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Detection of Antibiotic-Resistant Bacteria from Drinking Water Sources of Hyderabad City and its surrounding

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Abstract

This study was aimed at identifying the antibiotic-resistant bacteria from different drinking water sources of Hyderabad city and its surroundings. For the proper representation of the city, the samples were collected randomly from surface water, groundwater, and water distribution network. Antibiotic resistance pattern of bacteria was determined against commonly used antibiotics of the Hyderabad city, using standard Disc Diffusion method. Antibiotic sensitivity and resistivity testing were performed for 62 samples collected in this study. The most common organisms that were isolated in the samples were: *Shigella*, *Pseudomonas*, *Vibrio*, and *E. coli*. Antibiotic resistance was checked for 16 antibiotics and out 16 antibiotics, each sample was seen to resist at least two antibiotics. The findings of this study showed that the different drinking water sources of Hyderabad city are contaminated potentially with pathogenic multi-drug resistant strains of different organisms.

Keywords

Antibiotic-Resistance, Drinking water, Disc Diffusion Method.

A Correlative Study of Mixed Kitchen Waste Anaerobic Digestion at Mesophilic and Thermophilic Temperature

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Abstract

Currently, the world is facing several problems i.e. population explosion, increasing energy demand, climatic shift, varying economies, fossil fuels depletion, and safe disposal of municipal solid waste (MSW). About 40–70% of MSW contains organic matters (OM), which are readily biodegradable. Anaerobic digestion (AD) is an old technology and considered as the green technology by the number of researchers to deal the organic fraction of municipal solid waste (OFMSW). AD converts biodegradable compounds to biogas (methane and carbon dioxide) as a source of renewable energy and a nutrient rich by-product in the form of compost for agriculture. AD is a biological stabilization of OM, can be carried out at psychrophilic (<20°C), mesophilic (25-40°C), and thermophilic (50-65°C) conditions. In this study, a parametric comparative analysis was done at mesophilic (37°C) and thermophilic (55°C) ranges by considering the various parameters like pH, temperature, and organic loading rate (OLR). This study was carried out for 120 days of hydraulic retention time (HRT) and revealed that biogas production (BP) on a cumulative basis and the removal of volatile solids (VS) were 20% and 30% higher at thermophilic condition respectively. The coefficient of correlation (R²) of biogas production was 0.994 and 0.98 between 37°C and 55°C. The pH effect on BP was dominant at thermophilic rather than mesophilic temperature. Four organic loading rates (OLRs), 1.015, 5.075, 2.54, and 10.15 gVS/L/d were utilized to monitor the effect on reactor behavior and ultimately impact on biogas production. About more than 70% of total biogas production in case of both temperatures was achieved on 10.15gVS/l/d.

Keywords

Mixed kitchen waste; anaerobic digestion; mesophilic temperature; thermophilic temperature; cumulative biogas production; CSTR.

Melanoidins Removal from Biodigested Spent Wash using Fly Ash

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Abstract

One aim of this study was to utilize the fly ash generated from coal-fired power plant to produce a cost effective and sustainable technique to replace conventional cost intensive methods for melanoidins color removal from biodigested distillery wastewater. In this study, real melanoidins contained wastewater was collected from local molasses based distillery and was preserved at 4C before use. A fly ash sample was collected from coal at Jamshoro power plant, and was sieved to collect the smallest particle size of 0.15mm. The fly adsorbent was prepared by acid treatment after several washings with distilled water and was dried at 105oC overnight. Batch Experiment was performed in a conical flask as a function of contact time, adsorbent dose, pH and initial dilution of wastewater to optimize suitable conditions. Equilibrium adsorption data was interpreted through Langmuir and Freundlich isotherms models, while kinetic data was analyzed through pseudo-first order and pseud-second-order- kinetic models. Langmuir isotherm and pseudo-second-order kinetic model were found to best fitted to equilibrium and kinetic data with the R² value of 0.9639 and 0.9998 respectively. After 2 hours of contact time, 91% of melanoidins removal efficiency was achieved at the optimum adsorbent dose of 5 gm. The optimum dilution of spent wash was 5%, while pH and temperature were 7 and 303k respectively.

Keywords

Melanoidins, Fly Ash, Spent wash, ADMI

Absorption Potential of Charcoal and Sand: A Low-Cost Potable Water System

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Abstract

The scarcity of water is one of the major issues, about one-fifth of people on earth lack the access to safe drinking water. Bioremediation is widely practiced for the removal of such hazardous waste from the environment. Many European cities choose slow sand filtration as a water treatment method because of its simplicity, reliability, and economy. In this paper, we discuss the Adsorption potential of selected materials i.e. granular charcoal, granular sand, separately and with different layers of sand and charcoal was observed with different retention time to remove the microorganism from the water. It was noted that sand media adsorbed about 98.92%, granular charcoal 88.29% and different composition of the charcoal and sand showed adsorption capacity of 91.08%, 97.46%, and 98.82% respectively at pH 6.5. Many European cities choose slow sand filtration as a water treatment method because of its simplicity, reliability, and economy.

Keywords

Bioremediation, Sand, Charcoal, Filtration

Physico-chemical, Bacterial and Spatial Variation of Micro-organisms in Sandspit Coast, Karachi

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Abstract

Study of the coastal water of Karachi was carried out to investigate the presence of microbes. The isolation of the microflora of 16 water samples was done 9 isolates were obtained using various biochemical tests including IMViC, sugar fermentation tests, catalase test and Nitrate reduction test. The comparative analysis of the water quality and spatial variation of Sandspit was done. Sandspit is influenced greatly by industrial waste water. Water samples from these sites were taken using systematic water sampling. The sampling point's closer to waste discharge indicated a higher incidence of total heterotrophic bacteria, coliforms, *Staphylococcus aureus*, *Bacillus* spp. and *Salmonella* spp. *Escherichia coli* and *Pseudomonas aeruginosa* were dominant in Sandpit's water samples. Chemical parameters such as COD, result indicates water bodies are being highly polluted with wastewater effluent of the city.

Keywords

Coastal water, Karachi, Sandspit, Microbes, heavy metals

Preparation of Anionic Functionalized Nanofibers for the Removal of Cations from Drinking Water

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Abstract

Heavy and organic factors are causing great contamination of water across the world, especially cations, being non-biodegradable in nature cause problems and can store in living tissues which might be a great threat to both human health and ecological atmosphere. Our main interest of research work was to remove cations from drinking water. Cellulose nanofiber, highly absorbency material, was selected in this study for cations removal. Cellulose acetate (CA) nanofibers (NFs) membrane was fabricated using electrospinning technique. In order to create anionic charge on fabricated membrane, sodium chloroacetate was used. The adsorption of cations (magnesium and calcium) on this membrane was carried out to determine removal percentage. Subsequently, flame atomic absorption spectrophotometer was used for the analysis of cations. The synthetic solution of cations was made separately to check removal efficiency. The optimal removal efficiency of magnesium was 85.86% and calcium was 75% at 25ppm. This membrane has quite high adsorption selectivity for magnesium. Optimal time was 60 minutes at 60mg adsorbent after that there was no significant difference on the removal of cations. The adsorption capacity amplified by increasing nanofibers weight and time. Scanning electron microscopy (SEM) and Fourier-transformer infrared spectroscopy

(FTIR) techniques were used to characterize nanofibers. SEM data revealed an average diameter of electrospun nanofibers around $433\pm 5\text{nm}$ after deacetylation. This nanofiber converted into cellulose nanofibers having an average diameter of $330\pm 5\text{nm}$. In addition, FT-IR spectra confirmed the conversion of cellulose nanofiber into anionic nanofibers. The adsorption behavior of cations can be well described by Langmuir adsorption model and maximum adsorption capacity of calcium and magnesium which was estimated to be 62.5mg/g and 60.6mg/g . Membrane can also be reused for further cations adsorption

Keywords

Electrospinning CA: Cellulose Acetate NFs: Nanofibers CANFs: Cellulose Acetate Nanofibers CNFs: Cellulose Nanofibers f-CNFs: Functionalized Cellulose Nanofibers Anionic

Removal of Arsenic from Water Using Chitosan Zerovalent Iron Nanofibers

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Abstract

Water is a champion among the most basic substances on earth. All plants and animals must have water to survive. In case there was no water, there would be no life on earth, Therefore the presence of arsenic (As) in drinking water has transformed into a significant general prosperity stress far and wide. Arsenic has been seen all around as the most destructive inorganic contaminant in drinking water. Water inception of Asian countries, including Pakistan, is among the most impacted ones for arsenic contamination. Several techniques to remove arsenic from water has been reported, electrospinning is one of the most widely used technique to produce nanofiber because electrospinning technique is very simple and low cost method. In this research, Chitosan/Fe³⁺ nanofibers were prepared in the solvent of trifluoro acetic acid through electrospinning process, used as an adsorbent, and then it was cross-linked using a desiccator containing vapors of glutaraldehyde for 24 hours. The nanofibers were having a smooth surface morphology and 90-110 nm in diameter after analysis on Scanning Electron Microscope. The nanofibers extricated mixes of arsenic from artificial arrangement of water. ideal capacity of Arsenic from water through nanofibers was assessed up to 83.6%. The Freundlich and Langmuir isotherms were estimated in this study, out of those, Freundlich fits well with the regression (R²) of 0.984 (98.4%) with the adsorption capacity of 1.137

mg/g. The pH demonstrated a noteworthy effect on the adsorption practicality, when it was attempted in various acidic and dissolvable ranges. The examination on FT-IR and SEM appeared on that the anions of arsenic were incorporated by the table of adsorbent of nanofibers. Thus, Chitosan nanofibers were adjusted and that supposedly was amazingly able for the launch of arsenic from water and it might effectively be used for the treatment of water against arsenic.

Keywords

Chitosan, Electrospinning, Adsorption, Arsenic

Accessing Microbiological Contamination, and Characterization of Antibiotic Resistant Enteric and Non-Fermentive Pathogens from Different Drinking Water Sources

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Abstract

Background: Safe and clean water is a basic need for humankind, but due to many accounts people didn't reach this basic need. According to the World Health Organization (WHO) about 30,000 people and children die every day from water-related diseases in developing countries plus the condition of developing countries become worse due to the overuse, misuse and poor wastewater treatment process so that these antibiotics become part of aquatic water system and phenomena of antibiotic resistance has raised due to this problem which became a big problem for the people facing many disease. So, it is imperative to assess the quality of drinking water to ensure that it is acceptable for human consumption.

Objectives: The main purpose of this extensive research was threefold:

1. To evaluate microbiological quality of drinking water according to World Health Organization (WHO) protocols
2. Isolation and characterization of various waterborne pathogens, particularly of Enterobacteriaceae e.g. E. coli, Salmonella, shigella, and others non-fermentative enteric pathogen.
3. To determine the antibiotic resistance profile of subject isolates of the present study.

Methodology: Microbiological analysis of water samples was performed by multiple-tube fermentation technique and total bacterial count of water samples was determined by Heterotrophic plate count method. Pre-enrichment process was used to grow non-fermentive and fastidious enteric

pathogens. The antibiotic resistance profile was determined by Kirby-bauer method according to CLSI Guidelines.

Results: According to the above-mentioned methodology 45.45% (n=5) of the R.O water plant samples (n=11) was free from Heterotrophic organisms, coliforms and fecal coliforms, whereas 54.45% (n=6) of samples was contaminated with heterotopic organism 54.54% (n=6), as well as 36.36% (n=4) coliforms and 18.18% (2) fecal coliforms. Whereas tap drinking water samples (n=330) and Well /bore water type (n=26) was contaminated with Heterotrophic bacteria 44.1% (n=149) and 96.15% (n=25), coliforms 44.8% (n=148) and 16.5% (n=16) and fecal coliform 38.1% (n=126) and 53.8% (n=14) with 3.7% (n=1) and 0.14% (n=1) fit for potable rate respectively. On the other hand bottled drinking water 27.7% (n=9) samples was fit and 72.7% (n=24) of samples contaminated with heterotrophs, 30.30% (n=10) coliforms and 21.12% (n=7) fecal coliforms. The most prevalent bacteria isolated from water samples was *Shigella* spp. (63 isolates), *Vibrio* spp. (45 isolates), *Pseudomonas* spp. (45 isolates), *E. coli* (52 isolates), Catalase negative *Enterococci* spp. (24 isolates) and *Staphylococcus* spp. (18 isolates). Antibiotic profiling of above isolates showed strong resistance to most commonly practice antibiotics such as Ciprofloxacin (CIP), Erythromycin (E), Carbenicillin (CAR), Ampicillin (AMP), Bacitracin (B), Imipenem (IPM), Chloramphenicol (C), Gentamycin (CN), Meropenem (MEM), Linezolid (LZD) & Tetracycline (TE).

