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Conference*

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Abstract Book



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INVITATION

Dear Colleagues,

We kindly invite you to the **International Nuclear Sciences and Technologies Conference (INSTEC-24)** organized by **Ege University Institute of Nuclear Sciences** which will take place on **September 05-07, 2024**, in **Izmir, Türkiye**.

National Nuclear Sciences and Technologies Conference (NBTK) was hold by Ege University (1980), Turkish Atomic Energy Authority (ÇNAEM) (1984), Istanbul Technical University (1989), Atatürk University (1990), Ege University (1991), Uludağ University (1993), Istanbul Technical University (1996), Erciyes University (2003), Ege University (2005), Muğla University (2009) and Ege University (2016).

International Nuclear Sciences and Technologies Conference (INSTEC-22) was organized by Ege University internationally for the first time in 2022. INSTEC-24 will be organized to bring together world leading and junior scientists from the different branches of nuclear field research communities.

The goal of the International Nuclear Sciences and Technologies Conference, which has a history of 44 years; academicians and experts working in universities and research institutions in the fields of basic nuclear sciences, nuclear technologies and their applications come together to share scientific and technological knowledge, evaluate research results and provide an environment for discussion, as well as strengthening relations and increasing friendships between researchers within the framework of conference social events and providing continuity by establishing the background for joint scientific studies.

More detailed information is provided on the official website (**www.instec2024.com**).

We will be honored with your participation and contribution to International Nuclear Sciences and Technologies Conference which will be a great opportunity to meet with scientists from different countries around the world and sharing new and exciting results in nuclear field.

We are looking forward to seeing you in **Izmir-TÜRKİYE** on **05-07 September 2024**.

Prof. Dr. Sabriye YUŞAN
Ege University Institute of Nuclear Sciences

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- Radiation Protection and Safety
- Radioanalytical Techniques
- Radiobiology
- Radiochemistry
- Radioecology
- Radiopharmaceuticals
- Radiotracer Applications
- Radon
- Solid State for Radiation Physics

ABBREVIATIONS

O-: Oral Presentation

P-: Poster Presentation

INVITED LECTURES

**Needs of Medical Physicists in Diagnostic Radiology and Nuclear Medicine:
Presentation of the IAEA staffing algorithm**

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Medical physicists play an important role in diagnostic radiology and nuclear medicine focusing on patient safety, optimizing imaging quality, and improving treatment effectiveness. This is particularly noteworthy when compared to their colleagues in radiation therapy, who primarily concentrate on cancer patient care. In radiation therapy, medical physicists are responsible for treatment planning, ensuring the quality of therapeutic equipment, and performing dose calculations. Their specialized training in radiation oncology physics enables them to collaborate closely with radiation oncologists to enhance therapeutic outcomes. On the other hand, medical physicists working in diagnostic radiology and nuclear medicine focus on imaging technologies, ensuring the quality and safety of imaging procedures. They are responsible for calibrating imaging equipment and establishing protocols aimed at optimizing radiation doses, and while striving to deliver high-quality images with minimal exposure to patient.

Their expertise spans a range of modalities, including X-ray, MRI, CT, PET, and SPECT. Unlike radiation therapy physicists, who engage directly with treatment teams and sometimes interact with patients during the setup and verification process, their diagnostic and nuclear medicine counterparts generally have limited direct contact with patients. Instead, they work closely with radiologists and technologists to develop and maintain optimal imaging protocols. This paper also introduces the International Atomic Energy Agency (IAEA) staffing algorithm, a strategic framework aimed at evaluating and guiding the effective distribution of medical physicists in healthcare facilities. Utilizing this algorithm enables organizations to tackle staffing issues efficiently, thereby guaranteeing top-notch imaging services and secure radiation therapy for patients. This analysis emphasizes the importance of sufficient in both radiological and therapeutic environments, illustrating the distinct yet complementary roles of medical physicists in improving patient care.

The reconstruction of global change impacts on the coastal zone by using ^{210}Pb -dated sediment cores

Ana Carolina Ruiz-Fernández, Joan Albert Sánchez-Cabeza, Libia Hascibe Pérez-Bernal

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Global change refers to large-scale environmental shifts caused by human activities like population growth, industrialization, and land-use changes, occurring mainly since the past century. It impacts the Earth's climate, ecosystems, and natural resources, posing significant threats to environmental sustainability. Understanding these impacts is needed to develop mitigation and adaptation measures, although it requires long-term environmental records, often unavailable in developing countries.

Sediments act as natural archives, preserving historical data on anthropogenic activities. The ^{210}Pb dating method, which spans the last ~110 years, allows scientists to establish environmental chronologies that can be used to reconstruct the impacts of global change on coastal zones by analyzing ^{210}Pb -dated sediment cores.

Here, we review the foundations of retrospective reconstruction of environmental changes through the analysis of ^{210}Pb -dated sediment cores, covering from sampling methodologies to the most relevant dating models, and applications are showcased with case studies from Latin America. For example, in the Coatzacoalcos River region in Mexico, ^{210}Pb dating revealed a correlation between population growth with increasing sediment accumulation rates and trace metal concentrations, like mercury and arsenic. Similar studies in the Wider Caribbean Region revealed increased sedimentation rates and contamination, particularly from mercury and banned pesticides like DDT. These findings highlight the need for environmental regulations and their positive effects, such as the decrease in mercury discharge following factory closures.

We emphasize the value of ^{210}Pb dating in monitoring global environmental change, identifying historical trends, and guiding future coastal management and restoration efforts. Studies based on ^{210}Pb -dated sediment cores should be integrated into environmental management programs for a more sustainable future.

Plutonium in Corals: a good Anthropocene marker?

Joan-Albert Sánchez-Cabeza, Ana Carolina Ruiz-Fernández, Juan Pablo Carricart-Ganivet, Serguei Rico-Esenaro, José Antonio Corcho-Alvarado, Stefan Röllin, Paolo Montagna

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The proposal of the Anthropocene as a new geological epoch requires identifying globally synchronous markers. Fallout radionuclides, particularly plutonium (Pu) from mid-20th-century nuclear tests, have emerged as promising candidates. In this study, we examine the potential of using massive corals as stratigraphic archives for plutonium, evaluating samples from the Puerto Morelos Reef in the Mexican Caribbean. Sclerochronological analysis of these corals reveals, among other variables, the warming of sea surface temperatures in the region and a clear onset of plutonium deposition in 1955–1956 CE, consistent with global fallout patterns observed in other distant sites. High-resolution coral records are proposed as robust indicators of the Anthropocene, given their accessibility, precision in dating, and ability to capture various environmental changes. The findings reinforce the role of plutonium in corals as a primary marker for the proposed Anthropocene-type section, contributing to the ongoing efforts by the Anthropocene Working Group. Beyond their scientific significance, coral-based records hold potential for public outreach, environmental education, and the promotion of sustainable tourism.

Nanoradiopharmaceuticals applicaitons and cases

Ralph SANTOS-OLIVERIA

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Nanoradiopharmaceuticals represent an emerging class of diagnostic and therapeutic agents that combine the principles of nanotechnology and radiopharmacy to enhance the precision, efficacy, and safety of nuclear medicine. These agents leverage nanoparticles (NPs) as carriers to deliver radionuclides selectively to target tissues, offering improved pharmacokinetics, controlled biodistribution, and enhanced target-to-background ratios. Key advantages include the ability to functionalize nanoparticles with targeting ligands, such as antibodies or peptides, which enable site-specific accumulation in pathological tissues, including tumors. This targeted delivery not only minimizes off-target radiation exposure but also enhances therapeutic efficacy, particularly in the context of cancer treatment with theranostic agents. Additionally, nanostructures can accommodate multiple radionuclides or therapeutic agents, enabling multimodal imaging and combination therapies within a single platform.

However, several limitations hinder the clinical translation of nanoradiopharmaceuticals. Regulatory challenges arise due to the complexity of these formulations, which must meet both nanomedicine and radiopharmaceutical standards. Pharmacokinetics, especially nanoparticle clearance from the body, can vary significantly based on size, surface charge, and composition, posing risks of long-term toxicity and potential immunogenicity. Furthermore, the enhanced permeability and retention (EPR) effect, often relied upon for passive targeting in tumors, is highly variable among patients, reducing the predictability of therapeutic outcomes. Manufacturing scalability and reproducibility remain obstacles, given the need for precise radionuclide labeling without compromising nanoparticle stability.

In summary, nanoradiopharmaceuticals offer significant advantages, including enhanced targeting, multimodal capabilities, and improved therapeutic indices. However, limitations such as complex regulatory pathways, variable pharmacokinetics, and scalability challenges must be addressed to unlock their full potential. Future research focusing on biocompatibility, targeting efficiency, and manufacturing innovations will be critical to advancing the clinical applications of these promising agents.

Nuclear Medicine as “a World-Heritage”: Current Status and Future Perspectives

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Like many other scientific disciplines, Nuclear Medicine can be accepted as a World-Heritage, with respect to its foundation and evolution. There are numerous pioneers from various parts of the World, most of whom awarded with the prestigious Nobel Prize, such as Henry Becquerel, George von Hevesy and Marie Curie who put seminal efforts for the beneficial use of ionizing radiation, forming the roots of Nuclear Medicine. George von Hevesy from Hungary is the father of Nuclear Medicine with the invention of tracer methodology. Marie Curie originally from Poland, is the first scientist who thought of using radiation for diagnosis as the first examples of mobile X-ray scanners loaded on trucks better known as Le petit Curies during the difficult days of the world war, even though not coming from a medical background, among many other contributions to radiochemistry. The legacy of such genius scientists has given rise to format the evolution of Nuclear Medicine, showing some different characteristics depending on various geographies. There is no doubt that the debut of Nuclear Medicine in the old World of Europe is the production and isolation of radionuclides as open-radiation sources, soon later used for medical purposes. Therefore, it may not be surprising to see seminal developments in the field of radiochemistry and radiopharmacy originating from Europe, following the legacy of the pioneers. However on the other side of the ocean in the US better known as the New World, Dr Saul Hertz is the pioneer of using radioiodine to treat thyroid diseases, which later gave rise of incremental use of clinical nuclear medicine applications in that particular geography. Starting from those initial examples, Nuclear medicine has played a crucial role in diagnostic imaging from a molecular imaging perspective. The diagnostic component of nuclear medicine is mainly used for screening, early diagnosis, location of the disease spread, assesment of the prognosis and early treatment response all of which give rise to personalised medicine approaches. Moreover, nuclear medicine has been into a rapid evolution which goes far beyond its capabilities in diagnostic imaging, better known as theranostics or theragnostics. The term theranostics implies the whole process starting from diagnostic work-up with molecular imaging to the radionuclide therapy, with the use of the same targeting mechanism. Although the most common motto of theranostics is known as to treat what you see and to see what you treat, it also intrinsically has the capability to monitor the treatment response while treating, by means of molecular imaging. Therefore, theranostics concept functions as a bridge starting from diagnosis to the therapy, with two clear sides. Speaking of the -socio-cultural bridge, with legacy of the famous examples like the Silk Road and Spice Route, originating from Asia to Europe and later times to the New World. From this perspective, it may not be so suprising to observe that the debut of Nuclear Medicine is the first use of radioiodine for thyroid cancer patients by Prof Suphi ARTUNKAL in 1954, soon after its use in the Nerw World. The pioneers following his path were all internal medicine specialists and most probably this gave rise to the fact that Nuclear Medicine has evolved much faster with more insight to clinical appl, Nuclear Medicine is a real World-heritage depending on the enormous legacy of numerous scientists with various characteristics specific to particular geographies, leading on its way to the final target of personalised and precise medicine, by means of both basic nuclear sciences and clinical nuclear medicine applications.

Environmentally Friendly Sorbents Based on Nanotechnology for the Removal of Pollutants from Aqueous Solutions

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Nuclear power is one of the oldest low-carbon energy technologies. There are currently around 440 nuclear power plants in operation and around 60 reactors under construction. In addition, the upgrading of existing nuclear power plants in many countries due to energy crises is expected to increase nuclear capacity and thus also the generation of nuclear waste. Highly efficient technologies are needed to reduce pollution and protect the environment. Conventional techniques do not provide the required level of purification and use harmful synthetic chemicals. It is believed that the use of natural materials such as clay, minerals, biopolymers and adsorbents based on them could be a good alternative. Modern nanotechnologies are very effective in the removing and detecting of pollutants. The application of these green technologies ensures a healthy environment and is an effective way towards sustainable development. Composites based on chitosan, natural clay of local origin, montmorillonite and zeolite as well as composites of muscovite-mica-clay-graphene oxide-maghemite-magnetite and chitosan-graphene oxide-maghemite with magnetic particles of 14-15 nm and < 10 nm, respectively, were synthesised. The obtained composites showed high adsorption efficiency in the removal of Cs^+ , Co^{+2} , Eu^{3+} , Am^{3+} and Pu^{4+} from water samples. These adsorbents are environmentally friendly, cost-effective and do not require special disposal conditions after use. They can be used for waste disposal and for monitoring during long-term exposure of the adsorbent in natural waters.

Keywords: Adsorption, Cs^+ , Co^{+2} , Eu^{3+} , Am^{3+} and Pu^{4+}

Development Studies of Molten Salt Reactor Project in TÜRKİYE

Dr. Reşat UZMEN

FİGES A.Ş., Türkiye

The THERADE international Center for Research and Advanced Studies on Innovative Technologies for Radiations applied to Environment, Cultural Heritage Conservation and Protection, and Health Risks: A multidisciplinary intraeuropean fan of projects with the vision of pursuing sustainability, inclusion and well-being.

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Current Status and Distribution of Radioactive Nuclides in Central India: Advances in Environmentally Friendly Removal Technologies

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ORAL ABSTRACTS

O-01 Assessment of Cs-137 Radioactive Contamination Levels in the Salda Lake

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Artificially generated radioactive cesium-137 (Cs-137) is a man-made radioactive element produced as a byproduct of nuclear fission. With a half-life of approximately 30 years, Cs-137 poses significant health hazards if ingested or inhaled, leading to potential cell and tissue damage due to its ability to accumulate in the body. The quantification of Cs-137 dosage levels is crucial for evaluating the potential health ramifications of exposure, especially in regions affected by nuclear incidents or mishaps involving radioactive materials. Precise measurement of Cs-137 levels aids in decision-making regarding the necessity for protective measures and aids in the formulation of risk mitigation strategies. Techniques for determining Cs-137 dosage levels encompass environmental sampling, biological surveillance, and medical imaging, employing specialized equipment and methodologies for detecting and quantifying Cs-137 levels in diverse materials such as soil, water, and human tissues. The assessment of artificial radioactive Cs-137 dosage levels stands as a pivotal component of radiation safety protocols, serving to safeguard public health in scenarios where exposure to this hazardous substance is a concern. In this investigation, we assessed the concentrations of artificial radioactive Cs-137 in sediment samples collected from Salda Lake. Gamma activities were gauged utilizing a high-purity germanium (HPGe) gamma detector

Keywords: Salda, Artificial Radioactive, Cs-137, Sediment

O-02 Heavy Metal Pollution in Sediments from Bosphorus Derived From ^{210}Pb and ^{137}Cs Chronology

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Sediments are a natural archive recording environmental changes and sediment dating allows these changes to be assessed chronologically. The ^{210}Pb method has been used to date sediment cores for more than 50 years to study ecosystem changes over the last century. To validate the ^{210}Pb method, ^{137}Cs is widely applied as an independent dating method. Türkiye is surrounded by seas on three sides; especially the Istanbul and Dardanelles Straits, which are the only routes connecting the Black Sea to other seas, have heavy ship traffic and pose a high risk for environmental pollution (ship accidents, especially oil-tankers). Although heavy metal pollution has been demonstrated in various scientific studies carried out so far in and around the Bosphorus, only surface sediments have been studied and no detailed sediment dating with ^{210}Pb and ^{137}Cs in deep sea sediments has been carried out so far. In this study, heavy metal pollution and sedimentation rate in marine sediments in the Bosphorus and Black Sea offshore were investigated by ^{210}Pb and ^{137}Cs chronology. Therefore, (i) ^{210}Pb depth profile distributions were obtained in marine sediment cores obtained from the Bosphorus, sedimentation rate was determined, sediment dating was performed using mathematical models (CIC, CRS) and the accuracy of this dating was supported by ^{137}Cs dating technique, (ii) The changes of heavy metals/toxic metals in sediment records were obtained chronologically and the differences or similarities between contaminant concentrations in sediment cores were examined by multivariate statistical analysis methods, (iii) Heavy metal "Cu, Zn, As, Ni, Cr, Sn, Pb" concentrations of dated sediment cores; according to US EPA norms, Metal enrichment ratios (EF), geo-accumulation index Igeo, Sediment Quality Indices, Mean ERM Quotient (m-ERM-Q) were assessed and ^{137}Cs and natural radionuclide distribution maps were created for marine sediments covering the Bosphorus. A database has been built for the environmental changes in the Bosphorus and Black Sea coasts in the last 50 years which can be used for building a sustainable coast management system.

Keywords: Bosphorus, Black Sea, Bottom sediment, ^{210}Pb and ^{137}Cs dating, Igeo Ef, Heavy Metals, m-ERM-Q, Natural radionuclide distribution maps

O-03 Radionuclides (^{40}K , ^{232}Th , ^{238}U) and Trace Elements in Sediment and Seagrass (*Cymodocea Nodosa*) on the Aegean Coast

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Within the scope of this project, *Cymodocea nodosa*, a seagrass species commonly seen on the coasts of İzmir Bay, was used as research material. In this study, the exposure of organisms living in the marine environment to radionuclide and trace element pollution was investigated. ^{232}Th , ^{238}U , ^{40}K , and trace elements were examined together in sediment samples taken from selected stations in İzmir Bay, revealing differences in concentration changes between stations. *C. nodosa* samples, as well as sediment, were collected simultaneously from the same stations. Concentrations of ^{232}Th , ^{238}U , ^{40}K , and trace elements were determined. The transfer rate (transfer factor) from sediment to seagrass was calculated for each radionuclide and trace element. All data obtained and the relationship between them were evaluated using statistical methods. Environmental pollution studies aim to identify, assess, prevent, and mitigate existing problems. By determining the current problem, its level, and associated risks, we aim to create a comprehensive inventory. **Keywords:** Radiation, heavy metal, meadows, marine pollution
Acknowledgments: This study was supported by TÜBİTAK under Project number 123Y318.

