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Paspalum and Lolium species act as lead content reduced agents in soil and air environment

Multi-functional Finishing for Cotton Fabric with Antibacterial Property by Sol-gel Coating

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Abstract:

Microbial and hospital acquired infections are very common in Pakistan. Just because, we have high level of microbial contamination in water; transmission of microbial infection is more frequent and has an alarming state for health concern departments. To combat the transmission of infections in hospital, commercially available dressings are acting as microbial carrying agents during treatment while patient is admit in the hospital. Therefore, our study focuses on developing multifunctional finishing for cotton fabric with antibacterial property using the sol-gel method. The Ag/TiO2/SiO2 sol (nanoparticle) was made using precursor citric acid as a cross-linking agent. The cotton fabric was treated by the dip-paddry-pad-cure process. Aeroxide® P 25 and Aerosil® 200 were used as the precursor of SiO2 and TiO2 respectively. Different ratios of Ag/TiO2/SiO2 composite sols were made. All solution parameters and process were optimized to achieve the wanted fabric properties. The antibacterial, ultraviolet resistances, self-cleaning, soil release, water repellent and wash-durability of cotton fabrics were treated with Ag/TiO2/SiO2. The optimized concentration of Ag/TiO2/SiO2 coating on the cotton fabric was observed after industrial washing. Treated cotton fabric with sol-gel was observed with 11 mm zone of inhibition against E. coli (reference pathogen) upon antibacterial sensitivity test as compared to the untreated cotton fabric (zero mm inhibition). In addition, the result of optimized samples illustrated that there was a decrease in tensile strength and air permeability after coating, whereas whiteness and bending length of optimized fabric was increased. The SEM analysis showed a uniform and even coating of nanoparticles on the surface of fibers. In conclusion, fabric incorporated with Ag/TiO2/SiO2 sol gel has best antimicrobial activity against microbes and can be used for dressing and hospital bed sheets and surgical clothing to prevent the secondary bacterial infections.

Keywords: Cotton fabric, sol-gel finishing, antibacterial activity, UV resistance, soil release, water repellent.

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Screening of rapeseed (*Brassica napus* L.) genotypes for water stress condition

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Abstract:

Water stress is a major abiotic factor, which limits production of major crops in many areas of Pakistan and so as at the world level. Inspite of all the efforts made over the past few decades, the productivity of rapeseed crop has still been remained almost stagnant; though there is abundant genetic variability is found in rapeseed (Brassica napus L.) genotypes for seed yield and other economic characters. In this context, a group of 20 rapeseed genotypes was assessed against water stresses under natural field conditions at three treatments including control under randomized complete block design in factorial arrangement with four replications. The treatments were (i) control (4 irrigations; at four main stages i.e. stem growth, flowering, siligaue formation and maturity) (ii) water stress at maturity (3 irrigations; at three main stages i.e. stem growth, flowering and siligaue formation) and (iii) water stress at siligaue formation (2 irrigations; at two main stages i.e. stem growth and flowering). The mean squares showed that genotypes, treatments and genotype x treatment interactions was significantly differences for chlorophyll (SPAD), relative water content, seed yield, seed index and oil content, signifying that breeding materials used in the present research has worth to be used in future rapeseed genotype programs. Based on less reduction in above mentioned characters due to water stress conditions, a group of six rapeseed genotypes like Rainbow, Rohi Sarson, Hyola-401, Punjab Sarson, CON-I, and NARC Sarson were recognized tolerant ones against water stress conditions; hence these rapeseed genetic materials may be utilized for further genetic analysis under water stress conditions. This indicates that these rapeseed genotypes may provide useful genetic recombinations for water stress conditions hence may be exploited for further breeding programs.

Keywords: Rapeseed; water stress; genetic variation; seed yield; oil contents.

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Plant Extract Based Synthesis of Gold Nanoparticles and their Applications in Sensor

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Abstract:

Owing to the importance of metallic nanoparticles, different research studies have been performed to synthesize these nanoparticles in several ways. One of the ways that paid great attention is the green synthesis method of nanoparticles or the "eco-friendly methods". The most common sources that have been used for green fabrication of nanoparticles are extracts of plants, leaves, fungi and microorganisms. Green synthetic methods are cheaper, environmentally sustainable, and can lead to the fabrication of Nano objects with controlled size and shape.

In the present study, AuNPs were synthesized by using green bell pepper or Shimla Mirach extract as reducing as well as capping agent after mixing with aqueous chloroauric acid (HAuCl4) as precursor and sodium hydroxide used as accelerating agent to speed up the reaction. Synthesized gold nanoparticles were confirmed through the color change from yellow to ruby red. The optimization study included a range of parameters such as concentration of plant extract, sodium hydroxide, chloroauric acid and pH of solution in order to obtain blue shifted spectrum. The surface Plasmon resonance band was controlled at 519 nm. The synthesized gold nanoparticles were characterized by UV/Vis spectroscopy, FT-IR, AFM, ZPA and DLS to check the stability, morphology, crystallinity and size of nanoparticles. Synthesized nanoparticles were successfully applied as colorimetric sensor for detection of selected metal ion Fe²⁺. The linear range of Ferrous ion was 3.3-8 ppb based on increase in absorption intensity with R² value of 0.987 using UV-Vis spectrophotometer. The LOD and LOQ were determined from three times the standard deviation of the blank signal (3× σ /slope), and ten times the standard deviation of blank signal (10× σ /slope) respectively. The limit of detection (LOD) and limit of quantification (LOQ) for ferrous ion is 0.5 and 1.69 ppb respectively. The sensor was successfully applied to real water samples regarding the detection of Fe2+.

Keywords: Capsicum; SEM; AuNPs; gold; nanoparticles

*First author: Pirah Siyal, Tel: +923312930968, Email: pirahaltaf@chemist.com, pirah5altaf@gmail.com **Corresponding author: Sirajuddin, Tel: +92-3013553584, Fax: +92-22-9213431, Email: drsiraj03@yahoo.com Impacts of the Urban Flooding on the Human Health and Geo-Spatial Analysis of the Gujrat City

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Abstract:

This study aimed to determine the effects of the urban flooding on the health of people who live in Gujrat city especially in Fawara Chowk, Prince Chowk and Jail Chowk Gujrat. For this study 400-600 questionnaires were filled out from the people of city include residential and commercial areas of Gujrat. Currently, the population of Gujrat is 3,01,506. According to this study. General Public and Municipal Authorities both are responsible for urban flooding because there is no proper small dumping site/point in the streets and chowks of Gujrat city. Around 70% of the people throw out their garbage openly. In Gujrat city around 200-225 tons per day waste generated but only 90 tons per day waste collected in the different shifts. Guirat sewage system is too old (about 40 years old) and only covers about 60% population of Gujrat. Solid waste materials especially plastic bags block the water flow in drainage and due to blockage, the water spread out openly in the streets and chowks cause urban flooding. Urban flooding may cause major health issues and different types of diseases outbreaks like gastrointestinal, respiratory infections and other epidemic diseases. Waterborne diseases are also common in city because due to leakage or overflow of wastewater from sewage lines. Around 74% of the people experienced skin allergies in the past which was the major effect due to urban flooding. According to the information of Gujrat District, around 96,160 patients visited the Health institutions of Government out of these 31,245 were Diarrhea patients. According to this conducted study urban flooding causing impacts on the 40% of the total population of Gujrat (Diarrhea 11.4%, Dysentery 4.5%, Cholera 4.4%, Hepatitis 3.6% and Allergy 16.5%).

Keywords: Urban Flooding; Solid Waste; Wastewater; Diseases; Public Health; Management.

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Photo Degradation of Diclofenac from Water Using Photo Catalyst Riaz Ahmed Soomro^{1*}, Sheeraz Ahmed Memon¹, Khan Muhammad Brohi¹, Rafi O Zaman Brohi¹⁺

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Abstract:

The diclofenac is the NSAID compound. It is emerging pollutant in the environment. The main source of diclofenac in the environment is pharmaceutical wastewater and domestic wastewater. It cannot be removed by conventional treatment methods, so it requires a special treatment method to remove from water bodies. Advance oxidation process is latest water treatment method which utilize free radical reaction to directly degrade organic pollutants using catalyst. In this study, the Mn/Ni based catalyst was synthesized by chemical reduction method in which the ratio of Manganese and Nickel was 3:1. The Characterization of photo catalyst such as particle size, XRD, FTIR and SEM was carried out to examine shape and size of catalyst. The zeta particle sizer showed that the average particle size was 4 µm and SEM results indicated that the particles were circular in shape. The batch experiment was carried out in which various parameters such as effect of pH. photo catalyst dose, contact time and concentration of diclofenac were optimized. During this experiment the optimized parameters observed were at pH 03, optimized photo catalyst dose 25 mg, contact time 240 min and concentration of diclofenac 20 ppm. The maximum degradation of 90% were achieved during this study. After degradation the residual diclofenac concentration was determined using UV-Visible spectrophotometer (UV-1800 SHIMADZU CORPORATION Kyoto Japan).

Keywords: Diclofenac, photo catalyst, Advance oxidation process, Bimetallic.

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Menstrual Hygiene Practices and Attitude of University Girls towards Commercial Sanitary Products

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Abstract

Menstruation is culturally a taboo in Pakistan. Inappropriate education and lack of supplies to deal with menstruation result in reproductive tract infections whereas high literacy rates and adequate awareness is the major indicator to reduce the risk of infection due to menstrual hygiene. The purpose of this study is to gather information regarding menstrual hygiene (MH) practices, knowledge and usage of commercial products by university girls. A cross-sectional study was conducted and data was collected from 50 university girls of Mehran University of Engineering and Technology Jamshoro, between the ages of 18-25. Analysis was done through SPSS software version 22.

The result showed that the major source of information about MH for 69.7% girls was mothers and sisters. 86.8% girls do not know the organ responsible for menstrual blood discharge and, 54.5% girls had no knowledge about menstrual hygiene. 60.6 % girls were using disposable sanitary pads, 42.4% girls reported that they change pads 2 times a day whereas 24.2 % change their pads 3 times a day and 43% felt odor during menstruation. Furthermore 39% girls revealed spending 300-400 per month on sanitary pads. 42.4% participants responded that the menstruation interfere with their university performance due to pain. Interestingly, 63.6% girls showed positive attitude towards menstruation. Results emphasized the need of women education regarding menstruation.

Key words: Menstruation, Health, University girls, Sanitary products, Hyderabad.

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Evaluation of genetic resources of mustard (*Brassica juncea* L.) genotypes for drought tolerance

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Abstract:

Drought stress is considered as one of the primary factors, which is responsible for looming agricultural productivity, because of linking with other major abiotic stresses, such as salinity and heat stress. In Pakistan, the existing mustard genotypes are low yielding due to the abiotic factors including water stress; however, a great potential is also existed to improve seed yield of mustard crop. Therefore, the present research was carried out to screen-out the mustard genotypes for drought tolerance at Botanical Garden, Department of Plant Breeding and Genetics, Sindh Agriculture University, Tandojam during the rabi season 2017-18. In this study, a set of twenty Brassica juncea genotypes was sown in a randomized complete block design in factorial arrangements with three treatments having four replications against drought stresses. The treatments included control (four irrigations at main stages), water stress at maturity (three irrigations at main stages except maturity) and water stress at siligaue stage (two irrigations at main stages except siligaue and maturity stages). The analysis of variances indicated that all factors including genotypes, treatments and genotype x treatment interactions differed significantly for all traits, such as chlorophyll (SPAD), relative water content, seed yield, seed index and oil content, demonstrating that breeding materials utilized in the current study tended to have worth to be used in future mustard breeding programs. The mustard genotypes, such as AARI-Canola, Khanpur Raya, Dhoom-I, HUM-322, Galaxy and Coral-432 showed minimum decline in their performance under water stress conditions in comparison to control and were tagged as tolerant against drought, indicating that these mustard genotypes may provide useful genetic recombinations for drought stress condition.

Key words: Mustard; drought; genetic variation; seed yield; oil content.

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Green entrepreneurship: business's tendency toward waste management

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Abstract:

Harmful business practices polluting the environment and demanding the need to adapt green practices in a businesses to save the planet. Nowadays Pakistan is facing serious environmental problems that impact negatively in our surroundings. Businesses are being careless, do not properly dump their waste, polluting the environment and do not use and adapt eco-friendly products and processes respectively. There is need to overcome this problem of waste management and there's need to take step towards greener practices in businesses. This paper reflects why green practices are not applied by businesses and what are the factors that hindering the businesses to not adapt green practices. In this age, the salons are open in every area and there's no proper body to channelize how much these salons are polluting the environment; the chemicals, fake products and unrecyclable products they use on daily basis without realizing its environmental consequences. For this purpose, Salons were interviewed to understand their strategies. The results show that, to contribute in green environment salons are starting to use led bulbs, savers and eco-friendly decor. Salons are interested in using less harmful chemicals like ammonia free hair color and shows their interest in using no animal tested products. Though they agree that by adapting green practices, there is loss in customer base but those who seek quality services are remain the loyal customers. This research uses qualitative method and use the tool of semi-structured interview, for this purpose content analysis is used for the evaluation. In this research, Conceptual Green framework has been developed to support sustainable businesses. The framework introduces a way of conceptualizing value that specifically introduces new opportunities for value creation.

Keywords: waste management, business, green, environment.

Vulnerability mapping and Assessment of Gaj Dam failure using HEC-RAS and GIS techniques

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Abstract

The dam breach causes release of huge amount of water, which can results in devastating floods in downstream. Financial loss during a dam break scenario is inevitable; however, the human life at risk depends on inundated area, population at downstream and alarm time.

Present study analyses different hypothetical dam breach scenarios caused by extreme flood events. Several of dams yet built in Pakistan, lack Emergency Action Plan (EAP) for disaster preparedness; in case of a potential breach due to an extreme flood event. This study is targeted to estimate potential areas vulnerable to damages by a breach in Gaj dam reservoir-Pakistan. HEC-RAS model generated hypothetical breach was inspected. Geoprocessing along with HEC-RAS was utilized to generate inundation maps.

This study shows that integration of dam breach modeling procedures in HEC-RAS and GIS techniques can generate an accurate peak outflow and flood inundation maps showing the vulnerable areas to potential flooding. Such pilot study can guide towards formulation of proper Emergency Action Plan to minimize flood impacts at downstream of a dam.

Key Words: Dam Breach, Emergency Action Plan, Gaj Reservoir, Flood Inundation, Vulnerability Assessment

Impact assessment of land drainage on soil salinity and vegetation using GIS and Remote Sensing: A case Study of Mardan Salinity Control and Reclamation Project

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Abstract:

Soil salinity is the main obstruction in the sustainability of irrigated lands as it substantially degrades the soil quality. Land drainage projects are installed to enhance the soil conditions for improved crop yield. One of the techniques used for assessing the impact of such projects on agriculture is remote sensing. Remote sensing provides reliable, appropriate, timely and cost-effective information of widely spread crop fields. Numerous remote sensing indices and algorithms have been used to detect salinity and vegetation. The objective of this research was to use those indices and detect the change in vegetation and salinity during 1979-2019 in Mardan Salinity Control and Reclamation Project (SCARP) area. Landsat images of May for 1979, 1999 and 2019 were acquired. Twenty-seven samples were collected from the study area. The electrical conductivity, soil texture, sodium adsorption ration, calcium and magnesium of these samples were determined in the laboratory. The electrical conductivity data was used to validate the remote sensing results for salinity. Normalized Difference Vegetation Index and Normalized Difference Salinity Index were used, and the maps of vegetation and salinity were developed. The preliminary results indicate that the project has improved the vegetation cover and decreased the salinity sufficiently.

Keywords: Remote sensing, Change Detection, Soil Salinity, Vegetation indices, Landsat, NDVI.

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Remediation of Ni (II) ions from Aqueous Media using Iron Oxide Adsorbent

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Abstract:

The presence of heavy metals (Ni, Cu etc) in aqueous solutions constitutes a major environmental issue. In this study, adsorption process performance was evaluated for remediation of Nickel (II) ions using iron oxide particles from aqueous media. The adsorbent was prepared by grinding the discarded and rusted pieces of iron; the powder was then sieved with 1 mm diameter to make the homogenous particle size. The iron oxide particles were characterized using Scanning Electron Microscopy (SEM), X-ray diffraction (XRD), and particle size analyzer to examine particle size and morphological characteristics. The zeta particle analysis showed that the average particle size was 700 nm and SEM results pointed that the particle were spherical in shape. The batch experiment was performed to examine the adsorption behavior of Ni (II) ions on iron oxide surface. Various adsorption parameters such as pH, adsorbent dosage, contact time and metal concentration were studied. The removal concentration of Ni (II) ions was measured using Atomic Absorption Spectrometer (AAS). During batch experiment the optimized conditions observed were at pH 8, 800mg adsorbent dose, 60 min contact time and maximum removal efficiency of 99% was observed for Ni adsorption on iron oxide surface. The kinetic study indicated that, Ni ions adsorption on iron oxide adsorbent followed second order kinetic model. Conclusively, it was observed that the iron oxide is a promising agent for the removal of Ni (II) ions from aqueous media. Hence, this adsorbent can be applicable for removal of other metals ions as well.

Keywords: Adsorption; Nickel; Iron oxide ; Aqueous media; Batch ; AAS.

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NCWE-19 # 24

Proposing Recyclable Bottled Water Product; Fulfilling Demand by Eliminating Dumping (A Case of Jamshoro District, Sindh, Pakistan) Varda Shaikh¹, Arabella Bhutto¹, Adnan Pitafi¹

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Abstract:

Water is essential to human development, also it keeps the integrity of natural environment, since water is essential for both humans and environment it is clear that water issues can't be settled in segregation. 'Clean water and sanitation' is the 6th Sustainable Development Goal (SDG), which ensures clean and safe water is the basic need so its availability should be enough to cater living beings. In Pakistan clean water supply is critical, according to one estimate contaminated water causes 40% deaths in Pakistan. The gap of clean drinking water has been aroused, consequently this gap is filling by bottled water businesses. In Jamshoro, specifically site area and right bank barrage colony are facing serious problem of dirty tap water, people use gallons and bottled water for cooking and drinking, they neither use filtered water, nor they boil it because the quality of tap water is very low. As per high demand, people use packaged water more frequently so they dispose it in same frequency, the bottled water plastic is polluting the environment. There must be a solution which can fulfill the demand and save the environment too. This research is proposing recyclable bottled water in replacement of traditional plastic bottles, for this purpose this research uses Quality Function Deployment (QFD) method, which is helpful in new product development by translating user preferences into technical characteristics. To fulfill the purpose, two tools are developed which are survey questionnaire and semi-structured interviews. A novel Quality Function Deployment (QFD) model is developed to support this research, which introduces six parts of it (customer requirements, weightage/importance, technical Requirements, technical co-relationships, relationship matrix and competitive assessment.). This model intends to support water businesses to introduce that bottled water which can fulfill the demand as well as save the environment.

Keywords: Recyclable Bottled Water; Jamshoro; Quality Function Deployment (QFD) method; Sustainable Development Goal (SDG).

An Investigation of Existing Sanitation conditions of Poultry Slaughtering Facilities and Hygienic Practices among Poultry Butchers

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Abstract:

The present study was conducted in the Hyderabad district to assess the present sanitation conditions of poultry slaughter shops and meat handling and hygienic practices among the poultry butchers. Twenty poultry shops located in different areas of Hyderabad were selected for the study. Data were collected by a well-structured questionnaire survey. Study was conducted from April 23rd to May 12th at morning time. During survey personal interviews and visual observations were also made. After that collected data were tabulated and analyzed statistically by using, statistical package for social sciences (SPSS). The study comprises three sections. Firstly the personal hygiene of the butcher was analyzed based on meat handling, hand washing, apron wearing, hair covering, jewelry wearing and money handling. Secondly, the infrastructure available at the shop and slaughtering tools were analyzed using a prepared checklist. At this point condition of chicken cages and relative environmental factors were also observed. Afterward, the main butcher at the shops was interviewed by a questionnaire survey to assess his educational status, working experience, training, number of birds slaughtered per day, etc. All the studied butchers were bearing poor hygienic status owning to the lack of knowledge, illiteracy, and nature of the work. More than 50% of butchers were without any formal education and none of the butchers had received any formal training in slaughtering and meat handling practices. Almost 70% of the shops were lacking adequate ventilation and lighting. Most of the studied shops were without hand washing facilities, soaps, detergents, clean water and disinfectants which are prerequisites of hygiene. To improve hygiene levels and reduce diseases due to the consumption of contaminated meat, regular surveillance of the shops and formal training of butchers are necessary.

Keywords: butchers, poultry, hygiene, sanitation, and slaughter

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Copper nanoparticles as reusable catalysts for reduction of 4-nitrophenol under mild conditions

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Abstract:

Recently, green chemistry has attracted substantial consideration as it is difficult to overcome the environmental contamination encountered by the world population. Nitrophenols (NP) are among the most common organic pollutants in industrial and agricultural wastewaters. Other hand 4-nitrophenol (4-NP) is widely used as the precursor for production of 4-aminophenol (4-AP), which is less and used for marketed as a photographic developer, its oxalate salt has been reported being a corrosion inhibitor, synthesis of industrial dyes, drying agent, and also used as important intermediates in the preparation of analgesic and antipyretic drugs. Present research work represents the synthesis of environmental friendly copper oxide (CuO) nanoparticles by hydrothermal method. The Scanning Electron Microscopy (SEM) demonstrates the morphology of ranolazine derived CuO NPs consisting of well-defined rice like structure. The X-ray Diffraction (XRD) analysis verified the pure monoclinic CuO crystal phase and crystallite size was determined to be approximately □ 12 nm. These Functionalized CuO NPs were studied for heterogeneous catalytic activity for the reduction of 4-NP to 4-AP aqueous system under mild conditions. To examine the catalytic response, CuO NPs were applied for the reduction of 4-NP in the presence of NaBH, as a reducing agent. The results showed that when increasing the amount of CuO NPs the 99 % reduction of 4-NP was observed in 360 s. The rate of reaction for catalysis between $In(C_{0})$ of 4-NP versus time (s) has been obtained from the slopes of the linearly fitted plots and found to be 8.8× 10⁻³ s⁻¹ respectively. The reusability of CuO NPs showed good catalytic efficiency, non-toxic approach and cost effective nature.

