



IWA-PPFW 2017

2nd IWA Regional Symposium on Water, Wastewater and Environment

The **P**ast, **P**resent and **F**uture of the World's **W**ater Resources

IWA
the international
water association

22-24 March 2017
Cesme-Izmir-TURKEY



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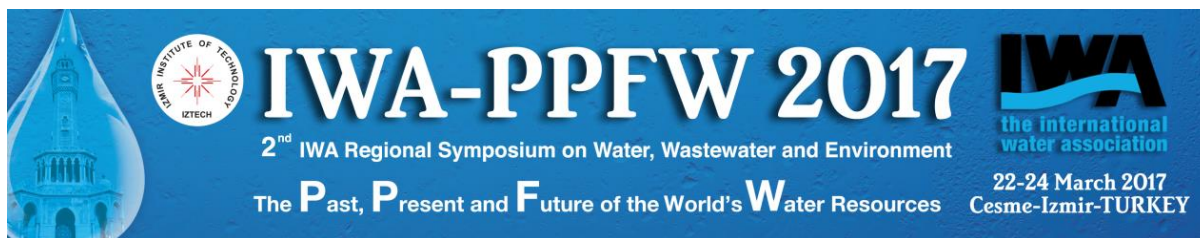
ABSTRACT BOOK

EDITORS

Alper BABA

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PREFACE

The 2nd Regional IWA Symposium on water, wastewater and environment is hosted by the Izmir Institute of Technology in Çesme-Izmir, Turkey between the dates of March 22 and 24, 2017. Following the previous IWA conferences, the theme of this conference was 'The past, present and future of the world's water resources' which established the trend of thinking of the participants and determined the composition of the papers those were presented. Inspired by the IWA's vision that is 'A world in which water is wisely managed to satisfy the needs of human activities and ecosystems in an equitable and sustainable way' the community of professionals concerned with water, presented their experiences for sustainable urban and basin-related water solutions.

The purpose of the symposium was to highlight water as a source of life and to stress the need for water cooperation between all actors in society to protect its value and exchange ideas between academia and industry on various forms of water cooperation that are fundamental to water use and water management. Also to identify good practices for water cooperation and demonstrate its merits for poverty eradication, economic development, environmental sustainability and peace.

The conference technical programme was organized in the following general areas: Water Treatment; Ancient Water Systems; Water Resources; Hydrology and Hydrogeology; Modeling and Simulation; Water Quality; Waste Management; Ecotoxicology and Health Risks and Water Reuse. We hope that the contents of the related papers will be beneficial source of information on water, wastewater and environment related engineering applications.

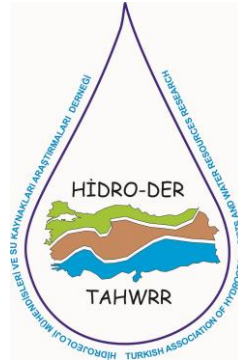
211 abstracts were presented in 30 sessions during the three days of the conference. We wish to acknowledge and express our sincere gratitude to the Organizing Committee for their valuable efforts and to the Scientific Committee for their precious time spent in reviewing of the submitted papers.

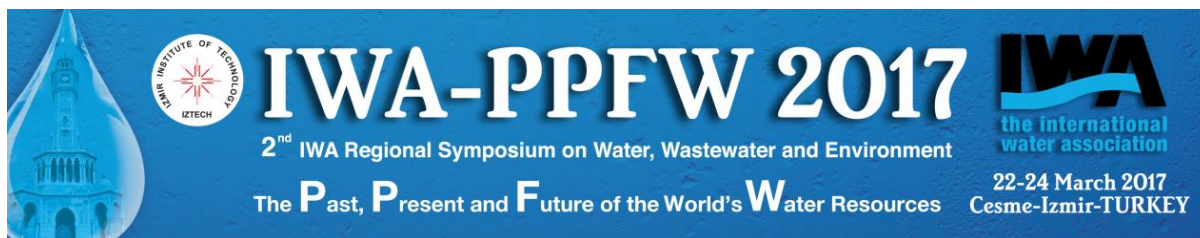
On behalf of the Organizing Committee

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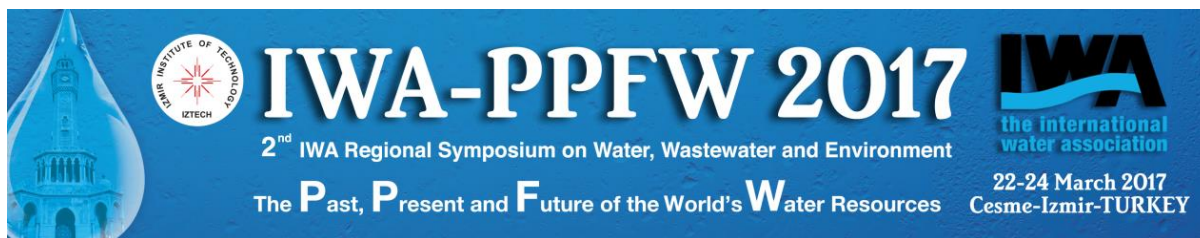




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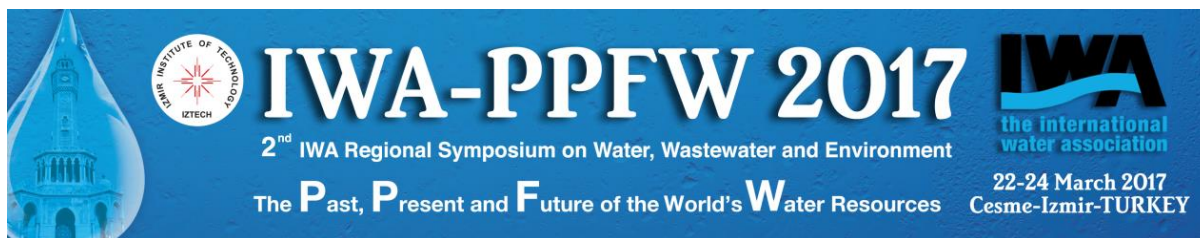
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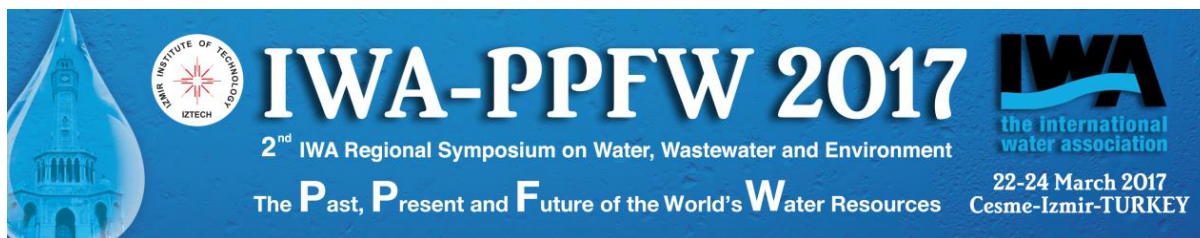


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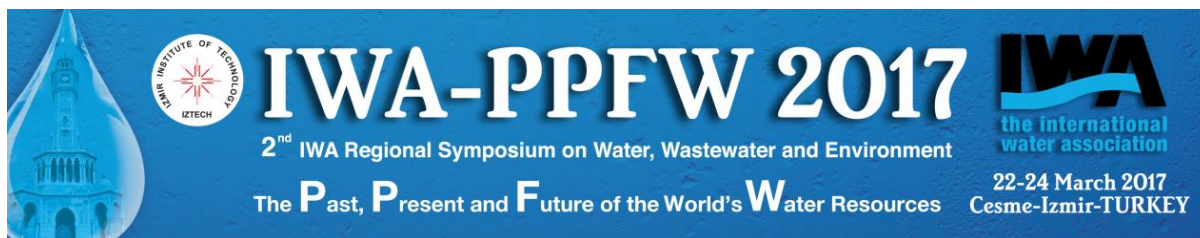
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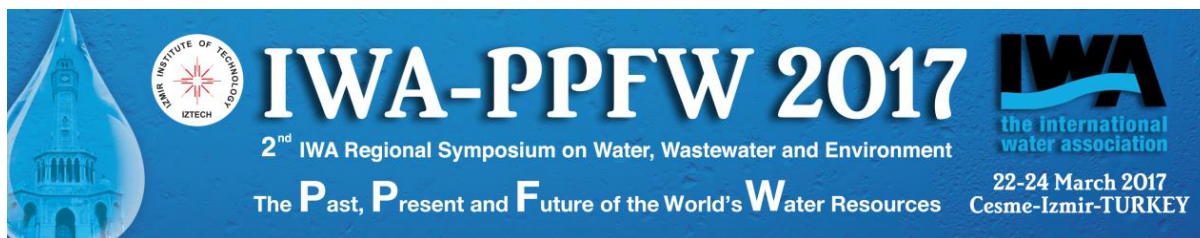
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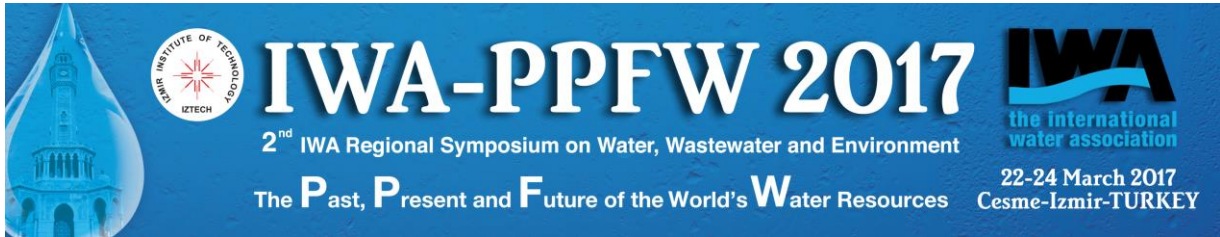
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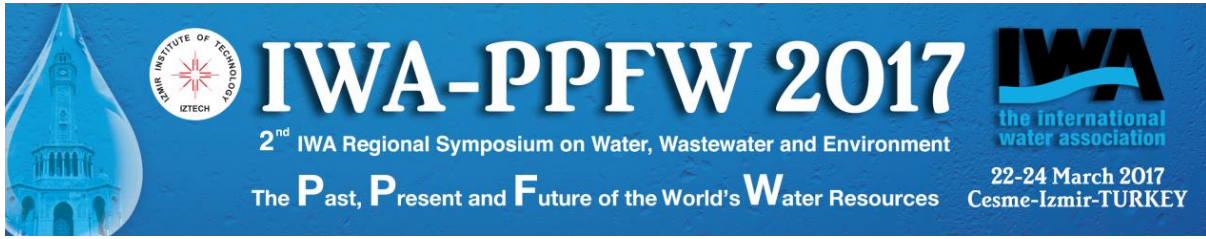
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THEME A – WATER SOURCES

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WATER RESOURCES MANAGEMENT FOR WATER SECURITY IN THE FUTURE

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Abstract: Water is an essential natural resource for all life on earth. Co-existence and integrity of nature and humans requires sufficient water of high quality. Socio-cultural and economic development is directly dependent on water and water-dependent ecosystems. Existence or scarcity of water has been the key factor that has determined the rise and fall of civilizations. The 21st century, an era of rapid changes, will most likely experience severe problems in supplying sufficient water of good quality where it is needed due to increase and mobility of the population as well as the natural and human-caused alteration of the hydrological cycle in addition to climate change. Hence, water resources management with an aim to attain water security in the future is an emerging issue at present. Achieving water security requires maintaining acceptable levels of risks for water shortage and excess, inadequate water quality and failure of the resilience of freshwater systems. Thus, a risk-based approach to water resources management is required to reduce or avoid water risks. The components of this approach as well as coherence of policies on agriculture, trade, energy, and climate change with water management policies will be addressed herein to achieve water security in the future.

Keywords: water resources, management, water security, risk

HISTORICAL WATER WORKS IN TURKEY

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Abstract: A very large number of ancient hydraulic works exist in Turkey; several ancient water works are still in operation after several centuries or even several millennia. These make Turkey one of the foremost open-air museums of the world in this respect. These works include a variety of hydraulic structures such as dams, water collection chambers, pipes; rock-cut and masonry canals; tunnels, inverted siphons; aqueduct bridges, watercourse covering structures.

They date back to the IInd Millenium BC, the Hittite period in Central Anatolia; to the first half of the Ist Millenium BC, the Urartu period in Eastern Anatolia; to the second half of the Ist Millenium BC and the Ist Millenium AD, the Hellenistic, Roman and Byzantine periods in Western and Southern Anatolia; to 11th to 14th centuries, the Seldjoukide period in Central and Eastern Anatolia; to 14th to early 20th centuries, the Ottoman period in Turkey.

Keywords: water works, historical water, Anatolia, Turkey

METAL TRANSPORT IN A RIVER TRIBUTARIES WHICH IS IMPORTANT DRINKING WATER SOURCE

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Abstract: Metals are considered both toxic and trace, necessity compounds for the healthy life and water. Drinking water quality is very essential for the human life. Transport of the metal in the river system has critical importance for the water supply issues. Metals are transported in the river systems via sediment mainly because of erosion, deposition, adsorption of the other components. Melen River tributaries were selected and investigated to reveal the transports and effects to Main River as seasonal. The river system is located in northeast Turkey. The watershed which covers the river tributaries has agricultural, industrial and urban areas. Each season surface sediment samples were taken along with surface water. Twenty-one different metals were analyzed by ICP according to standard of the ISO 11885. Results showed that each tributary has their own character and different effects to Main River. Besides seasonal effects were detected different too.

Keywords: Drinking water, metals, Melen River, toxic elements

EVALUATION OF WATER USE ALTERNATIVES IN NORTHERN CYPRUS

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Abstract: The scientific studies indicate that global warming will effect Mediterranean area more than many other regions. Cyprus is among the countries that will be affected seriously. Due to the Mediterranean climate, in Cyprus, the amount of rainfall decreases while evaporation rate increases causing water scarcity problems.

This study evaluated water usage alternatives for different purposes, considering the quality, economy, quantity, self-sufficiency and long-term solutions. For drinking; tap water was the cheapest option, however due inability to meet the standards for drinking water quality, it is not an option leaving reverse osmosis the cheapest option followed by tanker water service to houses and bottled water being the most expensive option to acquire drinking water in NC. The comparison of the costs of drinking water options in NC has been determined. In NC, the business of drinking bottled water is a backbone of both small local and corporate businesses since it is almost the only option for obtaining drinking water, thus can lead to environmental hazards such as; aesthetic pollution due to some people throwing bottles to environment. Efforts have been made to combat water scarcity problems in NC including; transportation of water from Turkey has been one of the alternatives. The recent and unique one is transmitting freshwater through pipelines under the sea, supplying 75 million m³ of freshwater per year to NC.

It will be very beneficial If NC focuses on investing in long term solutions like; wastewater treatment plants for both acquiring water for irrigation purposes and solving sewage issues. Presently the usage of wastewater is not effectively done in NC, seawater desalination with the use of solar energy which is abundant on the island to get drinking water would be obtained at a lower price than using bottled water which poses potential harm to human health and the environment.

According to the results of this study, it was found that the most popular alternative for obtaining drinking water in NC is bottled water.

Keywords: Northern Cyprus, water scarcity, alternatives, drinking water, irrigational water, aquifers, climate changes.

INVESTIGATION OF GROUNDWATER RECHARGES MECHANISM IN ALASEHIR PLAIN: FROM PHYSICAL CHARACTERIZATION TO MODELING

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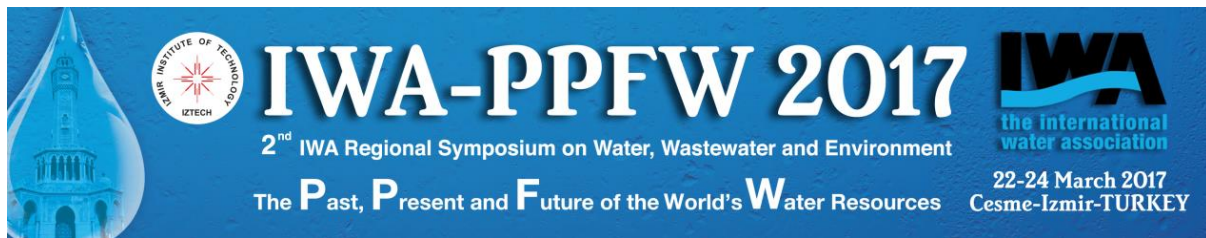
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Abstract: Characteristics of aquifer that allows the flow of groundwater, recharge and discharge mechanism effect the available groundwater potential. In order to determine the available potential of groundwater, the budget components are the most important parameters. In general, different analogical methods are applied in different countries, instead of using measurable data. Determination of the groundwater recharge is the most difficult parameter to be measured among the hydrological budget parameters. In general, the analogical methods are insufficient to determine the groundwater recharge rate. Precipitation, evaporation-transportation and runoff can be measured from the surface meteorological station. However, estimation of groundwater recharge cannot be measured directly. At the moment of climate change, visualization of the spatial distribution of the groundwater recharge estimation and mapping are needed. Therefore, improvements of easy groundwater recharge techniques are very important tools for groundwater basins to develop the water management planning.

A multi-disciplined research project has been conducted in Alasehir Basin which is the main part of Gediz River Basin. The main objectives of this project is not only to characterize the aquifers but also to determine the groundwater recharge components in Alasehir Basin. This project contains several groundwater recharge methods including soil moisture, water table fluctuation, environmental isotopic, chemical techniques, and surface runoff modeling. In this project, firstly, 3 meteorological stations were constructed at various locations to determine all water budget parameters within the Alasehir Basin. A comprehensive hydrogeological study has been conducted for identifying the elevations and aquifer materials. About a 1500 m long borehole was drilled and core samples were taken from the boreholes to characterize the aquifer parameters such as porosity, hydraulic conductivity and soil classification. During the borehole operation, hydraulic conductivity tests were applied to determine the hydraulic conductivity of the aquifer. After the core drilling, these boreholes were transformed to monitoring wells. About 20 groundwater level data logger were installed in these monitoring wells. Later, groundwater samples will be taken from the monitoring wells and they will be analyzed for numerous chemical and isotopes analysis to determine the groundwater recharge rate. In addition, about a 1000 m long of pumping test wells were drilled to different levels at



10 different locations. Pumping wells will be used to determine the specific yield and other hydraulic parameters that are necessary to determine the groundwater recharge by using the water table fluctuation method. In addition, 5 soil moisture systems were installed at different depth (5 m, 10 m and 15 m) to monitor moisture content changes in the unsaturated zone. Hence, real soil water content changes will be obtained and evaluated by other methods. The surface runoff modeling will be used to determine the spatial distribution of the groundwater recharge and visualization using a Geographical Information System (GIS) technique. In the final phase of the project, the most practical and economical groundwater recharge methods will be evaluated based on the results of the previous methods.

Keywords: Aquifer characterization, recharge methods, modeling, Alasehir, Turkey

Acknowledgments: This study was funded by the Scientific and Technological Research Council of Turkey (TUBITAK), project no. 115Y065.

SURFACE WATER QUALITY CLASSIFICATION OF BÜYÜK MENDERES RIVER

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Abstract: The quality of natural waters can be seriously affected by industrial discharges, agricultural activities, water withdrawal, drought and floods. Büyük Menderes River in Turkey is subjected to these factors. It is required to evaluate its water quality for sustainable surface water management in Turkey. Therefore, the study was conducted in Büyük Menderes River to determine its water quality classes according to Republic of Turkey Ministry of Forestry and Water Affairs' Regulation for Management of Surface Water. Seasonal samples were collected from 48 surveillance monitoring stations including coastal and transitional waters. The parameters monitored stated in the regulation were physical ones as temperature, pH, conductivity, colour, oxygen conditions as dissolved oxygen, oxygen saturation, COD and BOD, nutrient parameters like nitrogen and phosphorus, and the other parameters as total suspended solids and turbidity. Seasonal variations in water quality of each station were evaluated and then annual averages of the monitored physico-chemical pollution parameters were used to determine the water quality class of stations and whole river basin. The lowest quality physico-chemical parameter was considered in determining water quality class of water body. The results indicated that water quality of Büyük Menderes River based on the monitored stations varies between class II and class IV.

Keywords: Surface water, water quality, management, Büyük Menderes,

ANALYSIS AND COMPARISON OF SPATIAL RAINFALL DISTRIBUTION APPLYING NON-GEOSTATISTICAL/ DETERMINISTIC INTERPOLATION METHODS: THE CASE OF PORSUK RIVER BASIN, TURKEY

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Abstract: Displaying remarkable changes across time and space, precipitation is one of the most significant climatic factors for environmental applications. Accurate precipitation data are of great importance for estimation of surface water, ground water, forecast of events such as floods, draughts and other hydrological studies. Interpolation methods are usually applied to afford spatially distributed precipitation data. However, due to the sparsity of rain gauges, different spatial interpolation methods may result in deviations from the real spatial distribution of precipitation. In this study, three different interpolation methods of Non-Geostatistical model were investigated with regard to their suitability to produce a spatial precipitation distribution in Porsuk Basin, located in northwest of Central Anatolia, Turkey. The objective is to compare the estimated precipitation with the real gauged data to obtain an optimal value with the least margin error. Data from 15 rain gauges for the period 1927-2015 were spatially interpolated using Thiessen Polygons (TP), Spline (SP) and Inverse Distance Weighting (IDW) methods. Reliability of the results were compared using the Mean Absolute Error (MAE), Mean Square Error (MSE), Root Mean Square Error (RMSE) and Correlation Coefficient (R^2). IDW provided the highest performance result in comparison with the other two methods, generating MAE, MSE, RMSE and R^2 values of 33.359, 1710.385, 41.357 and 0.7118 respectively. This is followed by Spline generating MAE, MSE, RMSE and R^2 values of 34.277, 2377.730, 48.762, 0.6719 and TP method generating MAE, MSE, RMSE and R^2 values of 41.904, 2401.463, 49.005 and 0.5283 respectively. The results show that IDW is the best choice in comparison with SP and TP methods.

Keywords: Interpolation, Inverse Distance Weighting (IDW), Non-Geostatistical, Porsuk River Basin, Spline (SP), Thiessen Polygons (TP).

AN INVESTIGATION AND COMPARISON OF HYDROELECTRIC ENERGY POTENTIAL: A STUDY OF PORSUK RIVER BASIN, TURKEY

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Abstract: Over the last decades, popularity of renewable energy has risen rapidly, and hydropower has consistently been the most familiar type of renewable energy in the world, based on being inherent technical, clean, economical and compatible with the environmental. In addition, electricity demand is increasing swiftly around the world in recent years, especially in the developing countries like Turkey. Hydropower is the most important renewable energy source in Turkey. Geographic region of Turkey is holding a major utility for extensive usage of hydropower energy sources. Turkey has many streams applicable for energy generation, most of which are still unexploited. This study was carried out with the aim to analyse and compare the hydroelectric energy potential of two dams, (1) Porsuk dam, constructed for the purposes of flood control, supplying domestic, industrial and irrigation water, and (2) a new dam, planned for hydroelectric energy generation purpose in Porsuk basin, Turkey. Simulation Analysis for Hydropower Projects (SIMAHPP-4) professional software was used for determination and comparison of hydroelectric energy potential on both dams. Hydroelectric energy potential was computed from the average monthly discharges flowing over axis of the dams. Average monthly flow rate over Porsuk dam was provided from General Directorate of State Hydraulic Works. Drainage-area ratio method was applied to calculate monthly flow data on the axis of the planned dam. The power plant considered for Porsuk dam was designed with an annual energy production capacity of 25.89 GWh, an installed power production of 4.93 MW, and a design flow of 10.10 m³/s. Following that, the power plant considered for the planned dam (non-existent or imaginary) has been designed with an annual energy production capacity of 18.98 GWh, an installed power production of 5.42 MW, and a design flow of 18.41 m³/s, respectively. As a conclusion, since these water structures are overcosting and have to be serviceable for a long period of time, it could be advantageous to investigate applying several computational methods.

Keywords: Dam, Hydroelectric Energy Potential, Porsuk River Basin, Renewable Energy, Simahpp

DETERMINING LINEAR AND AREAL MORPHOLOGICAL CHARACTERISTICS OF MELEN WATERSHED IN TURKEY

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Abstract: Determining physical parameters of a watershed is essential to understand its structure, to assess the hydrological processes and to well-define the negative pressures on it. Linear and areal morphological parameters enable scientists to acquire quantitative data, and thus fundamental information that is required in planning and management of the watersheds at the basin scale can be obtained. In this study, Melen Watershed located at the Western Black Sea Region of Turkey is the first practice of interbasin water transfer in the country. The water is transferred to one of the most crowded megacities of the world, Istanbul. Therefore, inventing data on the morphological characteristics of the basin utilizing the modern technological tools of Remote Sensing (RS), Geographical Information Systems (GIS), and modelling via Soil and Water Assessment Tool–SWAT model is conducted in the study. Outcomes of this study aim to provide valuable and up-dated physical and spatial information on the basin that can be used in further complex hydrological analysis and as input data in watershed modelling practices.

Keywords: GIS, Melen, remote sensing, watershed

ADOPTING A STRATEGIC FRAMEWORK FOR TRANSBOUNDARY WATER RESOURCES MANAGEMENT IN AFGHANISTAN

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Abstract: This article first reviews the water resources potential and Transboundary Rivers of Afghanistan with current endeavors that have been taken for transboundary water resources management. The reasons why Afghanistan is in need of controlling its transboundary waters and resolving current disputes with the neighboring countries over transboundary waters are stated and some examples of successful international water treaties are presented, as well those might be considered as references by Afghanistan. Then, concerns about the global warming resulting in rapid snowmelts that makes 80% of the country's precipitation and the consequent possible flooding that may result not only in some disasters and deterioration of the ecosystem, but also a serious scarcity of water resources in such a landlocked country are discussed. Moreover, challenges and concerns in terms of hydro-hegemony for such a late developing upstream country that is suffering decades of war are also stated in this paper. Finally, an initial strategy framework is proposed that how Afghanistan in current situation can survive from conflicts with its neighbors related to transboundary waters. Also, how the country may continue its hydraulic mission without any concerns and disruptions, which are significant challenges for the time being.

Keywords: Afghanistan, Amu Darya, climate change, international water treaties, transboundary waters, water treaties negotiations strategy

WATER MANAGEMENT IN THE HAMAMS OF ANCIENT CORINTH (PELOPONNESE) DURING THE OTTOMAN PERIOD

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Abstract: The Ottoman Turkish tribe started conquering the Balkan peninsula around the last decades of the 14th c. Especially Peloponnese was occupied by the Ottomans twice: originally in mid-15th c., till the second half of 17th c. and from ca. 1715 till the Hellenic Revolution War. During these times, many building types were constructed as they were responding to the public needs of the Ottoman society (social and commercial ones), presenting a multicultural architectural character. Religious buildings, such as mosques (cami), mescit, tekke, türbe, imaret, medrese, and secular buildings, i.e. public and ii. domestic ones, (of commercial use, such as bedestens and social use, i.e. hamams, fountains, markets, caravanserais, libraries, etc. and saraies etc.). As Islam prescribes ablution before prayer and the overall importance of water, there was a wide demand for the construction of fountains, public baths and water supply facilities, which definitely were rare before the Ottoman occupation. The existing Ottoman monuments that have survived in the geographical region of Corinthia are found mostly in the major administrative centre of Ancient Corinth (Gördüs) and at the hill of Acrocorinth, while others are found scattered in smaller settlements of the area (i.e. Vasiliko)

Keywords: Water management, Ottoman Corinth, hamams, fountains

IMPLEMENTATION OF EUROPEAN UNION WATER FRAMEWORK DIRECTIVE IN TURKEY - MANAGEMENT OF DANGEROUS SUBSTANCES

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Abstract: In industrial countries, the last two centuries can be characterized by the introduction of increasing amounts of chemicals into the environment. However, an integrated information system regarding their toxicity and negative impacts on the environment has not yet been implemented properly. Therefore, the challenge of understanding and managing water quality problems is growing. Within the European Union harmonization process, there are some liabilities introduced to Turkey in the field of environment. Implementation of the European Union Water Framework Directive is one of them. The Directive aims to achieve good water quality status of both surface water and groundwater and specifies the necessary measures that should be taken for protection of aquatic ecosystems. With the objective of adaptation of the WFD, many projects have been conducted in Turkey to meet the requirements. As a result of these projects, national specific pollutants, water types, water bodies and surface water monitoring network for previously designated river basin districts were identified. In addition, Environmental Quality Standards based discharge limits for priority substances and specific pollutants discharged from point and diffuse pollution sources are trying to be established.

Keywords: water management, water quality, water framework

TECHNOLOGY OF SORPTION EXTRACTION OF IONS OF COPPER (II) AND ZINC FROM INDUSTRIAL WASTE WATERS

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Abstract: Using mathematical model the values of adsorption parameters calculated on laboratorial and industrial level were given. Samples of Na-form of bentonite were obtained. Na-form of nano-bentonite shows very high results in regard to adsorption. Kinetic laws of the process were studied. The values of entropy and enthalpy of adsorption of zinc ions, as well as equilibrium coefficients depending on temperature were calculated. Negative values of Gibbs-free energy ΔG^0 show that on bentonite sample the process of thermodynamic adsorption is possible. As well high values of ΔG^0 with increase in temperature shows that at high temperatures adsorption is possible.

Keywords: sorption, nano-bentonite, ion active stuffs, kinetics, entropy, enthalpy, free energy, zinc ions

TRANSFORMING WATER TENSOR

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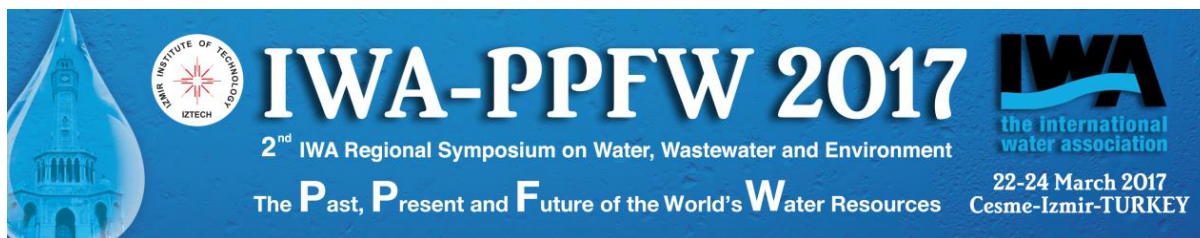
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Abstract: Water resources engineers consider water that nature supplies as a tensor which can be expressed as $W = 0$ (Place, Time, Quantity, Quality). This form is usually very different from what we need which can be expressed as $W^* = 0$ (Place*, Time*, Quantity*, Quality*) as an example most of fresh water is supplied by nature in ice form at poles where we need at our taps. So Place in this tensor must be transformed to Place*. Similarly most of the water in this geography is available at winter or at spring where we need it mostly at hot summer months. So Time nature supplies water must be transformed to Time*.

Similar reasoning's can be made for Quantity and Quality aspects of water tensor. Transforming tensor W to tensor W^* is defined as water resources engineering where transforming devices are called hydraulic structures.

In this study how these transformations for main six groups of water usage can be achieved is presented by real life examples.

Keywords: Water tensor, water quality, water quantity



ID_2986

THE OTTOMAN AQUEDUCT SYSTEM OF KOS, GREECE

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Abstract: At the southern hilly rural area of the town of Kos, at the northern area of the homonymous island, there was an ancient water supply network relied on the springs of Vourina (Burinna), or Vorina. The surviving structure of the spring presents Hellenistic characteristics but should be originally earlier. Fragmental parts of a Roman period aqueduct are still found in the western part of the Odeon. Most of the existing evidences lead to the fact that the structure of that period was not in use after the late antiquity or early Byzantine period. The surviving parts of the Ottoman aqueduct system belong to the long main branch of the system. That branch was 4.5 km long, originating from Vourina spring, supplying the town. Another short aqueduct, 1.5 km, is recorded in late 19th century map, supplying the village of Platani, conveying water from nearby springs. The only remains related to that structure should be considered the fountain across the main mosque of the village. Similarly the main arched aqueduct was supplying the fountains in the town either corresponding to mosques or not. The sound quality of the structure permitted its operation till the early period of the Italian occupation.

Keywords: Aqueduct system, Ottoman aqueduct system, Kos

ID_2979

OCCURRENCE OF PLESIOMONAS SHIGELLOIDES FROM WATER ENVIRONMENTS IN DUZCE/TURKEY

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Abstract: Fresh water samples analyzed in Duzce/Turkey showed the presence of *Plesiomonas shigelloides*. Sixteen strains were isolated from polluted and non-polluted water environments. In addition, the antibiotic susceptibility tests were evaluated against the isolates. While all the isolates were susceptible to the Amikacin, Cefotaxime, Gentamicin and Tetracycline, these were resistant to Ampicillin.

Keywords: *Plesiomonas shigelloides*, water environments, Düzce, Turkey.

ID_2881

EVALUATING IMPACTS OF URBANIZATION ON RECHARGE OF GROUNDWATER RESOURCES: CASE STUDY: BORNOVA PLAIN (IZMIR/TURKEY)

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Abstract: Increasing the World's population and industrialization in parallel with urbanization has created serious problems on water resources. Over the next forty years it is expected to add 2,5 million people on world population. To fulfill the needs of increasing population, the water demand will increase but the increasing of demand towards water is more rapid than increasing of population. Urbanization is a global phenomenon that is quickly altering the physical structure of any region. Bornova plain is located in water basin of İzmir where it is the most important settlement of the Aegean Region from the ancient ages to the current era. In this study, impacts of urbanization and population growth on groundwater resources were analyzed using GIS in Bornova Plain, where it is one of the most important groundwater aquifers and it supports about 16% of domestic water resources of İzmir City. The plain had been used as agricultural lands until the 1950s, while today they have been opened for the university, industry, commerce, and settlement. Especially, Bayraklı district had facilitating conditions for settlement and housing, spreaded their urban habitat areas to an extent in the last ten years. In 1965, Bornova accommodated half of its population in rural areas after receiving so much immigration. It inevitable opened the city-centre to housing and it thus considers the surrounding village areas as urban areas. By the year 2000, the rural population had already been melted into the urban population. The agricultural areas in rural parts of the country will have completely disappeared in 50 years' time. Much of the surface of plain is rendered impermeable by buildings, roads and surface coverings. Because of this covering, groundwater recharge is reduced and it thus causes increasing and accelerating runoff in the Plain. The groundwater recharge from precipitation was about 27 % in 1925, but this amount dropped to 13% in 2012. Groundwater recharge from precipitation will be 1% in 2030.

Keywords: Urbanization, water resources, GIS, groundwater, Bornova plain, İzmir

ID_2976

THE IMPACTS OF PLANNING CRITERIA'S ON GROUNDWATER SOURCES: CASE OF IZMIR NEW CITY CENTER

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Abstract: Cities with historical background, according to their geographic or economic alteration generally possess different town centers. Mostly for better protection against human or non-human factors the center of cities are relocated. The city of İzmir is one the magnificent case of city center resettlements. The premier location of city that is estimated to be 5000-8000 years before was in Bornova reeds in the north. Far from the sea and as results of serious disease the settlement relocated to Smyrna in Bayraklı. Smyrna was then abounded after massive earthquakes. Pagos hills (Kadifekale) with its great defending potential become the next city of Smyrna. Then, the economic value of harbor and rail-way moved the city to the cost. In all this location selection, geographic characters present crucial role in optimizing the decision. However, the most recent planning projection for new city center seems to completely dismiss this fact. Izmir new city center, planned to be settled in Bayraklı where soil, land properties and groundwater resources do not support the planned ideas. Not only the location of new city center is arguable but the character of development is also critically stressed on nature. For example, Halkapınar, located near new center of Izmir, is one of the important groundwater resources in the area. This region is providing 16% of İzmir drinking water. The groundwater levels range from 1 m to 10 m in Bayraklı Region. Geographical Information Systems (GIS) utilizing in urban-nature interaction assessments, present clear and easy to understand picture of the problem. Especially, when comprehensive data is not available and precise examination is impossible, the GIS could be applied for data creation and geoprocessing analysis. The results could be unique and it can provide valuable information for decision supports. While the aim is to provide a threshold for site selecting the data is more likely to be comprehensive then precise. Accordingly, evaluating the planning criteria impacts on groundwater resources in scale of a city center, with the help of GIS could limit to what this study aims to reveal. The study examines the stress that buildings had on land in 2001 and 2016 by using GIS geo- statistical analysis. The changes argue the planning decisions and also warn for future crises. Although plans have been implied in the case but the study results may lead to sets of further studies and prevention actions in case.

Keywords: groundwater, planning decision, water resources, GIS, Izmir

ID_2812

GROUNDWATER RESOURCES IN LOCAL DEVELOPMENT STRATEGIES: CASE OF IZMIR

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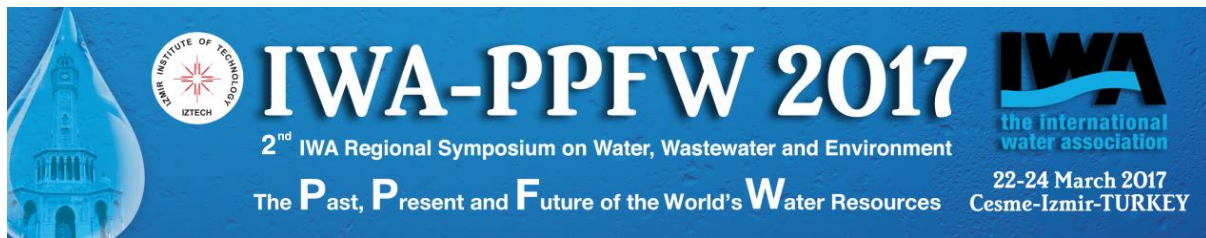
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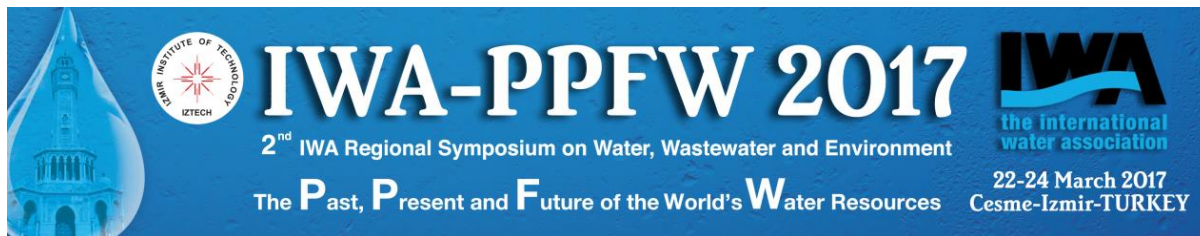
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Abstract: Rural socio-economic development has gained utmost importance in Turkish Metropolitan Municipalities within the frame of recent legal changes extending boundaries towards their peripheral areas. With this regard, İzmir Metropolitan Municipality has completed series of local development strategies aiming at the sustainable development of the city's rural hinterland. For three fertile sub-region of Izmir, namely as Yarımada, Gediz-Bakırçay and Küçük Menderes, local development strategies were prepared consecutively. In the framework of local development strategies; agriculture, tourism, settlement pattern and culture, local innovation and entrepreneurship, and environmental issues and water resources were examined as project themes. Among them, water resources has utmost important since the local development of whole sectors are largely dependent on them. Therefore, local development strategies have underlined the reality of river basins and potentials and limitations on groundwater resources due to the fact that surface waters have already been contaminated. More than half of Izmir's water budget (nearly 70%) comes from groundwater resources. In recent years, rapid increase in population, and uneven development in tourism and industry have brought more pressure on these precious resources. To become more water resilient Izmir needs to follow good practices in management of groundwater all over the world. The paper reviews these cases and creates a pathway to Izmir integrated with local development strategies. Methodologically, local development strategies were based on the idea that rural regions are not places of isolation and deprivation, by asset-based development and creative approaches, it can reestablish the healthy continuum between urban and rural. Thus, building on local assets was the main development strategy. This long-term endogenous development path was first identified, mapped and then presented within the form of local asset-based development ideas. At the first stage, description and mapping of local natural and cultural assets were determined via interactive community meetings. Then, an asset-driven database was constituted to make spatial mapping of given assets. Lastly, potential conflicting asset-based development ideas from each development theme were tested with each other and subsequently 'spatial interaction analysis' was scrutinized to understand any contrasting relations for the future development of the selected river basin regions. This study aims to make 'spatial interaction analysis' that elaborates potential conflicts between groundwater resources and asset-based development ideas within the frame of selected development themes such as settlement patterns, agriculture and tourism. By doing this, we scrutinize availability of groundwater resources in selected regions, distribution of water budget among



sectors, and implications of the anticipated conflicts between contrasting strategy ideas. The results of spatial interaction analysis give us potential action areas bridging the conflict between selected ideas and pave way to find novel solutions to provide sustainability of the important river basins of Izmir. The model presented in this study is important for basins that live rapid development pressure and water scarcity at the same time. Thus, the paper seeks to find sustainable path of local development without harming valuable groundwater resources implying not only Izmir but also cities around Mediterranean basin.

