



**USPCAS-W**  
 Mehran University  
 of Engineering & Technology  
 Jamshoro, Pakistan



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# ABSTRACT BOOK

# International Conference on Environmental Sustainability

**March 03 - 04, 2022**



Organised by:

**U.S.- Pakistan Center for Advanced Studies in Water**

Collaborators:



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**MESSAGE FROM**  
**PROF. DR. RASOOL BUX MAHAR**  
**DIRECTOR, USPCAS-W, MUET, JAMSHORO**

***“The greatest threat to our planet is the belief that someone else will save it”***

I feel pleasure to welcome all the delegates to the International Conference on Environmental Sustainability 2022 (ICES 2022). We are proud to share this event is being organized by USPCAS-W with collaboration and support of ECOSOL, NESPAK, tearfund, and HANDS & MI (Medico International) with focus on Environmental Sustainability. The main objective of this conference is to highlight the issues on Environmental Sustainability and way forward towards sustainability. To broaden the scope and to add value the conference proceedings will be held at MUET Jamshoro. 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/committee who reviewed abstracts and full papers. 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 ECOSOL 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 have accepted our invitation to talk on Environmental Sustainability which will 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.

In the end, we welcome all collaborative partners' engagements focusing on SDG6. This event is example of such a collaboration. We look forward to work more closely with HANDS & MI (Medico International), tearfund, ECOSOL and NESPAK to advance mutual agenda, with particular reference to Environmental Sustainability.

# Comparative Analysis and Effect of Ethylenediaminetetraacetic Acid (EDTA) and Diisopropanolamine (DIPA) on Antibiotic Resistant Bacteria

Sumbal Mudassar Tarar<sup>1</sup>, Rabeea Zafar<sup>1,2\*</sup>, and Muhammad Arshad<sup>1</sup>

<sup>1</sup>Institute of Environmental Sciences and Engineering, School of Civil and Environmental Engineering, National University of Sciences and Technology, Sector H-12, Islamabad, 44000, Pakistan.

<sup>2</sup>Department of Environmental Design, Health and Nutritional Sciences, Faculty of Sciences, Allama Iqbal Open University, Sector H-8, Islamabad, 44000, Pakistan.

## Abstract:

Antimicrobial resistance is an emerging threat to global public health sector. Resistance to standard antibiotics and absence of new antibiotics portrays a grim situation which demands new strategies to cope with complicated infections. Therefore, the aim of this study was to identify and examine antimicrobial tendencies of two chelating agents, ethylenediaminetetraacetic acid (EDTA) and diisopropanolamine (DIPA), on Antibiotic resistant strains of bacteria, *Acinetobacter johnsonii*. The resistant strain was exposed to known concentrations of EDTA and DIPA. Multiple replications of cultures exposed to EDTA and DIPA ranging from 10mM to 100mM were then plated during a two-hour time course. Concentration of 75mM of EDTA resulted in a 92.5% reduction of *Acinetobacter johnsonii*, whereas 95% reduction was observed at the concentration of 100mM of DIPA. Moreover, UV-visible spectrophotometry was used for determination of chelating agent ethylenediaminetetraacetic acid (EDTA) and Diisopropanolamine (DIPA). It resulted in good absorption spectra for two Ni(II) complexes chelating agents at pH 4. Absorption maxima was determined at 588nm and 650nm for EDTA and DIPA, respectively. In essence, this study has demonstrated an effective way to combat antibiotic resistant bacteria by using the antimicrobial properties of chelating agents.

**Keywords:** Antibiotic Resistant Bacteria, Chelating Agents, EDTA, DIPA & Spectrophotometer.

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\* Corresponding author: Ms. Rabeea Zafar, Email: [smtarar.mses2018iese@student.nust.edu.pk](mailto:smtarar.mses2018iese@student.nust.edu.pk)



# Design and Fabrication of Microbial Fuel Cell for Secondary Treatment of Industrial Wastewater

Syed Wamiq Ali Jafri<sup>1\*</sup>, Abdul Sattar Jatoi<sup>2</sup>, Ghulam Mujtaba<sup>3</sup> and Abdul Rehman Iqbal<sup>4</sup>

<sup>1</sup>Department of Mechanical Engineering,  
NED University of Engineering & Technology, Karachi, 75270, Pakistan.

<sup>2</sup>Department of Chemical Engineering,  
Dawood University of Engineering & Technology, Karachi, 74800, Pakistan.

<sup>3</sup>Department of Energy & Environment Engineering,  
Dawood University of Engineering & Technology, Karachi, 74800, Pakistan.

<sup>4</sup>Department of Environmental Engineering,  
NED University of Engineering & Technology, Karachi, 75270, Pakistan.

