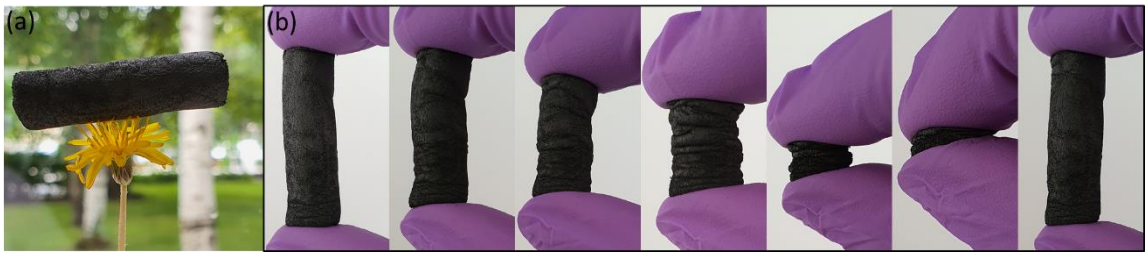

Figure 2. Digital camera photographs of (a) ultralight and (b) flexible CoZn-MOF/rGO sponge

XRD analysis was also applied for the investigation of crystal structure of the synthesized CoZn-MOF, rGO and CoZn-MOF/rGO sponge (Figure 3). The observed diffraction peaks for CoZn-MOF matched with those of previous reports [8]. The main diffraction peaks observed for prepared bimetal MOF were indexed as 011 (7.3°), 002 (10.3°), 112 (12.7°), 022 (14.7°), 013 (16.4°), 222 (18.0°), 233 (24.6°) and 134 (26.7°) plans, respectively. The high peak intensities also confirmed the high crystalline structure of MOF. The peak at about 25.4°, corresponding to the characteristic crystal diffraction of the graphene structure (002) was observed in the XRD spectrum of both rGO sponge and CoZn-MOF/rGO sponge, indicating that the composite paper has been successfully prepared.

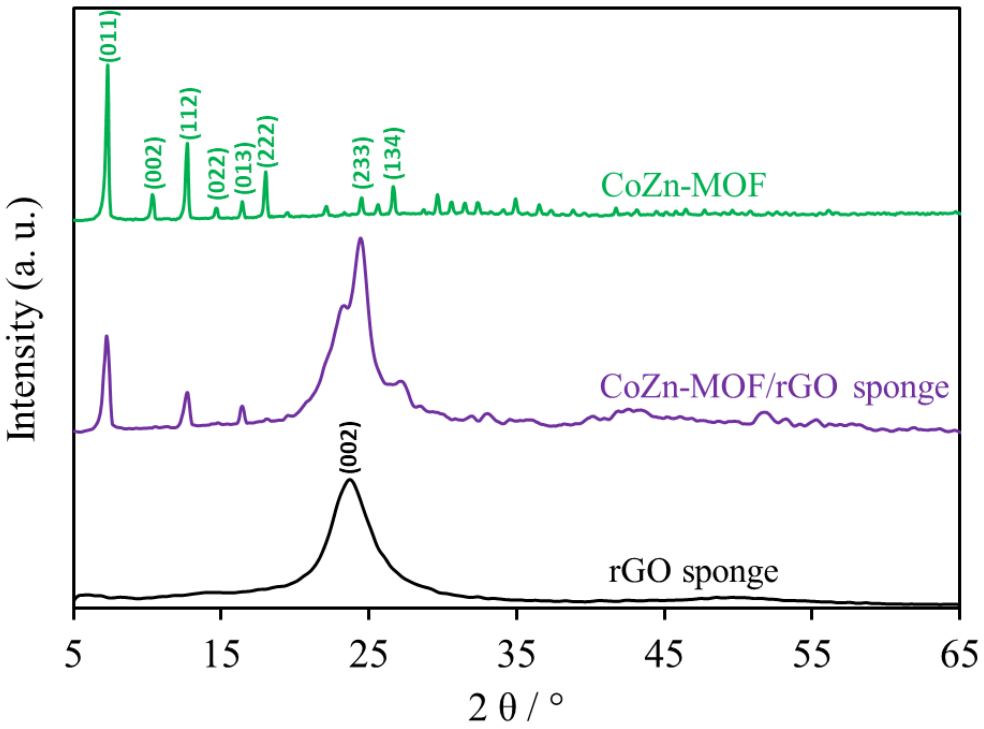

Figure 3. XRD patterns of rGO sponge, CoZn-MOF and, CoZn-MOF/rGO sponge.