Keywords: Copper oxide nanoparticles, 4-nitrophenol, 4-aminophenol, heterogeneous, non-toxic approach, catalysis

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NCWE-19 # 30

Solid Waste Management Issues and Solutions in Pakistan: A Review Muzafar Hssain Shah^{1*}, Muhammad Safar Koria¹, Farooq Ahmed¹

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Abstract:

Solid waste management situation in Pakistan is one of the grave issues as according to the BioEnergy Consult (well-known consultant in waste management) more than 5 million people die each year due to waste-related ailments and in developing country like Pakistan, 20 million tons of solid waste is generated annually. Moreover, there is an annual growth rate of about 2.4 percent. Being the 6th most populated country in the world there is a lot of consumerism of the various products thus leading to greater quantity of waste. This research indicates waste management sector of Pakistan and its social, cultural, legislative and economic issues. Likewise, it discusses about the improper handling of landfill process as most landfills lack proper on-site waste management mechanism therefore contributing additional threats to the environment of Pakistan. The methodology adopted for this research is that 6 research papers were reviewed thoroughly and 2 quality books were comprehended. The results of research are to reduce the amount of waste generated, there is a need of proper management of landfill space. Furthermore, extracting maximum benefit from waste Materials found in municipal solid waste can be used to make new products .In this paper, recommendations have been incorporated briefly about solid waste management issues regarding on-site handling, and segregation, collection, transportation and disposal are discussed. Also mitigation measures are highlighted in order to overcome environmental as well as socio-economic problems which are associated with solid waste management in Pakistan.

Key Words: Solid waste, environmental issues, treatment, disposal, collection, management

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Development of a Low Cost Grey Water Treatment System Farman Khaskheli^{1*}

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Abstract:

The grey water is the major contributor to the wastewater generation, approximately 60% to 80% of the total waste. The grey water is not much containing contamination as compared to black water and other wastes water. The project involves developing a lowcost treatment system for greywater treatment to create an economical system. The system was designed on the basis of the collected volume of seven (07) days. Constructed wetland was selected as a technology for the treatment of grey water of washrooms at Department of the NED University of Engineering and Technology. The treatment system consists of three stages. First stage is the primary treatment system; Second stage is constructed wetland for the treatment of primary, secondary and advanced treatment. Constructed wetland contains Canna and Cypress plants for the biological treatment. The major part of the system is the constructed wetland treating the BOD_{ϵ} and COD up to 80% and 60% respectively. Third stage consists of storage pond to store the treated grey water with storing capacity of 11.72 cubic feet for five (05) days. Qualitative analysis was done by conducting the Chemical and Biological tests. Sindh Environmental Quality Standards and USEPA Guidelines were followed for comparison of results. Average untreated grey water BOD, was 47 mg/L and average treated BOD, was coming out to be 7.67 mg/L with a percentage reduction of 83.6%. Average untreated grey water COD was 33 mg/L and average treated COD was coming out to be 12.67 mg/L with a percentage reduction of 61.6%. Escherichia coli bacteria were present having 07 CFU per 100 mL solution and reduced to 02 CFU per 100 mL solution in average influent and effluent grey water respectively. Total coliform contain 17 MPN and 05 MPN of influent and effluent grey water respectively. Pseudomonas aeruginosa bacteria were not present in the untreated grey water.

Keywords: Grey water; Wetlands; Constructed wetlands; Biological tests; Economical.

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Congruous Utilization of Gray Water

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Abstract:

The unmanage usage of clean water and poor disposal of sewerage water disturb the quality of rivers, ground water aquifer and its excessive utilization at domestic level with increasing population make the Pakistan a water scarce country. The water consumption at domestic level in Pakistan varies from 30 liters per capita per day to 350 liters per capita per day. During domestic consumption use of water for drinking and cooking is 4%, toilet 10-18%, shower 28-30%, wash basin and prayer 12%, kitchen 15- 21%, laundry 10%, house cleaning/ car washing 5-9% while gardening consume extra pumping of water. In household, we use clean ground water in toilet, shower, wash basin, kitchen, laundry, house cleaning, and car washing other then the guantity of water that we use for drinking and cooking purposes. By modifying the collection of used water, 75 - 80% water that is called gray water (waste water of shower, wash basin, kitchen, laundry and car wash) can be recycled, while remaining 20–25% water is sewerage water (used in toilet and house cleaning) will directly throw to sewerage line. Separation of gray and sewer water at the level of collection will help to treat and recycle the gray water with low cost Pakistani technology to extract mud, detergent and chemicals. We could efficiently use treated water for toilet, house cleaning, car washing, construction of civil work, maintain green belt, secure the ground water aquifer, preserve the electricity consumption and clean and green disposal of waste water. This idea is also applicable on larger scale to use the treated water for agricultural purposes.

Keywords: Gray water, sewerage water, Treatment, Recycling, clean disposal, Reuse.

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Water Inundation Modelling and Mapping of Darawat Dam ¹'Shafique Ahmed

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Abstract:

Outrageous occasions like flooding because of dam failure are of worry for any nation with regards to harm caused to life and also to the property. This circumstance calls for sufficient administration estimates, for example, Emergency Action Planning (EAP). There are 150 dams above the height of 15m in the Islamic Republic of Pakistan. The greater number of these do not have an EAP. An essential aspect of these EAPs is the consideration of an inundation map that identifies the downstream regions affected by a potential dam rupture. The objectives of this study were to conduct a hypothetical dam breach analysis to estimate inundation level, flow velocity, and flood arrival time and to identify which areas/ populaces are most defenseless from flooding for Darawat dam; located in Jamshoro, Sindh, Pakistan. In the end, a sensitivity analysis was also conducted by modifying manning's "n", breach width, and downstream bed slope. A hypothetical dam fracture was examined, by running the Hydrologic Engineering Centre River Analysis System (HEC-RAS). HEC-RAS along with ArcGIS was employed to create maps of maximum flow as well as the time required to reach that flow at the downstream side. The expected vulnerable areas were identified by incorporating the inundated depth produced by the model under different situations of dam breach on a Digital Elevation Model (DEM). This study shows; how a mix of dam breach displaying techniques and GIS post-preparing, can generate a maximum discharge rupture and succeeding inundation map. It also specified; the areas up to 80 km2 downstream in the vicinity of the dam, are hazardous and manning's "n" is the most sensitive parameter. The Present examination is guite helpful in constructing EAP. The current research successfully explored the future catastrophe due to dam break and mitigation plans can be proposed concerning possible dam break in the future.

Keywords: Emergency Action Planning; Inundation; Dam breach; Hypothetical; Discharge; Hazardous.

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Determination of Hydraulic Characteristics of Aquifer System at Command Area of Seri Distributary using AQTESOLV Software Asma Memon¹, Abdul Latif Qureshi², and Shafi Muhammad Kori³

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Abstract:

Pumping test is conducted to estimate hydraulic characteristics of an aquifer, and it is considered one of the most widely used techniques for examination of the hydraulic response of an operational tubewell. The hydraulic characteristics, i.e. coefficient of transmissibility (transmissivity), T, and coefficient of storage (storativity), S, of the aquifer system were obtained from pumping test data, carried out at head reach and another at tail reach of the selected canal command area. Pumping test was conducted at each tubewell sites, head and tail reach of Seri distributary for a period of 24 hours; Seri distributary off-takes at Almani cross-regulator from Rohri Canal (RD -1038). The T and S values were obtained by Theis and Cooper-Jacob solutions, and analyzed using AQTESOLV software. The average values of transmissivity were estimated as 19.38 ft²/min and 24.25 ft²/min at head and tail reach; and storativity values as 0.001354 and 0.004995, respectively, which are considered as a representative value of the study area. Standard error for transmissivity and storativity were found less than 1.4 percent. However, per estimated results, the hydraulic conductivity at head reach was more than that of tail reach. Thus, it is recommended that continuous pumping more than 12 hours at the tail reach should be avoided, due to slow movement of water table recovery was pointed out at tail reach.

Keywords: Hydraulic characteristics, Transmissivity (T), storativity (S), AQTESOLV, Pumping test, Rohri canal.

Identification of Antibiotic-Resistant Bacteria in Sanitary Systems of the Primary Schools of Hyderabad District Pakistan

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Abstract:

Antibiotics can treat many deadly bacterial diseases effectively. A large percentage of antibiotics prescribed worldwide in outpatient settings are unnecessary. However, rapid increase in community-acquired antibiotic-resistant infection has been observed in Pakistan. School setting may be particularly important as large number of children are sitting together and sanitation or hand washing facilities may not be sufficient, poses high chances of fecal oral transmission. The microorganisms carrying resistance genes for advanced antibiotics are prevalent in human wastes. This study has identified the presence of these enteric bacteria in sanitary systems of the primary schools of District Hyderabad, Pakistan. We considered public primary schools, registered with education and literacy department. 27 schools were selected randomly. This study comprises of two parts, the wash facilities assessment followed by school latrine sampling for antibiotic resistance. Antibiotics resistances was analyzed using streak and spread method at national water quality lab, US-Pakistan Center for Advanced Studies in Water. Azithromycin and Cefixime were found to be more resistant to E-coli and KEC bacteria's as compare to Meropenem and Ciprofloxacin. However Meropenem was highly susceptible to E.coli, and KEC by 92%, 81% respectively. The identification of Antibiotic Resistant Bacteria that are health hazard for carriers and can lead to direct exposure to other community through contamination by fecal waste.

Keywords: Antibiotics resistance; Microorganisms; Schools; Human waste; fecal oral transmission; antibiotic-resistant infection.

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Investigation of microbial community dynamics in membrane bioreactor treating fish processing wastewater

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Abstract:

The fish processing industries are located along the coasts, all discharge their wastewater directly into sea estuaries without proper treatments, causing serious problems to sea as well as pollute the environment. To treat fish processing wastewater (Karachi industry), a pilot-scale Anaerobic Aerobic Membrane Bioreactor (AnAMBR) system was operated. The reactor was maintained using synthetic wastewater (SW) followed by fish processing wastewater (FPW). The pH of the reactor was maintained between 7.2 to 7.5. The average Chemical oxygen demand (COD) removal efficiency obtained was 98%. Total two samples were collected, one from initial stage of AnAMBR containing synthetic wastewater and one sample after stabilization of AnAMBR, containing (FPW). Cells from the wastewater samples were fixed with 4% paraformaldehyde solution and were preserved at -20 °C for a week. Fluorescence in situ hybridization (FISH) technology (culture independent technique) was used to investigate bacterial composition in AnAMBR by using fluorescently labelled probes. The total population stained with DAPI detected 92% of eubacteria using EUB338 probe. The population of α -proteobacteria was decreased from 33 to 17%. whereas number of halotolerant bacteria (Nitrosomonas) and sulfur reducing bacteria increased from 7 to 16% and 11 to 39% respectively. Sulfur reducing bacteria were found to be predominant. The α -proteobacteria are responsible for bulking and foam formation, leading to deterioration of the settling properties of the sludge. Reduction in the number of α -proteobacteria is beneficial for the biological treatment of wastewater in MBR.

Keywords: Fish industry, AnAMBR, FISH technique, wastewater treatment

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Fabrication of Selective Calorimetric Sensor for Hg²⁺ Using Green Synthesized Silver Nanoparticles

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Abstract:

This study demonstrates a green route, environmental friendly and cost effective colorimetric method for quantitative analysis of Hg²⁺ using plant extract capped silver nanoparticles. Citrus Japonica Leaves for the first time used as bioreductant which acts as the reducing and capping agent to synthesize more stable AgNPs. The formation of AgNPs was noticed as yellowish-Golden color appearance after 30 min of heating showing Surface Plasmon Resonane (SPR) band at 403 nm in visible region under optimized parameters, including pH, reaction time, and concentrations of silver salt, sodium hydroxide, and leaf extract. The fabricated green extract based AgNPs were characterized by UV-visible spectroscopy, FT-IR spectroscopy, SEM, XRD, AFM, DLS and Zeta-Potential analyses. The green synthesized AqNPs proved to be highly selective calorimetric sensor for Hg²⁺ showing visible color change from yellowish golden to light brown color in aqueous medium. The prepared silver nanoparticles were highly selective to detect Hg²⁺ on the basis of the linear relationship between SPR band intensity and different concentration of Hg²⁺. The linear range of Hg²⁺ is 0.7-100 μ M/L with an R² value of 0.996 by UV-Vis spectrophotometer. The selectivity and sensitivity of green prepared silver nanoparticles for Hg2+ shown a lower limit of detection (LOD) and limit of quantification (LOQ) as 0.124 and 0.04 µM respectively without any significant interference by Ni²⁺ Zn²⁺, Ar²⁺, Co²⁺, Pb²⁺, Cd²⁺, Cr²⁺ and Fe²⁺.The developed sensor was effectively tested for detection of Hg²⁺ in real water samples.

Keywords: Silver nanoparticles, colorimetric sensor, mercury.

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Fouling reduction of membrane in Membrane Bioreactor using polyethylene glycol, Alginate, Granular Activated carbon (PACA) Matrix

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Abstract:

Membrane bioreactor is very effective wastewater treatment technology now a days. Membrane bioreactor has many benefits over conventional activated sludge process, the notable advantages are, membrane bioreactor occupy less area, and it provides a better quality of effluent. But the problem with this technology is membrane fouling. Membrane fouling cause great flux decline, increased power consumption, and finally replacement of membrane, which pose great increment in operational cost of the system. In this study membrane fouling in membrane bioreactor is reduced by immobilizing the biomass on biocompatible matrix called PACA matrix. In this study two identical sized aerobic reactors were setup having a volume of 5.5 I. Polyvinylidene fluoride (PVDF) membrane is submerged in both reactors. The reactors were seeded with 5 litters of sludge taken from local biogas plant and were operated with synthetic wastewater of 2000ppm Chemical oxygen demand. The efficiency of Chemical oxygen demand removal of both the reactor was up to 99%. After reaching the study state condition, PACA matrix was introduced in one of the reactors. And fouling behavior was monitored using a Dead-end filtration test, and the initial and final value of Alpha was compared. Initial and final value of Alpha showed considerable decrement in membrane fouling. Trans-membrane pressure was also monitored, which showed less flux decline in reactor having PACA matrix than the reactor without PACA matrix.

Keywords: Membrane Bioreactor (MBR), PACA Matrix, Membrane Fouling, Dead-end Filtration, Alpha test, trans-membrane pressure.

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Implementation of Environmental Policy in Pakistan Junaid Ahmed Sohoo¹⁺

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Abstract:

Currently, Pakistan is confronting with multiple environmental concerns such as improper waste disposal system, increasing water crisis, rising air pollution, climate change, urban sprawl and loss of biodiversity. Owing to these, there has been destruction in varied sectors of Pakistan. In order to deal with these growing issues, it is requisite to formulate efficient environmental policy and implement it in true letter and spirit. This study reveals the historical background of former environmental policies of Pakistan and causative factors behind their failure. Moreover, it discusses about the drawbacks in current environmental policy of Pakistan and instant actions taken by the regulatory authorities. Over and above, it evaluates the functioning capabilities of federal and Provincial Environmental Protection Agencies and efforts taken by them to cope up with various environmental issues especially the most critical issues of Pakistan right now like climate change and air pollution. On the other hand, various repercussions and negative impacts of flawed environmental policy of Pakistan elaborated too in this paper which will put light on some ground realities related to the paucity of interest by government. The methods adopted for the analysis of this research is that four quality books on environmental policy of Pakistan were thoroughly studied and important information was extracted from them for comprehensive research. Likewise, five quality papers were reviewed related to environmental policies which gave roadmap to intensive investigation of the topic. The final results of this research are economic growth is given priority by various beneficiaries like stakeholders and business tycoons, identification of any violation of environmental law does not lead to any severe actions, there is no any revision of existing environmental law and sustainable development is not adopted in its real shape in Pakistan. The most important recommendation is strong legislation and formation of monitoring body of environmental experts.

Keywords: Environmental Policy; Regulatory Authority; Climate change; EPAs; .Environmental law; Air quality

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Climate change demanding the sustainable business approach (A study to initiate a bottled water business in Jamshoro Sindh) Maryam Qazi¹, Arabella Bhutto¹, Adnan Pitafi¹

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Abstract:

Hydration is the key ingredients towards healthy life. As drinking water quality is in public health filtration plants continuous to decline in underdeveloped and developing countries, thus making the water unfit for consumption by the masses. Rapid urbanization in Pakistan has brought unprecedented pressure on safe drinking water in cities and villages and this has created an unprecedented opportunity for various businesses. In addition to this, there are some potential environmental consequences associated with it which need to be considered for the sustainability of business and environment. This research is to investigate the consumer preference on bottled water and analysis of sustainable business model by using the value proposition canvas. This research uses method of semi structured interviews and survey questioners for this investigation and previous reports and articles. The significance is in adding to the body of literature in bottled water industry and to highlight the perceptions held about the environmental consequences of bottled water consumption and the considerable challenges marketers have to address if they are to persuade consumers to consider alternatives to this consumption practice. This tool adopts a multiple stakeholder view of value and introduces a way of conceptualizing value that specifically introduces value missed or wasted in addition to the current value proposition and more opportunities for value creation.

Keywords: climate and environmental change, sustainable business, Clean Drinking Water, Bottled Water, value proposition canvas.

Removal of Hydrogen Sulfide from biogas by using Nanofibers membrane

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Abstract:

Biogas is a source of sustainable and renewable energy that is produced by the anaerobic digestion of organic matters, contains 40-75% of CH₄, 25-50% of CO₂ and 0.1-3% of H₂S and other impurities. H_2S is known as a toxic impurity, and it corrodes the engine, pipelines and storage tanks, and also reduced heating value, energy losses, GHG emission etc. Therefore, H₂S removal is necessary. In this study, neat Polyacrylonitrile (PAN) and Polyacrylonitrile (PAN) with manganese dioxide (MnO₂) nanofibers adsorbent was developed. The synthesis was done by a simple and scalable process of electrospinning. The nanofibers thus obtained were characterized and were analyzed for their adsorption capability for Hydrogen sulfide (H₂S) from biogas. The diameter, appearance, morphology of the electro spun fibers were checked using different characterization tools including scanning electron microscope (SEM). The neat PAN nanofibers had an average diameter of 358 nm and the overall diameter of the nanofibers ranged between 100-500 nm. The PAN with MnO, nanofibers average diameter 450 nm and the overall diameter of the nanofibers ranged between 200-800 nm. The chemical characterization of the nanofibers were checked using FTIR spectra. The adsorption capability of the neat PAN and PAN with MnO₂ nanofibers for H₂S was analyzed using MQ-136 gas sensor.

Hydrogen sulfide removal efficiency up to 95% was achievable using neat PAN nanofibers. The efficiency achieved by using PAN with MnO_2 nanofibers was up to 99.94%. H₂S removal efficiency calculated for experimental variant like the use of different nanofibers membrane and flow rate variations of biogas mixture passes through column 1.2 liters capacity. This technique efficient for the removal of H₂S and also cost-effective, low maintenance requirements, feasible adsorbent, easy processing, light in weight and has low energy and allow all of the material to be used efficiently.

Keywords: Adsorption; Biogas purification; Electrospinning; Efficiency calculation; Hydrogen sulfide; Nanofibers membrane

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Recycling of banana plant residues for nutrient rich compost Saleem Maseeh Bhatti^{1*,} Muhammad SachalKhokhar¹, InayatullahRajpar¹, Qurban Ali Panhwar², Zohaib ur Rehman Bughio¹

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Abstract:

Agricultural waste management by Composting offers a viable solution to increasing organic wastes. The process of composting offers many benefits including enhanced soil fertility and soil health improved soil biodiversity and reduced environmental risks. This study is an effort to prepare composts from banana plant residues and animal manures and to determine their nutrients concentration. The composts were prepared in cemented pits at Sindh Agriculture University Tandojam. Banana plant residues (trunk and leaves), and various animal manures (cattle, goat and poultry) were collected from selected farms around Tando Jam. Three different composts having variable recipes were prepared, namely banana plants + cattle manure, banana plants + goat manure, and banana plants + poultry manure in 3:1 ratio. Banana trunk and leaves were chopped into smaller pieces (≤ 1 inch) and were filled in the bottom of the pit in a 9 inches layer, followed by 3 inches layer of animal manures (cattle manure or goat manure or poultry manure). This alternate layering pattern remained continued until the pit became full (in total 4 unit layers were prepared). Composts were turned after every 15 days interval, and at each turning temperature was noted and the composts were moistened, if required. The turning process was remained continued for five months, followed by one month for stabilization. Afterwards, composts were sampled, processed and analyzed for EC, pH, total C, N, P, K, and C:N ratio. There was significant difference among various composts with respect to most of the selected parameters (P < 0.05). However, the values of selected parameters in all three composts were within the acceptable limits proposed for mature compost. Hence, the defined agricultural waste recycling technique for banana plant residues should be adopted to attain nutrient rich material for crop husbandry and soil health.