Keywords: groundwater, local development, water resources, strategy, Izmir, GIS



ID_2770

MULTI-TEMPORAL WATER EXTENT ANALYSIS OF LAKE TUZ USING LANDSAT IMAGERY

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Abstract: Distinguishing inland water bodies from satellite imagery has always been one of the main practices of remote sensing. In some cases, this differentiation can directly be obtained by visual interpretation. However, in case of hyper-saline playa lakes, presence of high albedo salt crust in the lake bed hampers visual interpretation and requires further attention. Lake Tuz is a hypersaline playa lake which is ranked as the second largest lake in Turkey. Spatio-temporal changes in lake water extent are important both economically and hydrologically including salt production, lake water balance, drought and overexploitation issues. This study investigates the spatiotemporal changes in Lake Tuz water extent during the last decade using single-band thresholding and multi-band indices extracted from the multitemporal Landsat 5 TM and Landsat 7 ETM+ images. The applicability of different satellite-derived indices including Normalized Difference Water Index (NDWI), Modified NDWI (MNDWI), Automated Water Extraction Index (AWEI) and Tasseled Cap Wetness (TCw) were investigated for the extraction of lake water extent from Landsat imagery. Our analysis indicated that, overall, NDWI is superior to other tested indices in separating wet/dry pixels over the lake bottom covered with salt crust. Using a NDWI thresholding procedure, the annual and seasonal variation in the Lake Tuz water extent were determined and further linked to hydro-meteorological variables such as precipitation.

Keywords: satellite image, Landsat image, water index, Lake Tuz

BIM FOR 7DS' MANAGEMENT OF WATER DISTRIBUTION NETWORK –A CASE STUDY FOR TUMAKURU TOWN, KARNATAKA, SOUTH INDIA

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Abstract: Building Information Modeling (BIM) has been one of the disruptive innovations in construction sector, where stakeholders are relying on tangible aspects in several dimensions like Team Collaboration for Common Environment (CDE), Virtual Design & Construction (VDC), Quantity take-off, Clash detection, Lean Scheduling and Project Phasing Simulations. There are a slew of factors that inhibited the construction sector from welcoming disruptive innovations; however a paradigm shift occurred when assimilation of BIM in projects reaped robust outcomes. Traditional Water distribution projects' lures undue attention during construction phase; nevertheless slackness prevails from the operational phase of the built facility or as a result of owner's dearth of comprehensive control mechanism to safeguard the facility. This paper addresses the introduction of BIM framework in the development of 7Ds' as a real-time operational tool for enabling client to monitor operations during construction, construction and facility management phases. Moreover, the paper focuses with case study and an opinion poll for holistic apprehension of the integrated BIM platform for 7Ds' Management of Water Supply Network. Consequently, the assets's or facilities can be improved significantly with BIM platform which provides an avenue for asset information management system and improves the project performance beyond construction phase too. Apart from that capacity building of skilled professionals can be augmented with such BIM driven approaches.

Keywords: Integrated BIM work flow, 7Ds' Management (Facility Management Application), Capacity Building, Cost estimation, Quantity take-off, Clash detection and visualization

TREND ANALYSIS OF STREAMFLOW IN THE EUFRATES-TIGRIS BASIN 2631

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Abstract: Low, medium and high values of streamflow are a very important issue in hydrological, meteorological and climatological events. Moreover, these values are used to decide various design parameters based on scientific aspects and real applications everywhere in the world. In this context, a new trend test method recently proposed by Şen was used for monthly streamflow data recorded at two different stations. Station numbers and locations: 2174- Murat River (Akkonak), 2634-Gökçe Creek (Gökçe) selected from Euphrates-Tigris Basin of Turkey. The Mann-Kendall trend test was also applied to the same data, and the results were particularly discussed. 2117 and 2634 stations have statistically significant decreasing trend according to the Mann-Kendall and Şen trend test. 2117 and 2634 stations have a decreasing trend. Consequently, the proposed new method of Şen provided an important advantage in terms of statistically evaluation of low, medium and high values of streamflow data.

Keywords: Euphrates-Tigris Basin; Mann-Kendall test; Streamflow; Şen's trend test; Turkey.

TREATMENT OF OPIUM ALKALOID WASTEWATER BY HYDROTHERMAL GASIFICATION

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Abstract: Opium alkaloid wastewater is high strength to treatment and has materials of poisonous, toxics and inhibiting the microorganism activities. The aim of the study is to investigate what extent removal of chemical oxygen demand and toxic polluting compound in opium alkaloid wastewater as a result of hydrothermal gasification. The gasification of wastewater was investigated in a batch autoclave reactor at 500 °C, at a pressure range of 40.0 - 42.0 MPa without a catalyst and using reduced catalyst in supercritical water medium. The wastewater used in this work has a COD content of 3200 mg O₂/L and a TOC content of 11,500 mg/L. The highest COD and TOC removal efficiencies were reached in the presence of nickel impregnated form of activated red mud catalyst as 84.1 and 89.1%, respectively. A spontaneous advantage of this method is to produce valuable gases of H₂ and CH₄ at the end of operation as gaseous product. The H₂ and CH₄ yields were maximized at 32.5 and 27.8 mol/kg °C in wastewater with the addition of nickel impregnated activated red mud catalyst.

Keywords: wastewater, hydrothermal gasification, chemical oxygen

ID_2904

**MANGANESE SPECIATION STUDIES IN RAIN WATER:
APPLICATION OF HIGH PERFORMANCE LIQUID
CHROMATOGRAPHY-INDUCTIVELY COUPLED PLASMA
MASS SPECTROMETRY**

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Abstract: Monitoring manganese in rain water samples is important for understanding the mechanisms of acid rain formation. In our study manganese characterization methodology is proposed by on line high performance liquid chromatography-inductively coupled plasma mass spectrometry technique. In chromatography, cationic forms or anionic forms can be separated and detected with ion exchange column and UV detection modes. In our study the versatility of C-18 column for speciation analysis of cationic species were investigated and the suitability of detections were shown. On the other hand, because of the dilutions in on-line system, enrichment techniques seem to be necessary depending on the limits of detection values.

Keywords: Manganese, rain water, HPLC-ICP-MS.

PURIFICATION OF HYDROGEN FROM IMPURITIES OF CARBON MONOXIDE ON THE NANODIMENSIONAL CATALYSTS 2801

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Abstract: Hydrogen the highly effective ecological clean energy carrier. A raw resource for receiving hydrogen is gas, biomass, and both plants, and waste, some representatives of flora, for example, seaweed *Chlamydomonas reinhardtii*. Process of hydrogen receiving consists of two stages. At the first stage receive hydrogenous (syngas) representing mix of carbon oxide and hydrogen. At the second stage this gas is purified of carbon monoxide reaction of his water conversion and further selective oxidation. Results of research of catalytic activity of copper containing nanocomposite systems, the following composition of Cu – Me – O (Me - Co, Ni, Zn) and Cu – Me – Al₂O₃ (Me - Co, Zn) received by method of hydrothermal synthesis in a liquid phase in reaction of selective oxidation of carbon monoxide are presented in this thesis of the report. Composite materials are prepared in the autoclave from crystalline hydrates of nickel by a hydrothermal method in the presence of ethylene glycol, glycerol and formaldehyde. Products of reaction are characterized the by XRD, IR, UV, electron microscopy. Catalytic activity of these catalysts are spend in the reactor of flowing type with a fixed amount of the catalyst (0.1 cm³), in the range of temperatures 20-300 °C, volume speed 9000-11000 cm³/h. Temperature of process is measured by the chromel-kopel thermocouples at the exit from the catalyst. Studies have shown that the greatest activity Cu – Co – O catalysts give the conversion of carbon monoxide at the temperature of possess 180-190 °C. Thus, the hydrothermal method allows to control the morphology of disperse product and to obtain nanoscale oxide materials with high catalytic activity in the presses of selective oxidation of carbon monoxide.

Keywords: Purification, hydrothermal method, nanoscale, nanocomposite

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ID_2934

EFFECTS OF HYPOLIMNETIC OXYGENATION ON IRON AND MANGANESE CONCENTRATIONS IN RESERVOIRS

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Abstract: Iron and manganese accumulation in drinking water reservoirs is a challenging issue and should be controlled in order to prevent their adverse effects on human health. Accumulation of these metals not only clogs pipeline systems, but also cause stains on fixtures and laundry. Moreover, intake of high concentrations of iron and manganese result in several health problems. This study focuses on the release mechanism of iron and manganese from the sediments to the water column and investigates the methods to prevent this release. The effects of hypolimnetic oxygenation on iron and manganese concentrations at the water column and at the sediments were investigated through laboratory experiments. The experiments showed that iron concentrations in water column decreased in time without any aeration applied, but that was not the case for manganese concentrations. Release of manganese from the sediments to the water column were evident.

Keywords: iron, manganese, hypolimnetic oxygenation

ID_2802

SIMULTANEOUS SEPARATION OF BORON AND LITHIUM FROM GEOTHERMAL WATER BY ADSORPTION MEMBRANE FILTRATION HYBRID PROCESS

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Abstract: Geothermal waters contain various kinds of elements including boron and lithium. Boron is one of the essential elements for plants but it becomes toxic once the amount exceeds the demand. Lithium is a crucial element in many application areas such as batteries, thermonuclear fusion, medical drugs, ceramic glasses, adhesives and electrode welding. In this study, a hybrid process combining adsorption and membrane filtration was used to separate boron and lithium simultaneously from geothermal water. According to the results obtained using boron selective ion exchange resin Dowex XUS-43594.00 and lithium selective λ -MnO₂ adsorbent; separation efficiencies for lithium and boron were 100% and 83%, respectively.

Keywords: Adsorption-membrane hybrid process, boron, geothermal water, lithium.

ID_2994

ALLELOPATHIC CONTROL OF HARMFUL CYANOBACTERIAL BLOOM MECHANISM AND APPLICATION

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Abstract: Harmful algae bloom (HAB), in particular cyanobacterial bloom, is becoming a worldwide aquatic problem. The allelopathic inhibition of algae by plants has showed enormous potential in HAB control. Among them, the use of barley straw is by far most successful. In this research, inhibitory effects and action modes of oriental type of barley - Tibetan barley were proved, in addition to the widely reported validity of algal inhibition effects by their occidental relative; algicidal effects of barley straw decomposing prepared by eight different procedures were systematically compared, and the general laws of this allelopathy were discussed by the use of non-linear mathematical model; a estimation of the potential algicidal effects of oriental barley straw applied in typical eutrophic Chinese waters was also performed. The natural chemicals in barley straw were screened, and the key allelochemical, which effectively inhibits cyanobacteria growth, was isolated and identified through bioassay-guided natural product chemistry procedures, and its mechanism was also studied on the single cell level. Furthermore, the cyanobacterial inhibition abilities of series of natural flavonoids were studied based on the quantified structure and activity relationship (QSAR) analysis, to facilitate the future application of this method. The observation in this work will provide a theoretical gist and technology guide for the use of barley straw methods in algal control filed; meanwhile this work could also contribute to the recycle and reuse of agricultural wastes like straws.

Keywords: algicidal effects, cyanobacterial, barley straw methods, bloom mechanism

ASSESSING THE PRESSURE AND THREATS: IMPACTS OF GLOBAL ENVIRONMENTAL CHANGES ON WATER RESOURCES IN KENYA

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Abstract: Environmental changes whether resulting from anthropogenic pressure or natural ecological processes have adverse effects on water resources. The effects include sea level rise, drying rivers and springs, decreased quantities of rainfall, poor water quality on surface and underground systems, melting of snow and ice on mountain tops. Addressing water and climate change, Water Dialogue (2004), noted that stress will increase significantly in those regions that are already Arid and Semi-Arid (Sub-Saharan Africa). Countries in this region are mostly the developing countries and are associated with inadequate abilities to mitigate the far reaching effects of global environmental changes which affect the mostly the hydrological cycle. The anthropogenic pressure has been caused by ever increasing world's cultivated area which is estimated to grow by 12% by 2050 (FAO 2011) due to increased demand for food as population grows. Population increase in rural areas and development of cities poses stress on the existing scarce water resources which lead to changes in the fluxes, pathways and stores of water. This paper seeks to assess the momentous pressure and stress on the water resources in Kenya, caused by global environmental changes.

Keywords: Climate change, anthropogenic pressure; global environmental changes

ID_2990

STRENGTHENING OF THE UNDERWATER HISTORICAL ARTIFACTS WITH WHITE CEMENT CONTAINING NANO TiO₂ AND ITS ENVIRONMENTAL EFFECT

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Abstract: Starting from the Palaeolithic period, people lived and established civilizations in Anatolia in every period. The traces of these civilizations are found in almost every region. These historical monuments, which have survived from the past to the present day, must be strengthened, preserved and left to tomorrow because of the common values of all human civilization as much as our country. Repeated earthquakes and environmental influences make historic buildings losing their appearance and their strengths day by day. Some of the artifacts lies under water and need to be carefully repaired due to the reason that they are in direct contact with water. In this study, a mixture of two types of fibre reinforced mortar prepared with white cement containing Nano TiO₂ particles was designed to be an alternative to the current strengthening methods. And the environmental impact to the water ecology have been investigated.

Keywords: Self-cleaning mortar, underwater artifacts, TiO₂, sea pollution.

A RESEARCH ON THE USAGE OF NANO CALCIUM CARBONATE AS CEMENT REPLACEMENT MATERIAL

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Starting from the Palaeolithic period, people lived and established civilizations in Anatolia in every period. The traces of these civilizations are found in almost every region. These historical monuments, which have survived from the past to the present day, must be strengthened, preserved and left to tomorrow because of the common values of all human civilization as much as our country. Repeated earthquakes and environmental influences make historic buildings losing their appearance and their strengths day by day. Some of the artifacts lies under water and need to be carefully repaired due to the reason that they are in direct contact with water. In this study, a mixture of two types of fibre reinforced mortar prepared with white cement containing Nano TiO₂ particles was designed to be an alternative to the current strengthening methods. And the environmental impact to the water ecology have been investigated.

Keywords: Self-cleaning mortar, underwater artifacts, TiO₂, sea pollution.



ID_2997

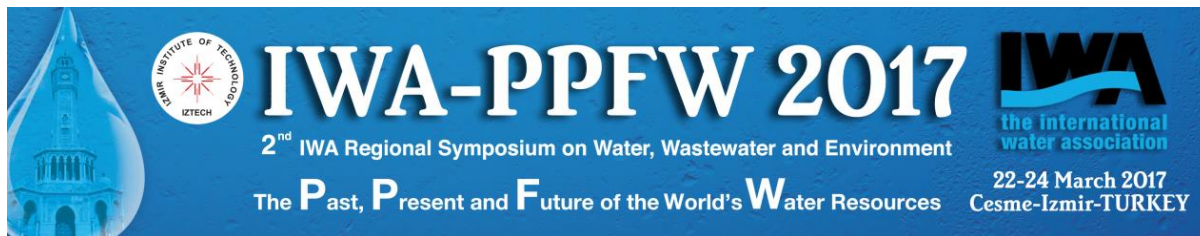
THE IMPORTANCE OF WASTE MANAGEMENT EDUCATION IN ENGINEERING DISCIPLINES: IMPACTS ON CIVIL, ELECTRICAL AND INDUSTRIAL ENGINEERING TRAINING PROGRAMS

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Considering the civil, industrial and electrical engineering education in Turkey under current conditions, we can clearly conclude that waste management education deserved and expected importance is not given. As other engineering disciplines and their projects, waste is also created by those engineering branches. To prevent damaging the ecosystem and maintain a better quality of life, all engineering disciplines training programs should include waste management and other related topic based courses. Within the scope of this study, training programs for the engineering programs in Turkey were evaluated in terms of waste management courses, and the suggestions for the improvements were presented.

Keywords: Waste, waste management, engineering education, waste management courses.



THEME A – WATER SOURCES

POSTER PRESENTATION

EXPERIMENTAL ANALYSIS OF CONTAMINANT INTRUSION INTO WATER DISTRIBUTION NETWORK DURING FLUCTUATING PRESSURE EVENTS

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Abstract: Experimental setup have been conducted to investigate contaminant ingress and movement in drinking water distribution networks (WDN) when negative or low pressure takes places due to sudden power shut off. The minimum time required for the contaminants to start entering into the system, and the time required for the contaminant to be fully distributed is calculated at different operating pressure. The risk that the contaminant ingresses into the WDN immediately after power shut down or low pressure incident is tested to measure the risk. A highspeed camera is used to monitor the contaminant transient evolution through the WDN at different pressure.

Keywords: Contaminant intrusion, regulations, sensor, water distribution network

NATURAL RESIN FUNCTIONALIZED HOLLOW SILICA SPHERE BIONANOCOMPOSITE MATERIAL FOR ADSORPTION

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Abstract: Bionanocomposite material supported multifunctional (hydroxyproline with enriched glycoprotein) has been shown to be efficient in chelation with boric acid and can be used for removal of boron at ppm levels. Acacia Senegal (AS) is a natural biodegradable and nontoxic biopolymer. Hollow silica spheres gaining increasing attention, thanks to low density, high specific surface and good adsorption performance. In this work, acacia senegal and hollow silica sphere nanoparticles were combined for adsorption of boron. First of all, HSS was synthesized and then functionalized with AS. Sol-gel process was used for the preparation of hollow silica spheres. Characterizations of AS functionalized Hollow Silica Sphere (HSAS) were done by FT-IR, and SEM technique. For boron, the HSAS was demonstrated as the best adsorption capacity (q_{\max} 3 mmol g⁻¹). The HSAS can achieve a good adsorption of boron effect.

Keywords: absorption, Acacia Senegal, nanoparticles, Hollow Silica Sphere

POLYMERIZATION OF STYRENE 4 SULFONATE WITH MACROPOROUS HYDROTALCITE AND THE SUBSEQUENT CARBONACEOUS REPLIQUA USED IN THE WAS

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Abstract: The chemisorption properties of hydrotalcite (HT) with novel macroporous properties have been investigated for azo dye, Orange II (O-II), and compared to coprecipitated HT and their calcined derivative. Adsorption isotherms satisfactorily fit the Langmuir model. Adsorption capacities of the layered double hydroxides (LDH) macroporous structures are very high, particularly for the calcined materials (4.34 mmol/g) compared to standard HT (0.504 mmol/g), showing that accessibility to the LDH layer surface insures better sorptive properties. For both synthetic materials, the calcination/reconstruction process gives rise to highest concentration for adsorption of O-II and a partial intercalation of O-II molecules in the structure as shown by the expansion of the basal spacing ($d = 2.4\text{nm}$). Conversely, the uncalcined HT phases mainly display a surface exchange chemisorption process.

TISSUE HEAVY METAL AND NUTRIENT CONTENTS OF SEAWEED IN DONGTOU ISLAND, CHINA

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Abstract: Seaweed has long been recognized as a food rich in essential minerals and bioactive compounds. Nowadays, the seaweed aquaculture has also found to play an important role in coastal water bioremediation. This study aims in screening the adsorption capacity of heavy metals for wild Chinese seaweed species and exploring the nutrient contents in these wild seaweed species. Totally 32 seaweed samples were collected from the East China Sea, representing 12 species of the Phaeophyta, Rhodophyta and Chlorophyta. Heavy metals and nutrient elements in all these seaweed samples were determined by three different methods: (1) inductively coupled plasma-mass spectrometry (ICP-MS) for the detection of Cu, Cr, Ni, Zn, Pb, Cd, As, Se, Mn and Co; (2) inductively coupled plasma-atomic emission spectrometry (ICP-AES) for the detection of Al, Ca, K, Mg, Na and Fe; (3) thermal decomposition amalgamation atomic absorption spectrophotometry for Hg. For heavy metals, the concentrations of Al, Zn and Cu are relatively abundant in all the seaweed samples. *Gelidium divaricatum* shows the highest values for Cr, Al and Pb concentration. *Sargassum fusiforme* has the highest As content. For nutrient elements, the contents of Ca and K are relatively higher than other nutrient elements in each phylum. *Ulva pertusa* has the lowest values for Mn, Ca, K and Na and the highest content of Mg. Interestingly, the tissue content of Fe and Mn showed a positive correlation, while the correlations of Ca and Na, Ca and K, Ca and Mg are negative. The results demonstrate the impressive potential of applying Chinese seaweed species as a tool of marine environmental bioremediation.

Keywords: Seaweed; Heavy metals; Nutrient elements; Adsorption capacity; Edible value

ID_2996

PHYSIOLOGICAL AND BIOCHEMICAL RESPONSES OF SEAWEED TO DIFFERENT NUTRIENT CONCENTRATIONS AND WATER EXCHANGE RATES

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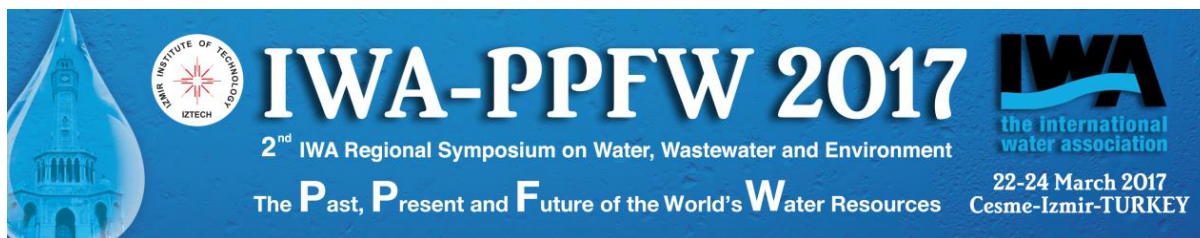
Abstract: Eutrophication has become a hot global issue for coastal ecosystems nowadays. Seaweed as a promising candidate for coastal eutrophication bioremediation, its ability of bioremediation and how it response to environmental factors arouse the attention of relative researchers. Nitrogen and phosphorus are necessary for growth, meanwhile, water exchange can not only maintain continuous nutrient supply, but also alleviate pH, remove metabolites and dirt. In this study, two common seaweed species - phaeophyta *Sargassum fusiforme* and chlorophyta *Ulva pertusa* - were used to investigate the effects of different nutrient concentrations and water exchange rates on seaweed growth, the concentration of chlorophyll a, carotenoid, soluble protein and soluble carbohydrate. The results demonstrated that the growth of *S.fusiforme* is simulated under the medium nutrient concentration (MNC, 50 $\mu\text{mol/L}$ NH_4Cl and 5.0 $\mu\text{mol/L}$ K_2HPO_4), inhibited under the low nutrient concentration (LNC, 25 $\mu\text{mol/L}$ NH_4Cl and 2.5 $\mu\text{mol/L}$ K_2HPO_4) and the high nutrient concentration (HNC, 100 $\mu\text{mol/L}$ NH_4Cl and 10.0 $\mu\text{mol/L}$ K_2HPO_4), the SGR of *U.pertusa* under MNC and HNC are higher than that under LNC regardless of water exchange rates. Besides MNC and HNC promoted the accumulation of chlorophyll a and carotenoid of *S.fusiforme*, and soluble protein of *U.pertusa*. In a word, these two species can be potential to carry out bioremediation in coastal eutrophication areas.

Keywords: Chlorophyll, eutrophication, nutrient, seaweed,



Theme B Water History & Climate Change

ORAL PRESENTATION



ID_2805

A BRIEF HISTORY OF WATER REUSE

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Abstract: Domestic wastewater was used for irrigation and aquaculture by prehistoric civilizations (e. g. Mesopotamian, Indus valley, Egyptian, and Minoan) since the Bronze Age (*ca.* 3200-1100). Thereafter, wastewater was disposed or used for irrigation and fertilization purposes by Greek civilization and later by the Roman one in areas surrounding cities (e.g. Athens and Rome). In more recent history, wastewater application to the land for disposal and agricultural use was originally operated in European cities and later on in USA. Today, planning of projects for water reclamation and reuse is significantly increasing in several regions of the world. Also, recycled water is used for almost any purpose including potable use. This paper provides a brief overview of the evolution of water reuse over the last 5000 years. It provides a historical context and links to some of the latest developments in sustainable water reclamation and reuse. By understanding the practices and solutions of the past, we are better placed to meet present and future challenges.

Keywords: evolution of water reuses criteria; history of water reuse; potable water reuse; sewage farms

ID_2792

TREND DIRECTION CHANGES OF TEMPERATURE AND PRECIPITATION TIME SERIES IN TRARZA REGION OF MAURITANIA FOR PERIOD OF 1970-2013

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Abstract: Trend analysis for annual temperature (maximum, minimum, and average) and precipitation collected from three stations (Boutilimit (Station 1), Nouakchott (Station 2) and Rosso (Station 3)) is studied to detect the impacts of climate change on water resources in Trarza region in Mauritania. For this purpose; the Mann Kendall (MK test), the Spearman's rho (SR test), and the Şen trend test are used for the trend identification in the time series and the Pettitt test is used for detecting the change point of the series while the Thiel-sen approach is used to estimate the magnitude of the slope in the series. For the precipitation, two stations (Boutilimit and Rosso) indicate statistically significant increase of trends, while no trend is detected in Station of Nouakchott (detected by MK test and SR test). In the case of temperature, almost all the stations show statistically significant increasing trends in the maximum, minimum and average temperatures. On the contrary, the Şen trend test indicates increasing trend in the precipitation for the three stations in terms of the low, medium and high values. The magnitude of precipitation detected by The Thiel-sen test in Boutilimit and Rosso is found at the rate of 2.93 and 3.35 mm/year at 5% significance level, respectively. As the results of the Pettitt test for identifying abrupt changes on the precipitation (e.g.; jumps), the change points are found in Boutilimit and Rosso stations in years of 1988 and 1993, respectively. For the magnitude, trends on the annual maximum, minimum, and maximum temperatures detected by Thiel-sen are found at the rate of 0.2-0.4°C per decade for almost all the stations (no trend was detected in the maximum temperature for the station of Boutilimit). The change points of the temperature (T-max, T-min and T-avg) trends detected by Pettitt test are found in the same year (1995) for all the stations, in contrast to the precipitation trends.

Keywords: No-parametric test; Şen trend test; trend analysis; precipitation; temperature; Arid; Trarza region; Mauritania.

ID_2838

METEOROLOGICAL DROUGHT ANALYSIS FOR LASHKARGĀH AND GARDANDIWAL STATIONS OF HELMAND RIVER BASIN, AFGHANISTAN

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Abstract: Drought is arduous natural disaster causing damages to the world ecosystem. Various drought indexes (DIs) are universally used to investigate the drought conditions such as intensity and duration. This study evaluates the drought appearances in Lashkargah and Gardandiwal stations of Helmand River Basin (HRB) in Afghanistan. Thirty seven years monthly recorded precipitation data from 1979 to 2015 is employed with different DI methods which include Standardized Precipitation Index (Normal-SPI, Log-SPI, and Gamma-SPI), Percent of Normal (PN), and Deciles. All methods are applied to annual long term precipitation data set. Results show that all DI methods provide almost the same results for the stations. The log-SPI and gamma-SPI predict extreme drought conditions, whereas, the normal-SPI determines wet and less drought conditions. The results emphasize that the PN method predicts more moderate drought years in comparison with SPI method, however, Deciles method shows longer period of extreme and severe drought than other methods. As a result, the five methods indicate various drought intensities in 1997, 1999, 2000, 2001, and 2002 with a peak extreme drought in 2001 in the Lashargah station. The Gardandiwal station area experienced the drought conditions continuously from 1998 to 2004 with a peak extreme drought in 2001 as well. Therefore, extreme drought conditions happened in 2001 in both stations confirm to the recorded drought reports for the same region.

Keywords: Afghanistan, Helmand River Basin, Drought Indexes, SPI, PN, Deciles.

ID_2961

CARBON FOOTPRINT FROM WASTE WATER TREATMENT PLANTS

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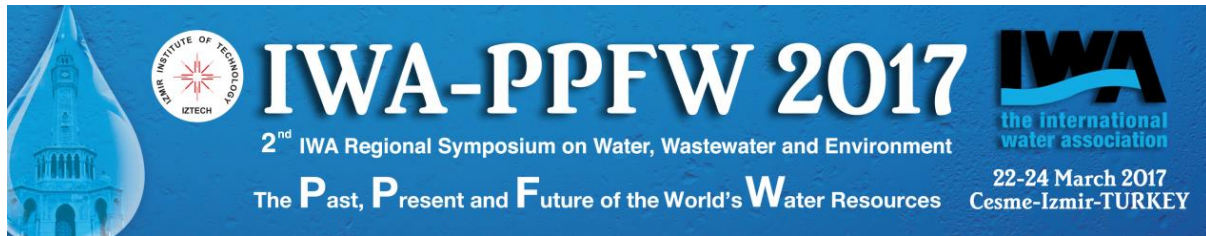
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Abstract: Carbon footprint is the total set of GHG (greenhouse gas) emissions caused directly and indirectly by an individual, organization, event or product. Waste water treatment plants, can emit gases that are harmful to the climate, such as nitrous oxide (N₂O), carbon dioxide (CO₂), and methane (CH₄). In recent years, carbon footprint from waste water treatment plants has been a topic of attention.

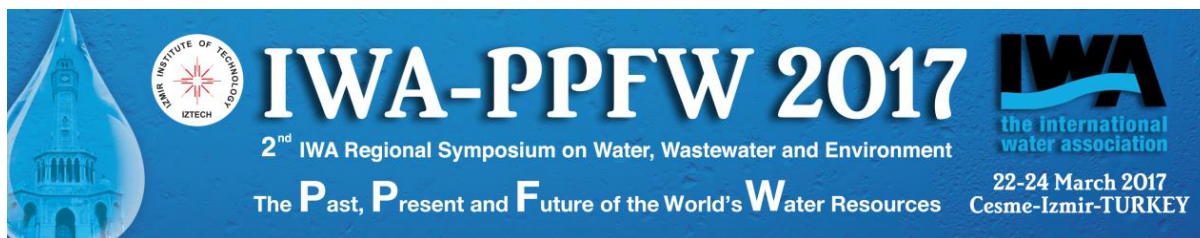
In this study; in some process waste water treatment plants under different operating conditions carbon footprint calculation and mitigation methods have been examined. The variation of potential greenhouse gases emission has been investigated by measuring with gas chromatography instrument and micro sensors, using mathematical models and calculating with commercial software and equations and iterative methods under different operating conditions and parameters. Optimum operating conditions and operating parameters in waste water treatment plants can provide carbon footprint minimization. In this study the major sources of greenhouse gases for different types of waste water treatment plants (industrial waste water treatment plants, municipal waste water treatment plants etc.) and carbon footprint calculation and mitigation methods have been investigated.

Keywords: carbon footprint, waste water, treatment



Theme B Water History & Climate Change

POSTER PRESENTATION



ID_2926

CHANGE-POINT IDENTIFICATIONS OF KEY WATER QUALITY PARAMETERS IN LAKE TAIHU

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Abstract: The water quality parameter shifts in lakes or reservoirs may occur due to anthropogenic and natural effects. Detection of change point is essential for sustainable management applications to proof results of management applications and to enforce more implementation protection plans. In this study, Meiliang Bay is selected as study area, which has the worst water quality part of Lake Taihu, because it is one of the most studied lakes in the world to reduce its eutrophication. It is hypothesized that the influence of major regulations including eutrophication fighting methods and management strategy may cause change points in time series of key water quality parameters (total nitrogen, total phosphorous and Chlorophyll a concentrations and Secchi disk depth) over a study period from October 1991 to December 2011. Change-points have confidence level over the 90% according to CUSUM chart. The total number of change-point is 18 and 21.43 % of them were in 2003 with 14.29 % in the following year, 2004. Other critical periods are 1998 and 1999 and they have 21.43% of total change-point. Most probably water transfer is affected for 2003-2004 and regulations for 1998-1999. The change points may help to decide on the management continuation or not.

Key words: Change-point, Lake Taihu; Nitrogen; Phosphorus; Chlorophyll a; Secchi disk depth.



Theme C Wastewater & Environment

ORAL PRESENTATION

ID_2957

POLY(ACRYLAMIDE) GRAFTED ONTO CROSS-LINKED POLY (4-VINYL PYRIDINE) FOR THE REMOVAL OF METHYL ORANGE AND METHYLENE BLUE FROM AQUEOUS SOLUTIONS

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Abstract: Dye removal from the industrial effluents has become an important issue in the last decades in terms of both health and environmental considerations. Dyes are produced in industries such as textiles, rubber, printing, cosmetics paper, plastic, etc. and due to their toxicity; the removal from the industrial effluents is very important. In this study, poly(acrylamide) grafted onto cross-linked poly (4-vinyl pyridine) (P4-VP-g-PAm) was synthesized and used for the removal of anionic dye methyl orange (MO) and cationic dye methylene blue (MB) from the aqueous solutions. The factors influencing the adsorption process was studied as a function of pH (2–10), adsorbent dose (0.01–0.1 g), contact time (1–120 min), initial dye concentration (30–100 mg/L), and temperature (298–338 K). The adsorption process was investigated in terms of Langmuir, Freundlich and Dubinin-Radushkevich isotherms to characterize the uptake of the MO and MB by the adsorbent. Several adsorption kinetic models were used to fit the experimental data, viz., pseudo-first-order, pseudo-second-order and intraparticle diffusion models. Thermodynamic parameters such as Gibbs free energy, enthalpy, entropy were evaluated to predict the nature of adsorption. As a result, P4-VP-g-PAm was found to be an efficient adsorbent for the removal of MO and MB from aqueous solutions.

Keywords: dye removal, anionic dye methyl orange, cationic dye methylene blue

START UP OF ANAMMOX REACTOR AND SHORT TERM EFFECTS OF TiO₂ NANOPARTICLES ON ANAMMOX BACTERIA

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Abstract: Biological nitrogen removal is widely accomplished by conventional nitrification and denitrification processes in wastewater treatment systems. Conventional nitrification and denitrification processes lead to high operational cost due to oxygen requirement and external carbon addition. In recent years, anammox (anaerobic ammonium oxidation) has been discovered as a new approach for ammonium removal. In this process, ammonium is used as electron donor and nitrite is used as electron acceptor and mainly nitrogen gas and some nitrate are produced. These systems produce less sludge compared to conventional processes, consume less oxygen and do not require external carbon addition. Nowadays, metallic and metal oxide nanoparticles are being used at medical and electrical industries, personal care products. Eventually, these nanoparticles are discharged to domestic wastewater treatment plants. In literature, there is no study which investigates the nanoparticle inhibition on Anammox systems.

The first objective of this study is to investigate the inhibitory effects of TiO₂ on enriched Anammox culture. The second objective of the study is the recovery of anammox process by TiO₂ nanoparticle addition. Both batch and continuous experiments have been performed during the study. Five 0.1, 0.2, 0.3, 0.4 and 0.5 mg/L TiO₂ nanoparticle concentrations were used. Concentration of TiO₂ nanoparticle increased step by step if there is no inhibition in the system.

Keywords: Anammox, TiO₂ inhibition, nitrogen removal

ID_2872

ELECTRICITY GENERATION FROM MEAT PROCESSING INDUSTRY ACTIVATED SLUDGE USING SINGLE CHAMBER MICROBIAL FUEL CELL (MFC)

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Abstract: The microbial fuel cell (MFC) production from biodegradable organic wastes is considered as a new concept based on the recent molecular discovery of specific microbes capable of catalyzing efficient half reactions at electrode surfaces. MFCs are bioelectrochemical transducers that are capable to convert microbial reducing power into electrical energy. The recent interest in MFCs is the possibility of combining waste degradation with energy generation. This technology uses microorganisms to catalyze the direct production of electricity from organic materials (Rezaei et al., 2007, Logan and Regan, 2006). This study has investigated the electricity production from waste activated sludge taken from meat processing industry wastewater treatment plant using MFC harvesting electricity under anodic and cathodic conditions. The single chamber MFC reactors were designed at laboratory scale and different electrodes as titanium and carbon cloth were used during experiments. Single chamber MFCs were inoculated with 80 mL anaerobic sludge and fed with sludge up to 300 mL of active volume. Sludge characterization studies were first done before feeding the reactors. Maximum power, maximum current, power and current densities were calculated for all experimental series. single chamber MFC-titanium reactor has maximum 81.71 mW/m² maximum power density and 16.13 µA/cm² maximum current density; while they were 45.53 mW/m² and 9.74 µA/cm², respectively for single chamber MFC-carbon reactor.

Keywords: sludge, organic wastes, microbial fuel cell

Acknowledgements: This study was supported by Dokuz Eylul University Scientific Research Projects Coordination Unit under award Project # DEU-BAP: 2011.KB.FEN.046 '2011101' "Electricity Generation from Wastewater Sludges using Microbial Fuel Cell (MFC)".

ID_2874

GREEN CAMPUS APPLICATION: REUSE OF CAMPUS WASTEWATERS FOR IRRIGATION PURPOSE

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Abstract: Considering water needs for irrigation, landscaping, recreational and industrial facilities in Turkey, reuse applications of reclaimed water is very important to manage our fresh water resources as well as all over the World. In recent years, research activities on water reuse applications have rapidly increased to manage natural water sources efficiently and to apply sustainable water management. In the scope of this context, reuse of domestic wastewater originated from Dokuz Eylül University (DEU), Tinaztepe Campus for irrigation purpose in the campus area has significant effects on both beneficial uses of natural water sources and as well as showing the green campus application in the university. The main objectives of the study are to obtain irrigation water quality from reclaimed water by applying required treatment units, to investigate the reusability of reclaimed water for this aim, to determine the most appropriate membrane bioreactor system achieving the required quality. Firstly, flowrate of the domestic wastewater occurred in the campus area were measured and the fluctuations during the winter and summer sessions were determined. Composite wastewater samples were taken from sampling manholes for wastewater characterization studies. Depending on the experimental studies and previous data, the design of a wastewater treatment plant was done regarding the water needs and required quality for irrigation purpose. This paper presents the field study results and shows the benefits of this application for a green campus case.

Keywords: Wastewater, irrigation water, reuse

Acknowledgements: This study was supported by Dokuz Eylül University Scientific Research Projects Coordination Unit under award Project # DEU-BAP: 2015.KB.FEN.0004 “Reuse of Dokuz Eylül University Tinaztepe Campus Wastewaters for Irrigation Purpose and Design of Final Application Project”.

ID 2860

MODIFICATION OF MULTIPLE AMIDE FUNCTIONS ONTO CROSSLINKED POLY (VINYL BENZYL CHLORIDE (PVBC)-CO- (ETHYLENE GLYCOLE DIMETHACRYLATE) (EGDMA)) RESIN FOR REMOVAL OF PHENOL

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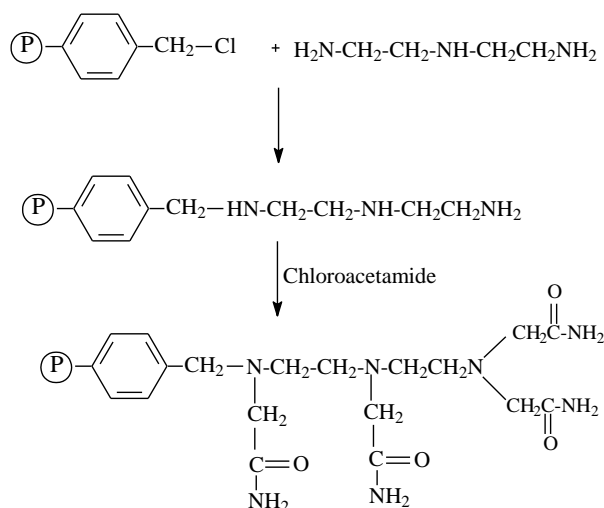
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Abstract: Phenol and its substituted derivatives are widely found in the effluents from pesticides, synthetic rubber, plastic, pharmaceuticals, petrochemicals, and other industries (1). Phenols are generally considered to be one of the most important organic pollutants discharged into the environment causing unpleasant taste and odor of drinking water (2). There are several methods to remove phenol.

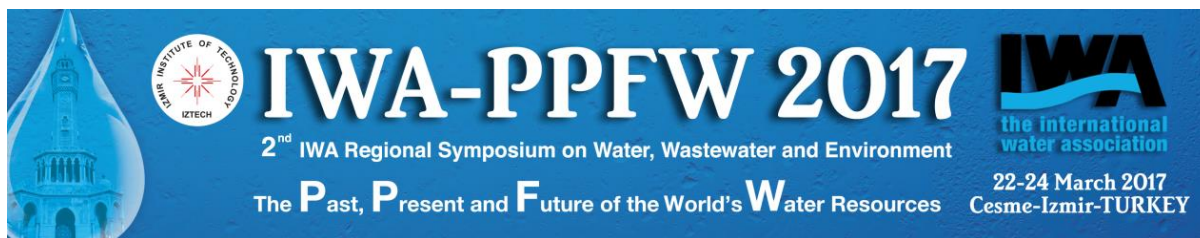
A cross-linked PVBC resin was prepared by suspension polymerization and the resin was reacted with excess of diethylenetriamine (DETA). The resulting amine modified resin was modified with chloroacetamide to obtain multiple amide functional groups.



Scheme 1. Preparation of multiple amide function resin

The sorption behavior of the resin was investigated using a batch system. The resulting polymeric sorbent has been demonstrated to be an efficient sorbent for removal of phenol.