CV measurements were employed to investigate the electrochemical performance of the CoZn-MOF/rGO sponge electrode material (Figure 4).

The peak potentials during the reversible reaction of Fe^{+2}/Fe^{+3} as well as the difference between the oxidation and reduction peak current values (ΔE) in CV experiments give information about the electrochemical performance of the electrode. The higher the peak current and the lower the ΔE value, the higher the electrochemical activity of the electrode. Figure 4 shows that the ΔE value of CoZn-MOF/rGO sponge electrode is 484 mV. This result displayed that the flexible and ultralight CoZn-MOF/rGO sponge exhibited good electrochemical performance

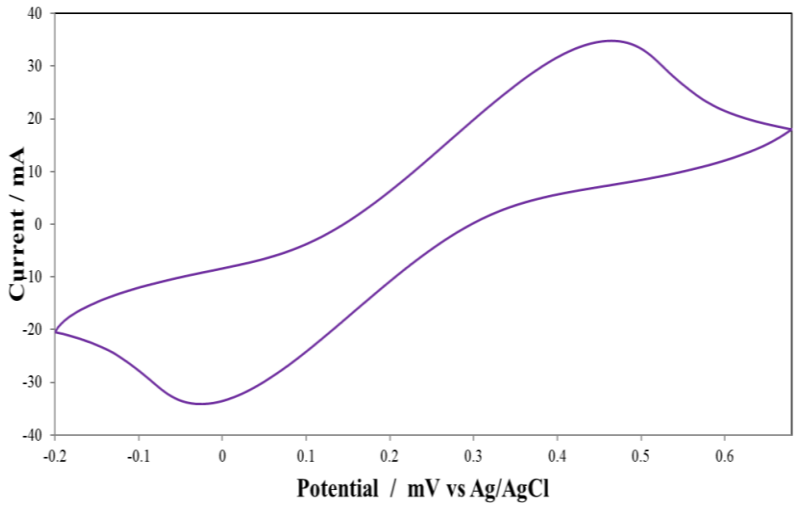

Figure 4. CV curve of CoZn-MOF/rGO sponge electrode in a solution containing 10 mM $K_3Fe(CN)_6$, 10 mM $K_4Fe(CN)_6$ and, 0.1 M KNO_3.

Conclusions

In summary, a flexible and ultralight CoZn-MOF/rGO sponge was fabricated by foaming sol-gel method. The flexible and ultralight CoZn-MOF/rGO sponge and CoZn-MOF were characterized using SEM, EDAX, XRD, and XPS. Flexible and ultralight CoZn-MOF/rGO sponge might be used in various applications such as sensor, catalysis, Li-ion batteries, and supercapacitors.

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AGRICULTURE
ORAL PRESENTATIONS

ID:55-AOP

The Effect of Different Organic Fertilizers on Soil Properties in Tolering Climate Change