Keywords:Agricultural waste management, Banana plant residues, Animal manures, Compost, Nutrients concentration and Soil fertility

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Indoor Air Pollution Analysis of District Tharparkar, Focusing on Woman and Children

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Abstract:

Indoor air pollution is generated due to numerous home based sources and activities, like; cooking, cleaning, heating, garbage, appliances, motors, carpets, cleaners, cosmetics etc, those contains potential to harm the indoor environment. Indoor air pollution gets worst due to some worst anthropogenic activities like; energy saving measure, low ventilation, bad design and so on. Indoor air pollution is responsible for about 4 millions of premature deaths annually, in which major cause is use of dirty and solid fuels for cooking purposes. Major disease among children is pneumonia, and half of these cases are due to indoor air pollution which effects mostly the children below the age of 5. Major diseases causing pollutants are found in biomass fuels and coal fuels like; particulate matter (PM), carbon monoxide (CO), NOx, SOx (mainly from coal), formaldehyde, and polycyclic organic matter, including many carcinogenic chemicals. Temperature, relative humidity, broad cool or hot surfaces, and draft influence the impression of indoor-air quality and adjust the impacts of synthetic and microbiological contaminants. The indoor air pollution varies mainly due to socio-economic condition so the nations. Developing nations are most effected by indoor air pollution as compared to the developed one and among developed nations indoor air pollution is worst in rural areas as compared to the urban area. Housewives, kids and elderly are mostly effected by indoor air pollution. As women are responsible for cooking and other activities, gets affected the most and worst as compared to others, and children under the age of 5 remains with mother during those activities, gets affected too, leading to the premature deaths. Number of premature death in Tharparkar are; 479 in 2016, 450 in 2017 and 499 in 2018. The common cause of deaths related to indoor air pollution are; 23% by Low Birth Weight, 19% by Birth Asphyxia and 1.8% by Respiratory Distress Syndrome (RDS). Current research study the indoor air pollution in district Tharparkar, focusing on women and children.

Keywords: Indoor Air Pollution, Social Survey, Human health, Tharparkar, Rural Areas, Women and Children.

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"Tobacco Smoking; Human Health and Socio-Economic Well-Being, A Survey."

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Abstract:

Environmental Tobacco Smoking (ETS) being one of the major indoor air pollutant, accounts for human health effects ranging from simple headache to cancer and death. ETS is one of the major producer of indoor hazardous gaseous pollutants, specially CS. Major sources of tobacco smoking are indoor smoking, Huga smoking, pipe smoking, E-cigarette etc. Tobacco smoke contains more than 7000 chemicals in the form of gases and solid particles, in which 10% is tar and nicotine and 90% gasses and vapors Some gases include formaldehyde, acrolein, ammonia, nitrogen oxides, pyridine, hydrogen cyanide, vinyl chloride, N-nitro sodi-methylamine, and acrylonitrile. More than 40 chemical of which are carcinogenic. Tobacco accounted for an expected 4% of the global burden of sickness in 2000, in particular due to active smoking exposure. Estimates indicate that 3000 lung cancer deaths every 12 months may be attributed to passive smoking inside the united states of America at the side of masses of thousands of youth breathing ailment instances. ETS exposure affects large numbers of humans dwelling in both growing and developed countries. Apart from human health and environmental impact, tobacco accounts for many economic and moral issues. This study consists of review research and social survey conducted from 50000 people from different part of society, including labors, non-smokers, family members, smokers, students, female smokers and many more. Objectives of this study is to evaluate ratios of different smokers with respect to age, professions and nature, and many more perspectives.

Keywords: Tobacco smoking, Indoor Air Pollution, Social Survey, Human health and economic impacts.

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Indigenous Natural Indigo Dye for Denim Industry

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Abstract:

Presently, denim industry is the fastest growing textile manufacturing sector in Pakistan and it has a promising local and international market for work and fashion clothings of all age groups. Synthetic indigo dye is widely used for denim dyeing which is toxic due to presence of aniline compound. Due to increasing awareness and control for sustainable manufacturing and products, fashion brands, manufacturers and scientists are looking for the alternates. Natural indigo dye has been one of those alternate options as natural dyes are non-toxic, bio-degradable and renewable. However, natural indigo dye has been used only in the cottage industry so far. The present research includes the industrial scale application of natural indigo dye extracted from indigenous indigofera tinctoria plants for dyeing of undyed denim fabric. The indigo dye extraction process was developed in collaboration with Archroma Pakistan Ltd. to make the dye suitable for dyeing procedures practiced in denim industry. The industrial scale dyeing procedure (i.e. pre-wetting, dyeing and washing) was optimized using the developed dye in terms of dye bath temperature, concentration of dispersing agent, concentration of sodium hydrosulphite (reducing agent) and concentration of sodium hydroxide. The color yield (K/S) and colorfastness properties of the fabric dyed with natural dye was better than the synthetic dye.

Keywords: Denim; Indigofera tinctoria; Natural Indigo Dye; Sustainability; Dyeing

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Emission measurement of diesel vehicles and the effect of hot and cold start conditions of engine on emission concentration

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Abstract:

Worldwide, an increasing use of diesel vehicles has been noted to have an important role in air pollution. Along with their contribution to adverse environmental impacts, diesel engines carry toxic compounds that cause many human-related health problems. Carbon monoxide (CO), carbon dioxide (CO₂), nitrogen oxides (NO₂), sulfur dioxide (SO₂), and hydrocarbons (HCs) are the major pollutants resulting from using diesel oil fuel. The aim of this study was to analyze the concentration of exhaust emissions, including CO, CO₂, NOx, SO₂ and HCs from a fleet of university buses. We studied the exhaust pollutants according to the age of vehicles (1978 – 2009). Measurements were carried out in two phases. First, on a single day, readings were recorded for both the cold and the hot start engines for each phase. In the morning (Phase-I), emissions from approximately 36 university buses running on petroleum diesel were measured. In the evening (Phase-II) of the same day, the same practice was carried out and the results were compared with that of phase-I. To measure gaseous emissions, we used a flue gas analyzer Testo 350. The readings were then categorized according to the model year of vehicles. Thereafter, the emissions which included CO, NO₂, SO₂ and unburned HCs from the vehicles during cold-start were observed to be higher than that of the hot-start conditions for both the phases. Along with engine temperature, there were various other parameters which were linked to the concentrations of pollutants emitting from diesel-powered buses like acceleration, type of fuel, maintenance cycle, air-to-fuel ratio, and efficiency of the engine. The study concluded that the transport-related pollution in the premises of university is indeed significant with possible severe health consequences leading to poor academic performance for both faculty and students.

Keywords: automobile pollution; diesel vehicles; exhaust emissions; emission concentration; diesel particulate emissions; emissions measurement

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IOT BASED REMOTE MONITORING SYSTEM FOR SUSTAINABLE WATER DELIVERY SERVICES

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Abstract:

Water pollution is one of the biggest threat to sustainable and eco-friendly development. Water pollution causes diseases to human health and also destroys the eco system. The water pollution has increased with time by lot of factors like the increase in population, industrialization, and urbanization, which results in directly affecting human health. In Pakistan monitoring of water quality is a tedious job in remote areas due to the lack of laboratories and awareness. It takes long time in order to collect sample and preservation. In order to deal with this problem, we propose an IOT based water quality monitoring system through android application which allows us to monitor live water quality for 24hours /day. The system consists of five sensors which monitor DO, Turbidity, TDS, pH, and Temperature of water and transfers this data towards the microprocessor, which analyze the data and transmit the data over server through the WIFI connectivity. When there is the unavailability of WFI then the data is sent towards the user via the SMS and email. If the value of contaminating increases from guideline values then the buzzer beeps and messages sent towards the user about the condition along with that treatment is also suggested by the system. The readings that had been analyzed by the lab equipment's are Turbidity 35.2 NTU, TDS=0.32g/l, pH= 7, Temperature= 32 °C, DO= 7 mg/l and the readings that is given by the proposed system are Turbidity 35 NTU, TDS=0.35g/l, pH= 7.1, Temperature= 32 °C, DO= 7.32 mg/l. The proposed system gives the reading that is near to the lab equipment readings.

Keywords: Internet of things, Water pollution, Water quality, Remote monitoring system, Sensors, Raspberry pi.

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LOT Based Monitoring of Air and Noise Pollution Through Android System

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Abstract:

Today, many advanced systems, techniques are present to monitor Air quality and Noise levels but, everywhere in the world it is not likely that these systems are available. In remote areas where there is the unavailability of modern analyzing equipment's. This system is the alternate provides Fastest and accurate monitoring. This work presents the design and implementation of a system that is an innovative technique based on cuttingedge technology of "Internet of things" for air and noise guality monitoring. It has been observed that commercially available equipment enables monitoring by visiting the site that is it requires man power to operate and these systems are expensive and time consuming. In order to avoid these problems, the system of IOT based Air and Noise pollution Dualmonitoring system through Android Application is proposed. The system consists of seven sensors (i.e. ME₄, MQ₁₃₅, MQ₆, MQ₇, MQ₄, DHT₄₁, LM₃₉₃), which monitors SO₂, NO₂, CO, CO₂, CH₄, NH₆, H₉, Benzene, Smoke, Dust, temperature, noise, leak gasses and combustible gases. Data is transmitted to server through the WIFI connectivity for 24 hours/day. When there is the unavailability of WIFI then data is sent towards the user via SMS and email. If the value of contaminate exceed the guideline values then the buzzer beeps and user is intimated through sms and email, along with its remedy. In order to check the accuracy of the proposed system some sites were selected whose air and noise pollution conditions were monitored from proposed and commercially available systems. The proposed system provides results same as that of the commercially existing equipment without visiting field via application, sms and email. In less than two min, accurately and for 24 hours/day. This makes the system cost-effective, fastest and easily operable Water

Keywords: Internet of things, Air pollution, Noise pollution, Remote monitoring system, Sensors, Raspberry pi.

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Status of Solid Waste Management in Peshawar, Pakistan Waqas Ahmad^{1*}, Muhammad Hassan^{1*}, Tahir Nawaz¹, Muhammad Ashfaq², Muhammad Assad Khan¹

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Abstract:

Pakistan faces both an energy crisis on one hand and difficulty in transporting waste from generation to final disposal because of a quickly expanding population. The number of inhabitants in Pakistan was recorded as 208 million in 2017 census and constantly expanding with the growth rate of 2.4%, making it one of the world's most crowded nations and further exacerbating waste management issues. The main objective of this article is to examine the present waste management procedure of Peshawar city and what should be done to improve it. A major part of the Peshawar population belongs to the low and middle-class income region and based upon this fact, squander generation rate per capita fluctuates in various parts of the city. To achieve the goal of information gathering of waste generation daily, quantitative analysis survey was being performed in Peshawar city along with WSSP and interviews conducted with household. Besides, every zone's garbage collecting vehicles were monitored and their performance was tracked which demonstrates that 2208 tons/day waste is generated every day. Municipal solid waste collection and disposal services in the city are not in the same class as it should've been. On the grounds that roughly 60 percent of the solid waste is collected and the remaining are present there at gathering points, or in streets, where it radiates a large amount of contaminants into the surrounding environment, making it unsuitable for human interaction. A noteworthy part of the waste is dumped in an old furnace misery around the southern side of the city. This investigation gives a superior plan to improve the waste accumulation system by firing of suspicious drivers and, recruit new staff. Proper training and ethical awareness should be provided to them. The vehicles that are not being used properly, should be utilized at full capacity. Further analysis should be performed like budgetary costing of every ton waste from the waste generation site to a landfill site, social, technical, political and environmental.

Keywords: Pakistan, MSW, Solid waste Management, Peshawar strategy

Assessment of Indoor Air Quality in Educational Building

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Abstract:

Mostly, people spend their time indoor, this makes indoor environment of great health concern to the occupants because most of poor-quality air is inhaled inside dwellings. Globally, indoor air pollutants poses the most important indoor air quality challenges because of the number of individuals it affect, different types of pollutants involved and the acuteness of the risks involved. This study was carried out to investigate different parameters affecting the quality of built environment and thermal comfort in educational buildings with different types of ventilation systems. CO_2 , CO, temperature, relative humidity and volatile organic compounds (VOCs) were measured during the weekdays. E-instruments IAQ monitor AQ-Expert and Extech-CO210 CO_2 data logger were used to measure these parameters. Statistical analysis was performed to find significance of the measured parameters between different buildings. Also, measurements were compared against ASHRAE 55 & 62.1 standards for minimum required performance.

Keywords: CO₂ concentration, VOCs, Thermal Comfort, Educational Building, Indoor Air Quality,

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Synthesis of novel arsenic tagged imprinted polymer for the detoxification of Arsenite ions from the aqueous environment Muhammad Sagaf Jagirani¹, Aamna Balouch¹, Sarfaraz Ahmed Mahesar¹

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Abstract:

Arsenic is known as a highly toxic pollutant that seriously threatens to the environment and human health. Especially, As3+ is highly toxic than As5+. Uptake of the very low amount of As3+ compounds can be fatal. The major causes of arsenic toxicity are mining, fossil fuel combustion, biogeochemical reactions, pesticides, and other arsenic-based additives. Although, mostly population exposed to arsenic via food, soil, air, and water. Drinking water has significant influences on human health. As3+ is considered as a carcinogenic element and has adverse effects on human health and causes skin diseases, lungs diseases, prostate cancer and nasal passage. The permissible limit given by the World health organization (WHO) for As in drinking water is 0.010 mg/L.

In this study, we prepare synthetic arsenic imprinted polymer (As-IP) by simple precipitation polymerization method by using 4-vinylpyridine and 2-hydroxtethylmethacrylate as ligand and functional monomer use for the selective elimination of arsenic (As3+) from the aqueous environment. To achieve maximum sorption capacity several factors i.e. pH, agitation time, shaking speed, and sorbent dose were optimized. This prepared polymer was characterized by using SEM, EDX and FT-IR. Adsorption isotherm and kinetic data of As3+ fallow the Langmuir isothem and pseudo-second-order kinetic model. The maximum sorption capacity of As-IP is 106.3mg/g. The limit of detection (LOD), and limit of quantification (LOQ) was found to be 0.87 and 2.9µg/L.

Keywords: Include; Arsenic imprinted polymer; Precipitation polymerization; Real water samples.

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Detection and antibiotic resistance of *Legionella* pneumophila isolated from tap water of targeted hospitals of Hyderabad Sindh.

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Abstract:

Legionella pneumophila is relatively a new agent to cause waterborne diseases to humans and are transmitted via aerosols. Legionella pneumophila is a remarkable pathogen because of its water to air transmission course. A causative agent to cause Legionnaire's disease (LD), a severe form of pneumonia. It is one of those bacteria that can be lethal to humans. This study was designed to detect and suspect the antibiotic resistance of Legionella pneumophila in tap water of targeted hospitals of Hyderabad Sindh. Total 20 water samples were collected from tap water of washbasins of 20 targeted hospitals of Hyderabad Sindh. Culture dependent method was used to detect the presence of Legionella pneumophila. Charcoal extract yeast medium was used with the growth supplement of Buffered Charcoal Yeast Extract to detect and suspect the antibiotic resistance of Legionella pneumophila. Results showed that 95% of the water samples were positive for *Legionella pneumophila*. Disc diffusion method were used to determine the resistance of 4 routinely used antibiotics: ciprofloxacin, levofloxacin, azithromycin, moxifloxacin against Legionella pneumophila. Among these antibiotics we found zone of inhibition between 10-15 mm, 12-21 mm, 9-20 mm, 9-16 mm respectively. This study concluded that presence of Legionella pneumophila in the targeted hospitals is of major public health concern and people are at higher risk of its exposure.

Keywords: *Legionella pneumophila,* Waterborne diseases, Antibiotic resistance, Hospital, Tap water, Washbasin.

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Preliminary Estimates of Uncertainty of ADCP Measurements near a Sharp-Crested Weir in Open Channel Flow

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Abstract:

The Acoustic Doppler Current Profiler (ADCP) is used extensively for velocity and discharge measurements in open channels, including in the development of rating equations (relating discharge to head) for hydraulic structures. However, estimates of measurement uncertainty, particularly in the proximity of a hydraulic structure, are rarely reported. This study aims to investigate the nature and magnitude of uncertainty in discharge measurements under the turbulent curvilinear flow effects induced upstream of a sharp-crested weir using an ADCP in a laboratory setting. Discharge measurements with the ADCP were made at locations that were one, two and three times the weir height (P_{w}) upstream of the weir positioned within a 5-m long open channel flume and were compared to simultaneous measurements with a Laser Doppler Anemometer (LDA). Differences between LDA and ADCP discharges at 1P, 2P, and 3P, were 40.7%, 10.1% and 5.1%, respectively. It was observed that discharge measurements with the ADCP near the weir were more greatly influenced by turbulence effects. As a result, values of discharge measured with the ADCP were lower near the weir compared to the actual discharge. Hence, it is recommended that rating equations should be developed and the gauging station (for measuring head) should be positioned upstream at a distance of at least three times the weir height. At this location, the discharge estimate yielded by a rating equation developed using an ADCP will be about 5%.

Keywords: ADCP; LDA; Hydraulic Structure; Discharge; Flume

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Membrane assisted photocatalytic degradation of colorants: An application to treat tertiary textile waste effluents

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Abstract:

The purpose of this thesis was to find an effective alternative method to slurry-based photocatalysis, a method which can solve the problems of nanoparticles recovery and acclomeration in the current industrial used photocatalytic technology. For that, this work highlights the importance of one step filtration and degradation of organic pollutants by merging membrane and photocatalysis technology. Bi2O3 based nanoparticles were selected in this study due to their visible light-harvesting ability, and nylon-6 was selected as polymer due to its rigid chemical, thermal and mechanical properties. Bi2O3 nanoparticles were synthesized by thermal annealing route and were immobilized on nylon-6 nanofibers via electrospraying. FESEM images confirm the spiderweb formation of nylon-6 nanofibers with 178 nm average diameter, and successful incorporation of Bi2O3 nanoparticles on the membrane. XRD pattern confirmed the successful transfer of properties from nanoparticles to the membrane, and monoclinic α - Bi2O3 phase of the membrane was determined from the XRD data. From DRS spectra, the band gap was evaluated and found to be 2.78 eV. IC dye was degraded inside a fabricated membrane photocatalytic reactor reaching 85% degradation efficiency with the apparent kinetic rate of 0.95 × 10-2 min-1. For comparison, cationic RhB dye and mixture of IC and RhB were also degraded to evaluate the behavior and degradation kinetics of membrane on different ions and structures. The membrane showed preference on degrading anionic dyes in comparison with cationic dyes, due to the selectivity of anionic molecules by oxidizing scavengers. Furthermore, up to 80% TOC removal was achieved within 4 hours of irradiation, and cyclic stability of the membrane was also evaluated by experimenting successive cycle.

Keywords: Photocatalysis, Bi2O3, Nylon-6, Membrane, Indigo Carmine (IC)

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Assessment of temporal variation in water Quality of RBOD-I (MNV Drain) and its role in degradation of Manchar Lake

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Abstract:

Manchar, one of the biggest shallow freshwater natural lakes of South Asia, is degraded due to the discharge of uncontrolled and untreated effluent of RBOD-1 (Right Bank Outfall Drain) since last few decades. Also, the supply of freshwater from the hill torrents and Indus River has decreased significantly due to the impacts of climate change. Further, it is projected that construction of NaiGaaj Dam, will further decrease the influx of fresh water into the lake. The water quality of the lake will further aggravate, and soon it will be counted as a salty lake of Pakistan. Thus, it is of prime importance to monitor the quality of the water in RBOD throughout the year to device the sustainable and environmentally friendly filling and emptying mechanism of the lake. Thus, the present study was conducted from October 2017 to December 2018, to assess the temporal variation in water quality of RBOD-1. Total numbers of 26 water samples were collected from zero point of RBOD-1 at the interval of 15 days throughout the year. The samples were analyzed at soil water laboratory at USPCAS-W MUET Jamshoro for different physico-chemical parameters. The EC and pH were measured using EC and pH meters, respectively; EC was converted into TDS by multiplying EC values with 640.While Ca+Mg,CO3, HCO3,and Cl were measured through titration methods. Whereas, the arsenic was determined by using the Merck Arsenic kit, and Na was determined through flame photometer. The results of the study revealed that EC of RBOD-1 varied from 2.4ds/m to 18.67ds/m, pH from 7.1 to 8.95, TDS from 1536ppm to 11948.8ppm. No arsenic (As) were found in the water. The CO3 ranged from 0.4 meq/L to 4.4 meq/L, HCO3 from 0.4meq/I to 12.22meq/L, CI from 60meq/L to 19500meq/L. This suggests that Manchar lake can be filled with RBOD-1water when it has low EC i.e. during monsoon period. While during rest of the period the effluent of RBOD water should not be discharged into the lake.

Keywords: Manchar Lake; Water Quality; RBOD 1; ArcGIS 10.3; Degradation of lake; Physico chemical Properties

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Assessment of microbial contamination in drinking water of Railo Miyan, Jamshoro.