Keywords: Radiation, heavy metal, meadows, marine pollution

Acknowledgments: This study was supported by TÜBİTAK under Project number 123Y318.

**O-04 Evaluation of TPA (Terephthalic Acid) as an Adsorbent for Ce(III) And Sr(II)
Adsorption From Aqueous Solutions**

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PET (polyethylene terephthalate), a thermoplastic polymer resin extensively utilized and classified within the polyester group, features prominently in numerous items, including grocery bags, apparel, as well as water and soft drink containers, commonly serving as a single-use commodity. Nevertheless, the substantial volume of PET waste presents a notable environmental hazard due to its non-biodegradable nature. To mitigate this impact, effective recycling measures involving both chemical and physical processes are essential for PET materials. TPA (terephthalic acid, also known as 1,4-benzenedicarboxylic acid) is a foundational building block in the production of polyester terephthalates. And it is one of the products that emerge as a result of acidic or alkaline hydrolysis of PET. The solubility of TPA in non-basic solutions is quite low, and it contains two carboxyl groups with pKa values of 3.54 and 4.46 at 25°C. TPA, characterized by its fine powder form, exhibits properties making it a suitable candidate for the adsorption of metals from aqueous solutions. In this study, the utilization of TPA as an adsorbent was explored to investigate the removal of Ce(III) and Sr(II) metals containing radio-toxic isotopes from aqueous solutions. Parameters such as the initial pH and concentration of the metal solution, contact time, and temperature, which affect the efficiency of adsorption, were examined. Using the obtained results, thermodynamic data were acquired, isotherm modeling was conducted, and kinetic investigations were carried out. A characterization study was conducted by performing particle size analysis, zeta potential measurement, FTIR analysis, and XPS analysis on the adsorbent TPA.

Keywords: Adsorption, strontium, cerium, polyethylene terephthalate, terephthalic acid ,plastic waste

O-05 Measurement of Indoor Radon Concentration Using Different Types of Devices and Accompanying Health Hazards

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Indoor radon concentration measurement has been considered a useful parameter in the evaluation of health hazards due to radon. In this study, Radon (^{222}Rn) levels were evaluated in different selected residential buildings in the city center of Kırklareli (Turkey). Short-term indoor radon measurements were carried out simultaneously in the summer and winter seasons using portable two digital active radon detectors, the Radex MR107 Radon Monitor and the AlphaGUARD PQ 2000. The results of both measurement techniques were analyzed and compared. The maximum value of indoor radon concentration is observed during the winter season due to poor ventilation. The obtained data showed that the AlphaGUARD PQ 2000 radon detector provides more sensitive results compared to the Radex MR107 Radon Monitor at radon concentrations below 30 Bq m^{-3} . All radon concentrations were found to be below the recommended values given by the Turkish Atomic Energy Authority (TAEK), the International Commission on Radiological Protection (ICRP) and the World Health Organization (WHO). The annual effective equivalent dose of indoor radon was estimated to indicate associated human health risks and compared with the limit values recommended by ICRP and The United Nations Scientific Committee on the Effects of Atomic Radiation (UNSCEAR). Since the duration of a person's stay in the dwelling varies, the recommended time spent annually inside the building (7000 h) by ICRP was used. The mean annual effective doses from indoor air in dwellings were 0.58 and 0.68 mSv y^{-1} for the AlphaGUARD PQ 2000 radon detector and the Radex MR107 Radon Monitor, respectively. The estimated dose levels for both monitoring techniques were found below the annual dose limits recommended by ICRP and UNSCEAR.

Keywords: indoor radon, active radon detectors, annual effective dose, seasonal variation

O-06 Comparison of Four Image and Single Image Estimated Renal Dosimetry Results in ^{177}Lu -PSMA Treatment

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Introduction Dosimetry should be performed in PRRT as a legal obligation. For dosimetry calculation, 3 or 4 images should be scan from the patient after treatment. These images pose a problem for clinics and patients where treatment is frequently performed. For this reason, software that makes dosimetry estimates with a single image has been produced. The aim of this study is to compare the dosimetric results calculated by estimating with 4-image dosimetry and a single image at the 4th hour. **Material and Method** The study included 334 treatment dosimetry data (1st cycle 66, 2nd cycle 62, 3rd cycle 57, 4th cycle 52, 5th cycle 36, 6th cycle 26, 7th cycle 20, 8th cycle 10, 9th cycle 3 and 10th cycle 2) of 66 patients who received ^{177}Lu PSMA treatment in our clinic. Patients underwent total body and SPECT/CT imaging at the 4th, 24th, 48th and 96th hours after treatment. After dosimetric calculations were made with 4 images of all treatments, the estimated results were calculated according to the first treatment result using the 4th hour images of the 2nd and subsequent treatments of the patients. These results were compared. Result 4 images and prediction result averages was calculated as 2nd cycle $3.5 \pm 1.62 / 3.22 \pm 1.27$, 3rd cycle $3.52 \pm 1.1 / 3.53 \pm 1.49$, 4th cycle $3.51 \pm 1.0 / 3.39 \pm 1.36$, 5th cycle $3.22 \pm 0.95 / 3.21 \pm 1.45$, 6. cycle $3.59 \pm 1.25 / 3.21 \pm 1.62$, 7. cycle $3.39 \pm 0.93 / 3.20 \pm 1.27$, 8. cycle $3.04 \pm 0.68 / 3.04 \pm 1.07$, 9. cycle $3.29 \pm 0.25 / 3.33 \pm 1.27$, 10. cycle $3.21 \pm 1.06 / 3.30 \pm 0.77$. **Discussion** When the results were examined, it was seen that there were differences of up to 129%, and one patient overestimated a total of 17.42 Gy in 7 treatments. Considering these results, we recommend dosimetric calculation with multiple imaging.

Keywords: Dosimetry, ^{177}Lu -PSMA, Radionuclide Therapy, Estimate

O-07 Variation of Soil Gas $^{222}\text{Rn}/^{220}\text{Rn}$ Concentration Ratios Along the Balçova-Narlidere Segment of the Izmir Fault

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Soil gas anomalies useful for getting information about natural processes through gases released from the earth's crust in metropolises with excessive urbanization. Radon (^{222}Rn) and Thoron (^{220}Rn) are very useful isotopes for geodynamic events such as earthquakes etc. Measurements of ^{220}Rn and ^{222}Rn activity concentrations in soil gas were carried out on the Balçova- Narlıdere segment of the Izmir Fault which is one of the most important active tectonic structures in Türkiye's Active Fault Map. Due to very intense urbanization, there is limited studies in the literature related to the Izmir Fault Zone and its two segments. This study also discusses the usability of the $^{222}\text{Rn}/^{220}\text{Rn}$ ratio as a geodynamic precursor. Soil gas measurements were performed by RAD7 radon detector and RADH₂O. The measured Radon (^{222}Rn) and Thoron (^{220}Rn) activity concentrations were between 965 and 17500, 2250 and 25750 Bq m⁻³ respectively. This study is supported by the TÜBİTAK 1001 Scientific and Technological Research Projects Support Program: Earthquake Research Call and by Basic Science Research Program-Project No: 121Y404.

Keywords: Radon, Thoron, Izmir Fault, Balçova-Narlidere segment, Soil gas, Siesmicty

O-08 Assessment of Soil Gas Radon Variations in Terms of Seismicity in Yalova, Türkiye

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Radon gas forms due to the radioactive decay of rocks underground and can seep into the Earth's surface through fissures and subsurface voids. Earthquakes are associated with fractures and movements in the Earth's crust, during which subsurface gases and fluids can be released. In this context, abrupt changes in radon gas levels have been proposed as indicators of subsurface movements preceding earthquakes. However, determining the exact relationship between radon gas levels and earthquakes is challenging. The dispersion and accumulation of radon gas are influenced by a multitude of complex factors, including local geology, soil properties, and geodynamic processes. Thus far, studies have not conclusively demonstrated a significant relationship between radon gas levels and seismic activity. Nevertheless, some research has shown that increases in radon gas levels occur before earthquakes in specific geographical regions. In this study, a continuous radon monitoring station was established in Yalova. Radon gas measurements were conducted using the Alphaguard radon measurement system. Measurements were taken at 10-minute intervals. The relationship between seismic events occurring in the region and changes in radon gas levels was determined.

This study is supported by the TÜBİTAK 1001 Scientific and Technological Research Projects Support Program: 123Y145.

Keywords: Radon, precursor, Soil gas, Anomaly, North Anatolian Fault Zone

**O-09 Strontium Removal by Activated Carbon Produced “Posidonia Oceanica”
Seagrass**

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Sr is used in the industrial sector and Sr isotopes resulting from the operation of nuclear power plants can cause negative effects on people and the environment in case of possible leaks or accidents. With the increase in nuclear energy production, the risk of contamination of water with radioactive waste is a problem that cannot be ignored. Therefore, the removal of strontium ions from aqueous solutions is of great importance. Strontium dissolves because of several chemical reactions in the human body. This situation poses a significant problem for human health. When strontium is inserted into the body, it may accumulate in the area where it is located, damage tissues or be excreted. For this reason, strontium; especially the issue of cleaning water is of great importance for human and environmental health. In removing strontium from water, the adsorption method stands out due to its advantages of being economical, easy to apply, fast and practical. In this study, activated carbon was obtained by burning *Posidonia oceanica* and used for adsorption of strontium from aqueous solutions. *Posidonia oceanica*, commonly known as Neptune grass or Mediterranean tape weed, is a seagrass species that is endemic to the Mediterranean Sea. The morphological and structural properties of adsorbent were determined using various characterization techniques BET, SEM and FTIR analysis methods. The adsorption capacity of the adsorbent for strontium ions was examined by changing parameters such as pH of solution, temperature, initial Sr concentration and contact time. The adsorption isotherms and thermodynamic studies were carried out. Experimental results of equilibrium adsorption were tested with Langmuir, Freundlich and Dubinin-Radushkevich isotherms. Thermodynamic parameters, Gibbs free energy change (ΔG), enthalpy change (ΔH) and entropy change (ΔS), were calculated.

Keywords: Adsorption, Strontium, Activated carbon, Seagrass

O-10 Investigation of Indoor Radon Levels in Schools in the Bornova District of İzmir Province

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Over the last couple of decades, lifestyles worldwide have undergone significant transformations. Urbanization, technological advancements, prolonged working hours, and increasing individualization have collectively led to a paradigm shift. Presently, we find ourselves spending approximately 75% of our day within indoor environments. Prolonged exposure to enclosed environments poses various risks, both natural and man-made. Among these hazards is radon gas which is the second leading cause of lung cancer after smoking. The aim of the study is to measure indoor radon levels in schools, calculate the radiation dose (annual effective dose) for students, teachers, and staff spending time in these schools, and compare the obtained data with international reference values. For this purpose, three primary school in the Bornova district of İzmir province were selected and indoor radon measurements were performed LR 115 Type 2 solid state nuclear track detectors (SSNTDs). Following the determination of indoor radon concentrations, exposed radiation doses were calculated and interpreted in terms of international reference values. Annual effective dose values ranged from 0.53 to 8.32 mSv y⁻¹, all of which fell below the recommended limit established by ICRP (3-10 mSv y⁻¹). This study is supported by TUBITAK 2209A University Student Research Projects Support Program.

Keywords: Radon, Indoor radon, annual effective dose.

O-11 Determination of Radon (^{222}Rn) Levels in Halkapınar Springs and its Relation with Seismicity.

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The earthquake, with a magnitude of 6.9, occurred in the north of Samos Island on October 30, 2020, causing significant damage in İzmir, the third most populous city in Turkey, with a population of nearly 5 million. The city is 70 km far from the earthquake epicenter, remind the possible effects of an earthquake will occur in an active fault passing through İzmir city center. The İzmir Fault (IF), spanning 40 km, is the most important fault in the region. Halkapınar Springs, situated on the Pınarbaşı segment of the İzmir Fault Zone (IF), is one of the city's vital water resources. This study aims to determine radon concentrations in Halkapınar waters and assess their implications for seismic activity. Radon activity concentrations in water were measured using RAD7H₂O equipment (DurrIDGE, USA). Water samples were collected from wells in specially designed 250 ml bottles and analyzed in the laboratory. During measurements, water sample temperatures were recorded alongside radon levels. This study is conducted as part of the collaboration between Ege University Nuclear Sciences Institute and İZSU (İzmir Water and Sewerage Administration General Directorate). It constitutes a part of İlayda SAPMAZ's master thesis, currently in preparation at the Institute of Nuclear Sciences, Ege University."

Keywords: Radon, Halkapınar Springs, Water, Seismicity, Earthquake

O-12 Assessment of Radionuclide Concentrations in Construction Materials Employed in Housing Structures with in İzmir Province

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This study investigated the activity concentrations of naturally occurring radionuclides (^{226}Ra , ^{232}Th , and ^{40}K) in cement, brick, granite, and kaolin samples utilized within construction projects across İzmir Province, Turkey. High-energy gamma spectrometry was employed to quantify these radionuclide concentrations. The analysis revealed variations in activity concentrations, particularly within brick samples. These variations were attributed to the diverse origins of the raw materials employed in their production. Similarly, cement samples displayed activity concentration fluctuations dependent on the specific additives incorporated during the manufacturing process. Kaolin samples obtained from the Düvertepe kaolin quarries in the Sındırgı district of Balıkesir province exhibited activity concentrations compliant with established standards. Their use, therefore, presents no significant radiological concerns. Additionally, the study estimated the annual dose rates (mSv/y) potentially attributable to the analyzed materials. These findings were subsequently compared with previously reported values in relevant literature.

Keywords: Natural radioactivity, cement, kaolin, brick, building materials, ^{226}Ra , ^{232}Th , ^{40}K

O-13 Investigation of the use of Electrospun Graphene Based ZnO Nanofiber In Uranium(VI) Adsorption

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The presence of pollutants such as radionuclides in water resources and ecosystems poses a serious threat to the environment and living organisms. Removal of these pollutants from wastewater and environmental waters has become an important research topic in recent years and various methods have been intensively researched. Adsorption, a practical and economical method, is one of the most important and widely used technologies in removing heavy metals from wastewater. Studies conducted in recent years have shown that the synthesis of nanostructures with unique properties for use in various water purification applications is of great interest. Nanostructures such as nanofibers, nanowires and nanorods are obtained by various methods such as chemical vapor deposition, hydrothermal synthesis, electrochemical deposition and electrospinning. Among these methods, electrospinning stands out as an economical, easily controllable and effective method for the production of composite nanofibers with diameters ranging from 10 to 100 nm. In this study graphene based ZnO nanofibers have been synthesized and investigated as adsorbent material to adsorb uranium (U(VI)) from aqueous solutions. XRD, FTIR and SEM techniques were employed for the characterization of the synthesized materials, and their ability to adsorb uranium (VI) have been optimized using response surface methodology (RSM).

Keywords: Adsorption; electrospinning; graphene based ZnO nanofiber; response surface methodology; uranium(VI)

O-14 Diurnal Variation of Soil Gas Radon (^{222}Rn) and Carbon Dioxide (CO_2) Concentrations Around İzmir Fault Zone (IF)

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Radon is defined as a geodynamic precursor and environmental indicator because it is an inert gas and a member of the uranium decay series. It is reported that soil gas and water radon concentrations show anomalies before and/or after earthquakes and volcanic eruptions. These reports have led to a tendency to use radon anomalies as earthquake precursors and studies on this subject have increased. It is also reported that radon concentrations show meaningful spatial and time-scale variations. Although radon is a good tracer, some physical effects, such as changes in meteorological parameters, affect the migration of the gas into the atmosphere. An earlier work by our research group showed that indoor radon concentrations are slightly higher in the morning (downtime and early hours of the day) and then decreased in the afternoon. Therefore, there is a necessity to study the diurnal variation of soil gas radon along and/or around a fault zone because there is significant attention on radon as a potential earthquake precursor. In this study, we aimed to study the diurnal variation of soil gas radon around the İzmir Fault Zone (IF). Soil gas measurements were performed by RAD7 radon detector and multigas data logger. Measurements were taken between 50 and 70 cm depth. We measured both radon (^{222}Rn) and carbon dioxide (CO_2) over 300 locations around the İzmir Fault Zone. This study is supported by the TÜBİTAK 1001 Scientific and Technological Research Projects Support Program: Earthquake Research Call and by Basic Science Research Program-Project No: 121Y404.