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Sustainable agriculture is an important global issue. The soil has lost organic matter in the past centuries. Is it a good practice to reduce global warming? In fact, one of the practices promoted to combat climate change is increasing soil organic matter. The use of organic fertilizers can enhance crop yield and soil properties while restraining pests and diseases. Organic fertilizers are derived from natural sources (e.g., livestock and poultry excreta, plant residues, biogas residue, and agricultural by-products), and their usage can have a positive impact on pollution. Our concern about organic matter nowadays is because soils play a major role in the global carbon cycle and the amount of SOC is determined by the balance between the rates of organic carbon input and output. The carbon input is the sum of all organic carbon compounds added to the soil per unit of time (usually a year). It consists of the carbon present in crop residues, roots that die off, organic carbon in manure and wastes, etc . Carbon gain in soil involves storage and a possible reduction of carbon in the atmosphere. Carbon storage is determined by the environmental conditions (climatic factors) and the type of soil and transformation processes, including biological interactions. Several natural factors influence the amount of organic matter in the soils like temperature, soil moisture and water saturation, texture, topography, salinity, acidity, vegetation, and biomass production. Soil organic carbon (SOC) is a very important component of the global carbon cycle and the fate of SOC will have an important impact on the future global climate. The use of stabilized organic compounds that can be stored in soils for centuries has been studied in the last decades, especially considering charcoal and biochar. The application of certain biochars can help to sequester carbon, and improve soil conditions in some soil types/climates. For example, Biochar has significant effects on the physical nature of agricultural soils and can mitigate anthropogenic climate change while improving agricultural soil fertility.

Keywords: Organic Fertilizers, Climate Change, Soil Properties

ID:75-AOP

Milk Yield Traits of Anatolian Buffalo Reared In Pasinler

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This study was conducted to determine the milk yield characteristics of Anatolian Buffaloes grown in Pasinler District of Erzurum province. In addition, the effects of some effective environmental factors on milk yield and composition have been investigated.

The research produced a milk yield record of 104 buffalo cows that gave birth between Dec 2012 and 2015. In milk yield traits, lactation sequence (LS) was determined as 220,03±3,383 days, lactation milk yield (Trapez II) (LMY) was determined as 791,61±17,196 kg and daily milk yield (DMY) was determined as 3.57±0.056 kg. Furthermore, in the sample examined in the version 597 milk % fat, % protein, % lactose, % dry matter, % fat-free dry matter, density, and somatic cell count (Log_{10}SCC) respectively %6,79±0,066, %4,29±0,019, %4,84±0,014, %16,83±0,059, %10,03±0,024, 1.0302±0,00008 g/cm^3 and 4,90±0,018 cells/ml was determined. The effect of lactation sequence on: LS, LMY, DMY and non-fat dry matter, season on: LS, DMY and non-fat dry matter, and year on milk and milk composition characteristics was found to be significant ($p<0.01$).

The traits studied were significantly affected by lactation sequence*year interaction. In light of these findings, it may be proposed to increase the number of animals in enterprises by taking into account conditions and economic conditions, to make breeding with breeds with good milk yield direction, to take care of care-feeding, to create marketing models for milk and dairy products.

Keywords: Milk yeild, Pasinler, Anatolian Buffalo,

Acknowledgement: This work was supported by Atatürk University Scientific Research Projects Coordination Unit (Project No: BAP-2012/223).

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ID:78-AOP

Removal of Crystal Violet Dye from Aqueous Solutions Using *Robinia pseudoacacia* L. (Fabaceae) Fruits Biosorbent

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Since synthetic dyes used in the textile and cosmetic industries are toxic and carcinogenic, these synthetic dyes must be removed from water [1]. In recent years, biosorption studies have been carried out in the removal of aqueous solutions of synthetic dyes by using natural materials, abundant in nature. Biosorption studies have been preferred because their eco-friend, cheap and sustainable properties [2]. The aim of this study was a biosorption study to remove crystal violet dye from aqueous solutions by using fruits of *Robinia pseudoacacia* L. (Fabaceae) as a natural biosorbent (RPF). In this study, parameters such as pH, initial dye concentration, biosorbent dose, stirring speed and temperature were investigated. In addition, isotherm, kinetic and thermodynamic studies were also carried out. According to the results of the studies carried out under the experimental conditions: pH: 6, initial dye concentration: 10 mg/L, biosorbent dose: 1 g, contact time: 30 min., stirring speed: 150 rpm and temperature: 298 K. It was observed that the RPF biosorbent removed 77% of the crystal violet dye from aqueous solutions. Freundlich, Langmuir, Elovich, Temkin and Dubinin–Radushkevich isotherms were calculated. In kinetic studies, the correlation coefficient of pseudo-second order kinetics (R^2=0.995) was found to be higher than pseudo-first order kinetics (R^2=0.924). In addition, according to the ΔG values found in the thermodynamic studies, it was observed that the process was endothermic and naturally spontaneous. As a result, it was concluded that the low cost, eco-friendly and effective treatment of the RPF biosorbent was used in the removal of synthetic dyes from aqueous solutions.

