

Water Governance and Capacity Building Support Activity



ABSTRACT BOOK

Young Researchers' National Conference



Water & Environment

with a focus on Urban WASH

March 29-30, 2021



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MESSAGE FROM

DR. SHAIKH TANVEER AHMED, CHIEF EXECUTIVE HANDS

HANDS was founded by Prof. A. G. Billoo (Sitara -e-Imtiaz) in 1979. HANDS has evolved in 41 years as one of the largest Non-Profit Organizations of the country. We have an integrated development approach and disaster management expertise. Currently HANDS working with a network of 35 branches across the country is empowering a population of more than 30 million settled in 22,000 villages in 57 districts of Pakistan. HANDS strength is 12 Volunteer Board Members, > 8,000 workforce and thousands of community-based volunteers of more than 6,600 partner organizations. HANDS is registered under the Societies Act, certified by Pakistan Center of Philanthropy (PCP) and Tax exempted by the Income Tax Department Government of Pakistan.

Water, Sanitation, and Hygiene (WASH) Department of HANDS is committed to provide safe water and sanitation services to its target population. WASH department consists of a series of projects, based on the foundation of field tested best practices and proven capabilities. The innovative models by HANDS WASH Department are low cost, durable, socially acceptable and environmentally friendly.

The world is rapidly urbanizing, swelling impoverished urban settlement populations – exacerbating exclusion and inequality in access to WASH services for the poorest and most marginalized children and their families. According to UNICEF, as of 2018 an estimated 4.2 billion people, or 55 per cent of the global population, were living in urban areas. A third of them were children, and about 300 million of these children were living in slums – the worst form of informal settlement. Furthermore, 53,000 Pakistani children under five die annually from diarrhea due to poor water and sanitation.

Pakistan's vulnerability to disasters including earthquakes, floods, droughts, and internal displacement due to conflict, often leaves hundreds of thousands of affected people in need of emergency water and sanitation support. Sustainable access to water, sanitation and hygiene in health centers and schools also remains a challenge especially for girls who lack adequate facilities to manage their menstruation. The effects of climate change and rapid urbanization also contribute to challenges of improving access to safe water and sanitation.

The need for an increased focus on urban WASH is driven by this increasing number of vulnerable children and their families living in poor urban environments across the world. Deep and profound inequalities within urban areas mean that

many children living in slums and other impoverished urban settlements are being deprived of their right to water and sanitation, with serious implications on their survival, growth and development.

Realizing the need of the time, HANDS has organized this Water and Environment Conference with focus on **Urban WASH** in collaboration with U.S - Pakistan Center for Advanced Studies in Water (USPCAS-W) of Mehran University of Engineering and Technology. I want to acknowledge the support of American People through United States Agency for International development (USAID-Pakistan) for organizing this conference under Water Governance and Capacity Building Support Activity.

I am confident that this joint effort of HANDS and USPCAS-W will add value to the knowledge on the subject and will provide help to the research and practicing community in resolving WASH related challenges of the country.

MESSAGE FROM

DR. RASOOL BUX MAHAR DIRECTOR, USPCAS-W MUET JAMSHORO

I feel pleasure to welcome all the delegates to the National Conference on Water and Environment 2021 (NCWE 2021). We are proud to share that this annual event is now being organized for 4th consecutive year, now with collaboration and support of HANDS and USAID, Pakistan and in-built focus on Urban WASH. To broaden the scope and to add value, first day of the conference proceedings will be held at MUET Jamshoro and the second day program will be held at HANDS Karachi. I notice that a number of provincial and national organizations are represented at this conference.

As always, we received a record number of paper submissions. The Technical Program Committee, supported by a team of faculty members and technical experts reviewed and helped short list the abstracts. Only those approved by the committee have been accepted for presentation and included in the abstract book. The Technical Committee deserves our gratitude for putting an immense amount of work to prepare a quality technical program that covers the latest advancements and research output most relevant to the conference. And big thanks to all those who have participated from MUET Water Center and HANDS in organizing this event. It includes faculty members, students and staff of the center and the support from MUET administration. It takes enormous courage, endurance, and dedication to organize a mega event like this.

Besides technical sessions, several plenary speakers representing diverse water-related disciplines have very kindly accepted our invitation to enrich your technical knowledge, update you about recent developments, and present their vision and way forward for future.

Now allow me to say few words about the Center which was established in 2014 with the financial support of the USAID, Pakistan and technical support of the University of Utah and other partnering universities of USA. The Center is committed to focus upon, discuss, and engage along with other stakeholders in achievement of the Sustainable Development Goals (SDGs). The SDG 6 focuses entirely on availability and sustainable management of water and sanitation. The Centers' agenda primarily focuses upon postgraduate degree programs (HID, EE, IWRM and WASH), applied policy research, facilitation of public-private partnerships, and provision of policy advice in a range of water-related disciplines. Overall objective is to contribute solutions to Pakistan's

water-related challenges by educating and training the next generation of water sustainability leaders.

In the end, I wish to add this center is a national center and we welcome collaborative engagements focusing on SDG6. This event is example of such a collaboration. We look forward to work more closely with HANDS to advance mutual agenda, with particular reference to WASH.

"APPLICATION OF HYBRID SOLAR COLLECTOR FOR WASTEWATER PURIFICATION AND DESALINATION BY PHOTOCATALYTIC MATERIAL A LOW-COST TREATMENT"

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ABSTRACT:

Access to safe drinking water is one of the challenges of current era, because water is essential requirement for human life, unfortunately 1/6th of the world population lack to have access of safe drinking water. According to World health organization, more than 1.5 million deaths due to intake of contaminated water specially the age of five and more. Population growth, demographic changes, and climate change only to increase the demands for water throughout the economy. This rapid growth in population reduced the availability of pure water per person to 900 cubic meters per year by 2050.

Hybrid solar collector by using photo catalytic material an excellent application for domestic as well as industrial usage. Efficiency raised by 70% in the level of productivity.

The operational cost of hybrid solar collector is quite intensive especially for the local people and easy to operate as compared to RO plants. The outcomes of this research TDS has reduced between 200-600 ppm (mg/l) by using photocatalytic material (ZnO) with Aluminum sheet as a absorber, resulting the purification of wastewater is about 60 ml at 37C0 of oil field sample 50 ml at 39C0 of Qaida bad and 70 ml at 41Coof Larkana sample recovered. The indentation of this study is towards the low-cost treatment system for desalination and purification of wastewater by utilizing solar energy to meet the standards of World health organization and the efficiency, design feasibility of hybrid solar energy utilized for drinking water by removal of contaminations.

Keywords: Hybrid solar collector, contaminations, desalination

ARSENIC REMOVAL FROM GROUND WATER USING SOLAR CAPACITIVE DEIONIZATION ELECTRODIALYSIS MODULE

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ABSTRACT:

Arsenic (As) is among one of the most toxic naturally occurring metallic elements present in water resources. Arsenic in water is serious natural calamity and public health hazard which originates from both anthropogenic as well as geological sources. Drinking water contaminated with Arsenic is the worldwide problem which causes severe health hazards to humans. Disposal of untreated wastewater into large water bodies pollutes the surface and underground water resources due to leaching of toxic metals, chemicals, and other species. This has further intensified the Arsenic intoxication in drinking water and damages the marine life. Arsenic in water causes many waters borne diseases for human beings as it is considered a potent human carcinogen, associated with risk of cancer of skin, lungs, urinary bladder, liver, and kidney. Pakistan is also facing serious public health adversities due to Arsenic contamination. According to the report of Pakistan Council of Research in Water Resources (PCRWR) and United Nations Children's Emergency Fund (UNICEF) Sindh and Punjab are two major provinces of Pakistan affected by Arsenic contamination. As reported the Arsenic concentration in underground water is higher than the WHO limits. Still there is no proper treatment plant for the removal of Arsenics contamination from drinking water resources in interior Sindh areas. There are several techniques to remove arsenic from water i-e oxidation, coagulation, ion exchange, membrane process and adsorption. This study comprises fabrication of Solar Capacitive Deionization Electrodialysis Module and Its applicability for removal of Arsenic contamination from underground drinking water resources. Several water samples were treated through this technology and Arsenic was removed successfully up to 80% being cost effective and easy to use.

Keywords: Arsenic; Electrodialysis Cell; Capacitive Deionization, Electrodialysis.

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REPRESENTATIVE LABORATORY TESTING OF POLYMER-BASED SEEPAGE REDUCTION

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ABSTRACT:

Water scarcity is a global issue that needs to be managed by taking preventive measures in all water sectors. The agriculture sector uses a tremendous amount of freshwater, and the canal irrigation network loses a significant amount of water due to seepage. In this article, the outcomes of a laboratory-based research study are presented. The study uses Infinity flume to evaluate the effect of synthetic and biodegradable polymers on the hydraulic conductivity of silty sand and loam soils. The Infinity flume is a new technique representing the canal's floc-formation and pore-clogging better than the column method. Mass flow rates are measured from the infinity flume and then converted into the soil's saturated hydraulic conductivity by using Darcy's law. The constant head method is used in this study. The study showed that the Linear Anionic Polyacrylamide (LA-PAM) reduced 15-29% and 18-44% the hydraulic conductivity of the silty sand and loam soils, respectively. Whereas the maximum reduction after application of Carboxymethyl Cellulose is noted to be 23% in loam soil.