Keywords: Batch system, chloroacetamide, phenol



ID_2967

PAST, PRESENT AND FUTURE OF TOILET FLUSHES - AN APPRAISAL THROUGH WATER SCARCITY, WATER QUALITY AND “FIT FOR PURPOSE” USE

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Abstract: The fact that the world is in a trend of approaching water stress and eventually to scarcity at this time, necessitates efficient use of water resources taking both the quantity and the quality of water into consideration. While water savings / water efficient consumption is a key element of control upon quantity, “fit for purpose” use of water is an approach which aims to match the quality of the water to be used for a specific demand with the requirements of that particular demand, which allows the use of the high quality water to be allocated to those beneficial uses which really necessitate that high a water quality. One very striking example is the option of using grey water in water efficient toilet flushes rather than water of drinking water as it is regularly done. Water savings of up to 6 times could be achieved through improved flushing options from the perspective of diminishing the amount of water used since 1970’s, as demonstrated upon the example of the Turkish megacity Istanbul, while possible future use of reclaimed grey water instead of high quality potable water from household taps is a wise choice in accordance with “fit for purpose” use.

Keywords: Water scarcity, water quality, water saving

ID_2942

CONTOUR AND 3-DIM REPRESENTATION OF FOOD ADDITIVE REMOVAL PERFORMANCES OF CATALYTIC WET AIR OXIDATION AS A GREEN WASTEWATER TREATMENT METHOD

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Abstract: Catalytic wet air oxidation performances of the LaBO₃ (B: Fe, Cu, Co) perovskite catalysts were investigated to remove the food additive Tartrazine from the aqueous solutions. LaCoO₃ catalyst which has 14.67 m²/g of BET surface area was determined to be the most suitable perovskite catalyst for the removal of Tartrazine in the catalyst screening experiments. A parametric study was carried out in the presence of LaCoO₃ catalyst. The interactive effects of the reaction temperature, catalyst loading, and the initial pH on Tartrazine degradation and decolorization are presented by contour and 3- Dim graphs. The optimum reaction temperature, catalyst loading, and the initial pH was determined as 60 °C, 0.5 g/L, and 3, respectively, whereas the initial dye concentration, reaction pressure and the air flow rate were fixed at 100 ppm, 1 atm and 0.61 L/min, respectively. Under the optimum conditions approximately 44% degradation and 55% decolorization were achieved.

Keywords: oxidation, treatment, Tartrazine, wastewater

ID_2906

ADSORPTION OF THE ANIONIC AND CATIONIC DYES BY WASTE ORANGE PULP DERIVED ADSORBENTS: EQUILIBRIUM AND KINETIC MODELING

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Abstract: In this study, the potential use of dried orange pulp (DOP) and acidic hydrolyzed orange pulp (AHOP)- as adsorbents for the removal of Remazol Black-B (RBB), an anionic reactive dye, and Methylene Blue (MB), a cationic dye, was carried out using a batch system. The effects of initial pH, particle size range and temperature on the initial adsorption rate, capacity and dye removal efficiency were investigated. The results indicated that adsorption was strongly pH-dependent but slightly temperature-dependent for each adsorbent-dye system. For RBB adsorption studies, while working pH value for DOP system was determined as 2.0, it was observed that this value shifted to 8.0 when AHOP was used. At the temperature range changing between 25°C-45°C it was seen that with increasing temperature, while the adsorption capacity of DOP increased, the adsorption capacity of AHOP decreased. On the other hand, the experiments performed by AHOP showed that MB adsorption rate and capacity was much more less than that of obtained by DOP at pH 6.0 which was determined as optimum pH value. Due to this reason the experiments of MB adsorption were carried out with only the dried orange pulp adsorbent. The Freundlich and Langmuir adsorption models were used for the mathematical description of adsorption equilibrium and isotherm constants were evaluated. It was decided that the Langmuir model was more suitable to describe the adsorption equilibrium for each system in the concentration range studied. According to the Langmuir model, while the highest RBB uptake capacity of DOP was determined as 62.4 mg/g at 25°C and pH 2.0, this value was figured out for AHOP as 84.4 mg/g at 45°C and pH 8.0. Similarly, the highest MB adsorption capacity of DOP was determined as 105.6 mg/g at 25°C and at a pH value of 6.0. Simple mass transfer and kinetic models were applied to the experimental data to examine the mechanisms of adsorption and potential rate-controlling steps. It was found that both external mass transfer and intra-particle diffusion played an important role in the adsorption mechanisms of dye, and adsorption kinetics followed the second order and the saturation type kinetic models for each sorbent. Finally, the thermodynamic parameters of adsorption were obtained by using thermodynamic equations for each system.

Keywords: Remazol Black B (RBB), Methylene Blue (MB), Orange Pulp, Adsorbent, Pretreatment, Acidic Hydrolysis, Adsorption

ID_2845

ASSESSMENT OF WATER QUALITY RELATED TO LEAD/ZINC MINES IN UMURBEY DAM BASIN, NORTHWESTERN TURKEY

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Abstract: The purpose of this study is to determine hydrochemical properties of the water resources and to assess the potential environmental consequence of the mining activities in Koru and Tesbihdere lead/zinc mine districts, and investigate detrimental effects caused by mining activities on the water resources and sediment quality in Umurbey dam basin (Biga Peninsula, NW Turkey). Cadmium, Cu, Fe, Mn, Pb and Zn concentrations in sediments downstream of Tesbihdere and Koru mines and in Umurbey dam sediments are higher than average values of world river sediments. The chemical analyses revealed that Fe, Zn Pb and Mn concentrations of a total of water resources (spring, surface water, groundwater and waste pool) reached to 2890 µg/l, 1785 µg/l, 1180 µg/l and 984 µg/l, respectively. Manganese concentrations of water samples collected from Umurbey dam was measured 584 µg/l. The metal discharges from Pb/Zn mines on Koru riverbed were huge, and Koru river was classified as polluted water (class III) according to Turkish inland water quality regulations. Leakage from flotation slurry deposits in Umurbey dam basin may pose long-term risk for environmental health.

Keywords: lead/zinc mine, water resources, water quality, Umurbey dam, heavy metal

ID_2861

PRODUCTION OF ACTIVATED CARBON FROM OILSEED RESIDUE BIOCHAR BY CHEMICAL ACTIVATION AND ITS USABILITY TO ABSORB REACTIVE DYE STUFF

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Abstract: In this study, activated carbon was produced from biochar obtained through pyrolysis oilseed residue by chemical activation and an adsorption capacity of activated carbon for removal of reactive dyestuff from aqueous solutions was investigated. The surface area and micropore volume of activated carbon was 1277 m²/g and 0.4952 cm³/g, respectively. The surface characterization of both biochar and activated carbon was undertaken using by Fourier transform infrared electroscope and scanning electron microscopy. The experimental data indicated that the adsorption isotherms are well described by Langmuir isotherm model. The activation energy of the system was calculated as 0.5-158 kJ/mol and the type of adsorption of dyestuff on the activated carbon was described as physical adsorption. Also, reactive dyestuff removal capacity appeared to be comparable to commercial products.

Keywords: activated carbon, absorption, biochar

ID_2862

THE REMOVAL OF PESTICIDE FROM AQUEOUS SOLUTIONS BY USING ACTIVATED CARBON OBTAINED FROM FRUIT JUICE INDUSTRY SOLID WASTE

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Abstract: Among the numerous agrochemicals in use today, the herbicide 2,4-Dichlorophenoxy acetic acid (2,4-D), has been widely applied to control broad-leaved weeds in gardens and farming. 2,4-D is commonly preferred because of its low cost and good selectivity. On the other hand, 2,4-D is a poorly biodegradable pollutant. Therefore, this study has focused on the adsorption of 2,4-D from aqueous solutions by using activated carbon derived from the orange (*Citrus sinensis* L.) pulp, known as a waste of fruit juice industry. Toward this aim, the effects of contact times, adsorbent dosage, initial pH, solution temperatures and initial concentration of solution on the adsorption of 2,4-D were investigated. The experimental data indicated that the adsorption isotherms were well described by the Langmuir equilibrium isotherm equation and the calculated adsorption capacity was 75.76 mg g⁻¹ at 318 K. The adsorption kinetic of 2,4-D obeys the pseudo-second-order kinetic model. The thermodynamic parameters indicated a spontaneous and endothermic adsorption.

Keywords: Activated carbon, pesticide, solid waste

ID_2951

REMOVAL OF 3-CHLOROPHENOL FROM AQUEOUS SOLUTION BY ADSORPTION USING TURKISH SWEETGUM BARK

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Abstract: Sweetgum, is a deciduous tree native to the eastern Mediterranean region, particularly of the south-western part in Turkey and commonly known as Turkish sweetgum, was investigated as biosorbent for removal 3-chlorophenol (3-CP) from aqueous solutions in this study. Batch biosorption experiments were carried out to investigate the effects of physicochemical parameters such as pH, contact time, and initial concentration. The results showed the removal of 3-CP was not very fast, during the first (250 minutes) and optimal biosorption capacity was at pH 6 of the solution and the biosorption process of 3-CP on Turkish sweetgum was described by a pseudo-second-order model predicting a chemisorption process. In addition, the equilibrium data were well characterized by the Langmuir isotherm model that confirmed the mono-layer coverage.

Keywords: Adsorption, sweetgum, biosorbent

ID 2849

DETERMINING BIOETHANOL PRODUCTION CAPACITY OF KLUYVEROMYCES SP. IN THE PRESENCE OF APPLE POMACE

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Abstract: Rapid depletion of fossil fuels will be a serious problem in the near future. Therefore, there is an urgent need to alternative energy sources. Among them bioethanol is one the most promising one. Some kind of different raw materials can be used for bioethanol production. Of these lignocellulosic materials such as agricultural wastes are promising feedstocks. *Saccharomyces cerevisiae* is the commonly used yeast for bioethanol production. However, there are some studies about new ethanol producer microorganisms in the literature. For this purpose, in our current study we isolated novel osmotolerant yeast strains from biscuit factory wastes and they were used for bioethanol production. Among them *Kluyveromyces* sp. coded as isolate 8 had higher ethanol production capacity than the other isolates in the media containing apple pomace as carbon source. Apple pomaces were supplied from local market Ankara/Turkey. Pomaces were hydrolyzed in 1% H₂SO₄ (v/v). Microbial growth, sugar consumption and bioethanol amounts were monitored periodically. *Kluyveromyces* sp. produced 9.5±0.21 g/L ethanol at 8 hours in the apple pomace medium. The highest ethanol amount was detected at pH 5. In this study apple pomace supported the growth and ethanol production of *Kluyveromyces* sp.

Keywords: bioethanol, *Kluyveromyces* sp, pomaces

ID_2855

REMOVAL OF SOME PHENOLIC MICROPOLLUTANTS FROM RAW HOSPITAL WASTEWATER BY BIOLOGICAL AND MEMBRANE PROCESSES

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Abstract: Micropollutants, such as pharmaceutical compounds, personal care products, antibacterial agents, pesticides, surfactants, plasticizers and different industrial additives are considered a rising concern in the environment because their presence in lower concentrations have been associated with endocrine disruption, chronic toxicity and development of pathogen resistance. The aim of the study was to determine the most efficient treatment method to remove ciprofloxacin (CIP), gemfibrozil (GFZ) and triclosan (TCS) from raw hospital wastewater among biological and membrane treatment processes. The treatability of these three phenolic micropollutants were investigated using an anaerobic/aerobic sequential biological reactor system at 5, 30 and 55 days of sludge retention times (SRTs), an ultrafiltration (UF) and a reverse osmosis (RO) membrane at 2.75, 3.75 and 4.75 bars of transmembrane pressures (TMPs). As a result of the study, it was found that the RO process with a 4.75 bars of TMP was more efficient than the anaerobic/aerobic sequential biological process at a SRT of 55 days to remove the CIP, GFZ and TCS from the raw hospital wastewater.

Keywords: Biological treatment, hospital wastewater, membrane treatment, phenolic micropollutants.

ID_2660

TREATMENT OF WASTEWATER CONTAINING ANTIBIOTIC WITH A NEW KIND OF COMPOSITE VIA ADSORPTION

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Abstract: In this study, maghemite ($\gamma\text{-Fe}_2\text{O}_3$) nanoparticles were impregnated to nanoporous carbon obtained from tomato waste (TWNC). The prepared magnetic composite (MTWNC) was characterized and used to remove tetracycline (TC) from water and then easily be separated from medium by a magnetic technique. The morphology and surface chemistry of MTWNC were studied by FTIR, SEM, SEM-EDX, VSM and BET surface area analyses. Batch adsorption studies were carried out and the effects of pH, initial TC concentration, adsorbent dose, ionic strength and temperature were investigated. The adsorption kinetics of TC onto MTWNC was feasible, spontaneous and endothermic in nature.

Keywords: adsorption, composite, treatment, wastewater

ID_2853

REMOVAL OF PHENOL FROM AQUEOUS SOLUTION BY USING POLYMER MODIFIED NANOCLAY

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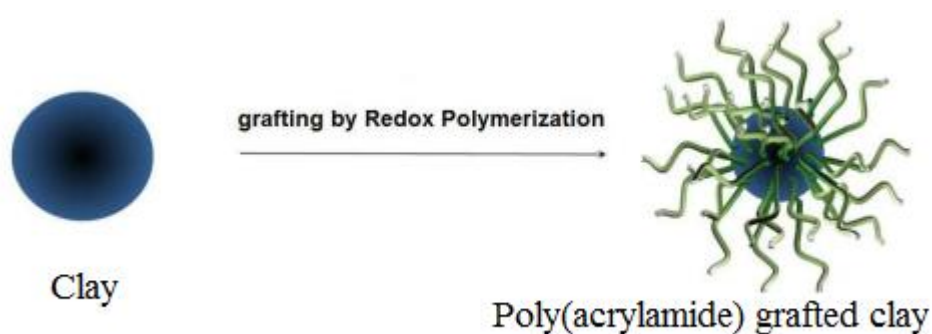
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Abstract: Phenol is primarily used in the production of phenolic resins, which are needed in the automotive plywood, construction and appliance industries. Other important uses of phenol are as a disinfectant and in medicinal products.

Among several methods used in wastewater treatment, adsorption is a convenient and effective technique to remove low concentrations of chemicals from water. Various adsorbents such as zeolites, polymeric sorbents, carbon nanotubes and clay have been investigated for the removal of phenol and phenolic pollutants from wastewater.

Clays are also used as fillers in polymer matrices due to their nanosize structure, thermal and mechanical resistance, and high adsorbing properties.

In this study, poly (acrylamide) was grafted onto clay via redox polymerization method by using cerium (IV) ammonium nitrate as initiator. The resulted core-shell type sorbent was used to phenol from aqueous solutions.



Keywords: Phenol, polymer, nanoclay, treatment

ID_2965

VISIBLE LIGHT PHOTO-FENTON OXIDATION OF TARTRAZINE IN THE PRESENCE OF BISMUTH OXYHALIDE CATALYSTS

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Abstract: A catalyst screening and parametric study for the removal of the food dye, tartrazine, were investigated by photo-Fenton-like oxidation method in the presence of metal impregnated bismuth oxyhalide catalysts. The catalyst was prepared in two steps: synthesis of bismuth oxyhalide and impregnation of Fe³⁺ or Cu²⁺ ions. After obtaining three different catalysts namely BiOCl, Fe-BiOCl and Cu-BiOCl, catalyst screening experiments were carried out. Both for BiOCl and Fe-BiOCl, neither degradation, nor decolorization could be achieved. However, Cu-BiOCl was much more successful and the further parametric study was carried out in the presence of Cu-BiOCl. The operating conditions evaluated were catalyst loading, visible light power, initial H₂O₂ concentration, initial pH and reaction temperature in terms of degradation and decolorization efficiencies. The optimum operating conditions were determined as 0.25 g/L for catalyst loading, 100 W for visible light power, 6 mM for initial H₂O₂ concentration, 6 for initial pH and 60 °C for reaction temperature by keeping the initial dye concentration constant as 50 mg/L. Maximum efficiencies obtained at optimum operating conditions were 48% for degradation and 75% for decolorization.

Keywords: decolorization, photo-Fenton, tartrazine

ID_2822

4-CHLOROPHENOL REMOVAL FROM WASTEWATER WITH PHOTSENSITIVE BINARY OXIDES UNDER SOLAR LIGHT IRRADIATION

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Abstract: Environmental applications of heterogeneous photocatalysis have been intensively studied in the past decades. Heterogeneous photocatalysis has shown a high efficiency in the photooxidation of many organic pollutants. UV and/or visible light are often used to accelerate the degradation of the pollutants catalyzed by these heterogeneous catalysts. The application of these lights needs specific equipment and additional cost. In this study, preferably solar light used accelerate the degradation and it is an advantage for process costs. ZnTiO₃ with perovskite structure is a potential candidate for applications in microwave dielectrics, gas sensors, sorbents for the desulfurization of hot coal gases and paint pigments. Recent studies have also found that it can be a useful candidate for microwave resonator materials and more preferably for low temperature co-fired ceramics. There are several methods to prepare ZnTiO₃ powder such as solid state reaction and sol-gel. Fundamental studies concerning the phase and the characterization of the ZnO-TiO₂ system have been done, and five compounds often exist in the ZnO-TiO₂ binary system including ZnTiO₃ (cubic, hexagonal), Zn₂TiO₄ (cubic, tetragonal) and Zn₂Ti₃O₈ (cubic). In this work, a novel photocatalyst of zinc titanate-titanium dioxide nanoparticles were prepared by sol-gel method using citric acid as chelating agent and ethylene glycol as stabilizer. In addition, transition metal oxide (Fe₂O₃, Co₃O₄ and CuO) loaded ZnTiO₃-TiO₂ nanocomposites were successfully prepared by solid state dispersion method. The structural, morphological and optical properties of samples were characterized by TGA/DTA, XRD, BET, FT-IR, DRS, PL, XPS and SEM techniques. The photocatalytic activity of samples was investigated by degradation of 4-chlorophenol in water under sunlight. The Fe₂O₃ loaded sample was found to exhibit much higher photocatalytic activity than the other composite powders. 7Fe₂O₃/ZnTi sample has the highest percentage of 4-chlorophenol degradation (100%) and highest reaction rate (1.27 mg L⁻¹ min⁻¹) was obtained in 45 minutes. The enhancement of photocatalytic activity for ZnTiO₃-TiO₂ sample with Fe₂O₃ addition may be attributed to its small particle size, the presence of more surface OH groups, lower band gap energy than other samples in this paper and the presence of more hexagonal ZnTiO₃ phase in the morphology.

Keywords: nanocomposites, wastewater, photocatalysis

ID_2823

PHOTOCATALYTIC ELIMINATION OF 2,4-DICHLOROPHENOL WITH V₂O₅-TiO₂ HETEROSTRUCTURAL SEMICONDUCTORS

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Abstract: In this study, binary oxide catalysts were successfully prepared with different wt% V₂O₅ loading by solid-state dispersion method and these nanocomposites were modified with surfactants. The catalysts were analyzed by XRD, DRS, FT-IR, SEM and BET techniques. The photocatalytic activities of the catalysts were evaluated for the degradation of 2,4-dichlorophenol under UV irradiation. 50 wt% V₂O₅-TiO₂ exhibited much higher photocatalytic activity than pure V₂O₅, TiO₂ and P-25. It was observed that the interaction between V₂O₅ and TiO₂ affected the photocatalytic efficiency of binary oxide catalysts. In addition to, CTAB and HTAB assisted samples significantly enhanced the efficiency of 50V₂O₅-TiO₂ catalyst. The highest percentage of 2,4-dichlorophenol degradation (100%) and highest reaction rate (2.22 mg L⁻¹ min⁻¹) were obtained in 30 minutes with (50V₂O₅-TiO₂)-CTAB catalyst. It is concluded that the addition of surfactant to binary oxide remarkably enhanced the photocatalytic activity by modifying the optical and electronic properties of V₂O₅ and TiO₂.

Keywords: 2,4-dichlorophenol; Degradation; Photocatalysis; Surfactant; Binary oxide; Characterization

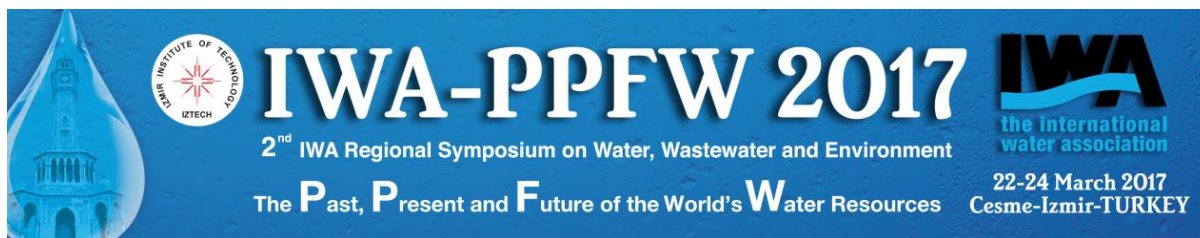
REMOVAL OF POLYPHENOLS FROM WASTEWATER

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Abstract: Laccase-catalyzed oxidative polymerization of 1-naphthol was carried out in a closed system containing acetone and sodium acetate buffer. The effects of initial 1-naphthol and dissolved oxygen concentrations on the initial reaction rate were investigated. A multiplicative mathematical model, using a function of 1-naphthol and dissolved oxygen concentrations, was developed for enzymatic polymerization and the corresponding biokinetic parameters have been evaluated for the first time. The activation energy and reaction rate constant of the laccase-catalyzed 1-naphthol polymerization were calculated as 57 kJ/mol and 311 l/s, respectively. The activation energy calculated was in the typical range of 30-60 kJ/mol and rate constant was of the order of magnitude of previously reported values for laccase-catalyzed reactions with different monomers. The obtained polymer was insoluble in water in contrast to that obtained from conventional polymerization methods and was only soluble in common organic solvents. The removal of precipitate can be achieved from the waste water of plants more at ease where phenolics are produced as side products. A mill can be placed in water circulating at several positions. As a consequence of the turning operation of the mill the polyphenols will be attached to the arms specially designed and thus be removed from wastewater to be recycled and used as engineering plastics which is comparable to the high costing and time consuming methods employed during the separation process of liquid-liquid mixtures.

Keywords: polyphenols, polymerization, wastewater



ID_2922

RAPID AND EFFICIENT COAGULATION AND FLOCCULATION OF DOMESTIC WASTEWATERS WITH HYBRID SYSTEMS

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Abstract: In wastewater treatment plants rapid coagulation-flocculation, low sludge volume and low coagulant-flocculent material amount are required in case of high wastewater rates and when a small area is available for wastewater treatment plants. In this work, rapid and efficient coagulant-flocculent formulations are developed for high precipitation rate and low sludge volume. Furthermore, coagulant-flocculent/ wastewater, volume ratio is kept at max 0.002-0.003% and total settling time is kept less than 5 min as preset system requirements. For this aim inorganic and polymeric salts are used together as two components and three component hybrid systems. Formulations are applied to real wastewater samples and efficiency of formulations is compared.

Keywords: Precipitation, wastewater, wastewater treatment, sludge.

ID_2844

UTILIZATION OF ACTIVATED CARBON PREPARED FROM PUMPKIN SEED SHELL FOR THE REMOVAL OF DYESTUFF FROM AQUEOUS SOLUTIONS AND WASTEWATER BY MICROWAVE RADIATION

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Abstract: In this study, the removal of the cationic (Methylene Blue, MB) and anionic (Acid Blue 193, AB) dyestuff from aqueous solutions and wastewater (synthetic) using activated carbon prepared from pumpkin seed shell as adsorbent (as catalyst) in the microwave-assisted (MW) method. This process is the combination of MW irradiation, MW adsorbent (as catalyst) and oxidant. The effects of radiation time, dosage of adsorbent and oxidant, initial dyestuff concentration on the removal efficiency were investigated. With the initial dyestuff concentration of 100 mg/L, dyestuff removal percentage was obtained 99% at low power by 3 min, 0.2 g activated carbon and 0.5 mL hydrogen peroxide for MB and 90% at low power by 3 min, 0.6 g activated carbon and 0.5 mL hydrogen peroxide for AB. Results suggest that the prepared activated carbon of pumpkin seed shell has potential in remediation of dyestuff contaminated waters.

Keywords: adsorbent, dyestuff, wastewater

ID_2636

CHALLENGES IN THE SYNTHESIS AND CHARACTERIZATION OF STABLE AND EFFICIENT NANO ZERO VALENT IRON

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Abstract: Nano Zero Valent Iron (NZVI) is an excellent adsorbent/reductant with wide applicability in remediation of persistent contaminants in soil, water and groundwater aquifers. However, there are concerns on the environmental fate of NZVI, its propensity for agglomeration as well as its stability in the air. Several modification methods have applied materials such as chitosan, carboxyl methyl cellulose and other coating substances to ensure production of NZVI with excellent air stability and dispersibility without compromising their activity for contaminant degradation and other use. None of these methods was able to strike the balance in term of air stability, activity, cost and toxicity of NZVI. The modifications of NZVI using polyphenolic containing plant extracts offer a better option. In the current studies, highly efficient green nano zero valent iron (gNZVI) was successfully synthesized by the modification of conventionally synthesized NZVI with an amount of dried leaf extracts of *Harpephyllum caffrum* (a South African garden plant with known antioxidant properties). Systemic characterizations and activity testing with TGA and organic dye (Orange II sodium salt) respectively confirmed the effectiveness of the synthesized gNZVI. Further characterizations with, TEM SEM, XRD, FT-IR and BET confirmed the synthesis of crystallized, well dispersed and predominantly 10-50 nm in diameter size gNZVI. The synthesized gNZVI is air stable, well dispersed with high reactivity in wastewater treatment of persistent organic pollutants.

Keywords: Nano particle, NZVI, GNZVI, TGA, TEM, XRD, BET, SEM, chitosan, *Harpephyllum caffrum*

ID_2815

OPTIMIZATION OF MICROBIAL POLYHYDROXYBUTYRATE (PHB) PRODUCTION UNDER AEROBIC DYNAMIC FEEDING REGIME AT DIFFERENT CARBON AND NITROGEN LOADINGS

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Abstract: The aim of this study was to research the polyhydroxybutyrate (PHB) production under fully aerobic operation conditions in sequencing batch reactor. Aerobic dynamic feeding regime, a successful strategy to enrich PHB producers in mixed culture, was used as PHB production process. In this process, the feast period was allowed the PHB storage while a certain part of stored PHB was used for continued growth in famine period. In the first part of study, the effect of various ammonium nitrogen loading at the constant influent carbon loading was investigated on PHB accumulation ability of aerobic dynamic feeding activated sludge, corresponding to different C/N ratio. The results indicated that nitrogen limitation was a successful strategy for PHB synthesis under ADF regime and operational conditions containing carbon of 375 mgC/L and nitrogen of 3.75 mgN/L was founded optimum, corresponding to nitrogen limiting conditions. The rest of the study, SBR was operated with increasing carbon and nitrogen loading at the constant C/N ratio. PHB content of cell dry weight improved with the 3-fold increment and reached maximum value obtained during all study periods. Additionally, total organic carbon removal efficiencies were over 67%.

Keywords: Aerobic dynamic feeding regime, carbon and nitrogen loading, nitrogen limitation, polyhydroxybutyrate (PHB)

ID_2816

TREATMENT OF RAW TEXTILE WASTEWATER BY SULFATE REDUCING BACTERIA IN MICROBIAL FUEL CELLS

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Abstract: The microbial fuel cell (MFC) converts chemical energy of organic compounds in the wastewater to electrical energy through catalytic reactions of microorganisms. Decolorization of textile wastewater is crucial before it is discharged because of including quite color, organic matter, and toxicity. For this purpose, the aim of this study is to investigate the simultaneous treatment of raw textile wastewater and bioelectricity production in MFC technology. The raw wastewater concentration had a great effect on the electricity generation characteristics of MFC system. MFC was fed with raw textile wastewater at varying dilution ratios (85%-0%), but dissolved organic carbon (DOC) and sulfate concentration was always kept constant around 400 and 600 mg/L, respectively. DOC removal was adversely affected at increasing dilution ratios resulted from increasing inert DOC. This study indicate that this system removed about 69% of DOC, 68% of sulfate and 55% of color removal at the optimum conditions containing dilution ratio of 50%, corresponding to yield of about 29 W/m² power density and 210 Pt-Co effluent color concentration.

Keywords: MFC, raw textile wastewater, dilution ratio, electricity generation.

ID_2962

APPLICATION OF OZONE/FENTON ON BIOLOGICALLY TREATED REAL TEXTILE WASTEWATER AS POST TREATMENT TO REMOVE RESIDUAL COLOR AND COD

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Abstract: The aim of this study was to investigate the applicability of ozone or/and Fenton process to remove residual color and chemical oxygen demand (COD) from biologically treated real textile wastewater, corresponding to residual color of 1358 Pt-Co and COD of 528 mg/L. Initially, Fenton process was optimized under varying $\text{Fe}^{2+}/\text{H}_2\text{O}_2$ molar ratios ranging between 5 and 0.2 at the constant Fe^{2+} concentration of 3 mM. Optimum $\text{Fe}^{2+}/\text{H}_2\text{O}_2$ molar ratio was found 1 providing high color removal (73.3%) with low sludge production (213 mg/L). Afterwards, ozone process was applied at varying reaction times and the increasing ozonation time from 5 to 60 min resulted in decreasing effluent color and COD concentrations while ozone consumption increased from 0.03 $\text{kgO}_3/\text{kg COD}$ to 0.21 $\text{kgO}_3/\text{kg COD}$. Therefore, optimum time was determined to be 30 min. Afterwards, combined ozone/Fenton process was optimized under different chemical dosage of Fe^{2+} and H_2O_2 but with optimum ozonation time obtained from previous part. The use of combined process provided higher color removal efficiency at lower ozone consumption compared to separate systems, corresponding to about 97% color removal and 0.07 $\text{kgO}_3/\text{kgCOD}$ ozone consumption.

Keywords: Fenton, ozonation, treatment, wastewater

2663
**REUSE OF PURIFIED WASTEWATER BY PHYTOREMEDIATION
FOR IRRIGATION**

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Abstract: Green spaces in the city of Biskra resist to an arid climate, of the summer season and consequently suffer from water shortage, caused mainly by evaporation and transpiration from plants. To remedy this problem, the study suggests to use the ability to reuse wastewater of sewerage, treated by constructed wetlands (phytoremediation), for irrigation by drip system. This technique was applied to an area of the city of Biskra.

Keywords: Purification, constructed wetlands, reuse water, macrophyte, irrigation, drip system

WASTEWATER PIPELINE DESIGN IN ACCORDANCE WITH SEA-PIPE-SOIL INTERACTION

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Abstract: After the treatment of the wastewaters, a pipeline is used to transfer the treated water from the onshore pump station to the wastewater collection marine environment. This technique is required for the dilution process in the marine environment instead of a secondary treatment. When the pipeline design for wastewater treatment is implemented, the stability issues of the pipelines must be considered because the pipeline design is based on factors such as currents, waves, geotechnical conditions, physical properties of the water and pipe's material characteristics. At this point, a computer program is beneficial for the quick design of wastewater pipelines. To find a suitable design under these various design limitation and factors, the algorithm of the Submarine Pipeline Design (SUPLID) software was developed which is a powerful tool for stability analysis of the submarine pipeline against dynamic current-wave motion and seabed characteristics. The SUPLID program provides a flexible design environment for the design engineer for dimensioning and stabilizing the pipeline system with or without artificial weights. In this study, the main methodology and the structure of the SUPLID program was introduced and one of its application for a typical submarine wastewater pipeline was discussed.

Keywords: Wastewater pipelines, computer-aided design of sub-sea pipes, sea-pipe-soil interaction, stabilization of sub-sea pipes

ID_2914

SELECTIVE EXTRACTION OF ATRAZINE ON IMPRINTED MEMBRANES PREPARED BY USING GAMMA IRRADIATION

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Abstract: Atrazine is one of the most widely used herbicides all over the world. Besides its carcinogenic potential, atrazine causes serious health problems such as weight loss, birth defects, decreased reproductive organ size and disorders in hormone functionality. It has been reported that atrazine can accumulate in water, soil and some organisms [See *et al.*, 2010]. European Union declared that triazine group herbicides such as atrazine, simazine and metribuzine are in the priority substances list for water policy. Also the use of atrazine has been banned in European Union since 2004. Its acceptable limit is declared as 3 ppb by USA Environmental Protection Agency, EPA. However, atrazine is still one of the most abundant herbicides in surface water.

This study presents synthesis and characterization of atrazine imprinted polymers by using *in-situ* membrane preparation via gamma irradiation. Methacrylic acid was selected as functional monomer and functional monomer/template molecule ratio was determined as 2/1 [Lakshmi *et al.*, 2013] where ethylene glycol dimethacrylate was used as crosslinker. Atrazine imprinted membranes were characterized by using ATR-FTIR, XPS, SEM, AFM and PALS. In the AFM and SEM analyses, it was observed that the presence of template molecule imparts homogeneity to the topology of imprinted membranes. In the positron annihilation lifetime spectroscopy (PALS) analysis it was observed that presence of atrazine causes a decreasing in the size distribution of free volume holes while an increasing in the size of holes in the matrix. Binding characteristics were investigated as a function of various factors such as concentration of template molecule, pH and time. Evaluation of adsorption isotherms showed Bi-Langmuir behaviour for atrazine imprinted polymers. Results of kinetic studies showed that imprinted polymers showed pseudo second order kinetics where adsorption was chemically controlled. Finally, specific binding experiments were carried out for atrazine imprinted polymers using molecules with similar chemical structures, namely simazine and metribuzine.

Keywords: Atrazine, *in-situ* membrane, molecularly imprinted polymer.

ID_2921

A VERY SENSITIVE SENSOR FOR PB(II) DETERMINATION IN AQUEOUS ENVIRONMENT

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Abstract: Track-etched membranes are a special kind of membranes where pores are built ‘one by one’ by swift-heavy ion bombardment onto polymeric films. The present work reports on the combination of RAFT polymerization and radio-induced grafting polymerization to functionalize the nanochannels of track-etched β -PVDF membranes with poly (acrylic acid) (PAA) as schematically shown in Figure 1. This ensemble or PAA grafted nanochannels is transformed into a nanoporous electrode by deposition of a thin gold layer on both surfaces of the membrane as described in our patented work [Barsbay et al., 2013]. The result is a new kind of β -PVDF based mercury free electrode, referred to as a functionalized membrane electrode (FME) with PAA grafts with well-defined lengths inside the nanochannel walls and porous gold conductive layers on each side of the film.

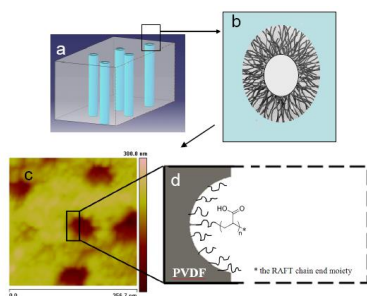
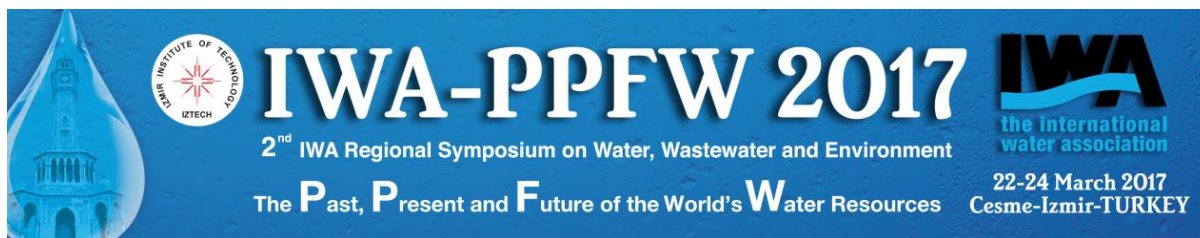


Figure 1. (a) Scheme of functionalized track-etched nanoporous PVDF membrane (b) Scheme of the well-organized radiografted polymer chains on a pore wall by RAFT polymerization (c) AFM photograph of PAA grafted track-etched PVDF membrane surface showing the nanochannels of ~ 70 -80 nm diameter with a chemical description of the pore interior (d) covered by PAA grafted chains ended by the RAFT moiety.

Synthesized PAA-g-PVDF copolymers with various degrees of grafting from 5% to 93% were characterized by various methods. The controlled fashion of RAFT mediated grafting was proved by an extensive size exclusion chromatography (SEC) analysis and AFM results. The FMEs synthesized have been found to be sensitive to sub-ppb concentrations of Pb^{2+} in square-wave anodic stripping voltammetry (SW-ASV) measurements. The sensitivities of RAFT mediated FMEs compared to those synthesized by conventional free-radical polymerization method were found to be almost three times higher at sub-ppb concentrations of Pb^{2+} in SW-ASV analysis whereas this improvement decreases to around 40% at higher concentrations. Given the economic benefits and sensitivity of the FMEs developed, it is believed that the reported method may carry our understanding and ability a step forward for preparing membrane electrodes for analytical applications. Along with the potential benefits, the present work presents a unique combination of two major approaches to nanotechnology:



Growing of graft chains from the radicalic species on the walls of nanochannels with a perfect control of the chain length as well as molecular weight distribution as a clear demonstration of 'bottom-up' approach whereas formation of nanochannels of β -PVDF membranes by swift heavy ion bombardment as an example of "top-down" approach.

Keywords: membrane, nanochannels, sensors

ID_2828

REMOVAL OF SODIUM DODECYL BENZENE SULFONATE (SDBS) FROM WATER BY CHITOSAN FILMS

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Abstract: Environmental pollution has become a serious international problem in recent years. Surfactants are one of major pollutants of wastewaters. Among them, sodium dodecyl benzene sulfonate (SDBS) is well known anionic surfactant. Surfactants harm aquatic life and causes water pollution [Lechuga *et al.*, 2016]. Therefore, it is important to removal of surfactants from environmental water. Chitosan is a cationic charged natural polymer and it has biocompatible and biodegradable properties. This study aims to remove an anionic surfactant (SDBS) from aqueous solutions by chitosan films as a nontoxic adsorbent. Sodium sulfate were chosen for ionic crosslinking to increase durability and stability of films in aqueous media. The concentrations of SDBS in aqueous solutions were determined by UV spectroscopy. In order to optimize adsorption conditions, several experiments were done. Effect of pH, contact time and initial SDBS concentration were investigated as preliminary studies. All adsorption experiments were conducted at 25 °C in a temperature controlled water bath shaker. Experimental results were modeled by isotherm and kinetic models.

Keywords: Chitosan films, kinetic models, polymer, wastewater,

ID_2841

LIFE CYCLE ASSESSMENT STUDY ON WATER REUSE APPLICATIONS

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Abstract: Life cycle assessment (LCA) approach was used in the assessment of environmental impacts of some polishing units for the aim of agricultural irrigation of the wastewater treatment plant (WWTP) effluents. These alternative polishing units were assessed: (1) microfiltration and UV disinfection (Case-1), (2) cartridge filter and ultrafiltration (Case-2), and, (3) just UV disinfection (Case-3). Two different energy sources, electric grid mix (Scenario-1) and natural gas (Scenario-2), were into consideration to assess the environmental impacts of them. Afterwards effluent of each case has evaluated to the criteria required for irrigation of sensitive crops corresponding to Turkey regulations. Evaluation of environmental impacts was carried out with GaBi 6.0 LCA software. The results of the study revealed that, cartridge filter and ultrafiltration combination with electric grid mix has the biggest impact on the environment for almost all impact categories. In general, the most environmentally friendly solution is the UV disinfection.

Keywords: life cycle, treatment, disinfection, water reuse

ID_2920

REMOVAL OF CATIONIC DYE (METHYLENE BLUE) FROM AQUEOUS SOLUTION WITH ACTIVATED BIOSORBENTS

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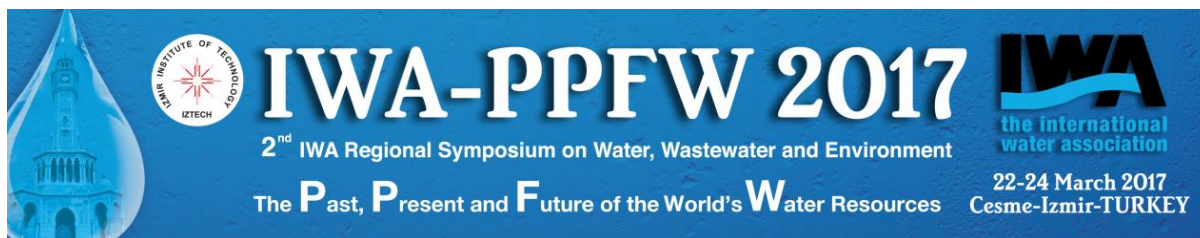
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Abstract: In this study, the aim is to remove of cationic dyes by using rosehip seeds activated by sulfuric acid (SARS). Adsorption of methylene blue was evaluated in terms of time, pH, initial solution concentration, adsorbent amount, temperature. Changes of surface properties were examined by SEM, BET, FTIR, Boehm titration, pH_{pzc} and elemental analysis. The adsorption mechanism was explained by using Langmuir, Freundlich isotherm models and Pseudo first-order, Pseudo second-order, intraparticle diffusion kinetic models. After activation, it was observed that the surface properties of SARS and adsorption capacity were quite changed. Mechanism of MB adsorption onto SARS was found to be as ion exchange mechanism and fit Langmuir isotherm and second order kinetic model

While the Q_{max} value of the unactivated rosehip seed was found to be 35.79 mg/g, the Q_{max} value of activated rosehip seed was found to be 181.81 mg/g at pH 10 at room conditions. As a result, it was observed that activated biocarbons could be used for removal of cationic dyes (methylene blue) from aqueous solutions.