Keywords: Radon, CO_2 , İzmir Fault, Soil gas, Anomaly, Diurnal

O-15 Synthesis and Characterization of Bio-Based Solvents for the Separation of Thorium, Uranium and Rare Earth Elements

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Uranium is the primary material used in nuclear fuel, with extensive study and application in nuclear science and technology. Recent studies, however, suggest that thorium may emerge as a promising fuel material for next-generation nuclear power plants. Both uranium and thorium are obtained from ores and other mineralogical formations in the Earth's crust, often alongside rare earth elements. Therefore, thorium and uranium must be purified through chemical processes before they can be used as nuclear fuel. Among various separation and purification techniques, solvent extraction is notable for its selectivity and efficiency, and it has a well-established background. However, the solvents typically employed in these processes pose significant environmental hazards. This creates a pressing need for environmentally friendly solvents. In this study, oil-based bio-solvents were synthesized using sorbitol and stearic acid via Fischer esterification to address this concern. In synthesis experiments, stearic acid and sorbitol were used in molar ratios of 2:1 and 3:1 respectively. The synthesized sorbitan distearate (SSA2) and sorbitan tristearate (SSA3) were employed in solvent extraction studies with a mixed medium containing thorium, uranium, lanthanum, cerium, samarium, praseodymium, europium, and gadolinium at a total concentration of 400 mg/L. The pH values of the aqueous phase and contact times between the two phases were investigated. The results indicate that at lower pH levels, SSA2 and SSA3 did not show any selectivity toward thorium, uranium, or rare earth elements. However, above pH 3, SSA2 extracted almost all of the thorium from the mixed medium, with a separation factor higher than 3000. Throughout the study, SSA2 was compared with Cyanex-272. It was observed that SSA2 performed better in separating thorium from mixed solutions, whereas Cyanex-272 was more effective in separating uranium from rare earth elements, achieving higher separation factors. This work was supported by The Scientific and Technological Research Council of Turkey (TUBITAK). The authors would like to thank TUBITAK for providing financial support for this project (Project No: 123C318)

Keywords: Keywords: Uranium, thorium, rare earth elements, bio-based solvents, solvent extraction

O-16 Imaging Potential of ^{89}Zr Radiolabelled Trastuzumab Conjugated Magnetic Nanoparticles in Breast Cancer

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In recent years, nanostructures have been designed for the effective treatment of cancer using tumour-targeted theranostic agents that have high treatment success and do not cause side effects in the patient. However, the most important factor in the success of treatment is the correct staging of the disease and the evaluation of the response to treatment. For this reason, studies on imaging methods have been carried out in recent years to visualise organs and improve image quality. In our study, we aimed to evaluate the potential of positron emission tomography/magnetic resonance imaging (PET/MR) hybrid imaging of breast cancer with radiolabelled antibody integrated magnetic nanopatform design. A tumor targeted hybrid imaging agent was synthesised on a single nanopatform and MR images were performed using dual contrast agent. For this purpose, manganese-iron nanoparticles containing manganese (Mn) for T1 contrast images and iron as T2 contrast agent were synthesised. The tumor targeting agent Trastuzumab (Tra) was integrated into the nanoparticles. The binding efficiency of trastuzumab to nanoparticles was determined as 58%. The structural characterisation of these synthesised nanoparticles was determined by vibrating sample magnetometry (VSM), X-ray diffraction (XRD), Fourier transform infrared spectroscopy (FTIR), dynamic light scattering (DLS), and zeta sizer. Morphological structures were determined by scanning electron microscopy (SEM) and transmission electron microscopy (TEM) images. The cytotoxic effects of nanoparticles on cancer cells as in vitro were determined, and the potential of the nanopatform for dual-mode T1 and T2 weighted magnetic resonance imaging (MRI) was determined. The p-SCN-Bn-Deferoxamine (DFO) chelating agent was conjugated to trastuzumab and a tumour-targeted hybrid imaging nanopatform (Tra-Np). Then DFO@Tra and DFO@Tra-Np were radiolabeled with ^{89}Zr . The quality control of the radiolabelled compound was performed by the Thin Layer Radio Chromatography (TLRC). The radiolabelling efficiency of the nanopatform was found to be $78\pm 2\%$. The radiolabelling efficiency of trastuzumab (^{89}Zr -DFO-Tra) was found to be $98\pm 2\%$

Keywords: Magnetic nanoparticles, Imaging, PET, MR

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O-17 Luminescence Characterization of Nanophosphors CaGdAlO_4 Doped With Terbium and Praseodymium

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Calcium gadolinium aluminate (CaGdAlO_4), calcium gadolinium aluminate doped with terbium ($\text{CaGdAlO}_4\text{:Tb}$), and calcium gadolinium aluminate doped with praseodymium ($\text{CaGdAlO}_4\text{:Pr}$) nanophosphors were all synthesized using a microwave-assisted combustion process in this study. Structural properties of the phosphors were determined by X-ray diffraction (XRD) analysis. The effect of Tb (terbium) and praseodymium doping on the thermoluminescence properties of calcium gadolinium aluminate materials have been investigated by analyzing thermoluminescence glow curves after irradiation with 254, 302, and 365 nm UV radiation. Photoluminescence (PL) excitation and emission spectrum of the phosphors were researched. The luminescence properties of CaGdAlO_4 materials were examined by considering the contributions of Tb and Pr rare earth ions. As a result, it was observed that both photoluminescence and thermoluminescence characterizations were significantly affected by doping process.

Keywords: Calcium Gadolinium Aluminate, Microwave-Assisted Combustion Method, Thermoluminescence, Photoluminescence.

O-18 Investigation of Radon Adsorption Capacity of Metal Organic Frameworks by Using Solid -State Nuclear Track Detectors

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According to the World Health Organization, indoor radon concentrations in buildings are the second biggest risk factor for lung cancer. Therefore, investigating and reducing radon accumulations are among the most important subjects worldwide. New adsorbents based on efficient methodologies should be found. In this study, solid-state nuclear track detectors (SSNTDs) are used to measure the radon adsorption capacity of synthesized Metal-Organic Frameworks. The effectiveness of this method will be investigated. Measurements were taken with detectors both with and without adsorbent inside the radon tank to test. This study is supported by the Ege University Scientific Research Projects Coordination Unit. Project Number: FM-GAP-2022-23967.

Keywords: SSNTDs, Metal-organic frameworks (MOFs,), Radon, Adsorption

O-19 in Vitro Efficacy of ^{177}Lu -DOTA-Trastuzumab Targeted Carbon@silica Nanostructures for HER2-Positive Breast Cancer

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The role of HER2 in cancer prognosis and the necessity for accurate HER2 status assessment are well-established emphasizing the need for effective therapies^{1,2}. Recent advances in nanotechnology have introduced targeted radiotherapy using radiolabeled nanoparticles, such as the ^{177}Lu -labeled and targeted nanostructures offering a promising approach for the selective treatment of HER2-positive breast Cancer³. The development and in vitro evaluation of these nanostructures are critical, as they hold the potential to improve current treatment modalities by ensuring targeted delivery and sustained release of therapeutic agents directly to tumor sites 4–6. This research aimed to assess the in vitro effectiveness of the ^{177}Lu -labeled mesoporous carbon@silica nanostructure combined with Trastuzumab (DOTA@TRA/MC@Si) to determine its suitability as a specific radiopharmaceutical for the treatment of HER2-positive breast cancer. For this purpose, PEI-MC@Si nanocomposite was initially synthesized, followed by its reaction with DOTA-NHS-ester. Subsequently, this DOTA@PEI-MC@Si was conjugated with TRA to target the cancer cells specifically. The results indicated that the DOTA@TRA/MC@Si nanocomposite had been successfully labeled with ^{177}Lu , achieving a radiochemical purity of $93.0 \pm 2.4\%$. In vitro, evaluations indicated that the uptake of ^{177}Lu -DOTA@TRA/MC@Si was observed to be significantly higher in HER2-positive SK-BR-3 cells ($44.0 \pm 4.6\%$ after 24 hours) compared to MDA-MB-231 cells ($21.0 \pm 2.3\%$). The IC50 values for TRA-dependent uptake in SK-BR-3 and BT-474 cells were $0.9 \mu\text{M}$ and $1.3 \mu\text{M}$, respectively, which may suggest a strong affinity for HER-2 expressing cells. The ^{177}Lu -DOTA@TRA/MC@Si nanocomposite demonstrated promising uptake in HER2-positive cell lines, suggesting its potential as a nanoparticle-based therapeutic agent for enhancing the treatment of HER2-positive breast cancer.

Keywords: ^{177}Lu , DOTA, mesoporous carbon and silica nanomaterials, HER2+ breast cancer, radiolabeling.

Acknowledge:

Ege University BAP Commission financially supported this research with project number FDK 21380, TÜBİTAK 2211-C, and TÜBİTAK 2214-A scholarship program. I would also like to express my gratitude to Friedrich-Alexander-Universität Erlangen-Nürnberg for their funding support, and to Prof. Dr. Olaf Prante and his team for their contributions to the study.

O-20 Failure of Electron Spin Resonance Technique to Detect Irradiated Foods: Poppy (Papaver Somniferum) Seeds

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At a scan range of 500 mT, the ESR spectrum of both the un-irradiated and irradiated poppy seed samples contains three signal components. Two of these signals are a broad singlet signal located in the $g=2.1$ region and sextet signals of Mn^{2+} (a range of about 50 mT). The third signal component is a radiation-sensitive narrow singlet signal between the third and fourth lines of the sextet of Mn^{2+} signals, with a spectroscopic splitting factor of $g=2.0044$. This radiation-sensitive signal is present in the ESR spectrum of un-irradiated poppy seed samples and does not comply with any of the European standards (EN 1786, 1997; EN 1787, 2000; EN 13708, 2001) used to identify irradiated foods by the ESR technique. Microwave saturation behavior, which is recommended as an additional procedure to these European standards, was studied at room temperature and at low temperature (133 K) to identify radiation treatment. In addition, variations in radiation-sensitive ESR signal intensities in irradiated and un-irradiated samples were investigated by fading (at ambient temperature) and variable temperature studies. From the results obtained, it was concluded that irradiated poppy seed samples could be identified only in a very short time after irradiation.

Keywords: ESR; Poppy seeds; Irradiated food detection; Gamma irradiation; Papaver somniferum.

**O-21 Adsorption of Strontium Using Magnetic Biochar Obtained from Tree of Heaven
(Ailanthus Altissima)**

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Finding a sustainable solution to increasing water pollution becomes more important every day. Although biochars from different biomass source are used for this purpose, it is necessary to develop more innovative, more effective and sustainable solutions due to their low effectiveness against toxic pollutants. In this study, magnetic biochar (MBC) was obtained by using Tree of Heaven (Ailanthus Altissima) biomass impregnated with $\text{FeCl}_3 \cdot 6\text{H}_2\text{O}$ by impregnation - pyrolysis method. The biomass was saturated with a solution containing different proportions of ferric chloride and then dried. The dried solids were pyrolyzed in a nitrogen atmosphere at different temperatures and times. Thus, pyrolysis and magnetization were carried out in one step. The saturation magnetization and surface area values of MBC impregnated with $\text{FeCl}_3 \cdot 6\text{H}_2\text{O}$ at a ratio of 1:5 and pyrolyzed in a nitrogen atmosphere at 600 °C for 1 hour were found to be 8.92 emu/g and its was 405.44 m²/g, repectively. After determining the most suitable adsorbent, the effects of experimental parameters such as pH, contact time, initial strontium concentration and temperature on strontium uptake were investigated.

Keywords: Magnetic biochar, Ailanthus Altissima, impregnation, pyrolysis, adsorption, magnetization

O-22 Microscopic Analysis of Electric Dipole Strengths In $^{185,187}\text{Re}$

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This study theoretically examines the giant dipole resonance (GDR) and pygmy dipole resonance (PDR) properties of deformed $^{185,187}\text{Re}$ nuclei in the region close to the N=126 closed shell. Our results show that the GDR spectra of $^{185,187}\text{Re}$ nuclei are split into two peaks due to the effect of deformation. Moreover, the obtained GDR spectra are similar to those of nuclei with oblate deformation. It was found that the dipole strength of the PDR region of $^{185,187}\text{Re}$ nuclei increased depending on the N/Z ratio. Unlike nuclei with a prolate shape, it has been found that the dipole strength of the K=1 branch is more dominant in the PDR region, and the dipole strength of the K=0 branch shifts to higher energies. *This work was supported by the Scientific and Technological Research Council of Turkey (TUBITAK) (Project No. 123F207).

Keywords: TGI-QPNM, GDR, PDR, E1

O-23 A Theoretical Study on the Oblate Shape of $^{191,193}\text{Ir}$ Nuclei

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In this study, the oblate structure of $^{191,193}\text{Ir}$ nuclei will be examined theoretically for the first time with the Translational and Galileo Invariant Quasiparticle Phonon Nuclear Model (TGI-QPNM). The dipole strength of the K=0 branch in the GDR region was found to be more dominant than the K=1 branch. This shows that the GDR mode of $^{191,193}\text{Ir}$ nuclei exhibits the behavior seen in oblate nuclei. The results that were obtained are also compatible with the experimental data. Also, the study discussed the microscopic structure of the dipole strength in the PDR region of the $^{191,193}\text{Ir}$ for the first time. The results show that the PDR region's dipole strength comes predominantly from the K=1 branch. *This work was supported by the Scientific and Technological Research Council of Turkey (TUBITAK) (Project No. 123F207).

Keywords: TGI-QPNM, $^{191,193}\text{Ir}$, oblate nuclei, GDR, PDR

O-24 Synthesis and in Vitro Evaluation of ^{99m}Tc Radiolabeled Salinomycin Loaded Mesoporous Silica Nanoparticles on Cervix and Ovarian Cancers

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Cervical and ovarian cancers are known to be common gynecological cancer types in women. Many scientific studies have been performed about these cancer types for diagnostic and therapeutic purposes and it appears that drug-carrying systems are very popular among these studies. In the literature, there are many studies showing biocompatible and non-toxic silica nanoparticles are effective for transporting a variety of molecules targeting cancer cells. In this project, the target was to develop a radionuclide-labeled drug carrier system that offers both diagnostic and therapeutic opportunities for cervical and ovarian cancers. In line with this aim, salinomycin (Sal), from ionophore group drugs, was encapsulated in mesoporous silica nanoparticles (MSN). The synthesized salinomycin-loaded mesoporous silica nanoparticles (Sal-MSN) were labeled with technetium-99m (^{99m}Tc), a radionuclide with ideal features for imaging, and the bioefficacy of the radiolabeled compound (^{99m}Tc -Sal-MSN) on cervical and ovarian cancer cell lines was assessed with in vitro methods. Experimental studies determined that the radiolabeling yield of ^{99m}Tc -Sal-MSN was $98.68 \pm 2.52\%$. Within the scope of in vitro studies, cytotoxicity, apoptosis and cell involvement studies were completed on human cervical cancer cell (HeLa) and human ovarian cancer cell lines (SKOV3). It is thought that the results obtained in this study will contribute to studies about developing new agents for use with radiolabeled MSN-based drug carrier systems. This work has been financially supported by Ege University Scientific Research Projects Coordination Commission (the project number 17 TIP 046).

Keywords: salinomycin (sal), technetium-99m (^{99m}Tc), mesoporous silica nanoparticles (MSN), cervix, ovarian cancer

O-25 Adaptive Neuro-Fuzzy Inference System (ANFIS) Modelling of First and Second Photonuclear Sum Rules in Giant Dipole Resonance

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Energy-dependent sum rules serve as multifunctional instruments applied throughout diverse fields of physics. These sum rules facilitate the correlation between the discerned distribution of collective excitations and fundamental attributes of the nuclear environment, such as nuclear radius and symmetry energy. This study analyzes the bremsstrahlung-weighted sum rule σ -1 and inverse energy weighted sum rule σ -2 using the Adaptive Neuro-Fuzzy Inference System (ANFIS). ANFIS integrates neural networks and fuzzy logic using a hybrid learning approach based on gradient descent backpropagation and least-squares computational techniques for optimization. The system's R values for this sum rule are found to be 0.99, and the results are compared with existing literature values. The study demonstrates the feasibility of using ANFIS to compute these sum rules even without experimental data. *This work was supported by the Scientific and Technological Research Council of Turkey (TUBITAK) (Project no.123F219)

Keywords: Bremsstrahlung-weighted sum rule; inverse energy weighted sum rule; Adaptive Neuro-Fuzzy Inference System

O-26 Development of a Novel Zr-89 Radiolabeled Multimodal Nanoparticle System

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Multimodal imaging techniques gained importance in the preclinical stage with the development of multifunctional nanoparticles. Doxorubicin (DOX) is a cytotoxic anthracycline antibiotic typically used in combination with other chemotherapeutic agents in the treatment of various cancers. In this study, a new biotinylated multimodal nanoparticle system iron oxide lipid-polymer hybrid nanoparticles (PPLN-IO-BIO) were prepared, composed of poly (D, L-lactide co-glycolide), PLGA; polyethylenimine (PEI); and lipids. Biotin was conjugated to the surface of the nanoparticles as a tumor-targeting agent. The final product was characterized to evaluate its physicochemical and biological properties. The resulting PPLN-IO-BIO-DOX nanoparticles had a mean particle size of $195,36 \text{ nm} \pm 7,32 \text{ nm}$, a zeta potential of $32,94 \text{ mV} \pm 7,015$, and good stability. For the radiolabeling studies, the chelating agent (p-NCS-Bz-DFO) was conjugated to DOX-loaded PPLN-IO-BIO nanoparticles. DOX-loaded PPLN-IO-BIO-DFO nanoparticles were easily radiolabeled with ^{89}Zr at 37°C .

Keywords: Doxorubicin, multimodal nanoparticles, biotin, zirconium-89, cell culture

O-27 New Approach to CRPC With [^{99m}Tc]Tc-XCT-790: in Vitro Therapy with Auger Energy

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The initiation and progression of prostate cancer are driven by androgens binding to the androgen receptor. This signaling cascade can be initially targeted by various androgen deprivation therapies, which are successful at first. However, 10-20% of cases progress to a more aggressive disease stage after androgen deprivation: castration-resistant prostate cancer (CRPC). In recent years, radionuclide therapies have played a significant role in CRPC treatment, with [¹⁷⁷Lu]Lu-PSMA-617 being the most commonly used radiopharmaceutical. For treating micrometastatic lesions, radiopharmaceuticals containing Auger electron (AE)-emitting radionuclides have gained importance due to their high cytotoxicity, high linear energy transfer (LET), and short-range biological effects, as alternatives to β -emitting radionuclides. Technetium-99m ([^{99m}Tc]) AE emitters stand out due to their ease of production and cost-effectiveness. Increased expression of estrogen-related receptor alpha (ERR α) has been shown in various cancers and is associated with poor clinical outcomes. ERR α exhibits an up-regulation pattern in CRPC. In this study, the efficacy of the ERR α inverse agonist XCT-790, radiolabeled with [^{99m}Tc], was evaluated in vitro for CRPC. XCT-790 was radiolabeled with [^{99m}Tc], optimizing pH, temperature. The radiochemical yield and stability of [^{99m}Tc]Tc-XCT-790 were determined using Thin Layer Radio Chromatography (TLRC) and High-Performance Liquid Radio Chromatography (HPLRC). Structural analysis of the molecule was performed using HPLC, Liquid Chromatography-Mass Spectrometry (LC-MS), and Nuclear Magnetic Resonance (1H-NMR) with inactive rhenium. In vitro studies included cytotoxicity and incorporation assays of inactive XCT-790 and [^{99m}Tc]Tc-XCT-790 on PC-3, RWPE-1, and PC-3-PIP cell lines. TLRC analysis revealed a radiochemical yield of 97.75 $\pm$ 2.22% (n=10), confirmed by HPLRC. [^{99m}Tc]Tc-XCT-790 showed a 96.46 $\pm$ 1.02% radiochemical yield after 4 hours. Structural analysis indicated that XCT-790 forms an octahedral structure with [^{99m}Tc], and [^{99m}Tc]Tc-XCT-790 has hydrophilic properties. Cytotoxicity studies showed that XCT-790 had varying effects on PC-3, RWPE-1, and PC-3-PIP cell lines, with a significant decrease in viability in androgen receptor-negative PC-3 cells after 24 and 48 hours. [^{99m}Tc]Tc-XCT-790 exhibited decreased uptake over time in RWPE-1 cells, while PC-3 and PC-3-PIP cell lines showed higher uptake rates. The variable uptake rates of [^{99m}Tc]Tc-XCT-790 in different cell lines suggest its potential for therapeutic and diagnostic applications, warranting further preclinical studies for CRPC.