Keywords: Hydraulic conductivity; Infinity flume; Linear Anionic Polyacrylamide, Carboxymethyl Cellulose

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FABRICATION OF ECONOMICAL SMART SOIL MOISTURE SENSOR FOR SMART IRRIGATION.

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ABSTRACT:

Adaptation to smart irrigation provides great opportunity to increase water productivity and crop yields. This evolution of smart irrigation in the Indus Basin will help in catering the future stresses, which will be induced by climate change and increasing competitive water use. It is essential to fabricate locally produce a low cost sensor system, which can be adapted at a large scale. In this research, we fabricated a low-cost potable soil moisture sensor coupled with a decision algorithm, and validated it for the local conditions. Sensor framework showed the efficiency of the capacitive soil moisture sensor with range of 0 to 35% wright bases moisture content, high data accuracy with MAPE (Mean Absolute Presents Error) less than 1%, and greater than 90% of data integrity. The sensor system's calibration equation for all soil types came to be - moisture in percentage = 1045.7e^{-0.014*capacitance}) with 99% co-relation with the gravimetric method. The weight bases moisture content can converted to volumetric moisture by incorporation dry density of soil. The decision support system based on the fuzzy logic algorithm optimized the overall sensor system with the objective of minimizing the water supplied to the system. In this study, algorithm is tested for a prototype. Large-scale implementation with maximum sensor nodes; the proposed algorithm will help to quantify the water demand for irrigated agriculture in Pakistan. Implementation of this system at large scale will help to reduce the water use at the farm, increase the efficiency of irrigation system, and will help to save water for other uses.

Keywords: Smart irrigation, Moisture sensor, Soil moisture, Automatic irrigation and Water saving

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DYNAMIC STUDY OF LEAD ADSORPTION USING MODIFIED PAN FIBER IN FIXED BED COLUMN: A SIMULATION BASED STUDY

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ABSTRACT:

Water is the basic and primary need for every human being on this planet but the rapid growth in the human population, industrialization and civilization has resulted in polluting the precious gift of nature "water". There are various impurities in water but metal ions in water become a critical problem worldwide. Lead Pb (II) is the most hazardous heavy metals ion, posing serious and lethal threat to human beings and whole eco-system. The main idea to conduct this research is the Expulsion of lead from the lead contaminated water with the help of the Modified PAN fiber which is most effective and efficient adsorbent also simplest way to eliminate the lead. This work is carried out on the adsorption technique and PAN fiber was chemically modified with the DETA (diethylenetriamine) and then loaded with the phosphorous solution which shows better adsorption efficiency. The characterization of M-PAN fiber was performed through the FTIR which showed the presence and cross-linkages of the functional group on the fiber surface and SEM, EDX which illustrated the morphological characteristics, topology, and the composition of various substances. Atomic Absorption spectroscopy (AAS) was used to analyze the percentage of lead in the samples. Adsorption study was carried out on the effects of various experimental parameters which includes bed depth, flow rate, adsorbent dosage, and contact time the optimum result of lead adsorption found. The PAN showed a maximum lead adsorption capacity is 97.55 % on these optimum conditions i.e. at 6 cm bed height, 1 ml/min feed flow at the inlet concentration of 50 mol/lit. Simulation study also done to show the effect of bed height and feed flowrate of different inlet concentration for the lead removal on ASPEN ADSIM V10. This research has directed that polyacrylonitrile (PAN) fiber can effectively remove lead when it is modified with DETA (diethylenetriamine) with the coating of phosphorous solution it gives a new alleged by using organic fiber with inorganic substance.

Keywords: Modified Polyacrylonitrile fiber, Toxic metals, Lead Removal, Adsorption study, ASPEN ADSIM V10

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EVALUATION OF EXTREME PRECIPITATION OF 2010 OVER KABUL RIVER BASIN USING A REGIONAL CLIMATE MODEL

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ABSTRACT:

Extreme weather events can cause severe social and economic damages. The Weather Research and Forecasting Model version 3.8.1 was applied from 1st May to 16th September 2010 with initial and boundary conditions derived from the Climate Forecast System Reanalysis (CFSR) data, which has 38-km horizontal resolution. The model was set up by using two-nested domains with increasing resolution moving inward from 6-km to the 2-km grid spacing. The model derived precipitation was compared with TRMM 3B42 and stations data collected from Pakistan Meteorological Department and Water and Power Development Authority by using bias, percentage bias, root mean square error, and Pearson correlation. The results revealed that the simulated precipitation was improved slightly from d01 to d02. However, the model showed mixed results with overestimation at some stations and underestimations at others. Hence, it was concluded that the WRF model could be used to forecast heavy precipitation in complex terrains.

Keywords: Kabul River Basin; WRF Model; Indus Basin; Climate Change.

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DEVELOPMENT OF IRON EMBEDDED-BIOCHAR (ACACIA NILOTICA) FOR ARSENIC SORPTION VIA FIXED-BED COLUMN ADSORPTION

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ABSTRACT:

Arsenic is poisonous, and researchers are continuously making efforts to develop efficient biochar that could effectively treat arsenic-contaminated water. Iron embedded biochar has shown adequate sorption ability to arsenic water. In this study, an Acacia nilotica-biochar (B55O) was prepared through pyrolysis at 500° then impregnated with ferric nitrate to fabricate modified biochar (FB550). To check their characteristics, SEM, EDS and FTIR determined their physiochemical properties. They authenticated that biochar had negatively charged surfaces, multi porous texture, and substantial functional groups. Then, an adsorption study was conducted using a fixed-bed column at different conditions. Experiments resulted well on synthetic water at a flow rate (3 ml/min), bed height (15 cm) because of the maximum removal rate and uptake capacity (μ g/g). The maximal sorption capacity in the real water study was 274 μ g/g. FB550 treated groundwater effectively and could be a sustainable solution treatment of arsenic-contaminated water.

Keywords: Biochar, characterization, fixed-bed column adsorption, arsenic



REMOVAL OF LEAD FROM AQUEOUS SOLUTION BY PROSOPIS JULIFLORA BIOCHAR

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ABSTRACT:

Because of the industrialization and anthropogenic activities, heavy metals discharge into the environment is increasing. Lead is one of the toxic heavy metal which can bio-accumulate and cause various health problems. Batch adsorption study was carried out for the adsorption of Pb(II) ions from aqueous solution by Prosopis Juliflora biochar. The results obtained showed that initially adsorption was fast and equilibrium time was found to be 6 hours. Maximum adsorption occurred at pH 5. As the initial Pb(II) ions concentration increased, adsorption capacity increased but the removal efficiency decreased. An increase in dosage of adsorbent increased removal but the adsorption uptake decreased. Maximum adsorption capacity was found to be 2.5 mg/g. Adsorption kinetics of Pb(II) ions on biochar followed pseudo second order and the adsorption behavior best fitted the Langmuir adsorption model. Based on this study, it can be proposed that Prosopis Juliflora biochar can be used for Pb(II) ions removal in water treatment.

Keywords: Biochar, Heavy Metals, Adsoprtion, Isotherm.

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ANTIBACTERIAL AND PHYTOCHEMICAL ANALYSIS OF *LACTUCA* SATIVA (LETTUCE) LEAVES AGAINST ISOLATED CLARITHROMYCIN-RESISTANT BACTERIA

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ABSTRACT:

Currently, the highlighted and serious problem regarding public health is to be considered antibiotic resistance. It has become more contagious due to different transmission routes, including spread through contact or droplets or airborne. The most important determinant of the entry mode is the chemical structure of the drug molecule. However, antimicrobials based on plants have immense potential than available drugs in clinics to combat these superbugs without any known side effects. This study aimed to investigate those natural products that were active in our research against Clarithromycin-resistant bacteria. *Lactuca sativa* (Lettuce) showed the best activity against gramnegative bacteria were observed at different optical densities using UV-visible spectrophotometry at 600nm; best activity was observed at 1 ml/50ml. Different phytochemicals were identified. However, further research on the quantitative analysis of isolated phytochemicals to discovering novel antibiotics and their speedy and plant-based control is mandatory.

Keywords: *Lactuca sativa*; lettuce; clarithromycin-resistance; natural products; phytochemicals.