Keywords: Adsorption, activated carbon, biosorbent, cationic dye



ID_2829

WASTEWATER ANALYSIS BY USING ICP-OES

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Abstract: In this study one of the wastewater analysis techniques was explained. A wastewater sample was analyzed by using ICP-OES. Some metals such as Cd, Cr, Cu, Pb, Zn concentrations were determined, which have been restricted by national regulations. The results showed that the sample metal concentration met the discharge limits.

Keywords: metals, analysis, wastewater, ICP-OES

ID_2941

STUDY OF BIODEGRADABILITY EVOLUTION RATE AND OPTIMISATION OF KINETIC AND STOICHIOMETRIC PARAMETERS FROM AGRO-FOOD WASTEWATER

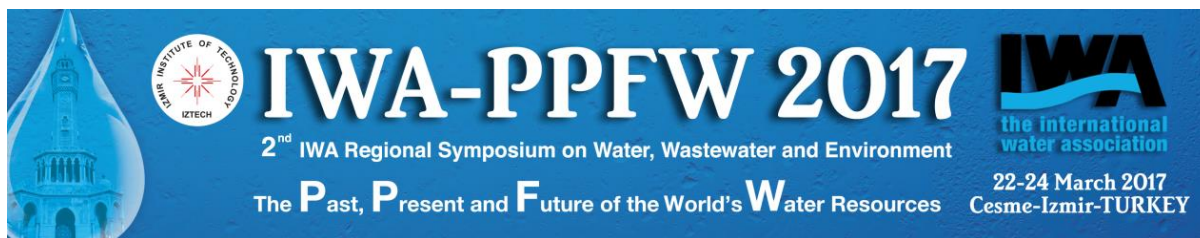
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Abstract: Waste of food industries presents diversity and seasonal variability. They consist mostly of organic waste (Orhon and al, 1999). Biological processes are the important processing step for industrial wastewater effluents and particularly the food industry. Experimental measures for understanding the biological treatment is required for industrial wastewater, because urban effluents are well studied in literature, while industrial effluents are much more complex and diversified (Insel et al. 2002). A better understanding of industrial waste can guide and choose the optimal treatment faster to apply them. Van Hulle et al. 2004 have used the extended ASM1 to take into account the specific chemical industry wastewater components. Lucas et al. 2005 have modified the ASM2d. They added the biological food industry wastewater reactions. Karahan et al. 2007 have used the modified ASM3. This model was adopted to evaluate textile wastewater components. Zhongda Xu et al. 2006 compared ASM1 to ASM2d model, with respect to sensitivity to various nitrogen fractions in the tomato wastewater. However, a successful application of such modelling requires the estimation of kinetic and stoichiometric parameters as well as wastewater and activated sludge characterization. It is therefore necessary to describe quantitatively the microbiological kinetics processes and to detail substrate and biomass characteristic. In this paper, the aerobic degradation kinetics parameters of agro-food wastewater organic matter will be discussed. The respirometry is a common method used to determine the wastewater characteristics (Petersen et al., 2003, Lagarde et al., 2005). The respirometry is a dominant method for kinetic and stoichiometric parameters calibration. It is based on the measurement and interpretation of the oxygen consumption rate. Several studies have shown and verified the accuracy of this methodology for ASM calibration models (Spanjers and Vanrolleghem, 1995; Pollard et al., 1998). Finally, methods based on batch respirometry experience are recommended by IWA task group (Henze et al., 2002, Petersen et al., 2003). The main objective of this work is to describe the aerobic biodegradation of organic matter and to estimate kinetic and stoichiometric parameters from Tunisian agro-food wastewater using respirometry methods.

Keywords: Industrial wastewater, modeling, estimation, agro-food wastewater.



ID_2867

REDUCTION DYE IN PAINT AND CONSTRUCTION CHEMICALS WASTEWATER BY IMPROVED COAGULATION FLOCCULATION PROCESS

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Abstract: A coagulation-flocculation process was applied to wastewater of paint and construction chemicals producing factory in Turkey. Ferric chloride was used as coagulant and several natural based materials, namely limestone, pumice, sepiolite, bentonite and mussel shell were used as flocculant aids. The effects of dosage of flocculant aids on the pH, color and electrical conductivity of wastewater were studied. The experimental results showed that the treatment with all substances was very effective. The pHs of treated wastewater were obtained in the range of 5-7 without needing pH adjustment process. 15 Pt-Co color values were obtained on average, which is similar to pure water clarity. The amount of solute in the wastewater was evaluated by the electrical conductivity values. According to the results, under the optimum treatment conditions, chemical oxygen demands (COD) were determined.

Keywords: flocculant, treatment, wastewater

MICROFILTRATION CERAMIC MEMBRANES WITH BIOCIDAL PROPERTIES OF THE SURFACE

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Abstract: Porous ceramic supports (pore size 10-100 µm, porosity 30%) of tubular form were obtained by the method of isostatic pressing based on natural quartz sand with its subsequent sintering, microfiltration membranes (the size of pores – 5,0 – 10,0 µm, thickness of coating – 150-200 µm) was formed on the surface. The method of protection of filtering surfaces of ceramic membranes from bio-fouling by applying biocidal layer that contains complex compounds of poly(6-aminocapamethylene) guanidine is developed.

Keywords: membrane, ceramic membrane, microfiltration

ID_2937

THICKENER WATER NEUTRALIZATION BY FLY ASH OF SILOPI THERMAL POWER PLANT - SLURRY AMD TREATMENT

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Abstract: The long duration of biological methods to neutralize AMD may remove metals from acidic polluted solution. This study introduced chemical neutralization and aeration treatment of polluted acidic waters in Şırnak Coal Mine site and Siirt Copper Concentrator site as happens in waste waters of chemical industries and textile processing plants. The construction engineering of collector ponds were also so much critical in the point of cost of a case remediation model and muddy fertilization by Şırnak Thermal Power Plant waste, bottom ash and fly ash in agricultural fields soil in Şırnak Coal Mine site, and how these facts may affect the possibility of remediation in the future were discussed.

Organic fertilizer matter of fuming acid and humic acid containing humate formed. Soil remediation process for both muddy bottom precipitates of treatment pools and aeration pools were collected and treated by CO₂ saturated waters. The comparison of the common methods are described and discussed with fly ash utilization and CO₂ gas of power plants containing alkali matter improved neutralization and carbon matter of soils.

Keywords: Acid mine drainage; Geochemistry, Soil remediation, Restoration, Construction;

ACTIVITIES FOR REDUCTION OF ENERGY CONSUMPTION IN SEWAGE TREATMENT PLANTS BY 50%

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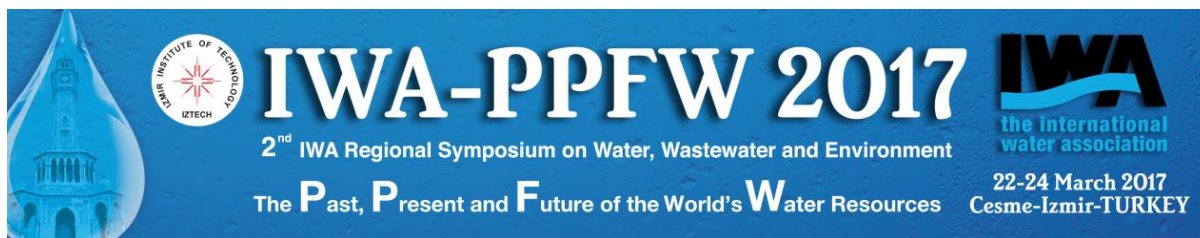
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Abstract: With the purpose of reducing the energy consumption in wastewater treatment plants (WWTPs) by 50%, the Japan Institute of Wastewater Engineering and Technology is performing a collaborative research with commercial vendors and local public organizations.

As a result of the collaborative research, technical materials have been published, and by changing the air diffuser and air blower in the wastewater treatment facilities to an efficient type through collaborative research performed until now, it has become possible to reduce energy by 25 to 40% as compared to the conventional type, and in addition, it has been confirmed that it is possible to reduce the amount of energy consumed as compared to the conventional type by performing air flow rate control using an ammonia sensor and adopting an energy-saving type reactor agitator. Furthermore, in sludge treatment facilities, it is possible to reduce the amount of energy consumption by 63 to 75% as compared to the conventional type in the case of a sludge thickening facility by installing an energy-saving facility, and in addition, the energy consumption reduction effect has been confirmed in sludge dewatering facilities and sludge incineration facilities.

Keywords: energy consumption, wastewater, treatment, wastewater



Theme C Wastewater & Environment

POSTER PRESENTATION

ID_2958

THE USE OF VOLCANICS AS A NATURAL SORBENT IN THE REMOVAL OF LEAD AND COPPER FROM WATERS

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Abstract: Water pollution is among the most important environmental issues today, and heavy metal pollutants are the main cause of this problem. The presence of heavy metals in water sources is critical because they accumulate in living forms and are not biodegradable¹. Lead (Pb) and copper (Cu) are the oldest known toxic substances which are widely used in many industrial applications^{2,3,4}. These toxic metals find their way to enter the water bodies through wastewaters. Therefore, their removal from the waters is a very important environmental concern. In this study, the ability of the youngest volcanic rocks of Western Anatolia, Kula volcanics, has been demonstrated to remove Pb(II) and Cu(II) from aqueous solutions, for the first time. The batch method was employed and inductively coupled plasma mass spectrometry (ICP-MS) was used in all determinations. The optimum parameters viz., pH, contact time, sorbent amount/solution volume ratio were evaluated. The sorbent capacities are found to be as 9.90 and 11.37 mg g⁻¹ for Pb(II) and Cu(II), respectively. The method was applied to the natural river water samples and it was observed that the sorbent can successfully be applied for the removal Pb(II) and Cu(II) ions with acceptable accuracy and precision.

Keywords: natural sorbent, lead, pollution, treatment

ID_2959

INVESTIGATION OF LEAD, COPPER AND ZINC SORPTION BY NATURAL MAGNETITE AND ITS APPLICATION IN THE WATER TREATMENT

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Abstract: Toxic heavy metals in air, soil, and water are global problems that are a growing danger to the environment. There are hundreds of sources of heavy metal pollution, including the coal, natural gas, paper, and several industries etc.. Monitoring the concentration of heavy metals and their removal has become increasingly important in global systems. Lead (Pb), zinc (Zn), and copper (Cu) were metals of interest in this study due to their potential pollution impact into the environment. These toxic metals find its way to the water bodies through wastewaters³. In this study, natural magnetite was investigated for the removal of Pb, Cu and Zn ions from water samples. The optimum experimental conditions including pH, sorbent amount and contact time have been established. The sorbent capacities were found to be as 13.09, 7.98 and 35.95 mg g⁻¹ for Pb, Cu and Zn, respectively. The sorbent was also found to remove the target analytes (≥98%) in the presence of several competitor ions (Fe, Al, Ni, Co, Mn, Cd, Ba, Ca and Mg). The application of the sorbent for the removal of Pb(II), Cu(II) and Zn(II) ions gave applicable results (>90%) with high accuracy and precision for ultrapure and river water samples.

Keywords: treatment, heavy metals, sorption

POLYMER WASTE DERIVED NANOPOROUS CARBON FOR REMOVAL OF METHYL ORANGE AND BROMOPHENOL BLUE FROM AQUEOUS SOLUTION

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Abstract: Adsorption behavior of m-aminophenol, nitrophenol and pentachlorophenol from aqueous solutions on activated carbon, synthesized on the base of industrial by-product polyolefin wax (from industrial production of polyethylene at low pressure) and phenol-formaldehyde resin, was investigated. It was established that adsorption capacity is related to the surface area and composition, as well as to the nature of the carbon adsorbent. Despite its high porosity, the obtained nanoporous carbon displays adequate adsorption capacity towards investigated aromatic compounds.

All studied adsorbates show high affinity towards carbon, confirming that retention mechanism occurs via non-covalent interactions between electronic density of the adsorbent and molecules of aromatic pollutants. Electrostatic interactions may also appear depending on the solution pH and the charge distribution of the carbons, and these effects have significant influence on the performance of the carbon adsorbent.

Keywords: carbon adsorbent, nanoporous carbon, polymer,

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ID_2972

ENVIRONMENTAL ASSESSMENT OF GAMMA RADIATION AND METAL LEVELS IN SEDIMENTS OF MERIC RIVER, TURKEY

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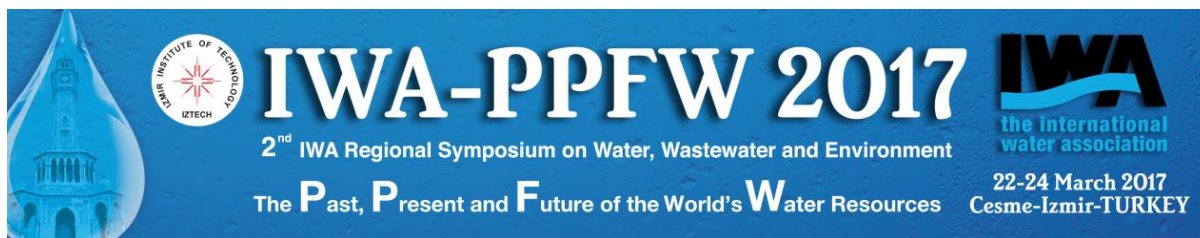
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Abstract: Environmental radionuclides and metals are widespread in the earth's environment. Natural and artificial radionuclides and their impacts on the environment are the subject of aquatic radioecology studies.

In this study, it is aimed to determine the radioactivity (^{226}Ra , ^{232}Th , ^{40}K and ^{137}Cs) and metal levels (Ni, Pb, Zn, Fe, Cd, Co, Cu, Mn) in sediment of Meric River in Trakya region. In sediment samples radioactivity levels were measured and determined by using HpGe gamma spectrometry. Heavy metal concentrations were measured by atomic absorption spectrometry. The average activity concentrations of ^{226}Ra , ^{232}Th , ^{40}K and ^{137}Cs in sediment samples are $27.50 \pm 0.83 \text{ Bq.kg}^{-1}$, $32.27 \pm 0.86 \text{ Bq.kg}^{-1}$, $660.77 \pm 6.78 \text{ Bq.kg}^{-1}$, $3.11 \pm 0.32 \text{ Bq.kg}^{-1}$, respectively. The total heavy metal concentrations in the sediments decrease in the order of $\text{Mn} > \text{Fe} > \text{Zn} > \text{Cu} > \text{Pb} > \text{Ni} > \text{Co} > \text{Cd}$. The total average absorbed dose rate in the study area is found to be 59.84 nGy.h^{-1} , whereas the annual effective dose rate has an average value of $73.39 \mu\text{Sv.y}^{-1}$.

Keywords: gamma, radionuclide, metal, sediment, river

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ID_2803

REMOVAL OF METHYLENE BLUE FROM AQUEOUS SOLUTION BY ADSORPTION USING BENTONITES

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Abstract: Increasing amount of dyes in the ecosystem particularly in wastewater has propelled the search for more efficient low-cost adsorbents. The effective use of the sorption properties (high surface area and surface chemistry, lack of toxicity and potential for ion exchange) of different clays as adsorbents for the removal of different type of dyes (basic, acidic, reactive) from water and wastewater as potential alternatives to activated carbons has recently received widespread attention because of the environmental-friendly nature of clay materials.

In this study, the adsorption of a basic dye (methylene blue) on Sodium Bentonite; NaB and Calcium Bentonite; CaB samples were studied. The Langmuir and Freundlich adsorption models were applied to describe the equilibrium isotherm and the isotherm constants were determined for each of the samples. The Langmuir model agrees very well with experimental data. Characterization of bentonites was made using Fourier transform infrared spectroscopy (FTIR) with a Perkin Elmer 100 FTIR spectrometer in the 4000 to 400 cm^{-1} wave number range using DRIFT (Diffuse Reflectance Infrared Fourier Transform) technique.

Keywords: Adsorption, Basic dye, Bentonite, Characterization, FTIR.

ID_2851

BIOETHANOL PRODUCTION FROM TURNIP JUICE DISCARDS BY PICHIA STIPITIS

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Abstract: Result of inevitable depletion of fossil fuels there has been an increasing interest in alternative energies. Because of its renewable and environment friendly features bioethanol is one of the most important energy sources. Using of bioethanol is important strategy for reducing global warming. Bioethanol can be blended with gasoline at the vehicles use to reduce CO₂ emissions up to 90%.

Turnip juice is a popular soft beverage in Turkey. After turnip juice production; black carrots and turnips are not used for another industry and disposed as a waste. Therefore, in the current study we examined bioethanol production potential of turnip juice discards. Initial biomass loading, fermentation time and pretreatment conditions were optimized.

Turnip juice discards were obtained from Kilikya Şalgam Co. and dried in the oven at the 70 °C. To obtain fermentable sugars; discards were hydrolysed in 1% H₂SO₄ (v/v). Yeast growth, initial and consumed sugar concentrations were monitored periodically. Bioethanol concentration was determined by using gas chromatography.

It is found that *P. stipitis* was produced 0.32±0.06 g/L bioethanol at the end of 12 hours in the 50 g/L turnip juice discard medium. It could be concluded that turnip juice discards are suitable feedstock for second generation bioethanol production.

Keywords: bioethanol, turnip juice, *pichia stipitis*

ID_2832

CHROMIUM (VI) BIOREMOVAL FROM WASTEWATERS USING MICROALGAE NAMELY GONIUM SP.

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Abstract: Increasing industrialization has made contamination of heavy metals into the environment. The most widespread heavy metals can be found in the environment is Cd, Cr, Cu, Hg, Pb, and Zn. Especially Cr(VI) has high toxic, carcinogenic and mutagenic effects. Thus, Cr(VI)-contaminated wastewaters have to be treated. Biological treatment methods are preferred for their efficiency, safety, and economy. In biological treatment methods, microalgae are promising organisms having ability to remove toxic heavy metals from the environment, and growth rate by utilizing different carbon sources. *Gonium* sp. was obtained from Ankara University, Faculty of Science Laboratories' culture collection. Experiments were done under different pH levels (7.5-9.5) and pollutant concentrations (3-20 mg/L). Trials were performed in F/2 media under a 2400 lx light intensity for an incubation for 15 days at 30 °C. During the incubation period, samples were taken every 5 days. The concentration of Cr(VI) in the supernatant was determined spectrophotometrically (540 nm) using diphenyl carbazide reagent in acid solution. Chromium(VI) bioremoval by *Gonium* sp. was very high after incubation for 1 day under different pH levels. *Gonium* sp. biomass had higher removal capacity under pH level of 8.5. With an increase in pollutant concentration, bioremoval efficiency decreased.

Keywords: bioremoval, chromium, wastewater

ID_2950

TAGUCHI OPTIMIZATION METHOD FOR 2,4,5 TRICHLORO PHENOLS FROM AQUEOUS SOLUTION USING TURKISH SWEETGUM (LIQUIDAMBAR ORIENTALIS) BARK

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Abstract: Removal of chlorophenols from the aqueous solutions is very important because they are one of the dangerous pollutants. In this research, adsorption of 2,4,5-trichlorophenol (2,4,5-TCP) from aqueous solution were performed by using Turkish sweetgum bark. These studies were carried out by batch system and the effect of some parameters such as pH, contact time, initial concentration and the amount of adsorbent were investigated. It was used to Taguchi's Orthogonal Array (OA) analysis to find best experimental parameters for the optimum design process in this study. The results show that Turkish sweetgum bark can be used to as biosorbent for the removal of 2,4,5-TCP from aqueous solution and the adsorption of 2,4,5-TCP on Turkish sweetgum bark can be explained clearly by Taguchi's Orthogonal Array (OA) analysis.

Keywords: 2,4,5-trichlorophenol, biosorption, Turkish Sweetgum, kinetics

ID_2661

BIOSORPTION OF REACTIVE BLACK 5 DYE FROM AQUEOUS SOLUTION BY CHEMICALLY MODIFIED PARSLEY STALK: A KINETIC ANALYSIS

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Abstract: Parsley stalk (PS) was modified and used as a novel biosorbent for the removal of an anionic dye from water. The modification method was found to be very efficient for Reactive black 5 (RB 5) adsorption. The experimental kinetic data were well fitted by the pseudo-first order kinetic model. The intraparticle diffusion model indicated the multi-linearity of the process.

Keywords: adsorption, biosorbent, kinetic analysis

ID_2662

EQUILIBRIUM STUDIES RELATED TO THE BIOSORPTION OF A TOXIC TEXTILE DYE BY MODIFIED WASTE MATERIAL

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Abstract: A waste material, parsley stalk (PS) was chemically modified and used as an economic dye remover for wastewater treatment. The chemically modified parsley stalk (MPS) effectively adsorbed Reactive black 5 (RB 5) dye from aqueous solution. In order to determine the maximum adsorption capacity of MPS, the isotherm studies were carried out and it was found that the MPS has a biosorption capacity up to 54.05 mg/g at 333 K.

Keywords: biosorption, treatment, wastewater

ID_2820

ADSORPTION BEHAVIOUR OF BISPHENOL A ONTO NEW POLYMERIC SORBENTS

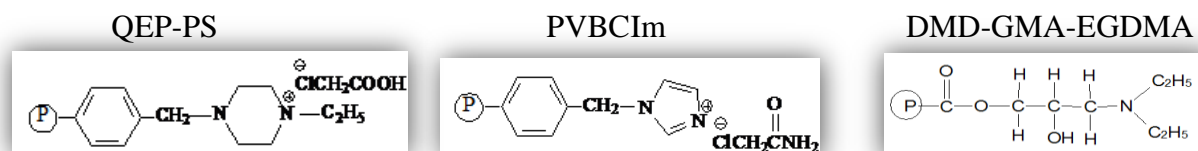
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Abstract: BPA is very important because of its widespread use as a material for components of industrial polymers and nonionic surfactants. Aquatic toxicity of BPA is serious for freshwater, salty algae, invertebrates and fish. Experimental studies have shown that microorganisms cause high biodegradation. For this reason, it is very important to remove the chemical substance from the waste water. In this study, adsorption of bisphenol A was examined on the quaternization of cross-linked ethyl piperazine modified polystyrene based resin QEP-PS, polyvinyl benzyl chloride (PVBC) resin with imidazole by modifying obtained PVBCIm and modification of (GMA-EGDMA) copolymer by N,N-dimethylethylenediamine DMD-GMA-EGDMA.



In the aqueous solution the adsorption of organic waste will be determined by UV-vis spectrophotometer at the 25 °C. For concentrations of hazardous organic wastes in aqueous solution, Freundlich, Langmuir, and BET isotherms will be applied at 25 °C.

Keywords: adsorption, bisphenol, polymers, waste

ID_2650

REMOVAL OF ANIONIC AZO DYE FROM WASTEWATER ONTO MESOPOROUS CARBON MATERIAL AT DIFFERENT ADSORPTION TEMPERATURE

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Abstract: The purpose of this work is to evaluate the mesoporous carbon material (TWAC) as anionic azo dye adsorbent. The activated carbon was prepared by chemically activating tomato processing waste (TW) under the influence of zinc chloride (ZnCl₂). A batch adsorption study was conducted to investigate the suitability of tomato processing waste (TW)-based activated carbon for the removal of anionic azo dye Acid Orange 7 (AO7) from aqueous solutions. Physico-chemical and superficial characteristics of the TWAC, together with the interactions with the anionic azo dye Acid Orange 7 (AO7), were investigated by means of the determination of the isotherm adsorption at different temperatures. Equilibrium data were analyzed using the Langmuir and Freundlich isotherms. The isotherm analysis indicated that the adsorption data could be represented by the Langmuir model. The maximum monolayer adsorption capacity was determined as 312.5 mg g⁻¹ under determined optimum conditions. Thermodynamic study showed that the adsorption was spontaneous and endothermic. The results indicate that TWAC can be employed as low-cost alternative to expensive commercial activated carbon for treatment of industrial wastewater containing AO7.

Keywords: adsorption, mesoporous carbon, treatment, wastewater,

ID_2651

KINETIC STUDIES OF BASIC VIOLET 3 DYE ADSORPTION FROM AQUEOUS MEDIA USING AGRO-INDUSTRIAL BASED ACTIVATED CARBON

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Abstract: The objective of this study was to develop a high efficiency activated carbon (TWAC) sorbent prepared from tomato processing waste (TW) for Basic Violet 3 (BV3) removal. The controlling mechanism of an adsorption process can be assisted by kinetic analysis. Adsorption kinetic behavior was also studied under different experiment conditions. To study the adsorption mechanism of BV3 on this activated carbon adsorbent, the experimental data were linearly fitted using two typical two-parameter kinetic equations (i.e. pseudo-first-order and pseudo-second-order, as well as intraparticle diffusion models). It was found that the experimental results fitted well with pseudo-second-order model with R^2 of 0.997. The kinetics evaluation indicated that TWAC is a good dye adsorption material.

Keywords: adsorption, activated carbon, kinetic study

ID_2893

EFFECT OF ANTISCALANT CONCENTRATION ON PERMEATE FLUX IN A PILOT-SCALE SUBMERGED MEMBRANE BIOREACTOR (MBR) FOR INDUSTRIAL WASTEWATER TREATMENT

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Abstract: In this study, MBR tests were performed using a pilot-scale MBR system installed at wastewater treatment plant of ITOB Organized Industry Zone, Tekeli-Menderes, İzmir. The purpose of this study was to minimize membrane fouling due to the existence of hardness in wastewater by using antiscalant during the operation. The effect of antiscalant dosage on permeate flux and permeate characteristics was investigated.

Keywords: antiscalant, membrane, treatment, wastewater

ID_2923

REMOVAL OF CR(VI) USING ACTIVATED CARBON PREPARED FROM SUGAR BEET BAGASSE ACTIVATED WITH H₃PO₄

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Abstract: Activated carbons were prepared from sugar beet bagasse by chemical activation with phosphoric acid (H₃PO₄) and the prepared activated carbons were used to remove Cr (VI) from aqueous solutions in batch adsorption experiments. The effects of impregnation ratio and activation temperature were investigated in activated carbon preparation. The pore properties including the Brunauer-Emmett-Teller (BET) surface area, pore volume, pore size distribution and average pore diameter of the activated carbons were determined by physical adsorption of N₂ at -196 °C. The highest BET surface area and total pore volume were achieved as 1054 m²/g and 1.031 cm³/g, respectively. The microstructures of the activated carbons were examined by scanning electron microscopy (SEM). The resulting activated carbon was used for removal of Cr(VI) from aqueous solution. The effects of pH, temperature and contact time were investigated. Isotherm studies were carried out and the data were analyzed by Langmuir, Freundlich and Temkin equations. Three simplified kinetic models were tested to investigate the adsorption mechanism.

Keywords: adsorption, activated carbon, sugar beet

ID_2846

REACTIVE BLACK 5 REMOVAL WITH SACCHAROMYCES CEREVISIAE IN THE PRESENCE OF SUGAR BEET MOLASSES MEDIUM

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Abstract: The effluents of textile industries create serious damage to the environment as a result of their toxic, mutagenic and carcinogenic effects. Textile industries create millions of tons waste water every day and pollutes ecosystem by dye. These problems become serious threat for environment and human health. Reactive Black 5 is a commonly used dye in industry and the wastes containing this dye should be treated. Biological treatments are a relatively inexpensive way to remove dyes from wastewater. Several microorganisms, such as yeasts, are better raw biosorbent materials for the removal of dye due to their unicellular nature and high growth rate. In the study bioremoval capacity of the *Saccharomyces cerevisiae* was investigated.

Bioremoval experiments were carried out in 250 mL Erlen Mayer Flasks working volume with 100 mL. 8% molasses medium was used for microbial growth. 3 mL sample were taken from medium and dye concentrations and microbial growth were monitored periodically with spectrophotometer.

As a result, in the first day of incubation time *S. cerevisiae* showed 29.26%±3.74 removal yield in the presence of about 75 mg/L initial dye concentration at pH 5. This result shows *S. cerevisiae* is a promising microorganism for dye removal.

Keywords: biosorbent, bioremoval, sugar beet, *Saccharomyces cerevisiae*

ID_2847

BIOREMOVAL OF COPPER (II) IONS BY CANDIDA SP. IN MOLASSES MEDIUM

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Abstract: Increasing of human population and industrial activities create pollution problems for the environment. Among them heavy metal pollution has been known as a crucial problem because of its toxicity. To overwhelm this problem there is an urgent need for effective methods. Bioremoval of the heavy metals with microorganisms is one of the best choice for sustainable future. By this purpose, we determined Cu(II) removal capacity of the *Candida* sp. in molasses medium supplemented with 1.0 g/L (NH₄)₂SO₄ and 0.5 g/L KH₂PO₄.

The yeast cells were transferred into 250 ml Erlenmeyer flasks containing nearly 25 mg/L Cu(II) concentrations in 100 ml of liquid medium. The flasks were incubated at 30 ± 1 °C on a rotary shaker at 100 rpm for 3 days. During the incubation period, a 3-mL sample was taken daily from each flask. The concentration of Cu(II) in the supernatant was determined spectrophotometrically at 460 nm, by using sodium diethyl dithiocarbamate as the complexing agent.

In the present work, it was found 14.25%±2.85 removal yield at first day of incubation time at pH 5 in the presence of 25 mg/L Cu (II). The study suggests that *Candida* sp. is a promising bioagent for bioremoval of the copper.

Keywords: Bioremoval, bioagent, copper

ID_2836

USAGE OF THERMOPHILE MICROALGAE BIOMASS IN TREATING REACTIVE BLUE 220 (RB220) CONTAMINATED WASTEWATERS

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Abstract: With an increase in textile industry, there is an increase in textile wastewaters. Synthetic dyes in wastewater, due to its colour property, prevent the diffusion of light into the aquatic systems. Treatment of dye-contaminated wastewater is frequently insufficient and relies on costly physical or chemical methods. Usage of biological agents such as microorganisms offers an attractive alternative. Among the microorganisms, thermophile microalgae have been preferred for forming biomass more quickly than mesophilic ones. Six different thermophile microalgal strains (Strain A, B, C, D, E, and F) were obtained from Ankara University, Faculty of Science Laboratories' culture collection. They were tested with regard to their growing in different media (F/2 or BG11), growing in media with increasing dye concentrations (50, 100, and 200 mg/L RB220), and dye bioremoval capacities. Strains were cultivated under continuous illumination (2400 lx) for 14 days at 30 °C. The residual dye concentration was determined spectrophotometrically (435 nm). After incubation for 7 days, growth of algal strains was screened and the media which microalga showing the highest growth was determined as BG11. Within six microalgae, Strain A had the highest survival capacity in all tested pollutant concentrations. Bioremoval efficiency of Strain A was found 21.8%.

Keywords: bioremoval, biomass, microalgae, wastewater,

ID_2924

PREPARATION OF MOLECULARLY-IMPRINTED NON-WOVEN FABRICS SELECTIVE FOR TETRACYCLINE BINDING

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Abstract: Antibiotics may be the most useful family of drugs improved for human health. In addition to this basic application, they are widely used to treat animal and plant infections. Due to their widespread applications, there is a big antibiotic release to the ecosystem such as natural spring water sources. More importantly, some certain places such as hospitals and farms suffer a constant antibiotic release, which causes a persistent pollution (Yin *et al.*, 2010). In such cases, the organisms are continuously exposed to antibiotics at sub-therapeutic levels. The second most widely used antibiotic family in the world is tetracyclines. The residues of tetracyclines are detected in soil and spring water samples. The presences of low level of this compound in aqueous environment can induce the development of antibiotic-resistant pathogens and cause serious problems for human health and ecosystem balance (Reardon, 2014). The specific removal of antibiotics is an immerging issue from water sources. Several adsorbents have been used for removal of tetracycline from wastewater. However, conventional absorbents suffer from the lack of specific selectivity. Molecularly imprinting is one of the most useful methods to synthesis cheap and reliable materials with high specific selectivity. Molecular imprinting includes polymerization/crosslinking of functional monomer/monomers with excess amount of crosslinker in the presence of a certain template molecule. Removal of template molecule leaves specific binding sites in polymeric network.

In this study, tetracycline imprinted polymers were prepared by using radiation-induced Reversible Addition-Fragmentation chain Transfer (RAFT) polymerization mediated grafting method. PE/PP non-woven fabrics were accompanied as support material. Methacrylic acid (MAA) and ethylene glycol dimethacrylate (EGDMA) were used as functional monomer and crosslinking agent, respectively. In order to obtain maximum binding performance tetracycline imprinted polymers were prepared with different monomer/template molecule and monomer/RAFT agent ratios. The binding performances of tetracycline imprinted polymers grafted on non-woven fabrics were tested against various factors such as concentration of template molecule and pH by Uv-Spectroscopy. The results indicated the success and selectivity of the imprinted polymers.

Keywords: tetracyclines, polymers, non-woven fabrics

ID_2933

GRAFTING OF DI (2-ETHYLHEXYL) PHTHALATE IMPRINTED POLYMERS ON PE/PP NON-WOVEN FABRICS BY USING GAMA IRRADIATION

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Abstract: Phthalates are a group of organic esters known as estrogen-like chemicals or environmental hormone. The most common phthalate is di(2-ethylhexyl) phthalate (DEHP), which is widely used as plasticizer, e.g., to make polyvinyl chloride (PVC) more flexible and soft. A wide variety of consumer products also contain DEHP, such as flooring and other building materials, household furnishings, clothing, cosmetics and personal care products, lubricants, waxes, cleaning materials, blood bags. DEHP enter the environment mainly via direct releases to air and waste water, from sewage sludge and from solid waste. If it was long-term accumulated in the human body, it would lead to hormonal imbalance and the decrease of immunity. It could affect the human reproductive capacity and cause baby gender confusion, cardiovascular disease and even gene toxicity (Yang *et al.*, 2015).

In this study, using the technique of molecular imprinting DEHP-imprinted poly (methacrylic acid-co-ethylene glycol dimethacrylate) was grafted onto polyethylene/polypropylene (PE/PP) non-woven fabrics via gamma irradiation. In order to achieve pre-polymerization complex formation, template molecule (DEHP) and the functional monomer (methacrylic acid) were first mixed and then crosslinking agent (ethylene glycol dimethacrylate) was added into mixture. DEHP imprinted polymers grafted non-woven fabrics were characterized by using ATR-FTIR, XPS, SEM, and PALS. In order to determine the size of the cavities Positron Annihilation Lifetime Spectroscopy (PALS) measurements were performed (Rañada *et al.*, 2014). Binding characteristics were also investigated. Finally, specific selectivity studies were carried out by using analogues of DEHP which are called as dimethyl phthalate (DMP), diethyl phthalate (DEP), dibutyl phthalate (DBP) phthalate.

Keywords: DEHP, gamma irradiation, molecularly imprinted polymer, positron annihilation lifetime spectroscopy

ID_2918

RENEWABLE CELLULOSIC ADSORBENT FOR THE REMOVAL OF CU(II), PB (II) AND CD (II) IONS FROM AQUEOUS MEDIA

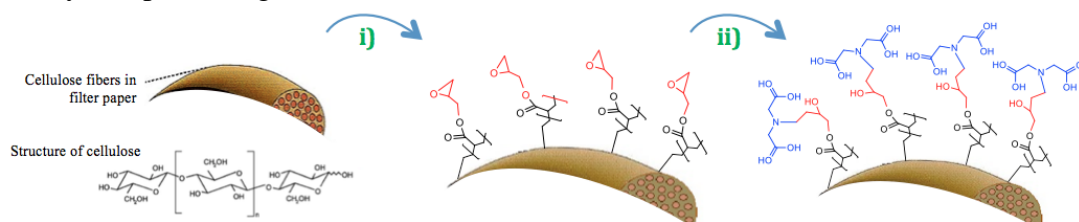
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Abstract: As the industrial activities increasing rapidly all over the world, contamination of water sources with toxic metal ions is being a more serious global concern. Chromium (II), lead (II) and copper (II) are widely used in many industrial activities and are of the most toxic heavy metals found in water sources. The maximum permissible limits of Cd²⁺, Pb²⁺ and Cu²⁺ content in potable water are 0.005 mg/L, 0.01 mg/L and 1.0 mg/L, respectively (Imasuen and Egai, 2013). As heavy metals cannot be destroyed in the natural environment, concentration, separation, and removal of these ions have become increasingly attractive areas of research and have led to new technological developments. Sorption is considered as an effective and common treatment method in many water treatment schemes. Cellulose possesses many potential applications as sorbent, as it is the most abundant natural polymer known to have larger specific surface area than many other common natural polymers. However, the molecular structure of cellulose limits its usage in adsorption studies without proper modifications (O'Sullivan, 1997).

The primary objective of this work is to prepare chemically modified cellulose for the removal of Cd(II), Pb(II) and Cu(II) ions from aqueous media. For this purpose, poly (glycidyl methacrylate) (PGMA) was grafted to cellulose via radiation-induced and Reversible Addition-Fragmentation chain Transfer (RAFT) polymerization mediated grafting (Barsbay et al., 2014). Esterification of cellulose with iminodiacetic acid (IDA) in aqueous solution under mild conditions has proceeded efficiently to yield a renewable, natural-based and effective adsorbent with well-defined properties as provided by the radiation-induced controlled polymerization technique, namely RAFT, applied during the graft copolymerization step and with sufficient degree of substitution value, as confirmed by XPS, FTIR, elemental analysis and contact angle measurements. Batch experiments were carried out on the resulting adsorbent to examine its Cd(II), Pb(II) and Cu(II) ions removing capability and promising results were achieved.



Scheme 1. Activation of cellulose: i) Radiation-induced and RAFT-mediated grafting of GMA to cellulose, ii) Immobilization of IDA chelating species to cellulose.

Keywords: adsorbent, cellulose, heavy metal

ID_2919

CELLULOSE-BASED MOLECULARLY IMPRINTED POLYMERS FOR THE REMOVAL OF ATRAZINE FROM AQUEOUS MEDIA

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Abstract: Molecularly imprinted polymers [MIPs] are tailor-made materials with high specific selectivity for a certain template molecule in trace amount. This method includes polymerization/crosslinking of functional monomers around a template molecule. Removal of template molecule creates specific binding sites for template molecule in the network in terms of functionality, size and shape (Salian and Byrne, 2013). Molecularly imprinted polymers have been used for recognition and/or removal of various target molecules including pharmaceutical compounds, aromatic compounds, sugar and its derivatives, pesticides, beta-blockers, peptides, sterols, etc. in different applications such as solid phase extraction, sensor systems and capillary electrophoresis (Bompart and Haupt, 2009; Salian and Byrne, 2013).

In this study, Reversible Addition-Fragmentation chain Transfer (RAFT) polymerization method was utilized to imprint atrazine, a model herbicide, onto cellulose via surface-initiated polymerization of methacrylic acid (MAA) from the substrate using γ -rays for the generation of radicals. Ionizing radiation (γ -rays) was used as one of the most promising methods for the surface modification of various substrates. RAFT polymerization is one of several kinds of controlled radical polymerization methods yielding tailor-made polymers with predetermined molecular weights and narrow polydispersities (Barsbay et al., 2009). Cellulose was served as a renewable porous substrate with a large surface area. Cumyl dithiobenzoate (CDB) and ethylene glycol dimethacrylate (EGDMA) were employed as the RAFT agent and crosslinker, respectively, during the synthesis. The surface-imprinted cellulose, hereafter MIP, was characterized by ATR-FTIR, XPS, SEM and positron annihilation lifetime spectroscopy (PALS). Atrazine uptake measurements by HPLC demonstrated that RAFT polymerization could be successfully utilized in conjunction with radiation-induced grafting technique for the preparation of well-defined MIPs. The MIPs synthesized by RAFT method presented a better binding capacity compared to those prepared by conventional method where no RAFT agent was employed.

Keywords: atrazine, polymers, cellulose, RAFT method

ID_2763

DIFFERENT PRODUCTION METHODS OF ACTIVATED CARBON FROM ARUNDO DONAX FOR CONTAMINANT REMOVAL FROM WASTEWATER

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Abstract: Many contaminants, such as dyes, heavy metals, surfactants, and other chemical compounds have been discharged into rivers, seas, lakes, etc. because of various factors, e.g. widespread industrialization and careless human activities related to domestic wastes. Also, dye manufacturing, plastic, paper-making, textile, leather, cosmetic, and printing industries lead to millions of tons of colorful wastewater every year (Liu *et al.*, 2012; Feng *et al.*, 2011). To conserve the environment and natural resources, wastewater treatment has been one of the crucial solutions, and activated carbons prepared from waste materials have been popular in wastewater treatment applications due to low cost and efficiency (Yahya *et al.*, 2015). In this study, the different production methods of activated carbon from *Arundo donax* were carried out to determine an economically feasible activated carbon with the highest surface area by using zinc chloride as a chemical agent. Also, the effects of production conditions, such as impregnation ratio, carbonization temperature, and carbonization time, on the surface areas and pore volumes of obtained activated carbons were investigated in detail. Moreover, activated carbons obtained were characterized using scanning electron microscope (SEM), Fourier transform infrared spectroscopy (FTIR), the point of zero charge, Boehm titration, and elemental analysis.