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Abstract:

Access to safe drinking water has been a major concern all around the world, as it can serve as transmission route for the several enteric pathogens responsible for water borne diseases. This study aimed to assess the physio-chemical parameters of water quality to compare them with the WHO limits. Moreover, the study also intended to determine the concentration of targeted pathogens (Salmonella typhi, Shigella flexneri and Vibrio cholerae) in drinking water. For this, a total number of 30 samples were collected randomly in the month of march through august from households, reservoir, schools and masjid of village named Railo Miyan, Jamshoro. The microbial analysis of water samples was carried out by using the culture based method in which 100ml of sample was filtered for the colonies of each concerned pathogen. The physio-chemical characteristics of samples were analyzed by using the scientific instruments in the laboratory. After that the data analysis was carried out using excel and the descriptive statistics table was formed. The statistical analysis showed that except turbidity the range of all other physio-chemical parameters of water samples were within the permissible range of WHO standards. Whereas, the water samples were highly contaminated with referenced pathogens. The concentration of Salmonella typhi was higher (52.7 CFU/100ml) in the households as compared to the concentration of Shigella flexneri and Vibrio Cholerae. The least number of colonies of Shigella were observed in the schools and masjid at the concentration of (13.7 CFU/100ml) and (12.2 CFU/100ml). The maximum concentration of vibrio cholerae was observed in the reservoir and water source at the concentration of (37 CFU/100ml) and (74 CFU/100ml). Hence, the study concluded that drinking water of Railo Miyan is unsafe for the consumption due to the presence of biological contamination. Which is the major public health concern and people are at high risk of getting waterborne infections. There is an immense need of point of use water treatment to supply safe drinking water to the consumers of this village.

Keywords: Waterborne diseases, microbial contamination, public health, Railo Miyan, drinking water, WHO guidelines, water treatment.

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In pursuit to hybrid anaerobic membrane biotechnology for wastewater reuse and energy recovery

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Abstract:

Recent concerns over water scarcity, climate change and sustainability of wastewater-energy nexus have regarded the wastewater more as a resource rather than a waste; for water, energy and fertilizing elements it contains. Anaerobic membrane biotechnology is currently recognized as a promising technology for wastewater treatment. However, membrane fouling is an inevitable phenomenon and longstanding challenge as it can reduce membrane lifetime and increases capital/operational costs. Despite important progress in reducing energy consumption for membrane operation, energy decrease remains as one of the important targets in anaerobic membrane biotechnology research and development. This objective may be achieved by different ways looking only on the membrane operation or looking at the whole process. A novel approach to control membrane fouling with much less energy expenditure than one required by conventional ways is anaerobic fluidized membrane bioreactor (AFMBR). However, higher sustainable membrane flux and optimized membrane operation needs a careful consideration in next generation of particle sparged AFMBR for the treatment of wastewater, being objective of energy neutral or energy positive membrane operation. This presentation will overwhelm a novel staged anaerobic fluidized bed ceramic membrane bioreactor (SAF-CMBR) system developed to treat low-strength wastewater. An alumina dioxide ceramic membrane was applied for the SAF-CMBR system submerged in fluidized bed of granular activated carbon (GAC). GAC as fluidized media was used for biofilm development and to control fouling by mechanical scouring actions created on the membrane surface through recirculation of reactor bulk without biogas sparging. The SAF-CMBR system was operated continuously for 350 days at 25°C with hydraulic retention time (HRT) varying from 2.1 down to 1.32 h depending on the membrane flux applied. The overall COD removal efficiency of more than 90% was obtained. A higher net sustainable membrane flux of 22 L/m²/h was achieved during continuous operation by combination of maintenance cleaning using sodium hypochlorite solution and scouring effect of GAC particles without any adverse effect on organic removal. The electrical energy required for membrane operation reduced to as 0.024 kWh/m³, which is only 10% of the electrical energy produced from methane produced in the system; conceding the system as net energy positive/producer.

Keywords: Anaerobic membrane bioreactor, wastewater treatment, membrane fouling, energy recovery

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Removal of Hexavalent Chromium in Aqueous Solution by Zein/Nylon Nanofibers Membrane Using Electrospinning Method

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Abstract:

Hexavalent Chromium is one of the highly toxic metal. It is also present in the water bodies from anthropogenic sources; may cause several environmental and health issues. There are many methods have been employed for the removal of such pollutants but adsorption process is more efficient, economical as well as ecological. Due to its inherent benefits such as; low cost, more efficiency, and simple design with no byproducts therefore it is commonly used nowadays. The objective of the study is to prepare nano-composite membrane as an adsorbent material for the removal of hexavalent chromium through batch adsorption method. Zein/Nylon-6 nanofibers membrane was prepared using electrospinning method. Zein is the biodegradable and biocompatible protein material, derived from maize (corn) and used for several applications but is less stable in aqueous solution. Thus, blending of zein polymer with other polymer such as nylon-6 will enhance its stability and mechanical strength. Experimental study was conducted by varying the important parameters such as pH, time, dosage and initial concentration of Chromium (VI). Experimental results shows efficient performance of nano-composite for removing Chromium (VI) was achieved at pH 2 after contact for 60 min at room temperature. Nanofibers membrane was characterized by Uv-vis spectrophotometer, SEM, FTIR, and tensile test to analyze different properties including morphology, chemical composition, and strength of the nano-composite membrane.

Keywords: Adsorption, Zein/Nylon-6, Electrospinning, Composite Nanofibers, Chromium (VI).

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Preparation of Antifouling Mixed Matrix Membranes comprising of Polysulfone and porous UiO-66, Zeolite 4A and their composite (Zeolite 4A@UiO-66) for the Treatment of Drinking Water

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Abstract:

Due to the demand of safe and reliable drinking water and increased regulations, the trend of using filtration membranes in drinking water treatment process has been increased. Among polymeric membranes, Polysulfone (PSf) membranes have been used in drinking water production. These membranes have intrinsic hydrophobic nature which makes them prone to organic fouling due to the presence of organic matter present in water. Generally, with the addition of hydrophilic fraction in polymer matrix, water layer form on the membrane surface that don't allow the foulant material to deposit on the membrane surface and result in reduced fouling. Therefore, this paper reports the development of high performance mixed matrix membranes (MMMs) comprising of two kinds of porous fillers; UiO-66 and Zeolite 4A and their composite (Zeolite 4A@UiO-66) with polysulfone (PSf) polymer matrix. The individual and complimentary effects of nanofillers were investigated on membrane morphology and performance; pure water flux, humic acid rejection, static humic acid adsorption and antifouling properties of membranes. All MMMs exhibited higher hydrophilicity and low static humic acid adsorption than neat PSf membrane. Pure water flux of MMMs was also higher than neat PSf membrane but the tradeoff between permeability and selectivity was witnessed in the MMMs comprising of single filler. However, the MMMs with composite nanofillers (PSf/Zeolite4A@UiO-66) showed no such tradeoff and an increase in both permeability and selectivity was achieved. All MMMs with lower nanofiller loadings (0.5 wt% and 1 wt%) showed improved flux recovery. PSf/Zeolite4A@UiO-66 (0.5 wt%) membranes showed superior antifouling properties without sacrificing permeability and selectivity.

Keywords: Mixed matrix membranes; antifouling; drinking water treatment; humic acid removal

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"Efficiency of Charcoal, Sand, and Coconut Husk in the Development of a Hybrid Filter to Remove Microbial Contaminants from Drinking Water"

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Abstract:

Contaminated drinking water is one of the major issues in Pakistan. Removal of microbial contaminants through filtration can provide clean drinking water, and make water accessible and affordable. As developing countries are facing critical issue, especially, in poor communities in rural areas where turbidity in water and fecal contamination is most common and responsible for the transmission of waterborne diseases like diarrhea and typhoid in children. Charcoals of corn cob and coconut shell having particle size of 1 mm while the length of Column were 5 cm, 10 cm, and 15 cm for each purifier; sand particles having size of 0.595 mm having column lengths of 5 cm and 10 cm, coconut fibers also investigated for removal of turbidity and microbes. 15 cm layered column of corn cob charcoal showed better efficiency then coconut shell charcoal while 10 cm layer of sand showed better efficiency than 5 cm layer for the removal of turbidity and microbes from water. In addition, coconut fiber also showed good efficiency in the removal of turbidity and microbes. In conclusion, having microbial removal efficiency, charcoal, sand, and coconut fibers might be the potential candidates in the development of hybrid filter to remove physical impurities (Turbidity) and fecal contamination (E.coli) from drinking water to make water potable and affordable.

Keywords: Drinking water, hybrid filter, fecal contamination, sand, and charcoal

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A GIS based approach for delineating groundwater vulnerability zones using DRASTIC approach: A case study of Shaheed Benazirabad (Nawabshah)

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Abstract:

Increasing population in Pakistan, coupled with altering climatic conditions, has imposed huge pressure on natural resources such as water. This has led to change for water use in the country. The increasing dependence on groundwater for irrigation purposes makes it vitally important to assess its vulnerability to external pollution sources. Prevention and control of groundwater pollution is necessary for sustainable use of groundwater. The first step towards formalization of the policy for sustainable groundwater use is to assess the vulnerability of the areas that are most susceptible to the contamination. DRASTIC method is the most commonly used technique for finding the aquifer vulnerability using seven hydrogeological parameters. The main objective of this research is to use GIS based approach using DRASTIC method to find groundwater vulnerable zones. DRASTIC use seven parameters which are depth to water table(D), net recharge(R), aguifer media(A), soil media(S), topography(T), impact of vadose zone(I) and hydraulic conductivity(C). This methodology was applied on District Shaheed Benazirabad (Nawabshah), Sindh, Pakistan to find most vulnerable groundwater zones. Electrical conductivity (EC) was included to include its impact and to modify DRASTIC to DRASTICE. From DRASTICE we got the vulnerable zones with categories very low vulnerable, low vulnerable, moderately vulnerable, high vulnerable and very high vulnerable. Most of area comes under very low to low vulnerable zone, some of the area comes under high vulnerable zone whereas, very small portion of area comes under very high vulnerable zone. Descriptive statistics was also done to delineate the correlation among the different water parameters. Descriptive statistics shows that the cation and anion abundance are in series Na+ > Mg2+ > Ca2+ and SO42- > CI- > HCO3- respectively representing the important minerals effecting groundwater vulnerability.

Keywords: Groundwater; aquifer vulnerability; DRASTIC; GIS; descriptive statistics.

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Treatment of Bio-digested Sugarcane Distillery Effluent by Using Hybrid Electrodes in Electrocoagulation Process

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Abstract:

In Pakistan, there are 21 distilleries in operation which generate 25×10⁸ L of dark brown highly organic effluent per annum. This effluent is discharged directly into nearby rivers, ponds, lakes, and drainage systems. The untreated effluent is having dark-brown color, high TDS (20, 000 to 25, 000 mg/l) and high COD (95,000 to 10, 5000 mg/l). This effluent damage the quality of surface water, groundwater and soil. Although several methods are used to treat the distillery effluent, however these methods are either expensive or less effective. One of the most effective method which can be used for the treatment of distillery effluent is electrocoagulation (EC). Overall objective of this study is to optimize operating conditions for maximum color and COD removal by using hybrid electrodes in the EC technique. For this study, the Sugarcane Distillery Effluent (SDE) samples were collected from Matol (Pvt) Limited, Matiari, Pakistan. Later, 500 ml of the SDE sample was taken in the Perspex glass reactor of volume 1 L in which three electrodes of aluminum (AI) and stainless steel (SS) were connected to variable DC power supply at a certain distance with the arrangement of AI-SS-AI. The SDE treatment process is carried out by varying the distances (10, 20 and 30 mm) between the electrodes, time durations (60, 90 and 120 minutes), current densities (100, 200 and 300 A/m²) and concentrations (25, 50, 75 and 100%). This study showed EC procedure is simple, fast, low-cost, easily treatable and ecological in nature.

Keywords: sugarcane, electrocoagulation, distillery, hybrid electrodes.

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Defluoridation of Groundwater through Solar Power Electrolytic Defluoridation Unit

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Abstract:

Excessive fluoride in drinking water is a global problem that affects 200 millions of people and at least 25 countries. The optimum amount of fluoride in drinking water recommended by the World Health Organization, 2011 is 1.5 mg / L, but excessive fluoride intake has caused teeth and bones fluorosis in the world. Comparing to these WHO guidelines, Pakistan is severely affected by fluoride contamination where maximum groundwater fluoride concentration is found 49 mg/ L. Within Pakistan, the Thar Desert, situated in the southeastern area of Sindh, where 80% groundwater is contaminated with excessive fluoride, which has caused fluorosis in the region. This study aims to develop a prototype to remove excessive fluoride content from the groundwater up to the desired level and make water fit for drinking purpose. In this study, an electrocoagulation reactor with an anode and a cathode is manufactured to remove the fluoride from drinking water. The aluminum electrodes are used in the reactor. This process is based on electrolysis, in which direct current (DC) is obtained from solar panels, and then DC is supplied to aluminum electrodes. During this process, aluminum anode dissolves and form polyhydroxy aluminum ions, which remove fluoride by complex formation. The effects of operational parameters such as initial pH, current intensity and initial fluoride concentration are considered. It is expected that this reactor would minimize the fluoride concentration up to the desired level and produce potable water with palatable taste. It is also expected that this method of defluoridation would produce less sludge than other methods.

Keywords: Fluoride, Electrolytic Defluoridation, Aluminum Electrodes, Operational parameters, optimization

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Fabrication of Zinc decorated Magnetic Biochar for the Removal of Phosphorus from Aqueous Solution

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Abstract:

Globally, Water eutrophication is an environmental problem. Eutrophication is a process in which water bodies become enriched with nutrients which stimulate the growth of algae. The UNEP (United Nation Environmental Protection) specifies that about 50% of the lakes are affected by water eutrophication all over the world. Phosphorus is considered as one of the limiting nutrients, which cause eutrophication with a negative impact on Health, Food security, Tourism, and Economy. It needs to remove phosphorus from surface water as we conserve our ecosystem. In this study magnetic biochar is made from the banana stem which is the agriculture waste and used as potential adsorbent. The banana waste (Cavendish dwarf) is collected from nearby Hyderabad fields and collected banana plant stem cut into small pieces of 2 cm. The sample pyrolyzed at 350 c for 1 hour with a constant N2 flow rate of 25 mL/min, after preparation of Biochar, the sample sieved and crushed to the size of 0.5mm and 10 g of that Biochar is mixed in 200 ml of deionized distilled water and mixed at 200 rpm for 30 minutes homogeneously with 4 g of FeCl3.6H2O. The magnetic biochar will have higher adsorption capacity for phosphorus than pristine biochar. The modified biochar will be used as an efficient adsorbent in water filtration system for wastewater treatment to remove phosphorus. This study will conclude that banana plant has lots of environmental issues due to burning but making biochar from waste leads to environmental sustainability and overcome the eutrophication problem.

Keywords: Magnetic Biochar, Banana waste, Phosphorus, Eutrophication

Biochars May Reduce Irrigation Water Sodium Adsorption Ratios

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Abstract:

Saline Ground water is a severe worldwide environmental problem that adversely affects soil productivity. Specific to Pakistani, ground water of Sindh province contains high quantities of soluble salts when used for irrigation purposes, can affect soil quality, crop growth and yield. Biochar has been proven to improve soil quality, but its use for improving ground water quality has yet to be explored. This study hypothesized that biochars with greater electronegativity will reduce salinity to a greater extent as compared to less electronegative biochars, due to electrostatic interactions. A laboratory batch adsorption experiment was performed to determine the efficiency of biochars to adsorb salts, and reduce the sodium adsorption ratio (SAR), from lab-created median saline water having an electrical conductivity of 1.9 dS/m. Four different biochars (wheat straw 450C, lodgepole pine 700C, Kentucky bluegrass 500C, Hemp 500C) were used potentially reduce SAR. Results showed that, out of all biochars hemp biochar adsorbed the greatest amount of salts and reduced the amount of SAR by greater than 10%. The application of some biochars may be an integrated solution for water resource management by improving water guality, with biochar electronegativity potentially indicating which biochars may be best for reducing salt concentrations and positively altering irrigation water SAR for improved crop growth.

Keywords: Ground Water Salinization; Biochar; Electronegativity; Soil salinity; Crop Growth; Agricultural Productivity

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Performance Evaluation of Drinking Water Interventions in Subdistrict Chachro

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Abstract:

Government of Sindh installed the Reverse-Osmosis plants and extended piped-water supply to resolve the issue of drinking water shortages in district Tharparkar. Main reasons of water shortages are brackish groundwater, limited rainfall and non-availability of surface water. This study aims at evaluating performance of RO plants and piped-water, in comparison to dug-well water quality in four union-councils of Chachro i.e. Chachro, Mithrio Charan, Sarangyar and Rajoro. This study has two parts; water quality testing and household survey for drinking water assessment. 29 drinking water samples including 12 RO Plant water, 12 dug well and 5 piped-water were randomly collected for physicochemical analysis and collected 200 surveys from community. Statistical analysis was performed on SPSS.

Physicochemical analysis reveals that number of samples have exceeded limits against the national standards for drinking water. TDS in 12 dug-well and 3 RO, Fluoride in 1 dug-well, Arsenic in 9 dug-well, 2 piped-water and 1 RO plant, Hardness in 12 RO, 11 dug-well and 5 piped-water, and chlorides in 5 RO, 3 piped-water. Values of physicochemical parameters i.e. TDS, pH, Turbidity, Fluoride(F⁻), Total Hardness, Arsenic(As) and Chlorides(Cl⁻) of the water samples were found in the ranges of 900- 4600 mg/l, 6.8- 9.3, 0.08- 19.2 NTU, 0.005- 1.56 mg/l, 370- 3200 mg/l, 5µg/l- 462µg/l, 160- 4040 mg/l respectively.

Statistical Analysis shows that quality of drinking water of RO Plants and piped-water was better in terms of TDS, Fluoride, Arsenic and Chlorides contents. HH survey reflect same results in terms of first and second choice as piped-water and RO respectively.

Keywords: RO Plant, SPSS, TDS, Floride (F⁻), Arsenic (As).

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Polyvalent Phage Therapy Against Antibiotic Resistant Escherihia coli

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Abstract:

Antibiotic resistance is defined as the inability of antimicrobial agent against microorganisms. Over dosage, self and improper medication, and misuse of antibiotics are some of the major causes of antibiotic resistance. To overcome this problem many studies have been conducted on phage therapy. Phages are highly specific in their mode of action, as a single phage can affect only single bacteria. In this study, a bacteriophage was isolated from reversed activated sludge and spotted against erythromycin resistant *Escherichia coli*. The isolated phage was genetically characterized and visualized under a Transmission Electron Microscope. The results showed that the isolated phage was tailed phage. The phage was effective against *E. coli*. This study provides an insight for future applications of phage therapy to treat antibiotic resistant bacteria.

Keywords: Phage Therapy. Antibiotic resistance, E. coli, Bacteriophage,

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Synthesis of Silver Nanoparticles and their incorporation in nanofibers by electrospinning.

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Abstract:

A remarkable development is observed in the field of nanotechnology in the past few decades. The capacity of creating large scale structures at the nano level, atom by atom, is available due to nanotechnology. It provides good practical applications in various areas of water and wastewater. Use of nanomaterials in sensors is one of the environmental applications of nanotechnology. Nano-sensors based on nanomaterials are important because of small particle size, reactive surface area, and improved properties (physical, chemical and biological). This study presents the facile method for the synthesis of silver nanoparticles (AgNPs) and their doping in the Electrospun nanofibers for sensing application. The AgNPs were synthesized by chemical reduction method (Brust method) using silver nitrate (AgNO₂) as a precursor. UV–Visible spectroscopy, Fourier Transform Infrared Spectroscopy (FTIR), scanning electron microscopy (SEM), atomic force microscopy AFM, Energy dispersive spectroscopy (EDS) and zeta potential analysis were used as characterization techniques to determine different parameters of AgNPs and nanofibers such as particles size, morphology, and shape. The reduction of AqNO, into AqNPs was confirmed by UV-visible spectroscopy. The surface Plasmon resonance frequency for the synthesized nanoparticles was observed at 394 nm. SEM results showed that the nanoparticles have spherical morphology and size ranges between 10 to 30 nm. The EDS images were used to check the qualitative and quantitative status and AFM was used for the three-dimensional analysis of the nanoparticles. The FTIR analysis was conducted to confirm the stability of nanoparticles provided by capping agent. The SEM and EDS imaging was also used to examine the morphology of the fabricated nanofibers doped with AgNPs which were collected on the Aluminum foil attached on the collector. The fabricated nanofibers will be further studied for the detection of organic pollutants.

Keywords: Nanotechnology; Silver Nanoparticles; Nanofibers; Composites; Electrospinning; SEM.

Comparative study of physical characteristics of homemade and laboratory based biochar

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Abstract:

Recent advancement in technology is significant in removing various contaminants from drinking water. Currently some biomasses like biochars are the source of great attention, because of the characteristics it adheres to adsorb specific pollutants present in water. Biochar is a carbonaceous compound produced by burning biomass in the absence of oxygen. The surface properties of biochar then, enable it to attract pollutants physically and chemically. In this study three different types of biochars were produced by using different preparation conditions. Scanning Electron Microscopy (SEM), Brunauer-Emmett-Teller (BET), and Zeta potential were used to compare the physical characteristics of homemade and lab-based biochar. SEM is used to give surface image of biochar. BET analysis is used to identify the surface-area of biochar, whereas surface charge of the biochars was obtained by using Zeta potential. The SEM images were taken at 1000x magnification, which shows that biochar formed at different conditions have different porous structure. The laboratory based biochar has more pores than homemade biochar. Which means that it has more areas to adsorb pollutants. Whereas homemade barrel based biochar is less porous. Surface area of laboratory based biochar was 0.8854 ± 0.0505 m²/g, whereas surface area of homemade biochars- barrel and brick kiln based biochar were 99.4495 ± 9.0919 m²/g and 6.3414 ± 0.4274 m²/g respectively. The surface charges of laboratory based, barrel and brick kiln based biochars were - 41.37mV, - 40.30mV and 42.67mV respectively. All biochars have shown negative zeta potential. The highest negative zeta potential is of brick kiln based biochar, so it has more negative surface charges than barrel and laboratory based biochar. The basic material was wood for all of the three biochars, but the production conditions were different, and due to this reason resulting biochar contains useful surface properties to be compared and used for studies like adsorption.