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TREATMENT TECHNIQUES FOR FORMALDEHYDE CONTAINING WASTEWATER: A REVIEW

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ABSTRACT:

Many industries utilize chemical substances such as formaldehyde for different purposes. These industries are discharging their wastewater containing hazardous formaldehyde directly into water bodies without any proper treatment. The purpose of this review is to study various treatment techniques for formaldehyde-containing wastewater like MABR, RPBR, and advanced oxidation processes. The removal efficiencies of formaldehyde 90-99%, TOC 80-90%, and COD 80-95% have been achieved but these techniques had time taking and energy consumption issues. Another treatment option known as electrocoagulation (EC) is used for the treatment of different industrial wastewaters such as distillery, tannery, textile, dairy, and many others. EC is a novel approach for the treatment of formaldehyde-containing wastewater. So, the focus of this study is on the EC treatment option due to its easy handling, less energy consumption, and required less time.

Keywords: urea-formaldehyde, melamine-formaldehyde, wastewater, treatment

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FLUORIDE LEVEL IN DRINKING WATER SOURCES AND PREVALENCE OF DENTAL FLUOROSIS IN SCHOOL CHILDREN OF DISTRICT THARPARKAR SINDH

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ABSTRACT:

The high concentration of fluoride that is found naturally in groundwater has caused widespread fluorosis in many developing and developed states, including Pakistan, which is facing a problem of acute dental fluorosis, serious teeth diseases inside school children in the Tharparkar district. Fluorosis affects especially children who are more vulnerable to fluoride than adults. **A total of 900 students were examined**, 589 (65%) of children had normal teeth, 186 (21%) questionable, 62 (7%) very mild, 33 (4%) mild, 18 (4%) moderate, and 13 (1%) severe changes were examined. The lower and higher fluoride content and was found to be 0.45-2.70 mg/L in the drinking water of that's schools. Estimated daily intake (EDI) and risk assessment of dental fluorosis hazard index (HI) showed that well water condition is in an alarming situation. Often analyzed that the fluoride level in the drinking water samples of reverse osmosis plants has an acceptable limit. Most well water sources in the Tharpakar district are highly polluted by the concentration of fluorine F ions, so they are not suitable for drinking.

Keywords: Dental Fluorosis; Estimated Daily Intake; Hazard Index; Fluoride level;

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ADSORPTION PERFORMANCE OF ACACIA NILOTICA BIOCHAR FOR ARSENIC

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ABSTRACT

Arsenic, a known toxic element, is a global issue. It has affected millions of people worldwide by causing diseases, including internal cancers, neurological and vascular effects. Various treatment methods are devised for the sequestration of arsenic, which has many drawbacks. Among treatment methods, adsorption offers a more reliable option. In this study, a new environmentally friendly and low-cost biochar was prepared from Acacia nilotica. The biochar was characterized by various techniques. Batch adsorption experiments were performed to test the biochar's performance. Parameters for batch adsorptions were pH (2-12), adsorbate concentration (10-10,000 μ g/L), adsorbent concentration (1000-15,000mg/L), and contact time (5-1440mins). The data follows the Freundlich isotherm model suggesting multilayer adsorption over a heterogeneous surface. While kinetic data follows the pseudo-second order, suggesting chemisorption. The adsorption capacity was 179.19 μ g/mg(90.76%). It was concluded that the optimum removal at pH 7 reduces the issue of pH adjustment and cost.

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Keywords: Arsenic, Adsorption, As[III], Removal

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ABSTRACT:

Arsenic, a known toxic element, is a global issue. It has affected millions of people worldwide by causing diseases, including internal cancers, neurological and vascular effects. Various treatment methods are devised for the sequestration of arsenic, which has many drawbacks. Among treatment methods, adsorption offers a more reliable option. In this study, a new environmentally friendly and low-cost biochar was prepared from Acacia nilotica. The biochar was characterized by various techniques. Batch adsorption experiments were performed to test the biochar's performance. Parameters for batch adsorptions were pH (2-12), adsorbate concentration (10-10,000 μ g/L), adsorbent concentration (1000-15,000mg/L), and contact time (5-1440mins). The data follows the Freundlich isotherm model suggesting multilayer adsorption over a heterogeneous surface. While kinetic data follows the pseudo-second order, suggesting chemisorption. The adsorption capacity was 179.19 μ g/mg(90.76%). It was concluded that the optimum removal at pH 7 reduces the issue of pH adjustment and cost.

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Keywords: Arsenic, Adsorption, As[III], Removal

DESIGNING A SYSTEM USING ULTRASONIC SENSOR FOR REALTIME MONITORING OF FLOW DEPTH IN CANALS

Hasnain Gul^{*1} and Dr. Babar M. Munir¹ ¹Postgraduate student, USPCAS-W, MUET Jamshoro ¹Professor, USPCAS-W, MUET Jamshoro

ABSTRACT:

In a gravity-fed Canal Irrigation System (CIS) or any natural stream, flow measurement is vital for regulating flows and assessing the hydrological system. Traditionally, flows are assessed by observing the flow depths (D) through gauges and correlating them with calibration curves explicitly developed for that particular canal or stream at a particular cross-section. Thus, knowledge of flow depth is vital for assessing the flow rates (Q). In fact, efficient Irrigation Water Management (IWM) begins with measuring the -Q and -D. However, monitoring (measuring and recording) this vital variable (D) manually is intermittent, error-prone, and laborious; it often yields poor and undesirable outcomes. Measurement of flow depth by an electronic device will improve the efficiency of canal irrigation system, bring transparency, and help the irrigation managers in decision making. In this article, a study is presented for developing a system based on an electronic device that measures flow depth continuously and stores it to assess flow rate. The study brings forth a unit of Ultrasonic Sensing System (USS), capable of Monitoring real-time data on flow depth. The system comprises of a measuring unit containing Ultrasonic Sensor as its principal component and a user-interface over a freemium cloud, ThingSpeak, which serves as a Dashboard and Database. The study puts forward a blueprint, presenting a comprehensive design, implementation procedure, and performance evaluation of Ultrasonic Sensing (US) System. The system was implemented and analyzed in the lab and field to evaluate its efficacy and reliability. The performance of the device is evaluated statistically with the coefficient of determination, $R^2 > 0.98$.

Keywords: Flowrate, Flow depth, Ultrasonic Sensing System, Canal irrigation system, and real-time data.

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COMPARATIVE STUDY OF *EUPHORBIA* AND *LEMON FICUS* AS DISINFECTANT AGAINST SINK MICROBES

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ABSTRACT:

Herbal disinfectant is the cheapest source to clean the surface and is a noel idea. This study was conducted to develop herbal disinfectant and to investigate the comparative study of *Euphorbia Milii* and *Lemon Ficus* disinfectant against sink microbes through disc diffusion method and minimum inhibitory concentration. The plant extracts were extracted with tannic acid using an aqueous solvent. Gram-positive and Gram-negative bacteria were isolated from the kitchen sink's surface, and disinfectant activity was evaluated. The results showed that the Euphorbia disinfectant contained a zone of inhibition of a maximum of 14 mm for *Escherichia coli* and 20 mm for *Staphylococcus aureus*, while for Lemon Ficus, it contained 16.6 mm for each of the bacteria. Minimum Inhibitory Concentration was recorded with optical density using UV spectrophotometer at 600nm. The MIC was performed with and without Tannic Acid, which showed inhibition of bacterial growth. Both results were compared to check which is more effective against microbes.

Keywords: Disinfectant, Euphorbia, Minimum Inhibition Concentration, Spectrophotometer.

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IDENTIFICATION OF ANTIBIOTIC-RESISTANT BACTERIA IN HOSPITAL SINK OF JAMSHORO, PAKISTAN

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ABSTRACT:

Antibiotics are characterized as one of the life saving drug group to treat the bacterial infections. Because of the increasing issues of resistance, antibiotic resistance has been percieved as a major health threat to humans. Our study determines the presence of the antibiotic resistant bacteria in the sink traps of the hospitals of the district Jamshoro, Pakistan. The study has two parts, the first part comprises of assessment of water, sanitation and hygiene facilities through the guestionnaire survey which comprises of the three major sections: 1) Water, 2) Sanitation, 3) Hand hygiene. In second part we collected sink samples from the same healthcare facilities for antibiotic resistance and then analyze these samples by using streak and spread method (antibiotic sensitivity method) in the water quality laboratory at US Pakistan center for advanced studies, Mehran university of engineering & technology Jamshoro The results found that 84.62% of the isolated for the gram negative bacterial growth, display resistance to all tested antibiotics (Ertapenem, Cefixime, Aztreonam, and Ciprofloxin). However 7.69% of isolates display resistance to three antibiotics out of four and those are Ertapenem, Cefixime, and Aztreonam. While remaining 7.69% of isolates were only resistance to Ertapnenem and Aztreonam. The Pearson Correlation indicates that only Ertapenem has good positive correlation with other three antibiotics. The water, sanitation, hygiene and healthcare waste management in the surveyed hospitals were below the standards set by the world health organization. Also the Water, Sanitation and Hygiene conditions were found unsatisfactory with reference to world health organization minimum standard set-up for healthcare facilities. There is a big need to improve the Water, Sanitation and Hygiene services in healthcare settings through awareness and training sessions.