Keywords: *Arundo donax*, activated carbon, chemical activation, pore distribution, characterization, spectroscopy.

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ID_2762

RHODAMINE B REMOVAL FROM AQUEOUS SOLUTION BY ACTIVATED CARBON OBTAINED FROM OKRA WASTES

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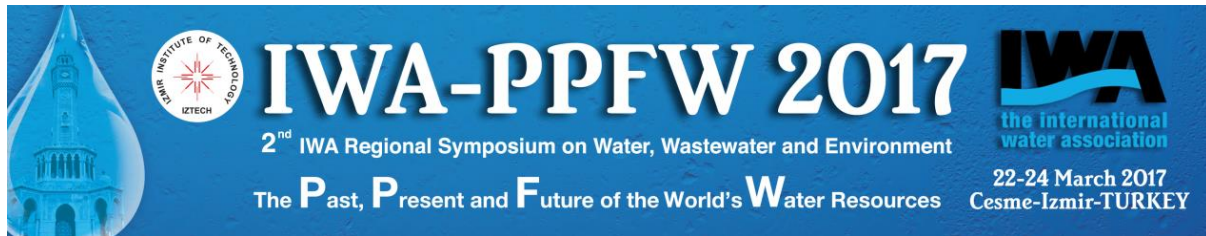
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Abstract: Rhodamine B (RhB) is a synthetic basic dye and it is a suspected carcinogen, so RhB has been banned from its usage in food industry for many years. However, RhB is extensively used in paint, leather, textile, paper, and food industries as well as in biomedical laboratories (Singh *et al.*, 2010; Mehrdad and Hashemzadeh, 2010). Similar to other synthetic dyes, waste RhB solutions are discharged into water resources from the dyeing industries without any treatments (Singh *et al.*, 2010), and this severely harms aquatic life. Activated carbon is widely used for adsorption processes due to its high specific surface area and surface reactivity, allowing fast removal and high adsorption capacity (Deng *et al.*, 2011). Recently, waste resources have been taking attention as starting materials in producing activated carbon to reduce cost and manage waste materials. Therefore, RhB removal from aqueous solution has been carried out using activated carbon (OAC) produced from okra wastes by chemical activation with ZnCl₂. Also, RhB adsorption performance onto optimized OAC was assessed by conducting adsorption parameters, such as adsorbent dosage, initial dye concentration, temperature, and pH. The kinetic and equilibrium data via batch adsorption were evaluated, and thermodynamic studies were investigated for the thermodynamic feasibility and the thermodynamic nature of RhB adsorption onto OAC. Moreover, the adsorption mechanism was shed light on to comprehend what interactions are possible and responsible for RhB adsorption onto OAC.

Keywords: Okra wastes, Rhodamine B, activated carbon, adsorption, chemical activation, kinetic, thermodynamic.

Acknowledgements: This study was not supported financially by any research foundation.



Theme D Ancient Water Systems

ORAL PRESENTATION

ID_2807

HYDRAULIC AND HYDROLOGICAL INVESTIGATION ON THE ANCIENT FOUNTAINS OF HZ SULEYMAN MOSQUE

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Abstract: Each ancient structure can be accepted as the footprint of ancient civilizations, because they reflect cultures, religions, language, and civilization and development levels of people lived in the past. Particularly, ancient water structures, give information about the early age nature of the region (i.e. hydrological, meteorological, geological characters of the region). Anatolia is rich of ancient water systems. The systems were built by different civilizations in different periods, with different materials and construction techniques. However, due to different reasons, some of them have not been survived up to day. In terms of ancient water structures, one of the richest cities in Anatolia is Diyarbakir. There are many published works performed on the man-made fountains in the literature, with most of their architectural feature interests. In this study, a well-known fountain called as the fountain of Hz. Suleyman Mosque is discussed in detail. Although the architectural specifications of the fountain were previously studied but herein the fountain is examined both hydraulically and hydrologically. Such published studies have not been found in the literature, so it is hoped to be an easy guide for further studies along the same line.

Keywords: Diyarbakir, Hz Suleyman Mosque, ancient water structures, fountain

ID_2798

ANCIENT WATER SUPPLY SYSTEMS AND WATERWAYS; KEHRIZ SYSTEM IN ŞANLIURFA

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Abstract: In this study; ancient water supply systems and their transmission structures, called kehriz, in Şanlıurfa Province which were built in ancient times are investigated and mapped in details. As one of the oldest cities in the world, Şanlıurfa is hosting many civilizations throughout the history, since 11500 BC. The existing materials related on archaeological heritage shows that the Şanlıurfa city has very important water supply and transmission experiences. Kehrizes are ancient and interesting water transmission structures that convey water from far away to meet the needs of people by hand-made galleries. Three main waterways in Şanlıurfa Province; Old Kehriz, New Kehriz and Germüş Water, as important and interesting water structures, are studied and documented in Şanlıurfa Province. Throughout the history of the city, different communities using the city destroyed most of the cultural structures of earlier civilizations. However, all communities have protected and developed water supply systems. Therefore, water structures remain up to now and some of these systems are still in use.

Keywords: ancient water, waterways, Kehriz system

ID_2799

HISTORICAL WATER STRUCTURES OF ŞANLIURFA; FOUNTAINS

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Abstract: Şanlıurfa, one of the oldest city in the world, is hosting several civilizations throughout the history since 11500 BC. The archaeological findings say that the city is hosting very important water supply experiences. Many of them, which can be classified as the pre-Islamic (Roman) and post-Islamic (Ottoman) Period, were constructed in the center. Turkish baths, aqueducts, reservoirs, charity structures, cisterns, maksems (water distribution structures), bridges, wells and fountains are some of these structures. Architectural effects of Roman period can be observed in the Ottoman Periods water structures. One of the most important display of architectural influences in the late Ottoman Empire and in the early times of the Republican period is the fountains. The fountains, sequenced on the ancient water transmission systems that called “kehriz” in the center, are the ones still living as important ancient water structures of Şanlıurfa. As a part of detailed investigation of the ancient water supply, transmission and usage systems in Şanlıurfa province, in this research, some of the fountains have been investigated and documented in their location, inscription, historical and newest photographs with technical details.

Keywords: historical water, kehriz, fountains

ID_2817

INVESTIGATION OF HISTORICAL WATER STRUCTURES OF ŞANLIURFA: BATHS AND PUBLIC BATHS

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Abstract: Bathing has been a vital part of our life since early ages. The bath structures constitute a very important contribution to the cultural heritage of the world, also in Turkey. Today each house has a bathroom and people do not have time to go to the public bath because of the fast pace of life. Nevertheless, many people still believe to the necessity of the baths for health and importance for our social life. Most of the cities of Turkey have many water structures carried traces of the past and cultural symbols. Investigation of these structures and achieving lessons from them, especially the baths, is our responsibility to the history. As one of the oldest cities in the world, Urfa also has many historical and new baths. The ancient baths continue to convey many cultural backgrounds to us, while resisting the adverse conditions of the day. With this study, Urfa's bathhouse inventory was tried to be created. The construction periods of the baths, their current situation, and plans are presented with photographs. Thus, a scientific document has been presented. Although the result of religious beliefs in different civilizations is different in societies, “hamam” culture and architectural analysis, and the place of the baths in the public life is very important and it has always been important in the socialization of the societies as well as serving the needs of the people.

Keywords: historical water, baths, Urfa

ROMAN WATER INTAKE STRUCTURES AT THE JADRO RIVER SPRING

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Abstract: Access to good quality water in sufficient quantity has always been a precondition for both sustainability and development for every form of life in a certain area. An excellent example is the Jadro river spring, situated in the Croatian coastal area. This spring, located near the well-sheltered and accessible coast, was an important water resource for two important Roman settlements: Salona, the largest Roman city on the eastern Adriatic coast and the Emperor Diocletian's palace. Due to a sufficient quantity of good quality water and its elevation above sea level, two reliable water supply systems were constructed. These water supply systems kept functioning from 1st century BC to 7th century AD (the Aqueduct of Salona) and from 4th century to 7th century (the Aqueduct of Diocletian's palace). The latter has been reconstructed in the late 19th century. Today, the Diocletian's aqueduct is still in function as a part of Split water supply. This paper will present the results obtained by the analysis of the two Roman water intake structures at the Jadro river spring: one belonging to the Aqueduct of Salona and the other to the Aqueduct of Diocletian's palace. The spatial development of the water intake structures at the Jadro spring will be presented through 6 distinctive phases from the natural terrain up to the present time.

Keywords: Roman water, Jadro spring, Croatian

A BRIEF HISTORY OF WATER WELLS FOCUSING ON BALKAN, INDIAN AND CHINESE CIVILIZATIONS

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Abstract: The provision of water has been a major engineering issue in human history. Groundwater has been utilized since the Prehistoric times to cover the human needs. Initially, the exploitation of groundwater has been made by shallow wells and later by boreholes. A water well is an excavation in the ground by digging, driving, boring, or drilling to access groundwater in aquifers. Groundwater has been used in Helladic world since Neolithic times. Ancient Chinese also developed a drilling tool for water wells which, in principle, is similar to modern machines. Moreover, the Indus valley civilization had well-constructed wells mainly for drinking purposes. The construction of wells varied according to local conditions, determined by geology, hydrogeology, morphology, as well as to the local tradition. Furthermore, a well was not just a water source but also became a cultural symbol on the history, related to local religion and custom. For example, the stepwells in India became not only sources of drinking water, but cool sanctuaries for bathing, prayer, and meditation. In the present paper the evolution of wells through the centuries is examined. The examples of water wells technologies demonstrate that the ancient people had an outstanding engineering knowledge of water supply, which is interesting for water engineers and hydrogeologists even nowadays.

Keywords: Groundwater, Hellenic civilizations; Stepwells, Water source, Wells digging

ID_2969

ASSESSMENT OF THE PRESENT STATE AND PERSPECTIVES OF THE OLD DAM OF RELLEU (MARINA BAIXA, ALACANT, SPAIN)

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Abstract: The old arch dam of Relleu (Alicant, Spain) was during three centuries the slendest in Europe, with a height of 32 meters. Its walls upstream and downstream and its drain tower were built with ashlar and the nucleus was made from masonry. At the beginning of the 20th century, the dam was decommissioned and nowadays is quite entirely silted up and is being degraded. This infrastructure used to regulate the scarce flows of the Amadorio river and managed the floods of a Mediterranean regime catchment. At present, there is an increasing interest to declare the dam site of cultural interest and stop its degradation.

For this purpose, research has been performed on the history of the infrastructure, the hydrology and the capacity to manage floods of the basin. The geology and the geometry of the dam, the auxiliary dam which derives water from another basin, the water leakages, the needs of maintaining and repair the structure and where exactly are the fallen off ashlar were also being determined. Apart, the situation of the quarry which stones were used to build the dam has also been determined. It is also to value the landscape where the dam is located, including the spectacular gorge downstream the dam.

The reasons for this research are the desire of ensuring the survival of the dam and if possible recover part of its functionality. Finally, to preserve the hydraulic and constructive heritage values of the dam and its surrounding are necessary.

Keywords: Hydrology, geology, Relleu dam,

THE CONSTRUCTION AND MAINTENANCE OF AN ANCIENT KAREZ SYSTEM

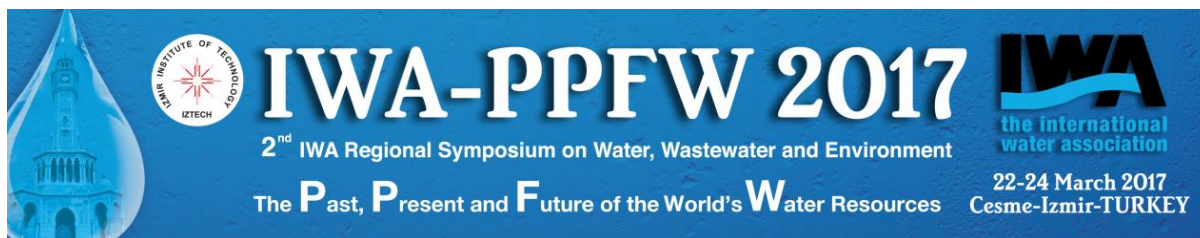
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Abstract: Ancient Karez have a history of millennium. It has been called as Qanat in Turkic and Persian regions. Karez is underground tunnel which is constructed in alluvial fan by digging the mother well of the system and extending underground tunnel in foothills of the mountains. This system extracts groundwater to surface by gravity without using any pumping equipment. The essential components of Karez are mother well (Sarchah), access wells (Chah), underground tunnel, open channel (Karez canal), drinking water point (Awkhura) and small storage ponds (Karez Z). There was a technological development during the Karez expansion era. Ancient Karez system is viable in hot, arid and semi-arid climate regions and is one of the best ways of extracting groundwater by gravity in such regions. Sufficient slope is vital for extracting groundwater to the surface by gravity in Karez system. In this study, we assess the condition of ancient Karez system in Afghanistan. Some recommendations provided in order to encourage the associated organizations for the improvement of cleaning and maintenance of the ancient Karez water supply systems in Afghanistan.

Keywords: Karez, Ancient water supply, Afghanistan, Irrigation system, Arid climate



Theme D Ancient Water Systems

POSTER PRESENTATION

ID_2753

DETERMINATION OF PB IN DRINKING FOUNTAIN WATER IN KIRKLARELI BY FAAS AFTER PRECONCENTRATION ON QURCETIN MODIFIED USING GRANULAR ACTIVATED CARBON

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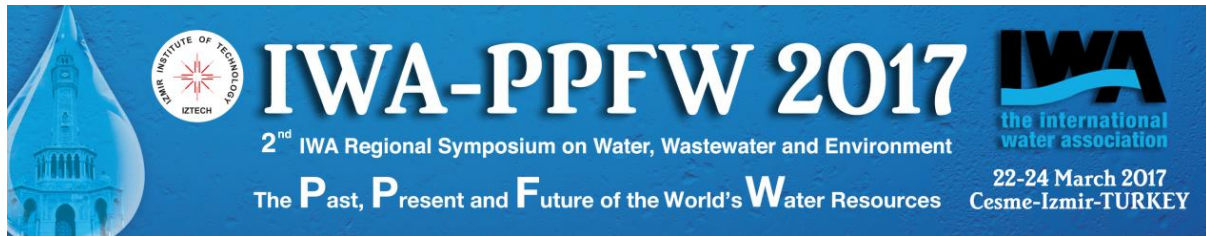
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Abstract: The purpose of this study was to determine the level after preconcentration of trace heavy metals ions using drinking fountain water (20 point) in Kırklareli by flame atomic absorption spectrometry (FAAS). The method is based on the adsorption of Pb on quercetin loaded on granular activated carbon (AC). In this study, the influence of variables including solution pH, the amount of the ligand and solid phase, the condition of eluting solutions and sample volume on the recoveries of metals were optimized. Under the optimal experimental conditions, the preconcentration factor, detection limit, linear range and relative standard deviation (RSD) of Pb (II) ions were 1 (for 5 mL of sample solution), 7.26 ng mL⁻¹, 10.0–500 ng mL⁻¹ and 1.8% (for 50.0 ng mL⁻¹, n=15), respectively. Relative standard deviation (RSD) were found below 10%. The influence of the analytical parameters including pH (2.0-12.0), amount of sample volume, adsorbent and eluent, type and concentration of eluent were investigated. In addition, the accuracy of proposed method was also checked by the analysis of certified reference material NIST SRM 1643e (trace elements in natural waters). The method was successfully applied for the determination of Pb in water samples from Kırklareli, Turkey. The recoveries of Pb was generally higher than 95%.

Keywords: Activated Carbon, trace heavy metals, fountain water, Kırklareli

Acknowledgements: The authors thank the Kırklareli University Research Foundation for their support (KLUBAP/011).



Theme E Hydrology and Hydrogeology

ORAL PRESENTATION

ID_2856

RECHARGE-DISCHARGE MECHANISM AND GROUNDWATER FLOW DYNAMICS OF KARST AQUIFER IN THE WATERSHED OF YUVACIK DAM (KOCAELİ, TURKEY)

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Abstract: Watershed of Yuvacık Dam located at the eastern Marmara region (Turkey) is the most important water resource for Kocaeli city with its surface water and groundwater potential. There are significant karst springs in the basin having average discharge rates ranging from 20 to 873 L/s. Drinking water needs of some regions of the city is supplied from these springs. For sustainable management and protection of such resources, it is essential to determine the recharge-discharge mechanism and hydrodynamics of the system. A wide range of data including distribution of karst features, extension of cave systems, streamflow and spring hydrographs and dye tracing test results were used to evaluate the structure and hydraulic behavior of the karst aquifer. Analysis of baseflow recession curves obtained from different sub-basins (Kirazdere, Serindere and Kazandere) between years of 2006 and 2015 indicated the existence of interconnected multipartite storages with groundwater residence times ranging between 10 and 60 days. Only in Kirazdere sub-basin, the existence of a deep and slowly discharging reservoir with a groundwater residence time of 125 days was also determined. These results are also consistent with the recession coefficients obtained from karst spring hydrographs. Concentrated and diffuse autogenic recharge areas are widespread in the basin. However, water budget analysis suggests that allogenic recharge areas also contribute the recharge of the karst aquifer. The results of tracer tests conducted at the different locations in Kirazdere and Serindere sub-basins showed that travel times for the tracer ranged between 10-12 hours and 1.5-3.5 days. All results suggest that karst aquifer in general exhibits a rapid recharge and discharge dynamics and protection of such concentrated recharge zones in the watershed are critical for sustainable management of these groundwater resources.

Keywords: Recharge, karst aquifer, Yuvacık dam, Kocaeli

ID_2908

EVIDENCE FOR SEA WATER INTRUSION IN KARSTIC AQUIFER OF KARABURUN PENINSULA, NW TURKEY

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Abstract: Karstic aquifers are considered to be significant sources of groundwater and are mostly under threat due to sea water intrusion in many parts of the world. Seawater intrusion is also a common problem on karstic aquifers of Karaburun Peninsula in north of Mediterranean Region. The hydrogeology of Karaburun Peninsula is fairly complex and is mostly characterized by highly permeable karstic formations with significant water storage in an otherwise water scarce area. The karstic aquifers of the region were recently found to be under severe salt water intrusion, which significantly altered the position of fresh water/sea water interface as a result of excessive pumping and fault zones controlling the karstic network.

In this study, structural, tectonically, hydrogeological and hydrochemical properties of the groundwater resources of Karaburun Peninsula were evaluated and the status of salt water intrusion was assessed. The results indicated that significant levels of karstification in the carbonates of the region created a number of karstic structures which are tectonically controlled. Karstic aquifers in Ildırı region were found to be affected by sea intrusion with electrical conductivity values reaching to levels as high as 30000 µS/cm. The high levels were attributed to direct saltwater intrusion towards the karstic cavities along the fault lines from at least two directions in the Ildırı well field region.

Keywords: Coastal aquifer, groundwater, karstic aquifer, seawater intrusion, Karaburun Peninsula

Acknowledgment: This study is funded by the Scientific and Technological Research Council of Turkey (TÜBİTAK) through project number 113Y042

ID_2956

PREDICTING FLOOD PLAIN INUNDATION FOR NATURAL CHANNELS HAVING NO GAUGED STATIONS

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Abstract: Flow hydrographs are one of the most important key elements for flood modelling. They are recorded as time series; however, they are not available in most developing countries due to lack of gauged locations. This study presents a flood modelling method for rivers having no gauged stations, thereby no information about discharge time series. The modeling procedure involves three steps: (1) The method predicts hydrograph by reverse flood routing, obtaining hydrograph in an upstream ungauged station by means of information about channel geometric characteristics, downstream flow stage and downstream flow hydrograph. (2) So-obtained upstream hydrograph becomes an inflow for HEC-RAS models which computes flood wave spreading. (3) The GIS-based flood map produced by HEC-RAS is overlapped to the related imagery (orthophoto images) to delineate the flood-risk areas. The developed model is applied to Guneyisu Basin in Rize province in Eastern Black Sea Region of Turkey. The model- produced flood map is compared to the observed one with success.

Keywords Reverse routing, Flood modelling, Hydrograph generation, Hydraulic modelling, Geographic Information Systems, HEC-RAS

FREQUENCY ANALYSIS OF LOW FLOWS

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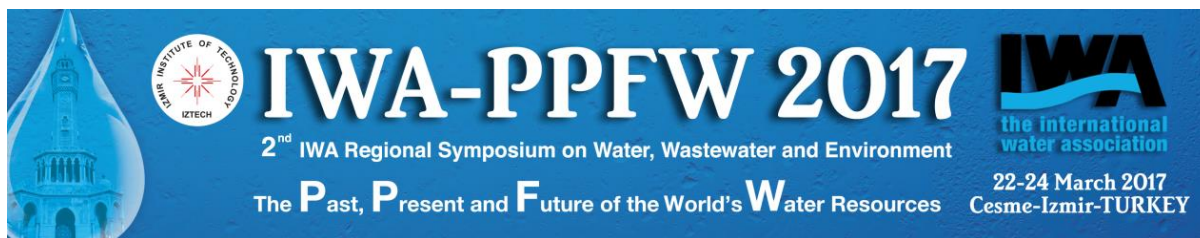
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Abstract: This study attempts to find out the best-fit probability distribution function to low flows of Meric-Ergene, Gediz, Seyhan and Ceyhan hydrological basins in Turkey. Different duration days are used in frequency analysis of low flows. Analysis in this study is performed on minima of 1, 3, 7, 10, 14, 30, 60, 90, 120, 150 and 273 days calculated from daily flow time series of each stream gauge. Weibull (W), Gumbel (G), and 2-parameter Log-Normal (LN2) among the 2-parameter probability distributions are selected along with the Pearson Type III (P3) and 3-parameter Log-Normal (LN3) from the 3-parameter probability distribution function family. Selected probability distribution functions are checked for their suitability to best-fit low flow time series. LN3 distribution mostly conformed to low flows particularly for Gediz and Seyhan basins.

Keywords: frequency analysis, flows, hydrological basin



ID_2935

A METHOD FOR LOW FLOW ESTIMATION AT UNGAUGED SITES: A CASE STUDY IN TURKEY

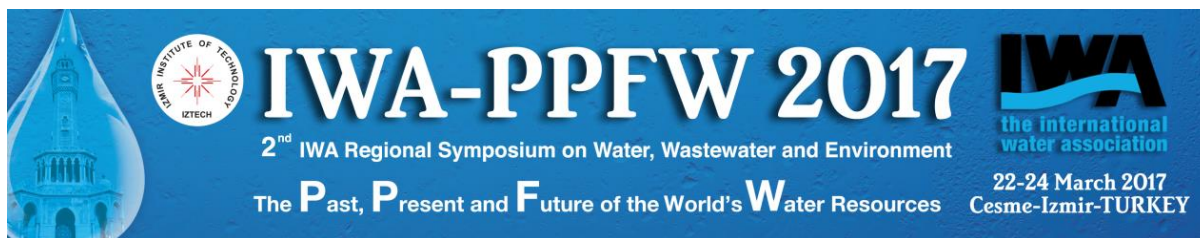
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Abstract: The increasing effects of climate changes require estimation of low flows to design efficient Water Management Systems. And depending on the management practice, this can be needed for various return periods. Especially in Turkey, due to the scarcity of gauging stations and their lack of data makes system designs to be planned and implemented extremely difficult. Thus, the development of estimation techniques for low flows at ungauged sites is crucial. The purpose of this study was to develop regional models that could make clever predictions at ungauged sites. By taking into account the number of gauging stations, how they are spread around, and the number of data each station has (at least 20 years) the regions where low flows and drought are an issue in Turkey; Aegean Region, East Anatolia Region, and South East Anatolia Region were analyzed for the purposes of this study. A total of 31 gauging stations were selected from the following basins: Susurluk Basin (3), Gediz Basin (5), Büyük Menderes Basin (7) which belong to the Aegean Region; Fırat Basin (21), and Dicle Basin (26), which belong to the East Anatolia and South Anatolia Region. Clustering Analysis was then performed to separate the gauging stations into homogeneous groups by taking into account 17 different hydro-climatological variables that defined the stations. 3 homogeneous groups were created and regional models were developed to estimate low flows at ungauged sites for any return period from 5 to 50 years via regression analysis. In the end, the regional models that were developed proved to have high predictive capabilities. However, it is important to note that the methodology in this study was applied to specific regions. Thus, it is advised to carry out this study in all of Turkey with stations that have at least 50 years of data to obtain more efficient results.



ID_2928

FLOW DURATION CURVE MODEL FOR UNGAUGED BASINS

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Abstract: Flow duration curve can be used to determine discharge at any exceedance probability of time. Determination of the discharge is important in such watershed management practices as the design of irrigation systems and hydroelectric power plants. In this study, flow duration curves are modelled for use in ungauged basins. The model is based on the normalized dimensionless flow quantiles. Seyhan Basin in southern Turkey was selected as the study area to implement the proposed model. Seventy-four gauging stations were used in developing and testing the model. Discharge for each gauging station is calculated with two nonlinear regression equations of drainage area. Calculated and observed flow duration curves are compared. The method requires further development to better approximate the modelled flow duration curve to the observed counterparts.

Keywords: curve model, ungauged basin, flow

2623 FORECASTING FLOOD RISK IN THE INDUS RIVER SYSTEM OF PAKISTAN USING HYDROLOGICAL PARAMETERS AND DAMAGE ASSESSMENT

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Abstract: Hydrological parameters are among the widely-used parameters in assessing flood risk. On the other hand, anticipated flood damages in case of flooding, are estimated with the help of expected losses in areas nearer to the watercourse. The major source of almost every-year flooding in Pakistan is the Indus River system that comprises the major rivers of Pakistan. We first use observed data to construct regular data models based on various probability distributions namely normal, log-normal, gamma, Weibull, largest extreme value, gamma-3, and log-Pearson type-3 distributions and thereby compute probable maximum flood. Secondly, we perform log-Pearson type-3 analysis with and without historic adjustment on the observed data series of 17 years to forecast floods with return periods T of 2, 5, 10, 25, 50, 100, and 200 years. We also categorize existing structures based on the risk of flooding. Lastly, we estimate risk of flood damages in terms of expected losses based on observed data. The present study reveals that the log-Pearson type-3 distribution is relatively better for estimating probable maximum flood. The exceedance probability to assess the risk of flooding in the various structures of the said rivers. The analysis shows that flood damages in Pakistan may be reduced by increasing the design capacity of the structures and also by giving awareness to people about the flood-generating factors.

Keywords: forecasting flood risk, Indus river,

ID_2973

TREND ANALYSIS OF PRECIPITATION, TEMPERATURE AND WIND DATA IN SAMSUN (TURKEY)

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Abstract: Climate change effects have been remarkably perceived today; the determination of trends in precipitation, stream flow, winds, evaporation, and temperatures has become considerable for the planning and management of water resources and engineering projects. Nowadays there is a lot of studies have been made in progress on global and regional climate changes in literature. The objective of this study is to analyze monthly, annual and seasonal trends in average temperature, total precipitation, and average wind data by Mann- Kendall, linear trend and Sen's Trend tests. The data sets are obtained for the period 1980 to 2015 for Samsun station. Samsun is the largest city placed in north of Turkey in the Central Blacksea region.

Keywords: Trend analysis, Mann-Kendall Test, Sen's Trend Test, Linear trend, Samsun, Turkey

ID_2879

AREAL VARIABILITY OF L-MOMENT RATIOS FOR PEAK DISCHARGES IN TURKISH RIVERS

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Abstract: In the design of hydraulic structures, it is important to estimate the flood for a given return period. Determination of an acceptable design criterion depends mostly on the probability distribution of the flood.

In this study, L-Moment ratios (L-coefficient of variation, LC_v ; L- coefficient of skewness, LC_s ; L- coefficient of kurtosis, LC_k) of 167 flow gauging stations are calculated for annual peaks of Turkish rivers. Besides, the spatial distributions of these statistics are given with L-Moment ratio maps and the use of the maps was explained integrated to L-Moment ratio diagrams.

With these maps, the disabilities arising from the usage of point information of a project will considerably be avoided. So, for a project area even without any observations or data the maps of L-Moment ratios provide to estimate the frequency distribution models of peak discharges and a robust basis for flood frequency analysis.

Keywords: L-Moments ratio maps, L-Moment ratio diagrams, Flood frequency distributions.

ID_2905

ANALYSES OF LAKES MOGAN AND EYMR WATER LEVEL VARIATIONS: CAUSES AND CONSEQUENCES

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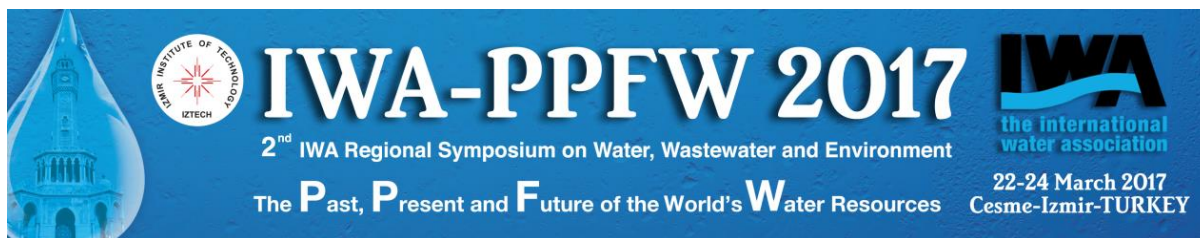
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Abstract: The Mediterranean Basin is identified as one of the most vulnerable regions to climate change. Turkey, being located in the Mediterranean Basin, is predicted to be severely affected by the adverse effects of climate change, particularly in terms of water resources. Lakes and associated ecosystems have always been severely affected by the impacts of climate change. Changes in air temperature and precipitation have direct impacts on the physical, chemical, and biological characteristics of the lakes. This paper examines the possible linkages between climate variables and the water levels of shallow interconnected Lakes Mogan and Eymir, located 20 km south of Ankara in Central Turkey. The variations in the lakes' water levels during 1996–2015 are studied and the impacts of climate variables on the lake levels are assessed to address the long-term consequences. Analyses of the meteorological data showed that annual precipitation has crucial influence on the variations in the lakes' levels. Although the annual temperature also played an important role in the long-term trends, its consequences were not as significant as the precipitation.

Keywords: Climate change, Lakes Mogan and Eymir, lake levels



Theme E Hydrology and Hydrogeology

POSTER PRESENTATION

ISOTOPE HYDROLOGY AND GEOCHEMISTRY OF THERMAL SPRINGS OF ALGERIA

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Abstract: This paper deals with the results of a hydrochemical and geothermal studies of the thermal waters in the northeastern of Algeria. Seven samples were taken in November 2012 and April 2014. To identify the origin of the thermal groundwater, the following tracers were used in this study: major chemical constituents, stable isotopes $\delta^2\text{H}$, $\delta^{18}\text{O}$, principal component analysis (PCA) and geothermometry. The physicochemical parameters (temperature, pH, and electric conductivity) were measured *in situ*, the temperature of the thermal water samples varied from 38 to 96°C. The pH value of these springs is slightly acidic to neutral, with high electrical conductivities about 4500 μm .

Chemical and isotopic contents were used in the investigation on the origin and evolution of thermal water and the evaluation of reservoir temperature in the geothermal systems. The plot of the cations and anions on Piper diagrams indicated two major hydrochemical facies namely sodium chloride (Na-Cl) and sodium sulfate (Na-SO₄), respectively. The mineral composition of the thermal waters reflects the geological formations found at the depth of origin and chemical changes samples were highly influenced by water-rock interaction.

The thermal waters in the study area are depleted in ^{18}O and ^2H and fall on the global meteoric water line (GMWL), indicates their deep-circulating meteoric origin (local geothermal gradients range from 25 to 45 °C/km), show that most thermal waters fit along the meteoric water line, with some exceptions due to Mediterranean precipitation, possible water-rock isotopic exchange or mixing occurs between the ascending geothermal water and shallow confined groundwater.

The subsurface reservoir temperatures were calculated using different solute geothermometers. The highest estimated reservoir temperatures are indicated by the CCG and Na-K-Ca geothermometer, while slightly lower estimates are obtained using silica geothermometers.

In present study, multivariate statistical method - Principal component analysis PCA - is used; PC1 (41%) explains the minerality, (ionic composition), for which temperature is of secondary importance PC2 (18%).

Keywords: Algeria, hydrology, geochemistry, isotopes, thermal springs

ID_2635

FLUORIDE MOBILIZATION MECHANISM AND ITS INFLUENCE ON GROUNDWATER QUALITY PARAMETERS FOR DELTAIC PLAIN DISTRICT OF LOWER INDUS BASIN

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Abstract: Groundwater contamination is one of the major concerns of deltaic plain areas of lower Indus basin. Forty groundwater samples from hand pumps were geochemically evaluated and investigated to ascertain the quality of water in three union councils of Sanghar District, Sindh Pakistan. Studies are focused to identify the mobilization mechanism of Fluoride and its impact on the concentration trends of ground water quality parameters. Water quality is assessed for pH, TDS, Ca, Mg, Na, HCO₃, SO₄, SAR and Nitrate (NO₃-N). Groundwater chemistry results indicate a safe drinking water quality of F⁻ (3.1-9.2 mg/l) and Nitrate (0.2-0.8 mg/l) as per WHO permissible limits. The concentration of pH (7.0-8.3) shows a dominance of alkaline concentrations in groundwater. Chemical analysis revealed Na-Cl is accompanied by the ion pair of Ca-HCO₃ (Stiff Diagram). Hydrogeochemical classification specifies Mixed-Type concentration inclining Na-K-Type ionic concentrations (Piper Diagram). Analytical studies exhibited that the areas rich in Ca⁺⁺ display a comparatively low concentration of dissolved Fluoride. It is found that alkaline environment is favorable for F⁻ dissolution in ground water of the study area. Fluoride concentrations in south western Sanghar district can be attributed to alkaline soils and the climate (semi-arid). The values of ground water pH show a slight alkaline condition prevailing in the study area which may provide a possibility of Fluoride release in groundwater. Fluoride correlation with HCO₃ does not fully support the alkaline environment. The under saturation of calcite can be credited to the slightly alkaline pH of the study area.

Keywords: Groundwater quality, major ion, contamination

ID_2825

INVESTIGATION OF MAJOR ION CHEMISTRY IN GROUNDWATER OF THE BURDUR LAKE BASIN

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Abstract: The Burdur Lake basin is located in the southwest of Turkey and is semi-closed basin. The Burdur Lake is a tectonic lake and lake water is salty and highly alkaline. Also, groundwater chemistry has been controlled by hydrogeochemical processes in the basin. In present study 35 groundwater samples were collected and analyzed to investigate hydrogeochemical processes and groundwater chemistry. The dominant ions are Ca^{2+} , Mg^{2+} , Na^+ , HCO_3^{2-} and SO_4^{2-} in groundwater and different hydrochemical facies such as Ca-HCO_3 , Ca-Mg-HCO_3 , Mg-Ca-HCO_3 , Na-Mg-SO_4 and $\text{Na-SO}_4\text{-HCO}_3$ were determined. One of the most important geochemical processes which controlled the groundwater chemistry is weathering and the limestone, gypsum and silicate are the major sources for mineralization in the study area. In addition, statistical analysis was performed to determine inter relationships within chemical data. According to R-mode factor analysis, Mg, Na, Cl, SO_4 , EC and TDS have significant control on the groundwater chemistry. The obtained results indicate that the mechanism controlling groundwater chemistry at the Burdur Lake basin is originally regulated by the geogenic process.

Keywords: Burdur lake, major ion, mineralization

ID_2826

WATER BALANCE OF THE SALDA LAKE AND THE INFLUENCE OF BUDGET COMPONENTS, (BURDUR/ TURKEY)

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Abstract: Water budget of lakes must be determined regarding to their sustainable usage as for all water resources. One of the major problems in the management of lakes is the estimation of water budget components. The lack of regularly measured data is the biggest problem in calculation of hydrological balance of a lake. A lake water budget is computed by measuring or estimating all of the lake's water gains and losses and measuring the corresponding changes in the lake volume over the same time period. Lake Salda is an inland closed basin and located within the Lake District of Turkey. In addition, Salda Lake is one of the important wetlands of Turkey and is in the status of protected areas. Therefore, the Lake is used for only tourism and fishing. In addition, it is planned that the water of Salda Lake will be used as drinking water in the future. Therefore, Salda Lake is indispensable water source and sustainable management is important for region. Recharge of the Salda Lake is supplied from especially precipitation, surface and subsurface water inflow. The discharge components of the lake are evaporation. According to rainfall, evaporation and the lake water level relations, rainfall is dominantly effective on the lake water level such as direct recharge to the lake and indirect recharge with groundwater flow.

Keywords: Water balance, Salda Lake, water budget

ID_2971

INVESTIGATION ON THE WATER SOURCE CHANGE BY USING GIS - RELATIONSHIP BETWEEN CLIMATE AND HYDROLOGY OF BATMAN PROVINCE, TURKEY

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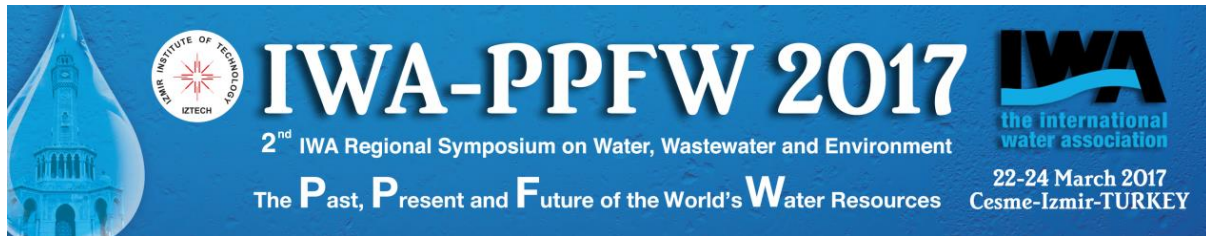
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Abstract: The parameters and data controlling hydrologic processes by Geographic Information Systems (GIS) have become an integral part of hydrologic studies. The main management is to bring together the use GIS to model s and hydrologic data. The general distribution of the inputs and parameters can control the surface sources or underground loss. GIS maps commonly describe topography, land use and cover, soils, rainfall, and meteorological variables may become model parameters or inputs in the simulation of hydrologic processes.

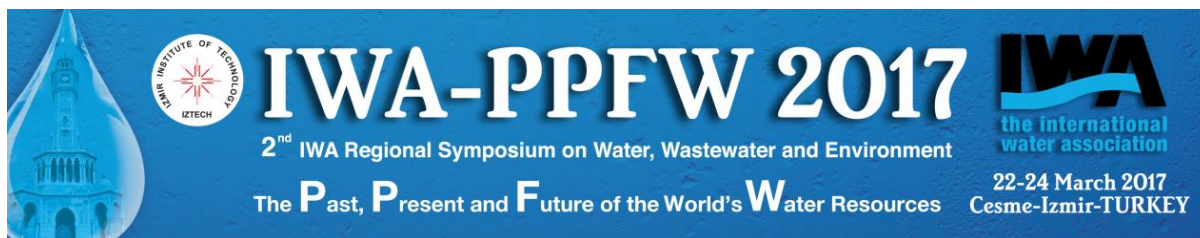
This investigation of water logging can be extremely useful in suitable water management strategies by reclaiming existing water logged areas. The problems of water logging and quality mostly exist in the irrigated areas like in South Eastern rocky plains of Batman, Turkey. The climate change and groundwater changes generally results in over irrigation, seepage losses through channel and distributions, poor water management practices and inadequate control of drainage system. Analysis of high water table in water logged areas and drainage of irrigated areas have not been paid adequate attention in the planning and management of water resources, partly due to lack of requisite data and partly due to flood and rainfall in the country. In order to develop suitable water management strategies and controlling the extent of water logging in the area. GIS may facilitate the reconstruction of the ecological environment but also to accommodate the sustainable development of the water resources and waste water.

In this study, the hydrological characteristics of the Batman city were explained and the effect of these characteristics on the city was examined. In the investigation, hydrological features and the urbanization with new settlements needs modeling regarding available water source. The hydrological property of settlement areas with dense populated areas in the model was determined by Geographic Information Systems (GIS) techniques. The main purpose of this study is to investigate the effect of settlement on the basic hydrological structure by studying the characteristics of the ground topography, ground water elevation, slope and viewing. GIS techniques were used in the creation of the thematic maps and in the analysis of the parameters. Finally, the GIS study models created, the available water source change and a stream network model was provided sufficient source control at the Batman province. The presence of this stream network structure in the Batman province reveals the potential flood scale and flood risk. This study produced more systematic data with hydrological studies



carried out with GIS support. GIS has made it possible to obtain more qualified data by enabling the use of multi-criteria decision making method (CCCF) in this research.