Keywords: biochar, laboratory, barrel, brick kiln, SEM, zeta potential

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Water desalination by using graphene incorporated nanofibers membrane

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Abstract:

Desalination is one of the earliest methods known to the man for obtaining salt-free water. Membrane distillation (MD) has gained great interest in desalination technology. The Air Gap Membrane Desalination (AGMD) is an emerging technology to produce fresh water from brackish/saline water. AGMD method has gained attention because of its benefit of small scale desalination with the help of alternative energy sources. The present work involves the development of a laboratory scale AGMD unit, build to test the efficiency of desalination by using novel nanofibers membrane. The membrane was synthesized to obtain effective and energy efficient desalination method. To obtain the objective of the study, superhydrophobic nanofibers were synthesized by electrospinning using polyethylene terephthalate (PET) as the main polymer. Electrospinning, a simplistic method was used to fabricate graphene incorporated nanofibers membrane. The synthesis of nanofibers was carried out at 16v with a distance of 12cm between needle to the collector. SEM and EDS were carried out for the characterization of the nanofibers. Analysis of the characterization of the nanofibers has shown that incorporation of rGO has significantly enhanced the membrane properties and structure. Different concentrations (1-10 w %) of rGO was incorporated in the membrane and fluctuations in the desalination efficiency was analyzed at varying concentrations. The prepared nanofibers were installed as the treatment membrane in the AGMD and the performance of the membrane was increased by incorporating reduced graphene oxide rGO in it. The system (AGMD) was operated at low temperature (30-70) and commercial (PET) flat bead free membrane has excellent salt rejection (80-85%) using the 1000ppm NaCl solution as feed. On the basis of these experimental results, a system can be designed for the treatment of salinity for ground and seawater.

Keywords: Water Treatment, Desalination, rGO/PET blend, Hydrophobic Nanofibers, Electrospinning, Air gap membrane distillation.

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Antimicrobial resistant bacteria in drinking water of Mehran University of Engineering and Technology

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Abstract:

Antimicrobial resistance (AMR) is an ever-increasing global public health threat that involves all major microbial pathogens and antimicrobial drugs. To detect antimicrobial resistance in the water, supplied through the water distribution network of Mehran University Employees Cooperative Housing Society Treatment Plant, Jamshoro, and tape water samples were collected and analyzed for (AMR). Antibiotic sensitivity test was done through standardized Kirby Bauer Disc Diffusion test. Pathogenic bacteria including E. Coli, Salmonella, Shigella, Pseudomonas, and Vibrio Cholera were tested through membrane filtration method. The colonies of pathogenic bacteria were sub-cultured in MH media, and their antimicrobial resistance were tested against thirteen antibiotics i.e., Amoxycillin (AML 5µg), Ampicillin (AMP10 µg), Azithromycin (AZM 15 µg), Bacitracin (B 10 μg), cefixime (CFM 5 μg), ciprofloxacin (CIP 5μg), ceftriaxone (CRO 30μg), Imipenem (IPM µg10), Meropenem (MEM µg10), Metronidazole (MTZ µg5), Streptomycin (S µg10), Rifampicin (RD µg5), vancomycin (VA µg30). The petri dishes were incubated at 37°C for 24 hours. The zones of inhibition were measured. The results showed E. Coli, Salmonella. Shigella, pseudomonas, and vibrio cholera were highly resistant against Bacitracin (B 10 μ g), Metronidazole (MTZ μ g5) and cefixime (CFM 5 μ g). However, they showed sensitivity against Imipenem (IPM µg10) and ceftriaxone (CRO 30µg). In conclusion, all observed pathogens were found highly resistant, however, Imipenem (IPM µg10), ceftriaxone (CRO 30µg) and ciprofloxacin (CIP 5µg) were most effective drug of choice.

Keywords: Antimicrobial resistance, drinking water, disc diffusion method, bacterial pathogens, multiple drugs.

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Ultra-fast Degradation of Arsenic by Greener L-Cysteine Derived Magnetite Iron Nanoparticles.

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Abstract:

More than seven (7) Lac people are diagnosed with arsenic-related diseases and 100 million humans are endangered by arsenic-contaminated water sources, particularly in Asia. In this study we reported the greener, smaller size and stable synthesis of Iron Nanoparticles (Fe₂O₄) using L-Cysteine having pH (10) which are magnetite in nature and their catalytic application behave as an efficient catalyst for the removal of arsenic from the water in a very short time. These particles were characterized by different characterization techniques including Transmission electron microscopy (TEM), Energy dispersive spectroscopy (EDS) and Ultraviolet-Visible spectroscopy (UV-Vis). The size of Fe_3O_4 NPs were in range of 5-30nm, they were spherical in shape and the spectrum was observed between 300-700nm wavelength. Arsenic solution of 0.5mg/L (500µg/L) was prepared using arsenic standard solution by VWR chemicals, Belgium. For application study using Inductively Coupled Plasma- Mass Spectroscopy (ICP-MS) of PerkinElmer to check the reduction of arsenic concentration levels by L-Cysteine functionalized magnetite iron nanoparticles. The results obtained from ICP-MS shows 89-90% reduction in arsenic levels with the presence of iron nanoparticles (Fe₃O₄ NPs) act as an excellent ultrafast catalyst to remove the arsenic contamination from the water rapidly.

Keywords: Arsenic, Iron Nanoparticles, L-cysteine

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A Spatio-temporal Analysis of Drought in Upper and Lower Areas of Baluchistan, Pakistan

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Abstract:

Baluchistan is the province of Pakistan; climate is arid and most vulnerable to the hydrological threats, droughts particularly. Therefore, it's important to study the climate, droughts, variability of seasonal precipitation and their trends for province's water resources management, agriculture and development and planning activities. The aim of this study is to analyze the rainfall trends spatially and temporally in upper and lower areas of Baluchistan. For this purpose, monthly rainfall dataset comprising of 37 years for the period of 1980 to 2017 were recorded at 4 rain gauge stations in the study area. In this study, drought monitoring index that is Standard Precipitation Index (SPI) was used to investigate change in spatial and temporal rainfall patterns in 4 selected rain gauge stations i.e. Zhob, Sibbi, Jiwani, and Pasni.Baluchistan has both the mountainous and flat topography. These four stations were selected based on Upper and lower topography of Baluchistan. Zhob and Sibbi lies upper regions whereas, Jiwani and Pasni lies on lower regions. The significance of selecting these stations is to observe climate changes with respect to time at upper and lower stations.3-month timescale Standardized Precipitation Index (SPI) values based on Gamma distribution for a low rainfall and a high rainfall were generated for selected meteorological stations of Baluchistan, Pakistan. The SPI results showed that all the four stations showed decrease in rainfall from the past to the present (2017). Zhob faces extreme dry and severely dry weather conditions in the years 2011 and 2015, whereas, Sibbi also faced severely dry and moderately dry conditions in the years 2002 and 2004. The outcome from this study will suggest that the water resources management strategies must be adjusted according to the changing trends of precipitation. Thus, it is necessary to know the multidimensional of droughts characteristics in spatial as well as temporal conditions in order to minimize the related risk of disaster whenever it threatens, and it will make scenario clearer for policy makers which will help them to make the decision.

Keywords: Baluchistan, SPI, Spatial, Temporal, Gamma distribution, Meteorological stations

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Evaluation of an existing groundwater monitoring network in Dad division, district Shaheed Benazir Abad, Lower Indus basin Zulfigar Ali^{1*}, Wagas Ahmed^{2*}, Carlos Anthony Oroza³, Dr. Abdul Latif Qureshi⁴

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Abstract:

Groundwater monitoring has become a challenging task for semi-arid regions of the world. It requires significant investment and laborious work to successfully monitor the groundwater. It is essential to prioritize the monitoring network without compromising on the representative data. Statistical methods can help in prioritizing the network with confidence interval for estimation. In this study, groundwater monitoring network in lower Indus basin, consisting of 21 piezometers is evaluated through two statistical approaches. In the first approach, we applied Mann-Kendal trend test and Sen's slope estimator for prioritizing piezometers showing statistically significant trend; and in second approach, variance-based ranking of piezometer is done through Principal Component Analysis (PCA). Seasonal (i.e. pre-monsoon and post-monsoon) depth to water datasets is evaluated from 2009 to 2015. Trend analysis results showed that there were five piezometers which showed an increasing trend and the similar results were shown by principal component analysis method which ranked the same piezometers as highly important monitoring locations.

Keywords: Groundwater monitoring, Optimization, Principal component analysis (PCA), Mann-Kendal trend test, Sen's slope estimator.

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Green synthesis of bismuth nanoparticles using native algae and their antibacterial activity

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Abstract:

Emergence of antibiotic resistance among pathogenic bacteria is causing a major threat to human health. The increase in drug-resistant pathogens is a major challenge in present time. For the reduction of pathogens several physical and chemical methods are used which are either expensive or produce toxic byproducts. In this research the bismuth nanoparticles were synthesized by using biological method. For the synthesis of nanoparticles 10ml aqueous extract of algae were added into 90ml of aqueous solution, 1mM (bismuth oxide) then the mixture was exposed to the controlled temperature for 20 minutes. The appearance of yellowish color indicates the synthesis of nano particles. Bismuth possess antimicrobial activity against pathogenic bacteria. Characterization of bismuth nanoparticles will be conducted by using UV-visible spectra analysis, X.ray diffraction (XRD) and scanning electron microscopy (SEM). Antibacterial activity of algal based bismuth nanoparticles was measured by observing zone of inhibition against *E.coli*. The maximum zone of inhibition against *E.coli* was 22mm to 24mm.

Key words: Bismuth nanoparticles, algae, antibacterial activity, E.coli

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Assessment of copper toxicity in water using thiosulfate oxidizing bacteria (TOB) Bioassay

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Abstract:

Copper is an essential nutrient for life found in water, rocks, and sediments. Copper is present in our daily intake of food and water. A little high/low dose of copper can cause health problems such as gastrointestinal distress, anemia, kidney, and liver damage. This study aims to assess the toxicity limit of copper through thiosulfate-oxidizing bacteria (TOB) bioassay. Bioassay is the best technique for the assessment of toxicity of heavy metal in water as compared to other methods. Bioassay mechanism is cheapest and gives appropriate results in the decision making the process. Bioassay depend on thiosulfateoxidizing bacteria that can oxidize thiosulfate (S_2O_3) into sulfate ion (SO_4^{2-}) (as sulfuric acid) in the presence of oxygen. As a result, the reaction will rise electrical conductivity (EC) and decrease the power of hydrogen (pH). Thiosulfate Master Culture Reactor (TMCR) will acclimatize bacteria and work in fed-batch mode at 30°C. Dome biogas plant sludge was taken as a source at the volume of 10 ml with 240ml of tap water and 250 ml of stock solution of sodium thiosulfate in 1000 ml bottle. There were two basic parameters (EC) and (pH) which were analyzed to identify the bacteria. The initial reading of (pH) was (7.75) and EC was (1989µs/cm). After 4-5 days the (EC) was increased and (pH) was decreased those were (pH) (2.53) and (EC) (3640µs/cm). To maintain pH NaOH and HCL were used. The variation of (EC) and (pH) was identified with time and it has been shown in graphical form. The toxicity of copper will assessed with different concentration. Effective concentration (EC50) concerning the circumstances for 50% growth inhibition which will be calculated by using sigma plot Hillslope method or through SPSS software in the end.

Keywords: Thiosulfate-oxidizing bacteria, copper toxicity in water, heavy metal toxicity assessment, Bioassay, TMCR, Batch test

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An assessment of awareness for health, safety, and environmental hazards amongst workers in marble processing and handling units: A case of Hyderabad Pakistan

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Abstract:

The research deals with hazard awareness of workers in the marble market and the availability of safety procedure and equipment for them. The study is carried out in an informal marble market in Hyderabad city for past two months. These units are small and medium size processing units where technological or automation facilities are less likely to be present. Due to the labor intensity of this sector it is of high importance that the labor force is aware and trained to handle day to day work assignments with up most consideration for health safety and

environment(HSE). This research aims to investigate the HSE awareness, training provided, equipment available and technological gaps in these informal units in regards to the human resource associated in this sector. Research method used in this study is mix method, having qualitative and quantitative questions and questionnaire is used for interviews to collect data in person. Through cluster sampling technique, sample size of 15 respondents from a total of 150-

200 business units is selected. The paper provides a framework for human resource development and technological up- gradation mechanism of small and medium size enterprises with relatively high risk hazards. This research paper also provides HSE procedural recommendations for SME firms and policy recommendations for regulatory bodies to provide institutional support to these firms.

Keywords: Health Safety Environment(HSE) hazards, Marble market, HSE equipment, HSE training, Technological gaps, Small and medium enterprise, Technological upgradation mechanism.

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Ultra-Fast Photocatalytic Degradation of the Azo Dyes Using Metal/ Metal Oxide Nano Composites

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Abstract:

Water pollution is one of the biggest problems worldwide nowadays. Due to the contamination by many toxic effluents coming from textile industries. Many technologies have been applied to treat wastewater of these industries, such as adsorption, chemical ion exchange, coagulation, flocculation, membrane filtration, electrochemical methods, and flotation, but nanotechnology is emerging technology for treating of wastewater, in particular removing azo dyes. In this study a nanocomposite of Au/ZnO was prepared by chemical precipitation method using some chemicals such as Gold chloride 10ml of 100ppm, and Zinc acetate 10ml of 0.5M, sodium citrate 10ml of 1.0M, mixed with each other than slightly heated and stirrer for 5 minutes after that 10ml of 1.0M sodium hydroxide were added to active reaction suddenly color changed from white to white milky.Nanocomposite filtered and put in oven at the temperature of 50c for 30 minutes it converts into powder form and used for degradation of dyes under the ultraviolet light illumination. its morphology and structure were characterized by Ultra Voilet - visible spectrophotometer, X-ray diffraction, Scanning Electron Microscopy Analysis, and FT-IR. The UV- visible absorption spectra of nanocomposites samples showed distinct band center around 400-460nm and the X- ray diffraction was used to study the crystalline structure of nanocomposites and it shows eight well peaks at 2-theta from this peaks it indicate that the existence of anatase form of Au/ZnO nanocomposites. The nanocomposites FT-IR spectrum show an intense peak at ~ 504cm-1 and no any charged Occurred in the FT-IR pattern upon introducing Au into ZnO matrix. The morphology of Au/ZnO also investigated with SEM and it shows that Au is highly spread with small size and uniform morphology over surface of the ZnO. The prepared Nano-composite with comcentration of 0.5ml of 1.0M NABH4 were applied for the degradation. The concentration of 0.5 ml of 0.001M of Methyl Orange were taken and put in cubits than sodium borohydride added after that scanning program starts 5mg of nanocomposites added than within 6 minutes degrading of methyl orange occurred completely and same concentraion of Erichic Black Tea, and Brown Cesol Green used separately degradation occurred within 6 minutes and dyes degraded completely from the waster. The result was analyzed by the help of uv-visible spectrophotometer and nanocomposites also used for the degradation of the combined three dyes mixture and degraded completely from the waster within 8 minutes. After that this nanocomposite applied for the degradation of selected textile industry wastewater and dyes completely degraded within 9 minutes. The results show that the Au/ZnO nanocomposites is very effective for the degradation of dyes from wastewater.

Keywords: Synthesis of Au@ZnO Nanocomposite, Characterization, Degradation of Methyl Orange, Erichic Black Brown Cresol Green, wastewater.

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Synthesis of Neem Seeds Biochar through Slow Pyrolysis

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Abstract:

Biochar is the carbon contained solid product of biomass pyrolysis, which can be used as a chemical feedstock for adsorption of pollutants. Different biochar has different properties and characteristics that adsorb different types of pollutant. A biomass plant "*Azadirachta indica*" commonly known as neem is grown abundantly in the semi-tropical region. Neem seeds have antibacterial property as well as insect repellent properties. Neem seed was washed and activated through slow pyrolysis at control conditions. Pyrolysis was conducted in a furnace at a constant temperature of 350°C in the presence of nitrogen. The pressure of nitrogen was kept constant. The initial time for ramp up the temperature was 30 minutes. The total time for experimentation was 3 hours 30 minutes. All volatile liquid was evaporated. The weight of the biomass was reduced up to 70%. The material was being steamed under high pressure to increase the material porosity. *Scanning Electron Microscope* (SEM) shows a porous surface of biochar. *Energy Dispersive X-Ray Analysis* (EDX) shows 47.87% carbon content, 35% oxygen content and 6% nitrogen content was present in the biochar composition. Zeta potential shows that the biochar is negative in its ionic state that is -30 Mv.

Keywords: Biochar, Neem seeds, slow pyrolysis.

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Environment Friendly Membranes for Effective and Efficient CO₂ Capture

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Abstract:

Excessive CO2 emissions have led to increased amount of greenhouse gasses and are prime cause of global warming but it is inevitable to avoid CO₂ emission completely. Carbon capture and sequestration (CCS) is therefore, an ultimate step in all industries especially for those which involve combustion of fuels. The CCS techniques that are conventionally employed in industries are aminebased absorption or scrubbing systems. Since, such techniques give high separation efficiency but add too much to the overall cost owing to their extremely high energy requirements. Research and development in field of membrane technology seems to overcome the challenges of conventional techniques. MOF-based Mixed matrix membranes is emerging as a promising approach for CO, separation since it combines the benefits of high surface areas and adjustable properties attributed to MOFs, along with cost effective nature of membrane technology. In this work we incorporate a porous metal organic framework (MOF), NOTT-300, in CO₂ selective Pebax[®]1657 for CO₂ capture. NOTT-300 is a unique MOF having hydroxyl (-OH) group in its structure which interacts with CO, molecules enhancing CO, capture. NOTT-300 was prepared and characterized by Fourier Transform Infrared Spectroscopy (FTIR), X-ray diffraction (XRD), and Scanning Electron Microscopy (SEM). Various filler loadings (10 wt. %, 20 wt. % 30 wt. % and 40 wt. %) were prepared. The prepared membranes were characterized using SEM and FTIR. Physical properties of membranes were also investigated by finding fractional free volume and glass transition temperature. Pure and binary gas permeation and selectivity was investigated for CO₂, CH₄ and N₂ at multiple pressure and temperature. Combining CO₂-philic properties of MOF and CO₂ selective polymer, improved CO₂ capture was observed. In comparison to neat Pebax membrane, the incorporation of NOTT-300 at 40% filler loading enhanced the permeability of CO_2 by 380%, and selectivity to 68% and 26% for CO₂/CH₄ and CO₂/N₂ respectively. The results proved the promising potential of NOTT-300 as filler material for MMMs aimed at CO₂ capture because of their high porosity and CO₂ philic properties.

Keywords: Global warming; CO₂ capture; mixed matrix membranes; NOTT-300.

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Removal of Selenium from Water Using Bimetallic Nanoadsorbent Nanik Ram^{1*}, Sheeraz Ahmed Memon¹, Rafi-uz-Zaman¹, Abdul Qayoom¹

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Abstract:

Selenium in wastewater is of particular concern due to increasing concentration, high mobility in water and toxicity to organisms. Selenium ions are toxic at concentration above 40µg/L. This study was carried out to determine the removal efficiency of selenium using iron and manganese based bimetallic nano-adsorbent. In this study bimetallic nano-adsorbent was synthesized by using chemical reduction method, nano particles were characterized by using Energy Dispersive X-ray Spectroscopy (EDX), Scanning Electron Microscopy (SEM), X-Ray Diffraction (XRD) and then it applied to remove selenium ions in aqueous system. The selenium removal efficiency was optimized by varying the parameters such as contact time, Se concentration, dosage of adsorbent and pH of solution. The pH effect was investigated between 6-9. Results confirmed that alkaline (8.5) pH enhanced the selenium adsorption capacity towards nano-particles. The optimized dosage of adsorbent was 25mg and the optimized contact time was 60 minutes. Both Langmuir and Freundlich adsorption capacity of bimetallic nano-adsorbent towards the removal percentage of selenium is 95% under optimized conditions.

Keywords: Removal; Selenium; Iron; Manganese; Bimetallic; Adsorption.

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Low cost Synthesis of Silver impregnated Reduced Graphene Oxide for water treatment application

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Abstract:

The groundwater of Pakistan is highly contaminated and unsafe for drinking purposes because most of contaminants exceed their standard limit based on the WHO and NEQS (National Environment Quality Standards). Graphene Oxide (GO) and reduced graphene oxide (RGO) have been reported with enhanced removal properties. The contaminated water with high concentrations of Fe, Cu, Zn, Pb and Cd were subjected to pass through silver impregnated GO and rGO coated sand. The microbial load of 10,000 bacteria per ml and Heavy metals 10 ppm for Fe, Cu & Zn and 1 ppm for Pb and Cd maintained water was passed through coated sand. The disinfection of polluted water observed 100% for one liter per 50 gram of coated sand, which reduced to 77% for next one liter. Similarly Cu, Fe and Zn removal were observed 97%, 99% and 98% respectively for first one liter and reduced to 93%, 95% & 92% respectively. On the other hand Pb and Cd removal were observed excellent around 97% and 99.5% for first one liter and reduced to 91.3% and 92.7% for next one liter. The enhanced properties of disinfection and heavy metal removal properties make its application in water treatment feasible. However further research is needed to reduce the cost of synthesis.