Keywords: Hospital Sinks, Antibiotic resistance, Hygiene, Healthcare.

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BLENDING EFFECT OF BIOMASS AN ALTERNATIVE TO COAL IN CO-FIRING ON THE EMISSION OF NOX/SOX

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ABSTRACT:

During the combustion of fossil fuel, emissions of NOx and SOx had many environmental problems like acid rain, corrosion effect due to the content of Sulphur in coal, etc. Concerning this, studies have been carried out to explore the ability of biomass to reduce the levels of nitrogen oxide(NOx) and Sulphur oxide(Sox). The existing study focuses on the impact of combustion using coal and biomass combined. To study the combustion activity of coalbiomass blends and their emissions, different ratios of coal and biomass have been used. In different ratios, such as 80/10, 70/20 and 60/30, and 50/40, four different biomass were mixed with coal. During the co-combustion of coal at a ratio of LC80 percent + BTW 20 percent, the minimum emissions were observed and maximum emissions were sorted at 100 percent LC. For beneficial results about NOx and SOx emissions from the co-combustion process, it will be easy to decide on the use of biomass with coal. Finally, the researchers concluded that utilization of biomass with Lignite coal may take remedial action regarding environmental damage. Less energy will be utilized through biomass combustion than coal to decrease the emission of pollution.

Keywords: Renewable energy, Co-Combustion, Lignite coal, NOx emission, SOx emission

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ASSESSMENT OF MICROBIAL CONTAMINATION ON THE HANDS OF POULTRY BUTCHERS AND DETERMINATION OF ANTIBIOTIC RESISTANT OF SALMONELLA

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ABSTRACT:

Meat handled with satisfactory hygiene standards is one of the major requirement to protect the consumers' health. The present study was conducted in Hyderabad and Jamshoro districts of Sindh to investigate the hand washing practices of poultry butchers. Also the microbial analyses of butchers' hands were carried out by using some standard microbiology tests. Total 38 samples were collected from hands of the butchers by using sterilized cotton swab. Three hygiene indicator bacteria were focused, i.e. *Salmonella, Shigella* and *E. coli.* Bacterial colonies were identified on the basis of their morphology. *Salmonella* isolates were confirmed by Triple-sugar-Iron agar test and Urease test. Moreover keeping in mind the recent outbreak of extremely drug resistant XDR Typhi the antibiotics resistance of *Salmonella* is also determine. The results revealed that out of 39 samples 37 and 38 samples were positive for *salmonella* and *Shigella*. And prevalence of *E. coli* was found 100%.

Keywords: Hands, Hygiene, Butchers and Meat

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COMPARATIVE ANALYSIS BETWEEN REUSABLE AND DISPOSABLE SANITARY PADS AND ASSESSING HYGIENIC STATUS OF WOMEN IN IMPOVERISHED COMMUNITY OF SINDH

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ABSTRACT:

Menstruation Hygiene Management (MHM) is considered as forbidden topic to discuss especially in rural areas. Female commonly use traditional methods such as cloths, cotton etc. during menstruation as they are lacking proper knowledge with regards to MHM and on top of it they don't have capacity to buy sanitary products. The present study was conducted to assess the MHM and to further determine the availability eco-friendliness of sanitary products among rural women. The structured validated survey questionnaire was used to acquire information from 20 Households with regards to MHM. The availability of sanitary products was determined using walk through survey of the catchment market near the rural area. The sanitary products were processed in the USPCASW water quality lab for biodegradability. The biodegradability of sanitary pads was checked by wet soil burial test. The survey results showed that 90% women regard menstruation as physiological change and 30% had correct knowledge regarding menstrual organ. 55% respondents were well informed prior to menarche while only 40% females received knowledge from family whereas others got knowledge from teachers, peers and media. Around dozen of sanitary products were found in the nearest city of the study area (village). The biodegradation results showed that the reusable sanitary pads were biodegraded more than disposable sanitary pads. However, due to the humidity and weather change the biodegradation process gets slow down. It is concluded that there is dire need to run awareness programs and sessions with regards to menstrual hygiene practices on one hand and provide them with the easy affordable access to sanitary products.

Keywords: Menstruation, Hygiene, Biodegradation, Sanitary Pads

TREATMENT OF WASTEWATER GENERATED FROM THE USPCAS-W CENTER BY USING MEMBRANE BIOREACTOR SYSTEM

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ABSTRACT:

This study was conducted on domestic wastewater of research institute, where various chemicals or biological materials were utilized, that represent the main generators of waste constituents of ecological concerns. However, in this paper domestic wastewater treatment is considered with the application of aerobic membrane bioreactor (AMBR), the AMBR system received its influent from sewage wastewater which produced an effluent of much-better-quality in terms of total suspended solids (TSS), biological oxygen demand (BOD5), Volatile Suspended Solids (VSS), chemical oxygen demand (COD), and pH. This Study resulted that in the case of AMBR treatment in terms of domestic wastewater leads to exceptional water quality. Consequently, The AMBR system proved to be an innovative approach for the enhanced removal of solids and micropollutants. Moreover, in terms of reuse, the high-quality processed water enables it to be recycled for irrigation.

Keywords: Domestic wastewater, membrane bioreactor, wastewater treatment

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ASSESSMENT OF LEGIONELLA SPECIE AND ITS ANTIBIOTIC SENSITIVITY IN DRINKING AND TAP WATER OF PRIMARY SCHOOLS

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ABSTRACT:

The world of research is finding new ways to assess different pathogenic bacteria and their solution in the same way this research found specific microbial contamination in drinking and tap water of primary schools known as Legionella pneumonia, these are coccoid or rod shaped, intracellular pathogens, gram negative(Collins, Espersen et al. 1983) and motile. Legionella Spp. In this findings drinking water and tap wate quality was assessed from the primary schools of Hyderabad district in Sindh Pakistan. This research was conducted between **September to December** of 2020 year, this findings belong to a specific microbial contamination in water of primary schools called *Legionella pneumonia* which is important human pathogenic bacterium that occupies air sacs of lungs and cause infection (Wikipedia). It is considerably found in contaminated air and natural contaminated water as well as domestic hot water supply. In this finding we found Legionella pneumonia in our water samples from all primary schools of Hyderabad.

Keywords: Legionella spp., Legionnaires disease, Primary schools, low immunity.

IDENTIFICATION OF ANTIBIOTIC RESISTANCE MICROBES EMERGING FROM HOSPITAL LAUNDRY WASTEWATER

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ABSTRACT:

Emerging multiple antibiotics resistant microbes is a worldwide issue. This study was performed to identify antibiotics resistant bacteria emerging from the hospital laundry waste. The samples were collected from the LUMHS hospital laundry of Jamshoro district. Serial dilution spread plating and streaking methods were used for bacterial identification and isolation by using selective media susceptibility of antibiotics was measured by standard disc diffusion method.

The results have recorded the presence of the average of E.coli (9.25×104 CFU/ml), Enterococcus (3.31×104 CFU/ml), and pseudomonas aeruginosa (2.62×104 CFU/ml), were respectively. Finally, we have tested commonly used antibiotics such as ciprofloxacin (CIP), azithromycin (AZM), and cefixime (CFM). All isolated bacteria are highly resistant except pseudomonas aeruginosa that is sensitive to ciprofloxacin and azithromycin only. While laundry is harboring resistance microbes, however, these are increasing day by day, the appropriate steps should be taken to inhibit these pathogens and prevent environment and public health.

Key words: Hospital laundry wastewater, antibiotic resistance, identification.

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PHOTOCATALYTIC DEGRADATION OF ORGANIC DYES USING NICKEL/ TITANIUM PHOSPHATE (NI/TIP) NANOCOMPOSITE

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ABSTRACT:

The novel nano composite of Nickel/Titanium Phosphate (Ni-TiP) with different Ni contents was prepared by impregnation method. The physical properties of the Ni-doped TiP photocatalysts were studied by several techniques such as X-ray diffraction (XRD), scanning electron microscopy (SEM) and UV-Vis spectroscopy. Synthesized catalyst was used for photocatalytic degradation of Rhodamine B (RhB) under visible light. The prepared catalysts were named as NiTiP-1, NiTiP-2, NiTiP-3, NiTiP-4, and NiTiP-5. Among these catalysts, NiTiP-4 can degrade up to 80 % RhB (10 mg/l) in 120 minutes at pH-7 by applying 50 W halogen lamp. Ni-TiP-4 can degrade up to 84% RhB (30 mg/l) in 120 minutes at pH-7 by applying 50 W halogen lamp. The Ni-doped TiP samples revealed higher photocatalytic performance than the pure TiP sample under visible light irradiation. The photocatalytic mechanism has also been presented. The prepared catalyst has good recycling efficiency which is up to 4 recycles.