Keywords: Water management, GIS, Batman



Theme F Modeling and Simulation

ORAL PRESENTATION

ID_2641

NUMERICAL MODELING OF GROUNDWATER FLOW IN SHAGRA BASIN, NORTH DARFUR STATE, SUDAN

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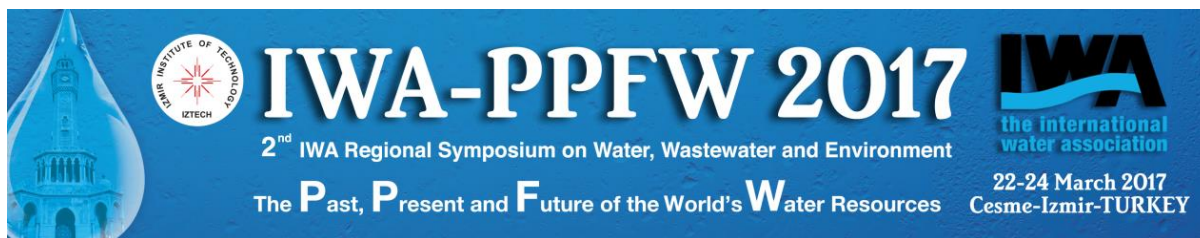
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Abstract: The objectives of this work are to design an appropriate conceptual model, provide description of the hydro-geologic framework, implementation of groundwater modeling techniques, determine the behavior of groundwater flow system and calculate aquifer capacity and groundwater balance components in Shagra basin. ArcGIS, Rockwork, Digital Elevation Model (DEM) and Visual MODFLOW techniques were used for water system conceptualization, data base manipulation, model calibration and findings. Trail-and-error calibration technique was used under steady state conditions. The calibration of the three-dimensional finite difference flow model of the Shagra basin was conformed using the Root Mean Squared error (RMS), Absolute Residual Mean (ARM), Normalized (RMS %) and mass balance percent discrepancy criteria. Fairly good visual comparison between the measured and simulated heads at each observation well as less than 1 m and consistent results on hydraulic head distribution, confirm model validation in the study area. The aquifer storage capacity and groundwater balance components which include pumpage, recharge, evapotranspiration and general head boundary (GHB) were measured for entire model domain for steady state conditions. The general flow direction of the groundwater was found to be from northwest to southeast part of the model area as detected from the contour map of the simulated heads in that direction. Sensitivity analyses reflected that the model is more sensitive to hydraulic conductivity and least sensitive to specific storage. Results of numerical model showed that the groundwater model is an accurate representation of the actual historic groundwater system and confirm the validity of the model to be used for future prediction and its accuracy in simulating irregular boundary geometries.

Keywords: Model calibration, aquifer, trail-and- error technique, water balance, conceptual model



ID_2970

EVALUATION OF NUTRIENT RETENTION IN VEGETATED FILTER STRIPS USING THE SWAT MODEL

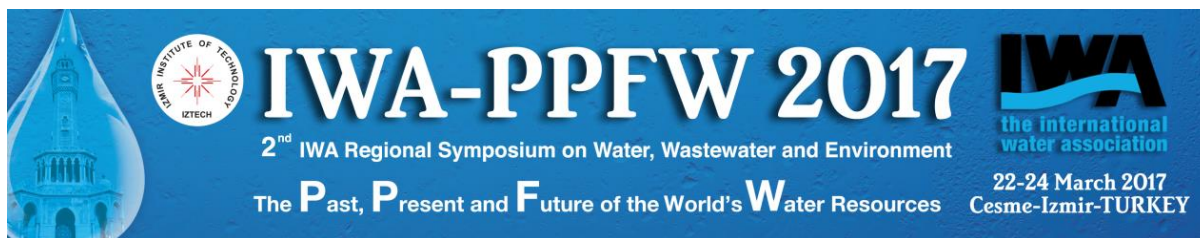
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Abstract: Nutrient fluxes in stream basins need to be controlled to achieve good water quality status. In stream basins with intensive agricultural activities, nutrients predominantly come from diffuse sources. Therefore, best management practices (BMPs) are increasingly implemented to reduce nutrient input to streams. The objective of this study is to evaluate the impact of vegetated filter strip (VFS) application as an agricultural BMP. For this purpose, SWAT is chosen, a semi-distributed water quality assessment model that works at the watershed scale, and applied on the Nif stream basin, a small-sized basin in Western Turkey. The model is calibrated with an automated procedure against measured monthly discharge data. Nutrient loads for each sub-basin are estimated considering basin-wide data on chemical fertilizer and manure usage, population data for septic tank effluents and information about land cover. Nutrient loads for 19 sub-basins are predicted on an annual basis. Average total nitrogen and total phosphorus loads range are estimated as 47.85 t/yr and 13.36 t/yr for the entire basin. Results show that VFS application in one sub-basin offers limited retention of nutrients and that a selection of 20- m filter width is most effective from a cost-benefit perspective.

Keywords: SWAT model, Nutrient fluxes, vegetated filter strip



ID_2769

A REVIEW OF WASTEWATER TREATMENT PLANT MODELING AND SIMULATION TECHNIQUES

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Abstract: In this review paper, modeling and simulation techniques for input-output relations of wastewater treatment (WWT) plants and related academic and commercial studies are investigated in the light of available literature. From the traditional basic physical and mathematical models to the most recent automated control and information techniques (statistic and computational intelligence), a great variety of approaches have been proposed and reported in business, manufacturing and engineering aspects of WWT. The focus of current study is the literature development on long-term evolution of modeling, optimization and energy efficiency in WWT in order to predict the behavior and perform efficient operation on the wastewater process. For a large scale WWT process, which includes physical, chemical and biological processes, the recent algorithms that are commonly used to obtain accurate models are investigated.

Keywords: Treatment, wastewater, modeling

ID_2953

COMPETITIVE MULTI-COMPONENT EQUILIBRIUM MODELLING OF CR(VI), NI(II) AND CO(II) ONTO ALGAL BIOMASS

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Abstract: Heavy metal removal using algal biomass as a biosorbent, has emerged as a potential low cost and environmentally friendly alternative technique to the existing methods. Since industrial effluents contain several metals, the necessity of the adequate equilibrium modelling of multi- component sorption systems could not be ignored. However, the characteristics of the industrial effluents, makes the prediction and validation of the behavior of each component very complicated due to the involving interaction and competition effects.

The aim of this study is to determine the applicability of the multi-component isotherm models to the sorption of Cr(VI), Ni(II) and Co(II) in a ternary system by using algal biomass *Gracilaria verrucosa*. For this aim, ternary sorption data have been analyzed by using multi-component Langmuir, Freundlich, Redlich-Peterson, Sips and Sheindorf-Rebuhn- Sheintuch models.

The results showed that, algal biomass is a feasible sorbent for the simultaneous removal of metal ions from aqueous solutions. The gathered equilibrium data for the ternary system is represented best by the competitive Langmuir model. The metal sorption capacity decreased with an increase in the concentration of the other metal ion and the combined action of Cr(VI), Ni(II) and Co(II) ions on algal biomass is found to be antagonistic.

Keywords: Algal biomass, heavy metals, biomass, biosorbent

ID_2982

AN EVALUATION OF HYDROLOGIC MODELING PERFORMANCE OF EPA SWMM FOR BIORETENTIONS

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Abstract: Recent techniques should be investigated in detail to avoid present and future problems of urbanization like flood, drought and water pollution. Low Impact Development (LID) Best Management Practices (BMPs) such as bioretentions, green roof, rain barrels, vegetative swales, and permeable pavements have been implemented to diminish adverse effects of urbanization. In this study, a hydrological model for Rainfall-Watershed-Bioretention (RWB) System is developed by using Environmental Protection Agency Storm Water Management Model (EPA SWMM). RWB system is an experimental setup which consists of an artificial rainfall system, drainage area and four bioretention columns with different soil mixture. The hydrological modeling capability of SWMM for bioretentions is presented using the experimental data obtained from the experiments conducted in RWB system under different rainfall events and for bioretentions with different design. Finally, the modeling results of SWMM is compared with the results of the Hydrological Model of RWB System (HM-RWB). Results show that EPA SWMM performs well in modeling bioretentions whereas the results of HM-RWB are in better agreement with the experimental data.

Keywords: Storm water treatment; bioretention; Low Impact Development (LID); hydrological model.

ID_2859

EVALUATION OF MITIGATION STRATEGIES FOR DIFFUSE PHOSPHORUS POLLUTION IN A SHALLOW LAKE THROUGH INTEGRATED MODELING APPROACH

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Abstract: Lake Mogan which is located 20 km south of Ankara, Turkey has a watershed area of 970 km², and it is dominated by areas with dry agricultural practices. Intense agricultural activities and high urbanization rates are the most important factors affecting the water quality in Lake Mogan. In this study, the effects of different best management practices (BMPs) on diffuse phosphorus load and the required percent reduction in total phosphorus load are evaluated. For this purpose, Soil and Water Assessment Tool (SWAT) and a Phosphorus budget model are utilized in an integrated manner. The results show that the most effective BMP scenario results in 11.1% reduction in the total phosphorus load. However, according to phosphorus budget model external total phosphorus load has to be decreased by 16.5% to 91.6% to reach limit phosphorus concentration value in Lake Mogan. There are several management alternatives suggested other than BMPs to improve the water quality in Lake Mogan such as flow augmentation and sediment dredging. Therefore, it is recommended that a water quality model of Lake Mogan should also be developed and integrated with SWAT model to develop holistic solution proposals in the watershed.

Keywords: SWAT Model; Lake Mogan; Diffuse Pollution; Lake P Budget Model; Best Management Strategies; Shallow Lakes

ID_2821

PREDICTING PRESSURE LOSS FOR A NEWTONIAN FLUID IN ANNULUS UNDER EFFECTS OF TEMPERATURE AND ROTATION VARIATION BY ARTIFICIAL NEURAL NETWORK

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Abstract: Determining pressure loss in annulus has been a great attention of researchers in various engineering branches. Either analytically or numerically, it is difficult task to determine the pressure loss in annulus under effects of temperature and inner pipe rotation. Recent enhancement in computational intelligence technology enables to predict pressure loss within reasonable accuracy. In this study, various Artificial Neural Network (ANN) models are investigated to figure out the best algorithm. In order to train the algorithm, experimental data which was conducted at flow loop in Izmir Katip Celebi University, Fluid Mechanics & Hydraulics Laboratory. The results showed that pressure loss in annulus under effects of temperature and inner pipe rotation can be predicted within $\pm 4.01\%$ error margin.

Keywords: Artificial Neural Network, prediction, numerical model

ID_2787

UNIVERSAL EMPIRICAL MODEL FOR PREDICTING RAINFALL— RUNOFF INDUCED TOTAL SEDIMENT LOAD FROM BARE LAND SURFACE

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Abstract: Empirical model based on bed slope, rainfall intensity, rainfall duration, and mean particle diameter was developed using measured experimental data. The data collected from the literature belong to event based rainfall—runoff flume experiments. The flume experiments have wide range of rainfall duration (5—60 minutes), rainfall intensity (32—117 mm/h), bed slope (7—40%), and mean particle diameter (0.15—0.45 mm). Total of 272 sets of data were employed in the development of the empirical formula. 62% of the data were used for the calibration and the rest for the validation of the developed model. The optimal values of the coefficients and exponents of the empirical model were obtained by employing the genetic algorithm (GA). The predictions were improved when developing empirical models separately for the slopes less than 20% and equal or greater than 20%. Performance of the model was further tested against field experimental data. The model does not require measurement of flow rate and thus has important implication for ungauged basins.

Keywords: Empirical model, bare slope, sediment load, genetic algorithm, prediction

ID_2869

DETECTION OF THE CAUSATIVE METEOROLOGICAL PARAMETERS OF SOLAR DIMMING IN THAR DESERT OF NORTHWEST INDIA

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Abstract: A reliable estimate of the availability of solar radiation on the earth's surface is an important aspect in view of the increase in over-dependence on the fossil fuels in both developing and developed countries. Solar radiation is the most important parameter used in analyzing the performance of various renewable energy based instruments, in evaluating the risk of forest fires and in hydrological modelling. Records of solar radiation of Jodhpur, an arid site of Rajasthan, are used to identify whether there exist any signs of solar dimming in the Thar Desert situated in the northwest India. Decreasing trends in solar radiation obtained by using the Mann-Kendall non-parametric test were witnessed in the range of (-) 0.31 to (-) 0.70 Mega Joule/m² per decade at Jodhpur in different durations: all the four seasons; annual time scale; and all but one of the twelve months. The observed solar dimming may possibly be due to rising air pollution caused due to ever-increasing vehicles and industrialization in recent past at Jodhpur. Wind speed is also found to be one of the most important driving factors of the dimming over the Thar Desert site in northwest India.

Keywords: Solar radiation; Jodhpur; Thar Desert; Trend; Mann-Kendall.

ID_2929

EXPERIMENTAL ANALYSIS OF SEDIMENT INCIPIENT DEPOSITION IN RIGID BOUNDARY OPEN CHANNELS

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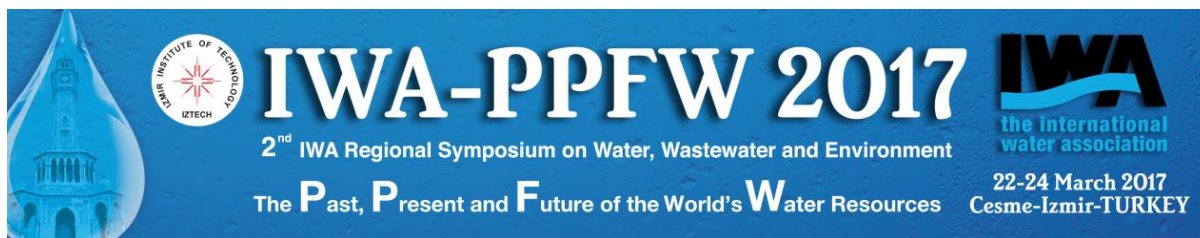
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Abstract: Drainage systems must be designed in a way to minimize undesired problems due to deposition of sediment such as decrease in hydraulic capacity of the channel, blockage and transport of pollutant. Channel design considering self-cleansing criteria are used to solve sedimentation problems. Incipient deposition is one of the nondeposition self-cleansing design criteria that can be used as a conservative method for channel design. To this end, experimental studies have been carried out in five different cross-section channels namely; trapezoidal, rectangular, circular, U-shape and V-bottom. Experiments were performed in a tilting flume using four different sizes of sands as sediment in nine different channel bed slopes. Two well-known methods for evaluation of sediment motion namely; Novak and Nalluri and Yang methods are considered for experimental data analysis. Equations developed based on experimental data in this study are found in agreement with the literature. It is concluded that design velocity and shear stress are both dependent on the channel cross-section shape. Rectangular and V-bottom channels need lower and higher incipient deposition velocities and shear stresses, respectively, in comparison with other channels.

Keywords: Drainage system; incipient deposition; rigid boundary channel; sediment transport; self-cleansing



ID_2894

COMPUTER-AIDED DESIGN OF MARINE OUTFALL DIFFUSERS

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Abstract: Marine discharge systems aim; the collected wastewater in urban wastewater networks, wastewater treatment according to needs identified after the marine environment by giving a high dilution rates is to make harmless. Marine discharges systems; consist of conveying pumping system, wastewater pipelines and diffuser. Diffusers are usually placed in the end of the pipeline to provide dilution of wastewater to be discharged. They have certain port spaces and diameters. They can be designed as buried or freely laid to sea bottom.

In this study, computer-aided design of marine discharge diffusers is investigated from aspect of dilution and wave effects due to external flow, internal hydraulic flow analysis and mechanical analysis including thin-thick walled steel-pipe stress analysis and local buckling and buckling propagations. Waste water discharges must be analyzed by near field, far field and bacterial thinning with cloud heights. Finally, the feasible diffuser geometry due to internal and external flow is determined by assigning the certain diameter required hydraulically for discharge, providing the required specifications for dilution and obtaining the required pipe thicknesses from steel pipe structural analysis.

The considered pipe diffuser system is especially laid freely at sea bottom. At the beginning of the study, the main principles of fluid mechanics were guiding. Internal pipe pressures, velocities and reaction forces due to the hydrostatic external pressures at the end of port diffusers are calculated by basic principles of fluid mechanics considering steady-state flow. External forces generated from waves are also calculated by using the Linear wave theory. Under these external and internal forces, the pipe stability and strength are carried out in terms of jets, plumes and microorganism concentration due to effluent dilution are discharged horizontally and vertically. In scope of computer-aided design, hydraulic and stress analyses, initial and boundary conditions foreseen for dilution are taken into consideration. To find suitable diffuser size, the internal and external pressures, flow rate transmitted by diffuser, internal pressures and velocities in varied-cross section diffuser including ports in certain intervals are calculated iteratively and sequentially by generating special MATLAB software (called as Diffuser Pipe-DESIGN) to satisfy the required conditions. The algorithms are classified into three groups: algorithm on hydraulic analysis, algorithm on structural analysis and algorithm on diluting analysis. At the same time, the relating case study based on this software is taken into consideration in the scope of this study. Finally, the DIP-DESIGN software provides many advantages in designing diffusers with considering the external and internal flow conditions, specifications of dilution and pipe size and geometry requirements.

Keywords: Computer, aided, software, diffuser, pipeline, outfall

THE RAMCAP APPROACH FOR WATER SUPPLY SYSTEMS RISK ASSESSMENT IN EMERGENCY CONDITIONS

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Abstract: Water supply systems are vital infrastructures that play an important role in consistency and survival of a human society, especially in critical situations (due to natural disasters or human-made threats). Evaluating and enhancing resilience in water infrastructure is a crucial step towards more sustainable water management in metropolises at emergent situations. Unlike the traditional risk analysis where we utilize an integrated risk analysis approach that shifts the objective from analyzing multiple and unknown threats to analyzing the more identifiable and measurable system responses to extreme conditions, i.e. potential failure modes. The purpose of this research is to provide an understanding of the RAMCAP approach and its use to identify priorities and coordinate preparedness of a typical water supply systems in the western of Tehran. The study focuses on protection (avoiding hazardous events or their consequences) and resilience (rapid return to full function after those events that occur). The RAMCAP approach is a high-level approach that can be tailored to various sectors, thereby providing a mechanism for comparing risk and risk-management benefits at scales ranging from assets to whole sectors of the economy. The study reveals RAMCAP provides an overview of a water system's resilience to various failure modes. For each failure mode, it identifies the range of corresponding failure impacts and reveals extreme scenarios (e.g. the complete loss of water supply due to only 5% pipe failure, or still meeting 80% of demand despite over 70% of pipe failure). The method can be used as a comprehensive diagnostic framework to evaluate a range of interventions for improving system resilience in future studies.

Keywords: RAMCAP, Resiliency, Risk Analysis, Threats, Water supply systems

ID_2912

NUMERICAL FLOOD MODELS IN THE PROJECTED WASTE DISPOSAL SITE IN IZMIR

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Abstract: Determination the location of waste disposal sites has always been a challenge for researchers and government organizations. Since the problem on fundamental level is complicated and bound to several of parameters. The effects of the project from the perspectives of economic, social and environmental should be evaluated delicately. This study focuses on surface water accumulation and flood effects; one of the several criteria at the step of decision making to determine the location of waste disposal sites. As a candidate area Yamanlar region (Izmir), where is located on the caldera, is chosen for examining from surface water effects. The methodology that followed for the study was creating 1-D and 2-D numerical flood models through the objected land and evaluating the solution to keep candidate are safe from effects. Models geometrical data taken from ArcGIS via the Hec-Georas interface and build in one of the well know surface water simulation program Hec-RAS. The result show that the highest rainfall value was found to be 136.4 mm on 8 February 2010 in Izmir. Based on this meteorological data, flood analysis was done Hec-RAS. From the analysis result indicated that it is necessary to design a flood channel that can able to support 1.674 m³/sec for main channel upstream, 2.407 m³/sec for main channel downstream and 0.732 m³/sec for side channel flow rates under suitable hydraulic conditions.

Keywords: Numerical model, waste disposal site, flood effect, natural disaster

ID_2980

NUMERICAL MODELING OF EFFECT OF THE OUTLET TYPE ON STRATIFICATION USING FLOW 3D

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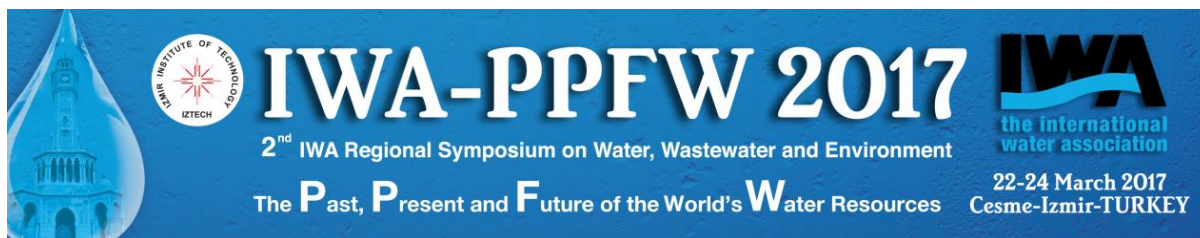
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Abstract: This paper studies on the stratification capability of reservoirs or lakes with different conditions by changing some important parameters that can affect the temperature and suspended sediment distribution patterns in reservoir/lake, numerically. The commercial software package Flow3D was selected for simulations of this research. Therefore, series of model scenarios were done to understand and quantify the formation of the stratification and propagation of suspended sediments and temperature in reservoirs and lakes with several changes in some important parameters included as discharge, temperature of water, suspended sediment concentrations and outlet type. An important parameter, which this article focuses on it, is the type of outlet of dams included the spillway and the bottom outlets. The results of the simulated models, were compared, graphically. According to these results, conclusions were made. The main use of results of this study is to improve the reservoirs or lakes operation.

Keywords: Numerical model, stratification, simulation



ID_2813

OPTIMAL DEWATERING OF AN EXCAVATION SITE BY USING A LINKED SIMULATION-OPTIMIZATION APPROACH

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Abstract: The objective of this study is to propose a linked simulation-optimization approach for solving the optimal dewatering problems of a given excavation site. In the proposed approach, an analytical groundwater flow model is considered to simulate the flow process in the subsurface. This flow model is then integrated to an optimization model where differential evolution (DE) algorithm is used. The objective of the DE based optimization model is to determine the locations and the pumping rates of the proposed dewatering wells by minimizing sum of all the pumping rates as the objective function. During the search process, the constraints related with the drawdown and well locations are considered by means of the penalty function approach. The performance of the proposed approach is evaluated on a hypothetical excavation site for different well numbers. Identified results for given excavation site indicated that, the optimal dewatering system can be successfully determined by using the proposed approach.

Keywords: Dewatering, simulation, optimization approach

ID_2936

NUMERICAL MODELING OF EFFECT OF THE OUTLET TYPE ON STRATIFICATION USING FLOW 3D

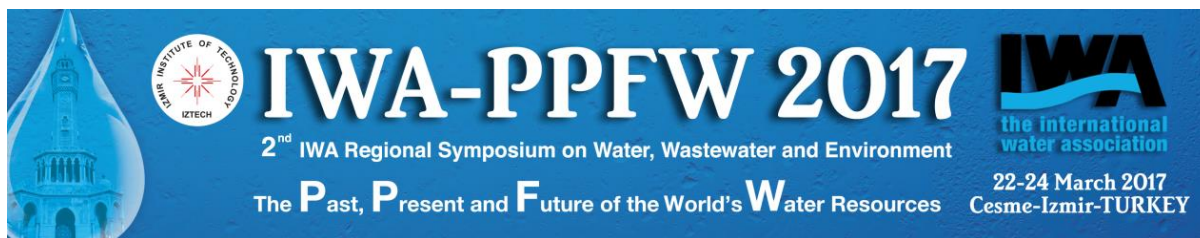
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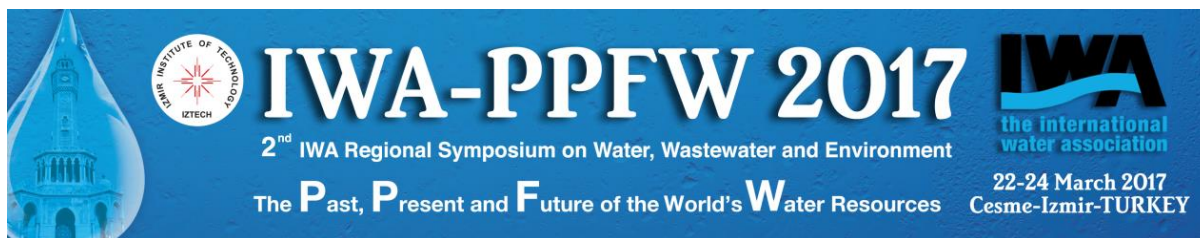
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ABSTRACT: This paper studies on the stratification capability of reservoirs or lakes with different conditions by changing some important parameters that can affect the temperature and suspended sediment distribution patterns in reservoir/lake, numerically. The commercial software package Flow3D was selected for simulations of this research. Therefore, series of model scenarios were done to understand and quantify the formation of the stratification and propagation of suspended sediments and temperature in reservoirs and lakes with several changes in some important parameters included as discharge, temperature of water, suspended sediment concentrations and outlet type. An important parameter, which this article focuses on it, is the type of outlet of dams included the spillway and the bottom outlets. The results of the simulated models, were compared, graphically. According to these results, conclusions were made. The main use of results of this study is to improve the reservoirs or lakes operation.



Theme G Treatment Technology

ORAL PRESENTATION



ID_2837

ARSENIC REMEDIATION OF DRINKING WATER: AN OVERVIEW

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Abstract: Removing arsenic from water is a challenging task. It may require the use of expensive treatment methods. The handling and disposal of treatment residuals may introduce additional complications. Therefore, source substitution options should be adopted wherever appropriate. When removal of arsenic becomes inevitable, decision makers should recognize and thoroughly evaluate the impact of replacing or adapting existing treatment practices (if there are any) or adding new treatment technologies for achieving the target arsenic removal. Remediation methods for arsenic removal/reduction from drinking water can be broadly grouped into (1) precipitation processes, (2) adsorption and ion exchange processes, (3) membrane processes, (4) oxidation processes, (5) bioremediation and (6) identification of different sources. In this talk, firstly a brief introduction on the aqueous chemistry of arsenic will be provided to guide the audience through the key processes related to arsenic removal. Afterwards, an overview of arsenic treatment options will be provided.

Keywords: Arsenic removal, water, coagulation, filtration, adsorption

ID_2818

THE USAGE OF VETIVERIA ZIZANIOIDES(L.) NASH AND CYPERUS ALTERNIFOLIUS L. BY FLOATING METHOD FOR TREATMENT OF OLIVE MILL WASTEWATERS

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Abstract: Olive mill effluents (OMEs) pose a great environmental danger due to its strength, types of contaminants, and high phytotoxicity. They are a unique problem in the Mediterranean countries because of wide spread production. Many treatment methods were proposed, some of which have been applied but due to common small scale traditional production, these processes could only be considered by large companies. Therefore, in this study, treatment of OMEs through an innovative floating method with Vetiver grass (*Vetiveria zizanioides* (L.) Nash) and Umbrella palm (*Cyperus alternifolius* L.) which are rich in fringe root structure and adaptable in the Aegean region were investigated. The OMEs were analyzed at the beginning of the experimental duration for their phenol, and other components. Later, the OMEs were diluted by 5, 10, 20, 30, and 40% with DI water, and pHs were adjusted. Then vetiver grass and umbrella palm were planted in water by floating technique. Their growth in the roots and leaves were monitored. The total phenol concentration was measured at the beginning and end of experiment by a UV spectrometric method.

Preliminary results showed that umbrella palm effectiveness in the removal of phenolic compounds were significantly higher than vetiver grass. Up to 15% dilution, significant removal of phenolic compounds was observed. Above 15% dilution, the both plants did not adapt to the content of water. Any growth in roots and leaves were observed.

Keywords: Treatment, waste water, UV spectrometric method

ID_2379

REMOVAL OF ARSENATE FROM GROUNDWATER BY ELECTROCOAGULATION PROCESS USING AL BALL ANODES: BOX-BEHNKEN DESIGN FOR MODELING AND OPTIMIZATION

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ABSTRACT: This study aims at removal of As(V) from groundwater by an air-injected electrocoagulation (EC) reactor using aluminium (Al) ball anodes. The groundwater was collected in the Kocaeli region in Turkey (pH : 7.6, conductivity 1055 mS/cm and hardness 418 mg/L). The Box-Behnken statistical experiment design (BBD) were used to investigate the effects of major operating variables e.g. initial pH (pH_i : 5.5–8.5), operating time (t_{EC} : 2–18 min), current (i : 0.1–0.5 A), size of Al anode ball (d_p : 5–10 mm), initial As(V) concentration (C_0 : 100–1000 $\mu\text{g/L}$), air flow rate (Q_{air} : 2–10 L/min) and column height of Al ball (h : 2–8 cm). ANOVA results of the quadratic model equations which contain the incorporate effects of the variables such as effluent total arsenic concentration, removal efficiency, operating cost and energy consumption proved accuracy of the model ($R^2 \geq 0.87$, $\text{Adj-}R^2 \geq 0.71$ ve $\text{Prob}>F = <0,0001$). Removal efficiency of As(V) was decreased with increasing initial concentrations of arsenic from 100 to 1000 $\mu\text{g/L}$ while its removal efficiency increased with operating time, height of anode and applied current. The model predicted for a residual As(V) concentration to 9.9 $\mu\text{g/L}$, which is the maximum contaminant level established by World Health Organization (WHO) in drinking water at the optimum operating conditions (pH_i : 7.03, i : 0.29 A, t_{EC} : 10.12 min., d_p : 7.37 mm, C_0 : 613.4 $\mu\text{g/L}$, h : 5.1 cm and Q_{air} : 6.4 L/min). The maximum removal efficiency of As(V), minimum operating cost and energy consumption of the EC process were obtained as %98.87, 0.442 $\$/\text{m}^3$ and 1.85 kWh/ m^3 , respectively.

Keywords: Arsenate removal; Electrocoagulation; Optimization; Al ball anodes; Box-Behnken statistical experiment design; Air-injected electrocoagulation reactor

ID_2873

AREAL VARIABILITY OF L-MOMENT RATIOS FOR PEAK DISCHARGES IN TURKISH RIVERS

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Abstract: In the design of hydraulic structures, it is important to estimate the flood for a given return period. Determination of an acceptable design criterion depends mostly on the probability distribution of the flood.

In this study, L-Moment ratios (L-coefficient of variation, LC_v ; L- coefficient of skewness, LC_s ; L- coefficient of kurtosis, LC_k) of 167 flow gauging stations are calculated for annual peaks of Turkish rivers. Besides, the spatial distributions of these statistics are given with L-Moment ratio maps and the use of the maps was explained integrated to L-Moment ratio diagrams.

With these maps, the disabilities arising from the usage of point information of a project will considerably be avoided. So, for a project area even without any observations or data the maps of L-Moment ratios provide to estimate the frequency distribution models of peak discharges and a robust basis for flood frequency analysis.

Keywords: L-Moments ratio maps, L-Moment ratio diagrams, Flood frequency distributions.

ID_2857

CROSS-LINKED CHITOSAN/MARBLE POWDER COMPOSITES FOR THE ADSORPTION OF DIMOZOL BLUE

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Abstract: Cross-linked chitosan(C)/marble powder (M) composites with different weight ratio percentage (C100M0, C70M30, C50M50 and C30M70) were prepared from marble powder and chitosan, and were cross-linked using glutaraldehyde. To evaluate the adsorption behavior of the chitosan/marble powder composites, 0.1 g adsorbent was added into 50 mL Dimozol Blue solution with fixed concentrations (60 mg L^{-1}). At equilibrium, the adsorption capacity of C70M30, C50M50 and C30M70 for Dimozol Blue dye is about 27 mg/g and is greater significantly than that of C30M70. The adsorption kinetics of Dimozol Blue onto the chitosan/marble powder composites from aqueous solution was investigated. Kinetic studies reveal that Dimozol Blue dye adsorption was described well by the pseudo-second-order model for all the composites. In this study, the morphology and the surface area of the chitosan/marble powder composites were also characterized with a scanning electron microscope (SEM, Bruker, Germany) and using Micromeritics (ASAP 2020) BET (Brunauer, Emmett and Teller) instrument, respectively. The results of this study indicated the applicability of the chitosan/marble powder composites for removing industrial dyes from aqueous solution.

Keywords: Adsorption, Dimozol Blue solution, SEM, BET

ID_2889

SEPARATION OF BORON AND LITHIUM FROM AQUEOUS SOLUTION VIA BIPOLAR MEMBRANE ELECTRODIALYSIS (BMED)-INFLUENCE OF INITIAL ACID AND BASE CONCENTRATIONS

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Abstract: In this study, the application of bipolar membrane electro dialysis (BMED) in separation of boron and lithium from aqueous solutions was investigated. For this purpose, model solutions which contain lithium and boron were used. Effect of initial acid and base concentrations in acid and base compartments on separation efficiency was investigated. It was found that the change in the concentrations of acid and base solutions has a significant influence on removals and recoveries of boron and lithium. As a result of the work, maximum lithium and boron recoveries were obtained as 66% and %55, respectively.

Keywords: BMED, aqueous solution, Boron, Lithium

ID_2629

EFFECTS OF DOSING ACTIVATED CHLORIDE ON THE COAGULANT USAGE IN DRINKING WATER TREATMENT

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Abstract: Presence of OCl⁻ (activated chloride or hypochlorite) give simultaneous reactions with the unwanted materials in water. By this way, coagulation of these materials is accelerated. As a result of this less coagulation agent is needed for the treatment of the drinking water. In this study, we dosed OCl⁻ to the water before the coagulation pools. The coagulant dosage reduced by the analysis of suspended solid particles.

Keywords: Coagulation, drinking water, treatment

ID_2964

USE OF FILTERABILITY INDEX IN GRANULAR FILTRATION: EFFECT OF FILTER MEDIUM GRADING AND PRETREATMENT CONDITIONS

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Abstract: In this study, the use of filterability index to compare the effectiveness of different media and their grading as well as the effects of pretreatment conditions applied before filtration on particle capturing performance of the filters were investigated.

Keywords: Filtration, pretreatment

ID_2975

ELECTRODIALYTIC ED AND EDI PROCESSES FOR BRINE PRODUCTION FROM SEAWATER

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Abstract: Performances of electromembrane systems were investigated for brine production from seawater. Electrodialysis (ED) and Electrodeionization (EDI) systems were operated with ten cell pairs under constant voltage runs. Before the experimental studies for several concentrations of dilute and concentrate streams Limiting Current Density (LCD) values were determined experimentally for both systems.

The process performances of ED and EDI were compared for brine production from seawater for chlor alkali process. Both ED and EDI processes were studied with various concentration levels at constant potential value defined as some ratios of LCD value. Experimental results show that, the EDI process has lower specific power consumption (SPC) than the ED process. Also, the study showed that the EDI process with a constant voltage mode could be used as an effective brine production process due to lower SPC.

Keywords: Seawater, Electrodialysis (ED), Electrodeionization (EDI)

ID_2887

UTILIZATION OF ELECTRO-MEMBRANE PROCESSES (ED, EDI) FOR PURE WATER PRODUCTION FROM RO PERMEATE AND RO CONCENTRATE OF GROUNDWATER

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Abstract: In this study, the applications of electrodialysis (ED) and electrodeionization (EDI) methods in pure water production from reverse osmosis (RO) permeate and RO concentrate streams of ground water were investigated. For this purpose, groundwater samples were taken from a fruit juice factory which is located in Izmir. For laboratory experiments, a lab-scale membrane filtration test system was employed. The BW30 membrane was used as (RO) membrane. The permeate stream was used as the feed of EDI system while the concentrate stream was first fed to ED system. Then, the obtained ED dilute was used as the feed of EDI system. The qualities of product waters obtained in both cases were compared.

Keywords: Electro-membrane process, groundwater, Utilization

ID_2890

WASTE LDPE AND HDPE WASHING WASTEWATERS PHYSICO-CHEMICAL TREATABILITY WITH SULPHONATED POLYSTYRENE (SPS)

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Abstract: LDPE and HDPE type plastic wastes caustic washing (in 42% NaOH solution at 90 °C) wastewater characteristics and responses to applied coagulation flocculation treatment procedures were compared. Sulphonated polystyrene (SPS) was synthesized from waste PS plastic and was utilized as flocculant. The classical sulphonation method was applied to the waste polystyrene (PS) plastics instead of virgin polystyrene as raw material. LDPE and HDPE type plastic washing wastewater compositions differ. In terms of organic and inorganic content, the former has higher turbidity, K, Si and P while the latter contains more organic matter, SS, oil-grease, S and Ca. Therefore, the response of the wastewater to applied coagulation-flocculation process differs. The process was highly pH dependent and while the original pH (13) of HDPE washing wastewater was optimum in its physicochemical treatment (74-97% turbidity removal), LDPE washing wastewater required neutral pH (7) for the similar treatment level (87-99%). A second-generation material, SPS was synthesized from polystyrene type plastic wastes and utilized as flocculant in this study. It was found at similar performance to conventional flocculant PE. Optimum dosages, performances and pHs for SPS and PE were close to each other or SPS has slightly higher performance in turbidity and oil-grease removal.

Keywords: Coagulation-flocculation, LDPE, HDPE, plastic washing wastewater, waste PS sulphonation.

ID_2827

HETEROGENOUS PHOTOCATALYTIC DEGRADATION AND MINERALIZATION OF 2,4-DICHLOROPHENOXYACETIC ACID (2,4-D) HERBICIDE IN AQUEOUS SUSPENSIONS OF TiO₂

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Abstract: In the present work, the performance of the photocatalytic degradation and mineralization of commercial 2,4-dichlorophenoxyacetic acid (2,4-D) in water using UVA/TiO₂ process in batch condition was investigated. The effects of the fundamental photocatalytic parameters such as pH of the solution (3-9), amount of TiO₂ (0-2.0 g/L), irradiation time (0-90 min) and initial herbicide concentration (10-50 mg/L), on the photodegradation efficiency of 2,4-D was investigated. Photocatalytic oxidation of 2,4-D showed 99% degradation and 47% mineralization at 3 h under UVA light (365 nm/36 Wm⁻²) at pH 5, initial herbicide concentration 25 mgL⁻¹ at constant rpm (150 rpm) and constant temperature (22 ± 1 °C). The results also show that the half-life (DT₅₀) of a 25 mg/L aqueous solution of 2,4-D was 15 min in optimized conditions. Moreover, 20 % total organic carbon (TOC) and 34% absorbable organic halogen (AOX) removal was achieved at optimized conditions in 3 hours. Scanning electron micrograph (SEM) and energy dispersive spectroscopy (EDS) results showed the adsorption of 2,4-D molecules on TiO₂ nanopowders and FTIR results supported the degradation of 2,4-D herbicide in aqueous solution during the photocatalytic process.

Keywords: 2,4-dichlorophenoxyacetic acid (2,4-D), herbicide, photocatalytic degradation, TiO₂ nanoparticle, UV irradiation.

ID_2649

INFLUENCE OF A NOVEL SURFACE MODIFICATION PROCESS ON THE PHYSICOCHEMICAL CHARACTERISTICS OF BLACK TEA (CAMELLIA SINENSIS) WASTE

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Abstract: In this work, black tea waste (BTW) surface was modified using bleaching treatment method by household chlorine water. The study focuses on a comparison of the physicochemical feature before and after bleaching process. BTW and bleached-black tea waste (B-BTW) were characterized by Fourier transform infrared (FT-IR) spectroscopy, Scanning electron microscopy (SEM), Thermogravimetric analysis (TGA), X-ray powder diffraction (XRD), Brunauer-Emmet-Teller analysis (BET), and surface acidity and pH_{pzc} measurements. Compared to black tea waste, different functionalities and morphology on the surface have formed after the bleaching process. The results indicate that household chlorine water has remarkable effects on BTW.

Keywords: Black tea, modification, bleaching treatment method

ID_2840

NUTRIENT REMOVAL IN FED-BATCH OPERATED PHOTOBIOREACTOR SYSTEM BY CHLORELLA VULGARIS

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Abstract: Nitrogen and phosphorus removal from wastewater by *Chlorella vulgaris* micro algae by fed-batch operated photobioreactor system was investigated. The photobioreactor was operated at different initial ammonium nitrogen concentrations and N/P ratios. $\text{NH}_4\text{-N}$ concentration was varied between 12.6 mg/L and 32 mg/L at constant light intensity, Light/Dark cycle and N/P ratio as 1100 lux, 20 h / 4 h and 4/1, respectively. N/P ratio was changed between 4.6/1 to 7.3/1 at constant initial $\text{NH}_4\text{-N}$ concentration of $\text{NH}_4\text{-N}_0 = 42 \pm 2$ mg/L. The other parameters were adjusted as light intensity=1100 lux and L/D=20h/4h. The highest $\text{NH}_4\text{-N}$ and $\text{PO}_4\text{-P}$ removal efficiencies were obtained as 84% and 83%, respectively, at initial 12.6 mg $\text{NH}_4\text{-N/L}$. The minimum N/P ratio for efficient removal of nitrogen (75%) and phosphorus (75%) at high $\text{NH}_4\text{-N}$ concentration of 42 ± 2 mg/L was determined to be N/P=4.6. The most important factor affecting algal nutrient uptake were determined as initial nitrogen concentration

Keywords: algae, fed-batch, nutrient removal, photobioreactor.