Keywords: Prostate Cancer, XCT-790, Tc-99m, In Vitro

O-28 Even-Odd Proton Rich N=49 Isotones Nuclear Structure Investigations

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Exotic nuclei far from β stability are of increasing interest for spectroscopic studies, for nuclear structure purposes, in such unstable regions. These nuclei have a significant impact on the history of theoretical and experimental knowledge development [1]. In order to test and understand the role of some spectroscopic properties, shell model calculations have been performed for interpreting and developing the two body matrix elements of N-N interaction. Furthermore, the interactions between nucleons in different orbits lead to modifications on shell structure of the nuclear systems, thus to the appearance of possible new magic numbers. The consideration of this effect may offer the opportunity to predict some missed nuclear structure properties, in non-investigated regions. In this context and with the intention of reproducing the nuclear structure properties of even-odd N=49 isotones; we have carried out calculations, by means of NuShellX@MSU [2] nuclear structure code, using recent experimental single particle energies [3, 4]. The two-body matrix elements (TBMEs) of the used effective interaction in Ni core were deduced from those of snet realistic one in ^{56}Ni mass region [5]. Basing on the original interaction, the TBMEs are then modified taking into account the monopole effect [6-8] in ^{78}Sr to introduce z38n40 new interaction. The obtained results are then compared to the available experimental data.

Keywords: N=49 isotones Proton drip line Nuclear Structure Spectroscopy NuShellX@MSU nuclear structure code Gamma Decay

O-29 Shell Model Calculations in Isotopic Chain Beyond Doubly Magic ^{56}Ni Core

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Significant advances in developing experimental techniques and radioactive beams have made it possible to explore more exotic nuclei and understand isotopic sequences in the nuclear chart, from the proton-rich nuclei boundary to the rich-neutron drip line. These nuclei have long been an important topic in nuclear structure and dynamics. The information on the excitation energies of individual states and the nucleon-nucleon interaction that can be gleaned from each part of the nuclear chart makes it possible to test the basic ingredients of nuclear model calculations [1,2]. Furthermore, nuclei in the nickel region are known to exist in shape coexistence in their nuclear structure. These coexistences refer to the ability of a nucleus to adopt different nuclear shape configurations (prolate, oblate, etc ...) with relatively close energies which makes their theoretical and experimental study particularly interesting. This nuclei behaviour in other isotopes of the nuclear chart challenges our simplistic view of spherical nuclei and understanding this phenomenon contributes to a better comprehension of the fundamental properties of nuclear matter [3,4]. We investigate some nuclear spectroscopic properties calculations such as low-state energies and transition probabilities of even-even isotopes beyond the ^{56}Ni nucleus [5]. The calculations are carried out within the framework of the nuclear shell model using NuShellX@MSU [6] nuclear structure code. This study is based on the f5pg9 valence space composed of eight proton and neutron orbitals with recent experimental values of single-particle energies outside the ^{56}Ni doubly magic core. The various effective interactions [7,8] were adopted in the pn-formalism. This work aims to provide a detailed description of the nuclear structure and shape evolution of these isotopes. The obtained results show a reasonable description of the available experimental data in the low-lying yrast and yrare states of these even nuclei.

Keywords: NuShellX@MSU Code, ^{56}Ni mass region, Low-lying states, Gamma transition probabilities.

O-30 Absorbed Doses for ^{68}Ga -PSMA PET/CT Prostate Imaging

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When utilizing ^{68}Ga -PSMA PET imaging, it is important that the radiopharmaceutical is uptaken by the kidneys and liver parenchymal tissue. Since these organs are both sensitive to radiation and vital for life's sustainability. In this study, the absorbed radiation doses by the liver and kidney were calculated by three different methods. These dose values were compared with each other. Phantom models, which simulate the human liver and kidney in terms of size and density, were designed and produced to determine the absorbed doses by the liver and kidneys 60 minutes after a 148 MBq ^{68}Ga -PSMA injection. Absorbed doses were determined with TLD-100 chips placed in the phantoms. In the second stage, the absorbed dose distribution in the liver and kidneys for Ga-68 activity and absorbed dose values were calculated using Monte Carlo software and the IDAC Dose software separately for the TLD settings. The absorbed radiation dose delivered to the patient with the ^{68}Ga -PSMA PET/CT imaging procedure and its uptake by the liver and kidneys were then determined. With an activity of 22.2 MBq for the liver and 11.1 MBq for the kidneys. The liver and kidney doses were calculated as 1.3E^{-2} mGy/MBq and 3.01E^{-1} mGy/MBq in phantom TLD, respectively. The calculation doses compared the results of 0.7E^{-2} mGy/MBq and 4.5E^{-2} mGy/MBq in the IDAC Dose with 0.8E^{-1} mGy/MBq and 0.9E^{-2} mGy/MBq in the EGSnrc simulation.

Keywords: Prostate Pet İmaging, Monte Carlo EGSnrc, Ga-68 PSMA PET/CT

O-31 The Role of RS and GIS Methods in Nuclear Leakage Spatial Risk Assessment: A Sample Study

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Remote sensing (RS) techniques and Geographical Information Systems (GIS) tools have been widely used in recent years in research on nuclear power plants. These studies can be classified as before, during and after the operation of nuclear facilities. Spatial environmental risk analyses and site selection studies can be conducted during the planning phase of the plant. The studies carried out after the plant is operational consist of monitoring temporal changes such as land cover, water temperature, coastal changes, isolation and disposal of radioactive wastes. In the case study, it is aimed to bring a new spatial perspective to emergency action plans in case of leakage. The area determined as the centre (impact area) of the nuclear facility was determined as a buffer zone within a radius of 30 kilometers. In this study area, risky areas were identified by visibility and proximity analyses using GIS. In addition, satellite images and machine learning classification techniques were used to determine the land use characteristics of the study area with a resolution of 10 metres. Population data were obtained from the WorldPop dataset on the Google Earth Engine (GEE) platform with a resolution of 100x100 metres. The prevailing wind direction was mapped using the ERA5 dataset of the European Centre for Medium Term Weather Forecasts (ECMWF). Road data was obtained using OpenStreetMap data. All these data were classified and normalized according to their weights. Afterwards, pixel-based risk areas were determined using appropriate mathematical methods. In this way, areas requiring priority evacuation in the event of a leak were identified.

Keywords: risk assessment, visibility, buffer, land classification, nuclear leakage

O-32 Synthesis, Characterization and Application of Cys-Graft-Poly(2-Hydroxyethyl Methacrylate) Nanopolymers Radiolabeled with Technetium-99m for Biomedical Applications

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The study aimed to synthesize, characterize, and evaluate the potential biomedical applications of Cys-graft-poly(2-hydroxyethyl methacrylate) [Cys-graft-poli(HEMA)] nanopolymers radiolabeled with technetium-99m ($[^{99m}\text{Tc}]\text{Tc}$). The Cys-graft-poli(HEMA) nanopolymers were synthesized using graft polymerization techniques and subsequently radiolabeled with $[^{99m}\text{Tc}]\text{Tc}$. Radiochemical yield, stability, and lipophilicity were assessed. Quality control was performed using Thin Layer Chromatography (TLC) and High-Performance Liquid Chromatography (HPLC), achieving a radiochemical efficiency of $96.84 \pm 3.41\%$ with stability over 4 hours. Lipophilicity, assessed by partitioning in n-octanol and phosphate buffer, yielded a logP value of -2.08, indicating the hydrophilic nature of the nanopolymer. Cytotoxicity tests on Hek-293 cell lines demonstrated biocompatibility, with IC50 values of $1065 \pm 4.62 \mu\text{g/mL}$ at 24 hours and $3814 \pm 96 \mu\text{g/mL}$ at 48 hours. Cellular uptake studies revealed maximal uptake at 120 minutes. These findings suggest that $[^{99m}\text{Tc}]\text{Tc}$ -Cys-graft-poli(HEMA) nanopolymers have significant potential for targeted imaging and therapeutic applications in nuclear medicine, offering a promising direction for future research in nanomedicine.

Keywords: Cys-graft-poli(HEMA) nanopolymers, Graft polymerization, Nanomedicine, Technetium-99m radiolabeling

O-33 Radiation Shielding Properties of New Knitted Fabric-Reinforced Composites at Nuclear Medicine Energies

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Radiation shielding in nuclear medicine typically relies on using dense materials such as lead a high atomic number element for its great density and low cost. Since lead is heavy and harmful to the environment, research on alternative materials that are light, flexible, inexpensive, and have a high radiation shielding capacity has accelerated. In this sense, composite materials that can be produced by reinforcing different matrix with environmentally friendly reinforcements are promising. In this research, it is aimed to examine the radiation shielding capabilities of three different composite materials reinforced with knitted fabric of rib and inlaid rib structures from glass and copper filaments for photon energies emitted by radionuclides used for imaging in nuclear medicine. Radiation shielding parameters of composite materials produced in Dokuz Eylül University, Faculty of Engineering, Department of Textile Engineering, were investigated using a gamma camera system with a pinhole collimator at Dokuz Eylül University Hospital, Department of Nuclear Medicine. According to this for photon energies of Lu-177, Tc-99m, I-123, and I-131 radioactive sources, the mass attenuation coefficient for the composite materials with various fabric structures of glass and copper filaments were calculated. Among the findings of three composite materials, the mass attenuation coefficients were in the range of 0.06-0.12 cm²/g. In addition, the mass attenuation coefficients determined for the composite materials were seen to be comparable to those of concrete, which is effectively used in radiation shielding, and composite materials were proposed as a promising alternative material for shielding low and medium energy gamma radiation in Nuclear Medicine units.

Keywords: knitted fabric, composite, gamma camera, radiation shielding

O-34 Soft Error Risk Assessment in Heavy Ion Radiation Therapy for Prostate Cancer

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Carbon ion radiotherapy, which demonstrates higher biological effects and dose concentration than conventional radiotherapy, is expected to be effective against various types of solid tumors. However, nuclear reactions in the treatment equipment and patients generate secondary particles such as neutrons and ions, which can cause soft errors in the surrounding electronics. When soft errors occur in a cardiac implantable electronic device (CIEDs), malfunctions can be fatal. In this study, a risk assessment of the treatment of prostate cancer patients was performed through simulation using clinical data. Monte Carlo simulations were conducted using CT images of three patients who had undergone carbon ion therapy at the Gunma University Heavy Ion Medical Center (GHMC). PHITS was used for the simulation; input files were created from the CT data using RT-PHITS, and the irradiation equipment and beam data from GHMC were incorporated into the simulation. The patients were irradiated with 290, 380, or 400 MeV/u carbon beams from the patient's anterior, left, and right sides, for a total of 57.6 Gy(RBE) with 16 fractions. The fluxes of thermal, intermediate-energy, and high-energy (>10 MeV) neutrons and protons at the CIEDs position were calculated. We then estimated the number of soft errors that would be expected to be counted by our soft-error measurement system, using the soft-error cross sections for them evaluated in a previous study. The simulation results confirmed that the risk of soft errors varies depending on the irradiation conditions. The beam energy and wobbling radius have a significant impact on the soft-error risk. The estimated number of errors that would be measured by our soft error measuring system was 0.2. This value is sufficiently small given that in previous studies, 7 errors were observed even with guideline-compliant x-ray therapy. The risk of soft errors in CIEDs due to CIRT for prostate cancer appears to be acceptable.

Keywords: Soft Error, PHITS, Carbon Ion Radiation Therapy, Prostate Cancer

O-35 Analysing the Relationship Between Electricity Generation and Environmental Impact of Coastal Nuclear Plants in the European Union

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Nuclear energy is the most important energy source for mankind. With industrialisation, energy demand is an important input cost for both personal use and production. Developing countries and developed countries use nuclear energy intensively today. In addition to the positive gains of shore-side nuclear facilities, the environmental risks that may arise need to be investigated. The seas, where there is a lack of data, should be especially addressed. Carbon dioxide, the greenhouse gas in the atmosphere, is reduced by 25% with the help of the seas. In addition to carbon dioxide reduction, the aim of this study for the world is to develop Earth Observation methodology to investigate the environmental impacts on the sea by using Remote Sensing, Geographical Information Systems and Sensor technology in order to determine the impact of European coastal nuclear power plants on the sea. In this study, the data set was obtained from open source data. The data on latitude, longitude and annual electricity generation of coastal nuclear power plants in Europe were used in the study. Nuclear plant spatial information can be obtained from the International Atomic Energy Agency latitude, longitude and annual generation data. With these data, spatial distribution can be obtained in QGIS, an open source geographic information systems and remote sensing software. The study was carried out with location-based data sets centred on marine data and open source data. In the study, the relationship between electricity generation data and Google Earth Engine marine data set was developed by using the open source software language Python on the Google Earth Engine Code Platform. In addition to the determination and solution proposals for the lack of data on the sea and satellite image resolution weaknesses, the study has put forward the necessary methodologies for increasing the sensitivity and making high accuracy analyses.

Keywords: Nuclear Energy, Coastal Nuclear Power Plant , Environmental Impact, A Geographic Information Systems, Remote Sensing, Earth Observation, Google Earth Engine

O-36 Radiologic Risk Assessment of Outdoor Gamma Dose Rate in Çorum Province, Turkey

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Abstract

This study aims to obtain the absorbed dose rate in outdoor air and related health risks for the Çorum province in Turkey. Absorbed gamma dose rate readings were taken from 56 stations using portable NaI(Tl) scintillation detector. The outdoor absorbed gamma dose rates (terrestrial and cosmic) varied from 21 to 110 nGy⁻¹ with an average value of 44.96±17.27 nGy⁻¹. Because of the exposure of the inhabitants to the outdoor gamma the average annual effective dose was calculated as 55.14±21.18 µSv⁻¹. The risk value of cancer for adults in this region was estimated as 1.93×10⁻⁴ which is below the world average.

Keywords Absorbed gamma dose rate, Annual effective dose equivalent, Çorum, Lifetime cancer risk, Outdoor radioactivity

Acknowledgements

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Funding

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O-37 Sedimentation Rate and Chronology of Çınarcık Basin, the Marmara Sea

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Marine sediments serve as natural records that capture environmental changes, and sediment dating enables the chronological examination of these changes. Concentration anomalies in sediments are significant indicators of anthropogenic pollution, and these accumulations are attributed more to artificial influences than natural conditions. The radionuclides ^{210}Pb and ^{137}Cs are widely used time markers to determine sedimentation rates and sediment chronology over the past century. Present study reports the activity concentrations of ^{210}Pb and ^{137}Cs radionuclides in a sediment core sample from the Çınarcık Basin, the widest and deepest part of the Marmara Sea, were determined using low and high energy HPGe gamma detectors. The sedimentation rate and chronology for ^{210}Pb were established using the CRS (Constant Rate of Supply) and CIC (Constant Initial Concentration) models, and the results were verified through comparison with the ^{137}Cs chronology. Based on the evaluations, sedimentation rates according to CRS and CIC models are 0.36 cm.y^{-1} and 0.39 cm.y^{-1} , respectively. In the CRS model, depths of 13 and 15 centimeters from the surface correspond to the years 1989 ± 0.93 and 1984 ± 1.22 , respectively. The ^{137}Cs profile at the same layer shows a value of $8.11 \pm 2.43 \text{ Bq.kg}^{-1}$ at 14 cm, indicating the 1986 peak. Additionally, in the CRS model, a depth of 19 centimetres corresponds to the year 1963 ± 1.81 , and the ^{137}Cs profile at the same layer shows a value of $11.03 \pm 4.14 \text{ Bq.kg}^{-1}$ for the year 1963. The analysis of sediment core from the Çınarcık Basin revealed the activity concentrations of ^{210}Pb and ^{137}Cs radionuclides, which allowed us to determine the sedimentation rate and chronology of the basin over the past century. These findings provide a valuable foundation for assessing the historical anthropogenic pressures in the area. This will contribute to our understanding of the region's environmental history and the changes that its marine ecosystem has undergone.

Keywords: Sedimentation, Çınarcık Basin, Radiometric dating, ^{210}Pb , ^{137}Cs

**O-38 Natural Radioactivity Measurements and Dose Assessment in Beach Sands
Collected Along the Coastline of the Campania Region, Southern Italy**

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Human beings are regularly exposed to ionizing radiation, much of which originates from natural sources. Primordial radionuclides such as ^{238}U , ^{232}Th series and non-series ^{40}K have existed since the creation of the earth and are widely distributed in the environment. These radionuclides and their decay products are commonly found in varying concentrations in environmental matrices, in particular in soils, sands, water and rocks. In the present study, the activity concentrations of natural radionuclides (^{226}Ra , ^{232}Th , and ^{40}K) were determined for the beach sand samples along coastline of the Campania Region, Southern Italy. The spectrometric analysis was carried out at the Advanced Technologies Application and Research Centre of Kırklareli University, using a high-resolution (2.0 keV) high purity germanium (HPGe) γ -ray spectrometry system (ORTEC GEM70P4-95, USA). The beach sand samples were collected from ten different sites on the southern part of the coast of Campania Region, a popular summer touristic destination. The radiological health hazard indices due to natural radioactivity were evaluated for the radiological risk for the public and compared to the limits proposed by the United Nations Scientific Committee on the Effects of Atomic Radiation (UNSCEAR). The results of this study were compared with values in other parts of the world.