Conclusion: This research suggested that our different water sources carry high loads of pathogens and non-pathogenic bacteria. These waterborne pathogens were multi-drug resistant. The majority of the samples did not fit for human consumption, e.g. washing, cooking or drinking. So, government officials, decision makers, researcher and other stakeholders should pay prompt attention to provide safe and pure water to public.

Keywords

Water safety, Heterotrophic bacteria, Multi-drug resistance, MPN, coliforms and fecal coliforms.

Measuring Safety Management System of Oil and Gas Industry in Sindh

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Abstract

Oil and Natural Gas industry is very sensitive due to its vulnerability towards accidents. A small mishap may cause a huge disaster in the industry. A small or large accident would cause loss of time and money, and there is a famous quotation that "Time is Money". There can be various reasons to initiate accidents in oil and gas industry. Their main examples are presented here. (1) Explosions and Fire. Well blowouts, drilling, tripping out and swabbing can release combustible gasses. Other hazards may be welding or cutting near combustible materials, failing to control or maintain ignition sources near the wellhead and detonating perforating guns above ground. (2) Falls. Workers frequently fall from elevated rig areas, plummeting from rig floor to grade or open ocean. In some cases, openings lacked safety structures, or safeguards failed to secure workers to the rig. (3) Being Struck. Workers are often struck by falling or moving pipes, tongs, spinning chains, kellys or rotary tables. Sometimes, high-pressure hose connections failed, allowing whipping hoses to strike workers. (4) Becoming Caught. Clothing and extremities like hands, arms, legs and feet are at high risk for entrapment. Specific hazards included collars and tongs, spinning chains, pipes, rotary tables and drill strings. However, any area where contact distances rapidly

shift or confine workers can prove fatal. (5) Electrocution. Salt water and many of the chemicals used in the extraction process are corrosive. Electrocution can occur with the simplest of tasks, such as encountering faulty or worn wiring while changing a light bulb, for example. (6) Chemical Exposures. Hydrogen sulfide is colorless, accumulates in poorly ventilated areas and is highly combustible. It is also extremely toxic, with delayed effects, including respiratory paralysis, irregular heartbeat, nervous system effects, collapse and death. Many incidents of exposure occur during drilling and gauging operations. And (7) Rig Collapse. When weights exceed rigs' rated capacities, structural overloads result. In some cases, rigs' guy wires or anchors are improperly installed. In still others, rig masts are raised or lowered improperly, or neglect degraded structural integrity. Gulf of Mexico oil spill in 2010, caused a loss of humans and economic value. These accidents occur due to mismanagement of safety in the industry. In this research safety management is measured for Sindh. Through literature survey 34 attributes are selected and a questionnaire was distributed. The authors received 41 responses, which helped in measuring safety management of Oil and Natural Gas Industry of Sindh.

Keywords

Health & Safety Management, Measuring Safety Management System, Oil & Gas Industry Management System

Development of Prototype Water Filter using Nanofiber Membranes

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Abstract

The basic goal of water treatment is to remove undesired particles and bacteria present in water to make able for drinking. Electrospinning is simple and successful technique for producing nanofiber membranes in the application of water treatment. In this research, a recent development in prototype water filter nanofiber membrane was installed in a cartridge and it uses as domestic purpose for filtration of water. Nylon-6 is selected for the preparation of nanofiber membrane for water filtration due to their excellent chemical and thermal resistance as well as high wettability. Nanofiber membrane was prepared by electrospinning process 22% solution concentration produced the average fiber diameter ranges 140 nm. 10.5 inch's nanofiber membrane is prepared and install into the cartridge then fixed into the filtration assembly and water is processed and analyses the water parameter before and after such as turbidity and bacteria's, the prototype will transform liquid water from membrane to remove undesired particles and were successfully in rejection more than 90% turbidity and bacteria's from tap water the overall results are also compared with the conventional filter but nanofiber membranes are found superior then conventional and including with this smooth morphology of nylon nanofiber was also observed and FTIR was also measured. Finally, a short feasibility study was conducted in order to use this type of proto type water filter for

domestic purpose in place of conventional filter that this new system will be more efficient and cheaper than conventional.

Keywords

Nanofiber, membranes, nylon-6, water filter, prototype.

Ground-water quality in Islamkot and Mithi talukas of district Tharparkar (desert region), Sindh Pakistan

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Abstract

Assessment of groundwater quality for crop use appeared to be very essential for management and utilization of precious natural water resources. This study reports the quality of 53 hand pumps located in the most remote areas of the desert region, viz. Islamkot and Mithi talukas of district Tharparkar. The water samples were collected during April 2016 (just before the start of rainy season). The water samples were analyzed for EC, pH, CO₃²⁻, HCO₃⁻, Cl⁻, Ca²⁺, Mg²⁺ and Na⁺ concentration. The sodium adsorption ratio (SAR) and residual sodium carbonates (RSC) were estimated using their respective formula. The categorization of water samples on the basis of their salt content clearly revealed that the water bodies of majority (65%) of the area was hazardous, while 25% area was marginal. It was seriously very alarming to know that only 11% water bodies of the area under study had usable irrigation water. Contrarily, on the basis of SAR and RSC the majority (89% and 77% respectively) of water bodies were found to be free from the sodicity hazard. The study concluded that salinity, and not sodicity was the major threat to the area under irrigation through these water bodies. It is, therefore, suggested that the salinity tolerant crops and their genotypes may be used in this area.

Keywords

Groundwater quality, desert area, Tharparkar

An Empirical Study on Waterborne Diseases Faced by the People of Jacobabad City

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Abstract

Waterborne diseases are caused by infected or contaminated water. Every year about 3.4 million people died by water related diseases worldwide. Jacobabad is the underdeveloped city of Sindh province, having population of more than a quarter of million (275,000 est.) and situated at the borders between Sindh and Baluchistan. The city has been deprived from the basic need of safe drinking water and people are using dirty, polluted, adulterated and infected water which is injurious for health. This phenomenon has become a major cause of waterborne diseases which people of Jacobabad are facing day by day. Considering such alarming situation, the present study was conducted in civil hospital, Jacobabad from July through September 2016. A written informed consent was taken among 439 patients who visited the hospital during study time. The main six waterborne diseases were observed likewise, Hepatitis A (38%), Typhoid (26%), Diarrhea (16%), Cholera (9%), Dysentery (8%) and Dracunculiasis (3%). From the above collected cases, females were in preponderance with 58.1% and males with 41.9%. The highest ratio of patients belonged to the age group of 21 to 30 years. The majority of the people was using water supplied by Donkey cart vendors which is highly polluted. Waterborne diseases can be controlled if water will be purified and safe for biotic life.

Keywords

Waterborne, Jacobabad, Contaminated, Hepatitis, Drinking water.

Analysis of water quality of MUET water treatment & distribution system by taking into account seasonal variations

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Abstract

This study was carried out to analyze the quality of water being supplied to MUET through its water Treatment and Distribution System (T&DS) by taking into account seasonal variations. This study also checked the performance of the MUET T&DS. The water for MUET T&DS is taken from K.B. Feeder canal which takes off from the river Indus at Kotri barrage. The quality of the intake water was observed to be mainly dependent upon the quality of the water in the river Indus. Parameters including temperature, total dissolved solids (TDS), electrical conductivity, pH, DO and turbidity were measured by YSI water logger and HACH 2100Q turbidimeter respectively on different sites of the water treatment and distribution network on weekly basis from May 2016 to April 2017. The sites in water treatment plant include K.B. Feeder intake point, the coagulation tank (in & out), slow sand filter and treated water storage tank in MUET treatment plant. On the other hand, MUET storage tank of distribution system, Environmental Engineering (EE) department and Institute of Water Resources Engineering & Management (IWREM) were selected in water distribution network. However, total coliforms were analyzed by membrane filtration technique in the department of EE, MUET, Jamshoro by collecting water samples from GM Syed Hostel, Latif Hostel, Post filter tank, Inlet WTP, Outlet WTP, IWREM, IEE and ORIC in the month of November and December 2016. The current water treatment system does not offer adequate disinfection as was proved from positive results obtained

after analyzing samples for Total coliform. The average values of temperature are exceeding the WHO limit at all locations except slow and filter and post filter storage tank. The average values of turbidity at all selected locations is exceeding limit set by WHO i.e. 5 NTU. From all locations turbidity is maximum at intake (KB feeder) which shows the source as full of turbid material. The mean of pH values at locations is above 8 but is still lies within standard limit i.e. 6.5-8.5. The total dissolved solids content of slow sand filter is exceeding WHO limit, i.e. 500 mg/L. However, it is below limit at all other locations. Dissolved oxygen in water is considered good when it is above 4 mg/L as set by WHO, at all selected locations DO is above 4 mg/L. Thus, the results show that there is need of comprehensive monitoring along with efforts to ensure compliance with the standards set by WHO.

Keywords

MUET, Water quality analysis, Water treatment and Distribution network.

Analysis of Water Consumption and Conservation Measures in Academic Building in Pakistan

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Abstract

The building construction industry contributes substantially towards the exhaustion of the most of natural resources and water is one of them. In cities and towns, water resources are under increasing pressure due to population growth, waterway degradation, climate change and droughts. The increased amount of energy and advanced technologies are required to fulfill the per capita water demand for human needs. Likewise, unsustainable water use in buildings during its operational phase augmenting water resources consumption and degradation. In order to reduce resource consumption and harmful environmental impacts, green building construction is being promoted. Water conservation is one of the important components in the design of green buildings to save water and satisfy the increased demand for water. United States (U.S.) green building reference guide rating system contains 11 points out of 110 points for water efficiency for building design and construction. Considering these facts, this study aims to analyze water consumption in the institutional building during the operational phase in the city Jamshoro. Water consumption by occupants during working hours has been assessed. Two scenarios were developed to assess and calculate water use in existing infrastructure and then compared with criteria provided by Leadership in Energy and Environmental Design (LEED). It has been observed that currently, no any proper provision is provided for water reuse or recycling and ordinary water consumption reducing fixtures are used. Results show that 33.50% of total consumed water can be saved by using LEED design and construction criteria. Grey water reuse and reducing indoor potable water consumption

in the building can help to conserve water. Such water usage systems will not only help to reduce energy cost, but also contribute positively toward ensuring future availability of resources and improve environmental performance.

Keywords

Building operation; water conservation; water efficient techniques; green building; environmental

Assessment of Water Balance for Keenjhar Lake Located in Thatta Region Sindh, Pakistan

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Abstract

Seemingly, since two third of the surface of the earth is covered with water, it is obvious that water is one of the most vital elements necessary for the survival of life on earth. Accessibility of fresh water is a domestic issue. Rapidly growing population, expansion in irrigational area, development in urbanization and industrialization are putting enormous stresses on water resources, resulting in water scarcity. Keeping in view the importance of water, this study analyzes Keenjhar Lake one of the largest fresh water lakes in Asia. The main components, such as water balance of rainfall, inflow, outflow and evaporation of water from the lake were studied. The result of lake water balance revealed that the contribution of direct rainfall and the annual inflow components to the lake were 22.03% and 77.91% respectively whereas, evaporation, outflow water abstraction to K.G. canal constituted about 5.78%, 92.55% and 1.57% respectively of the total annual outflows to the lake.

Keywords

Keenjhar Lake; Inflow; Outflow; Water balance

Effects of Flooding on Changes in Eh, pH and Solubility of Cu and Zn

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Abstract

Soil pH and Eh (redox potential) play an important role in decreasing the concentration of Cu and Zn in paddy soils. To assess the effects of flooding and application of Cu and Zn coated urea on changes in Eh, pH and solubility of Cu and Zn in soils a glass house experiment was conducted at Universiti Putra Malaysia. Rice plants (30 days old seedlings of variety MR-219) on two soils (riverine and alluvium) were transplanted. Nine treatments consisting of variable rates and combinations of Cu and Zn coated urea were applied. The sources of fertilizers were copper sulfate and zinc sulfate. Eh values decreased with flooding time in both soils. The changes of Eh values were more negative in control treatments and stabilized after 3 weeks of submergence. The Eh changes were not so large in the treated soils. Soil pH increased with flooding time. During the 3rd week of submergence, pH increase was about to be neutral (pH 7.0 and above). In both soils, Cu and Zn treated soil showed lower Eh and higher pH values compared to untreated soil. Concentration of Cu and Zn in soil solution decreased with flooding. The concentration of Cu and Zn in soil was higher in treated soils than in the untreated soil. Reduced solubility of Cu and Zn in control treated soils were related to larger changes of Eh and pH values in these soils. Mean comparison with Tukey's test showed that Cu and Zn solubility decreased with decreased Eh and increased pH in the soil solution ($p < 0.05\%$).