Keywords: Ni doped TiP, Visible light Photocatalyst, Degradation of Rhodamine B (RhB)

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INVESTIGATE THE ANTIMICROBIAL ACTIVITY OF SYNTHESIED AND CHARACTERIZED ZINC OXIDE/TITANIUM PHOSPHATE NANOCOMPOSITE

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ABSTRACT:

In this study Zinc oxide (ZnO)/Titanium Phosphate (TiP) nanocomposite were synthesized through a simple precipitation method. Characterization of synthesized of Zinc oxide (ZnO)/Titanium Phosphate (TiP) optical properties, structural and functional groups of the synthesized nanocomposites have been characterized by using UV–Visible spectroscopy (UV–Vis), X-ray Diffractometry (XRD), Fourier Transform Infra-red (FT-IR). Thus, analyzed samples were subject to well diffusion agar method at various concentrations were analyzed for antimicrobial activities against Gram negative *E. coli*. Antimicrobial activity were observed by different concentrations (1-35) mg/ mL. Comparison of zone of inhibition of *E. coli* done on different concentration of nanocomposite. Best antimicrobial activity of zone inhibition (20 mm) done on optimized concentration of 30mg/mL from this study it is concluded that this novel nanocomposite is effective for antimicrobial applications. The synthesized green ZnO/TiP Nanocomposites was able to effectively use for *E. coli* antimicrobial applications.

Keywords: Zinc oxide (ZnO), Titanium phosphate (TiP), Nanocomposites, Antimicrobial

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TREATMENT OF RO MEMBRANES REJECT WATER USING ADSORPTIVE DISTILLATOR TECHNIQUE

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ABSTRACT:

Reverse osmosis membrane rejects water is a major environmental problem, and most conventional remediation approaches do not provide acceptable solutions. Distillation treatment typically removes most of the dissolved materials. Membrane rejected wastewater from AI-Rahim Textile Industry (ATI) was collected, and the **Adsorptive** distillation (AD) technique was applied in the present study. First and Foremost, laboratory scales distillator was utilized and TDS removal was tested at three temperatures 105, 110, and 120°C using 2g/l of mixed adsorbing media. Subsequently, maximum TDS removal condition was analyzed at varied dosages of adsorbing media. The optimum results were obtained at 110°C using 10g/l. so, further study was performed on industrial scale using optimized condition. Boiler waste heat was provided to AD as an energy source. The distillate was analyzed and observed that quality of distillate with TDS ranging up to 118 mg/L and energy consumption was analyzed to treat different volumes of brackish water.

Keywords: Distillation, Membrane Reject water treatment, Textile industry wastewater, TDS removal

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ASSESMENT OF CHLORINE-TOLERANT BACTERIA FROM DRINKING WATER SUPPLY OF LATIFABAD, HYDERABAD

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ABSTRACT:

Waterborne diseases are caused by pathogenic microorganisms which are transmitted through drinking water system due to the poor sanitation practice. These diseases can be prohibited with proper water treatment. Chlorination generally is used as a disinfecting agent for drinking waters over the centuries. Chlorine disinfectant is the main process to treat drinking water to get rid of bacterial contamination and viruses. In Hyderabad city, the water supply system is a major source of drinking water distribution after chlorination. The aim of this study was to detect the chlorine tolerant bacteria from the water supply system of Latifabad. Chlorine was used in chlorine dioxide at a concentration of 200, 100, 50, 25, and 12.5 ppm. 7 bacterial strains of chlorine tolerant bacteria were identified. The isolated strains were *Staphylococcus aureus*, *E.coli.* **EC** (*E.coli*), **PM** (*Proteus mirabilis*), **ST** (*Salmonella typhimurium*),**SA** (*Staphylococcus aureus*),

SE (Staphylococcus epidermidis), **SS** (Shigella dysenteriae/ flexner), **VC** (Vibrio cholera), . In conclusion, Latifabad drinking water system was showed the presence of chlorine tolerant bacteria. This study recommends that there is a need to change the decontamination methods for drinking water supply to improve the water quality for the community.

Keywords: Chlorine tolerant bacteria, Chlorine dioxide, *Staphylococcus aureus*, *E.coli*, Chlorination

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REMOVAL OF ATRAZINE HERBICIDE FROM WATER BY TITANIUM NANO-PARTICLES

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ABSTRACT:

In the present work, the nano-structural TiO_2 was synthesized by sol-gel procedure. Due to strong oxidizing power and high photo-stability TiO_2 is extensively used for this purpose. Pakistan as an agricultural country, it is one of the largest consumers of atrazine herbicide to overcome the unwanted weeds and roots. Atrazine as a main ingredient for agriculture, it also has some negative environmental impacts. In this research atrazine is first detected and then degraded by photocatalysis. photocatalytic reactor is used for this degradation purpose. In this research, TiO_2 nanoparticles were prepared from TiO_2 micro size powder by sol-gel technique. Obtained particles were characterized by SEM, UV, XRD, FTIR. Results shows that the TiO_2 as a catalysis gives efficient and fast degradation.

Keywords: Atrazine; Photocatalysis; Titanium Nanoparticles; Degradation

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EVALUATION OF FUNGAL REMOVAL IN BIOFILMS FORMED ON DIFFERENT PIPE MATERIALS OF DRINKING WATER DISTRIBUTION SYSTEM

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ABSTRACT:

Drinking water is contaminated by various microorganisms' causes' biofilm formation in the drinking water distribution system. Biofilms release microorganism including pathogens again into distribution system, thus contaminated water causes several health issues for the human life. A reactor, containing PPR, UPVC, GI pipe materials, in the real distribution system was operated for 6 months for biofilm formation, followed by disinfection of the biofilms by 1.5 mg/l hypochlorite disinfectant in order to check if this dose removes biofilms from used real distribution system pipe materials. Biofilm were scrapped after 5, 10, 15, 20 hours of post disinfection. Moreover, basic water quality parameters were assessed including temperature, pH, turbidity, DO, EC, TDS, free chlorine, salinity, and heavy metals. DNA extraction was carried from bulk water and biofilms using CTAB method. Bacterial viability test was carried by using fluorescence microscope. Water quality parameters were within the range such as temperature (13-31.5C), dissolved oxygen (7.2-8.9 mg/l), turbidity (2.50-7.86 NTU), TDS (355-786 mg/l), pH (7.1-8.26). In conclusion, biofilm removal was observed with 1.5 mg/l of hypochlorite disinfectant with at least 20 hours disinfectant contact time.

Keywords: Contamination, Disinfection, Biofilm, bacterial viability, drinking water distribution system.

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RAINFALL FREQUENCY AND TREND ANALYSIS OF RAINFALL IN THARPARKER

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ABSTRACT:

Climate change has caused extreme weather events in Sindh province, over the past 20 to 30 years. The frequency and severity of natural disasters such as floods and droughts have increased manifold. The study was conducted across the Tharparker to assess the rainfall trend to examine the rainfall trend and rainfall frequency analysis of rainfall stations datasets were used for the trend analyses. The study analyses the rainfall trend in the last 43 years dividing it into two periods from 1979-2000 and 2001-2014. The method was applied by using the daily rainfall and monthly rainfall data. To statistically analyze variations in the daily data set the Pearson III distributions were used. The results of the study have challenged the central concepts about rainfall trends in Tharparkar. However, many differences in the rainfall trends results compared to the return period are apparent. The results indicate that continuous fluctuations in rainfall and drought occurred at Tharparker.

Keywords: Rainfall frequency, Climate change, Tharparker, HEC-SSP

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DROUGHT TRENDS IN SINDH PROVINCE: A CASE STUDY OF THARPARKER DISTRICT

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ABSTRACT:

Drought is one of the severe threats and can be devastating to the arid regions of the Tharparkar region. Tharparker is an arid and drought-prone region. The focus of this study is to determine the drought characteristics (drought duration, severity, and intensity) over the Tharparker region by using the Standardized Precipitation Index(SPI) at 3-month timescale series. We interpolated the GPCC data at the Mithi station. The GPCC data is freely available at 0.5 degrees resolution for 126 years (1891-1916). The results showed that the extreme drought events occurred in 1899, 1912, 1918, 1939, 1947, 1969, 1970, 1974, 1992, 2000, and 2003. The findings of this study can be helpful for water managers in future to control the negative effect of climate change in the Tharparker region.

Keywords: Tharparker; precipitation; SPI; GPCC; drought characteristics;

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"PROFILING OF CARBAPENEM AND AZITHROMYCINRESISTANT ACINETOBACTER BAUMANNIIISOLATED FROM JAMSHORO"

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ABSTRACT

Acinetobacter.baumanii have the ability to cause a wide range of diseases like pneumonia, peritonitis, urinary tract infections, etc. It resist different antibiotics, which is an alarming situation for human health. This study focus on detecting antibioticc-resistant *A.baumanii* from the waste water of Jamshoro, total 40 samples were collected, and bacteria were allowed to grow on selective agar media and observed for the zone of inhibition for carbapenem and azithromycin. The results showed that *A.baumanni* resisted 100% against carbapenem and 93% against the azithromycin. The obtained results revealed the dangerous situation to propagate antibiotic resistance. It is concluded that excessive use of carbapenem and azithromycin is rapidly showing antibiotic-resistant. It is highly recommended that the inappropriate use of both antibiotic should be avoided; otherwise, it can cause a great disaster to human health.