Keywords: Radioactivity, Gamma, Dose, HPGe, Beach Sand, Italy

O-39 Investigation of the Usability of Ce and N Doped Hybrit Carbon Quantum Dots for the Removal of Neodymium Ions

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In this study, the main objective is to evaluate the potential of Ce and N doped hybrid Carbon Quantum Dots (CQDs) integrated into hydrogel matrices for the detection and removal of neodymium (Nd) from aqueous solutions, addressing an important environmental issue. Neodymium (Nd) is widely used in various industrial applications, including magnets and electronics, but its presence in water can have toxic effects on the environment. Therefore, detection and removal of Nd from aqueous solutions are critical for environmental protection. CQDs were synthesized in a single step using a hydrothermal method with "Agaricus Bisporus" mushrooms, Ce, and N in specific ratios within a Teflon container. These CQDs were then used to modify hydrogel matrices for adsorption studies. The morphologies of the prepared Ce and N doped hybrid Carbon Quantum Dots (CQDs) were studied by scanning electron microscopy (SEM), Fourier transform infrared spectroscopy (FTIR) and X-ray photoelectron spectroscopy (XPS). Additionally, fluorescence images of the CQDs samples under different wavelengths of UV lamps were obtained for visual verification. In adsorption experiments, parameters affecting the adsorption efficiency such as solution pH, contact time, Nd (III) concentration and temperature were investigated using batch adsorption technique. The adsorption capacity of the CQDs for Nd (III) ions was determined using ICP-OES. Adsorption isotherms and kinetics were investigated to determine the interaction, adsorption capacity, and rate of the CQDs with metal ions. This study highlights the significant potential of Ce and N doped CQDs integrated into hydrogels for the effective removal of environmentally harmful metals like Nd, offering a promising solution for environmental pollution monitoring and control.

Keywords: Adsorption, Neodymium, Cerium, CQDs, Hydrogel

O-40 Synthesis and Characterization Studies of CMC/NCC Nanocomposites Derived from Textile Waste for the Adsorption of Lanthanum Ions from Aqueous Solutions

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In this study, the efficiency of nanocrystalline cellulose (NCC) reinforced carboxymethyl cellulose (CMC) nanocomposites obtained from textile wastes on the adsorption of lanthanum (La), one of the rare earth elements and lanthanide group, was investigated. In the initial stage of the study, microcrystalline cellulose was obtained from cotton-based textile wastes by the acid hydrolysis method. In the second stage, nanocrystalline cellulose was synthesized from microcrystalline cellulose using a basic reaction. The physical properties of the produced MCC and NCC materials and CMC-NCC biopolymer were characterized by FT-IR, SEM and XRD analysis. Various parameters affecting the adsorption of lanthanum from aqueous solutions using CMC biopolymers were investigated. These parameters include solution pH, initial element concentration, agitation time and temperature. Optimum conditions were determined and the amount of adsorbed elements, distribution coefficients and adsorption efficiencies were calculated and evaluated. The results obtained showed that lanthanum was effectively adsorbed by CMC biopolymer. In the study, thermodynamic parameters related to the adsorption of lanthanum on CMC biopolymer were also calculated. It was determined that the adsorption process was endothermic and voluntary. It was also observed that the experimental data were consistent with Langmuir, Freundlich and Dubinin-Radushkevich isotherm models. Due to the porous hydrogel structure of CMC biopolymer and its various functional groups, the adsorption mechanism is complex and may be suitable for different isotherm models. In conclusion, the use of CMC-NCC biopolymer for adsorption of lanthanum ions from dilute aqueous solutions can be an economical, effective and environmentally friendly option. This biopolymer can be preferred over other conventional separation and treatment methods in terms of its high capacity, simple process, economic advantages and environmental protection.

Keywords: Adsorption, lanthanum, rare earth elements, cellulose, bionano composites

O-41 Possible Applications of Zeolitic Rocks in the Nuclear Waste Field

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We report results for applications of a zeolitic rocks in the field of nuclear waste disposal. The used zeolites are from Bulgarian deposits which covers the central parts of Eastern Rhodopes mountain. The quantity of the zeolitized material in these deposits varies from tens to some hundred millions tons. Our research shows the presence of manganese hydroxides in the pale greenish clinoptilolite zeolites from the "Beli Plast" deposit, forming thin crusts with a thickness of several mm, impregnations and dendritic aggregates with a black, in some cases black-brown color in places. Results of a preliminary study which are conducted on the zeolite rocks located north of Cold Well Dam will be presented. The presence of certain microporous minerals, referred to as octahedral molecular sieves (OMS) and octahedral layered materials (OL) will increase the value of the zeolite raw material from the deposit in order to use them as a sorbent of heavy metals and radionuclides to solve some radioactive waste problems. Acknowledgements: This work was supported by the grant of the Ministry of Education and Science of the Republic of Bulgaria, ACTRIS BG, No. D01-365/04.12.2023 under National Road Map for Scientific infrastructure.

Keywords: Zeolite; Todorokite; Mordenite; OMS; OL

O-42 Development, Characterization and Investigation of Sorption Properties of Graphene Oxide/alginate Based Nanobiocomposites for Strontium Removal

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Strontium enters the environment through nuclear weapons testing, uncontrolled releases from nuclear reactors and fuel reprocessing plants, and nuclear accidents. Strontium radioisotopes ⁹⁰Sr ($t_{1/2} = 28.87$ years, beta ray source) can cause serious radiological damage due to their high half-lives and easy adsorption by biological tissues. Strontium, one of the main fission products, is similar to calcium in terms of chemical properties and can be replaced by calcium in the human body. Strontium, which can emit beta rays with an energy of 0.564 MeV, can cause damage such as leukemia, anemia and genetic changes in the human body. Within the scope of this study, it is planned to synthesize modifiable/adaptable nanobiocomposites for the removal of strontium radionuclides from aqueous media. One of the components of the nanocomposite adsorbent material will be graphene oxide with high mechanical strength, superior thermal and electrical conductivity and high flexibility. As another component, it is planned to use biologically based alginate obtained from brown seaweeds. With different synthesis methods with different third components to be added to the obtained materials, nano-bio-composite adsorbents will be obtained and their usability in batch adsorption systems of strontium radionuclides from aqueous media will be tested. In this study, it is planned to improve the adsorption efficiency and selectivity of graphene oxide/alginate nano-bio-composite by modifying it with different components (chitosan, ZnO etc.). Different methods such as SEM-EDS, XRD, FT-IR, BET and XPS were used for the characterisation of the synthesised nano-bio-composite adsorbent. The adsorption behaviour of the synthesized nanobiocomposites towards strontium ions was planned by full factorial experimental design method and the simultaneous interactions of the main experimental parameters such as pH, strontium concentration, temperature and contact time were investigated. With the experimental data to be obtained, adsorption isotherms and adsorption kinetics was analysed to determine the sorption mechanism.

Keywords: Graphene oxide, alginate, strontium, experimental design

O-43 Development of a Methyl Thymol Blue-Loaded Alginate Hydrogel for the Quantitative Detection of Sr(II) Ions in Water

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Strontium-90 (Sr-90), a byproduct of nuclear weapons tests and nuclear accidents, accumulates in aquatic environments such as seas, lakes, and rivers. Chemically similar to calcium, Sr-90 can easily accumulate in bone and muscle tissues, leading to significant health risks due to its radiotoxicity. Therefore, the detection and removal of Sr-90 from aqueous solutions have become crucial. In this study, alginate beads were modified with commercially available Methyl Thymol Blue (MTB) probe molecules for the detection of strontium ions in water samples. The Methyl Thymol Blue was immobilized onto alginate beads, and the color changes of the beads in the presence of strontium ions were quantitatively determined using RGB (red, green, blue) color coordinate values evaluated with the ImageJ (Image Java®) program. The conditions for the colorimetric detection of strontium ions were optimized by considering various factors. The solution pH (2-9), strontium concentration (1-250 mg/L), temperature (25-40 °C), and reaction time (1-60 min) were systematically varied to identify the optimal conditions for strontium detection. At 25 °C, pH 8, and 10 mg/L strontium concentration, the colorimetric coordinate method provides a simple and facile technique for metal ion detection, which can be easily observed with the naked eye. This method, with its simplicity and portability, offers a potential application for on-site testing and monitoring. To enhance practical application, the colorimetric detection of strontium ions was digitally analyzed using portable devices such as mobile phone cameras. This approach allows for quantitative analysis without the need for complex laboratory equipment, making it accessible for field use. The method was tested under various environmental conditions to ensure reliability and robustness. Field tests were conducted to validate the method's effectiveness in real-world conditions. ImageJ software and portable devices were employed for accurate and rapid analysis of RGB values, further enhancing the method's practicality and reliability. This research contributes significantly to the field of environmental monitoring by providing a simple, efficient, and portable solution for the detection of strontium ions in aqueous environments. Acknowledgement: This project was supported by the TÜBİTAK 2211-C program, TÜBİTAK 2214-A PhD support program, and Ege University Scientific Research (BAP-22104) Project programs. KEYWORDS: Strontium, Alginate bead, Methyl Thymol Blue, RGB color coordinate

Keywords: Strontium, Alginate bead, Methyl Thymol Blue, RGB color coordinate

O-44 Radio Ecology in India: Strategies for Improved Understanding and Mitigation of Radiation Impact

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Radioecology is critical in India due to its varied geography and numerous sources of radiation, both natural and artificial. The rapid growth of the nuclear industry, combined with increased uranium use, has led to severe issues with radioactive pollution. This pollution impacts soil, water, and the atmosphere, and poses significant risks to human health and ecosystems. In India, the use of uranium—key for nuclear energy—has heightened concerns over radioactive contamination. Uranium and its compounds are highly carcinogenic and biologically toxic. For instance, in Bangalore, the concentration of uranium in drinking water rose dramatically between 1998 and 2011, reflecting a broader problem of radioactive pollution. Recent studies utilizing laser-induced fluorimetry to analyze groundwater from 96 bore wells in Bangalore highlight the dangerous levels of uranium contamination. These studies reveal that the chemical toxicity of uranium, which primarily affects kidney function, is more immediately harmful than its radioactive properties. Long-term ingestion of uranium-contaminated water can lead to severe health issues, including kidney damage and increased cancer risk. To address these challenges, it is crucial to implement effective monitoring and mitigation strategies. Regular monitoring of uranium levels in water sources is essential, using advanced techniques like laser-induced fluorimetry. Additionally, improving water treatment technologies such as ion exchange and reverse osmosis can help remove uranium from drinking water. Strengthening regulations around uranium use and waste management, along with raising public awareness about the risks of uranium contamination, are also vital steps. Investing in research and development for innovative solutions will further enhance the effectiveness of these strategies, ensuring better protection for both people and the environment.

Keywords: Radioecology, Uranium, laser-induced fluorimetry, contamination, water treatment technologies.

O-45 Impact of Uranium on the Environment: A Machine Learning Perspective

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For a country like India, which has immense potential and diverse cultures, securing a sustainable energy future is a huge challenge. Its economy is growing quickly, with its population—the second largest in the world—driving up power demand. Even though there is huge potential for renewable sources of energy—for instance, wind and solar—they are still in the early phases of development. On the other hand, uranium-powered nuclear power takes a command position in the energy mix by providing an independent base load of electricity in the country. This way forward calls for much thought to the environment, thus calling for a delicate balancing act. Huge amounts of uranium are found in India. It is mainly extracted in the states of Jharkhand, Rajasthan, and Andhra Pradesh. Exploiting this resource is quite a tempting way to end the energy crisis. However, dangers are associated with both mining and processing uranium. Though it is used to generate clean energy, it is always at risk of harming the environment. The past experiences of India are a grim reminder of such outcomes. Such uranium mining operations will break the balance of the ecosystem due to radiation exposure. This may involve the crushing, grinding, and processing of the ore, which is part of uranium mining. In the process, quite a significant amount of contaminants and radioactive dust are released into the environment. This eventually results in contaminated soils, consequently affecting the microbial activity and fertility of soils. Features of uranium mining operations are the surface pits and tunnels. These can leach into, and thus contaminate, groundwater aquifers where they intercept. This contaminates the water table with radioactive elements, making it unfit for irrigation purposes and human consumption. This affects the survival of fish and other aquatic life by upsetting aquatic ecosystems and thus directly endangering human health. Most uranium mining takes place in remote areas where there are existing communities. These communities depend on land for their subsistence through farming and other traditional means. Their way of life might change, and they may be displaced by mining.

Keywords: Uranium, Environmental impact, K-Nearest Neighbors (KNN) algorithm, Environmental monitoring, Machine learning

POSTER ABSTRACTS

P-01 Clofoctol (o-CLO): Isolation from Cave Environment, Radioiodination and its Antibiofilm Effect

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Biofilm is a sticky and microbial structure formed by various microorganisms such as bacteria, fungi, algae, and others on different surfaces. Biofilm formation allows microorganisms to gain resistance against environmental conditions, which may reduce the effectiveness of traditional antimicrobial methods. Antibiotics are used to kill microorganisms or prevent their proliferation. However, microorganisms within biofilms may exhibit higher resistance to antibiotics. Special antibiotics targeting microorganisms that form biofilms or inhibiting biofilm formation have been developed. Clofoctol is an antibiotic used for the treatment of bacterial infections, works by inhibiting the synthesis of bacterial cell walls, thereby preventing bacterial proliferation and the spread of infections. Some radionuclides used in Nuclear Medicine can be selectively directed to infected tissues by labeling molecules that are selective for these tissues, besides their role in imaging functionality. In this study, clofoctol isolated from cave environment (o-CLO) and its synthetic derivative (s-CLO) were labeled with ¹³¹I (Iodine-131), a radionuclide used for diagnostic and therapeutic purposes in nuclear medicine (364 keV γ -rays and $t_{1/2} = 8$ days). It is observed that ¹³¹I-s-CLO was labeled with an efficiency of $95.67 \pm 4.12\%$, and ¹³¹I-o-CLO with an efficiency of $98.65 \pm 1.18\%$. Following radiolabeling, stability and lipophilicity experimental stages were performed for ¹³¹I-s-CLO and ¹³¹I-o-CLO compounds. Quality control studies were conducted using HPLRC and TLRC methods for these compounds. Lipophilicity results revealed that the logP values of ¹³¹I-s-CLO and ¹³¹I-o-CLO were 2.14 ± 0.34 and 3.31 ± 0.12 , respectively, indicating that both compounds are lipophilic. The binding efficiency of ¹³¹I, ¹³¹I-s-CLO, and ¹³¹I-o-CLO with six pathogenic microorganisms was examined. Subsequently, Quantitative Microdilution Method for Biofilm Formation and OD (Optical Density (OD_{630 nm})) studies were conducted to examine the bactericidal effect of Clofoctol under biofilm. Recently, there has been an acceleration in the development of new drugs targeting microorganisms within biofilms and biofilm structures. Upon evaluating all experimental results, it can be seen that Clofoctol, in conjunction with Nuclear Methods, has the potential to be used as a new strategic biofilm agent. This study was supported by The Scientific and Technological Research Council of Türkiye (TUBITAK), Project No: 123Z720.

Keywords: ¹³¹I (Iodine-131), Clofoctol, Radiolabelled antibiotics, Biofilm

P-02 Preparation, Optimization and Stability of Dye-Loaded Protein Structured Nanocolloids as a Novel Radiopharmaceutical Candidate

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In attempt to develop nanoparticles for drug delivery systems, albumin, a protein carrier for drugs, is the suitable choice, and albumin nanoparticles have been widely used drug delivery systems with applications in various diseases. For i.v administration of albumin nanoparticles, the particle size, surface charge, and drug loading are important parameters for consideration. The objective of the present study was the development of albumin based nanoparticles containing dye using a nanoprecipitation procedure. The developed nanoparticles were characterized by Scanning Electron Microscopy (SEM) and Dynamic Light Scattering (DLS). The effects of factors such as solvent/non-solvent ratio, pH, crosslinker, dye and surfactant concentration on the physicochemical parameters of the formulations were optimized. Also, in vitro stability studies of nanoparticles were measured in different conditions up to 3 months. According to the obtained results, the spherical nanoparticles had particle size of 93.88 ± 1.86 and 113.90 ± 1.91 nm, PDI value of 0.19 ± 0.01 and 0.44 ± 0.02 , and negative charge of -26.0 ± 2.87 and 57.4 ± 3.86 mV. The loading amount of the dye for dye loaded albumin nanoparticles was 15-20%. Also, under different conditions, nanoparticle formulations were stable, and did not exhibit a substantial change in DLS results. In conclusion, dye-loaded albumin nanoparticles in stable nano colloidal structure with ideal properties were prepared. ACKNOWLEDGMENT Funding Sources Financial support for this work was provided by TUBITAK (Grant No: 117S517).

Keywords: Nanocolloid, Albumin, Nanoprecipitation, Drug Delivery

P-03 Quantitative Imaging Characteristics of Terbium-161

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Introduction Recently, Terbium 161 (Tb-161) has emerged as a significant Auger electron-emitting radionuclide. The use of Auger electrons for targeted therapy, due to their high linear energy transfers and short-range biological effectiveness, is considered highly promising for the treatment of small-sized cancers and especially metastases. Additionally, Tb-161 also emits photons suitable for scintigraphic imaging. The purpose of this study was to evaluate quantitative parameters for Tb-161 in a clinical setting. **Materials and Methods** Initially, a gamma camera was calibrated for energy using a Tc-99m point source according to clinical routine, followed by the creation of a homogeneity map using Tb-161. A flat circular phantom with a diameter of 15 cm was employed to determine the optimal imaging settings and energy windows. The phantom was positioned approximately 5 cm from each detector surface in between the detectors. Gamma emission windows of $48.9 \pm 10\%$ and 74.6 ± 10 keV were used for imaging photon emissions from Tb-161. Data were collected from Detector 1 (on the table) and Detector 2 (beneath the table) using a LEHR collimator in a 256x256 matrix for static imaging. Five million counts were collected from both detectors. **Results** Sensitivity measurements were calculated separately for each detector. Sensitivity values for Detector 1 and Detector 2 in the 74.6 ± 10 keV energy window were 8.627 cps/MBq and 7.71 cps/MBq, respectively. In the energy windows of $48.9 \pm 10\%$ and 74.6 ± 10 keV, the values were 25.16 cps/MBq and 23.53 cps/MBq, respectively. **Conclusion** It is feasible to perform SPECT imaging using therapeutic amounts of Tb-161 and achieve good image quality with a 74.6 ± 10 keV energy window. The LEHR collimator is an effective choice for obtaining high-resolution images. The use of Tb-161 labeled radiopharmaceuticals in a clinical setting can be applicable for dosimetry.