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ID:86-AOP

Reproductive Traits of Anatolian Buffaloes Reared at Erzurum Conditions

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Anatolian buffalo plays a critical role in supplying a portion of the income and the necessities of the some rural region. Anatolian buffalo is one of the finest dairy buffalo race in grown Turkey. The success of any dairy farm depends upon efficient reproductive performances of a dairy animal. Different genetic and non-genetic factors influence its performance reproductive. Limited data are available on the phenotypic factors related to the productive and reproductive performance of Anatolian buffalo.

This study aims to reveal reproductive traits of Anatolian buffaloes. Reproductive traits of Anatolian buffalo under the present study will serve as standard and hence can be used as a reference or standard at a glance to compare the performances of Anatolian buffalo reared under different agro-climatic zones of Turkey. Therefore, reproductive traits like age at the first calving (AFC), calving interval (CI), gestation period (GP), dry period (DP), survival rate (SR), and calving rate (CR) of Anatolian buffalo are examined in this study. Data from 190 Anatolian buffalo cows maintained at the Pasinler, gave birth (born) in the period between 2012 and 2015 were used for this study. According to the results, it was found that average AFC was 34,88 months, CI was 400,36±11,895 days, GP was 318,60±3,721 days, DP was 178,90±12,560 days, SR was 91,45 % and CR was 80,00 %, as investigated reproductive traits. It was also observed that the effect of the year on calving rate was significant ($p<0.10$).

It was concluded that reproductive traits performance of Anatolian buffalo are middle level under the Erzurum conditions, so that it can be said that the productivity level of this breed may increase by the genetic improvement and better herd management. Besides, based on the present findings, it may be recommended to have a breeding programme which given due weightage to both production and fertility traits.

Keywords: Reproductive, Anatolian buffalo, Erzurum,

Acknowledgement: This work was supported by Atatürk University Scientific Research Projects Coordination Unit (Project No: BAP-2012/223).

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ID:99-AOP

The Role of Climate Changes in Reproductive Performance in Cattle-Review

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Reproduction is one of the most important factors determining profitability in a dairy business. Sustainability of this profitability can be achieved by obtaining one calf from each of the cattle that have reached pubertal age, in an annual synchronized manner. Obtaining an annual calf is a very grueling and challenging process in terms of business. During this period, the cattle should be subjected to optimum care and feeding conditions. If these essential conditions and comfort cannot be established, the first delayed physiological action by cattle is reproductive activities.

Body temperature is an important physiological parameter and is considered a health indicator in dairy cows. In dairy cattle, even small changes in body temperature have major negative effects on metabolic activities. Cattle can actively continue their reproductive activities in a certain temperature range, and this temperature range is called the thermoneutral range. The fact that the temperature values are higher than the level that the animals can tolerate causes the formation of heat stress, and the lower ones cause the formation of cold stress. Both of these stress factors will result in the disruption of reproduction and will negatively affect the profitability of the business in every respect. In this study, the effects of cold and heat stress on reproductive performance in cattle will be compiled.

Keywords: heat stress, cold stress, reproduction

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ID:120-AOP

Usability of Infrared Thermal Camera in The Diagnosis of Foot Diseases of Cattle

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In this study, it was aimed to determine the thermographic temperature values taken from the extremities (digital and interdigital region) of healthy and disease animals and reference data for thermographic examination in dairy cows healthy and with digital dermatitis (DD) and interdigital dermatitis (IDD). A total of 14 dairy cows, 7 healthy and 7 with digital lesions, were used in the study. Temperature values taken from the extremities of healthy with DD and IDD cows were evaluated according to the student's t-test. Extremity temperatures of animals with DD and IDD were 1-4 °C higher than healthy animals. The mean temperature values of animals with DD and IDD (34.28 ± 1.40) were higher than healthy animals (30.64 ± 0.11), and a statistically significant difference was found between these two groups ($P < 0.001$). As a result, it was revealed that thermography can be used for diagnosis as an auxiliary imaging technique in cattle foot diseases.