Keywords

Redox potential, Submergence, Acidic soils, Paddy, Coated urea.

Preparation of Activated Carbon Nanofibers for the Removal of Cationic Dye from Aqueous Solution

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Abstract

This work demonstrates the preparation of Polyacrylonitrile (PAN) based activated carbon nanofibers (ACNFs) through electrospinning followed by thermal treatment. Resulted activated carbon nanofibers having diameters in the range of 90-150 nm were then examined for the adsorption capability of cationic dye from aqueous solution. Batch mode experiments were carried out at room temperature to study the effect of amount of nanofiber, contact time and pH on dye adsorption. Morphology and structure of PAN nanofibers and ACNFs were characterized by scanning electron microscopy (SEM), Fourier transform infrared spectroscopy (FTIR).

Keywords

Carbon nanofibers; Cationic dyes; Methylene Blue; Water treatment.

Comparison of Inoculum Type on the Biogas Potential of Wheat Straw at Lower and Higher Organic Loading Rate

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Abstract

Inoculum plays a vital role in providing initial microbial population in anaerobic process. There is unavailability of standard inoculum in the region and available inoculums require pretreatment (dewatering, sieving, and pre-incubation), uncontrolled feeding may lead process failure in a short period. Thus, in this study, the effect of inoculum type (digested manure and acclimatized sludge) at lower (2gVS/L) and higher (10gVS/L) organic loading rate on the biogas production of wheat straw was evaluated. For this purpose, Biochemical Methane Potential (BMP) assays were conducted in 300 ml serum bottles, all the bottles were filled with the known amount of substrate and inoculum at 1:1 on volatile solid basis. Bottles were sealed with rubber stopper and aluminum cap, headspace flush with nitrogen gas to ensure anaerobic condition, and placed in an incubator under mesophilic condition. Digested manure and acclimatized sludge were collected, sieved through a 2mm sieve for the removal of bigger organic particles and incubated under mesophilic and anaerobic conditions for 14 days before being used as inoculum. A higher biogas yield of 599 ml/gVS was observed from wheat straw with digested manure as compared to other inoculum was 397 ml/gVS at 2gVS/L. Highest volatile solid removal 70 % was observed from the wheat straw inoculated with digested manure at organic loading rate 2gVS/L. Reactor inoculated with digested manure showed better buffering capacity in terms of pH, as final pH was 7.1 as compared to acclimatized sludge. Reactors inoculated with digested manure have optimum carbon to nitrogen ratio as compared to acclimatized sludge. Further, the results of

the study will be useful to manage agricultural by-products (wheat straw) judiciously.

Keywords

Biochemical Methane Potential, Digested manure, Inoculum, Sludge, Organic loading rate, Wheat straw.

Assessment of Biomedical Waste Management in KP Public Hospitals: An Ignored and Emergent Public Health Problem in Pakistan

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Abstract

Public sector hospitals in KPK breed substantial quantity of Bio-Medical Waste (BMW) per day (0.5 to 2.5 kg/bed/day). These wastes include Risk Waste (75%) and Non-Risk Waste (25%) which influence directly and indirectly the health of serving doctors, patients and hospital administration with a very sturdy pessimistic impact on our green environment and aquatic life. Hence this generated medical waste should be treated properly before it affects human and our green environment. This study aims to investigate the Common Bio-medical Waste Treatment Facility (CBWTF) of some hospitals with deep study of the biomedical waste generation, collection, storage and disposal situation of the hospital. Appraisal in this regard was done via detailed questionnaires, interviews, meetings, discussions, site visits and participant pragmatic approach. These studies divulge that biomedical waste were collected manually in all hospitals without proper training and without any precautionary measures and were then burned, dumped, entombing or mixed with municipal wastes. The incinerators of the most hospitals were found ill-functioning. From the mentioned study it can be concluded that proper and friendly strategy should be employed for the secure removal of biomedical waste.

Keywords

Hazardous Waste, Sustainable Environment, Bio-Medical Waste (BMW), Common Bio-medical Waste Treatment Facility (CBWTF), Hospital Waste Management.

Consumption of Groundwater of Taluka Matiari as Drinking Water, With High Salts, Fluoride and Arsenic Contents and Their Possible Effects

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Abstract

The groundwater is frequently used for drinking and irrigation in Matiari. A total number of 37 groundwater samples were collected from different locations of Matiari mostly used for human consumption. The water samples were collected from hand pumps, motor pumps and one sample from the water supply scheme. The water samples from Matiari were analyzed for physico-chemical parameters such as pH, EC, TDS, salinity, DO, COD, total hardness, cations Na, K, Ca, Mg, anions SO₄, Cl, alkalinity, orthophosphate (P), total phosphate (P), nitrate nitrogen (NO₃-N), nitrite nitrogen (NO₂-N), heavy metals Fe, Co, Mn, Cr, Ni, Cd, Cu, Pb and toxic elements F and As. The analysis of water samples shows that not all samples comply with WHO limits for the parameters measured. The arsenic 35% and fluoride 27% samples were higher than permissible limits of WHO. The samples were also examined for Correlation matrix, Piper diagram, cluster analysis and Principal Component Analysis. Piper diagram indicated most water samples is rich in mixed Ca-Mg-Cl and Ca-Na-HCO₃ type water. In principal component analysis four principal components were extracted that were accounted for 85.908% of the cumulative variance in the data set. The calculated parameters for irrigation such as Sodium Adsorption Ratio (SAR), Sodium Percent (%Na), Kelly Index (KI), Revelle Index (RI), Permeability Index (PI), Residual Sodium Carbonate (RSC) and Ion Exchange Process indicated most samples of Matiari were suitable for irrigation.

Keywords

Groundwater samples, Physico-chemical characteristics, water quality, cluster analysis, principal component analysis, Matiari.

High Concentration of Fluoride and Salts in Groundwater of Populated Villages of Taluka Qamber of District Qamber-Shahdadkot

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Abstract

The study investigated the water quality of groundwater of taluka Qamber. The collected samples were analyzed for electrical conductance, total dissolved salts (TDS), salinity, pH, dissolved oxygen (DO) cations Ca²⁺, Mg²⁺, K⁺, Na⁺, and anions Cl⁻, SO₄²⁻, total Phosphate-P (T.PO₄³⁻ -P), ortho Phosphate-P (O.PO₄³⁻ -P), NO₃⁻-N, NO₂⁻-N, alkalinity and hardness, heavy metals Cr, Mn, Fe, Co, Ni, Cu, Cd, Pb and a toxic element arsenic fluoride by using standard analytical procedures. Representative 21 groundwater samples were collected mostly used for human consumption. According to the research work 81% samples were not suitable for drinking purpose with TDS above than the maximum permissible limit of WHO (1000 mg/L). The concentration of pH, total Phosphate-P, ortho Phosphate-P, Nitrate-N, Nitrite-N and arsenic were within WHO limits. The concentration of essential metals more than half samples were higher than WHO guideline, but the concentration of fluoride in 81% were higher than permissible limits. For irrigation water quality determined on the basis of Kelly index (KI), sodium percentage (Na%), Chloride sulphate ratio, sodium adsorption ratio (SAR), permeability index (PI), Chloro alkaline indices¹ (CAI-1), residual sodium carbonate (RSC), and Chloride bicarbonate ratio indicated a majority of samples were suitable for agricultural and irrigation purposes.

Keywords

Groundwater, high fluoride, high salts, physico-chemical properties, irrigation, qamber.

Air and noise pollution and odor control

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Abstract

This study examined the problem of air and noise pollution and odor control with respect of its ill effect on the environment and life of human beings. Civil hospital, traffic zone (NIPA, Tibet Centre, Gul Plaza, M.A. Jinnah road, and Saddar), residential area (Gulshan-e-Iqbal), and industrial zone (S.I.T.E.) were selected for the study area to monitor the air and noise levels. The observed noise level at Civil hospital was above the threshold level (more than 35dBA) in any time. The ambient air quality, noise levels (AAQNL by AAQNS) for commercial zone and most of the values were found in the range of 95+10 dBA, among which 80% values were found in the range of 120 + 10 dBA. The AAQNL were alarming, indicating the impact of vehicular traffic. Statistical analysis was computed for mortality rate due to respiratory diseases from the recorded death during last twelve months. A wide range of symptoms are observed in people exposed to offensive odor including respiratory problems, vomiting, nausea, drowsiness, fatigue, eye complaints, nose and throat irritation, hoarseness, headache, diarrhea, chest tightness, nasal congestion, palpitations and shortness of breath. The data was collected from the vendors and residents exposed to the offensive odor for more than 10 hours by using a structured questionnaire blended with suitable open-ended questions. In industrialize city like Karachi offensive smell are yield by industrial plants, sewage systems and waste water processes of municipal and industries, livestock farms also contribute in producing the annoying odor. Odors in humans are perceived by chemo receptors in the olfactory epithelium, located in the nose. Unpleasant odor, especially in the densely populated area not only creates a significant harmful impact on human health, but also affect their memory. Simply smelling an odor is not a nuisance; therefore, in most cases single, mild, short-lived odor events are not considered nuisances. However, if the same event

is not short-lived, even a mild odor could be considered a nuisance. There is a dire need to recognize our responsibilities of a developing country and its time to play our role in reducing the air and noise and eliminate objectionable odor from our surroundings. On the other hand, governing authorities should take a step in implementing laws and regulation to maintain an environment where every citizen can enjoy basic environmental condition in order to live a healthy life, obviously with peaceful mind.

Keywords

ambient air, AAQNL, AAQNS, mortality rate

Environmental Impacts of Drilling fluids and Cuttings from the onshore oil wells of Lower Indus Basin of Sindh

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Abstract

The process through which drilling fluids, drilling mud, well cuttings and other toxic chemicals have contributed a lot in environmental pollution in Lower Indus Basin of Sindh. Experimental study has carried out by taking samples of different diameter and length in size and in dimensions from an XYZ field of the Lower Indus Basin. Well blow out and contact of fresh water on aquifers oil bearing sand has been made real challenge to produce brine products with oil and gas and it has added a lot of pollution but there is an acceptable method to dispose of this polluted water. Subsurface injection of oil field wastes provides a good method for disposal of water pollutants. It has been observed that fluid cuttings have an environmental effects and leave a toxic impact to their surface and surrounding environment their traces of contaminants of oil cannot be visualized easily because of the formulation of original mud cuttings provides an oleophilic surface of the cuttings and the subsurface. Such traces concept establishes its relevance to the environmental land pollution due to presence of such traces of oil the land cannot be fertile and furthermore, these cuttings bring saline water and in this way land pollution will be taken place. The study found that drilling mud and cuttings are toxic to human life in terms of water, fruits, vegetables, etc. because of the presence of such toxic traces arsenic will be generated in vegetables and fruits. Due to organism's behavior of the sedimentation process and bacterial decomposition within the cuttings piles anoxic conditions will also be developed. The result has shown a detailed sensitivity mapping and data collection to prepare for comprehensive site- specific guidelines for disposal in the Lower Indus Basin.

Keywords

Drilling fluids, Lower Indus Basin, Pollution, Toxic Chemicals

Highly Efficient Electrospun Nanofibers for Dye Removal Application

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Abstract

Development of green method for controlling dye pollution in water is currently a challenging issue. Most of the methods reported are either expensive or inefficient to meet the standard quality of usable water. Therefore, we attempt to prepare highly efficient and environmental friendly nanofiber membranes for the removal of anionic dyes through batch adsorption method. These nanofibers proved to be promising adsorbents as they required minimum adsorption time of 25 minutes, normal working pH, ambient temperature and minimum adsorbent dosage upto 25mg. The adsorption data fitted well with the pseudo-second order.