Keywords: Terbium 161, Sensitivity, Imaging

P-04 Natural Radionuclide Concentrations in Coal and Combustion Wastes in Medium-Scale Industry

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This study aimed to investigate the natural radionuclide concentrations in a coal-fired boiler process with a wet scrubber emission control system in an industrial enterprise located in the Manisa, Türkiye region. In the system, which was monitored for six days samples were collected from; the coals which were combusted in the boiler, the bottom ash and fly ash after coal combustion, and the sludge samples which accumulated in the treatment pools with the waste water discharged from the wet scrubber outlet were collected regularly. A 3"x3" NaI(Tl) scintillation detector was used to determine the radionuclide concentrations of the samples. Natural radionuclide concentrations are for coal; ²³⁸U; 140-180 Bq/kg; ²³²Th 10-17 Bq/kg and ⁴⁰K 61-99 Bq/kg; for bottom ash ²³⁸U, ²³²Th and ⁴⁰K respectively are; 154- 205 Bq/kg, 13-16 Bq/kg and 52-72 Bq/kg; the radionuclide concentrations in fly ash samples, respectively; 208-235 Bq/kg, 18-21 Bq/kg and 86-101 Bq/kg were measured. In wastewater treatment plant sludge, for ²³⁸U, ²³²Th, and ⁴⁰K respectively; were determined as 139-148 Bq/kg, 14-15 Bq/kg, and 56-61 Bq/kg. Gamma dose rate (D) absorbed in solid wastes, annual effective dose equivalent (AEDE), external hazard index (Hex), internal hazard index (Hin), Radium equivalent activity concentration index (Raeq), lifetime fetal cancer risk (YFKR), Gamma index (I_γ), and Activity utilization index (AUI) radiation parameters were calculated and compared with UNSCEAR limits and radionuclide enrichment factors of coal and ash were investigated.

Keywords: Natural radioactivity, Coal Boiler, Activity Utilization Index, Coal ash

P-05 Complexation Behavior of Caffeic and Cinnamic Acids Towards La(III), Sm(III), Th(IV) and UO₂(II) Ions

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Actinides and lanthanides are known for their high chemical toxicity, similar to other heavy elements in biological systems. Additionally, the behavior of their cations holds significant importance in nuclear waste processing. These elements also play crucial roles in nuclear fuel reprocessing, offering a diverse array of applications in therapeutics and diagnostics. Consequently, the metal complexations of the f-block (lanthanide and actinide) with naturally occurring ligands have garnered substantial interest in recent decades. Phenolic acids are natural compounds containing an aromatic nucleus and phenolic and carboxylic groups. Due to their antioxidant properties, phenolic acids give beneficial effects on human health. Stability and equilibrium constants offer invaluable insights into the strength of binding between bioligands and metal ions. Despite the numerous studies on phenolic acid complexes with divalent and trivalent metal ions, research on actinide and lanthanide complexes with phenolic acids remains relatively limited. Present study investigates the complexation of caffeic and cinnamic acids with La(III), Sm(III), Th(IV), and UO₂(II) ions. The formation of complexes between these selected metal ions and the acids was examined through pH titration experiments conducted at 25°C, 37°C, and 45°C in a KCl medium. Initially, the metal-ligand stability constants for each acid-metal ion pair were simulated using the HySS program. Subsequently, complexation constants were calculated using the HYPERQUAD2013 computer program. The resulting thermodynamic parameters were determined and analyzed based on the complexation data. Additionally, considering the potential antitumor activity of metal-phenolic acid complexes, cytotoxicity studies were performed on MCF-7 and A-549 cell lines using the WST method. Acknowledgement This study was financially supported by Istanbul University Scientific Research Project numbered ÖNAP-18875 (İstanbul-Türkiye)

Keywords: Stability constants, Phenolic acids, Actinides, Lanthanides, HYPERQUAD2013

P-06 Utilization of Cyanex-272 Impregnated Amberlite XAD Resins for Uranium Adsorption

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In this study, solvent impregnated resins (SIRs) were prepared by diluting the organophosphinic acid extractant Cyanex-272 in acetone and kerosene, and impregnating it onto Amberlite XAD-7 resins as macroporous polymeric solid support. The adsorption of U(VI) from nitric acid medium with prepared solvent impregnated resins (SIRs) was investigated by batch method. After determining the most suitable diluent and resin, with 0.5 mol L⁻¹ Cyanex 272-Kerosene:XAD-7 SIR; the effects of experimental parameters such as pH, U(VI) concentration, temperature, contact time and volume/mass ratio (V/m) on uranium uptake were determined. Optimum conditions were determined to be pH: 2.5; U(VI) concentration: 100 mg L⁻¹; temperature: 25 °C, contact time: 120 min, volume/mass ratio (V/m) 25 mL/0.1 g of SIR. The adsorption data were found to be compatible with the Langmuir and Freundlich isotherm models, and the maximum monolayer U(VI) sorption capacity was calculated as 82.65 mg U g⁻¹ SIR. Thermodynamic properties ΔH° , ΔS° and ΔG° were examined and it was determined that the process was chemisorption, endothermic, and spontaneous.

Keywords: Uranium, adsorption, Cyanex 272, solvent impregnated resin(SIR)

P-07 ^{89}Zr -Labeled DFO@Durvalumab-HSA Nanoparticles: in Vitro Potential for Triple-Negative Breast Cancer

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Breast cancer is one of the most common diseases worldwide, predominantly affecting women and the second leading cause of cancer-related death. Triple-negative breast cancer (TNBC) has limited treatment due to the lack of HER-2/neu, progesterone, and estrogen receptors. Nuclear imaging agents, particularly PET/CT technology, play an important role in the identification, treatment planning, staging, and assessment of therapeutic response in medical oncology. In the current study, DFO@mAb-NP (DFO@Durvalumab-HSA-DTX nanoparticle) nanoplatfrom was increasingly labeled with Zr-89 and evaluated as in vitro for imaging in triple-negative breast cancer (TNBC). The particle size of mAb-NP and DFO@mAb-NP was 178.1 ± 5 nm to 311 ± 26 nm and zeta potential alteration from -31.9 ± 3 mV to -40.5 ± 0.8 mV, respectively. The data demonstrated significant changes post-conjugation with DFO, evidenced by increased particle size. On the other hand, FTIR and UV spectral analysis results confirmed successful DFO conjugation, with notable shifts in peak wavelengths. The radiolabeling yield of ^{89}Zr -DFO@mAb ($98 \pm 2\%$) and ^{89}Zr -DFO@mAb-NP ($96 \pm 3\%$) was determined to be quite high by TLRC and HPLRC analyses. Cell uptake experiments of ^{89}Zr -DFO@mAb-NP showed an initial high uptake in MDA-MB-468 cells ($45.1 \pm 3.2\%$), which decreased over time, highlighting receptor-specific interactions. These comprehensive findings are the first step towards exploring the use of such nanostructures in the diagnosis and therapy of diseases for targeted imaging in TNBC.

Keywords: Triple-Negative Breast Cancer (TNBC), Zirconium-89 (^{89}Zr) Labeling, PD-L1, Durvalumab, Human Serum Albumin Nanoparticles

ACKNOWLEDGMENT

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**P-08 Investigation of Radon, Radium, pH and Conductivity Values of Drinking Water:
Menemen Region**

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It is known in the scientific world that the most significant contribution to natural radiation comes from radon, a colorless, odorless, tasteless radioactive inert gas. Radon concentration in indoor environments causes lung cancer. In addition, the relationship between radon and stomach cancer has been examined in some studies. Therefore, it is essential to investigate radon concentrations in drinking water. This study, conducted in the Menemen region of Izmir, aimed to assess radon gas and radium concentrations in residents' drinking water (both commercial and natural). Radon and radium concentrations of the collected water samples were measured using RAD-7. In addition to these measurements, pH and conductivity measurements of the waters were also carried out. The study also sought to determine the annual effective dose levels experienced by individuals living in the vicinity. According to results, a total of 50 water samples were analyzed, and radon concentrations were found to be 0.00-47.73 Bq/L, radium concentrations 0.00-0.48 Bq/L, pH values 6.75-8.43 and conductivity values 44-1328 µS/cm, respectively. The data obtained were compared with the literature.

Keywords: RAD-7, Radium, Radon, Menemen, Drinking Water, Conductivity, pH

P-09 Synthesis of Naphthalene Diimide Derivative Targeting G-Quadruplex Structures

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Glioblastoma (GBM) is an aggressive type of brain cancer whose location, tendency to spread to surrounding healthy tissue and heterogeneity have shown little progress in its treatment in recent years and the patient survival rate is very low. The biggest challenge in the treatment of tumors with a heterogeneous structure remains the availability of appropriate molecules that will affect all cancer tissues found in a heterogeneous structure. In order to overcome this problem, by identifying the basic molecular targets common to all cancer cells and types, designing structures specific to these targets is seen as a universal solution. At this point, G-quadruplex structures which can inhibit the telomerase activity gain importance in cancer treatment. The aim of this study is the synthesis of G-quadruplex ligand, which is used in the synthesis of new (radio-) metal complexes with teranostic property, targeting G-quadruplex DNA, which provides selective involvement in tumor tissues, for the simultaneous diagnosis and treatment of glioblastoma, one of the heterogeneous tumors with a high mortality rate. For this purpose, the naphthalene diimide diethylene triamine (NDI-DETA) ligand was synthesized in three steps aiming to target G-quadruplex structures. To enable efficient radiolabeling of the NDI-DETA G-quadruplex ligand with radioactive Tc-99m, a pyrazole diamine chelator was synthesized. Finally, the NDI-DETA ligand was modified with the pyrazole diamine chelator. All synthesis steps were characterized by structure analysis using ¹³C/¹H NMR and LC-MS. Consequently, the high-purity synthesis of the naphthalene diimide derivative for G-quadruplex ligands, which bind to G-quadruplex structures with high affinity and inhibit telomerase, thereby preventing uncontrolled growth of cancer cells, was achieved.

This study was financially supported by The Scientific and Technological Research Council of Turkey (TUBİTAK) Project numbered 122Z734.

Keywords: G-quaternary ligand, DNA, cancer, theranostic

P-10 Radiolabeling and Quality Control Studies of Dexketoprofen Trometamol Loaded Chitosan Nanoparticles

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In this study, dexketoprofen trometamol (DT) loaded chitosan-based nanoparticles were radiolabeled with technetium-99m (^{99m}Tc), and quality control and in vitro stability studies of the radiolabeled nanoparticles were performed. First, DT loaded chitosan-based nanoparticles were prepared spray drying technique. According to obtained results, nanoparticles with zeta potential of $+48.7 \pm 2.1$ mV, particle size of 650.8 ± 10.2 nm, polydispersity index of 0.437 ± 0.052 , and encapsulation efficiency of $75.1 \pm 1.5\%$ were successfully developed. Then, nanoparticles were radiolabeled with ^{99m}Tc using the stannous tartrate method, and quality control experiments for ^{99m}Tc -DT-chitosan nanoparticles were performed using radioactive thin-layer chromatography (RTLC). In addition, stability studies of ^{99m}Tc -DT-chitosan nanoparticles in different mediums (0.9% sodium chloride solution, serum) were performed. According to the obtained results, ^{99m}Tc -DT-chitosan nanoparticles were prepared with over 95% labeling efficiency by a novel, easy, and quick direct method with a 15 min incubation time at pH 9.0. To achieve the best radiolabeling conditions, 1 mL nanoparticle formulation, 1 mg of reducing agent (stannous tartrate), 0.1 mg of antioxidant agent (ascorbic acid), and 37 MBq ^{99m}Tc were used. Stability studies indicated that ^{99m}Tc -DT-chitosan nanoparticles were stable for up to 6 h in 0.9% sodium chloride solution at room temperature, and serum at 37°C. Further studies on the biodistribution of radiolabeled nanoparticles in experimental animals for inflammation imaging are in progress.

Keywords: dexketoprofen trometamol, chitosan nanoparticles, technetium-99m, radiolabeling.

P-11 Seagrass Active Carbon / Pectin Composite (AC-P) Formation for Strontium Adsorption

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Radioactive material releases have a profound impact on both living beings and the environment, particularly affecting aquatic ecosystems. These releases can stem from various sources, including nuclear accidents, industrial discharge of radioactive waste, mishaps during transportation or disposal of such materials, explosions, and acts of nuclear sabotage. With the increase in nuclear energy production, the risk of contamination of water with radioactive waste is a problem that cannot be ignored. Therefore, the removal of strontium ions from aqueous solutions is of great importance. Strontium (Sr(II)) stands out as a prominent contaminant in radioactive wastewater, commonly originating from nuclear fuel, medical, and industrial radioactive waste sources. In the aftermath of nuclear incidents, there's an immediate risk of surface water contamination, which is particularly concerning as these waters are crucial for agriculture, industry, and drinking purposes. Removing Sr-90, a long-lasting radionuclide with a half-life of 28.1 years, from polluted aquatic ecosystems is especially critical due to its significant radiotoxicity and ability to spread. In this study, activated carbon was obtained by burning *Posidonia oceanica* and used for adsorption of strontium from aqueous solutions. *Posidonia oceanica*, commonly known as Neptune grass or Mediterranean tape weed, is a seagrass species that is endemic to the Mediterranean Sea. The composite material was prepared by combining activated carbon produced from *Posidonia oceanica* and pectin biopolymer by precipitation method. The morphological and structural properties of composite adsorbent (AC-P, activated carbon/ pectin) were determined using various characterization techniques BET, SEM and FTIR analysis methods. The adsorption capacity of the composite adsorbent for strontium ions was examined by changing parameters such as pH of solution, temperature, initial Sr concentration and contact time. Samples were analyzed by using ICP-OES instruments. The adsorption isotherms and thermodynamic studies were carried out. Experimental results of equilibrium adsorption were tested with Langmuir, Freundlich and Dubinin-Radushkevich isotherms. Thermodynamic parameters, Gibbs free energy change (ΔG), enthalpy change (ΔH) and entropy change (ΔS), were calculated.

Keywords: Adsorption, Strontium, Activated carbon, Seagrass, Pectin

P-12 Fly Ash-TiO₂ Composites for Adsorption of Sr²⁺ from Aqueous Solution

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In the present study, the composite adsorbents based on fly ash (FA) were synthesized and the effectiveness in the removal of strontium from liquid radioactive waste was investigated. 10 w% titanium-doped (FA-Ti) adsorbents were synthesized by hydrothermal treatment. NaOH solution used as activation agent, synthesis were carried out at 120 °C with stirring speed 500 rpm for 24 hours. Synthesized adsorbents were characterized by XRF, XRD, SEM-EDX, DTA/TGA and BET surface area analysis. The results show that the adsorbents are containing glassy phases and crystalline phases. The sorption behavior of adsorbents for Sr²⁺ ions were examined in dynamic conditions with column technique. The effects of pH, initial Sr²⁺ concentration, flow rate and bed height parameters were investigated via experimental design approach with central composite design (CCD). Surface contour plots were drawn by obtained results. The ANOVA (variance analysis) of the model at 95% confidence level was examined. The predicted and experimental values are well suited. The values of F, P>F, Lack of fit F, R², adjusted R² and predicted R² show that the obtained models for all adsorbents can be used to navigate the model spaces. The breakthrough curves were obtained with experiments which were carried out at optimum conditions for strontium adsorptions of adsorbents and breakthrough times and capacities, saturation times and capacities and column efficiencies were calculated. Column performances were modeled via Thomas, Yoon-Nelson and Bohart-Adams approaches. According to results, the sorption behavior of FA-Ti columns can be explained with Bohart-Adams model. The selectivities of adsorbents were determined in Sr²⁺, Ca²⁺ and Ba²⁺ multi-component system. The selectivity order of all adsorbents is as follows; Ba²⁺>Sr²⁺>Ca²⁺ which indicate that ion exchange is the dominant in sorption mechanisms.

Keywords: Fly ash, titanium, composites, hydrothermal synthesis, strontium, column adsorption, experimental design

P-13 Luminescence Properties of BaSO₄ Doped with Gd Synthesized by Solid State Reaction Method

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Studies of thermally stimulated luminescence of BaSO₄ doped with different concentrations of Gd have been carried out. Nano crystalline sample of BaSO₄:Gd was synthesized by solid state reaction method. The characterization and elemental analysis of BaSO₄:Gd phosphors were using by X-ray diffraction (XRD) and energy-dispersive X-ray spectroscopy (EDX). The particle size was identified with Single Electron Microscopy (SEM) analysis. Thermoluminescence kinetic analysis using Tm-Tstop, initial rise (IR), variable heating rate (VHR) and glow curve deconvolution (GCD) methods were performed on the glow curves of BaSO₄:Gd phosphor.

Keywords: luminescence, BaSO₄, solid state reaction

P-14 Natural Radioactivity of Soils in Aydın-Germencik Geothermal Region

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Natural radioactivity is a major concern for human health and the environment, so it is important to determine levels of radioactivity in many areas. Studies in the literature show that natural radioactivity in the soil is a major source of concern, especially in geothermal areas are dense. Geothermal activity is characterized by the discharge of subterranean sources of thermal water and gases to the surface, often causing the dispersion of radioactive gases and elements into the soil and water. Therefore, determining the levels of natural radioactivity in soils in geothermal regions is critical to protecting the health of people living in these areas and their agricultural products. This study aims to analyze the natural radioactivity of soils in the geothermal region of Aydın-Germencik district. In this context, surface soil samples were taken from Germencik. The samples were prepared for natural radioactivity measurements in a laboratory at Institute of Nuclear Sciences. The activity concentrations of ²²⁶Ra, ²³²Th and ⁴⁰K in soil samples have been measured by NaI (TI) gamma spectrometer system and analyzed. The results obtained will be compared with similar studies in the literature. The study is expected to make a significant contribution to the current literature on determining levels of natural radioactivity in soil in geothermal region. In particular, the determination of natural radioactivity levels in geothermal areas in the Germencik district is seen as a critical step in protecting the health of products grown in the region's agricultural areas and the environment.