Keywords: *Acinetobacter.baumanii*,antibiotic-resistant,carbapenem, azithromycin.

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ANAEROBIC CO-DIGESTION OF TEXTILE SLUDGE WITH BUFFALO DUNG FOR THE PRODUCTION OF BIO-GAS USING SAMPTS (SEMI AUTOMATED METHANE POTENTIAL TEST SYSTEM)

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ABSTRACT:

Pakistan is one of the largest exporters of textile products. textile sector discharge hazardous heavy metals like lead chromium and nickel directly dumped into the sea without treatment affects eco life and open dumping affects humans. To mitigate this problem and make into useful waste. anaerobic digestion is one of the useful methods to use this waste and convert into bio methane. Anaerobic digestion is multi stage process that comprises of Hydrolysis, acidogenesis, acetogenesis and methanogenesis steps. Different ratios were run on BMP (bio methane potential), from textile sludge that is mixed with buffalo dung 1:0, 4:1, 3:2/, 2:3, 1:4/, 0:1. The ratio of blank sludge has 45.7 ml/g VS, 4:1 has 49.2 ml/g VS, 3:2 has 58.7 ml/g VS, 2:3 has 25.4 ml/g VS, 1:4 has 82.5 ml/g VS and blank dung has 76.6 NM/L. The optimum ratio of textile sludge and cow dung that has maximum methane yield is 3:2.

Keywords: Anaerobic- digestion, Bio-methane-generation, Textile sludge, cow dung.

EVALUATION OF THE TROPICAL RAINFALL MEASURING MISSION (TRMM) 3B42 VERSION 7 DATASET PERFORMANCE OVER THE UPPER INDUS BASIN

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ABSTRACT:

The unavailability of the continuous precipitation data (temporally and spatially) due to severe climatic conditions is a major concern over the complex topographic regions, particularly the Upper Indus Basin (UIB). To reduce this gap, various satellite-based products are available to collect climate data with better coverage. Out of all these products, this study aims to compare the Tropical Rainfall Measuring Mission (TRMM) 3B42 Version 7 gridded precipitation dataset with the gauge station data to assess its performance over the Upper Indus Basin. The study further selects twenty-one stations from the Pakistan Meteorological Department (PMD) and Pakistan Water and Power Development Authority (WAPDA) over fifteen years. The results indicate that TRMM underestimates precipitation over the UIB at most of the stations. It further highlights that certain improvements in the TRMM dataset may lead to more reliable results for future studies.

Keywords: Upper Indus Basin; TRMM; precipitation; climate data

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PERFORMANCE EVALUATION OF MEMBRANE BIOREACTOR USING ANAEROBIC-AEROBIC CONDITIONS COMBINED FOR TREATMENT OF INDIGO DYE EFFLUENT

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ABSTRACT:

Indigo dye-containing wastewater should be managed with viably utilizing eco-accommodating advances to forestall unfriendly effects on the climate and natural water assets. An Innovative Anaerobic-Aerobic Membrane Bioreactor (AnAMBR) has been designed to treat Indigo dye effluent on a pilot lab scale. It was consisting of two sequential bioreactors (a 6.5L anaerobic reactor and a 5.5L aerobic reactor). A flat sheet membrane was used and immersed in the aerobic reactor. The reactor was inoculated with sludge taken from Artistic Denim Mills, Karachi, The treatment limit of the reactor was 18L/d. Different AnAMBR operating parameters like mixed liquor suspended solids (MLSS) and mixed liquor volatile suspended solids (MLVSS) concentration were maintained at (3500-4000) mg/l and (3000-3500) mg/l, individually. Performance evaluation of the reactor was observed in the terms of COD (mg/l). The pH of the reactor was kept between 7.5 to 8.5. Additionally, more than 90% COD (mg/l) removal efficiency has been investigated. AnAMBR has brought about unrivaled execution and It has been demonstrated to be pertinent for treating textile industrial wastewaters.

Keywords: AnAMBR, Indigo Dye Effluent, Anaerobic-Aerobic Reactor, COD Removal

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ANTIBIOTIC RESISTANCE IN PATHOGENS OF BIOFILMS USING DISC DIFFUSION METHOD

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ABSTRACT:

Increase of Antibiotic resistance bacteria (ARB) specifically well-known bacterial pathogens an ever-increasing global public health threat. To determine antibiotic resistance in bacteria present in the biofilm samples 4an Annular Reactors setups designed and operated and biofilms were disinfected with 0.5, 1.0, 1.5, 2.0mg/l chlorine doses respectively Biofilm samples were collected from annular reactors and were analyzed for AMR using Standardized Kirby Bauer Disc Diffusion test to determine the Antibiotic sensitivity testing of Pathogenic bacteria including Pseudomonas, Vibrio Cholera, Salmonella, and Shigella. Listed pathogens were isolated from biofilms through membrane filtration method on selective media. Antibiotics including Bacitracin (B 10 μg), (Rifampicin (RD μg5), ciprofloxacin (CIP 5μg), Imipenem (IPM μg10), Azithromycin (AZM 15 µg), Amoxcillin, cefixime (CFM 5 µg), Metronidazole (MTZ µg5), Streptomycin (S µg10). and Ampicillin (AMP10 µg) were tested against above mentioned pathogens. Zones were measured by vernier caliper. The results showed that Pseudomonas, Vibrio Cholera, Salmonella, and Shigella were highly resistant against Rifampicin, Metronidazole (MTZ 5 μ g), Bacitracin (B 10 µg), and Amoxcillin (AML 5µg).. However, Azithromycin (AZM 15 μ g) and streptomycin (S μ g10) were most effective drug of choice to treat these pathogens.

Keywords: Antibiotic resistance, Multi drug resistance; Biofilms, Annular Reactor, Resistant bacteria

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COMMUNITY ACQUIRED CARBAPENUM RESISTANT IN URBAN LATRINE WASTEWATER OF HYDERABAD SINDH

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ABSTRACT:

Carbapenum resistant enterobacteriaceae are increasing in the community setting and people are now at a very higher risk as most of the diseases will not be cured effectively. Morbidity and mortality rate is increasing globally, due to irrational use of antibiotic medicines. Community acquired carbapenum resistant enterobacteriaceae are increasing in the underdeveloped countries like Pakistan. Human faecal excreta is the main reservoir of antimicrobial resistant genes and through this transmission of resistant bacteria becomes prevalent in the community.

In this study we had taken samples from community toilet waste water and their microbial analysis was done in the microbiological lab by means of the standard disk diffusion method .The zones of inhibition of antimicrobial testing shows that 50-59% samples of meropenum with Ecoli are intermediate and 28% are found to be resistant. With KEC results shows a higher prevalence of up to 31%.Government should take immediate action and make such policies to reduce the prevalent antimicrobials like carenum in the community.

Keywords: Carbapenum, enterobacteriaceae, waste water

STUDY OF CUMULATIVE BIOGAS PRODUCTION IN ANAEROBIC DIGESTER AT DIFFERENT RATIOS OF FOOD WASTE AND BUFFALO DUNG

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ABSTRACT

This study aimed to find the cumulative biogas production at different ratios of food waste and buffalo dung anaerobically co-digested. There were six reactors; with different ratios of food waste to buffalo dung, which were: 1:0, 4:1, 3:2, 2:3, 1:4, and 0:1. Bio methane potential reactors used in the study had a volume of 400 mL and were filled with water to substrate ratio of 1:1. Inoculum used for all the ratios except the blank samples was: 15%. A temperature of $37 \Box C \pm 5$ was maintained throughout the experiment. The electric motors of all the stirrers were given 120 rpm. The mixture was anaerobically digested for 40 days and the volume of biogas was found daily for each ratio. The ratio, at which the highest and lowest cumulative volume of biogas produced were: 2:3 and 1:0 respectively and the cumulative volume of gas produced was 414 ml and 222 ml respectively.

Key words: Anaerobic digestion, Bio methane potential, Inoculum, rotation per minute

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PHOTOCATALYTIC REMOVAL OF COD USING BISMUTH OXIDE COATED CLAY FILTER

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ABSTRACT:

Advanced oxidation processes (AOPs) are among the most suitable water and wastewater treatment technologies to remove organic matter. AOPs need further to be explored in treating organic pollutants present in wastewater. In the current study, the surface of an indigenously made clay filter was coated with bismuth oxide (Bi_2O_3) thin films via the dip-coating method. The clay filter was shaped through a standard 3D printed mold. The X-Ray Diffraction analysis revealed the immobilization of tetragonal- β -Bi₂O₃ on the clay surface. The photocatalytic properties of the Bi_2O_3 coated were investigated with COD removal under the visible LED light. The obtained results highlight a significant potential of the advanced photocatalytic process in treating organic pollutants i.e. using photocatalyst coated clay filters. The graphical abstract of the study is shown in Fig.1.