## Abstract:

In the current era of industrialization and rapid development, studies are in process for a sustainable technology due to increasing energy and environmental concerns. Microbial Fuel Cell (MFC) is one of the promising technologies and have been studied intensively. It harnesses the ability of microorganisms to generate electrical energy during the metabolism of organic substrate and resulting in removal of Chemical Oxygen Demand (COD). Although technical and economic viability of this technology is debatable on a larger scale and hurdles such as low power density, inefficient electron transfer, expensive electrode material and proton exchange membrane have decelerated the advancement of this bio electrochemical conversion technology. But at the same time, it has the potential to overcome energy and environmental challenges simultaneously. The aim of this study was to design, fabricate and test the MFC with several alterations for performance enhancement. The performance of MFC was investigated with change in electrode material as graphite, while utilizing *Saccharomyces cerevisiae* as microorganism and textile wastewater as substrate to recover energy. An average voltage of 0.075 V was produced during the period of 24 hours with a power density of 48  $\mu$ W at specific pH and temperature. Whereas 234.4 mg/L COD was removed with a removal efficiency of 74.9 %.

**Keywords:** Wastewater Treatment, Renewable Energy, Microbial Fuel Cell, Graphite Electrodes & *Saccharomyces Cerevisiae*.

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\* Corresponding Author: Mr. Sayed Wamiq Ali Jafri, Email: wamiq.ali90@gmail.com

# Eco-Friendly Remedy Against Clarithromycin-Resistant and Sensitive Bacteria Isolated from Tap-Water

Noor-Un-Nisa Ghanghro\* and Ayesha Tajammull

U.S-Pakistan Centre for Advanced Studies in Water, Jamshoro, Pakistan.

## Abstract:

*Colocasia esculenta* is a wetland herbaceous perennial plant. It has been historically known for its curing nature and treatment of different diseases. Recent studies depicted the presence of bioactive elements, which have been proven beneficial for health and boosts up immunity. This study was aimed to check the bacterial inhibitory activity, qualitative analysis, and proximate composition of phytochemicals, as well as quantitative analysis of phenolic compounds. Isolation and identification of gram-negative pathogens (*E. coli*, *Salmonella typhi*, and *Shigella flexneri*) and gram-positive bacteria (*Staph aureus*) from different drinking water sources was carried out from the Jamshoro district. Disc diffusion method helped to check the antibacterial sensitivity, while Minimum Inhibitory Concentrations were noticed by UV-Visible spectrophotometer. The qualitative analysis and proximate composition were observed by different standard methods, and qualitative analysis of phenolic compounds was conducted by HPLC and the result observed was based on the peak area and retention time. Four different concentrations (5, 10, 20, and 30 $\mu$ l) of *C. esculenta* were used to test antibacterial activities. As the concentration of *C. esculenta* increased the better activity was observed against isolates. The plant extract was found sensitive against both *E. coli* and *Staph aureus*. During proximate different phytochemicals were identified except glycosides. The extract was possessed the highest amount of total carbohydrate (21.66 $\pm$ 2.7) as compared to total protein (2.49  $\pm$  3.6 g/100g), whereas fat was very low in amount. Among the phenolic compounds, at retention time 19.82, only Gentisic acid (104.4055 $\mu$ g/mL) was measured. Potential MIC for *E. coli* and *S. aureus* was 1000  $\mu$ l /ml, *S. Typhi*, and *S. flexneri* was, 250  $\mu$ l /ml respectively. Overall, *C. esculenta* possesses good bacterial inhibitory activity with rich bioactive elements and phenolic compounds. It can be used as substitutes for the drugs to treat, thus promoting health implications.

**Keywords:** Clarithromycin-Resistant, Sensitive, Phytochemicals, Proximate & HPLC.

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\* Corresponding Author: Ms. Noor-Un-Nisa Ghanghro, Email: noor93nov@gmail.com

# A Step Towards Improving Energy Efficiency in Residential Buildings of KP in the Light of National Energy Conservation Policy of Pakistan

Sadam Hussain\*

CECOS University of Information Technology and Emerging Sciences Peshawar

## Abstract:

Pakistan currently faces severe challenges in terms of energy sector which is highly related sustainable development. The key objective is to design and manage energy systems that may not only meet the country's energy needs but also contribute to sustainable development goals, which can only be meet by energy efficiency and conservation. Khyber Pakhtunkhwa (KP), the household sector accounts 60% of its total energy share and has become the largest consumer of electricity. In this thesis, an effort has been made to investigate the extent of existing practices of energy efficiency and conservation in residential buildings of Khyber-Pakhtunkhwa in the light of National Energy Conservation policy guidelines for residential buildings. Sample from population has been taken by stratified random sampling method. Moreover, Energy survey of the residential buildings has been conducted partially through online survey and visits to various areas of KP. Secondly, the National energy conservation policy and previous literature has been reviewed with the aim to make understandings of the seriousness of institutions towards energy efficiency and conservation in residential sector. The research findings revealed two results: firstly, a huge potential for energy efficiency and conservation in residential sector of KP but at the same time the lack of distinct policy development, absence of institutional setups in provinces and inadequate policy implementation. Moreover, it has been found that there is lack of awareness of energy efficiency and conservation.