Keywords

Nanofiber, adsorption, purity

Synthesis and Characterization of L-Cysteine Capped Silver Nanostructures

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Abstract

This study reports the eco-friendly, facile and rapid synthesis of nonporous hollow water soluble L-cysteine capped silver nanostructures (L-CSY-AgNSs) in aqueous media. The formation of these AgNSs was carried out within few minutes (less than 5 min) of reaction at room temperature by green chemical method (without heating, hazardous organic solvents). These colloidal silver nanostructures were characterized by various characterization techniques including UV-Visible (UV-Vis) Spectroscopy, atomic force microscopy (AFM), scanning electron microscopy (SEM), Zeta potential analyzer (ZPA) and Energy dispersive spectroscopy (EDS). Firstly, the plasmon resonance band of AgNSs was observed at 392 nm using UV-Vis spectroscopy that confirmed the initial formation of L-CSY-AgNSs. AFM and SEM images confirmed the formation of smallest hollow porous distributed NSs having a size distribution in the range of $\geq 40 \pm 5$ nm. These Ag porous nano structures were highly stable for more than two months when stored at ambient temperature. The zeta potential study has confirmed the charges on AgNSs with good stability. EDS further confirmed the 80-90% intensity percentage of the silver element with a combination of the amino acid at atomic scale levels. This finding is a novel, eco-friendly and economical alternative for environmental safety against water pollution and extendable for control of other reducible contaminants like (microbes) in waterborne diseases.

Graphical Representation:



Keywords

Silver nanostructures; L-Cysteine; Electron microscope techniques; X-ray diffraction.

Evaluation of Oxy-Fuel Technology for NO_x Reduction, Carbon Capture and Sequestration for Thar Coal

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Abstract

Greenhouse gasses are one of the major concerns throughout the world due to their prominent role in global climate change. The Carbon Capture & Sequestration (CCS) is a promising solution to control anthropogenic carbon emission from power plants. CO₂ emissions from power plants can be converted into useful products. Oxy-fuel technology is a promising technology to reduce NO_x, with additional unit of CCS. In Oxy-fuel combustion, increased percentage of oxygen is provided to completely burn the fuel. The CCS cost decreases due to decrease in amount of the flue gasses and increased concentration of the CO₂. Consequently, the size of flue gas treatment system is reduced. It limits the NO_x formation and eliminate the need of its treatment, making the cost of NO_x treatment equipment and air separation unit (ASU) comparable. In this study, the numeric-simulation based analysis is done to get the theoretical emphases & analyze the benefit of using Oxy-fuel in combustion for coal. The decrease in the size of the flue gas treatment system is observed along with the flue gas condensation for carbon capture and sequestration. Thar coal is used as a fuel to theoretically calculate the flue gas volume and composition and the size of the flue gas treatment equipment. The process is simulated using ASPEN HYSYS software. The result shows that, due to the presence of N₂ in the flue gas, heat losses are up to 69% and in the absence of N₂, treatment equipment of the flue gas is reduced to 1/3rd. The comparison between the air-combustion and Oxy-fuel-combustion technology indicate the benefits of using Oxy-fuel to reduce the anthropogenic carbon emission from coal fired power plants.

Keywords

Oxy-fuel, Thar coal, power plant, NO_x reduction, Carbon capture and sequestration

Assessment of Heavy Metals Contamination in Drinking Water Treatment Plant MUET Jamshoro

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Abstract

In the present study, we have determined the traces of heavy metals such as zinc, copper, iron and chromium (Zn, Cu, Fe and Cr) in different stages of water quality such as source, MUET water treatment plant and distribution system. The water samples were coded as S1 (KB Feeder / Intake), S2 (Sedimentation Tank Outlet), S3 (Post filtration), S4 (MUET Storage) and S5 (IWRM) respectively. The pre-concentration of water samples were analyzed by atomic absorption spectroscopy. The average values of Fe, Zn, Cr and Cu were determined in different water quality samples coded as S1 (261.9, 7.983, 1.8, 2.125 $\mu\text{g/L}$), S2 (181.6, 13.61, 1.225, 1.833 $\mu\text{g/L}$), S3 (309.4, 2.233, 0.667, 1.333 $\mu\text{g/L}$), S4 (410.2, 6.325, 1.158, 1.6 $\mu\text{g/L}$) and S5 (329.2, 6.791, 1.966, 3.7 $\mu\text{g/L}$) respectively. The data obtained in this study were compared with reference to world health organization (WHO) water quality guidelines and indicated moderate-to-high pollution by some trace metals. The environmental pollution caused by the trace heavy metals is a long-term and irreversible process. The concentration of Zn, Cu, and Cr are under WHO and national environmental quality standards (NEQS) guideline limits, but average Fe values exceed the WHO and NEQS guideline limit. The average concentration of Fe was exceeded in sample location S3, S4 and S5 from 309.4, 410.2 and 329.2 $\mu\text{g/L}$) as compared to NEQS and WHO guideline limits.

Keywords

KB Feeder, Trace heavy metals, Water quality

Synthesis of PAN and Fe₂O₃ Composite Nanofibers for Lead Removal from Synthesized Water

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Abstract

The scope of this research is to remove lead metal ions from synthesized water. Lead is known for its toxic and non-biodegradable behaviour. The consumption of lead contaminated water is one of the major threats the world is facing nowadays. In this study, Polyacrylonitrile (PAN) and Ferric oxide (Fe₂O₃) composite nanofiber adsorbent was developed. The synthesis was done by a simple and scalable process of electrospinning. The nanofibers thus obtained were characterized and were analysed for their adsorption capability of Pb ions. The diameter, crystallinity, composition of the electrospun fibers were checked using different characterization tools, including; Scanning electron microscope (SEM), X-ray diffractometer (XRD) and Fourier transform infrared spectroscopy (FTIR). The nanofibers had diameter in the range between 300-700 nm. The adsorption capability of the PAN and Fe₂O₃ nanofibers for lead ions was analysed using the Flammable atomic absorption spectroscopy. The amount of metal ion adsorbed was influenced by the initial metal ion concentration, the amount of time the adsorbent was in suspension, the amount of nanofiber and the pH of the solution. The adsorption study was essentially a batch mode adsorption study. The adsorption data was checked for a different adsorption isotherm model and the adsorption kinetic study was also conducted. The data well fitted with pseudo second order and Freundlich adsorption isotherm model. The results showed that the PAN and Fe₂O₃ composite nanofibers are

effective in removing Lead ions from synthesized water. The nanofibers showed the high adsorption capability and strong affinity towards lead metal ions.

Keywords

Nanofibers, electrospinning, Lead, Adsorption, Polyacrylonitrile, Fe₂O₃

Treatment of Domestic Wastewater by Sustainable Microbial Fuel Cells having an Inexpensive, Reliable and Recyclable Anodes

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Abstract

Treatment of wastewater by using Microbial Fuel Cells (MFCs) have been proven as a promising but challenging technology so far. Researchers are coming up with different techniques every time to overcome the bottlenecks in this technology. One of the current issues is fouling of the electrodes which is hindering its commercialization. Depositions on electrodes reduce the working efficiency of the cell. In such cases, material selection of electrodes plays a significant role. The electrodes must be low-priced, noncorrodible, reliable and reusable. This research deals with the designing and fabrication of a single chamber MFC with an inexpensive, recyclable material (acrylonitrile butadiene styrene substrate, ABS) used as a node to treat the domestic wastewater. Activated carbon air-cathode was used where a biofilm was developed. The Current and voltage across the cell were measured with a Multi-meter. The efficiency of the fabricated single chamber MFC was checked by measuring the instantaneous Chemical Oxygen Demand (COD) and power generation with the utilization of organics in the wastewater. A current density of 67.5 mA/m² and power density of 1.6 mW/m² was generated in a single chamber microbial fuel cell having a hydraulic retention time of 48 hours. The COD reduction varied from 51% to 60%, which proved the existence of exoelectrogens in the domestic wastewater. These bacteria can be identified and used as inoculum in future studies to obtain high COD removal rate in treating the same domestic wastewater. The experiment also showed the successful application of carbon nanotube-based conductive paint polymer support as a node in treating the domestic wastewater. However,

the performance decreased gradually due to the deposition of inorganic on the cathode which can be studied further in future. Moreover, the design of this new anode could be studied in future to maximize the surface area for microbial colonization to obtain more power output.

Keywords

Microbial Fuel Cells, Anode material, Carbon nanotubes conductive paint, Polymer support, Air Cathodes, exoelectrogens

Maximizing the Production of Biogas by Varying Total Solids Concentration through Pilot Scale Anaerobic Digester

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Abstract

Increasing trends in population throughout the world, especially in this particular region, results to escalation in consumption rate of non-renewable resources of energy, which causes the emission of greenhouse gases; consequently, there is an upsurge in global warming and climatic change. In order to overcome these issues and compensate the future energy demand; production of biogas from the common domestic waste buffalo dung is one of the greatest renewable energy sources. In this particular study, a Pilot Scale experimental work was conducted, in which substrate (Buffalo dung) was used for anaerobic digestion process, whereas the production of biogas was analyzed as the function of buffalo dung to water ratio. For the experimental work, continuous anaerobic digester was designed and fabricated in which different ratios of buffalo dung to water were used to analyze the maximum production of biogas for 35 days, at the hydraulic retention time 20 days of the anaerobic digester treating buffalo dung and 15 days of production. As per readings the biogas 225.56 N L/g VSloss was produced from the ratio of 1.0 buffalo dung to the water, followed by 266.7 N L/g VSloss from the 2.33 buffalo dung to water ratio. Hence it was then observed that the maximum biogas i.e. 266.7 N L/g VSloss was produced from the 2.33 buffalo dung to water ratio.

Keywords

Biogas, Buffalo Dung, Water Ratio, Digestate

Chloride and Sulfate Ions Removal from Aqueous Solution Using Quaternized Cellulose Nanofibers: Adsorption Properties and Selectivity Towards Monovalent and Divalent Anion

Authors: Muhammad Muqeet¹, Zeeshan Khatri², Hammad Malik¹, Farooq Ahmed², Rasool Bux Mahar¹, Krista Carlson³

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Abstract

The purpose of this study examines the removal efficiency of two major anions present in natural waters through quaternized/cationic cellulose nanofibers (c-CNFs) membrane via batch adsorption method. Although various materials have been reported for the same purpose, but electrospun cellulose nanofiber membrane functionalized with 3-chloro 2 – hydroxy propyl tri - methyl ammonium chloride (CHPTAC) was reported first time in this study. The Scanning Electron Microscope (SEM) and Brunauer – Emmett – Teller (BET) surface area and porosity analyzer were used in order to analyze the surface morphology and specific surface area respectively. The results showed, average fiber diameter around 280 ± 10 nm evaluated through ImageJ software and specific surface area in the range of 4.9 to 15.2 m²/g respectively. In addition, success of chemical modifications examined by taking Attenuated Total Reflection - Fourier Transform Infrared (ATR-FTIR) spectra. FTIR results confirmed the successful conversion of cellulose acetate nanofibers (CANF) to cellulose nanofibers (CNF) and their cationization. Adsorption study was supported out as a purpose of contact-time, initial-concentration, pH and mass of adsorbent. Experimental adsorption data revealed, c-CNFs were more selective towards sulfate ions, as we obtained better adsorption results i-e 0.63 mmol of SO₄²⁻/g of adsorbent

corresponding to 62% removal. Turbidimetric method (for sulfate) and titration with silver nitrate (for chloride) were employed for the determination of residual concentration. Beside this, validity of experimental data was analysed through isotherm and kinetic modeling. Langmuir and Freundlich adsorption - isotherm models were employed and kinetic models include: pseudo - first order, pseudo - second order and intra particle diffusion kinetic models. Data analysis showed, the Langmuir isotherm model fits well. Moreover, experimental data followed the pseudo-second order kinetic model as we obtained higher R² value.

Keywords

Nanofiber, cellulose, adsorption, chloride, sulfate

Application of Surface-Functionalised Plasmonic Nanoparticles in Water Quality Monitoring

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Abstract

To prevent contaminates from producing catastrophic environmental damage, efficient detection protocols are the first steps to rapidly initiate the remedial strategies. Unlike, the conventional techniques, such as GC-MS, ICP-MS and AAS, which are time consuming and lab-based approaches. The use of plasmonic nanostructures ensures a promising avenue for the development of simple, sensitive and cost-effective sensor with the potential for on-site detection. In this regard, the present study describes the application of copper nanoparticles (Cu NPs) as an efficient LSPR based sensor for the colorimetric determination of mercuric (Hg²⁺) ions in aqueous system. To ensure selectivity the nanoparticles were the surface functionalised with L-cysteine (Cyst) molecules. The Cyst-Cu NPs demonstrated very sensitive and selective colorimetric detection of Hg²⁺ ions in the range of 0.5×10^{-6} to 3.5×10^{-6} mol L⁻¹ based on decrease in LSPR intensity as monitored by UV-Vis spectrophotometer. The developed sensor is simple and economic in contrast to those based on precious metal nanoparticles and sensitive to detect Hg²⁺ ions with detection limit down to 4.3×10^{-8} mol L⁻¹. The sensor developed in this work has a high potential for a rapid and on-site detection of Hg²⁺ ions. Moreover, the sensor was successfully applied for the assessment of Hg²⁺ ions in real water samples, collected from various locations of the Sindh River.