Keywords: Pollutant degradation, clay filter, bismuth oxide, photocatalyst, visible light

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PHOTOCATALYTIC DECOLORIZATION USING BISMUTH OXIDE CLAY FILTER

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ABSTRACT:

A Clay filter was made through 3D structured mold and coated with bismuth nitrate precursor solution through a sol-gel technique to obtain bismuth oxide thin film. Solar-assisted photodegradation of bismuth oxide clay filter was investigated using Indigo carmine dye. The photocatalytic properties of the Bismuth oxide clay filter were tested under both LED lamp and sunlight. The photocatalytic response and Indigo carmine degradation were studied using UV-Vis Spectrophotometer and Total Organic Carbon Analyzer at different time intervals. Bismuth oxide clay filter was found to degrade 95% Indigo carmine dye in 90 minutes under solar radiation. Whereas the Indigo carmine dye was only 65% degraded in 180 minutes under LED lamp through the bismuth oxide clay filter. Bismuth oxide-coated clay filter is found to have high efficiency under sunlight. The graphical abstract of the study is shown in Fig.1.

Keywords: Bismuth oxide; 3D structured clay filter; solar radiation; visible light

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Young Research National Conference NCWE-21

MARINE POLLUTION IN PAKISTAN; A LEGAL PERSPECTIVE (SYED MUHAMMAD HADI HAMDANI)^{*}

ABSTRACT:

This paper discusses the presence of marine pollution in light of applicable laws. The concept of conservation of marine ecosystem and maritime environment is enshrined in many international laws which carry binding force on states. Moreover, Pakistani legal framework also provides mechanism for protection of its waters; however, these provisions lack practicality and these laws are not implemented in its strict sense. Non-obedience of these compulsory rules and regulations leads to a flawed policy which increases substantial threats for marine ecosystem and causes irreparable loss to natural spectrum of waters. The existence of human life is dependent on the abundance of water. Flux of technology development that has paved its ways in the last century has also brought a significant and tangible threat to sea life. Aqua culture is over exploited by the mankind which negatively affects the species living in oceans. Legal regime which deals with the conservation of seas and waters is a complex interplay between different stakeholders on a multiple level.

This paper describes the legal perspective of conservation of land waters, coasts and seas and its protection from pollutants.

Keywords:

Maritime Law, Pollution, Conservation, Ecosystem and Legislation

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TEXTILE WASTEWATER TREATMENT USING MICROALGAE AND BACTERIA IN TWO STAGE PROCESS

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ABSTRACT

Unchecked disposal of textile wastewater (TWW) into water bodies is causing eutrophication. With the eutrophication phenomenon, microalgae which is ecofriendly (specie) that is already present in our aquatic system and consume nutrients naturally available and treat the wastewater as absorbent. Textile wastewater is a cheap source for the cultivation of microalgae and bacteria, as it contains essential nutrients (inorganic and organic) and different types of dyes and color (carbon source). Phyco-remediation along with biodegradation is the type of bio-remediation that not only treats the wastewater but also produces valuable products and clean water. In this systematic methodology of textile wastewater treatment, using a two-stage process, 0.1 g/l inoculums of bacteria added into the reactor, after that 0.5 g/l microalgae biomass also added in pre-treated with bacteria. As a result, the removal efficacy of color removal in a two-stage process is 23.23% with bacteria and in Pre-treated with bacteria removes 44.36 %. Moreover, with 1.6 g/l % DCW and 12.87 mg/l chlorophyll are obtained in two weeks of the experiment. Hence, results shows that microalgae and bacteria are promising and cost-effective microorganisms to the treatment of textile wastewater without production of any sludge and preserve the aquatic environment too.

Keywords: Chlorophyll, Color, Textile wastewater, Two-stage process

USE OF BACTERIAL CONSORTIUM AND MICROALGAE FOR THE TREATMENT OF MEA WW IN A TWO STAGE PROCESS

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ABSTRACT:

Monoethanolamine (MEA) is generally used for carbon capturing through absorption process. The wastewater coming from the process plant contain this amine solution, to protect the environment, treatment of this wastewater is needed. In this study, aerobic fed batch reactor was used to biodegrade the MEA wastewater through bacterial consortium in the 1st stage while in the 2nd stage the biodegraded nutrient rich wastewater was utilized for microalgal growth. The maximum COD removal achieved in 1st stage was 95% after 9 days, meanwhile NH₃ and NO₃ removal was 56% and 39% respectively. In the 2nd stage, the NO₃ and NH₃ removal was increased up to 71% and 70% respectively.

Keywords: Monoethanolamine, COD, microalgae, bacterial consortium

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SIMULTANEOUS PHOTOCATALYTIC AND MICROBIAL DEGRADATION OF WASTEWATER BY a-Bi,o, PARTICLES

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ABSTRACT:

This paper reports the synthesis and characterization of an efficient visible light active photocatalyst, i.e., α -Bi₂O₃ powder for the simultaneous photocatalytic degradation Indigo Carmine dye and two selected pathogens E. coli and Staphylococcus aureus. The α -Bi₂O₃ powder was synthesized by a simple by a solid-state reaction–annealing route at 550 °C and characterized with Xray Diffraction technique to determine the crystal structure which confirmed the synthesis of α -Bi₂O₃ particles. From UV-Vis analysis, the band gap was found 2.8 eV which proves it as visible light active photocatalyst. For the degradation Indigo Carmine took 90min in the presence of Staphylococcus aureus and 120min in presence of E. coli. Fluorescence Spectroscopy also confirms the bactericidal effect of synthetic particles.

Keywords: *Photocatalytic degradation, Indigo Carmine, E. coli, Staphylococcus Aureus*

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MODIFIED PHOTOSYNTHETIC MICROBIAL DESALINATION CELL TO ENHANCE WATER DESALINATION

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ABSTRACT:

Desalination is becoming common for converting saline water into potable water. Converting salt water of oceans into freshwater is a solution to overcome the need for freshwater. Some of the most common desalination technologies are reverse osmosis (RO), electro-dialysis and distillation. These methods are expensive and consume high electrical energy. To overcome these issues bio-desalination techniques were introduced. One of the method is Microbial Desalination Cell (MDC). But there is some constraint to MDC like, at anode and cathode chamber, expensive and toxic chemicals are used as catholyte which are not environmentally sustainable. In this research, Photosynthetic MDC (PMDC) was used at cathode and an activated sludge as an inorganic carbon source was used at cathode and an activated sludge as an inoculum and dead microalgae as an nutrient was used. The effect of salt removal was observed. The maximum salt removal efficiency was achieved by this photosynthetic MDC of 59 and 43% at dead microalgae biomass and live microalgae with sodium bicarbonate respectively.

Keywords: Microbial Desalination Cell (MDC), Bio-Desalination, Photosynthetic MDC (PMDC), Bio-Desalination Technique.

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EVALUATION OF EQUITABLE WATER DISTRIBUTION IN THE SECONDARY CANALS OF JAMRAO WEST BRANCH

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ABSTRACT:

Improper management of water cause inequity problems of water distribution in the agriculturally based countries. Assessment of irrigation performance is a key factor in water delivery services, which provide way to improve its measurement and the monitoring will improve its management. The lack of a decision support system and manual record decreases transparency and increases provincial, regional, and farm-level disputes. Agriculture in Sindh, where groundwater is saline, only depends on surface water coming from the Indus river. In 1997, a Participatory Irrigation Management (PIM) system was established by the Pakistan Government in the four provinces. The Farmers Organization (FO) has been established in Nara Canal Area Water Board (NCAWB). The increase in efficiency is possible with proper management and monitoring of water distribution by the FOs and NCAWB at the local level. Monitoring of water level and discharge plays a vital role in distributing water equitable among the water users. This study aims to measure the discharge, develop the rating curves, and calibration of the water-depth measuring sensors at head of the four off-taking distributaries/ minors of Jamrao West Branch of NCAWB. The performance evaluation was carried out using performance indicators; Delivery Performance Ratio (DPR) and Tail-end Supply Ratio (TSR). The gauge data for 2020 were taken from Irrigation Department for Sangro distributary, Daulatpur, Mir, and Gorchani minors. Based on the collected and observed data, performance of the system was made. The results showed that the Sangro distry and Mir minor comes under poor (DPR < 0.7), however the Daulatpur and Gorchani minors has fair performance (DPR is 0.7-0.9). Regarding water availability at the tail end, the TSR for Sangro, Daulatpur, Mir, and Gorchani comes 0.31, 0.41, 0.93, & 0.98, respectively. These values have represented that FOs of Sangro and Daulatpur minor have poor performance, whereas those of Mir and Gorchani minors provides good performance of water distribution up to their tail-end growers.