Keywords: Natural radioactivity, soil, geothermal region, Aydın-Germencik

P-15 Radioiodination of AuFe Nanoparticle Conjugated Topoisomerase I Inhibitor Camptothecine and Evaluation of its Efficacy on Cancerous Cells

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Magnetic nanoparticles are used in a wide range of nanomedicine applications, from diagnostics and therapeutics to drug delivery, due to their size-dependent properties and the ability to manipulate their magnetic behaviour with external fields. Gold-coated iron oxide (Fe@Au) nanoparticles are versatile nanomaterials that combine the magnetic properties of iron oxide with the unique properties of gold. The iron oxide core retains its magnetic properties, making Fe@Au nanoparticles responsive to external magnetic fields. This property is useful in applications such as magnetic drug targeting. Topoisomerase I is involved in DNA replication and transcription by unwinding supercoiled DNA. Camptothecins disrupt the replication and transcription processes in rapidly dividing cancer cells, leading to cell death. In this paper, topoisomerase I inhibitor Camptothecin was loaded on Fe@Au which synthesized by microemulsion method. Characterization of Fe@Au was utilized by TEM and VSM techniques. Average particle size was determined as $5,25 \pm 0.92$ nm and magnetic saturation was observed on 5.3 emu/g. Iodination of Camptothecin and Camptothecin conjugated Fe@Au (Fe@Au-CMP) with ^{131}I were performed by the iodogen method. Therapeutic efficiency of Camptothecin and Fe@Au-CMP were investigated on MCF7 and HeLa cell lines. Camptothecin was reduced proliferation rate of HeLa cells relatively more than MCF7 cell line.

Keywords: Topoisomerase I, Camptothecin, AuFe nanoparticles, ^{131}I , magnetic drug targeting

P-16 (e ,3e) Reaction of Methane(CH₄) Final State Correlation and Molecular Orientation Effects

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Abstract We present the fivefold differential cross section (FDCS) for electron impact double ionization of the methane molecule, for the t₂z molecular orbital. We use a theoretical approach called FBA-CW based on the first Born approximation where the projectile is represented by a plane wave, while Coulomb wave functions are used to describe the ejected electrons, taking into account their interaction with the residual ion with the usual Gamow factor then with the Ward and Macek function as a correction version. Our interest is to verify the role of the molecular orientation in the space on the fivefold differential cross section of the (e,3e) reaction. The different mechanisms are recognized under special kinematical conditions

Keywords: differential cross section, double ionization, electron impact.

P-17 The Sorption Properties of Strontium on High Poros Polyhype/nanoclay Composite

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In this study; it is aimed to remove strontium from water contaminated with Sr by adsorption method. Sulfonated polyHIPE/nanoclay was used as adsorbent. The polyHIPEs have high porosity and permeability. The morphology and chemical characterization of the adsorbent was examined by FTIR, SEM-EDX. In SEM-EDX analysis, element S in adsorbent structure and Sr sorption has been detected after adsorption. The batch adsorption experiments were carried out with 0.05 g of adsorbent added in 25 ml of strontium solution. Stock solution of Sr was prepared by dissolving $\text{SrCl}_2 \cdot 6\text{H}_2\text{O}$ in distilled water. The Sr^{+2} capacity of sulf-poliHIPE/nanoclay was found as 183.75 mg/g after 24 h shaking with 5.71×10^{-3} M (pH=6.3) solution. The relative importance of test parameters like pH, concentration, and shaking time were studied. It has been observed that adsorption is effective between pH 4-6, but not effective between pH 6-8. The adsorption efficiency remained at the level of 90% at concentrations between 25-300 mg/L, while it was observed to decrease to 70% after 300 mg/L. Optimum conditions determined for adsorption at room temperature; is contact time: 120 min, pH: 8, Sr concentration: 400 ppm. The equilibrium sorption data were analyzed using Langmuir, Freundlich and DRK isotherms. It was concluded that the study was more suitable for the Langmuir model (R^2 0.9781). Langmuir isotherm constants were calculated as q_m (mg/g) 172.414 and KL (L/g) 0.181. The E value was found to be 11.4708 kJ/mol from the D-R isotherm. The adsorption process can be monolayer and ion exchange. For adsorption kinetics, it showed compliance with the Pseudo second-order adsorption model. The desorption study was carried out by using 0.1 M HNO_3 , 0.01 M HCl , 0.1 M HCl , 0.1 M EDTA, 1 M EDTA. Best was desorbed with EDTA solutions. The study will be useful in removing radioactive Sr from aqueous waste that may result from possible nuclear accidents or nuclear leaks.

Keywords: Adsorption, Experimental Design, PoliHIPE, Strontium

P-18 Investigation of Thorium(IV) Removal Utilizing Reduced Graphene Oxide - Zinc Oxide Nanofibers With Response Surface Methodology

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In this study, we focused on the preparation of reduced graphene oxide functionalized with zinc oxide (rGO-ZnO). The rGO-ZnO nanopowder material synthesized via the hydrothermal method was used to produce fiber materials through the electrospinning technique. Both composite adsorbents were analyzed using XRD, SEM, XPS and FT-IR methods. The rGO-ZnO fiber composite adsorbent was investigated for the removal of Th(IV) from aqueous solutions using the RSM method. The central composite design (CCD) was used to create the experimental design matrix, optimizing various experimental conditions such as pH, temperature, concentration, and adsorbent amount. Theoretical and experimental results were determined according to the model. Additionally, adsorption isotherms at equilibrium were examined and their thermodynamic parameters were calculated. To date, there have been no reports on the synthesis of composites consisting of reduced graphene oxide and zinc oxide through electrospinning for Th(IV) adsorption applications using RSM.

Keywords: Adsorption; reduced graphene oxide; response surface methodology; Thorium (IV); zinc oxide

P-19 Aspergillus Niger as a Biosorbent: pH Influence on Radiostrontium Removal Efficiency

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The adsorption of radioactive isotopes, such as Sr-85, from aqueous solutions is crucial due to their environmental and health impacts. This study evaluates *Aspergillus niger* biomass as a biosorbent for Sr-85, focusing on the influence of pH on the adsorption process. *Aspergillus niger*, a microscopic filamentous fungus (3264* mouldy twist from wheat flour, Praha, Czech Republic, 1999, A. Kubátová (AK 164/99); LYO), was selected as an adsorbent for its high surface area and functional groups. The fungus was cultivated, harvested, and pre-treated. Batch adsorption experiments were conducted across a pH range of 1 to 12, with a constant biosorbent dosage and standardized initial Sr-85 activities. Results showed a significant pH dependency on Sr-85 adsorption. In acidic conditions (pH 1-2), adsorption was low, with 5.5% at pH 1 and 12.5% at pH 2. The adsorption efficiency peaked at 68.2% at pH 4 and remained high at pH 5 (67.5%) and pH 6 (62.2%). Alkaline conditions significantly reduced adsorption efficiency, with 63% at pH 8, 35.1% at pH 9, and 17.86% at pH 12. The optimal adsorption at slightly acidic to neutral pH is attributed to the ionization state of functional groups on *Aspergillus niger*, enhancing Sr-85 binding. This study highlights the potential of *Aspergillus niger* as an effective biosorbent for Sr-85, especially under slightly acidic to neutral conditions. Future work will focus on further characterization of the biosorbent and optimizing other operational parameters to maximize adsorption efficiency, thereby aiding in effective environmental remediation strategies.

Keywords: Biosorption, *Aspergillus niger*, Strontium, Radionuclides

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P-20 Radiosensitization Potential of Betulinic Acid and Bismuth Nanoparticle Combination in Melanoma Cells

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Melanoma, caused by malignant conversion of melanocytes, is one of the most aggressive skin cancers. Treating melanoma skin cancer may be possible due to the implementation of emerging nanotechnologies that can enhance cancer cell uptake, minimize toxicity, increase circulatory tissue, radiosensitize cancer cell, etc. In this study, synthesis of mesoporous silica (MSN) was considered appropriate considering the advantages of controllable structure, large specific surface area, good biodegradability and easy surface modification. Betulinic acid (BA) is a triterpene with various biological properties (anticancer, antiviral, antibacterial, etc.) but its low solubility and low bioavailability have limited its applicability. It is planned to overcome these problems by conjugation of betulinic acid to silica. The aim of this study is to investigate the characterization of bismuth-loaded, betulinic acid conjugated silica nanoparticles for cancer radiotherapy. First, mesoporous silica was synthesized, surface modified with APTES and then loaded with bismuth. Subsequently, betulinic acid conjugation was performed. The synthesized nanoparticles were characterized by Dynamic Light Scattering (DLS), Scanning Electron Microscopy (SEM) and Fourier Transform Infrared Spectroscopy (FTIR) analysis. In the DLS analysis, the average size distribution of bismuth oxide nanoparticles was found to be 300 nm. In the co-synthesis of silica and bismuth oxide, the average size distribution increased as expected. There was no significant change in the PDI value. The sizes of silica nanoparticles were in the range of about 150–200 nm and their morphology was spherical in SEM imaging.

Keywords: Nanotechnology, Cancer, Radiotherapy, Betulinic Acid, Bismuth

P-21 Assessment of Indoor Radon Concentrations Using Solid-State Nuclear Track Detectors (Lr-115)

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Solid-state nuclear track detectors (SSNTDs) are very popular for the indoor measurements of Rn-222 and its daughters. These small and inexpensive detectors allow for the short-term measurements of alpha activity of indoor radon and also provide the possibility of the surveys simultaneously for many measurements. Radon, a radioactive gas derived from the decay of uranium in soil and building materials, significantly contributes to indoor radiation exposure and is a recognized cause of lung cancer. In this study, Kodak-Pathe' LR115 Type II detectors, which are alphasensitive, will be used for measuring the indoor concentrations of Rn-222 in the Ege University Institute of Nuclear Sciences during 1 month. Ongoing study measurements are carried out in laboratories, classrooms and offices on the basement, ground and first floors of the institute building. All dosimetric calculations will be performed based on the guidance of the UNSCEAR 2000 report.

Keywords: Indoor radon, solid-state nuclear track detectors, Annual effective dose

P-22 The Effect of Irradiation Methods on Soft-Error Generation in Carbon Ion Radiotherapy

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Carbon ion radiotherapy is an effective treatment for cancer. However, carbon ion beam generates secondary particles that can cause temporary malfunctions, called soft errors, in electronic devices. Soft errors in an implanted cardiac device can have fatal consequences for the patient. Our previous study suggested that secondary ions generated in the range shifters, such as protons, deuterons, and alpha-rays, contribute significantly, while that the multi-leaf-collimator (MLC) may shield them. Since the scanning method does not use the MLC, the aspects of soft-error generation would be different. In this study, we compared the fluxes of secondary particles and generation of soft errors with two types of irradiation methods: passive and scanning. Pencil-shaped carbon beams were irradiated to an acrylic phantom using a passive system (with the range shifter of 0 or 40 mm and the MLC: the aperture size was 5-15 cm square, at Gunma University) or a scanning system (without them, at Yamagata University). To measure soft errors, a field-programmable gate array (FPGA) was placed around the irradiation field at a distances of 7.5 and 12.5 cm. The numbers of secondary particles at the FPGAs were estimated using PHITS simulation, reproducing the experimental setups. With passive irradiation, the number of soft errors with and without the range shifter was compared. For 10 and 15 cm square apertures of the MLCs, the number of soft errors was significantly different at the distances of 7.5 and 10 cm. For the 5 cm square aperture, a significant difference was observed only at the distance of 7.5 cm. With and without range shifters, the number of soft errors decreases with distance in both systems, passive and scanning. In simulation calculations, scanning irradiation with range shifters generates more ions and fewer high-energy neutrons than passive irradiation. When range shifters are used, the MLC shields secondary particles generated from the range shifters. However, the MLC also generates secondary particles. This creates the differential aspects of soft error generation with different irradiation methods. As a future work, we will determine the soft error cross sections of the secondary ions.

Keywords: Carbon ion radiotherapy, Soft error, FPGA, Neutron, CIEDs, Secondary ions

P-23 Validation of Methods for Measuring the Number of Soft Errors in Particle Therapy

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The number of patients with cardiac implantable electronic devices (CIEDs), such as pacemakers and implantable defibrillators, is increasing, and these patients are increasingly requiring radiation therapy. Particle therapy (both proton and carbon) produces neutrons, which can cause memory inversions in electronic devices, known as soft errors. Soft errors in CIEDs can have fatal consequences. We have developed a system for measuring the number of soft errors and have demonstrated its usefulness for carbon ion beams. We believe that quantitative evaluation of the number of soft errors is necessary for proton beams, which are now widely used in Japan. Therefore, this study compared the number of soft errors in scanning irradiation for proton therapy and carbon ion therapy. This study was conducted using scanning irradiation systems for proton therapy at Shonan Kamakura General Hospital and carbon ion therapy at Gunma University Heavy Ion Medical Center. A PMMA phantom was set on the treatment couch, and eight FPGAs were placed in a square at a distance of 7.5 - 12.5 cm from the center of the irradiation field. The proton or carbon ion beams were irradiated for 10 minutes. The neutron distribution was calculated using Monte Carlo simulation, and the number of soft errors was estimated using the cross sections we evaluated. Carbon ion beams generated of 3 - 7 times more soft errors than proton beams. The number of soft errors decreased with increasing distance from the center for both beams. Compared to estimated values, for proton beams, the experimental values were 1.2 - 2 times larger. The same was true for carbon ion beams. The number of high-energy neutrons causing soft errors was about 4 - 6 times higher for carbon ion beams. Considering the simulation results for proton beams and comparing them with the results for carbon ion beams, we believe that our system is measuring correctly for proton beams as well. In this study, the simulations did not consider walls, ceilings, or detailed irradiation equipment in the treatment room. Therefore, we believe that the estimates may have been underestimated.

Keywords: particle therapy, soft error, CIEDs, Carbon Ion Radiotherapy, Proton therapy

P-24 Sorption Characteristics of ^{111}In -Labeled Hydroxyapatite Nanoparticles

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Indium is widely spread in nature generally in very low concentrations. Indium and its compounds are integral to various industrial uses due to their semiconductor or optoelectronic properties used in the production of liquid crystal displays, semiconductors, low-pressure sodium lamps. Moreover, indium compounds are utilized in medical and radiodiagnostic fields. The toxicity and body distribution of indium within the body depends on its chemical form, water solubility, dosage, and the method of exposure. In nanomedicine, inorganic nanoparticles, particularly calcium phosphates like hydroxyapatite, which interact with biological systems, have recently become attractive biomaterials as nanocarriers. Hydroxyapatite offers several advantages over other drug carriers, including favorable biodegradability, biocompatibility, and pH-dependent dissolution. Oxalic acid and carbonate ions proved most effective for desorption of ^{111}In , highlighting hydroxyapatite's potential as a sorbent for this radioisotope. This study aims to investigate the influence of various conditions, such as contact time, pH levels, and the presence of competing cations, on the sorption behavior of ^{111}In on synthetic hydroxyapatite. It also examines the sorption of ^{111}In on synthetic hydroxyapatite relative to its concentration in the aqueous phase and the effect of complexing organic ligands like citrate, acetate, and oxalate on this sorption. The data will be interpreted using sorption isotherms, specifically Langmuir, Freundlich, and Sips, to determine which model best corresponds with the experimental data. Desorption experiments of ^{111}In will be conducted in the presence of various cations and anions. This study evaluates hydroxyapatite in sorbing and desorbing ^{111}In under various conditions. High crystallinity hydroxyapatite showed rapid ^{111}In sorption within 3 minutes and stable pH levels. Sorption remained constant across wide pH range, fitting well to Langmuir and Freundlich isotherms, with capacities of 0.437 and 0.605 mmol.g⁻¹. Organic ligands maintained high sorption while competitive ions like Fe³⁺ and Al³⁺ reduced ^{111}In sorption efficiency significantly. Acknowledgements: Funded by the EU NextGenerationEU through the Recovery and Resilience Plan of the Slovak Republic as part of project no. 09I03-03-V05-00012. This research was also partially supported by the Slovak Research and Development Agency, project No. SK-SRB-23-0057, and by the Scientific Grant Agency of the Slovak Republic under the VEGA project No. 1/0356/23.

Keywords: hydroxyapatite; indium; nanoparticles; sorption

P-25 Environmental Impact and Risks Associated with Radioactive Contamination of Aquatic Ecosystems

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The presence of radioactive contamination in aquatic systems poses significant environmental and health risks. Among these contaminants, ^{137}Cs anthropogenic radionuclides, which is strongly adsorbed by most soil particles and ^{210}Pb ; naturally occur in soil as a part of the ^{238}U decay series. These radionuclides are particular concern to their radioactive properties and potential for bioaccumulation. Understanding their distribution in soil is crucial for assessing environmental and health risks. The aim of this study is to measure the concentration of these radionuclides in soil samples collected from different location a long Rhumel River, the most important river in northeast Algeria, flowing through the cities of Constantine and Mila. This river plays a vital role in water supply and irrigation in the area. The measurement were carried out using a coaxial hyper pure germanium (HPGe) detector which is used to measure low radioactivity. The results are compared with internationally approved values and the recommended safety limits.

Keywords: Soil samples, ^{210}Pb and ^{137}Cs radionuclides, HP(Ge) detector, Rhumel river.

P-26 Investigation of Monomers Ratios in a 2M Mixture by Positron Annihilation Spectroscopy

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Dimethacrylate samples suitable for photopolymerisation are usually used in mixtures with different ratios, however, in the case of the 2M sample, the ideal monomer ratio of 1:1 is reported in the literature. Dimethacrylate-based photopolymers are highly cross-linked polymer networks, indispensable in applications requiring rapid polymerization processes, such as light-curable materials for dental applications. Different ratios of the starting monomers 1,10 decanediol dimethacrylate (D3MA) and urethane dimethacrylate (UDMA) in a 2M mixture with the addition of a 0.1 mol% photoinitiator (TPO-L) was used in UV light photopolymerization. The lifetime of the ortho-positronium was monitored by positron annihilation lifetime spectroscopy (PALS) and then the free volume sizes were determined. Near-infrared spectroscopy (NIR) was used to follow the double bond transformation in the region typical of dimethacrylates. Bulk density was determined using bulk density based on Archimedes' law. Based on the free volume size, double bond conversion and density of the material, the most suitable ratio of monomers used in dentistry and other application was determined. Acknowledgement: The authors gratefully acknowledge the support of grants UK/3013/2024 and APVV 21-0335. Funded by the EU NextGenerationEU through the Recovery and Resilience Plan of the Slovak Republic under Project No. 09I03-03-V05-00012.