Keywords: Reduced Graphene oxide; cost; heavy metals; removal properties; synthesis; water treatment;

Removal of heavy metals through modified jute fiber adsorbent Abdul Qayoom Lakhan^{1*}, Imdad Ali Kandhar¹, Khan Muhammad Brohi¹, Nanik Nandaani

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Abstract:

The benefits of expanding lifecycle of an adsorbent can reduce the cost and environmental impacts in waste adsorbent disposal and adsorbent fabrication, which gives value to the waste. In this study, the extending lifetime of jute fiber-based bio sorbents for sequentially remedying heavy metal ions was demonstrated by a simple and practical chemical conversion. The potential of a lignocellulosic fiber, jute, was assessed for adsorption of heavy metal ions like Cu (II) and Ni (II) from their aqueous solutions. The fiber was also used as an adsorbent after chemically modifying it, by oxidizing with hydrogen peroxide. The modified jute fibers gave higher metal ion adsorption. Sorption of metal ions was studied as a function of time, temperature, pH and concentration of metal ions in solution. The metal ions sorption was best fitted in the Langmuir adsorption isotherm model. At the optimized conditions, almost complete sorption of Cu (II) and Ni (II) ions was observed for oxidized jute fiber. The pH effect was investigated between 6-9. The optimized dosage of the adsorbent was 2g and the optimized contact time was 60 minutes. The most meaningful contribution of this study was to provide a new approach of bio based adsorbent regeneration and waste disposal for developing a sustainable water treatment technology.

Keywords: Jute fibers; Heavy metals; Adsorption; Langmuir; Sustainable technology.

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Investigation of Arsenite-Oxidizing Bacteria in Arsenic Contaminated Water

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Abstract:

Arsenic contamination in groundwater is a life-threatening concern, worldwide. Removal of arsenic from the drinking water resources is an essential step to reduce health related issues such as carcinogenicity and toxicity. Currently, existing conventional methods for arsenic removal are based on chemical transformation such as they can transfer arsenite {As (III)} to arsenate {As (V)}and have certain limitations. Most of them are expensive and generate harmful by-products. Therefore, biotransformation of As (III) to As (V), via bacterial generated products, is the natural approach to combat the problem. In this regard, very few bacteria have been identified to oxidize As (III) to As (V), present in groundwater. In this study, 10 groundwater samples were collected from different locations of Nevada, U.S.A to identify the presence of indigenous As (III) oxidizing bacteria. By using LB and R2A media, wide range of arsenic resistant bacterial colonies were isolated. Among them, 6 most promising bacterial colonies were selected for gene analysis. For genomic characterization, aoxBM and aioA primers were used for the confirmation of As (III) oxidizing genes in bacterial DNA. Results found that aoxBM had most promising amplification curve in all of the six isolated strains from the ground water. Additionally, *aioA* is also a marker for the As (III) oxidation, however, no amplification was found by the isolated strains with this primer. In a nut shell, it can be concluded that the microbes, isolated from groundwater, might be a potential candidate to biologically transform arsenic in drinking water. Bacterial strains having **aoxBM** marker can be used as bioremediation of arsenic contaminated drinking water.

Keywords: Arsenic; Bioremediation; Arsenite oxidation; Arsenite Oxidizing Bacteria; Biotransformation.

¹First author: Farah Maqsood, Tel: +92 332 2601825, email: <u>farahansari31@gmail.com</u> corresponding author: <u>Ayesha Tajammul, email: drayetalvi@gmail.com</u> The acclimation and activity of thiosulfate-oxidizing bacteria (TOB) for utilizing in TOB Bioassay

Rafia Khanzada¹ and Naveed Ahmed²

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Abstract:

This study will develop the method for the assessment of zinc toxicity in water by using thiosulfate-oxidizing bacteria (TOB) bioassay. Previously, TOB used as bio-indicator in bioassay for the assessment of hexavalent chromium (EC₅₀ = 78.46 ug/L) in groundwater and now this will study check the thiosulfate-oxidizing bacteria sensitivity for the determine of zinc toxicity in water. TOB Bioassay functioning based on the oxidation of thiosulfate through bacteria in aerobic condition to produce the sulfuric acid (SO₄²⁻ and H⁺), which increases the electrical conductivity (EC) and decreases the pH₂. Thiosulfate master culture reactor TMCR was constructed to grow bacteria, in 1000 ml bottle by taking inoculum of 10 ml from aerobically treated spent wash sludge and incubated at 30°C in fed-batch mode. The bacterial activity in TMCR was monitored by change in EC and pH. Before incubation the pH of the reactor was 6.2 and the EC was 1587 uS/cm, after 165 hours, the pH was decreased to 2.5 - 3.0 and the EC was increased to 1938 uS/cm due to increase in sulfate ions concentration. TMCR activity was monitored for 2 months. it will further be used for experimental studies of zinc toxicity on bacterial activity and determination of EC₅₀ (effective concentration for 50% growth inhibition).

Keywords: Bioassay; TOB bioassay; Toxicity, EC₅₀; Assessment method; Monitoring method.

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Developing Fibrous Drawstring Bag Incorporated with Natural Herbs to Improve Drinking Water Quality

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Abstract:

Water has been a fundamental part of the development of the human community; due to the presence of destructive micro-organism and chemical contaminants its purification turns as a significant issue all over the world. Using different technical treatment methods for drinking water purification and its distribution to the public is a long-term solution. Moreover, it is also costly and challenging for developing countries. Herbal treatment methods have been considered useful for improving biological and physicochemical qualities of water over decades. Efficiency to remove the bacteriological content and reduction of turbidity varies from herbal species to species. A wide range of herbs had reported as successful in the reduction of microbial load and turbidity of water. Moringa Oelifera, Coriandrum sativum, and Mentha Piperita considered as the effective coagulant, flocculant, adsorbent, and disinfectant. The purpose of this study is to develop an inexpensive and eco-friendly water purifier, Fibrous Drawstring bag, incorporated with natural indigenous herbs. For this, we have used an extract of natural herbs which is effective for antibacterial activity against pathogenic bacteria (Escherichia coli, Salmonella, and Staphylococcus aureus) and reduction of turbidity by adsorption process. To determine the efficiency of herbs Disc diffusion method have been done which followed MIC (Minimum inhibitory concentration) to determine the zone of inhibition against pathogenic bacteria, and it was found that natural herbs have efficiency to decrease microbial load more than 80% and further depends on different effective quantity of herb and contact time with water. Moreover, it doesn't produce harmful byproducts in drinking water. Drinking water from natural water resources containing pathogenic bacteria and turbidity was also verified using herbal fibrous drawstring and it was found it's equally effective like other costly treatment methods.

Keywords: Natural herbs, Fibrous bag, Disinfectant, Coagulant, Water purifier.

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REMEDY FOR SUPERBUGS: AN EYE-OPENING AND WORRYING GLOBAL CONCERN IN WATER WORLD

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Abstract:

A century ago, antibiotics were considered as miracle for saving lives. In the modern era of 21st century, bacteria have evolved resistance against these antibiotics. Antimicrobial agents present in plants have an enormous remedial potential to treat numerous infectious diseases. This study was carried out to check the suppressing activity of selective plants such as Ginger (*Zingiber officinale*), Coriander (*Coriandrum sativum*), and Spinach (*Spinacia oleracea*) against erythromycin resistant *E. coli, Enterobactor*, and *Enterococcus*. These superbugs were isolated from activated sludge using CHromAgar. Agar diffusion method was used to check selected plants activities against superbugs in term of zones of inhibitions. Growth activity of *E. coli* was measured via spectrophotometer after every 10 minutes for 4 hours. Among the selected plants, coriander showed the highest suppressing activity against *E.coli* (13 mm) as compared to *Enterobactor* (9.5 mm), and *Enterococcus* (8 mm). In conclusion, coriander has potential effect against erythromycin resistant superbugs.

Keywords: Superbugs, Antibiotics, Plant suppressing activity, Antimicrobial agents

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Effects of different pH and high concentrations of fluoride on the growth behavior of algal bio-assemblages

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Abstract:

Around 25 nations throughout the world are facing health risks due to high fluoride in ground water. The main sources of fluoride in ground water are fluoride-containing minerals and clay minerals, however, the discharge of wastewater also leads to fluoride contamination of surface and ground water. Although many de-fluoridation techniques, like coagulation precipitation, nano-filtration, electro-dialysis, adsorption, ion-exchange are in use, these are high in cost, energy consumption, post-treatment secondary pollutants and inefficiency of removing all pollutants present in water. Conversely, the biological treatments are simple in operation and can be carried out with less expense. Thus, the thrust of present study was to assess the growth behavior of algal biofilm at different pH (5, 6, 7, 8, 9, 10 and 11) and fluoride concentrations (10, 20, 30, 40 and 50 mgL⁻¹) for their potential use to bioremediate fluoride. In this regard, living algal biofilms were collected from Diplo, Tharparkar and maintained in BG-11 medium at the US-PCAS-W, MUET, Jamshoro. Results revealed that the biofilms are exceptional sensors and were able to change the pH of the growth medium from the selected pH (5, 6, 7, 8, 9, 10 and 11) to 8.5 within a time period of 7-days. However, pH 5, 9, 10 & 11 and fluoride at the concentrations of 40 and 50 mgL⁻¹ were found to decrease the biomass and pigmentation of algae in long run. Hence, algae can grow well and bio-remediate waters directly at pH(s) 6, 7 & 8 with a fluoride concentration not above than 30 mgL⁻¹ in eco-friendly manner. Moreover, algal biomass generated in such systems can be utilized for the production of different bio-fuels, including bio-diesel, bio-ethanol, etc.

Keywords: Bioremediation, fluoride, algae, wastewater, biofilm, pH.

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Evaluation of dry deposition of Heavy metals in Indus River near Kotri Barrage Using Mathematical Model

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Abstract:

Atmospheric deposition represent a major pathway of anthropogenic inputs of heavy metals into the surface water. This deposition causes damage to natural waters and in both terrestrial and aquatic living organisms. The aim of this study is to determine the deposition of toxic metals (Zn, Cr, Cd Fe, Ni, Pb, Mg, and Mn) in river Indus near Kotri barrage Jamshoro through dry atmospheric deposition. Thirty two samples of $PM_{2.5}$ were collected on filter paper at the selected locations through Haz-dust environmental particulate air monitor in the month of October and December 2018. The samples were digest through sequential leaching process and then analyzed on ICP-MS for heavy metal extraction. Dry deposition flux model = × was used for calculation of heavy metals deposition. The results shows that the average deposition flux rate of Cd, Cr, Fe, Mg, Mn, Ni, Pb, Zn during October is **0**.001, 0.229, 0.311, 0.076, 0.005, 2.651, 0.010, 0.113 mg/m²/hr respectively with maximum concentration of Nickle, and in December is 0.004, 0.062, 1.212, 0.200, 0.018, 0.005, 0.101, 9.092 mg/m²/h respectively with maximum concentration of Zinc . The result showed that deposition rate is more in December then October due to different atmospheric conditions i.e. wind direction and wind velocity.

Keywords: Dry deposition; Heavy Metals; PM₂₅; Kotri Barrage;

Determination of pathogenic bacteria in vegetables and wastewater used for irrigation purpose

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Abstract:

Abstract: Irrigating vegetables on waste water is common practice in most of the urban cities in Pakistan. As waste water contains various pathogens and resistant bacteria which may have negative impact on human health and environment; The research aimed to explore common pathogens present in vegetables supplies in market. We will further analyze any possible correlation of food toxicity with the poor water sanitation by identifying enteric gram-negative pathogens in vegetables and wastewater used for irrigation purposes. Spread plate method was used to analyze E.coli from vegetables. Preliminary studies shows the presence of E.coli for all the samples (Onion, Mint, and Cilantro) collected from local market. This study contributes to provide data about specific pathogenic bacteria in wastewater which help community and farmer to understand the problems associated with the wastewater grown vegetables and remedial measures can be recommended accordingly.

Keywords: Pathogenic bacteria, Wastewater, Vegetable irrigation.

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Pesticides Health Risk Assessment in the ground Water Quality of Hyderabad City, District Qasimabad, Sindh, Pakistan.

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Abstract:

The unwanted contaminations in Pesticides are harmful for lungs, liver and bladder. Nevertheless, at higher concentration it may cause vomiting, diarrhea, nausea, skin allergy, Hepatitis (B & C), tuberculosis, typhoid and kidney damage. The ground water resources are also contaminated by infiltration of pollutants into the soil and excessive use of pesticides. The groundwater in Indus River, is already contaminated with arsenic and approximately 13 million people are potentially exposed in Pakistan. Also, several food items including vegetables, grains and fish have been reported to be contaminated with arsenic, mainly present by groundwater pesticides. The study has investigated the water quality of groundwater used for agriculture and drinking purpose in Hyderabad city district Qasimabad, Sindh, Pakistan. More than 80% of water samples were unfit for drinking purpose. The concentration of heavy metals like Cu, Fe, Mn and Co were within WHO limits. But the concentration of As, Ni, Pb and Cd were above the WHO limits. The various water quality parameters and toxic chemicals like Arsenic (As) has been found hazardous for environment.

Keywords: Pesticides, contaminated, groundwater, agriculture, toxic, heavy metals.

Delineation of Groundwater Potential Zones for Sustainable Management of Groundwater Resources

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Abstract:

In Pakistan, the dwindling supply of water due to uncertainty of river flows have imposed huge pressure on fresh groundwater resource. Mismanagement of groundwater will be a threat to livelihood of people in Sindh. Overcoming this situation can be achieved by managing the pumping for sustainable groundwater use. In this study, groundwater management zones are delineated for Dad division, Rohri canal command by considering the groundwater pumping response to external stresses. Water balance assessment is carried out via calibrated groundwater flow model. Monthly water balance is quantified that helps to set a threshold for groundwater management zones. The results of this study indicates that the tail reaches of distributary command area will face high drawdowns, if the pumping continuous at the present rate. There will be areas at the head reaches that will face high water tables, if water table is not maintained. While evaluating the scenario for sustainable groundwater use.

Keywords: Groundwater; MODFLOW; Management zones; Modeling; Water resources; Sustainability.

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Assessment of accuracy of Acoustic Doppler Current Profiles (ADCP) using the Laser Doppler Anemometer (LDA)

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Abstract:

Streamflow measurement is an important phenomenon in hydraulics, it helps in managing and utilizing the water effectively and efficiently. Many equipment have been used since long time for measurement of stream flows such as current meters, floats, Acoustic Doppler Velocimeters (ADVs), and Acoustic Doppler Current Profilers (ADCPs) etc. Nowadays Acoustic Doppler Current Profiler are being used throughout the world for measurement of stream flow. ADCPs are modern, modified, and sophisticated form of flow measuring tools. Before completely relying on the ADCPs for flow measurement, they (ADCPs) should be assessed for accuracy. To assess this, experiments were conducted with StreamPro ADCP; concurrent measurements with ADCP and Laser Doppler profiler (LDA) were taken in a hydraulics lab flume in Colorado State University. Experiments were conducted in 12 different flow regimes, in first 3 regimes experiments were repeated for 3-5 times, their purpose was to find the difference between readings from both i.e. ADCP and LDA on other 9 regimes one time experiments was conducted that was for finding the variation in the difference by varying the Froude's number. Before conducting the accuracy experiments, instrument was checked for reliability by running it against similar different instruments in different configurations. ADCP under predicted the discharge in the sub critical shallow water conditions by 3-10%, other parameters such as flow regimes, battery power, bed conditions, particles present in the water etc. also affected the accuracy.

Keywords: ADCP, LDA, Stream Flow, Discharge Measurement, Hydraulics, Accuracy

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Removal of organic carbon and microbial contamination through Soil Column

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Abstract:

Natural filtration can be a cost-economic method for surface water treatment. A cylindrical column filled with soil, taken from canal bank, was used for removal of organic carbon and microbial contamination from canal water. The canal water (KB Feeder Canal) was transported and stored in 500 mL autoclaved bottle for every other day and water was passed through column at a flow rate of 4.56 ml/min at the room temperature. The idea was to assess the extent of degradation of microbial contaminants during natural soil filtration. Along with removal efficiency of pathogens, following parameters were also monitored: total organic carbon, total nitrogen, turbidity and total suspended solids (TSS). Total four microbes were used throughout the study viz. Total Coliform, Escherichia Coli, Salmonella Typhi, Vibrio cholerae were measured in the influent and effluent of the laboratory column. The rates of degradation of contaminants and pathogen removal obtained during this study can be used to develop a predictive model for biological, physical and chemical contaminants removal. The average removal efficiency of influent is (358.58). The soil column was found to be effective for removal of pathogen and the removal average efficiency were observed i.e, Total Coliform (1.81), Escherichia Coli (78.6), Salmonella Tophi (6.90), Vibrio cholerae (1.38). The removal average efficiency of TOC influent (25.7) and effluent (10.4), TSS were found in influent (235.0) and effluent (52.24) respectively. The results revealed that natural soil filtration at the bank of a canal can be efficient method for production of drinking quality water.

Keywords: Organic Carbon, Water quality, Total Nitrogen, Microbial contamination, Soil Column.

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"Health Risk Assessment of Textile Industry Reclaimed water" Vinod Kumar^{1*}, Tanveer Ahmed², Aneela Yasmeen³

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Abstract:

Due to depletion of water resources, the reclaimed water could be reused for industrial processes, irrigation or agricultural applications or potable purposes. However, in various studies it is reported that even after reverse osmosis toxic compounds, heavy metals and microorganisms could be found in reclaimed water, and the presence of these contaminants have adverse effects on Human health, agriculture and industrial plants; where reclaimed water is being reused. Among industrial sectors textile is only the sector that generates huge quantity of wastewater in dying process. Therefore, it is important to analyze and asses the quality of industrial reclaimed water for the possible health risks estimation before its reuse using Quantities Microbial Risk assessment (QMRA) and statistical techniques. The aimed study is being conducted on the reclaimed water of "Al-Rahim Textiles Industries Nooriabad" and "Younus Textile Mills Karachi" to assess the microbes includes Salmonella. Shigella, Total coliform, E.Coli and Vibrio cholera and heavy metals includes Cadmium(Cd), Cobalt(Cr), Nickel(Ni), Manganese(Mn), Magnesium(Mg) and chromium(Cr) in collected reclaimed water samples after RO process. The obtained results were used for the estimation of possible risk associated with the present level of contamination in reclaimed water and possible uses of that reclaimed water. Results highlighted that the concentration of heavy metals in reclaimed water were in acceptable range i.e. the obtained values of Cd, Mn, Co and Mg are 0.12, 0, 0 and 141.2 ppb, respectively. However, there was presence of some selective microbes in reclaimed water samples i.e. salmonella, shigella, Total Coliform, E.Coli and Vibrio Cholera were in the range of 09, 80, 6 and 166 CFU/50 ml, respectively. After analyzing such results in QMRA it concludes that there is health risk in this water that impacts the exposed peoples.

Keywords: Reclaimed water, Heavy metals, Microbial risk assessment

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Prediction of drought events in Quetta city using downscaled data Marui Uqaili¹, Ghulam Hussain Dars¹, Court Strong², Kamran Ansari¹

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Abstract:

Baluchistan lies in an arid zone and has faced severe droughts throughout history. Quetta, the capital city of Baluchistan, does not receive water from a canal irrigation system; due to which it has been facing drought conditions. Moreover, the groundwater table is depleting at a high rate because of over-extraction. Under these circumstances, the only source of water in Quetta city is precipitation, which is also decreasing due to climate change. If this condition continues then Quetta will be facing mild droughts in future years. This study mainly focuses on changing trends of precipitation due to climate change. This paper's prediction of drought uses PMD's (Pakistan Meteorological Department) downscaled data at a resolution of 25 km with CCSM4 software. The data is from 1960-1990 with RCP (Representative Concentration Pathways) scenarios 4.5 and 8.5 for 2040-2070 to evaluate short term and long-term effects of droughts. The map of Quetta city was generated by Google maps, then converted into a shape file by the help of GIS and Remote Sensing. SPI (Standard Precipitation Index) was used to predict the number of droughts which will be occurring in future years. By applying these methods, this paper found that because of decreasing trends in precipitation patterns, eventually, Quetta will be facing severe droughts.

Keywords: Baluchistan; Quetta city, Droughts, SPI, climate change

Preparation and assessment of the absorbance core for sanitary products made of cotton stalks

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Abstract:

Many women in the developing countries suffer from gynecological diseases caused by the use of unhygienic sanitary materials. These women lack the access to hygienic sanitary products. Commercially available sanitary products in Pakistan cause the environmental pollution, as these products are mainly made up of plastic. One potential novel solution to this problem is the use of cotton stalks in the sanitary product. In Pakistan, cotton is the prominent cash crop and stalks are residual plant material which is left behind after the collection of cotton fibers. Cotton stalks have been used for many years for different purposes. The main objective of this research is to prepare and analyze the absorbance potential of cotton stalks fibers for their future use in female sanitary products. In this regards cotton stalks were collected from the fields of Sindh Agriculture University, Tandojam. The research conducted from October 2018 to May 2019. 1-kg of Cotton Stalks was treated in 0.5M NaOH concentration at 100 C for 5 and 15 hours. The prepared material when tested for the saline absorbance, interestingly, the 5-hours material showed higher absorbance capacity. Thus 5-hours material was further analyzed in combination with cotton flock and SAP (super absorbent polymer). The results of the research showed that the blend of cotton stalks/ SAP is superior to the blend of cotton stalks/ cotton flock. This study recommends the use of different agricultural residues to make less expensive, eco-friendly and biodegradable feminine products.

Keywords: Sanitary products; Cotton stalks; SAP (Super absorbent polymer); Cotton flock

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Photocatalytic inhibition of selective microbes and degradation of organic dyes.