Keywords: Performance Evaluation; Wireless sensors; Delivery Performance Ratio (DPR); Tail-end Supply Ratio (TSR).

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USE OF SYNTHESIZED CLAY FILTER COATED WITH IRON DOPED TITANIUM DIOXIDE FOR DYE DECOLORIZATION

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ABSTRACT

Clay filter was synthesized. Iron-dopped titanium dioxide (Fe-TiO₂) particles were produced and immobilized on surface of clay filter as uniform thin film. The photocatalytic properties of the Fe-TiO₂ film coated on the clay media were investigated under sunlight.Decolorization of Indigo Carmine (IC) dye of 5ppm was analyzed at 30, 60, 120 and 180 minutes respectively using Fe-TiO₂ coated clay filter under sunlight.The results were compared with that of bare filters to justify the photocatalytic activity of coated filter.The obtained results highlight a significant potential of the advanced photocatalytic process in decolorizing organic dyei.e. using photocatalyst coated clay filters. The graphical abstract of the study is shown in Fig.1.

Keywords: Iron dopped titanium; clay filter; coating; dye decolorization

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A COMPARATIVE ANALYSIS OF CMEMS DERIVED WATER LEVELS WITH TIDE GAUGE DATA ON COAST OF KARACHI, PAKISTAN

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ABSTRACT:

This study aims to evaluate the correlation between the Satellite Radar Altimetry (SRA) derived water level heights and tide gauge on the coast of Karachi, Pakistan. The tide gauge data at the Karachi coast were acquired from the University of Hawaii Sea Level Center (UHSLC). Alternatively, altimetry-derived Sea Surface Heights (SSH) near the coast of Karachi, were acquired from Copernicus - Marine Environment Monitoring Service (CMEMS) database. The CMEMS altimetry datasets were plotted against the tide gauge data for the period Feb - 2007 to Aug - 2019 and were analyzed visually and statistically. The two datasets showed a notable correlation with the R² value of 0.81. The Root- Mean Square Error (RMSE) values produced were 2.9 cm. The linear trend of Sea Level Rise (SLR) for the period Jan - 1993 to Oct - 2019 was computed and yielded a value of 3.6 mm/year along the coast of Karachi. By the linear extrapolation of this data, it is speculated that a 133.4 mm gradual rise of sea level will be observed in the next 25 to 30 years around the coast of Karachi. The results of this study demonstrate the reliability of altimetry products to be considered as a tool when developing coastal management plans for the Karachi coast.

Keywords: Satellite Radar Altimetry; Sea Level Rise; Tide gauge; Sea Surface Heights

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QUANTIFICATION OF SEEPAGE LOSSES FROM LINED AND UNLINED DISTRIBUATRIES USING ACOUSTIC DOPPLER CURRENT PROFILLER (ADCP)

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ABSTRACT

A huge amount of water is lost through bed and both sides of distributary due to seepage. Quantification of water losses can not only provide solution to water scarcity but also increase conveyance efficiency. The key objectives of this study is to calculate seepage losses both lined and unlined Distributaries and compare their results by using inflow outflow method. The selected study area are both Lakhakhe lined and Sangro unlined distributaries in Mirpurkhas Sindh. The estimation of conveyance losses using inflow outflow method with electromagnetic type flow meter, this conventional technique was difficult, time consuming and limited measurement accuracy device than Acoustic Doppler Current Profiler (ADCP). The average conveyance losses were calculated 0.00359 m³/ sec per 100m length of unlined distributary and 0.00027 m³/sec per 100m length of unlined distributary and measurement 910 hectare meter. (ADCPs) are commonly used for making both water velocity and discharge measurement.

Keywords: conveyance losses, ADCP, discharge measurement

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REMOVAL OF ARSENIC FROM WATER USING BISMUTH COATED BIOMASS OF ALGAE

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ABSTRACT:

Heavy metal contamination in water has become a serious threat to the human health specifically, and environment in general. Various research studies reported Arsenic contamination in water in certain particular regions of Pakistan and can be linked to the serious health issues such as diabetes, neurological disorder, and skin and bladder cancer. In current study, in an attempt to overcome the issue, algae biomass coated with bismuth was used to remove arsenic from water. The coated biomass was characterized using SEM(Scanning Electron Microscopy, EDS(Electron Dispersion Spectroscopy) and FTIR(Fourier Transform Infrared Spectrometry) to check the morphology, elemental composition and functional groups present in the biomass. Batch study was done on different parameters to obtain the optimum conditions. It was concluded that maximum removal of 89% was achieved at 7 pH and maximum biosorption capacity was 5.2 mg.g.

Keywords: algae; heavy metals; bismuth; biosorption;

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INFLUENCE OF FE(III) AND AL(III) ON STRUVITE PRECIPITATION

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ABSTRACT:

Owing to the limited source of phosphate rock, research is being focused on the recovery of this resource from wastewater streams. Struvite precipitation is well known technique to recover phosphorus from wastewaters, the resultant product is used as slow-release fertilizer. The role of metallic ions could not be neglected, as it can hinder the formation of struvite, particularly those ions which are readily available in wastewater streams. This study was performed to evaluate the effect of Ferric and Aluminum ions on struvite precipitation. For this study first optimum condition for struvite precipitation was determined as pH 9 and Mg:P 1.2:1, struvite purity of around 27% was obtained. At those conditions Fe(III) and Al(III) was dosed to analyze their influence. The results indicate that the purity of struvite crystals reduced up to 18%, meanwhile in case of Al(III) the purity reduced to 2%.

Keywords: Struvite, Interfering Ions, Ferric, Aluminum

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COMPARATIVE ANALYSIS OF WASH AND INFRASTRUCTURE SERVICES AT HANDS INTERVENTION VERSUS NON-INTERVENTION AREAS IN 14 DISTRICTS OF PAKISTAN

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ABSTRACT:

The purpose of this study was to compare the presence of WASH & Infrastructure services in project implemented intervention versus non-intervention areas. A comparative cross sectional study was conducted during July to August 2020 in 14 districts of Pakistan. The results of study revealed hand pump as the biggest source of drinking water consumption among intervention areas 75.4% compared with 45.9% in non-intervention areas, provision of water through tanker in intervention areas 16.7% compared with the 9.1% in non-intervention areas, boiling as the most popular form of water treatment methodology 22.2%, compared with 19.6% in non-intervention areas, improved sanitation among intervention areas 45% population compared with 28.9% in non-intervention areas, 77.8% people washing their hands post defecation compared with 72.5% in non-intervention areas, 21% households in intervention areas applying all disaster risk reduction components to their shelters compared to 7% in nonintervention areas and 67.3% people in intervention areas using solar as an alternate source of energy compared 32.1% in non-intervention areas. The findings from the study conclude that non-profit with innovative, low cost and sustained models can act as an agent of change for WASH and infrastructure services in Pakistan.

Keywords: Non-profit; Impact Evaluation; disaster risk reduction; WASH; Infrastructure; Solar.

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PUBLIC-PRIVATE PARTNERSHIP IN WASH OPPORTUNITIES AND CHALLENGES

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Abstract:

The past decade has seen massive financing in the water and sanitation sector, either through local finance mobilization or foreign donor investment. To the best of our knowledge, there is no model available in Pakistan, which can be declared as PPP for WASH, there have been models for PPP for water service delivery, utility reforms. Since health and hygiene are a public good hence it attracts less investment owing to low return on investment.

We have adopted a mix methods approach for this formative research using literature review, relevant stakeholder's in-depth interview and direct observation. Multiple options were discussed for strengthening PPP in wash includes; Municipal Committee has a strong sentiment for enhancing the financial envelope of payments for sustaining a PPP model of services. Performance-based payments to the private sector operator and outsourcing to a private company with a 50% share will be an option. Moreover, user fee for services recovery in PPP would be a big problem and the willingness to pay for water services is low.

We are concluding that not enough experience or expertise exists within the Government or Municipality to run or manage a PPP model of services for water delivery. There are a strong fear and apprehension on a low collection of fee for services and we think this will have a major impact on the service delivery. Every stakeholder who is involved in the water service delivery has their interpretation of the PPP, which creates multiple interpretations and thus a common understanding does not exist among the stakeholders of Jacobabad project.

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SDG-6: Targets to be achieved by 2030

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

Achieve access to adequate and equitable sanitation and hygiene for all

6.3: 6.3: 6.3: 6.3: 6.3: 6.3: 6.3: 6.3: 6.3: 6.3: 6.3: 6.3: 6.3: 6.3: 6.3: 6.3: 6.3: 6.3: 6.3: 7.5: 7.



Substantially increase water-use efficiency across all sectors



Implement integrated water resources management at all levels

6.6: 😭

Protect and restore water-related ecosystems



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



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

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