Keywords: dimethacrylate; PALS; NIR; ortho positronium; free volumes

P-27 Efficiency of Nanocrystalline Cellulose Reinforced Carboxymethyl Cellulose Nanocomposites Obtained from Textile Wastes in Neodmium Adsorption

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In this study, the efficiency of nanocrystalline cellulose (NCC) and carboxymethyl cellulose (CMC) nanocomposites reinforced with nanocrystalline cellulose (NCC) obtained from textile wastes on the adsorption of neodymium (Nd), a rare earth element and a member of the lanthanide group, was investigated. In the initial stage of the study, microcrystalline cellulose was obtained from cotton-based textile wastes by acid hydrolysis method. In the second stage, nanocrystalline cellulose was synthesized from microcrystalline cellulose using basic reaction. The physical properties of the produced MCC and NCC materials and CMC-NCC biopolymer were characterized by FT-IR, SEM and XRD analysis. Several parameters affecting the adsorption of neodymium from aqueous solutions using CMC biopolymers were investigated. These parameters include solution pH, initial element concentration, agitation time and temperature. Optimum conditions were determined and the amount of adsorbed elements, distribution coefficients and adsorption efficiencies were calculated and evaluated. The results obtained showed that neodymium was effectively adsorbed by CMC biopolymer. In the study, thermodynamic parameters related to the adsorption of neodymium on CMC biopolymer were also calculated. The adsorption process was found to be endothermic and spontaneous. It was also observed that the experimental data were consistent with Langmuir, Freundlich and Dubinin-Radushkevich isotherm models. Due to the porous hydrogel structure of CMC biopolymer and its various functional groups, the adsorption mechanism is complex and may be suitable for different isotherm models. In conclusion, the use of CMC-NCC biopolymer for the adsorption of neodymium ions from dilute aqueous solutions can be considered as an economical, effective and environmentally friendly option. This biopolymer can be preferred over other conventional separation and treatment methods in terms of its high capacity, simple process, economic advantages and environmental protection.

Keywords: Neodymium, rare earth elements, adsorption, nanocellulose, bionano composites

P-28 Synthesis of Cerium and Nitrogen Doped Hybrid Carbon Quantum Dots for Environmental Monitoring Applications

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In this study, cerium (Ce) and nitrogen (N) doped hybrid carbon quantum dots (CQDs) were synthesized using a one-step autoclave hydrothermal method with Agaricus Bisporus mushrooms as the carbon source. This method was chosen for its simplicity, efficiency, and ability to produce high-quality CQDs. Quantum dots are semiconductor nanocrystals known for their unique photoluminescence (PL) properties. These nanomaterials absorb light across a broad wavelength range and emit light with high quantum efficiency. The emission wavelength is tunable based on their size: smaller quantum dots emit at shorter wavelengths (blue), while larger ones emit at longer wavelengths (red). Additionally, quantum dots exhibit high photostability and a significant Stokes shift, making them valuable for various applications, including biomedical imaging, lighting, display technologies, and solar cells. The CQDs in the supernatant were characterized using various analytical techniques. PL spectroscopy assessed the optical properties, revealing strong fluorescence critical for environmental sensing applications. SEM examined morphology, size distribution, and surface characteristics of the CQDs after cold vacuum drying. XPS provided insights into chemical composition and surface element distribution, while FT-IR identified functional groups on the CQDs' surface. The study demonstrates that the developed CQDs are highly efficient adsorbents for toxic metal ions and rare earth elements, significantly enhancing environmental monitoring and pollution control strategies. The promising properties of the CQDs confirm their potential for broader applications in various environmental and biomedical fields.

Keywords: Adsorption, Neodymium, Cerium, CQDs, Green synthesis

P-29 Radioiodination of Saponin Derivative, C1, Isolated from Astragalus Sp.

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Natural products are complex chemical compounds that are secondary metabolites produced by plants and some primitive animal organisms. Most studies have been conducted on the biological activity of natural compounds, particularly their anticancer, immunostimulant, anti-inflammatory, antioxidant, neuroprotective, and hepatoprotective activities. The structures of the diverse group of glycosides known as saponins, which are widely found in plants, have prompted substantial attention due to their extraordinary biological activities including anticancer properties. Among the different kinds of saponins, cycloartane-type saponins have been considered as a potential source for developing new anticancer agents. In the present study, C1 (3,6-di-O- β -D-xylopyranosyl-3 β ,6 α ,16 β ,24(S),25- penta hydroxycycloartane) is isolated and radiolabeled with ¹³¹I radionuclide utilizing iodogen method. Biodistribution studies on healthy male and female rats were performed to evaluate the bioaffinity of the ¹³¹I labeled C1 (¹³¹I-C1) compound. Astragalus hareftae (NAB.) SIRJ. was collected from Van, Turkey. Ege University Herbarium identified the plant material. The plant material was extracted and C1 was isolated. Structural analysis of the isolated C1 has been verified using Nuclear Magnetic Resonance (NMR) (¹H-NMR and ¹³C-NMR) analysis. C1 has been radiolabeled in high yields with ¹³¹I (¹³¹I-C1), widely used for nuclear medicine diagnosis and treatment. Quality control studies of radioiodinated C1 have been determined using Thin Layer Radio-Chromatography (TLRC). Additionally, the structural analysis of ¹²⁷I-I3C has been verified using ¹H-NMR and ¹³C-NMR. In the experimental studies, it has been seen that C1 radiolabeled with ¹³¹I in high yields. The organs and tissues where radioiodinated C1 was distributed in normal healthy rats were determined at different time points (0.5, 1, 2, and 4 h). This study carried out, as a natural product extract for developing new agents for imaging and therapy is thought to contribute to the investigations done in this area.

Keywords: Saponin, Astragalus, Radioiodination, Biodistribution

P-30 In Vitro Efficacy of Pemetrexed-Conjugated GO/ZnO Nanoparticles Produced by Green Synthesis Method on Lung Cancer

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In this study, graphene oxide (GO) nanoparticles were synthesized from graphite under laboratory conditions using the Tour method (Marcano et al., 2010), chosen for its eco-friendly and cost-effective nature. The GO nanoparticles were modified with zinc oxide (ZnO) nanoparticles to increase the number of reactive oxygen groups on their surface and facilitate the binding of anticancer drugs. This modification aims to enhance the biological efficacy of the nanomaterials, particularly in developing more effective chemotherapy treatments. The synthesized nanoparticles were conjugated with pemetrexed, a commonly used chemotherapy drug in lung cancer treatment. The conjugate aims to improve drug delivery to target areas and increase penetration into cancer cells. The in vitro efficacy of this conjugate will be investigated to assess its potential as a new therapeutic approach in cancer treatment. FTIR spectral analysis confirmed the successful synthesis of GO/ZnO nanoparticles, showing the presence of both graphene oxide and zinc oxide components. The FTIR and XPS results further validated the successful conjugation of pemetrexed to the GO/ZnO structure, evidenced by specific shifts and the detection of nitrogen, which is present in pemetrexed. The cytotoxicity study on the A549 lung cancer cell line demonstrated that increasing the concentration of the GO-ZnO-pemetrexed complex reduced cell viability, supporting the potential of this nanocomposite to reduce the required dose of pemetrexed in lung cancer treatment.

Keywords: green synthesis, nanoparticle, cancer

P-31 Determination of Natural Radioactivity and Radiological Risk Distribution of Surface Soils in Aliğa District Industrial Zone and its Surroundings

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Considering that soil is a non-reproducible resource, the protection and sustainable use of soils has become mandatory in terms of food security. Especially in regions where industry is dense, it is very important to monitor pollution periodically in order to ensure sustainable management of existing soils. Pollutants causing soil pollution are grouped as organic (pesticides, hormones) and inorganic (heavy metals, etc.) compounds and radioactive wastes. The most important effect of soil pollution in terms of environmental health is that the pollutants in the soil pass into the plant body and pass into the human body as a result of the consumption of these plants either directly or as food by animals that feed on them. In Aliğa, which is a petrochemical facility and is considered as a dense industrial area, industrial activities in the region and accordingly the pollution caused by the metal industry increase rapidly. Based on this information, the natural radioactivity content of surface soil samples taken from the region was evaluated and the distribution of radiological risk was monitored. In this research, the sampling method that showed distribution on fan-like circular lines used to determine the spatial distribution of soil radioactivity. The soil samples got simultaneously throughout the year, taking into account the areas where industrialization is intense. The activity concentrations of ²²⁶Ra, ²³²Th and ⁴⁰K in surface samples have been measured by NaI (Tl) gamma spectrometer system at Institute of Nuclear Sciences. The radiological risk of natural radioactivity in soils calculated and a geostatistical study executed within the scope of GIS. The study is awaited to make a significant contribution to the current literature.

Keywords: Soil, natural radioactivity, radiological risk, industrial zone, Aliğa.

P-32 Adsorption of Lanthanum Ions Using Magnetic Nanoparticle/clay Mineral Composite: A Study on Kinetics, Isotherms and Box–Behnken Design

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The present study developed a magnetic nanoparticle/clay mineral composite for the adsorption of lanthanum ions (La^{3+}) in order to optimize several experimental variables, including pH, ion concentration, equilibration time and temperature. The aim of the study was to identify the most effective conditions for La^{3+} adsorption. The adsorption data were found to be well-fitted to the linear forms of the Langmuir isotherm model, indicating a maximum adsorption capacity (Q_m) of 109 mg La^{3+} /g. Moreover, the adsorption process was found to follow pseudo-second-order kinetics. To optimize the adsorption process and develop a representative model, the Box–Behnken response surface methodology (BB-RSM) was employed. The Box–Behnken response surface methodology (BB-RSM) was employed to identify the optimal conditions for the adsorption process, taking into account the interactive effects of multiple variables. The study showed that the optimal operating parameters for the removal of lanthanum ions using the magnetic nanoparticle/clay composite were an adsorbent dose of 0.014 g, La^{3+} and a pH of 5.8. The findings suggest that magnetic nanoparticle/clay composites may offer a cost-effective alternative to expensive nanomaterials for the removal of lanthanide ions from water.

Keywords: Clay, composite, adsorption, lanthanum

P-33 Efficient Removal of Lanthanum (La³⁺) From Aqueous Solutions Using Dried Brown Algae: Understanding Adsorption Mechanisms and Optimization

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Inorganic pollutants in waste-waters pose significant environmental and health concerns. Industrial activities often release hazardous substances such as radioactive materials, including Lanthanum (La³⁺), into water sources, requiring effective treatment methods. Current methods to address water pollution, such as electrochemical deposition and adsorption with activated carbon, are effective but costly. This study focuses on the use of adsorption as a cost-effective method for removing La³⁺ from aqueous solution using brown algae as a biomaterial. Factors such as contact time, pH, initial concentration, and temperature were investigated to understand their impact on the adsorption capacity. Isotherm models (Langmuir, Freundlich, Temkin) were employed to analyze the adsorption mechanisms. The Langmuir model was found to be the most suitable for describing La³⁺ adsorption using dried algae, with a maximum adsorption capacity of approximately 109 mg/g. Thermodynamic parameters were also examined to assess the feasibility of the adsorption process. Response Surface Methodology (RSM) based on Box-Behnken Design was used to identify the most significant factors and interactions. The pH of the solution and the interactions between adsorbent dose and pH were found to be the most significant terms affecting La³⁺ adsorption. The results demonstrated the effectiveness of using dried macroalgae for the removal of inorganic pollutants from aqueous solution

Keywords: Lanthanum, brown algae, adsorption, response surface methodology

P-34 The Spatial Distribution of Thorium(IV) Ion Concentration in the Shivnath River Basin in Chhattisgarh State

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This research revealed thorium(IV) ions in Chhattisgarh's Shivnath River basin. We analyzed the materials for thorium(IV) ions using DDBQ UV-Visible Spectrophotometry. WHO limits river and beach sand thorium (IV) ions to 6 and 10 ppm, respectively. The current study identified Shivnath River thorium(IV) ions at 0.1–0.95 ppm. India's beaches contain 41.3 ppm thorium(IV) ions. Ganga River thorium(IV) ions are 7.9–28.3 ppm. Researchers evaluated CF (1.77), PLI (1.01), geoaccumulation index ($I_{geo} = -1.536$), and enrichment factor (2.35). Evaluating thorium(IV) ion mitigation with ANOVA.

Keywords: Shivnath River, Contamination Factor, Pollution Load Index, Enrichment Factor, Geo-Accumulation Index.

P-35 An Investigation into the Spatial Distribution of Uranium in Durg and Rajnandgaon District of Chhattisgarh , Focusing on its Presence in Soil, Rocks, Water, Plants and its Constituents

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Uranium levels in rock, soil, fruit, and water have been assessed in the Durg and Rajnandgaon districts of Chhattisgarh. The data indicates the movement of uranium among several environmental components, namely air, soil, rock, and water.(durg, Soil-2.8-1.26, Rock-4.2-1.8, Water-7.2-2.4 Fruit-0.9-0.01& Rajnandgaon ,Soil-2.1-0.1,Rock-0.5-0.07,Water-2.1-0.05,Fruit-0.22-0.01).The validation of uranium distribution was confirmed by a satisfactory two-way Anova analysis.

Keywords: Uranium ion, Anova analysis, Durg and Rajnandgaon(Chhattisgarh), environmental components

P-36 Green Steps for Bio Decorated Material: AMBP (Aegle Marmelos Bark Powder) a Promising Scavenger Towards Radionuclide Adsorption

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The purpose of prescribing drinking water guideline values is to safeguard the population from unexpected adverse effects in the course of time. Excess concentrations of uranium in water may cause both radio and chemical toxicity, resulting in serious adverse health effects. Therefore, it is extremely important to develop effective techniques for extracting uranium from water. The current study based on the preparation of AMBP using a green approach. The AMBP was then thoroughly examined and systematically analyzed to determine the optimal adsorption parameters, which were found to be a pH of 5.0, an adsorbent dose of 0.1 g, and a period of 55 minutes. The AMBP material demonstrated potential as a sorbent due to its convenient availability and efficient adsorption properties. The AMBP biomass achieved the highest U(VI) adsorption capacity ($Q_{\max} = 58.14 \text{ mg.g}^{-1}$) when used in batch mode.

Keywords: Adsorption, Uranyl ion, AMBP (Aegle marmelos bark powder) , Desorption

P-37 The Use of ^7Be , ^{137}Cs and ^{210}Pb in the Evaluation of the Contemporary and Medium-Term Sediment Deposition on the Meric River Floodplains

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As known, flood plains have increasing importance and give crucial outcomes for natural sciences. The most important issues are floods related to the water management in Trans boundary “Meric and Arda, Tunca Rivers” that Turkey is downstream country. Hence, there is a need for a detailed study about the determination of the sediment deposition on the Meriç River Floodplains by means of ^{137}Cs . In this study, 33 river bank sediments were collected at approximately 2 km intervals along the Tunca, Meriç and Arda Rivers. In addition, 26 surface sediments were taken from the Meriç flood plains. Furthermore, the region where the flood last receded was selected as the second study area and then 65 bulk samples were taken. For the Sediment deposition on the Meric River Flood plains, 8 cores were taken from the flood plains and four reference core from undisturbed sites as well. Sediment cores were taken with a corer of 6.7 cm in diameter and 1.0 m in length and the mouth of each core was tightly tied and kept in an upright position. The cores were sliced at 1-cm intervals for further analyses. Sediment subsamples were dried at 40-60 °C to constant weight, and water content was determined. The dried samples were powdered in a ball-mill for geochemical and radionuclide analysis. The quantitative determination of the ^7Be , ^{210}Pb and ^{137}Cs was carried out by HPGe gamma spectrometry. All physical parameters were also clarified for the sedimentation mechanism. In order to investigate the storage and remobilization of recently eroded sediment, bulk samples of river water (100-150 litres) were collected from the monitoring stations at Kirishane in Edirne. The results from this study carried out in the Meriç flood area are as follows; (i) ^{137}Cs and ^7Be inventory was obtained in Meriç Flood plains and distribution maps were created, (ii) heavy metal distributions of the food plains were also mapped, (iii) sediment quality parameters were obtained, and (iv) the ^{137}Cs technique was successfully applied to the flood plains and it was observed that the sedimentation rate in the Meriç flood plains varied between 0,589 - 0,994 $\text{gcm}^{-2}\text{y}^{-1}$. Acknowledgements: This study is financially supported by The Scientific Technological Research Council of Turkey (TUBITAK, Contract No: 117Y093).

Keywords: Meric River, floodplains, sedimentation rate, sediment deposition Be-7, Cs-137 and Pb-210 chronologies of atmospheric radionuclides

P-38 Sedimentation Rate of the Meriç Floodplains By ^{137}Cs Technique

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River floodplains have been recognized as significant sinks for storing suspended sediment and associated contaminants mobilized from the upstream catchment. Nevertheless, information on contemporary rates of overbank sedimentation is compelling to obtain using conventional methods. Measurements of the ^{137}Cs content of floodplain sediments provide an alternating approach to obtaining estimates of medium-term rates (ca. 40 -60 years) of overbank sediment deposition. The main problem is the floods related to the water management of the Transboundary Rivers "Meriç, Tunc and Arda", of which Turkey is a downstream country. The most important process associated with growing and increasing flood extent is the deposition of sediment in the river and the surrounding. Hence, this study deals with the determination of sediment deposition on the Meriç River Floodplains by means of ^{137}Cs dating technique. The average sedimentation rates calculated based on the observed data are in the range of $2,72 \text{ kgm}^{-2}\text{y}^{-1}$, while the maximum value reaches $7\text{-}8 \text{ kgm}^{-2}\text{y}^{-1}$.

Keywords: Meric River, Floodplains, sedimentation rates, sediment deposition, ^{137}Cs , chronology

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