ID_2911

REMOVAL OF NICKEL(II) IONS FROM AQUEOUS SOLUTION BY SEPIOLITE AS AN EFFECTIVE AND LOW-COST ADSORBENT

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Abstract: This study aimed to investigate the usability of two different sepiolite samples, meerschaum carving residue (MR) and an industrial sepiolite (IS), as adsorbents in removing Ni(II) ions from aqueous solution. The effects of adsorbent dosage, initial pH, contact time, initial concentration and temperature on the adsorption of Ni(II) ions onto the sepiolite samples were investigated using a batch method. The optimum adsorbent dosage was determined as 0.6 g adsorbent in 50 mL Ni(II) solution and the optimum pH value was 6 for both sepiolite samples. The equilibrium was reached in 480 min for MR and 360 min for IS. It has been determined that the adsorption process obeyed the Langmuir isotherm model and the pseudo-second-order kinetic model. Maximum Langmuir adsorption capacities at 45 °C were determined as 23.92 mg g⁻¹ for MR and 12.33 mg g⁻¹ for IS. In addition, it has been observed that the adsorption process was spontaneous and endothermic, and the randomness was increased.

Keywords: Aqueous solution, Langmuir, adsorption

2644 ADSORPTION OF HG(II) AND PB(II) FROM BINARY SYSTEM USING CLAY AND MODIFIED NANOCELLULOSE AS THE ADSORBENTS

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Abstract: Heavy metals contamination in water is very serious environmental problem due to its toxic effect for human and aquatic biota. Wastewater treatment of wastewater containing heavy metals is extremely necessary to improve the quality of water. Adsorption has been known as an efficient, effective, easy and economic method for the removal of heavy metals from water or wastewater. Natural resources such as bentonite and cellulose are abundantly available in some countries. Bentonite has exceptional characteristic such as high cation exchange capacity and high change on their lattice structure. Nanocrystalline cellulose is natural polysaccharide which is rod-like molecule with the range of 5-70 nm in width and 100 nm until several micrometers in length. It can be obtained through acid hydrolysis of cellulose. This nanocrystalline cellulose has hydroxymethyl groups that can be modified to enhance the adsorption ability. The adsorption of Hg(II) and Pb(II) from a binary system using bentonite and nanocrystalline cellulose as the adsorbents are given. The comparison of adsorption performance between bentonite and nanocrystalline cellulose towards Hg(II) and Pb(II) in the binary system were investigated through the isotherm, kinetic and thermodynamic parameters.

Keywords: adsorption, heavy metal, wastewater treatment, clay, cellulose

2633 COMPARING THE PERFORMANCE OF DIFFERENT BIOSORBENTS FOR SEQUESTERING OF HEAVY METALS FROM AQUEOUS SOLUTIONS

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Abstract: Heavy metals are ubiquitous in the environment and have been regarded as a nuisance which possesses a risk to man and other users of the environment. A study was carried out to assess the uptake of lead(II), copper(II) and Chromium(IV) from aqueous solution using the leaves and stem of *Diceriocraryum eriocarpum* plant (DEP) and chitosan synthesized from land snail shells. Fourier transform infrared (FT-IR) spectrometer supplied by Perkin Elmer (Waltham, MA, USA) and sampling accessories was used for functional group analyses. Surface area and pore width were determined by the N₂ gas Brunauer-Emmett-Teller (BET) method of analysis using a Micromeritics Chemisorption ASAP 2020 supplied by Norcross, USA. The chemical composition of the samples was analyzed using Rigaku, ZSX Primus II X-ray fluorescence spectrometer (Rigaku, USA). The surface morphologies of the samples were analyzed using scanning electron microscopy (SEM) (TESCAN, VEGA 3 SBU, Brno, Czech Republic). 4-8.7 mg of the biosorbents were heated between 30-900 °C at a rate of 10 °C/min using a TGA analyzer supplied by Perkin Elmer thermal analyzer (Waltham, MA 02451, USA) for thermal degradation studies of the biosorbents. From the characterization studies, three biosorbents have carbonyl and amino functional groups which have been regarded as good binding agents for heavy metals sequestering from aqueous solution. BET analysis of the biosorbents showed that they are all microporous and such materials have been reported widely in literature as suitable for the uptake of metals. The synthesized chitosan was a better biosorbent for the removal of lead(II) ions from aqueous solution compared with leaves and stem of DEP. However, when considering the uptake over a wide range of metals, DEP leaves was a better biosorbent than the others. The kinetics of the biosorption process for all the biosorbents was best described by the pseudo second order kinetic equation. Although both the Langmuir and Freundlich adsorption models could perfectly describe the biosorption process due to positive correlation coefficients exceeding 0.8 in all cases, the Langmuir model better described the process for the adsorption of Pb²⁺ onto DEP leaves and the synthesized chitosan based on the linearized coefficients while the Freundlich model better described that of DEP stem. All the biosorbents studied have high potential for use in water and wastewater treatment.

Keywords: Biosorption, *diceriocraryum eriocarpum* plant, heavy metals, synthesized chitosan.

ID_2814

OPTIMIZATION OF AEROBIC METHANE OXIDATION COUPLED TO DENITRIFICATION PROCESS IN MEMBRANE BIOFILM

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Abstract: The main purpose of this study is to optimize prerequisites for denitrification process in aerobic methane oxidizing membrane biofilm reactor (MBfR). The study was composed of two parts. In the first part, MBfR was operated at different O₂:CH₄ ratio and membrane surface area. O₂:CH₄ ratio of 0.6 with a surface area of 0.14m² was found optimum corresponding to dissolved oxygen and oxidation-reduction potential lower than 0.8 mg/L and -150mV in the bulk liquid, respectively. In the second part of the study, denitrification was tested under varying nitrate loadings at the optimum conditions obtained from the first part of the study. MBfR was operated well at 100 mg/L influent nitrate concentration, however increasing influent nitrate concentration to 400 mg/L resulted in decreasing nitrate removal efficiency from around 93 to 69%, respectively.

Keywords: Aerobic methane oxidation; membrane biofilm reactor; O₂:CH₄ ratio.

ID_2886

MEMBRANE FOULING DURING TREATMENT OF MBR EFFLUENT BY NF AND RO PROCESSES

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Abstract: In this study, long term experiments were performed with BW30 reverse osmosis (RO) and NF90 nanofiltration (NF) membranes by using membrane bioreactor (MBR) effluent as the feed solution. Chemical cleaning was applied after the experiments for flux recovery. Results of experiments show that the most of the initial flux can be recovered by chemical cleaning operation although a small portion of the initial flux was lost.

Keywords: membrane fouling, membrane bioreactor, nanofiltration, reverse osmosis, permeate flux

ID_2863

EFFECTS OF PRE-WASHING ON WASTE PET PYROLYSIS AND USE OF SULPHONATED POLYSTYRENE (SPS) IN PHYSICO-CHEMICAL TREATMENT OF WASTE PET WASHING WASTEWATER

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Abstract: The pyrolyzed material is separated into gas, liquid and solid (char) products. All fractions have utilities and economical value depending upon their characteristics. Washing the crushed dirty plastic wastes is an important preliminary process affecting the product quality. The first objective of this study is to obtain the product fractions of washed/unwashed waste PET and to determine the effects of pyrolysis temperature on the quality of the char and gas product. The second objective of the study is physico-chemical treatment of washing wastewater in which the synthesized sulfonated polystyrene (SPS) was used as flocculant. Waste PET plastics were washed in laboratory scale and wastewater was generated. The plastics were pyrolyzed in fixed bed pyrolysis system. Pyrolysis runs were performed at temperatures 300, 500 and 700°C with heating rates of 5°C/min. The results showed that increase in the pyrolysis bed temperature from 300°C to 700°C resulted in increase in the gas yield, as opposed to the decrease in oil product. At different chemical dosages and pH conditions turbidity, suspended solids, oil-grease and COD removals were between 80-90%. Both alum and FeCl₃ can be used as coagulants while the SPS can be suggested as flocculant in the treatment of waste PET-washing wastewater.

Keywords: PET plastic, pyrolysis, washing process wastewater, physico-chemical treatment.

ID_2916

PERFORMANCE ASSESSMENT OF PRESSURE-DRIVEN MEMBRANE PROCESSES FOR INDUSTRIAL WASTEWATER RECLAMATION AND REUSE-PILOT TESTS AT INDUSTRIAL ZONE

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Abstract: The idea of wastewater reclamation and reuse with modern day legislations was initiated in Japan in 1956 in order to restrict the use of groundwater by fast industrial growth at that time. Reuse of wastewater will conserve the fresh water resources and this will result in environmental protection. Membrane bioreactor (MBR) technology seems to be good alternative for wastewater reclamation and reuse as this process provides a good quality of product water. However, decreasing the salinity of product water is needed in some cases if the product water will be recovered and re-used as irrigation or process water. For this purpose, pressure-driven membrane processes such as nanofiltration (NF) and reverse osmosis (RO) could be employed for post-treatment of the MBR effluent (Koltuniewicz and Drioli, 2008; Li et al., 2008; Palaty, 2016).

In this study, ITOB-Organized Industrial Zone was selected as the pilot area where the membrane tests were conducted. This is a mixed organized industrial zone, where a wastewater treatment plant based on MBR process was first applied in Turkey. The wastewater treatment plant has a capacity of 8000 m³/day, although a 2,000 m³/day of plant capacity has been operating. The applicability of NF and RO processes in a pilot-scale system was investigated for post-treatment of MBR effluent to be utilized as irrigation and process water. For this, a pilot-plant consisting three TM720D-400 (RO unit) and three TM620-400 membranes (NF unit) was installed next to the MBR treatment plant. The quality assessment of NF and RO permeates was performed according to the guidelines of irrigation and industrial usage.

Keywords: Membrane bioreactor, waste water, membrane process, reuse-pilot tests

Acknowledgement: The financial support of TUBITAK (Project No.114Y500) is greatly acknowledged. We are grateful to ITOB-OSB for the great support in pilot tests. We thank S. Bunani and E. Altıok for their kind helps in instrumental analyses.

ID_2835

APPLICATION OF BOX-WILSON EXPERIMENTAL DESIGN METHOD FOR THE PHOTODEGRADATION OF YEAST PRODUCTION EFFLUENT

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Abstract: The effluent of yeast production industry includes high concentration of chemical oxygen demand (COD), nitrogen, dark color and nonbiodegradable organic compounds. In this study, a large baker's yeast production plant wastewaters operating in the Aegean region, the color removal was investigated with using Foto-Fenton ($\text{H}_2\text{O}_2/\text{Fe(II)}/\text{UV}$) oxidation processes. Effects of some operating parameters such as the initial oxidant and catalyst concentrations and pH of water on color removal was investigated using the Box–Wilson statistical experimental design method. Color removal was monitored throughout the operation period. Complete decolorization ($E=100\%$) was obtained with the addition of $2400\text{mg/L H}_2\text{O}_2$ and 121mg/L Fe(II) at 3.68 pH after 120 min. of exposure to the UV irradiation.

Keywords: Foto-Fenton oxidation, Box-Wilson, Decolorization, Yeast Production Industry.

ID_2954

WALL EFFECTS IN LIQUID-SOLID FLUIDIZATION

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Abstract: Liquid-solid fluidization has a number of applications in engineering (Epstein, 2003a, b). Expansion of granular filter media during backwashing is the most important application in Environmental Engineering. Another area of application that is of growing interest is fluidized-bed reactors used in wastewater treatment. It is important to have an understanding of fluidization principles and an ability to predict bed expansion as a function of liquid velocity to design such systems properly. Bed expansion correlations developed to date have been based on laboratory scale columns. Wall effects present in small columns, however, can limit the applicability of the resulting correlations to large full-scale equipment in which wall effects are not present. Existing models for wall-effects in fixed-bed processes are explained and compared in a recent study (Erdim et al., 2015). A systematic and conclusive evaluation of wall-effects, however, is still lacking in the fluidization literature. Fluidization experiments have been carried out in this work using five columns with different diameters and a large number of solid media with varying sizes and densities. Water was used as the fluid as water filtration is a primary area of application of this research. Results of this investigation, however, are valid not only for water but also for other liquids because all the data are expressed and analyzed in terms of dimensionless parameters like the Reynolds number. With approximately 4,000 separate measurements using five different columns, the present study is believed to be the most systematic and comprehensive single study focusing on wall-effects in liquid-solid fluidization.

Keywords: Fluidization, waste water, treatment

ID_2955

ON THE BACKWASH EXPANSION OF NON-UNIFORM AND NON-SPHERICAL FILTER MEDIA

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Abstract: Granular media filtration is one of the most important and commonly used operations in water treatment and is also widely used for advanced wastewater treatment. Successful filter design requires a correct specification of backwash rates for filter cleaning. Significant progress has been made in recent years towards a capability of accurate predictions of backwash expansion of spherical media (Akgiray and Soyer, 2006), uniform fractions of nonporous and nonspherical media (Soyer and Akgiray, 2009) and uniform fractions of porous nonspherical media (Yiğit Hunce et al., 2016). Nonuniform filter media, however, have not been studied in a systematic way so far. Current design calculations consider a bed with a size gradation to consist of several layers of approximately uniform size according to the sieve analysis data, and the expansion of each layer is separately calculated. The total expansion is calculated by adding the expansions of all the layers (Fair et al., 1971; Edzwald, 2011). The present work evaluates the accuracy of this approach and a number of alternative calculation methods by carrying out fluidization experiments with silica sand, garnet sand, perlite, crushed recycled glass, activated carbon, anthracite coal, and zeolite media.

Keywords: Backwash expansion, nonuniform filter media, non-spherical filter media

FUNCTIONAL GRAFTED NONWOVEN TEXTILE ADSORBENTS FOR ENVIRONMENTAL APPLICATIONS

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Abstract: Environmental pollution due to developments in technology is one of the most important problems of this century. The metal ions produced in wastes are of great environmental concern and economical interest. Specialized applications require more selective ion exchange resins that target one or more metal ions. In response to the need for greater selectivity, a class of resins called chelating ion exchange resins was developed. Chelating resins provide a significant improvement in ion selectivity relative to traditional ion exchange resins. A chelating polymer consists essentially of two components, i.e., a chelating group and a polymeric matrix. The properties of both components have to be taken into account when designing and synthesizing a chelating polymer. Graft polymerization on polymeric matrixes followed by functionalization is widely used for the surface modification of adsorbent materials. The polymeric adsorbents (hollow fiber, nonwoven fabric, film) of any desired forms with varied concentration of ion-exchange groups usually enhance adsorption efficiency of the adsorbents. Graft polymerization can be initiated by using gamma rays, electron beams, ultraviolet (UV), plasma treatment, and chemical initiators. Among these methods, ionizing radiation is one of the most promising methods, because of its creation of active sites for initiating grafting through the matrix of a polymeric substrate and its moderate reaction conditions. Radiation-induced graft polymerization being both economical and environmentally clean technique offers a number of advantages. From the point of view of matrix selection, high surface area materials are preferred because they are able to lead to higher adsorption capacity. Owing to its high surface area, fast adsorption kinetics and chemical stability under acidic conditions, polyethylene/polypropylene (PE/PP) nonwoven textile fabric has been extensively used as polymeric matrix to prepare adsorbents for heavy metal ions. Nonwoven textile fabrics (NWF) is also advantageous in that a higher flow rate is obtainable at lower operating pressures through the fabric and production cost is relatively economical [1-3].

In this study, different type of radiation grafted adsorbents have been prepared by using PE/PP nonwoven fabric for the recovery of uranyl ions from seawater and the removal of toxic metal ions from aqueous solutions. Different parameters including irradiation dose, monomer concentrations, reaction time and temperature were evaluated and optimized for grafting conditions. Adsorption performances of the grafted adsorbents were investigated by studying adsorption capacity, selectivity, uptake kinetics, and effects of competing ions. Considering the great surface area of nonwoven fabric, the synthesized nonwoven adsorbents can provide practical solutions to reduce waste discharges, recover useful materials, and reduce pollution.

Keywords: Nonwoven, polymerization, adsorption

ID_2885

EFFECT OF ACID AND BASE COMPARTMENTS COMPOSITION ON LITHIUM AND BORON RECOVERY FROM WATER BY BIPOLAR MEMBRANE ELECTRODIALYSIS (BMED)

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Abstract: In this study, the bipolar membrane electrodialysis (BMED) method for separation and recovery of lithium and boron was investigated. Lithium and boron were recovered as LiOH and H₃BO₃ with BMED, respectively. The effect of the compositions of acid and base compartments on BMED performance was monitored. The obtained results revealed that it was difficult to separate and recovery both lithium and boron with BMED when the initial acid and base solutions with lower conductivities were used. Therefore, acid and base solutions with moderate conductivities should be used for good separation and recovery performances by BMED method.

Keywords: BMED, bipolar membrane electrodialysis, lithium and boron recovery

ID_2824

CHARACTERISTICS AND ADSORPTION CAPACITIES OF LOW-COST NATURAL ADSORBENTS FOR ARSENIC REMOVAL

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Abstract: In this study, adsorption potential of iron coated sand (ICS) and sepiolite (ICSep) were investigated. Characterization of the materials was analyzed by using EDX (Energy-dispersive X-ray spectroscopy), scanning electron microscope (SEM) and BET method (Brunauer–Emmett–Teller). Batch experiments were conducted in order to obtain optimum adsorption parameters (i.e. contact time, adsorbent dose, and competition of ions). Isotherm studies were performed and adsorption capacities of the adsorbents calculated in this way. BET results stated that ICSep has much larger area than sand due to porous structure, and has micropores which provides an efficient adsorption. Results of the batch experiments showed that removal efficiency of arsenic could be over 90% in the conditions of adsorbent dosage 5.0 g/L, initial solution pH 7.0, and contact time 4 h, for both ICS and ICSep. Adsorption capacity of ICSep (0.501 mg/g) was found higher than ICS (0.142 mg/g). Arsenic removal rate of ICSep, in case of existing competing ions is 35% higher than ICS. Adsorption is a feasible method especially for rural areas and results of this study show that ICS and ICSep are efficient and cost-effective materials to remove arsenic from water by adsorption with recommended values by World Health Organization (WHO).

Keywords: Adsorption, EDX, SEM

ID_2871

BIOMATERIAL BASED HYDROGEL BEADS FOR THE REMOVAL OF HEXAVALENT CHROMIUM (Cr^{6+}) FROM AQUEOUS SOLUTIONS

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Abstract: The increasing use of heavy metals in industries has led to huge amounts of polluted aqueous effluents. This causes the water sources to be treated by means of a treatment methods which have low-cost and high efficiency. Among these methods, sorption related ones gain importance due to their advantages. For a sorption process, there are various types of naturally occurring and synthetically available sorbents that have high capacities of removal for pollutants. Great efforts have been made to study the sorption properties and mechanism on various biomaterials which are wastes of agricultural products or industrial productions. Since these raw biomaterials do not have sufficient capacity for treatment processes, they should be modified to improve the functional groups of them. The use of natural biopolymers such as chitosan and chitin is one of the techniques for modifying and improving low capacity sorbents [1]. Since high amino and hydroxyl functional groups are present in the structure of chitosan, functionalization with this un toxic and biodegradable material results in high efficient sorbents [2-3]. A waste biomaterial of olive oil production was prepared by crosslinking natural or synthetic polymers in the present study. Modification of these hydrogels was finalized via crosslinking in glutaraldehyde solution [4].

The objective of the present work was to develop hydrogel beads and evaluate their adsorption capacity for the removal of hexavalent chromium ions. Thus, for this purpose, the effect of pH, contact time, initial concentration, and amount of sorbent on extent of adsorption were investigated. Characterization of the sorbents before and after sorption process was carried out via SEM and FTIR. Adsorption rate for Cr^{6+} was maximum at an initial pH of 2 in 90 minutes contact time. The experimental data are fitted to Langmuir adsorption isotherm. It can be preferred as an alternative sorbent for the treatment of chromium including aqueous solutions.

Keywords: Chitosan, biomaterial, hydrogel, hexavalent chromium.

ID_2858

DRAMATICALLY ENHANCED FENTON OXIDATION OF CARBAMAZEPINE IN WASTEWATER

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Abstract: Pharmaceutical in natural waters could be an environmental problem because of their potential toxicology risk on living organisms. Conventional wastewater treatment plants are not enough to remove pharmaceutical therefore advanced oxidation process have become an attractive solution. Carbamazepine (CBZ), is an antiepileptic drug, is a most widely used medicine in almost every part of world. In present study, under laboratory conditions, coagulation followed by advance oxidation, using H₂O₂ and FeSO₄ (Fenton process) is used to degrade the concentrations of carbamazepine from water were conducted. Fenton process is known to be most effective and common methods for the treatment of such wastewaters. In the present study H₂O₂ was used with FeSO₄ for the treatment of carbamazepine and effects of H₂O₂, FeSO₄ concentrations COD and TOC removals were investigated. Experiments with optimal concentrations of H₂O₂ and FeSO₄ were carried out by changing pH and stirring time of solution (3, 3.5, 4), (15, 20, 30 min) respectively. Concentrations of FeSO₄ 10, 20, 30 mg/L and H₂O₂ 0.25, 0.5, 1 mL were selected. After reactions, 200 ml of samples were filtered and COD and TOC tests were performed. Results showed 75,86% COD and 42,78% TOC removal.

Keywords: Carbamazepine, Pharmaceuticals, Fenton Process, Water, Wastewater

ID_2864

DEGRADABILITY OF ASPIRIN FROM DRINKING WATER WITH USING OF HYDROGEN PEROXIDE

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Abstract: Pharmaceuticals, as important micropollutants in environment and have become a subject of arresting concerns, nowadays. Acetylsalicylic acid, the modern version of Aspirin, is one of the most important nonsteroidal anti-inflammatory, analgesic and antipyretic drugs in the world. Pharmaceuticals at certain concentration are toxic and could adverse effects on the ecosystem. Conventional wastewater treatment plants are not enough to remove micropollutants therefore advanced oxidation process have become an emerging solution. In this study, the effectiveness of aspirin degradation in drinking water uses H₂O₂. Biodegradability of the treated solutions are analyzed by TOC instrument. In this research, we have taken 50 mg/l acetylsalicylic acid synthetic solution. Later, we selected different H₂O₂ volumes (0,25-0,5-1 ml) and other conditions are pH (<3,5), 300 rpm stirring time (30 min), room temperature. After processing, 200 ml of samples was taken out from upper layers of samples and TOC tests were conducted. In this study, we aimed to optimum hydrogen peroxide volume with the best removal of aspirin.

Keywords: Aspirin, Micropollutant, Advance Oxidation, Tap Water, TOC

COMPARISON OF QUORUM QUENCHING AND BACKWASHING TECHNIQUES FOR BIOFOULING CONTROL IN SUBMERGED MEMBRANE BIOREACTOR

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Abstract: A variety of physical, chemical and biological methods have been adapted for control of biofouling in membrane bioreactors which is considered a major limiting factor in adaptation of MBR on large scales. This study was a combination of all the common types of biofouling control methods i.e. relaxation, permeate backwashing, chemical enhanced backwashing and Quorum Quenching. Membranes with different biofouling control strategies were operated and their effect on biofouling retardation, change in sludge characteristics and removal efficiency of organics and nutrients from wastewater were compared. Combined quorum quenching (QQ) and chemical enhanced backwashing (CEB) strategy resulted in 3.7 times longer filtration cycle in MBR as compared with that of permeate backwashing (PBW) but QQ+CEB strategy negatively affected the sludge characteristics. In comparison, QQ+PBW approach was found to reveal better sludge characteristics in terms of extra-cellular polymeric substance (EPS) and sludge retention time (CST) while exhibiting slight difference in biofouling control. COD and $\text{NH}_4^+\text{-N}$ removal efficiencies were found to be reduced from 93 to 79% and from 64 to 38%, respectively in MBRs with CEB using NaOCl concentration of 3.5 mg/L.

Keywords: Biofouling, membrane bioreactor, waste water

ID_2819

INVESTIGATION OF SHIPYARD WASTEWATER TREATMENT USING ELECTROCOAGULATION PROCESS WITH AL ELECTRODES

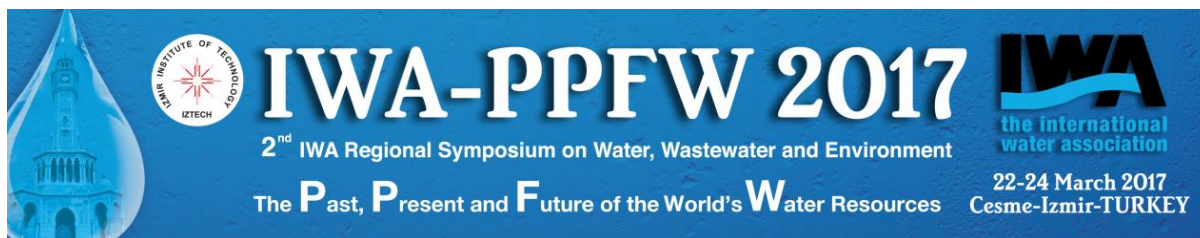
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Abstract: In this study, shipyard wastewater treatment was investigated by electrocoagulation using aluminum electrodes in a batch reactor. Approximate initial values of wastewater as chemical oxygen demand (COD), oil-grease and total suspended solids (TSS) were 6880 mg/L, 1640 mg/L and 1470 mg/L, respectively. All these parameters were evaluated under different operation conditions in this experimental work.

Keywords: Electrocoagulation, Oily wastewater.



Theme G Treatment Technology

POSTER PRESENTATION

ID_2938

REMOVAL OF ARSENIC, SELENIUM AND CHROMIUM BY VINYLPIRIDINE STRONG BASE FABRIC ADSORBENT

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Abstract: Recently, there has been increasing interest in the removal of arsenic, selenium and chromium due to their toxicological properties. Arsenic contamination in natural water sources is a global problem and the World Health Organization (WHO) guideline value for as in drinking water has been set to 10 ppb. Selenium is an essential trace element and can be considered beneficial to human health at low concentrations, but it can be toxic at higher concentrations. Chromium is commonly employed in the electroplating, leather tanning, paint, cement, metal finishing, and textile industries, and it is considered as toxic heavy metal found in water resources. In most environmental water sources (river, lake and rain water), arsenic, selenium and chromium exist in oxyanion forms (As(V), Se(VI) and Cr(VI)). These elements could enter into organisms from environmental waters. Therefore, it is particularly important to develop novel adsorbents for the removal of arsenic, selenium and chromium in environmental water samples.

The vinylpyridine (VP) is an important molecule containing tertiary amine functional groups and having a weak base property. Because tertiary amine groups can be chemically turned into quaternary amine groups which confer ion exchange properties, 4-vinylpyridine grafted polymers can be used as an ion exchange adsorbent. Polyethylene-coated polypropylene (PE/PP) nonwoven fabrics (NWFs) are commercially-available polymeric fabrics that can be used as polymeric support material in various applications. Radiation-induced graft polymerization method confers diverse functional properties to the hydrophobic polymer by using a particular hydrophilic functional monomer and adjusting the grafting medium. Thus, the adsorption property for certain ionic species can be improved by maintaining bulk polymeric structure.

This work describes a radiation-induced grafting of vinylpyridine onto PE/PP nonwoven fabric, quaternization to yield quaternized vinylpyridine strong base fabric adsorbent (QPVP) and studying of As(V), Se(VI) and Cr(VI) adsorption onto fibrous nonwoven fabric in aqueous solutions.

Keywords: Vinylpyridine(VP), adsorption, nonwoven

ID_2948

NONWOVEN COTTON FABRIC ADSORBENT FOR AS(V) REMOVAL

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Abstract: Arsenic is a naturally occurring hazardous metalloid that exists in four oxidation forms (–III, 0, +III and +V). Exposure to arsenic in long terms in drinking water may lead to both toxic and carcinogenic effects. According to these adverse effects, drinking water limit of arsenic was reduced to 10 µg/L by WHO (World Health Organization), EPA (Environmental Protection Agency) and European Community(EC). Adsorption and ion exchange are considered to be efficient and common methods used for arsenic removal in aqueous solutions [1-2].

In this study, plasma treated nonwoven cotton fabric was grafted with GMA and then modified with ethylenediamine to obtain functional fabric having weak base property. EDA-GMA-g-NCF as a novel adsorbent was used for the adsorption of As(V) ions from aqueous solution by studying the effect of pH, contact time, initial concentration, coexisting ions, ionic strength, desorption, reusability and tap water applications. The optimum solution pH was 3.00 for As(V) adsorption from aqueous solution. The adsorption equilibrium reached within 4h and adsorption capacity of nonwoven cotton fabric was found to be 213 mg As(V)/g adsorbent. Fabric adsorbent regenerated with 3% HNO₃ solution up to 9 cycles. EDA-GMA-g-NCF was treated with tap water samples spiked with As(V) ions in order to assess adsorption performance. It was found that EDA-GMA-g-NCF was able to remove more than 99% As(V) from tap water samples and met the drinking water standard value.

Keywords: Nonwoven, adsorbent, drinking water, aqueous solution

ID_2917

PREPARATION AND DEVELOPMENT OF FLOATING PHOTOCATALYTIC COMPOSITE PARTICLES VIA PICKERING EMULSION AND MEMBRANE EMULSIFICATION FOR DEGRADATION OF BISPHENOL

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Abstract: Floating photocatalytic composite particles were prepared via membrane emulsification and Pickering emulsion. An oil phase was injected through a water phase including the suspension of TiO₂ nanoparticles. The size of emulsion droplets was controlled by the membrane through which the lipid was injected into suspension of TiO₂ so that the created droplets were stabilized by TiO₂ nanoparticles on the shell having the lipid in the core. The most efficient stabilization of composite particles was achieved with the oleic acid as the core material which has the highest mass of TiO₂ included in the shell and the smallest particle size. This proves that the membrane emulsification process was a highly effective method of generating floating photocatalytic composite particles in terms of the controlling the particle size. Photocatalytic potential of those particles floated in water was tested for degradation of a target contaminant which is BPA as a function of initial concentration, pH, and composite particle core.

Keywords: Degradation, photocatalytic composite, bisphenol

ID_2946

FLOW-THROUGH ELECTROSORPTION PROCESS FOR REMOVAL OF 2,4-D PESTICIDE FROM AQUEOUS SOLUTIONS ONTO ACTIVATED CARBON CLOTH FIXED BED ELECTRODES

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Abstract: Waste water treatment systems have great importance in dealing with increasing environmental pollution. In the present study, a specially designed and constructed flow-through electrochemical cell was used to improve the efficiency of electrosorptive removal of 2,4-Dichlorofenoxyacetic acid (2,4-D) pesticide from aqueous solutions onto high area activated carbon cloth (ACC) fixed bed electrodes. During the electrosorption process, the change in concentration of 2,4-D was followed by an online UV–Vis spectrophotometric system. Effects of operational parameters such as applied potential, volumetric flow rate and existence of Na₂SO₄ salt on electrosorption of 2,4-D were examined. Optimum values were found to be 10 mL.min⁻¹ for volumetric flow rate and +900 mV for the applied potential to polarize ACC. Maximum capacity of 729 mg.gACC⁻¹ has been achieved for removal of 2,4-D pesticides. It can be concluded that the proposed waste water treatment system can be used for purification of real waste waters.

Keywords: Electrosorption, waste water, treatment

ID_2896

ACTIVATED CARBON PREPARED BY CHEMICAL ACTIVATION AS POTENTIAL SORBENTS FOR ACID AND BASIC DYES

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Abstract: Among several adsorbents, the activated carbons (ACs) outshine due to their great adsorption properties such as large specific surface and well-developed internal porous area, various functional groups on surface, high chemical and thermal stability. ACs are produced from biomaterial sources for a lower effluent removal cost with two well-known processes: physical and chemical activation (Pezoti, 2016; Tran, 2017).

Aim of this study was to prepare ACs obtained from different lignocellulosic materials and to investigate their dye sorption potential. Twelve activated carbons were produced from various biomaterial sources such as microorganisms (*Agaricus bisporus* and *Mortierella alpina*), plant residues (*Symphoricarpus albus* and *Thuja orientalis*) and agricultural residues (peapod and banana shells) through chemical activation processes. For this purpose, these biomaterials were activated by phosphoric acid and zinc chloride at 300–500 °C. Obtained activated carbons were investigated in terms of anionic and cationic dye biosorption performances (Rahman, 2005; Mohantya, 2005).

Elemental composition (C, H, N, S) and thermal properties of the samples were determined by elemental analysis and TGA/DTA analysis, respectively. Surface morphology and effective functional groups of the activated carbons were analyzed by SEM and IR analysis, respectively. Acid Blue 90 (AB90) and Basic Blue 1 (BB1) were selected as model anionic and cationic dye. The maximum adsorption yields of banana shells were found to be 86.37% and 88.43% while unprocessed materials have only removal yield of 61.63% and 56.04% for AB90 and BB1, respectively. Consequently, new and effective activated carbons were developed from different biological sources and successfully used for the removal of some toxic dyes from aqueous medium.

Keywords: Activated carbon, sorbent, basic dyes

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ID_2897

BORAGO OFFICINALIS: AN EFFECTIVE AND ENVIRONMENTALLY FRIENDLY BIOSORBENT FOR CADMIUM (II) AND MANGANESE (II) IONS

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Abstract: Cadmium and manganese are essential elements for humans and animals but high exposure of these in living bodies may cause Itai itai, manganese poisoning and Parkinson-like syndromes (Rollin, 2011) in addition to cardio and nervous system damages. These metals can enter ground and surface waters through different industrial activities such as battery manufacturing, smelting, metal mining and plating. Wastes from these industries are one of the major reasons of aquatic pollution (Kadirvelu, 2001).

In this study, *Borago officinalis* (*B. officinalis*) was successfully used for cadmium and manganese pollution control of aqueous solutions. Maximum biosorption capacities for cadmium (II) and manganese (II) ions were found to be 40.26 and 20.42 mg/g, respectively at original pH values of the solutions. Scanning electron microscopy (SEM), Transmission electron microscopy (TEM) and Fourier transform infrared spectrometry (FT-IR) indicated that the sorbate/biosorbent interactions are mainly electrostatic, complexation and chemical-ion exchange. FT-IR spectral analysis was carried out to determine the surface functional groups and possible interactions between *B. officinalis* and metal ions. After treating with cadmium (II) and manganese (II) solutions the carbonyl stretching vibration bands of untreated biosorbent (1622 and 1406 cm⁻¹) shifted to 1628 and 1421 cm⁻¹ for cadmium- and 1641 and 1421 cm⁻¹ for manganese-bounded biosorbent. In order to investigate the porosity of the biomass, BET specific surface area, total pore and micro-pore volume of the biosorbent were determined from N₂ adsorption isotherm and measured as 7.82 m²/g, 3.35×10⁻³ and 1.59×10⁻³ cm³/g, respectively. Zeta potential values of the biosorbent at pH 6.0 shifted from -57.87 to -21.60 and -22.70 mV after treated with cadmium (II) and manganese (II) ions, respectively (Akar, 2016). New cadmium and manganese signals in EDX spectra were further evidence of binding onto the *B. officinalis* surface.

Keywords: Biosorbent, cadmium, manganese, SEM, EDX

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ID_2898

REMOVAL OF MANGANESE IN CONTINUOUS BED SYSTEM USING IMMOBILIZED MACRO FUNGUS

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Abstract: Manganese has been widely used in numerous industries such as dry battery cells, ceramics, stainless steel, coal and metal mining. Wastewaters of these industries are yellowish colored and unpleasant taste and smell. Although manganese is essential for living things at even small amounts, high exposure in living bodies may cause manganism and Parkinson-like syndromes (Rollin, 2011). Therefore, manganese should be removed from these wastewaters (Akar, 2016; Jovanovic, 2016). Biosorption is an alternative technique used for the removal of effluents from wastewater by biological materials. This method is examined by many researchers because of its low cost, high selectivity, toxicant affinity, rate of uptake and recovery properties. Immobilized materials have some advantages such as online matrix isolation, high mechanical strength and better desorption potential (Akar, 2012; Madrid, 1997).

Present work investigates the manganese removal potential of silica gel immobilized *Lactarius salmonicolor* (ILS). Operating conditions were optimized by functions of biosorbent dosage and flow rate. pH of manganese solution did not adjust. The maximum experimental uptake capacity and biosorption yield was found to be 115.03 mg/g and 97.62%. The biosorption was found to be biosorbent dosage dependent and optimum amount of biosorbent was 5 mg. Biosorption capacity did not change when the flow rate raised from 0.5 to 4.0 mL/min. Consequently, ILS may be used as an alternative for the removal of manganese with the advantage of its great biosorption capacity, low cost and environmentally friendly biosorbent.

Keywords: Biosorbent, fungus, waste waters

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ID_2899

INVESTIGATION OF DYE DECOLORIZATION POTENTIAL OF MAGNETIC SORBENT PREPARED FROM MONTMORILLONITE: BATCH STUDIES

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Abstract: Reactive azo dyes are widely used in textile and dyestuff industries. They used in 50 percent of cotton textile dyeing operations but these dyes are not environmental friendly and have carcinogenic, mutagenic and toxic effect because of their stable complexes (Solis, 2012). Effluents generated from textile industries are heavily colored, present high biological and chemical oxygen demand and contain large amounts of salt and dyeing auxiliaries (Babu, 2007).

In this study, a magnetic based natural mineral sorbent has been prepared. Separation or recovery difficulties of sorbent from the liquid adsorption medium are limiting factors for the large-scale applications of the adsorption process. These limitations can be overcome by adaptation of the magnetic separation technique to adsorption process (Akar, 2013). For this purpose, adsorption potential for Bismark Brown Y (BBY) dye in a batch system using magnetic montmorillonite (MagMMT) composite was investigated.

Sorption performance of MagMMT was evaluated as functions of initial pH, sorbent dosage, contact time, initial BBY concentration and temperature. Sorption performance of MagMMT for BBY was found maximum (98.60%) at pH 4 with 0.04 g of sorbent. Fast sorption equilibrium was established within 10 minutes and the sorption data followed the pseudo-second-order kinetic model and Langmuir isotherm. Maximum monolayer sorption capacity of MagMMT was 136.46 mg/g. Desorption and reusability studies revealed that MagMMT can be a promising alternative for the effective sorption of azo dyes in environmental remediation.

Keywords: Decolorization, dye, Langmuir

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ID_2974

TREATMENT OF REAL TEXTILE WASTEWATER BY USING DIATOMITE

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Abstract: The aim of this study was to investigate the adsorption performance of a low-cost adsorbent, diatomite, for the treatment of real textile wastewater. The results showed that colour and COD removals were achieved within a relatively short time. An additional increase of 7% and 37% was observed for colour and COD removals in 1440 min, respectively. Diatomite concentration was found to be a critical parameter especially for the colour removal. An increase in adsorbent concentration from 10 g/L to 150 g/L resulted in an increase from 37% to 57%. Grain size on the other hand presented different removal trends. As colour removals were not significantly (<5%) increased, a higher COD removal (80%) was observed for the smallest particles size (<425 mm). The influence of thermal and acid/alkaline pre-treatments on the performance of the natural diatomite was also evaluated. Thermal treatments significantly decreased the medium EC, while colour and COD removals were not significantly changed. Similarly, acid and alkaline pre-treatments seem not to increase the adsorption performance of natural diatomite.

Keywords: Diatomite, treatment, adsorption, waste water

ID_2913

A COMPARATIVE STUDY FOR EFFICIENCY ANALYSIS OF MEMBRANE PROCESSES FOR CHEESE WHEY DEMINERALIZATION

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Abstract: Cheese whey is a liquid by-product of the dairy industry and it is obtained during the manufacture of cheese. It is rich in valuable components such as protein and lactose, minerals etc. The cheese whey represents a serious problem due to its high organic load with a high chemical oxygen demand. Therefore, cheese whey can cause a serious damage to the environment when it is discharged without any treatment. However, it can be utilized as additive in the production of many food products such as biscuits, baby food, chocolate, ice cream, ready soup, pastries, meat products, bread etc.

Membrane processes can be effectively and economically implemented at the large scale required for most dairy applications. The membrane separation technologies offer advantages in whey processing in terms of energy saving and reduction of damages to the environment. In this study, the efficiencies of membrane processes such as ultrafiltration (UF), nanofiltration (NF) and reverse osmosis (RO) were investigated for cheese whey demineralization. Experimental studies were performed using a laboratory scale membrane test system (SEPA CF II GE-Osmonics). The pH, temperature, salinity, conductivity, and TDS of the concentrate and permeate samples were measured by Hach Lange-HQD multi-meter. The efficiencies of the membranes for demineralization of cheese whey were compared according to the obtained results.

Keywords: Cheese whey, demineralization, membrane processes

ID_2830

DEVELOPING HETEROGENEOUS CATALYSTS WITH NATURAL ZEOLITES FOR PHOTOCATALYTIC OXIDATION OF TOXIC ORGANIC CHEMICALS

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Abstract: Advanced oxidation processes in the treatment of toxic organic pollutants in water and various designs of them are widely used and placed in the literature. There are some applications on combining different designs of these processes or using them in combined systems to develop efficient oxidation processes. One of these processes is the heterogeneous photocatalysis which is increasingly used and different applications on the designs of process mechanisms and reactors are still being developed.