Keywords

Copper nanoparticles, L-cysteine, colorimetric sensor, mercuric ions, amino acid.

Landcover Changes in Peshawar Using Remote Sensing & Gis

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Abstract

Landcover means the physical features on the surface of the earth, such as vegetation, forests, agriculture, water bodies, barren lands and built up areas by humans. Information on land use and Landcover change due to human activities helps in assessing impacts on the environment and devising mitigation strategies. Population growth has exerted tremendous pressure on Landcover as water bodies, vegetation is converted into built up areas particularly in urban regions. Peshawar is the capital city of Khyber Pakhtunkhwa, Pakistan. It is located 34.01 latitude and 71.58 longitude and it is situated at elevation 340 meters above sea level. Peshawar has a population of 1,218,773 making it the biggest city in Khyber Pakhtunkhwa. Peshawar features a semi-arid climate, with very hot summers and relatively cold winters. The city has experienced rapid urbanization over the past years due to urban sprawl. Landsat 7 Enhanced Thematic Mapper at a spatial resolution of 15m of 2001, 2007 and 2015 were used for land use/cover classification. Images of 2001, 2007 and 2015 were used to study the behavior of Landcover change using ERDAS Imagine and ArcMap. Various graphs were plotted to quantify and observe the Landcover changes in Peshawar. Vegetation and water bodies have converted into built up areas over the years.

Keywords

Landcover, land use, GIS, classification and Landsat.

Determination of Groundwater Quality Using Electrical Resistivity Survey

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Abstract

Groundwater is an important source of drinking water, especially in the areas where the surface water is scarce, or where surface water sources are polluted due to agricultural or industrial effluents. Community in the environs of the Manchar Lake is one of the examples. This study was carried out to explore the potential sites in the surroundings of Manchar Lake where good quality of groundwater can be obtained for drinking purpose. An electrical resistivity survey (ERS) was conducted at twenty-one sites in shallow depth grid (5 x 5 km²) by adopting Schlumberger electrode array configuration with a maximum spacing of 300 m in the current electrode (AB/2) and 20 m in the potential electrode (MN/2). The data was collected with the aid of the ABEM terrameter SAS 4000. The quantitative interpretation was done by using the IX1D resistivity software. ERS findings were verified by analyzing water samples collected from trial bores, made by the hand percussion method at three sites out of twenty-one. The trial bores were made up to 100 ft. depth and water samples were collected at an interval of 10 ft. depth from all trial bores. The collected water samples were analyzed for electrical conductivity (EC) and total dissolved solids (TDS). The results of this study revealed that, except site no.13 and 19, all other sites do not have a good quality of groundwater at any depth which can be used for drinking purpose. From the water analysis, it is also clear that the water at site 1, 3 and 7 where trial bores were made showing the saline quality of groundwater which indicates that the ERS findings are valid. However, at site 13 (Goth Haji Daad M.Rind Baloch) sand, sandy clay and clay layers are identified as first, second and third layer respectively. The first layer of site 13 lies in high

resistivity zone which indicates good quality of groundwater up to 3 m depth. At site 19 (Near Pir Baber Sher village, UC Jhangara-Bajara to Pir Babar Sher village) total four layers are identified in which top two layers lie in high resistivity zone whereas third and fourth layers lie in medium and low resistivity zone respectively. The first two layers of site 19 indicate the presence of good quality of groundwater, which can be obtained for drinking purpose by the installation of tube wells and hand pumps. The conclusion of this study shows that the quality of groundwater in the surrounding of Manchar Lake is not suitable for drinking in shallow depth because it is saline as obtained from this study. However, such study must be carried on in deeper depth by increasing the space between the current electrodes and made enough trial bores to validate ERS findings. In addition, other parameters which are necessary to find water as fit for drinking or not must also be analyzed.

Keywords

Manchar Lake, groundwater quality, electrical resistivity survey

Application of GIS and Remote Sensing for Flood Management: A Case Study of Larkana Division

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Abstract

Floods are among the most devastating events in nature; they cause a huge amount of damage to infrastructure, crops and they destroy many lives. Pakistan has faced several cycles of destructive floods in its history. It is difficult to control a flood. However, if the excess water is managed properly, then the extent of the flood and its damages can be reduced. Integration of a Geo Information System (GIS) with remote sensing data gives sufficient knowledge for many hydrological studies, including; flood prediction, generating drainage lines, highlighting flood risk zones and more effective flood management. The information extracted from digital elevation models with the help of ArcGIS software is the most helpful for making flood risk maps. In this paper flood-risk maps are generated for the Larkana Division by using digital elevation models employing the GIS approach. Depending on the elevation of the entire area, three risk zones are categorized: low, medium and high. The analysis shows that the most vulnerable site in Larkana Division is Shahdadkot. The results also indicate that some of the western locations in Jacobabad and the southern part of Larkana Districts are at high risk of flood damage.

Keywords

GIS-Remote Sensing-Damage assessment –Flood monitoring.

Manufacturing of Count 10Ne Carded Yarn for Making Jeans on Ring Spinning Frames using Recycled Useable Waste through Waste MSnagement skills

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Abstract

This paper illustrates a new method for manufacturing yarns using recycled usable wastes like as Pneumafil, roving waste, Ring bonda, Dirty cotton, Card Fly, carded sliver, drawn slivers, and Various types of cotton waste materials, such as manufacturing by-products and post-consumer material is used in conjunction with virgin yarns to produce recycled yarns of sufficient quality to be used for garment manufacture.

As the textile, apparel, fashion, and retail industries move to become more sustainable, an area of interest is the use of recycled fiber, yarn, fabric, and product content in the development and production of new products. The decision to use recycled materials in products must occur during design and product development and continue throughout manufacturing processes. In this research paper, count of 10Ne was made on Ring spinning frames from the recycling of useable wastes instead of selling in a market. All Yarn quality characteristics were determined on UT-4.This research is totally based on economic growth of the textile spinning industry.

Keywords

Useable waste, UT-4, Ring Spinning frame.

Health Impacts Assessment of Manchar Lake Degraded Water Quality

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Abstract

Access to safe drinking water is one of the basic human rights and essential for human health. Many freshwater lakes in Pakistan are the source of drinking water to the communities living in the surrounding areas. The contamination in these lakes due to increase in population, direct discharge of agricultural waste, untreated sewage and garbage into the lake water systems and absence of adequate sanitation facilities in the peripheral settlements has led to severe health hazards. The aim of this study is to assess health impacts of Manchar Lake degraded water quality on people of the neighborhoods that are directly or indirectly dependent on the lake for their livings. For this purpose, the data was collected through questionnaire surveys using stratified random sampling technique. The survey was conducted from the inhabitant living in boat houses, huts on bank of the lake, and in nearby villages. Water associated health-related data was collected from 210 households. Additional data was also collected through focus group discussions and local doctors. Data was analyzed through descriptive statistics and health impacts of lake water degradation of men, women, and children were assessed. The results show that children were significantly affected as compared to women and men by lake water due to degraded quality, unhygienic conditions, and poverty, since their businesses are associated with Manchar lake. Livelihood, health and water quality improvement interventions are required to avoid any disease outburst. A detailed assessment of health impacts needs to be carried out because most of the people living in the surroundings, visit hospital only if they physically feel sick rather than going for routine checkups.

Keywords

Health Impacts; Manchar Lake; Water Quality Degradation; Fishing Community

Fresh Water Quality Assessment of Kotri Barrage and its Canals

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Abstract

Major surface sources of drinking water in Pakistan are rivers, canals and lakes. River Indus and its canals provide water for various purposes such as agriculture, drinking, domestic, commercial and industrial uses. But, increased industrialization and urbanization have resulted in higher levels of heavy metals in these water sources. Also, other pollutants and hazardous chemicals are being continuously discharged into the Indus River System and pollute it. This study aims at examining the water quality at Kotri Barrage from where four canals off-take which is the source of water supply to millions of people of lower Sindh, including Hyderabad, the second largest city of Pakistan. Realizing the need to assess water quality of these canals, this study was undertaken to examine the water quality at the upstream of Kotri barrage in the year 2016-17. Five locations were selected and water quality analysis was done in the years 2016 and 2017. The samples were analyzed for eighteen (18) different parameters including five (05) physical parameters, i.e. temperature, turbidity, Total Dissolved Solids (TDS), Electrical Conductivity (EC) and Total Suspended Solids (TSS). The chemical parameters include pH, Dissolved Oxygen (DO), Sulphate, Hardness, Alkalinity, Chloride and Nitrate. And, heavy metals i.e. Lead (Pb), Arsenic (As), Cadmium (Cd), Copper (Cu), Iron (Fe), Zinc (Zn) and Manganese (Mn). The samples were tested using analytical methods including pH meter, conductivity meter, HACH DR/2000, direct reading spectrophotometer and atomic absorption spectrophotometer (AAS). The results of the analysis showed that toxic and heavy metal concentrations in water in July and August 2016 were then compared with National Organization i.e. WHO Standards of water. Pb, Cu and Zn concentrations in water were higher than

WHO permissible limits. Similarly, water analysis results of 2017 of heavy metals viz. Cd, Fe and Mn were comparatively higher during non-monsoon period. Remaining heavy metals were within the permissible limits because of the high dilution factor in monsoon season. The effort of this study can be utilized for monitoring the effects of pollutants over a period of time and thus would help in controlling these contaminants. This study has thus made a baseline of water quality, which may contribute in analyzing the Indus water basin model in future.

Keywords

Heavy metals, water, water quality standards, pollution, discharge, contamination.

Determination of flow direction, flow accumulation, and delineation of watershed based on DEM of the area using ArcGIS and HEC Geo HMS tools. A case study of Koroonjhar Mountainous area Nagarparkar

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Abstract

Nagarparkar is situated in the Desert of Thar, where the major source of drinking water is dug well. Most of the dug wells dry up during May to July, thus the availability of fresh water for livestock and domestic purpose is rare. During monsoon, runoff is generated at Koroonjhar Mountainous range, which is not harvested, but most of it is discharged into Run of Kuchh. The aim of this study is to delineate the Koroonjhar hill watershed and estimate the potential runoff generated using HEC Geo-HMS and SCS CN Method. Primary and secondary data was collected and processed using Arc Hydro tools in ArcGIS 10.3 and then watershed was delineated based on outlet point using HEC Geo HMS extension. In this way, a sum of total thirteen (13) watersheds were delineated. Results show that the total area of delineated watersheds was 82314 acres with the 100 sub-Basin, 46 Junctions and 13 Outlets. Runoff at different outlets was estimated based on 50 mm rainstorm event which most frequently occurred during the monsoon season. From the simulations, it was estimated that an event of 50 mm rain storm can generate about 4371 acre-feet runoff, which can be harvested and conserved for later use.

Keywords

GIS, HEC-Geo HMS, HEC HMS, Watershed, Runoff, Thar

Characterization of Physical and Biological Properties of Drinking Water of Hyderabad City

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Abstract

Provision of clean and safe drinking water and hygienic sanitation facilities are important in improving the health and saving the lives of humans which are affected due to consumption of contaminated water. Global statistics show alarming situation because the target of achieving access to safe drinking water and proper sanitation set by world Health Organization (WHO) has not been met yet. The problem of water pollution is due to a combination of two factors, i.e. decrease in water supplies and increase in water demand from all sectors which has resulted in deterioration of water quality. Water from various sources such as river and ground water in Pakistan is unfit for human consumption because of inferior quality. In this study, Hyderabad city is selected as the study area to identify the available water resources, to monitor water supply system and to evaluate the drinking water quality. Locations for sampling were marked on Google Earth and samples from four treatment plants and the area they serve were obtained. Physical parameters were checked over once in a month for a total of three numbers of times. The parameters like Temperature, Electrical Conductivity, pH and Turbidity were checked in the field (i.e. During sampling) while TDS was checked in a laboratory. Biological testing was also carried out once in a month. Biological parameter Total coliform was measured. Many of the samples showed results which exceeded National Environmental Quality Standards (NEQS). Parameters which exceeded the allowable contamination level was turbidity and total coliform. This research is aimed to contribute towards achievement of sustainable development goal of clean water for all. The results of this research may be used by WASA Hyderabad to address the pressing issue of water quality.