Keywords: Infrared thermography, digital and interdigital dermatitis, dairy cow

ID:121-AOP

A Statistical Approach on Reproductive Biology of Chukar Partridge (Alectoris chukar, Gray, 1830) Living in Hakkâri Province

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In this study, reproductive biology of Chukar partridge (*Alectoris chukar*, Gray, 1830) in Hakkâri province was studied.

Research; It was carried out between 2020 March and August in areas where the henna partridge species lives and breeds intensively within the borders of the province of Hakkâri. The breeding sites of the species were determined from certain observation points. 5 nests belonging to the species were determined at different altitudes in the breeding areas. Reproduction status was demonstrated statistically with certain measurements (nest dimensions, egg weight and width, nestling's beak, height and head dimensions) and observations on these nests. Reproductive status and changes of the components were made by applying the Regression and Variance tests with the help of the R statistical analysis program. A regression model was created to identify factors affecting nestling weight. In the model, nestling weight was taken as dependent variables, egg weight, egg length and egg width as independent variables. Accordingly, the effect of egg weight on nestling weight was found to be statistically significant($p<0.05$). Other variables were not found to be significant. In the second regression model created, head size dependent variables were egg length, egg weight and egg width as independent variables. In this model, the effect of egg weight on head size was found to be statistically significant($p<0.05$). When the beak size is taken as the dependent variable, the effect of other variables is not statistically significant($p>0.05$). Again, the effect of hatchling egg characteristics was not significant($p>0.05$).

In the analysis of variance, it was examined whether the mean egg and hatchling weights differ according to 4 different nests, and it was determined that both hatchling weights

and egg weights vary according to nests. The 1st and 4th nests and 3rd and 2nd nests were similar in the mean egg weight. However, in the mean weight of the nestling, the 1st and 3rd nests showed similarities with the 4th and 2nd nests.

Keywords: *Alectoris chukar*, Breeding Biology, Chukar partridge, Hakkâri, Regression model

Acknowledgement: This study was supported by Hakkâri University Scientific Research Project Directorate (Grant No: FM20BAP12)

ID:122-AOP

Toxic effects of Cypermethrin on Gill of Van Fish (*Alburnus tarichi* Güldenstaadt 1814)

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Lake Van is the largest lake in Turkey. In recent years, it has started to be polluted due to agriculture, animal husbandry, and domestic waste [1]. Developments in the agriculturel field have led to the use of many chemicals. One of these chemical groups is pesticides. Cypermethrin is one of the most commonly used pesticides in the lake Van basin, Turkey. The van fish is a vertebrate endemic species living in Lake Van. Therefore, it is used as a bioindicator in the determination of lake pollution [2]. In this study, the effects of sublethal dose (0.05 µg/L) of cypermetrin on gill of the Lake Van fish for 96h, the only vertebrate species living in Lake Van were investigated. As a result, reversible and irreversible anomalies were determined in fish gills exposed to cypermethrin.

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ID:129-AOP

Determination of Melatonin Level During Reproductive Migration in Van Fish (*Alburnus tarichi* Güldenstädt, 1814)

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The photoperiod is the time during which an organism is exposed to light throughout the day. Like many animals, fish are also affected by changes in daylight. In general, the pineal gland is part of the central nervous system. The pineal gland in fish is a light-sensitive structure containing photoreceptor cells. Melatonin hormone levels secreted from the pineal gland can also change salinity, nutrient availability, precipitation, pH of the environment, and the density of the environment, apart from the photoperiod. Melatonin is involved in processes such as determining the biological clock, adaptation to seasonal changes, and reproduction.