Zeolites are members of the aluminosilicate family and have alkaline earth elements in their structures. The main physical and chemical properties of zeolite such as ion exchange, adsorption molecular sieve structure, silica content the lightweight and porous structure makes zeolite can be used in various industrial fields. Natural zeolites are found a large nature reserves in our country and the operation are cheap and easy than the other minerals. Therefore, the natural zeolites can be used as a possible cost-effective catalytic material compared to other synthetic materials because the molecules can react within their nano-structure pores. Even though advanced oxidation processes are very efficient to remove organic chemicals from wastewaters, there are some disadvantages, such as formation of high amount of iron sludge and iron recovery problems from this sludge. To overcome these problems, recent investigations possible using of iron ion supporting zeolite minerals have been using as a heterogeneous catalyst in photocatalytic oxidation. The efficiency of these heterogeneous oxidation processes can be evaluated by examining temperature, pH, H₂O₂ dosage, catalyst loading, initial pollutant concentration, light intensity and compared with homogenous Fenton reaction by pollutant concentration removal.

The aim of this paper was to review applicability of zeolite supported heterogeneous catalyst in photocatalytic oxidation with different applications.

Keywords: Photocatalytic oxidation, zeolites, photocatalysis

ID_2943

GRAFTED POLYMERIC LIGAND EXCHANGER FOR REMOVAL OF CR(VI)

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Abstract: Polymeric ligand exchangers (PLE) have been used for the treatment of water contaminated with toxic anions like arsenic, chromate, selenite or fluoride [38]. A PLE consists of a polymer backbone with chelating functional groups that can bind tightly to a transition metal. The transition metal ion acts as ligand exchanger sites that selectively bind with target anionic ligand through concurrent electrostatic and Lewis acid-base interaction. The ligand-exchange process was found to have significantly greater selectivity than ion exchange especially at low concentrations. While sharing many common features with standard ion exchangers, a ligand exchanger employs transition metal ions as its terminal functional groups. The transition metal ion acts as ligand exchanger sites that selectively bind with target anionic ligand through concurrent electrostatic and Lewis acid-base interaction [1-2].

In order to prepare a PLE to remove Cr(VI) ions, glycidyl methacrylate (GMA) and 4-vinylpyridine (4-VP) was first grafted with emulsion technique onto pre-irradiated polyethylene/polypropylene (PE/PP) nonwoven fabric (NWF). The resultant epoxy groups of GMA grafted NWF were opened and reacted with 1,2,4-triazole. 1,2,4-triazol modified GMA grafted NWF and 4-vinyl pyridine grafted nonwoven fabric were then loaded with Cu(II) ions for the preparation of PLE adsorbents. High copper ion loading was observed for PLE nonwoven fabrics. Adsorption studies were conducted with copper loaded PLE adsorbents at different Cr(VI) concentrations and different pH values. Approximately 100% of Cr(VI) was successfully removed at low concentrations level. It was concluded that PLE NWF adsorbent can be used to remove Cr(VI) ions from aqueous solutions successfully.

Keywords: Grafted polymeric ligand, nonwoven, treatment

ID_2939

RADIATION-INDUCED GRAFTING OF POLY(2-(DIMETHYLAMINO)ETHYL METHACRYLATE) (PDMAEMA) AND POLY (GLYCIDYL METHACRYLATE) (PGMA) FROM PE/PP NON-WOVEN FABRIC FOR THE REMOVAL OF CR(VI) IONS FROM AQUEOUS MEDIA

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Abstract: Increased amounts of heavy metals in water resources may create serious health hazards owing mainly to their non-degradability and toxicity in the environment. Chromium is one of the main pollutants in potable water and commonly employed in the electroplating, leather tanning, paint, cement, metal finishing, and textile industries. Several methods such as electrolysis, ion exchange, reverse osmosis, solvent extraction, and adsorption are used to remove Cr(VI) from aqueous solutions. Among them, adsorption method is considered a cost effective and efficient method for the removal of Cr(VI) from aqueous solution (Imasuen and Egai, 2013). In order to prepare adsorbent materials, grafting of some functional polymers on existing suitable substrate matrixes followed by modification of the grafts by desired ligands is widely used. Polymeric adsorbents prepared by this way in various desired forms are quite promising in either concentration or removal of various metal ions. Radiation-induced graft polymerization technique is one of the most efficient methods to prepare chemical modified tailor-made adsorbent materials.

In this study, polyethylene/polypropylene (PE/PP) nonwoven fabric was grafted by poly (2-(dimethylamino)ethyl methacrylate) (PDMAEMA) and poly (glycidyl methacrylate) (PGMA) via radiation-induced graft polymerization technique. The grafted PDMAEMA chains were quaternized to yield QPDMAEMA, in order to achieve functional groups on the nonwoven adsorbent. PGMA chains were modified by ethylenediamine (EDA) through the opening of the epoxy ring of the GMA units, yielding PGMA-EDA. All the synthesized samples were characterized by XPS, FTIR, elemental analysis and contact angle measurements. The modified nonwoven adsorbents bearing QPDMAEMA and PGMA-EDA functionalities were used to remove Cr(VI) ions from aqueous media at various pH values and adsorbate concentrations. The optimum conditions were determined by carrying out batch experiments via ICP-MS measurements. The resulting adsorbents presented very promising Cr(VI) ion removing capability.

Keywords: Aqueous media, nonwoven, polyethylene/polypropylene, polymerization

ID_2892

APPLICATION OF ELECTRODIALYSIS (ED) FOR CONCENTRATE MANAGEMENT OF REVERSE OSMOSIS (RO) PROCESS

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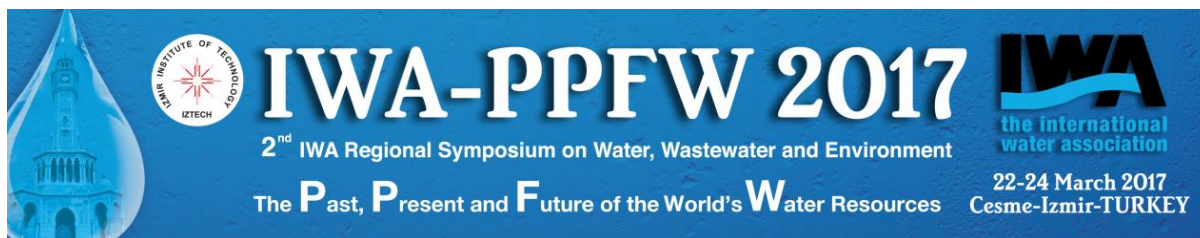
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Abstract: In recent years, growing population and industrialization has resulted in potable water scarcity worldwide. Treating polluted water is one of the strategies to be implemented to manage this challenge. In this study, application of electrodialysis (ED) for concentrate stream of reverse osmosis (RO) process applied for advanced treatment of membrane bioreactor (MBR) effluent was investigated. Before the ED process, the nanofiltration (NF) membrane NF-90 was used for pre-treatment of RO concentrate. During ED tests, effect of applied potential and flow rate on system performance was studied. An increase in applied voltage resulted in a high conductivity rejection in short time but the specific power consumption (SPC) increased accordingly. Taking into account rejection performance, process time and SPC, a 5 V of electrical potential was found to be suitable. When ED was applied to NF-90 permeate of RO concentrate, a conductivity rejection of 98% was achieved in 42 min at 5V of electrical voltage. The effect of flow rate was not so apparent during ED process. According to the obtained results, integration of NF with ED was found to be promising process for RO concentrate management.

Keywords: Electrodialysis, reverse osmosis, water scarcity



Theme H Environmental Issues

ORAL PRESENTATION

ID_2854

SEDIMENT AND WATER QUALITY ASSESSMENT WITH COASTAL MODELLING TECHNIQUES THROUGH THE MID-BLACK SEA COAST OF TURKEY

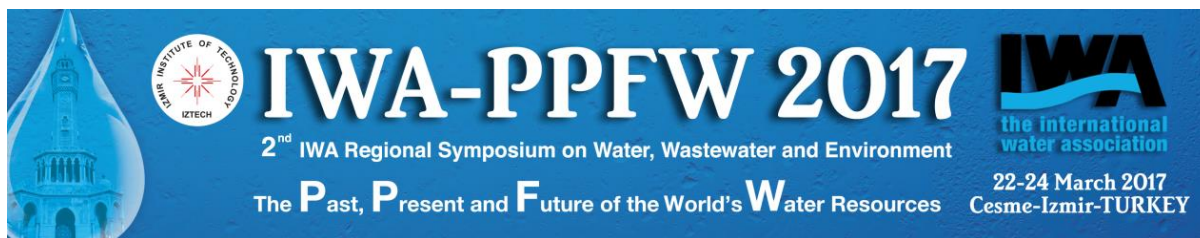
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Abstract: The Black Sea is a semi-enclosed sea and, located between 40°27'N-46°32'N latitude and 27°27'E- 41°42'E longitude. The Black Sea environment is highly contaminated in many urban and industrialized areas of the many countries, resulting in severe ecotoxicological impacts. Heavy metals are toxic substances that accumulate in food chains with the increasing concentrations and some of the prominent environmental pollutants are organic and inorganic pollutants (such as organochlorine pesticides, polychlorinated biphenyls, DDTs, PAHs, HCBs, HCHs) which are not only toxic to humans, but also highly bioaccumulative due to their high lipophilicity and persistence. The aim of this study is to discuss the water and sediment quality in the central part of the mid-Black Sea coast of Turkey, with further coastal modeling techniques by comparing the heavy metals and organic pollutants in different researches. The mathematical modelling is an important tool to manage the coastal area which is heavily polluted from land-based organic and inorganic pollutants such in the case of Black Sea basin. So, the near past monitoring researches were discussed here in order to collect data and calibrate the environmental models.

Keywords: Black sea, land-based pollution, coastal modelling techniques.



ID_2930

STATE OF THE ART: SURFACE WATER AND GROUNDWATER POLLUTION BY HYDROCARBONS AND HARMFUL PRODUCTS

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Abstract. The presence of pollutants as hydrocarbons or harmful products in the environment is a constant danger to water supplies and public health. The deficiency of water is gradually pronounced in recent years; paradoxically much water is lost due to a growing pollution of both underground and superficial resources. Contaminated groundwater directly pollutes surface waters when groundwater extraction or it attains the lakes or their tributaries, so the pollution of groundwater inevitably implies a pollution of surface waters. Another point on pollution by hydrocarbons is due to maritime transport, the desalination of seawater has reinforced the supply of drinking water. Before the water comes only in desalination installations it is important that it be stripped of trace hydrocarbons. This study gives a state of art on the pollution of surface water and groundwater and proposes preventive and curative solutions for the protection of water reserves.

Keywords: water protection, hydrocarbons, environment, prevention, remediation

ID_2831

ACID PRODUCTION POTENTIALS OF MASSIVE SULFIDE MINERALS AND LEAD/ZINC MINE TAILINGS: A MEDIUM-TERM STUDY

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Abstract: Weathering of sulfide minerals is a principle source of acid generation and occurs either spontaneously in nature or triggered by anthropogenic factors such as intense mining activities. In order to determine acid forming potentials of massive sulfide minerals and sulfide-bearing mine tailings, two basic approaches named static and kinetic test methods are available. Static tests are short-term, easily-applicable in a few days and in a laboratory, on the contrary kinetic tests are long-term procedures, taking approximately one to three years depending on application time, mostly carried out in related site. Kinetic tests are carried out for the purpose of correction and verification of probable errors from static tests, and are mainly disadvantaged due to long time requirement in order to get favorable results. In this study, experiments were carried out in a medium-term period of two-month, not as short as static tests and also not as long as kinetic tests. As a result of the study, pH and electrical conductivity (EC) oscillations as a function of time, acid forming potentials and elemental contents of synthetically prepared rainwater leachates of massive sulfide minerals and sulfide-bearing lead/zinc (Pb/Zn) mine tailings from abandoned and currently used deposition areas have been determined. Although the lowest final pH of 2.70 was obtained in massive pyrite leachate as expected, massive chalcopyrite leachate showed the highest titrable acidity of 1.764 g H₂SO₄.l⁻¹. On the other hand, currently deposited mine tailings showed no acidic characteristic with a final pH of 7.77. The final pH of abandoned mine tailing leachate was 6.70, close to the final pH of massive galena and sphalerite leachates, and produced slight titrable acidity of 0.130 g H₂SO₄.l⁻¹. Dissolution ratio of ~2.00% for massive sphalerite and galena was relatively low leading to low leachate EC values of 0.79 and 0.33 mS.cm⁻¹, respectively.

Keywords: Massive sulfide minerals, Mine tailings, Medium-term test, Acid mine drainage

ENVIRONMENTAL ASSESSMENT OF INSULATION MATERIALS ALONG LIFE CYCLE

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Abstract: The insulation materials have a significant effect in decreasing the energy consumption of buildings for a sustainable development. To obtain high energy efficiency and low environmental effects, the diverse set of insulation materials can be used for the optimal design of buildings. The aim of the present work is to find insulation material solutions for building applications with low environmental effects and low thermal conductivity. In this study, AHP is used for finding the most harmful insulation material with respect to environmental effects such as air pollution, waste, solid waste, and various macro criteria for the building design project. Multi-criteria decision making is applied on life cycle evaluation of four type of thermal insulation materials including polyurethane, EPS, glass wool and rock wool associated with environmental effects. With the method of AHP, criteria within the life cycle of insulation materials including thermal insulation for 1 m²K/W is chosen in this research. Manufacturing area data statistics, general market process regulations, energy consumption, bad emission, and life cycle source consumption of the four products are investigated and analyzed.

Keywords: Waste water, Air pollution, Multi-criteria decision making, Insulation material, Life cycle, Environmental effect

DETERMINING THE BEST DRINKING WATER USING MULTI-CRITERIA SELECTION METHOD

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Abstract: The bottled drinking water is significant for healthy hydration. It plays a vital role in lives of people. Consumers select bottled drinking water for a few reasons such as quality, convenience, and taste. The purpose of this study is to determine the most suitable bottled drinking water type for consumers. Households have five bottled drinking water alternatives. Choosing the best alternative amongst the ones depends on various criteria. For the purpose of this research, seventeen different characteristics are determined as the criteria that consumers value the most in bottled drinking water. Therefore, a selection method that considers all these criteria in the selection process is required. In this paper, Analytic Hierarchy Method (AHP) method is utilized on the decision of selecting the best bottled drinking water. The selection of the best bottled drinking water from five of different alternative brands is a complicated task since seventeen decision criteria need to be noted simultaneously. In this study, the selected alternatives are investigated in detail. Based on the data obtained from General Directorate of State Hydraulic Works, the obtained results by this way are evaluated from various points of view by AHP.

Keywords: Bottled drinking water, AHP, Mineral, Multi-criteria, Water quality

ID_2985

A STUDY ON THE RECYCLING OF GLASS FIBER REINFORCED CONCRETE WASTES

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Abstract: Glass fiber reinforced concrete rebound wastes have been considered difficult to recycle due to its quick hardening nature which cannot be remolded in a short time following spraying process. Most of the wastes are landfilled and this process causes negative environmental impacts, including water pollution. In this study, waste grc particles were grinded and used as filling material in original grc mix design. With the addition of nano calcium carbonate particles at the rate of 2.5%, 5% and 7.5 %, recycling would convert this waste material into a profitable and sustainable material. Moreover, water pollution is prevented due to lack of landfilling and waste preserving processes. Bending test results were executed as per the EN 1170-5 standard and results show that there is a strong potential of using recycled glass fiber reinforced concrete recycled particles as filling with nano calcium carbonate particles.

Keywords: Recycled glass fiber reinforced concrete, water pollution, and nano calcium carbonate

ID_2891

EVALUATION OF MBR TREATED WASTEWATER QUALITY BEFORE AND AFTER DESALINATION BY NF AND ROPROCESSES FOR AGRICULTURAL REUSE

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Abstract: Knowledge of irrigation water quality is critical for understanding what management changes are necessary for long-term productivity. In addition to crop yield and soil physical conditions, irrigation water quality affects fertility needs, irrigation system performance and longevity, and the water irrigation method. Irrigation water quality available to farmers has a considerable impact on plant growth, productivity of the plants, water infiltration and other soil physical conditions.

Application of advanced treatment technologies is so important to generate cost-effective and potentially climate-independent water resources of appropriate quality for agriculture. In this study, the quality evaluation of membrane bioreactor (MBR) treated wastewater was performed for its reuse in agricultural irrigation. In addition, the qualities of MBR effluents desalinated with nanofiltration (NF) and reverse osmosis (RO) processes were compared with the irrigation standards.

Keywords: MBR, waste water, agricultural reuse, water quality, nanofiltration (NF), reverse osmosis (RO)

ID_2834

THE INFLUENCE OF CARRYING OUT AN ENVIRONMENTAL MANAGEMENT SYSTEM ON LAWFUL WASTE MANAGEMENT IN AN ELECTROPLATING AND PAINTING METAL INDUSTRY

¹
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Abstract: Wastes and environmental pollution have been increased in parallel with development of technology, increasing product range and product amount. Therefore, for controlling environmental impacts ISO 14001 Environmental Management System is applied commonly all over the world.

In this study, ISO 14001 Environmental Management System and its positive impression on lawful waste management is analyzed in an electroplating and painting metal industry (X Metal), which is aimed reducing the use of natural resources and minimizing air, water and soil pollution.

With applying ISO 14001 Environmental Management System successfully, environmental policy, environmental aspects, legal and regulatory compliance, objectives, plans and programs, control activities, documentation and procedures structure, job definitions, management review meeting activities are determined. Due to trainings, personnel have learned waste management, environmental pollution and results. So, environmental awareness has been created and all of the personnel participation has been provided.

Also, ISO 14001 provide waste minimization in the industry (X Metal). Oily metal turning waste arising from mechanical production were sent to waste disposal firm with 12 01 20 waste code and “spent grinding bodies and grinding materials containing dangerous substances” waste name as a hazardous waste. After applying Waste Management system, it was determined that oily metal turning wastes are not hazardous waste because its oil-grease content is under %1. So, oily metal turning waste will be sent to a recovery firm, with 20 01 40 waste code and “Metals” waste name as a non-hazardous waste.

Keywords: ISO 14001, environmental management system, electroplating and painting metal industry, waste management.

ID_2915

WASTE MANAGEMENT AND EVALUATION OF CARBON FOOTPRINT IN HARBOURS

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Abstract: Environmental pollution and waste management are getting important because of industrial development, increasing population and unplanned urbanization. In these days, we are going through, natural sources come to an end rapidly and because of that waste management planning and implementation become obligatory. Improvements about these subjects work when it is supported by law.

In recent years, air pollution has an increasing rate. Because of that application of measurement and control is getting important. Global warming and greenhouse effect are terms which were entered our lives recently and they are popular. For this reason, there are many scientific study about these terms.

In this study, carbon footprint that was entered our lives with global warming and greenhouse effect were analyzed. Especially for ports and harbors, emission sources and their amounts was determined and carbon footprint of ships was calculated.

Global warming and greenhouse effect are getting more important day by day. To prevent from these kind of environmental disasters we should have information about these disasters causes. Carbon footprint is most important indicator of air pollutions. To decrease effect of global warming and greenhouse, carbon footprint should be calculated. Then we may know what we are deal with. Carbon footprint in ports was calculated for ships that approach the port. According to calculation ship generated carbon footprint is 65043.24 tonnes CO₂E per year. Container ships has the highest rate of carbon footprint which is 43728.8 tonnes CO₂E. Recommendations about decreasing carbon footprint in ports are as follows:

- Preparing carbon footprint inventory is the first step for decreasing.
- According to inventory calculations should be done.

In the light of calculation results, precautions have to be planned and interference should start from source that has highest carbon footprint value.

Keywords: Emission, carbon footprint in ports and harbors.

ID_2795

ASSESSMENT OF GROUNDWATER VULNERABILITY VIA A COMBINATION OF DRASTIC AND AHP METHODS IN SOUTHERN THRACE, TURKEY

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Abstract: The study area is an important plain for wheat, sunflower and rice production in Ergene Basin in southern Thrace, Turkey. The groundwater in the study area is used both for irrigation and drinking purposes. In order to assess the groundwater vulnerability in the region the DRASTIC method based on geographical information system (GIS) was used. In addition to the DRASTIC method, the Analytic Hierarchy Process (AHP) method was applied to determine the rating coefficients of each parameter of the DRASTIC method, and the vulnerability of the aquifer was re-assessed. For the determination of the statistical relation between the groundwater nitrate concentration and the vulnerable areas of the aquifer, simple linear regression analysis was applied; the highest R^2 value was obtained from the DRASTIC-AHP method. High nitrate concentration of the groundwater was observed in areas where vulnerability maps showed high potential of vulnerability. Compared to the DRASTIC method, the DRASTIC-AHP method has provided more valid results.

Keywords: Groundwater vulnerability, DRASTIC, Analytic hierarchy process, Ergene Basin, Turkey.

ID_2960

ENVIRONMENTAL AND HEALTH AND SAFETY MANAGEMENT SYSTEM INTEGRATION FOR A DAIRY FACTORY: A CASE STUDY OF CONFORMITY ASSESMENT

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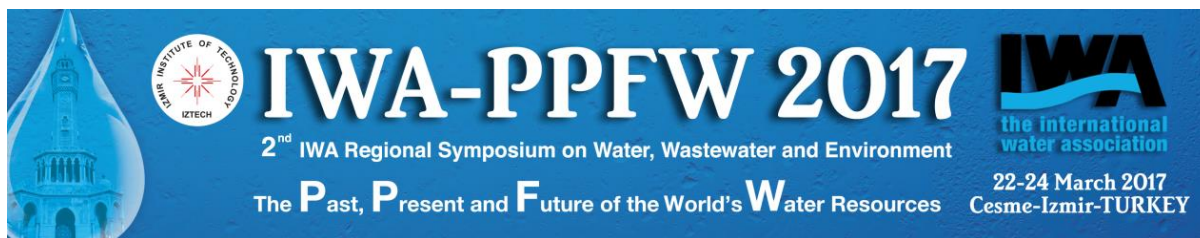
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Abstract: Environmental Management System, ensures to decrease company's operations due to the damage to the environment and to minimize the consumption of natural resources. Lately, the importance given to the environment has been increased all over the world, organizations try to be sensitive to the environment. ISO 14001 Environmental Management is demonstrated the importance given to the environment and sustainable development. As well, Environmental Management System to effectively enforce the company seems to be a decrease in costs by reducing consumption of natural resources.

OHSAS 18001 standard, the practices which may fascinate the health and safety of employees in the workplace is a management model envisages a systematic kept under control. In general terms, the concept of work safety of employees includes the protection of business and manufacturing all kinds of dangers and damages. Due to the priority of human life, this system is a must for industrial production facilities.

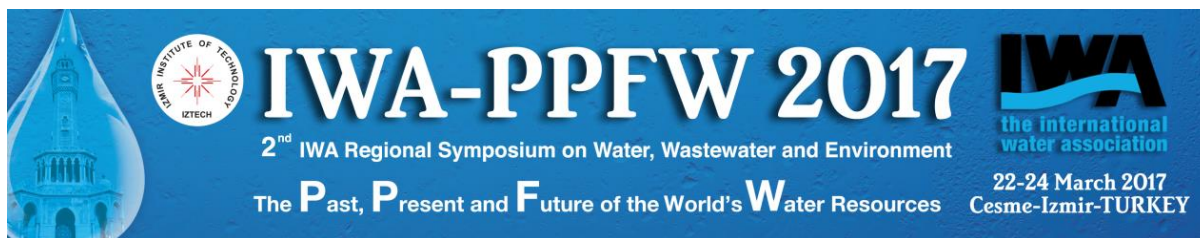
In this study, ISO 14001 and OHSAS 18001 implementation is investigated, the details are shown and analyzed for a dairy factory. In the dairy factory, ISO 14001 Environmental Management System is based on the environmental aspects evaluation and OHSAS 18001 Management System is based on hazard definition and risk assessment. In this study for a dairy factory in Turkey considering the environmental legal and other requirements of ISO 14001 and OHSAS 18001 implementation is examined in an integrated form. A section of conformity assessment related to Turkish environmental legislation has been given in this study.

Keywords: ISO 14001, OHSAS 18001, safety management, risk assessment



Theme H Environmental Issues

POSTER PRESENTATION



ID_2804

DETERMINATION OF THE SURFACE PROPERTIES OF KAOLINITE BY INVERSE GAS CHROMATOGRAPHY

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Abstract: Inverse gas chromatography (IGC) was applied to characterize the surface of kaolinite. The adsorption thermodynamic parameters (the standard enthalpy (ΔH^0), entropy (ΔS^0) and free energy of adsorption (ΔG^0), the dispersive component of the surface energy (γ_s^d), and the acid/base character of kaolinite surface were estimated by using the retention time of different non-polar and polar probes at infinite dilution region. The specific free energy of adsorption (ΔG^{sp}), the specific enthalpy of adsorption (ΔH^{sp}), and the specific entropy of adsorption (ΔS^{sp}) of polar probes on kaolinite were determined. ΔG^{sp} were correlated with the donor and modified acceptor numbers of the probes to quantify the acidic K_A and the basic K_D parameters of the kaolinite surface. The values obtained for the parameters K_A and K_D indicated a basic character for kaolinite surface.

Keywords: Inverse gas chromatography, Adsorption thermodynamic parameters, Acid-base surface characteristics, kaolinite.

ID_2883

PHOTOCATALYTIC ACTIVITY PERFORMANCE OF $K_2La_2Ti_3O_{10}$ THIN FILMS FOR DEGRADATION OF REMAZOL MARINE TEXTILE DYES

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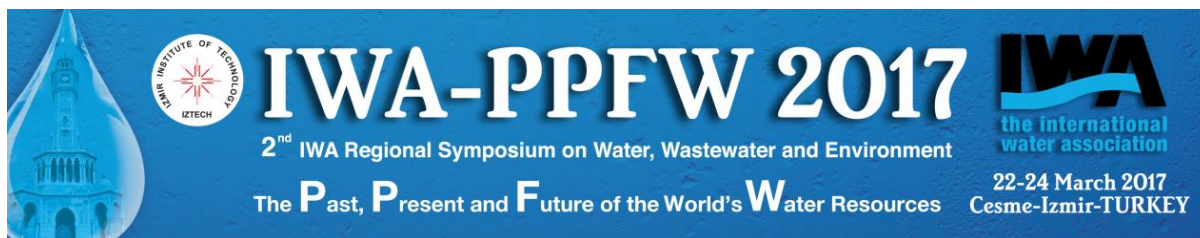
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Abstract: In this study, Potassium lanthanum titanate ($K_2La_2Ti_3O_{10}$, KLTO) coatings were manufactured in order to provide degradation of remazol marine textile dyes from water with the presence of sunlight. Phase identification and morphology of $K_2La_2Ti_3O_{10}$ coatings were characterized through X-Ray Diffraction (XRD) and Fourier Transform Infrared Spectroscopy (FTIR), respectively. Photocatalytic degradation experiments were carried out by using Atlas CPS+ solar simulator. Absorbance measurements were performed by using Jasco UV-Vis 1240 spectrometer.

New generation potassium lanthanum titanate ($K_2La_2Ti_3O_{10}$, KLTO) KLTO based coatings were successfully produced by using sol-gel method. Different samples of KLTO thin films were prepared according to their coating times and iso-propanol amount. Samples including KLTO thin films achieved higher photocatalytic activity than blank sample (without photocatalyst) for remazol marine solution. KLTO thin films achieved 90% degradation for remazol marine solution when blank sample was achieved 8% degradation. Consequently, KLTO thin films is successful to perform high photocatalytic activity.

Keywords: Photocatalytic activity, thin films, titanate



Theme I Ecotoxicology and Health Risks

ORAL PRESENTATION

THE SCHOOL AGE-CHILDREN: THEIR NUTRITION

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Abstract: Half to the world goes hungry every day and countless thousands are struggling to survive with an income of less than US\$2 per capita per day. Children of Afghanistan, Southern Africa and Ethiopia are in serious situation. Afghan parents believe their children able to get a place in an orphanage because they are simply unable to feed them. There are the reports of children being sold for bags of wheat.

The startling consequence of poverty in Bangladesh is that more than 50 percent of the population is the victim of some form of malnutrition. Millions of thousands of children do not get enough food, enough right kinds of food to eat to grow. They do not grow up as clever, as healthy, as tall, as they should be. Thousands of children die every year before they reach five years of age due to malnutrition & related diseases. The studies, shows that high level of nutritional deprivation combined with heavy burden of disease in school going age-children has negative consequence for a child's long-term development.

A child who eats no breakfast suffers greatly in tasks of concentration, his or her attention spans are shorter and even his IQs on testing than his well-fed peers. We cannot expect this child to learn & perform good work or get good grade when no fuel has been provided when needed.

Class teacher may scold the students for their inattentiveness in the class. But they are not aware of the fact that the late morning discomfort from hunger may become distracting even if a child has eaten breakfast.

The children facing the problem that arises when attempt having school work on an empty stomach may be due to hypoglycemia. The average child up to the age of 10 or so needs to eat every four hours to maintain a blood glucose concentration high enough to support the activity of the central nervous system. Brain is the chief glucose consumer.

A child's liver is considerably smaller and the liver is the organ responsible for storing glucose (as glycogen) and releasing it into blood as needed. A child's liver can not store more than about four hours' worth of glycogen hence need to eat fairly often. A teacher aware of the late morning slump in their class rooms wisely request that a mid-morning snack be provided, it improves class-room performance all the way to lunch, time. School lunches are designed to meet the needs of growing children.

The consequence of malnutrition is indicated by anthropometrics (stunting, wasting and

underweight) childhood morbidity and mortality poor physical and mental development and school, performance reduce adult size and capacity for physical work. Malnutrition exacerbated the effects of infections. Malnourished children have more severe diarrhea episodes as measured by duration risk of dehydration and associated growth faltering. They also have a higher risk of pneumonia. Infection can affect the growth of children several ways. one of these is the reduction of intake and poor utilization of ingested nutrients. In addition the body has an inflammatory response to many infections.

Inflammation may reduce the length of bones because of systemic and local disturbance of normal growth.

According to ACC/SCN working group on vitamin A and Iron reported (SCN 26th session 1999) an estimated 140-250 million pre-school children suffer from sub clinical vitamin A deficiency thus carrying increased mortality related risks. One hundred and seventy million children are under weight. 208 million are stunted and 49 million are wasted. More than 900 million people suffer from goiter 100 million are severely retarded and another 50 million suffer from other forms of brain damage due to iodine deficiency.

Keywords: Children, nutrition, hunger

ID_2833

ASSESSMENT OF ANTIMICROBIAL ACTIVITY OF EXTRACTS FROM DUNALIELLA SP. ON BACTERIA

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Abstract: Bioactive compounds from microalgal biomass have special interest in the improvement of new products. Microalgae having survival capability under extreme conditions (high salt concentration, high temperatures, etc.) have much greater potential in various biotechnological applications. Therefore halophytic microalgae *Dunaliella* sp. has great area in producing bioactive compounds having antimicrobial property. These compounds have also antifungal, antiviral, antitumor and antibiotic effects. *Dunaliella* sp. was used and obtained from Ankara University, Faculty of Science Laboratories' culture collection. Microalgae was cultivated in Johnson's media under continuous light as 2400 lx (30 °C, 14 days). Obtained biomasses were collected and freeze-dried. Ethanol was used to get the algal extracts. Microalgae were cultivated on media with different NaCl concentrations (10-25% (w/v)) to test the effectiveness of microalgal bioactive compounds. Antimicrobial activity was performed with paper disc diffusion method. It was determined that antimicrobial activity of the extracts was changing from bacteria to bacteria. The most effective bioactive compound was found extracts from *Dunaliella* sp. grown in media with 15% (w/v) NaCl on *B. subtilis* ATCC 6653. Microalgal extracts which had the highest antimicrobial effect for *B. thermospacta* ATCC 11509 and *S. aureus* ATCC 1026 obtained from *Dunaliella* sp. grown in media with 10% (w/v) NaCl.

Keywords: *Dunaliella* sp., microalgal, antimicrobial

ID_2927

THE EFFECT OF N- NITROSODIMETHYLAMINE TOXICITY IN RATS HEART TISSUE

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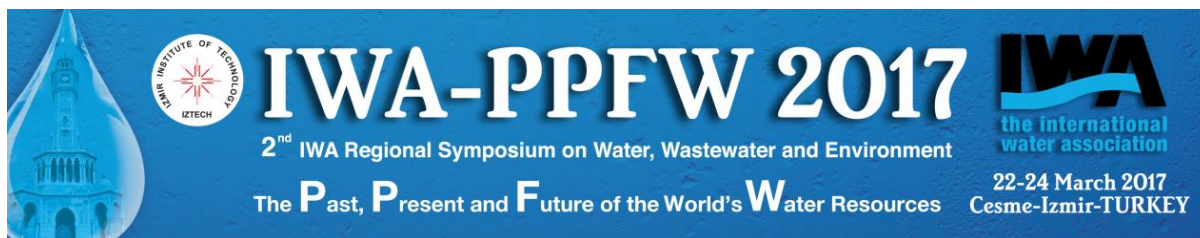
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Abstract: In this study the effect of *Ferulago angulata* (Schlecht.) Boiss.(FASB) extract on mineral (Ca, K, Na) and trace element (Cd, Co, Cr, Cu, Fe, Mn, Ni, Pb, Se, Zn) levels were determined in rat heart tissue which was oxidatively stressed with n-Nitrosodimethylamine (NDMA). NDMA occurs when sewage and drinking waters are disinfected (Kaserzon et.al., 2011). It is quite cancerogenic and toxic (Veena and Manu, 2012). *Ferulago angulata* has been used medically and it was reported that the plant has antioxidant and antidiabetic effects (Asghari et. al., 2012). Experimental period was continued with 60 Wistar albino rats in 21 days. Rats were intraperitoneally given NDMA (10 mg/kg) in first seven days. FASB plant extract was administered to the rats each day of the study. The rats were divided into six groups of ten rats each. Group 1: untreated animals were given an equal volume of normal saline (%0,9 NaCl). Group 2: animals were administered (10 mg/kg) NDMA. Group 3: animals were administered 150 (mg/kg) FASB. Group 4: animals were administered (10 mg/kg) NDMA+ 150 (mg/kg) FASB plant extract. Group 5: animals were administered 300 (mg/kg) FASB plant extract. Group 6: animals were administered (10 mg/kg) NDMA+ 300 (mg/kg) FASB plant extract. The mineral and trace element levels of heart tissue were analyzed by using ICP-OES (Inductively coupled plasma optical emission spectroscopy). The statistical analysis showed that the (10 mg/kg) NDMA administered group showed significantly lower results than the control group showed with regards to Co, Na and Zn levels ($p<0.01$, $p<0.05$, $p<0.05$, respectively). In addition, the NDMA administered group showed significantly lower results than the 300 (mg/kg) FASB plant extract administered group showed with regards to Co level ($p<0.05$). Also, the NDMA administered group was significantly lower than the 150 (mg/kg) FASB plant extract administered group showed with regards to Na level ($p<0.05$). Similarly, the NDMA administered group showed significantly lower results than the 300 (mg/kg) FASB plant extract administered group showed with regards to Zn level ($p<0.05$). We think that our study will shed light on future studies will be carried out.

Keywords: N- nitrosodimethylamine, hearth issue, *ferulago angulata*



Theme I Ecotoxicology and Health Risks

POSTER PRESENTATION

ID_2983

RADIONUCLIDE CONTENT OF ÇEŞME GEOTHERMAL REGION, IZMIR CITY, TURKEY

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Abstract: The Çeşme Geothermal Field (ÇGF) is located in west of Izmir (Turkey) on the northern coast of the Çeşme Peninsula along the seaside. This area is an important tourist resort with many remarkable thermal springs that have been used for bathing for several years. Geothermal resources can be seen in Triassic limestones, which are controlled by normal faults, are chemical composition close to the sea water composition. The result shows that limestone is karstic and this system is fed from the sea.

Radon (^{222}Rn) and polonium (^{210}Po) are important decay products of the ^{238}U series. ^{222}Rn is one of the most considerable sources of natural radiation to which people are exposed. It is an alpha-emitting noble gas and it can be found in different kinds of water. The main source of the ^{210}Po is from ^{222}Rn emanation, which is released from the earth's crust to the atmosphere. ^{210}Po has an alpha radioactivity, 400 times more radioactive than uranium and the most radiotoxic radiation type. In this study, it is aimed to investigate the possible enrichment of natural radioactivity (^{222}Rn and ^{210}Po) in the Ilıca and Şifne geothermal areas. For this purpose, fluid samples were collected from these geothermal areas. Physical and chemical properties of these samples were measured in situ. ^{222}Rn and ^{210}Po measurements carried out by collector method and alpha spectrometry. The results have shown that relatively high concentrations radon and polonium occur in the fluid samples.

Keywords: Çeşme, geothermal, radionuclide

ID_2984

ECOLOGICAL RISK LEVELS OF HEAVY METAL CONTAMINATION IN GEOTHERMAL FLUID SAMPLES FROM ÇEŞME-TURKEY

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Abstract: Geothermal fluid is natural heat flow from the depths of the Earth. These fluids are potentially significant sources of valuable minerals and metals. The concentrations of metals in thermal fluids from most geothermal systems around the world are usually one to three orders of magnitude greater than those of unpolluted non-thermal ground waters. The discharge of metal-rich geothermal waters can further contaminate other natural waters that serve as drinking water sources.

In this study, fluid samples were collected from the geothermal field around Çeşme Peninsula-Izmir to determine heavy metal levels in terms of ecological risk levels. Concentrations of selected heavy metals (As, Cr, Cu, Co, Ni, Pb, Zn) in fluid samples were determined by ICP-OES. Furthermore, the concentrations of heavy metals were used to assess their potential ecological risks. The contamination in the fluid sample from heavy metals was assessed based on enrichment factor, geo-accumulation factors, and ecological risk indices. The results were compared with the data from other areas in Turkey.

Keywords: Çeşme, ecological risk, heavy metal, contamination, geothermal fluid

ID_2839

PRODUCTION OF BIOACTIVE COMPOUNDS BY HALOPHYTIC MICROALGAL STRAINS

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Abstract: Today, investigations are focused to find new drugs to treat diseases. Several studies are performed to investigate bioactive compounds having antimicrobial characteristics. Bioactive metabolites originated from microalgae are of special interest in having antimicrobial, antioxidant, antiviral and antitumor properties. Compounds in the *Dunaliella* sp. are also very interesting related to the properties of this halophytic microalgae. *Dunaliella* strains (*Dunaliella* sp. 1, *Dunaliella* sp. 2, *Dunaliella* sp. 3, and *Dunaliella* sp. 4) were obtained from Ankara University, Faculty of Science Laboratories' culture collection. Strains were investigated in order to determine their antimicrobial activities in media with different nitrogen concentrations. Microalgae were cultivated in Johnson's media under continuous light (2400 lx) for 14 days (30 °C). Biomass was collected by centrifugation. Freeze-dried biomasses were exposed to ethanol and extracts were attained. Antimicrobial activity was done with paper disc diffusion method. *Dunaliella* sp. 2 had the most effective bioactive compound among all the tested microalgae. The effect of different nitrogen concentrations on the effectiveness of *Dunaliella* sp. 2 bioactive compounds, trials were done in media with 0.5, 1, and 1.5 g/L nitrogen concentrations. The extracts obtained from *Dunaliella* sp. 2 grown in media with 1 g/L nitrogen had higher bioactive characteristic.

Keywords: *Dunaliella* sp., antimicrobial, microalgal

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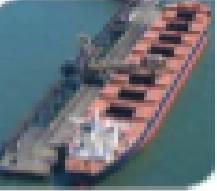
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MSC JEOTEKNİK, SONDAJCILIK, MÜHENDİSLİK İNŞAAT TİC. LTD. ŞTİ

MSC Mühendislik kurulduğu tarihten itibaren bünyesinde bulunan Jeoloji ve Jeofizik Mühendisleri ve çeşitli meslek dallarındaki danışmanları ile birlikte zemin etüdü, jeolojik-jeoteknik-jeofizik etüt, baraj, gölet, sulama, içme suyu projelerinin jeoteknik etütleri, maden arama araştırma, prospeksiyon ve mevcut maden sahalarında gerekli sondaj, inceleme ve etütlerin yapılması, yeraltısuyu araştırma, su sondajı, jeofizik etütler, hidrolojik, hidrojeolojik etütler, sıcak su etütleri jeolojik-jeofizik inceleme ve harita yapımı, şev stabilitesi, farklı oturmuş binaların düzeltilmesi, mini kazık, bulon, enjeksiyon, ankraj, püskürtme beton uygulamaları, zemin iyileştirme çalışmaları ve diğer mühendislik hizmetleri jeoteknik hizmetlerin geniş bir alanında hizmet vermektedir.

2001 yılında İzmir'de kurulan şirketimiz kamu ve özel sektör projelerinde pekçok Zemin(Temel), Su, Maden Sondajları, Zemin Etüdleri, İmar Planına Esas Jeolojik-Jeoteknik Etüdler, Heyelan Etüdlerinin yanı sıra; Enjeksiyon, Jet Grout, Fore Kazık, Mini Kazık, Ankraj gibi zemin ve temel mühendisliği konularında da görev almıştır.

MSC gücünü, uzman ve dinamik kadrosuyla edindiği bilgi birikiminin yanı sıra, başladığı her işi kusursuz bir şekilde başarıyla tamamlamasından almaktadır. Sahip olduğu özgüvenle mühendislik kuralları çerçevesinde, akılcı projeler üreterek en üst düzey hizmet anlayışı ilkesinden ödün vermeden sektöründe lider olma yolunda emin ve sağlam adımlarla ilerlemektedir.

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