Keywords

Drinking water, Quality Issues, Waterborne disease

WATER SUPPLY MANAGEMENT FOR JAMSHORO CITY

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Abstract

The case study is about Jamshoro city water management during the cut-off period of water for 15 days from Dec 25th to Jan 10th in Kalri Baghar canal. Kalri Baghar is an off taking canal from the right of Kotri Barrage. During this cut-off period Kotri Barrage authorities stop the flow of water in the canal for the maintenance purposes and there is no supply of water to the city. Kalri Baghar canal is the only source of fresh water supply to Jamshoro city; as the ground water is saline and not fit for potable use. So, during this cut-off period most of the city relies on water supply through water tankers and the tanker mafia take advantage of this situation by increasing rates. Therefore, a water storage facility is needed, which could fulfill the water demand of the city for these 15 days and could also be used throughout the year for constant supply. Different alternatives were assessed for the cut-off period of K.B feeder and depending upon their feasibility, best alternative was selected. Construction of water storage lagoons was found to be the most economic and efficient option. Findings revealed that lagoons are easy to build and operate. They have the capacity to store sludge and a well-designed and properly managed lagoon have many other uses as well. The Lagoon designed to have the capacity to supply water for 15 days to Jamshoro city. It can be used for throughout the year to meet the daily water demand of the city. It can be used for irrigation and recreational purposes as well. The Cost Benefit analysis of Lagoon revealed that it is a viable solution against tanker water use.

Keywords

Indus river, Water management, Kotri barrage, K.B feeder canal, Lagoons

Performance Evaluation of High Resolution Climate data in Projecting Climate Change: Case Study: Precipitation over Pakistan.

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Abstract

Downscaled World-Clim 30 arc seconds equivalent to 1 Km spatial high-resolution climate projections are regionally examined over Pakistan. The climatic parameters considered were average annual precipitation and seasonal variability. The global climate model data (GCM) of the CCSM4 model which participated in the CMIP5 (Coupled Modeled Inter-comparison project phase-5) were selected under two RCP (Representative concentration pathways) scenarios i.e. RCP-8.5 and RCP-6. This study focuses on 30 years observed gridded data (1970-2000) and 30 years' future downscaled high resolution World-Clim data (2040-2060). It was observed that maximum average monthly precipitation was found to be 166 mm for thirty years (1970-2000) in Kashmir and Islamabad areas while least rainfall received by Northern Sindh and Baluchistan areas. CCSM4 shows an increase in precipitation for RCP 6.0 and decrease for RCP 8.5 for the future projections. Northern and Southern part of the country showed significant variation while Central part have less variability when compared current and future projections. High Resolution World-Clim downscaled data for CCSM4 has been compared with CMIP5 data that is statistically downscaled having same spatial resolution of 1km and results of both downscaled products were significantly similar.

Keywords

Precipitation, CMIP5, RCPs, World-Clim, Global Climate Models, spatial resolution.

Social impacts of floods on women lives in District Muzaffar Garh

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Abstract

Floods are the most expected disasters in the world. Pakistan faced a million dollar economic and social losses, but there is still a hope to mitigate these losses through systematic structural and non-structural measures. The general goal of this study is to survey the social impacts of flooding and vulnerabilities during serious flooding in 2010, 2011, 2012, 2014 and 2015 in selected study village area Kundai, kotla ghulam shah, kotla baksh and sarki. The current study was supported to explore the social vulnerabilities as well as flood impacts on women's lives. The study has utilized both quantitative and qualitative methodologies. Primary Information gathering tactics of this study were based on survey of affected Households (HHs), key informant interviews, Focus Group Discussion and from observation. Secondary information gathered from distributed and unpublished materials, government files and reports and research reports. The analyses define that communities of the study area were living comparatively better lives before the flood occurred between the Indus and Chenab River in villages of district Muzaffar Garh southern Punjab. The study affirmed that, after devastating 2010 and consecutive flooding from 2011 to 2015 in lower southern Punjab were generated fundamental drivers of "vulnerability" in communities such as the weak embankment, displacement, pre-event poverty, pathetic emergency preparedness, inadequate resources, unreliable condition, and mental stress. The frequency affected on the wellbeing issues like emotional, injuries, infection, displacing, and pressure of protecting their livelihood and domestic animals. After the 2010 floods, there are some government help generated a preparative sense among rural affected communities. They start building their houses on average heights. But consecutive flooding

destroyed their assets and generated hopelessness. With a specific end goal of this study to highlight that how they minimized the effects through adopting mitigation methods, A few conceivable relief alternatives were made.

Keywords

Floods, community, vulnerability, vulnerable groups, impacts, socioeconomic.

Calculation for Crop Water Requirement for Major Food Crops in Pakistan by Using WEAP

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Abstract

As it is well known fact that Pakistan is an Agriculture Country and this sector contributes considerably in terms of the economy and GDP of the Country. Since the population of the country is increasing at an enormous rate of 2.3% per annum, therefore we would need to feed more mouths in future. To maintain the status of the Food Secure Nation, it is must to increase the productivity of food crops i.e. Wheat and Rice. Since the agriculture sector is the main consumer of water, increasing agriculture would result in more consumption of water at the cost of other sectors, with limited renewable water resources, therefore it is necessary to determine the increasing requirement of agriculture sector to produce more food crops and to formulate the schedule for the deliverance of the required water. For this purpose, the area under the food crop has been determined from report, published by Government of Pakistan Statistics Division, Federal Bureau of Statistics (Economic Wing) under the name and style of "Crop Area and Production" and has been projected for the next 15 years' period. For calculation of potential Evapotranspiration, Temperature data from 2000 to 2016 has been collected from Pakistan Meteorological Department (PMD) for three station, namely Hyderabad, Bhawalnagar and Jehlum; because they are installed at regular interval in the fields where Rice and Wheat are cultivated, and is averaged to determine the mean temperature, then potential reference Evapotranspiration was calculated using Blaney Criddle method. The data was inserted into Water Evaluation and Planning (WEAP) software and simulated. The results show that area under cultivation and water consumption of Food Crop has been increased enormously in past 10 years, and would require more water in future to maintain the current

increasing production rate. The only option left to follow increasing production trend with limited amount of water is to increase the efficiency of the System and to adopt water conservation techniques at farm level.

Keywords

Blaney Criddle method, Evapotranspiration, PMD, WEAP

Analysis of Water Resources Vulnerability Indicators for Jamshoro City

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Abstract

Water is one of the basic needs for survival of living things, food and agricultural practices. The weather indicators play a significant role in evaluating and quantifying the water availability. In this research study, water resource vulnerability indicators for Jamshoro city, including temperature, precipitation, flow of Kalri Baghar canal, and population, were analyzed. Historic trend analysis (1990-2016) of temperature, precipitation, and flow of K.B feeder canal was carried out, followed by prediction of future temperature and precipitation trends (2017-2025) Furthermore, population of colonies extracting water from K.B feeder was extrapolated as per annual growth rate of 2.62. MS Excel was used as the tool for statistical analysis and future forecasting. The results showed the annual maximum temperature for the past trends (1990-2016) increasing up to +0.0013°C and predicted an increase of +0.00045°C in future trend (2016-2025). For the annual minimum temperature, the results showed increase of +0.0026°C with an expected increase of +0.0009°C in future. On the other hand, the results of precipitation showed decrease in past trends -45.28% in Monsoon precipitation and decrease of -28.65% in the future, while the Non-Monsoon precipitation show decrease in past trends -0.52% and decrease of -0.17% in future. Results of flow in K.B feeder showed an increase of 1135 Cusecs. With the growing population, increase in temperature and a decrease in precipitation, there comes an increase in the demand side of water availability. Therefore, it is advisable to manage the water demand and supply of water according to increasing population by integrated water resource management for sustainable use.

Keywords

Climate change, water resources, vulnerability, temperature, precipitation, flow, population, Jamshoro

Assessment of Ground Water Quality and Soil Salinity/Sodicity Status Under Various Different Irrigation Systems in Arid Region of Jamshoro District

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Abstract

The research to assess ground water quality and status of soil salinity under different irrigation systems. The experiment was conducted at Gul Muhammad Farm, Thana Boula Khan, an arid region of district Jamshoro, during 2015. The data have been collected and analyzed under three irrigation system, i.e. Pitcher, Transparent Plastic bag and furrow irrigation. The results indicated that the soil under various irrigation was piedmont with sandy loam texture, DBD 1.6 gm/cm³, FC 14.6%, WP 6.5%, AM 8.4% and infiltration rate 1.60 cm/hr. These soil characteristics indicated that the drainability of the soil was high and water holding capacity was low. Various water samples were collected during irrigation (sowing to harvest period), The investigated results shown that EC_w was < 1.5 dS/m, pH < 8.0, SAR < 10.0 and RSC were non-detective. Thus, the quality of water used for cultivation of Lady finger/Okra crop under all irrigation methods were Class-I quality water. The soil under study was non-saline (EC_e < 4.0 dS/m) and non-sodic (pH < 8.0, SAR < 7.5 and ESP < 15.0) before crop sowing in all the three methods of irrigation at all the three sampling depths, which after crop harvest changed a little bit, i.e. under furrow and pitcher irrigation method, the EC_e, SAR and ESP decreased to wetted zone and increased at wetted periphery. Under polyethylene bag irrigation method, EC_e, SAR and ESP decreased at depths 0-15 cm and 15-30 cm, but these increased at lower depth i.e., 30-60 cm after crop harvest. However, the soil remained non-saline and non-sodic. It is recommended that due to commercialization of vegetable industries and increasing rates of vegetables, the consumers can produce own vegetables on cheaper and economical rates through pitcher and polyethylene bag methods of irrigation, which may be adopted

for kitchen gardens and on small scale production, particularly in water scarce areas like Thar, Kohistan and un-commanded canal areas as well as on the roof tops.

Keywords

Water quality, Soil salinity, Pitcher, Transparent plastic bags, furrow, irrigation systems, water use efficiency, water saving, Lady Finger/Okra crop.

A Comparative Study of Numerical, Analytical and Semi-Empirical Models for Soil Wetting Patterns in Subsurface Drip Irrigation System

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Abstract

The agriculture is the backbone of Pakistan's economy, which adds more than 21 % of the Gross Domestic Product (GDP). The agriculture of Pakistan is principally governed by its irrigation system and drainage, which is currently experiencing various challenges such as water logging and soil salinity, excessive use of underground water, inefficiency in deliverance and distribution, unreliable supply, and insufficient cost recovery. Subsurface drip irrigation (SDI) is one of the most efficient irrigation system used in many arid and semi-arid regions for irrigating orchards and vegetables. The effective design of subsurface drip irrigation not only conserves water efficiently, but also reduces the overall cost of the project. The soil wetting pattern developed under SDI depends upon various factors such as emitter flow rate, depth of drip-line, saturated hydraulic conductivity, duration of irrigation and type of soil. There are a number of models, which evaluate the water movement beneath the soil surface, however the accuracy of solution provided by different models become a question of research. The purpose of the present research study is to evaluate the accuracy of the solution provided by numerical HYDRUS 2D, analytical Wet Up and selected semi-empirical models used for simulation of soil wetting pattern under SDI. In this work, it has been found that the results obtained from Wet-Up, at different emitter depths, showed significant differences between predicted and observed data. However, HYDRUS 2D/3D and selected empirical showed good prediction of soil wetting pattern under subsurface drip irrigation.

Keywords

subsurface drip irrigation, hydraulic conductivity, numerical, soil wetting pattern.

Future Water Demand Assessment Using WEAP Model at Lower Indus Basin

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Abstract

The lower Indus basin is one of the most arid catchment areas in South Asia. Various kinds of water users (i.e., rural, urban, subsistence and commercial irrigated agriculture) are present in the catchment. The rising population in conjunction with the climate change, and the need to meet minimum flow requirements are going to greatly exacerbate the complexity of future water resources management in an already water-stressed sub-catchment. Being able to assess the ability of the catchment to satisfy potential water demands is crucial to planning and making wise decisions about water use and distribution. In this study, a scenario analysis approach will be used in conjunction with the Water Evaluation and Planning (WEAP) model, to assess the impacts of possible water demands on the water resources of the Indus River at Sindh in the year 2050. For each scenario, the water resource implications were compared to a 2015 “baseline.” The model will analyze unfulfilled water demands, and water availability in these scenarios.