Van fish is an anadromous endemic carp species living in Lake Van, which is among the few soda lakes in the world. The melatonin secreted from the pineal gland is also a hormone affected by environmental changes. In this study, the melatonin levels were determined in fish plasmas sampled from lakes and streams during breeding migration. Melatonin-secreting pinealocyte cells and their localizations were also marked immunohistochemically. It was determined that pinealocyte cells were localized in the lumen part of the pineal vesicle and the plasma melatonin level increased in fish passing from the lake to the river.

Key words: Van fish, Pineal gland, Melatonin, Immunohistochemistry

Acknowledgments: This study was supported by Yüzüncü Yıl University Scientific Research Projects Directorate (Grant No. FYL-2020-8916).

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ID:130-AOP

Investigation of Mucus Cell Localization and Density in the Digestive Canal of Van Fish

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Mucus is a polysaccharide compound containing sulfate and carboxyl groups. The amount of mucus secreted from cells in different organs increases with effects, such as stress, infection, toxic substances, physical and chemical damage. In addition, mucus secretion is an important factor for osmoregulation, respiration, resistance to diseases and is a very good natural defense mechanism against parasites and pathogens. In fish, as in other vertebrates, it is located in the parts of the digestive tract. Mucus cell localization and density vary according to fish species.

Van fish is an endemic cyprinid species living in Lake Van, one of the largest soda lakes in the World [1]. Like other cyprinid fish, Van fish do not have a true stomach structure. The fish is similar to the digestive tract of the fish in the cyprinid family, however, it also shows some differences [2].

In this study, mucus cells in the digestive tract of Van fish were stained using Periodic acid-Shiff (PAS) dye. It was determined that mucus cell distribution and cell sizes differed in the esophagus forming the digestive tract, stomach-like structure, anterior and posterior intestines.

Keywords: Van Fish, Digestive Canal, Mucus Cell, Neutral Glycoconjugate

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EDUCATION
ORAL PRESENTATIONS

ID:37-EOP

The Influence of Social Networking on Students Learning English

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The article deals with the development and huge impact of social networking on students learning English. The article discovers the positive influence of social media, different applications and podcasts. The purpose of the article is to study how social media use by university students affects their academic as well as their social life at the university. Participants consisted of students of the faculty of world languages and culture.

Keywords: social networking, social networking, SNS, media literacy, survey, interactivity, digital, cyber, online marketing, participatory web, user.

Introduction

In today's society, especially our generation, social media has become a part of our everyday lives. Social media has exploded as a category of online discourse where people create content, share it, bookmark it and network at a prodigious rate. Because of its ease of use, speed and reach, social media is fast changing the public discourse in society and setting trends and agenda in topics that range from the environment and politics to technology and the entertainment industry [10]. In the last ten years, the online world has changed dramatically, thanks to the invention of social media, young men and women now exchange ideas, feelings, personal information, pictures and videos at a truly astonishing rate. For instance, seventy-three percent of wired American teens now use social media websites [6].

The increased use of Social Networking Websites has become an international phenomenon in the past several years. What started out as a hobby for some computer literate people has become a social norm and way of life for people from all over the world [4]. Teenagers and young adults have especially embraced these sites as a way to connect with their peers, share information, reinvent their personalities, and showcase their social lives [4].

Social networking websites provide tools by which people can communicate, share information, and create new relationships. With the popularity of social networking websites on the rise, our social interaction is affected in multiple ways as we adapt to our increasingly technological world. The way web users interact and talk to each other has changed and continues to change. These users now socialize through the internet and it takes away from the person socialization that has been around forever. Social networking websites have affected our social interaction by changing the way we interact face-to-face, how we receive information, and the dynamics of our social groups and friendships [5].

Social media is a term that refers to a number of web-based applications through which users interact with one another. Interactivity is what distinguishes social networking sites from traditional (or "static") websites. Social media applications encourage users to share their experiences, opinions, knowledge, and sometimes their locations. These connections can contribute to a sense of engagement or loyalty among social media users. Figure 2 compares the characteristics of traditional media and social media. As the figure shows, traditional media approaches are centralized and focus on delivering one or more messages to customers. Social media methods are collaborative and rely on sharing information and soliciting feedback for their effectiveness. Using traditional media—distributing press releases, granting interviews, etc.— the organization tries to control the message. Using social media, such as YouTube and Twitter, organizations can post information that individuals can share, comment on, and sometimes modify (1).