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Abstract:

Organic, inorganic, and biological pollutants are typical water contaminants and they seriously affect water quality. In Pakistan Per year (household and industrial) mixed waste water is dumped into water bodies without any treatment only 3% is treated this untreated sewage, contains traces of different pathogens, dyes, pesticides, pharmaceuticals and personal products. The application of photo catalyst/semiconductor metal oxides, which was found effective and cost effective solution for the degradation of organic toxic compound like dyes into non-toxic compounds and also for the inhibition of pathogenic organisms. In the present work, Bismuth oxide nanostructures have been synthesized via simple hydrothermal method from bismuth nitrate as precursor and employed for visible light driven antimicrobial and photo catalytic activity. The antimicrobial activity of that synthesized nano particles was investigated against gram negative bacteria(E.coli) and gram positive bacteria(S.aureus) using optical density by taking readings at different interval of time. In dark the OD of E.coli was 0.0335at 10 min but after 20 min it was decreased to 0.0138 at 60 min it has again increased to0.0512. The decomposition of Indigo Carmine (IC) dye was also performed and the removal efficiency of the catalyst was found.

Keywords: Semiconductors Precursor, Antimicrobial, Dye, Hydrothermal, Inhibition.

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Development of point-of-use filtration for harvested rainwater using natural indigenous material

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Abstract:

Globally, 844 million people including scattered small communities have no access to safe drinking water, 1.8 billion people drinking water from fecally contaminated sources (SDG # 6.1). On the contrary to notion rainwater is clean and pure but it brings impurities through different sources. Rainwater is one of the major sources of untreated drinking and domestic water supply in Pakistan, Australia, and other countries. The overall objective of this study is to develop a low-cost filter for removing suspended solids, particulate matters & micro-organisms from rainwater. Column Studies carried out at different compression ratios of fiber by using synthetic rainwater at lab scale. The fiber filter shows a good removal of **turbidity 12.2 NTU**, **9.46 NTU**, **6.55 NTU**, **and 6.94 NTU from 60.3 NTU**, **106 NTU**, **146 NTU**, **and 249 NTU** at **2:1** compression ratio. This paper provides a simple, cost-effective, reliable de-centralized water treatment technique for the safe extraction and filtration of harvested tank rainwater for reducing water-borne diseases in rural communities in Thardesert, Pakistan.

Keywords: Point-of-use filtration, Harvested rainwater, Natural indigenous fiber, Microimpurities, Water-borne diseases, Arid region.

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Monitoring Sea Level Rise and its Impacts on the Pakistan Coast Using Satellite Radar Altimetry

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Abstract:

Sea level rise (SLR) is a serious threat to the coastal regions of the world and a continuous monitoring is imperative to manage this hazard. Pakistan is included in those countries, which are most vulnerable to sea level rise. Pakistan's coastline is about 990 km long in which the Makran coast is 720 km, and the Sindh coast is about 270 km long. Moreover, 10% population of Pakistan is living near the coastal zones, and over 20% coastal area is developed comprising 40% of industries in Pakistan (M.M Rabbani, 2008). Other infrastructures are also overgrowing after the construction of the Gwadar port and China Pakistan Economic Corridor (CPEC). A sea level rise of a few millimeter's per year is a dangerous hazard for the coastal areas of Pakistan. This rise can directly and indirectly cause land loss of low-lying areas and destruction of coastal ecosystems, infrastructures, human settlements agriculture lands and other resources. More importantly, the sea port of Karachi and Gwadar, which have significant role in this region, may be impacted.

The satellite radar altimetry can monitor variations in wave height and also measure the topography of sea surface. At the global scale, the measuring of sea surface elevation is possible through altimetry, which gives more precise data then tidal gauge for monitoring SLR. The satellite altimetry derived model is used to monitor sea levels along the Pakistan coast using data from 1993 till to date. Which helps in quantifying the rise in sea levels and by the extrapolation the potential of SLR can be predicted for future. Initial analysis shows rising trends of sea level 0.50cm/year according to altimetry data and 0.25cm/year according to gauge data near harbor of Karachi. This study may also lead to an ultimate goal of formulating an integrated coastal zone management program for adaptation and prevention of adverse effects of SLR.

Keywords: Sea level rise, Satellite altimetry, Integrated coastal zone management, Tidal gauge.

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Muhammad Sarfraz Khan^{1*}, Prof. Dr. Syed Farman Ali Shah², Dr. M. Mansha³

¹Student of ME (Chemical Engineering), MUET, Jamshoro

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Abstract:

Toxic trace heavy metals are released into atmosphere both due to manmade activities/ sources and naturally. These toxic and trace heavy metals like as Lead (Pb), Arsenic (As), Cadmium (Cd) may put adverse effect on human health. Due to rapid industrialization and modern living, the levels of toxic trace and heavy metals are increased in ambient air of urban area of Karachi. Field Sampling for Particulate Matter₂₅ (PM₂₅) was carried out at five (05) different selected sites including industrial and residential areas in the metropolitan Karachi. At each site, sample was collected for 24 hrs using continuous particulate sampler (Model PQ200, USA). The highest and lowest concentrations of PM₂₅ measured in ambient air were 174.65 µg/m3 and 45.74 µg/m3 respectively. As per Sindh Environmental Quality Standard (SEQS), prescribed limit (24 hrs average concentration) of PM₂₅ in ambient air is 75 μ g/m3. The highest concentration of PM₂₅ (174.65 μ g/m3) was found at location "Labor Square" adjacent to Landhi Industrial area that was not within prescribed limit of SEQS. Collected sample of PM2.5 (fine aerosol) were further analyzed for determination of toxicity load of trace heavy metals (Pb, As, Cd) using Inductively Coupled Plasma Mass Spectrometry (ICP-MS). The lowest and highest concentration ranges were found for Pb (0.2974-16.00 μg/m3), As (0.0025-0.0641 μg/m3) and Cd (0.0013-0.0084 μg /m3). Amongst above mentioned metals, Lead concentration (16.00 µg/m3) was found high at residential area "Baldia Town" adjacent to industrial area "Sindh Industrial Trading Estates (S.I.T.E.)". This study would be helpful for the concerned/ relevant authority/organization working for better health of common man to take corrective action so that deterioration of ambient air quality of Karachi may be avoided.

Keywords: Include; Fine Aerosol; Toxic Metals; Heavy Metals; PM₂₅; ICPMS; PQ-200

Acknowledgement: Thankful to SUPARCO for providing the technical supports for aerosol (PM _{2.5}) sampling and elemental analysis using ICPMS.

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Assessment of the consumptive water use estimated by MODIS and Landsat 8 in the Nara Canal, Sindh.

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Abstract:

This study is an effort to compare the consumptive water use derived from 500m MODIS and 30m Landsat 8 data. The focus of the study is on the assessment of water use in the Culturable Command Area (CCA) of Nara Canal in Sindh during the *Rabi* season of 2017-18. To completely understand the actual water-use and water availability at the field scale, an accurate mapping of actual evapotranspiration (ET_a) is essential. However, the spatial resolution of a satellite has always been crucial while mapping the ET_a . In this study, the MODIS Global Terrestrial Evapotranspiration (ET) Product and Earth Engine Evapotranspiration Flux (EEflux) were used to compare the ET_a obtained by MODIS and Landsat-8, respectively. The results showed that the average consumptive use in the CCA, as estimated by MODIS and Landsat-8 was, respectively, 92% and 130% of the authorized canal volume. Field data can further verify the accuracy of the data. However, Landsat data have a high potential to be used at a provincial level to have an enhanced knowledge of the consumptive uses, which can be helpful in irrigation scheduling and water resource management.

Keywords: Consumptive water use, Actual Evapotranspiration mapping, Nara Canal, METRIC EEFLUX, MODIS, ET satellite products

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Pollution reduction and Water Reuse in a Shrimps Processing Industry: Treatment and management strategy

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Abstract:

Water reuse within industrial units is a best management strategy for cost-effective water conservation and preservation of natural habitat. Shrimps processing industry consumes significance amount of water for processing of raw shrimps and generate same proportion of effluents, with high content of organic pollutants. In this context, present study aims at the quantification and characterization of the water intake and effluent generates, to identify reuse potential of the effluents. Water balance analysis was carried out with quantitative measurement of water intake and effluent streams, at each stage of the product processing and physiochemical analysis of the effluents was conducted. On average, industry demands around 7000 gallons of water per day, in normal production period and demand raises up to 10,000 gallons per day, in peak production period. Moreover, effluents have high values for chemical oxygen demand (COD) and total dissolved solids (TDS), ranges from 4000-7000 mg/l, which requires appropriate treatment for reuse/recycle water to enhance the sustainability of the process with reduced consumption of water resource. In this paper, an efficient management strategy is proposed for water reuse within the industry. Two treatment schemes, i.e. membrane bioreactor and electrocoagulation/filtration, were considered to make water suitable for reuse. On sector level, possible pollution load reduction were also considered upon implementation of the proposed water management strategy. This study is a first attempt in the history of Pakistan to provide an efficient and suitable pollution reduction solution in shrimp processing industry.

Keywords: Water balance, Water Reuse/recycle, Shrimps Process Industry.

History of Bad Governance of Water in Lahore Theme: Water Governance & Sustainable Groundwater Management Waqar Mustafa Sipra¹

¹Governor Awarded Author & Columnist. Ex Fellow LUMS University Lahore.

Columnist Daliy Dunya Islamabad.

Daliy Bhulaka & Mashriq Lhr

Abstract:

Water the most important thing in human life. In this paper i paint the Painful picture of Bad Governance of Water in the City of Lahore. The is on the River Bank of Ravi, Is Now suffering from the Drinking Water shortage.

As we know Lahore is very old city. The life of city is more than 1000 years. But after 1950 city's population is growing very rapidly due to many reasons. Lahore is the Capital of Punjab and knows for city of Education and Gardens..Living in Lahore is kind of Luxury.

Government also started making the many mega housing societies to attract people to move to Lahore very much after 1950. End Result Lahore become the city of 10 Million plus people and need to drinking and everyday use water goes up to sky.

Traditionally Lahore Walas (Lahoris) Like to take water from the underground sources like Manual Wells. Later its shift to the trend of Electric ways to water pumping. Now the end result of 100 years long bad water governance & Unsustainable groundwater management.

The city water level down up to 800ft plus in many majority areas of Lahore. I will explain in detail about the last 100 years unsustainable ways adopted by the City Management Authorities.

Key Word: Water Governance, Water Pumping , unsustainable, Management

Sanitation System Provoke Vegetables to Suffer from Bacterial Burden in Hyderabad

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Abstract:

Due to water scarcity and population growth, sewage use in agriculture occurs more frequently. Often for their survival and food security requirements, the poorest families depend on this commodity. However, this exercise has adverse health consequences to address. Consumption of fruit and vegetable products is frequently seen as a prospective risk factor for enteropathogenesis such as Salmonella, vibrio, and Escherichia coli infection, with elevated concentrations associated with lady finger, cluster beans, and ridge ground. Contamination routes are diverse and include the implementation of organic waste as fertilizer to agricultural property, contamination of water used for irrigation with fecal material, immediate contamination by livestock, small animals and birds and post-harvest problems such as worker hygiene. Hyderabad is a town where vegetables are completely contaminated with pathogens straight using wastewater for agricultural reasons. The purpose of this research was to quantify, accumulation of pathogens from wastewater to vegetables. Hence, plate count method shows that Lady finger (Salmonella=1.7 x 103, vibrio=2.1 x 103 and Escherichia coli =5.7 x 103CFU/gm), Cluster beans (Salmonella =1.1 x 103, vibrio =3.4 x 103 and Escherichia coli =6.9 x 103CFU/gm) and Ridge ground (Salmonella =2.8 x 103, vibrio =1.7 x 103 and Escherichia coli=4.8 x 103 CFU/gm). The transfer of micro-organisms in greater quantity and dangerous for use was proven after experimental study.

Keywords: Wastewaterirrigation; Vegetable; Pathogens accumulation; Fecalcontamination; Enteropathogenesis.

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Estimating Lake Volume Changes Using Optical Remote Sensing And Satellite Radar Altimetry

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Abstract:

The Sentinel-3A satellite was launched in February 2016 including the SRAL altimeter operating the high-resolution SAR mode.SAR altimetry typically allows to monitor water level with a posting rate of 20 Hz (300 m resolution in the direction of flight of the satellite) which is quite an attractive feature for the study of inland water bodies. Official Sentinel-3 and products collected over coastal and inland domains are freely available at: https:// scihub.copernicus.eu.Since the repeat cycle of the mission is of 27 days, 40 readings have be acquired since 2016 and used to investigate the potential synergy of satellite radar altimetry & optical remote sensing to estimate the change in volume of Manchar Lake, the largest freshwater lake in Pakistan whose surface area spans from 228 to 250 km². The water levels were calculated using data from the ESA G-POD (Grid Processing on Demand) SARvatore for Sentinel-3 service (http://gpod.eo.esa.int/services/SENTINEL3 SAR(), which provides alternative Sentinel-3 data at a finer posting rate of 80 Hz for inland water investigations (80m resolution in the direction of flight). To calculate the water extent, the NDWI (Normalized Difference Water Index) was calculated using Landsat 8 satellite data. This has been further combined with altimetry data to determine the temporal changes in volume. Medium resolution satellites (10-90 m) are available for lake studies such as Landsat 8 which gives 30 meters, 16 days spatial and temporal resolution, respectively. The results revealed that there exists a high potential in combining altimetry with optical remote sensing to monitor changes in lakes' volumes where in-situ measurements are limited or of a questionable quality. The regression analysis between Manchar Lake surface area and water level provided a correlation coefficient of 0.811 showing a strong statistical relationship between the two variables. Results presented in this study showed the increasing trend on volumetric variations over Manchar Lake. Highest water level was observed in May 2019 with an area of 222 km2 and water level was 39.604 m.

Keywords: altimetry; Manchar lake; optical remote sensing; volume; water level.

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Synthesis of Adsorbent (SUNSPACE) to Remove Organic Matter from Water

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Abstract:

In 21st century, in the era of smartness, world is facing crisis of basic need of survival i.e. water. It is the matter that catches prior attention as clean water is vital for life. In the opinion of different researchers; about half of the population of Pakistan has no access to clean water. Water pollution is considered as a major threat of this epoch especially in terms of organic pollution. However, no threat is bigger than human intelligence. Many remarkable water treatment techniques have been developed but they are not suitable for practical use by the reason of their high cost and unsustainability. In this work, sustainable and cost effective adsorbent named as SUNSPACE is prepared to remove Organic Matter from water. Adsorbent is made up of cheap and naturally abundant materials such as Sodium Alginate, Calcium Chloride, Cement and Sodium Bi-carbonate. Oedogonium and Spirogyra Algal species are added in the composition of adsorbent to analyze algal effects on adsorbent's efficiency as water treatment using Algae is a best technique of present time. Remarkable properties of adsorbent make it able to cover all flops of available water treatment techniques for instance high cost and unsustainability. Removal efficiency of adsorbent is analyzed by running UV Spectrophotometer. Adsorbent showed removal efficiency up to 91 % however both Algal and Non-Algal based adsorbents showed fluctuations in efficiency. Because of its outstanding nature and significant advantages, it can be the leading water treatment technique among available ones in coming time.

Keywords: Wastewater Treatment, Adsorbent, Organic Matter, Sustainability, Oedogonium, Spirogyra.

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Drinking Water Quality Investigation from different sources in Southern Punjab Region of Pakistan.

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Abstract

Background Information: Drinking water quality is being deteriorated day by day in Pakistan due to alarming increase in population and rapid industrialization. The aim of the study is to evaluate the differences in pH, electrical conductivity and Total Dissolved Salts (TDS) of drinking water received from different sources such as filter plants (FW), government supply tape water (GSTW) and underground water (UW).

Material and Methods: we analyzed 116 no of water samples in which, 58 were filter plant water samples , government supply tape water were 50 and underground water were 8. The water quality tests were performed on portable waterproof pH/EC/TDS meter by HANNA Instrument (HI 991300), Italy with probe no HI 1288. Normality was checked by applying D'Agostino-Pearson test (1). The parameters which have normal distribution were assessed statistically by independent t test. Whereas others (non-normal distribution) were assessed by Mann-Whitney U & Wilcoxon W tests.

Results: The Mean±Std value of pH, EC and TDS of FW were 7.70 ± 0.30 , 591.46 ± 280.58 and 295.75 ± 140.25 respectively and, GSTW 7.59 ± 0.24 , 790.6 ± 340.87 and 399.40 ± 166.74 respectively and, UW 7.78 ± 0.18 , 900.12 ± 312.11 and 449.50 ± 155.96 respectively. The independent t- test proved that there were no statistically significant differences in pH of three types of drinking water (P=0.060, P=0.135) in southern Punjab region i.e. pH falls within the normal range (6.5-8.5). Mann-Whitney U & Wilcoxon W tests proved that electrical conductivity and TDS significantly increased from filter water to underground water (P=0.000).

Conclusion: The pH of collected samples of DW remain within the neutral range but the higher range of electrical conductivity and total dissolved salts of government supply tape water and ground water due to heavy industrialization is alarming for southern Punjab Population.

Key Words: Drinking water (DW), Filter plant water, civilization, electrical conductivity, TDS, pH.

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Development of Flood Analysis system on Left Bank Outfall Drain (LBOD) Using Integrated Flood Analysis System (IFAS) Model Dolat Singh sodho^{1*}, Ghulam Hussain Dars¹, Dr. Kamran Ansari¹

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Abstract:

In the year 2011, the flood in Sindh was not riverine but rather it was because of abnormal precipitation, massive harm was caused because of the absence of the ability to drain the rising water into the Indus, this flood cause harm worth 3.7 billion US dollar. Considering all the flood damages and nonstructural strategies adopted to minimize the risk a study is being conducted for the flood analysis of Left Bank Outfall Drainage (LBOD) in Sindh using Integrated Flood Analysis Model (IFAS). IFAS Model uses satellite based rainfall data, land cover, elevation and soil geology data as input for flood flow analysis. This study has been conducted on LBOD catchment and its drainage network. The results shows the flow analysis of drainage network in the form of Hydrographs, and displayed the tank conditions and the applicability of IFAS model in LBOD catchment for flood flow analysis.

Keywords: LBOD, Flood forecasting, IFAS, Agriculture Effluent, Storm Water,

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Treatment and Handling of Reverse Osmosis rejected water in Textile industry

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Abstract:

The world demand for potable water is increasing steadily with growing population. Water distillation using solar energy is suitable for potable water production from brackish or RO rejected water. In this study, a solar distillation in a square basin is studied theoretically and experimentally at the USPCAS-W in Mehran University of Engineering & Technology (MUET). The other solar distillation tank was designed at Al-Rahim textile industry (ATI) Nooriabad Sindh. The solar distillation tank was fabricated with a base area of 30"x30", and the glass cover over solar distillation tank was inclined at 35° to the base of the Tank. Temperatures of glass cover, under RO rejected water inside the still, were recorded continuously and distilled water was measured for each day the initial results shows the high concentration of TDS about 7720 mg/l after solar distillation process

Keyword: Solar Distillation; Reverse Osmosis, RO rejected water, Textile Industry, TDS

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Wheat Crop Water Productivity of Perennial and Non-perennial Canals in Sindh

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Abstract:

As water resources become susceptible, there is an immense need to enhance the crop water productivity (CWP) especially for food crops to enhance food security. Pakistan is among those countries who have lowest wheat yield in the World and same is the case with crop and economic water productivity. This study aimed to evaluate and compare CWP and EWP of wheat on perennial (Nara) and non-perennial (Rice) canals of Sindh, Pakistan. Both canals off take from Indus at Sukkur barrage. Two distributaries were selected from each canal, one at head and second at tail reach. In total 400 respondents were interviewed with equal distribution. Data were collected through structured survey design and it included the information on tillage, irrigation water, seed varieties, fertilizer, pesticides, yield and selling price. Secondary data were collected from Sindh Irrigation Department. Farmers at Nara canal were fully depended on canal water due to the prevailing situation of ground water and on the other hand farmers at head reach of Rice canal were using ground water and farmers at tail reach were using untreated sewage water coming from Larkana city for irrigation purposes. The results shows that the water applied, wheat yield, CWP and EWP at Nara canal was 2198.515 m³ ha¹, 3159.042 kg ha¹, 1.782 kg m³ and 31.802 Rs m³ respectively and water applied, wheat yield, CWP and EWP at Rice canal was 3585.907 m^3 ha⁻¹, 3547.756 kg ha⁻¹, 1.303 kg m⁻³ and 22.674 Rs m⁻³ respectively. The average per hectare wheat yield on both canals is higher than national but lower than international per hectare wheat yield. The CWP and EWP of Nara canal is higher than Rice canal.

Keywords: Crop Water Productivity, Economic Water Productivity, Wheat, Perennial Canal, Non-perennial Canal.

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Drought Regionalization Based on Standardized Precipitation Evapotranspiration Index in Pakistan (1902-2015)

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Abstract:

Droughts are a common occurrence in Pakistan which are expected to worsen because of climate change. Modelling droughts is crucial to understand its behavior and adopt proactive strategies to minimize its impacts. The main objectives of this study are to calculate the 3-month Standardized Precipitation Evapotranspiration Index (SPEI) across Pakistan, and regionalize droughts using a spatial cluster analysis. We used Climate Research Unit (CRU) gridded precipitation and temperature data to calculate (SPEI) at a 3-month time scale across Pakistan for 113 years (1902-2015). Following its calculation regionalization of droughts was carried out across Pakistan using Spatial "K"luster Analysis using Tree Edge Removal (SKATER) method which has the benefit of taking into account the geographical contiguity of the data set. Five clusters were produced after applying SKATER analysis. Run theory was then applied to identify episodes of major droughts that struck the identified regions. Spatiotemporal analysis of the regions revealed the evolving characteristics of droughts across space and time. The results will benefit the policy makers in understanding, and then managing, future droughts effectively.