Keywords

Lower Indus Basin, Climate Change, Unfulfilled Water Demands, and Water Evaluation and Planning (WEAP)

Enhanced Storage Capacity and Quality of Haleji lake (Ramser site), and Hadero (Wildlife sanctuary) Connecting with River Indus through Keenjhar Lake for their Sustainable Revival

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Abstract

Over 50% of wetlands in the world have been lost in the past century, and the remaining wetlands have been degraded to different degrees because of the adverse influences of human activities. Though protected under Ramsar convention, the situation of Haleji wetland complex and Hadero wildlife sanctuary is not very promising. The current paper is focusing to revitalize the abandoned and devastated Ramsar site "Haleji wetland complex" and a forgotten wetland "Hadero Wildlife sanctuary", situated in Thatta district, Sindh province of Pakistan. Both these wetlands are of a great importance for natural habitat and reducing risk of coastal disasters and floods. The Haleji Lake was originally a saline lagoon; during 1930, it was rehabilitated and converted into a fresh water lake to cater the needs of American and British soldiers stationed in Karachi. Later, during 1994, the water supply source to Haleji was cutoff, turning the lake again as stagnant pond. The increasing population of cosmopolitan city Karachi urges the need to revitalize the great source of water harvesting and supply. The study mainly employed Arc-Hydro tools using remotely sensed data of ASTER GDEM 2 to determine the topography of both wetlands and their possibilities to connect with fresh water sources, and leeway to increase their respective water holding capacity. The physical survey was also conducted and Key informants' interviews (KI) and Focus group discussions (FGD) were

conducted through an open ended questionnaire to collect qualitative information. Water samples were collected from both wetlands and the feeding canal to examine the quality of water in water bodies. The study reveals that all the three wetlands can be re-connected with River Indus to turn them into fresh water bodies. It was also known that the canal once operational to feed the Haleji lake can be de-silted and re-used to interconnect all three lakes as there is a drop of 44 feet from outlet of Keenjhar to Haleji lake. Unfortunately, due to illegal water courses and non-sanctioning of water share for wetlands, the due right of fresh water is not reaching to abandoned lakes. The research paper provides the best solution to revitalize the wetlands to sustain life in the coastal belt.

Keywords

Wetlands, groundwater quality, natural habitat, remote sensing

Potential for Hydropower Generation – A Case Study of Nara Main Canal

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Abstract

Pakistan's hydel energy potential has escalated to 8000 MW having northern areas with major share and Sindh with minimal. For Sindh, the reason, for the absence of hydel energy, is the concept that it has plain terrain and not enough head for run of river projects. This study acts as a testimony for the availability of head as well as discharge enough to lit hundred houses. The present study has untapped 3.2 MW of electricity on Nara Main Canal at location, RD 26. RETScreen model was used to analyze the techno-feasibility of the electricity. The study concluded that at the 11% inflation rate, 9% discount rate and 20 years of life span with 300 USD per kW and 25% sensitivity analysis, an average of 5000 MWh electricity can be supplied to the grid.

Keywords

RETScreen, Hydropower in Sindh, Nara Main Canal (NMC), Reduced Depth (RD)

Analysis and Estimation of Missing Precipitation Data for Khirthar National Range, Sindh Province

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Abstract

Availability of good and reliable hydrological (precipitation) data is vital for most of the hydrological analyses, design, development and management of water resources systems. However, precipitation records are often missing, largely due to insufficient infrastructure of rain gauge stations or malfunctioning of the stations for specific durations. In the present research study, an effort is made in estimating the missing precipitation data, which, in fact, is a part of a larger study goal aimed at hydrologic assessment of a study area, namely "Kirthar National Range", using remote sensing and modeling approach. The study area (shown in Fig. 1), comprises of an uneven topography, spreads over an area of about 22,000 km² and consists of 5 administrative districts of the province of Sindh. Within the study area and in the vicinity, there are 2 and 12 gauging stations, respectively; which are being operated by various agencies. The precipitation data required for a larger goal of watershed modeling that shall be used for future planning and development of the study area is missing at one the gauging stations, namely, Thana Boula Khan (TBK). Thus, in view of the purpose as stated above, a rainfall record of 12 years (2005-2016) is used to estimate the daily rainfall data for the period. While examining the precipitation data, it was observed that at TBK station. While investigating the hydrological data obtained from the various agencies, it is revealed that available rainfall record of the various stations varies from 34-92 years. The average annual rainfall estimated for these stations varies between 51.12 mm (Dureji) and 288.95 mm (Badin); and the normal annual rainfall for the study area is estimated as 160.78 mm. Using the technique of the arithmetic mean (AM),

normal ratio method (NRM), quadrant method (QM), Thiessen polygon method (TPM), and Inverse Distance Weighting Method (IDWM) for missing precipitation data at TBK is estimated in the present study. The suitable method on error statistics basis is found in NRM on STD and RMSE and on the CC basis IDWM performed as a suitable method for the targeted station TBK. It is concluded that the investigations recognized that the suitable methods to be suggested for estimation of missing precipitation data on the number of adjacent available gauging stations and concerning correlation with the targeted gauging stations for which the missing precipitation data are estimated.

Keywords

Missing precipitation, comparative methods of missing precipitation, Kirthar National Range, hydrologic data, watershed modeling.

Forecasting Changes in Precipitation Pattern During 2011-2060 using Precis Regional Climate Modeling System for Kohistan Region of Sindh

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Abstract

Global climate change is a scientific reality and its effect on water resources cannot be ignored in any way. Its importance can be gauged from the fact that it has direct impacts on the availability, timing and variability of precipitation throughout the world. Changing precipitation patterns are challenging for the water managers. The climate of Sindh varies from arid to semi-arid, and there are many areas which are out of the Indus basin irrigation system; and directly or indirectly depend on the amount and timing of the rainfall there. One of such areas, Kohistan region, has been selected for the present study. The people of this area directly and indirectly depend upon the rainfall for their livelihood. PRECIS regional climate change model has been used to forecast the precipitation pattern for five decade sets from 2011 to 2060. The baseline ECHAM5 dataset for A1B Scenario downscaled to 25 km x 25 km resolution with PRECIS Regional Climate Model from 1961 – 1990 was used in this study. The model is coupled with ArcGIS 10.3.1 to obtain the forecasted results. The decade by decade analysis of the area show large shifts in the amount of precipitation. This will in turn affect the spate irrigation potential through hill torrents as well as groundwater recharge. The results will be useful for the water managers and the local population for better planning of their available resources.

Keywords

PRECIS Model, Climate Change, Precipitation Pattern, Regional climate model, Future Scenarios

Evaluating the Impacts of SCARP and Private Tube Wells on Irrigated Agriculture Cover using Remote Sensing and GIS Tools in District Matiari

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Abstract

Government of Pakistan is attempting several remarkable steps to improve agricultural yield and make it sustainable. Salinity control and reclamation project (SCARP) is one of those effective initiatives launched in 1980s in Sindh province to reclaim waterlogged and saline lands by setting up large-scale ducts and tube wells. But unfortunately, the government could not afford the operation and maintenance of wells in the 1990's which caused farmers to install private tube wells. In this connection, this paper evaluates impacts of SCARP and private tube wells on agriculture cover using remote sensing and GIS tools in Matiari district. The Satellite images of Landsat-5 of 1989, 1990 (prior to SCARP), 1993, 1998 and 2009 are analyzed with two separate techniques of image processing in ArcGIS i.e. the normalized difference vegetation index (NDVI) and unsupervised classification. The results showed that agriculture cover has increased during Rabi by 12% and 18% in 1998 and 2009 while 8% and 12% during Kharif season of 1993 and 2009. It is inferred that agriculture cover has increased more in 1993 and 1998 that is a short period after installation of wells as compared to 2009 which is long period after installation. Field survey revealed that no other major change was observed before 1990s, except installation of tube wells under SCARP project. Hence the above results witness SCARP and private tube wells satisfactorily increased the agriculture cover in Rabi and Kharif season because, always the increase in quantity of irrigation water has been the main cause of increase in agriculture in water shortage locations.

Keywords

Agriculture cover, remote sensing, NDVI, and SCARP wells

Potential for Conjunctive Use of Surface Water and Ground Water in Rajo Nizamani, Sindh

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Abstract

Focusing on the wheat crop, this study aims at identifying the appropriate ratios of ground and surface water used to obtain acceptable crop yield. This study co-relates water and soil salinity with the crop yield and tests the water allocation for the study area of Rajo Nizamani. Data related to water demand and supply, crop yield and net return was collected through field surveys, while analysis of water and soil salinity was done through in situ measurements of Total Dissolved Solids (TDS), using a TDS meter. It was observed that farmers on the right side to the watercourse had more surface water availability than others and had slightly higher crop yields. Groundwater salinity was higher on the left-hand side of the watercourse compared to the right-hand side. Soil salinity was greater in the fields irrigated with the higher proportion of groundwater. The average wheat crop yields obtained in the year 2017 for farmers of the left and the right side are 4.137 tons/ha & 4.88 tons/ha respectively. Soil and water salinity were observed affecting the crop yields negatively. Suitable groundwater usage values were obtained based on the difference between simulated and observed crop yield values.

Keywords

Conjunctive Water Use, Crop Yield, Soil Salinity, Rajo Nizamani, Sindh.

Application of GIS and HEC-RAS in Floods Forecasting: A Case Study of Lower Indus Basin, Sindh 2010

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Abstract

Flooding is one of the most disastrous natural calamities; because of the irreversible damage followed by the loss of assets that ultimately worth a fortune. The aberrant trends of rainfall are considered as the root cause of flood occurrence that can exacerbate due to lack of actual flood forecasting and subsequent mitigation. Even with the extensive amount of researches and findings in flood forecasting, the flood control is not an easy task, especially in developing countries where resources and expertise has always been a major issue. Conversely, the flood intensity can be alleviated with effective flood forecasting and flood management techniques. Remote sensing and GIS has emerged as one of the most innovative tools in this regard. With remotely sensed data, the concept of flood inundation mapping, flood hazard and flood risk mapping can be done efficiently. Therefore, this study is aimed to integrate the remotely sensed data in geometric module of hydrodynamic river modeling and analysis tool, namely: HEC-RAS (Hydrologic Energy Center – River Analysis System). In this study ALOS World 3D - 30m" (AW3D30) DSM was used, which is the most recent freely available digital elevation/surface model. Land Cover derived Manning's roughness coefficient, cross-section interpolated bathymetry and upstream flow hydrograph were parameterized in the model. An unsteady flow analysis was undertaken run for a period of 1 month. Within the river model, the calibration was done by comparing the observed and simulated stages at the peak flow, whereas the inactive flood plains calibration is done by comparing with the daily captured remotely sensed MODIS image. The model was duly calibrated and validated for 2010 flood.

The study demonstrates the flood risk maps along with the identification of vulnerable zones, with respect to the flood characteristics (depth, velocity, depth time velocity, arrival time and duration). Therefore, the study aims to conclude that with few modifications the newly launched DSM data can be used in flood simulation. Consequently, based on the extracted results, potential vulnerable spots can also be identified.

Keywords

Flood forecasting, Flood Risk mapping, DSM, Remote Sensing, MODIS.