There is evidence of a broad range of benefits to young people associated with the use of SNS. They are generally related to Media Literacy, Formal Educational Outcomes, Informal Education and Learning, Creativity, Individual Identity and Self-Expression, Strengthening Social Relationships, Belonging and Collective Identity, Building and Strengthening Communities, Civic and Political Participation, Self-Efficacy and Wellbeing. Below we will summarize some of these benefits, which has direct connection to our study.

Media Literacy

The role of media literacy for digital literacy and cyber safety has been well established, although policy and practice has been slow to respond to new ways of thinking about media literacy in a digital world. Traditionally media literacy has been understood and taught in relation to mass media, addressing issues of media ownership, censorship and advertising. However, today's online and networked media environment requires a more complex digital or web literacy that is often not explicitly taught in school. This environment requires that young people develop new skills to participate and stay safe in the new digital media environment. Consequently, there are a number of components to online media literacy (Third and Richardson forthcoming 2011), including:

- Technical literacy - for example, the knowledge and skills required to use a computer, web browser or particular software program or application;

- Critical content literacy - the ability to effectively use search engines and understand how they 'order' information; who or what organizations created or sponsor the information; where the information comes from and its credibility and/or nature;

- Communicative and social networking literacy - an understanding of the many different spaces of communication on the web; the formal and informal rules that govern or guide what is appropriate behavior; level of privacy (and therefore level of safe self-disclosure for each); and how to deal with unwanted or inappropriate communication through them;

- Creative content and visual literacy - in addition to the skills to create and upload image and video content this includes understanding how online visual content is edited and 'constructed', what kind of content is appropriate and how copyright applies to their activities;

- Mobile media literacy - familiarity with the skills and forms of communication specific to mobile phones (eg: text messaging); mobile web literacy, and an understanding of mobile phone etiquettes.

Research indicates that the use of social networking services can support the development of media literacy. The creation and sharing of content on services such as MySpace has been seen to increase both young people's 'technical literacy', as they learn to use code to create their profiles, and 'creative content and visual literacy' as they draw from and re-use media in appropriate ways for communication and self-expression. Given written text, photos, animation, sounds, music, video clips are core components of SNS, young people develop a deeper understanding of the production, nature and use of various forms of content, which is otherwise missing from school curricula.

Informal knowledge and skills

SNS can facilitate learning and skill development outside formal learning environments by supporting peer-to-peer learning of knowledge and skills, collaboration, diverse cultural expression, the development of skills valued in the modern workplace, and a more empowered conception of citizenship [15; 18]. Furthermore, because of the high level of agency and personalization involved, SNS can be particularly important learning spaces for young people who struggle in traditional educational settings. Beyond substantial educational benefits studies have shown that SNS support informal learning interests and

needs such as online marketing, advanced IT and creative content production as well as parenting methods for young parents. Such studies show that SNS constitute new avenues for engaging young people in learning activities. When sharing content and creating/maintaining relationships young people engage in peer-based, self-directed and interactive learning (accessible from outside the classroom), essential for engagement and deep learning. Furthermore, the knowledge and skills young people are learning through SNS are directly relevant to the 'participatory web' in which 'user generated content is now integral in a rapidly developing online business model that capitalizes on the social networks, creativity and knowledge of its users', and this means that new business models are expected to emerge. This has led some to claim that the learning enabled via SNS and social media will have a direct bearing on their economic futures.

There remain important questions about the extent to which informal learning enabled by SNS impacts upon formal learning. Although it cannot be presumed that daily use of technology outside of formal educational contexts translates into meaningful use for learning, SNS will provide the most benefit in terms of learning when there is integration of young people's SNS use in educational settings and their everyday lives.

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