Keywords: SPEI; Drought Regionalization; SKATER; Run Theory; Drought Management.

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Mapping of soil salinity using Electromagnetic Induction (EM38-MK2) and ESAP Software

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Abstract:

Soil salinity is one of the major environmental issues in the world that affects the crop yield and subsequently, the socio-economic conditions of the farming community. Monitoring the degree of severity and the progressive development of soil salinity is important to assess its adverse effects on production and productivity and on environmental degradation. Several methodologies have been developed to detect the presence of salinity across agricultural areas. However, those techniques only indicate where the problem is, neglecting its quantification. Soil salinity mapping using traditional methods of soil sampling and analyzing is laborious, expensive and time-consuming. The EM38-MK2 provides a measurement of both the guad-phase (conductivity) and in-phase (magnetic susceptibility) components within two different depth ranges without any requirement for soil-to-instrument contact. The maximum effective depth of measuring apparent EC with EM38-MK2 is 1.5 m which is the maximum root depth of many crops. The spatial reference of sampling points collected with Geode and EC of soil profile are simultaneously stored in Juniper Archer through Bluetooth. Collected data was analyzed in ESAP software and ArcGIS 10.3 software. Following the sampling design procedure soil samples were taken from 12 locations and electrical conductivity of the saturation extract (EC₂) was measured. The multiple linear regression (MLR) calibration model in ESAP, predicted EC from EM38-MK2 readings with $R^2 > 0.941$. Salinity map obtained from ArcGIS 10.3 software showed that more than 25% percent of the field had EC values above 4 dS m⁻¹.

Keywords: Electromagnetic induction, ArcGIS 10.3, ESAP, Soil Salinity, Electrical Conductivity, Soil Sampling

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Assessing Seawater Intrusion in Coastal Aquifers by Using Chemical and Isotopic Techniques: A Case Study of District Sujawal Zaki Zaidi¹, Altaf Ali Syal¹

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Abstract:

A 200 km river reach from the Kotri Barrage to the Arabian Sea is getting insufficient environmental flows to cope with seawater intrusion in the Indus delta Thus, the present study was conducted on the left bank of the River Indus to detect seawater intrusion near the Indus Delta at Thatta-Sujawal Bridge. The stable isotopic and chemical analysis were used to investigate the phenomenon. A total of 9 samples were collected at 50 km with an interval of 5 km between the samples, perpendicular to the reach. The physio-chemical parameters determined the presence of salinity in shallow groundwater to a depth of 10m. The cause of salinity was further investigated by isotopic and chemical analysis. The plots of stable isotopic compositions were obtained below the global meteoric water line (GMWL) indicating the evaporation effect. However, the ratios of conservative metals were unable to prove that the variation in concentration was due to the evaporation only. One of the potential causes of salinity might be the irrigation returns or the low recharge to discharge ratio of groundwater. Furthermore, a mixing model was developed using stable isotopic concentrations of hydrogen and oxygen, assuming the canal and river as the sources of recharge to the groundwater. The model concludes that the major contributor to the recharge was canal water not the river water.

Keywords: seawater intrusion; stable isotopes; ionic ratios, groundwater

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Assessment of Climate Change Impacts and Designing of Climate Smart Agriculture Practices for Wheat Crop

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Abstract:

Agricultural plans of Pakistan are under great threat of changing climate. It is very crucial to interpret the impacts of climate change on crop yield so that agricultural adaptations could be considered accordingly, especially in the Sindh province of Pakistan which is one of the most vulnerable areas. In this study, the impacts of climate change on wheat production has been inspected with a model 'Decision Support System for Agro technology Transfer' (DSSAT), for the period of 2018-19. The primary data was obtained from Tandojam, Sindh and secondary data was obtained from Pakistan meteorological department. Model was first calibrated and validated. The study used the data of three planting dates (15 Nov, 25 Nov and 05 Dec) and a base line data of weather (minimum temperature, maximum temperature, solar radiation, humidity and precipitation) from 1988-2018 with 10 future climatic projections (Current, 0.5°C rise in Temperature, 1°C rise in Temperature, 1.5°C rise in Temperature, 0.5°C rise in Temperature & 15% decrease in Rainfall, 1°C rise in Temperature & 15% decrease in Rainfall, 1.5°C rise in Temperature & 15% decrease in Rainfall, 0.5°C rise in Temperature & 15% increase in Rainfall, 1°C rise in Temperature & 15% increase in Rainfall and 1.5°C rise in Temperature & 15% increase in Rainfall) which was based on RCP 4.5 and 8.5 to illustrate how wheat crops get affected by the impacts of changing climate. Soil data was obtained from Agriculture chemistry section, Tandojam. Furthermore, soil data (soil texture, soil structure and organic composition) and detailed crop management (Plantation, cultivators, irrigation, fertilizers and harvesting) information as input. The results revealed the best planting date (25 Nov) which gives maximum yield and suggested different adaptations (increase in NPK input, application of FYM, different cultivators and efficient irrigation method) that simulated the increase in wheat yield significantly under climate change scenarios. Furthermore, decrease in wheat yield can also be reduced by changing planting dates.

Keywords: Climate change impacts, Wheat production, Adaptations, DSSAT model.

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Development of an Electrochemical Sensor for the Detection of Mercury lons in Water

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Abstract:

Mercury ions are present in various water streams around the world in various forms and concentrations for both natural and anthropogenic reasons, and cause a wide-range of health and environmental damages. Most of the conventional methods of detection are costly and require a set pre-testing protocols to be followed.

An electrochemical sensor was developed based on titanium nanotubes that showed an encouraging selectivity toward mercury ions. Development process included the use of electrochemical anodization method for the growth of nanotubes over titanium surface using ethylene glycol. Cobalt was deposited over and inside the nanotubes by the method sonication to provide selective features to the sensor. Using cyclic voltammograms, the sensor was found to offer a wide range of detection from 0.2 μ M to 5.7 μ M of mercury ions based on linear regressions and standard deviation of the test runs. Studies to obtain optimized values of electrolyte concentration and pH were performed using the same cyclic voltammetry tests. Interference study was conducted to check the sensor's behavior in the presence of other metals such as arsenic, chromium and lead, which showed that the sensor is highly selective toward mercury ions.

Keywords: Electrochemical Sensor, Mercury Detection, Titanium Dioxide Nanotubes

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Removal of Reactive Dye from Textile Wastewater Using Rice Starch as a Natural Coagulant

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Abstract:

Wastewater originates from textile industry consists of numerous pollutants which are harmful in nature. It is a proven fact that dyes have adverse effects on flora and fauna. It pollutes the surface water, air, soil. To escape from the negative impacts, scientists are looking for innovative solutions for the removal of dye from the wastewater. The existence of the dyes disrupts the water ecology, which reduces sunlight penetration. However, due to environment-friendly nature, biodegradable polymers have attained a pivotal role in wastewater treatment. Unique functional properties of rice starch make it a preferred coagulant for wastewater treatment. Morphological studies revealed significant variances among rice starch granule shapes (polyhedral and irregular) and size (ranges from 2 to 7 μ m). Comparatively due to the smaller particle size of rice starch surface area of per unit volume increases which makes it a better adsorbent. Surface area of rice starch is 1.27 m^2/g . The principal objective of the study was to develop a viable process for the removal of the Drimarine red reactive dye from the textile wastewater by utilizing rice starch, which is an inexhaustible, biodegradable, abundant, and plant-based biopolymer. Rice starch (coagulant) composition analysis was performed. Protein content was checked by using a Kjeldahl apparatus and other contents were determined through best instrumental techniques. Complete design of experiment was selected, and experiments were performed using a jar test apparatus. The main effects and interactions of temperature, dosage, and pH on the percentage colour removal were examined. A significant parametric interaction was observed. Maximum dye removal achieved 83.6% at coagulant dosage of 40 mg/l, pH

5, and temperature 40°C.

Keywords: Rice starch; bio- polymer; coagulation; wastewater; reactive dye; natural coagulant; dye removal.

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E-Hail Ridership Analysis of Hyderabad, Pakistan Hassam Bin Waseem^{1*}, Mir Aftab Hussain Talpur²

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Abstract:

E-hail is a smart transportation model used to call a taxi by electronic means, usually via smartphone applications (for example, Uber, Careem, etc.). In the absence of public transport, smart mobility services like E-hail are used these days to meet urban travel demand. The services are more safe, reliable, and cost-effective substitute for conventional taxis and other local private transport modes. Hence, they are becoming an imperative component of the transportation system in settings like Hyderabad, Pakistan, where commuters either rely on their own vehicle or on E-hail to travel. Thus, to unfold its criticality and comprehend its implications in Hyderabad, Pakistan; this study was aimed to identify the demographics and trip purposes of E-hail end-users. Data were collected from a random sample of 180 frequent E-hail users using an online questionnaire survey. Using frequency distribution, it was found that E-hail services were mostly used by singles aged between 16-30 having income within the range of 4K-50K PKR. Furthermore, E-hail trips were mostly found to be home-based (home-work, work-home, home-school, school-home). Moreover, passengers mostly reported problems of fraud, uneasiness, bad behavior of drivers, theft, and traffic law breach. Whereas, solutions like affordable fare, increase in E-hail vehicles frequency and professional development of drivers, were suggested as essential improvements to be made. The study is significant as, on one hand, it had built a strong knowledge base for policymakers and transport planners to legalize and regularize E-hail services according to the end-user demographics and socioeconomic characteristics. On the other hand, it would help E-hail companies to improve the quality of E-hail operations. To conclude, the results could be used to develop E-hail implications for Hyderabad to curtail the existing and futuristic transport problems which would further contribute to resolving interrelated social, economic, and environmental sustainability challenges.

Keywords: E-hail, Ride-hailing, Ridership Analysis, Urban Transport, Descriptive Statistics, Hyderabad

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Adoption of Green Practices in the Institutions of Hyderabad and Jamshoro

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Abstract:

Green Human Resource Management is the combination of best practices of Human Resource Management and the promotion of environmental sustainability through the environmental management system. The primary purpose of this research is to check the awareness of environmental management system, including the best practices of Human Resource Management. The quantitative methodology is used for this research. The targeted sample was faculty, administration, and final year students (graduate and Postgraduate) of the business institutes of Hyderabad and Jamshoro. The data was collected from the leading business school of Hyderabad, Isra University, SZABIST, and NUML and from the Jamshoro University of Sindh. Furthermore, it is identified that the best practices of Green Human Resource management are four practices. The contribution of these practices is more than 44 % of all methods. Institutions could improve the awareness level by meeting all the other practices at the same time if it can increase Green Human Resource Planning to improve other green practices of GHRM. The major recommendation of this research is to give information seminar to the Institutions. The drive for green campuses must be conducted to increase the awareness level of all practices. Awareness campaign of green practices can decrease the uncertainty of green practices in the Institutions. To increase understanding of stakeholder of Industries and Education Institutions a model to implement green practices will be sent.

Keywords: Green Human Resource Management, Environmental Management System, Environmental Management, Environmental Induction, Green Human Resource Planning.

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NCWE-19 # 148

Purification of waste water management by chitosan , extracted from shrimp waste.

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Abstract:

Chitosan is a natural glucosamine and N-acetyl-glucosamine copolymer similar to cellulose extracted from many animals such as crabs, lobster, shrimps etc. by hydrolization processes. Chitosan-based products have been suggested as a more environmentally friendly coagulant for water and wastewater treatment due to their biodegradability. In several previous laboratory research, chitosan was an efficient coagulant. Water purification is the fundamental requirement of life, many nations suffer from health problems such as diarrhea, food poisoning because of unhygienic water and water used in food. This research was conducted to verify the feasibility of biocompatible extracted chitosan with drinking water. The parameters studied were turbidity and pH. Conductivity, bacterial count, algal development are also significant variables to study and will be regarded for further research .The findings showed that turbidity and pH decreased with increased chitosan concentration. When chitosan levels rose from 0 to 1 g per 100 ml, turbidity and pH decreased. The linear equations depicted the relationship between all parameters and concentration of chitosan. However, the total number of bacteria, complete coliform bacteria, and algal growth are hailed for further research.

Keywords: shrimps; chitin; waste management; Pakistan

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Status of Solid Waste Management in Peshawar, Pakistan Waqas Ahmad^{1*}, Muhammad Hassan^{1**}, Tahir Nawaz¹, Muhammad Ashfaq², Muhammad Assad Khan¹

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Abstract:

Pakistan faces both an energy crisis on one hand and difficulty in transporting waste from generation to final disposal because of a quickly expanding population. The number of inhabitants in Pakistan was recorded as 208 million in 2017 census and constantly expanding with the growth rate of 2.4%, making it one of the world's most crowded nations and further exacerbating waste management issues. The main objective of this article is to examine the present waste management procedure of Peshawar city and what should be done to improve it. A major part of the Peshawar population belongs to the low and middle-class income region and based upon this fact, squander generation rate per capita fluctuates in various parts of the city. To achieve the goal of information gathering of waste generation daily, quantitative analysis survey was being performed in Peshawar city along with WSSP and interviews conducted with household. Besides, every zone's garbage collecting vehicles were monitored and their performance was tracked which demonstrates that 2208 tons/day waste is generated every day. Municipal solid waste collection and disposal services in the city are not in the same class as it should've been. On the grounds that roughly 60 percent of the solid waste is collected and the remaining are present there at gathering points, or in streets, where it radiates a large amount of contaminants into the surrounding environment, making it unsuitable for human interaction. A noteworthy part of the waste is dumped in an old furnace misery around the southern side of the city. This analysis represent that limited number of bins, as 17000 people per bin. Substandard design and location of bins make it difficult to proper utilize it. Underutilization of vehicles as the total maximum potential trips it could make is 1908 but on ground only 562 trips are made weekly which is 31% of it, it should be utilized at full capacity. Firing of suspicious drivers and, recruit new staff along with proper training and ethical awareness should be provided to them. Further analysis should be performed like budgetary costing of every ton waste from the waste generation site to a landfill site, social, technical, political and environmental.

Keywords: Pakistan, MSW, Solid waste Management, Peshawar strategy

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NCWE-19 # 151

Calibration of Head Regulator using Acoustics Doppler's Current Profiler (ADCP)

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Abstract:

Acoustic Doppler current profilers are being used to measure water velocity, channel bathymetry, and discharge. This instrument has various configurations and frequencies; choice of the appropriate instrument depends on various factors including depth, width, and sediment load of the stream being measured. The acoustic Doppler current profilers used in this study is RiverSurveyor M9, which is mounted on small boat. Profilers enable users to make fast, accurate, and economical discharge measurements. Reach of Nara Canal was selected for calibration some distributaries and minors were chosen with installed gauges. Determination of stage-discharge relationship in minors/distributaries is extremely important for proper distribution of water. Observational data at various stages cannot be collected simultaneously. It took a considerable amount of time and a great deal of difficulty to collect the data required for establishing the rating curves. The ADCP calibrated by using Current Meter in the same stream at the same stage which were almost similar, and sometimes with the error of +-2 to +-3%. Flow discharge is an essential parameter in the design of open channels. For most of the channels, the relationship between the stage and the discharge is a single valued one. Gauging of channel discharges is more difficult than gauging of water levels. Extension of the stage-discharge curve for hydraulic engineers is important in discharge estimation, water resources management and flood control. Data collection completed, and rating curves were drawn by using two methods, Ferro's (2000) dimensionless methods and Sauida's (2014) method. When compared the most accurate method was Ferro's dimensionless method with less than +-3% error, and error in Sauida's method was +-10%.

Keywords: ADCP, RiverSurveyor M9, Current-meter, Calibration, Head Regulator, Discharge measurement.

NCWE-19 # 152

Crop Farmers Perception and Adaptation Strategies to Climate Change in Faskari Local Government Area in Katsina State of Nigeria

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Abstract:

The study was designed to ascertain crop farmers' perception and adaptation strategies to climate change in Faskari Local Government in Katsina State of Nigeria. The Criteria for sampling was the Selection of sample of 75 through the Simple Random Technique divided in three wards in the Study Area. It was hypothesized that there is no Significant relationship between Socioeconomic Characteristics of the farmers and their Perception of Climate Change in Study Area. Face to face interview was conducted to get accurate results from key and sample respondents. Data was analysed using frequencies mean, percentages and descriptive methods. The major conclusions drawn from this paper were findings of the study regarding farmers awareness on climate change revealed that 27(36%) of the respondents are aware while 48(64%) of the respondents are not aware. Perception of respondents perceived adverse effects have shown that 20(26.6%) of the respondents perceived increased rainfall intensity. About 13(17.3%) respondents reported excessive heat. While majority 23(30.6%) believed that increased windstorm is responsible for diverse effects. Opinion regarding adaptation strategies revealed that 10(13.3%) of the respondents reported adjustment of date of planting. About 17(22.6%) respondents adopt the use of irrigation. While majority 25(33.3%) and 18(24%) adopted the use of improved crop varieties and diversification of the farming activities respectively. On the basis of the above conclusions Null Hypothesis 1 Ho is accepted and Alternate Hypothesis HA is rejected. On the other hand Null hypothesis 2 Ho is rejected while Alternate hypothesis HA is accepted. This research identified that farmers have no awareness regarding climate change adaptation strategies.

Keywords: Awareness, Adverse effects, climate change, Crop Farmer, Adaptation strategies, Nigeria.

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Analyzing the Impact of Hill Torrents of Koh e Suleiman Mountains on the Flood Water of River Indus: A Case Study of Vidore Hill Torrent

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Abstract:

The severity of floods is categorized in terms of its frequency and magnitude. Flash floods have proven to be the most damaging natural hazard. In Pakistan, concentrated rainfall is one of the major cause of floods in the catchments of river during the monsoon season. The contribution of these ungauged watershed (Hill torrents) to flood water increases the economic damages. According to reported figures in Pakistan, the flood of 2010 in Indus River killed more than 1,961 people and damaged property worth US \$ 9,500, 000. 13 major hill torrents coming from the Koh-e-Sulaiman are identified yet. These hill torrents cause havoc to the flood management of Indus in Sindh and Punjab as it elevates the flood levels in Indus River. These hill torrents come into the upstream of Indus at the place where it enters the Sindh province. In case of low discharge in Indus, there is no significant effect on the flood management plan in Sindh. The high discharge in Indus during flood days contributes to the high risk of breaches as observed in monsoon season of 2010 and 2015. This study aims to demarcate the catchments of Vidore hill torrent and the amount of runoff simulated during any rainfall event. For the current study GIS and remote sensing is being used to demarcate the catchment area using 30X30 m AIOS JAXA Digital Elevation Model (DEM) and the quantification of flows is done using a semi distributed model (HEC-HMS, SCS-CN). The average annual flow estimated in this study on 30 years rainfall data (1989-2018) is 18.5 Mm³. The monthly water availability shows the availability of approximately 56% of annual flows in months of July and August. The years 1998 and 2002 are showing same low runoff (2491630 m³), which is due to drought period in the region. The longest period having flow less than annual average flow is 1998-2004 (7-years). Overall 17 years have less than annual average flow. The wettest year is 2006 with annual runoff 59036819.8 m³ and overall eleven years have annual runoff higher than average annual flows. The study will also help in preparing a plan for the people living in those areas to better utilize the available water for their agriculture, domestic and livestock needs.

Keywords: Hill Torrents, Flash Flood, Rainfall Runoff, Watershed.

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Paspalum and Lolium species act as lead content reduced agents in soil and air environment

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Abstract:

In recent years, the pollution in air and soil environment has increased dramatically, created from various sources in developing and developed countries. Because of these conditions, human health, farmland and plant growth are adversely affected. Lead (Pb) is a harmful heavy metal element originates naturally in the environment, also from industrial products. However, normal progression always cleans the lead-contaminated air. Invasive species with the ability to tolerate or accumulate lead, and thus the natural processes are the best solution to resistant Pb in the environment. For this research study, data were observed from three experimental sites of different traffic concentrations: 1. Sukkur, 2. Pir village, (Pir-jo-Goth) and 3. Junctions of Theri road. Two plant species, namely Paspalum and Lolium were selected as lead content reduce agents. The samples were collected once a month for three months (September-November 2014). The research results indicated that different plant species can affect the reduction of lead content in air and soil environments. Moreover, the results showed that, Paspalum specie is more effective than Lolium specie in reducing lead content in air and soil environment.

Keywords: lead content, air and soil environment, heavy metal, Lolium specie, Paspalum specie.

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Paspalum and Lolium species act as lead content reduced agents in soil and air environment

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Abstract:

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Keywords: lead content, air and soil environment, heavy metal, Lolium specie, Paspalum specie.

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SUSTAINABLE DEVELOPMENT GOAL 6: Ensure Availability and Sustainable Management of Water and Sanitation for All

SDG-6: Targets to be achieved by 2030

- 6.1: D Achieve universal and equitable access to safe and affordable drinking water for all
- 6.2: Achieve access to adequate and equitable sanitation and hygiene for all

Improve water quality by reducing pollution, eliminating dumping and minimizing release of hazardous chemicals and materials

6.4: 🏍

6.3: 🔿

Substantially increase water-use efficiency across all sectors

6.5: 6.5

Implement integrated water resources management at all levels



Protect and restore water-related ecosystems



Expand international cooperation and capacity-building support to developing countries in water- and sanitation-related activities and programs



Support and strengthen the participation of local communities in improving water and sanitation management

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