Quality of Manchar Lake Water as Source of Irrigation and Its Effects on Soil Physico-Chemical Properties

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Abstract

Manchar is the biggest shallow water, natural lake of Pakistan, situated at a distance of about 18 km from Sehwan Sharif, District Jamshoro, and Sindh. The water of this lake is annually and seasonally used as irrigation water for growing different crops including wheat, cotton, sunflower, alfa etc. During the last few years it is experienced that the lands are becoming saline with the use of Manchar lake water. A study was conducted to evaluate the physico-chemical properties of soils irrigated with water from Manchar lake. The water samples were collected from lake to evaluate its fitness for irrigation purpose. The water samples were collected from Manchar lake, Danister canal, Phat and different tube-wells in the area. The soil samples were collected from the areas irrigated with Manchar lake water. The geographical maps of the area were used as guidelines and the location of the sampling site were recorded by using GPS. The results of water samples analysis had shown that EC of water from Manchar lake was high (10.8 to 14.11 dS m⁻¹) and in hazardous range. The pH of Manchar lake water was in the useable range (7.8). The Ca²⁺ content of water was (10.0 to 11.5 meq L⁻¹) and it is in useable range. The Mg²⁺ was high (25 to 3.5 meq L⁻¹) and in hazardous range. The Na⁺ content was high (79.3 to 119.5 meq L⁻¹) and in hazardous range. The HCO₃⁻ (3.6 to 4.2 meq L⁻¹) was in useable range. The sodium adsorption ratio (SAR) was high (18.9 24.9) and in the hazardous range of soils. Residual Sodium Carbonate RSC (-31.4 to -41.8) were also high. The analysis of soil samples irrigated from Manchar lake had shown that due to high EC of the water the EC, pH, Ca²⁺, Mg²⁺, Na⁺, Cl⁻, SAR, ESP of soils irrigated with Manchar lake were also high. Soil texture of soils irrigated with Manchar lake water was loam. The pH of soils irrigated by Manchar lake

were slightly alkaline in reaction and ranged from 7.4 to 7.6. The EC of soil samples had shown that soils were saline. The CaCO₃ data indicated that at different depths 100% soil samples were moderately calcareous. The soil was slightly to moderately affected by bicarbonates. The Sodium Adsorption Ratio (%) indicated that the soil was moderately sodic. Exchangeable sodium percentage of the soils were high and were sodic with ESP more than 15. The results of our study had shown that water of Manchar lake is not suitable for irrigation and its continuous usage degraded the soil in the area by increasing its salinity level.

Keywords

Manchar lake water, soil physico-chemical properties

Climate Change in the Gulf Countries: Impacts on Various Hydrological Parameters

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Abstract

Climate change is proving to have detrimental impacts on water resources almost all around the globe. In the recent years, climate changing patterns in Gulf countries have started to cause extreme temperatures, which in turns effect occurrence, intensity and interval of rainfall and drought. This trend is expected to continue in future. To predict the climate change in gulf countries, downscaled General Circulation Models (GCM) 'GISS-E2-R' was selected and analyzed under a concentration scenario using ArcGIS 10x. The model showed the possible changes in temperature and precipitation patterns for the period 2041-2060 under Representative Concentration Pathways (RCP) 6.0 which was presented in the Intergovernmental Panel on Climate Change 's (IPCC) fifth assessment report in 2013. The modelling results are then compared with current conditions (1960-1990) and the difference is calculated. The analysis showed an increase in temperature across the region, which might prove too hot for the human beings. On the other hand, an overall decrease in precipitation can be predicted from the result of analysis and modelling. The spatial change in temperature and precipitation is depicted through thematic maps. Thus, this study could guide policy makers and researchers of this region to take suitable actions to devise policies and take necessary steps to cope with the changing climatic patterns, mitigate its social impacts and secure its water resources.

Keywords

Climate Change, Gulf Countries, RCP6.0, GCM, Temperature, Precipitation.

Re-Modelling of Spinal Drain Cross-Sections for Draining Storm Water Due to Extreme Events in Lower Sindh, Pakistan

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Abstract

In 2011 rain flooded the right bank of the lower Indus inundating the districts of Mirpur Khas, Badin, Tando Muhammad Khan, Umerkot, Thar Parkar, Tando Allahyar and other districts of lower Sindh, Pakistan. During this event spinal drain main component of Left Bank Outfall Drain (LBOD) carried 9000 cfs discharge which was about twice its design capacity (i.e. 4600 cfs) causing several breaches and flooding the adjacent areas. After this event, there was a dire need to consider redesigning and rehabilitation of the LBOD infrastructure to cater the flood event in future. The purpose of the study presented in the paper is to recommend a re-design for spinal drain (which is the main component of LBOD), so that it can carry an extreme event such as 2011 floods. This was achieved by doing an extreme rainfall analysis and developing a HEC-RAS model to recommend the cross sections. In this study, worst case scenarios were simulated and recommendation was given for the optimal design parameter in spinal drain cross section to facilitate an unconstrained disposal of excess ground and storm water in case of an extreme rainfall events. Two redesigning scenarios i) Widening of cross section keeping design water level; (ii) Widening of cross section with 2 feet increase from design water level to the input of extreme flood hydrographs was simulated. It was found out that with proposed modifications in bed and lower banks, spinal drain will be able to convey up to 9000 cfs discharge with 1.0 ft to 3ft free-board which will save the areas of district Nawabshah, Sanghar and lower areas of Badin which were flooded during the rainfall event of 2011.

Keywords

HEC-RAS, Floods, Pakistan, Surface Drainage, Left Bank Outfall Drainage

A Multi Index Perspective for Drought Characterization in Sindh Pakistan

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Abstract

Sindh province is located in the subtropical zone of Pakistan and experience frequent droughts. The recurring droughts pose significant risk to the water resources of the area and their dependent ecosystems. The scarce network of met stations is not sufficient to provide reliable spatial and temporal information of drought severity across the study area. The characteristics of agriculture and meteorological droughts are studied from 1980-2016. Standardized Precipitation Index (SPI) and Standardized Soil Moisture Index (SSI) are used as indicators to study the meteorological and agricultural droughts respectively. A meteorological drought is defined by a deficit in precipitation and agricultural drought is defined by a deficit in soil moisture content. A combination of SPI and SSI is studied using a Multivariate Standardized Drought Index (MSDI). The index is based on the combination of a joint probability of SPI and SSI. The characteristics of historical droughts, their onset, persistence and termination are studied using MSDI. The results obtained from MSDI are compared with the SPI and SSI. The findings indicate that MSDI gives reasonable information for the overall drought characterization which is a reliable indicator for drought analysis in the data scarce regions. It has been observed that the drought starting from 1998 till 2003 is the most severe drought in the past 36 years. The precipitation and soil moisture data used in the study is taken from the Modern Era Retrospective Analysis for Research and Application (MERRA) product of the Goddard Earth Observing System NASA. The drought information, using MERRA data, is available at the Global Integrated Drought Monitoring and Prediction Systems (GIDMaPS), University of California, Irvine.

Keywords

Drought, Soil Moisture, Agriculture, Meteorological droughts, SPI, SSI, Multi variable Index

Dispersion Modeling of NO_x and CO₂ Emissions from Thermal Power Station Jamshoro

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Abstract

AERMOD air dispersion model is used to predict the ground level concentrations of CO₂ and NO_x from thermal power station Jamshoro located in Sindh, Pakistan. One year emissions data has been collected from thermal power station Jamshoro and five years' meteorological data has been collected from lake environmental. Daily, monthly and annual maximum and minimum concentrations of CO₂ and NO_x within 50 kms radius of the thermal power station Jamshoro have been determined through AERMOD air dispersion modeling. The results show that the daily maximum concentration of CO₂ and NO_x are 290 µg/m³ and 0.569 µg/m³ respectively in south-west direction near Thana Bula Khan and darwat Dam, and minimum daily concentration of CO₂ and NO_x are 124.169 µg/m³ and 0.2488 µg/m³, respectively in south-east direction. Long range transport of CO₂ and NO_x emissions can potentially impact on Environment and health of people living at far off places.

Keywords

Air dispersion model, AEROMD, Emissions, CO₂, NO_x, Thermal power station.

Willingness to Pay for Municipally Supplied Water Services: A Case Study of Hyderabad District

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Abstract

Water is the most important utility among all other services provided to a tenant of a state. Unfortunately, it is one of the most unserviceable utilities in most of the towns, districts, cities and even in the metropolitan areas of Pakistan. Improvement can only be made by changing the system and eliminating flaws from the scheme. An economic analysis is necessary, when a system is thoroughly studied and intended to be improved. Public opinion, is an essential ingredient of economic studies and is necessary for schemes where the general public is directly involved. The public's willingness to pay for fresh water in the urban areas of Hyderabad is the issue analyzed in this study. A total of 380 samples from the three administrative subdivisions (Latifabad, Qasimabad, and Hyderabad City) was randomly chosen to discover the minimum price that policy makers should consider choosing a level for a water tariff that would be accepted by the citizens of the district. A suitable water supply scheme can be designed that is beneficial mutually for management and populace. The study found that more than 70% of the individuals in the district are spending a substantial amount of money on such activities, which are directly or indirectly associated with water. A huge percentage of expensive water usage is observed with the increase in income.

Keywords

Willingness to pay, water pricing, Hyderabad, Water supply scheme, income class variation.

Evolution of Creeks Network in Indus Delta, Pakistan

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Abstract

Sea level rise (SLR) in response to looming climate change is considered as a major impediment to coastal areas. Acute wave activities and tidal propagations of semi-diurnal to mixed type are impairing the morphology of the Indus delta in Pakistan. Using a holistic approach, the evolution of the creeks network was simulated with a variety of in-situ and remotely sensed data. That was subsequently interpreted with supplementary topographic, oceanographic and land-cover evidence. Imageries of Near Infra-s (NIR) band of Multi-Spectral Scanner (MSS) and Operational Land Imager (OLI) on Landsat satellite from 1972 to 2017 were processed through image enhancement techniques for delineation of channel planform. Fourteen major creeks lying in the territory of Pakistan were sampled for the assessment of geomorphologic anomalies in their planform. Three transects (at the mouth, middle and terminal points) of each creek were examined over the timeline. Statistical analysis of spatiotemporal variations in the top width of the creeks suggested that a substantial amount of the delta alluvium has been engulfed by the Arabian Sea. Spatial analysis revealed that creeks locating on the right side of the Indus river were relatively less wide (3884 m) than those on the left side (5222 m). Khudi creek on the right side and Wari creek on the left side of the delta are the widest creeks among others. The mouth of each creek is well developed and had always been more varied than the remaining transects of the respective creek. Furthermore, the trend analysis of the creeks network showed that a

longitudinal variation in the width of each channel can significantly ($R^2 > 80\%$) be simulated by an exponential function. Hence, it is concluded that creeks on the left side of the river are evolving more rapidly. Therefore, geomorphologic vulnerability has increased perpetually. A comprehensive study of the coastal degradation is recommended and coastal managers and other relevant agencies should intervene to mitigate the land degradation impacts.

Keywords

Sindh coast, Indus River, tidal flats, morphology

Nexus Approach to Address Water-Energy-Food Security of Pakistan

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Abstract

Pakistan is facing serious challenges of environmental degradation and natural resources scarcity such as water, due to rapid rise in population and climate change. Countries, such as Pakistan have devised policies to increase production of cereal crops by providing subsidies on water and energy in agriculture sector. This policy has resulted in overexploitation and degradation of the natural resource base such as groundwater. This approach has not only exerted unsustainable pressure on resources, but has also led to under investment in technologies which will conserve water and energy while meeting the increased demand at the same time. The usual fragmented approach of various organizations involved in water-energy-food sectors has threatened the achievement of sustainable development goals. A nexus approach is therefore required to decouple intensive use of water and energy for increased food production. The intricate nature of water, energy and food requires a holistic approach to develop synergies and avoid tradeoffs in the nexus. This research presents a conceptual framework for water, energy and food nexus, identifying the key driving parameters in each sector and coupling parameters between these three sectors. Here, we present a conceptual model consisting of causal loop diagrams with feedback loops which will be utilized in developing a nexus framework to address WEF security of Pakistan.

Keywords

Water-Energy-Food (WEF) nexus, feedback loops, framework, security.

**“Defining Sustainability Indicator Metrics for Safe Water Supply Services”:
“A Case Study of Hyderabad City”**

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Daniyal Hassan***

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Abstract

Defining sustainability indicator's metrics for the provision of safe water supply is an organized strategy, which help in quantitative and qualitative assessment of indicators proposed by United Nations. This study will focused on defining sustainability indicator's metrics for the provision of Sustainable Development Goals (SDGs) target 6.1 for Hyderabad city. The hypothesis for this research is that the Indicators and their Metrics defined by UNs and WHO do not fit at some local conditions. So this study will help us in improving the monitoring progress of SDGs (target 6.1) for the city in particular and urban areas of the country in general.

Keywords

Sustainability, Hyderabad Sindh, SDG Indicators and metrics.



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:  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
- 6.3:  Improve water quality by reducing pollution, eliminating dumping and minimizing release of hazardous chemicals and materials
- 6.4:  Substantially increase water-use efficiency across all sectors
- 6.5:  Implement integrated water resources management at all levels
- 6.6:  Protect and restore water-related ecosystems
- 6.a:  Expand international cooperation and capacity-building support to developing countries in water- and sanitation-related activities and programs
- 6.b:  Support and strengthen the participation of local communities in improving water and sanitation management

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