**Keywords:** BCP, BECP, NEECA, PEECA, NECP, SDG, KP, & NTDC.

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\* Corresponding Author: Mr. Sadam Hussain, Email: engrsaddam67@gmail.com

# Important Aspects for Environment Sustainability

Fiza Shahid and Muhammad Ateeq Ur Rehman\*

Developex Engineering & Construction (Private) Limited, Lahore.

## Abstract:

Deforestation is one of the major causes which not only disturbs the sustainability of our friendly environment but also exposes the earth susceptible to serious seismic effects leads to the man-made disasters including land sliding, global warming, climate changes and serious health issues. Seismic waves generated as a result of an earthquake are directly responsible for liquefaction of foundation soil, which ultimately weakens the foundation of any building or infrastructure including roads, abutments, slopes, dams, bridges etc. due to partial or combined effect of lateral loading. According to the Geological Survey of Pakistan, most of mountainous regions in Pakistan are under seismic threat. In October 2005, earthquake of rector scale 7.6 caused not only massive destruction of precious human lives but also damaged and demolished numerous infrastructures and caused heavy landslides especially in Kashmir and surrounding areas. Trees are not only source of producing fresh oxygen essential for lives but they also give additional stability to ground and slopes against land sliding hazards. Forests play a vital role in controlling pollution and making friendly environment. This research paper is based on the study encompassing the behavioral changes in the soil and environment due to deforestation and cutting of trees in Pakistan particularly in last two decades. For the purpose, relevant data collected through case studies and field survey of different regions of Pakistan was thorough analyzed to suggest suitable recommendations in order to sustain our disturbed environment. It has been revealed that due to the rapid and large construction of infrastructures including roads, hi-rise buildings and development of housing societies, massive cutting of trees was carried out whereas, in replace, suitable remedial measures have not been taken so far up-till the desired level important for our environment sustainability to control pollution and land sliding especially in mountainous regions to save precious human health and life.

**Keywords:** Deforestation, Environment Sustainability, Land Sliding & Man-Made disasters.

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\* Corresponding Author: Mr. Muhammad Ateeq Ur Rehman, Email: engr.ateeq2020@gmail.com

# Exploring The Concept of Sustainability in Architectural Practices of Pakistan

**Saima Gulzar\***

School of Architecture and Planning, Lahore-Pakistan.

## Abstract

The concept of sustainability in architecture is not a new concept but recently redefined with the three fundamentals of economy, society and environment. Sustainability is the holistic approach for provision to the needs of the present world without disturbing the balance that retains the same provision for the future generations. The urbanization trends all over the globe generated the huge demands on the architecture and construction industry that is the one of the main economic activity with the maximum consumption of natural resources while depleting the environmental systems at the same time. Similarly, the urban growth patterns in the developing countries like Pakistan are one of the main contributors in the deterioration of environment. That further disrupts the natural resources and overall destroys the quality of life. Presently, all the metropolitan cities in Pakistan including Karachi, Lahore, Islamabad, Faisalabad etc. being the economical hubs and land of opportunities for the surrounding settlements are now struggling hard to overcome the urban hazards. The overloading in these urban areas has disconnected the ecological cycles and blocked the natural corridors (balance of urban vegetation and dwellers) in addition to the economic crisis in shape of slums settlements (poor quality of life). Sustainable architecture and development practices are the only solution to overcome all these urban hazards. A large number of people around the globe started changing their development and consumption patterns to achieve the goals of sustainability. In Pakistan, Lahore as a case study, the sustainable architecture solutions are studied to further explore their relevance to the modern era. Historically, the Walled City of Lahore is one of the best examples of the sustainable architecture from the past. It reflects all the three fundamentals economy, society and environment. The research concluded that the adoption of the same traditional sustainable architectural solutions can be replicated with the modern interpretations for the reduction in the resource intensive construction activity while achieving the sustainability holistic approach at the same time.

**Keywords:** Environment, Sustainability, Economic, Social, Architecture & Pakistan.

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\* Corresponding Author: Dr. Saima Gulzar, Email: saima.gulzar@umt.edu.pk

# Evaluation of the Regional Context to Achieve the Cost Effectiveness: A Study of Residences in Uch Sharif, Bahawalpur, Pakistan

**Jam Ayaz Mahmood and Saima Gulzar\***

School of Architecture and Planning, Lahore-Pakistan.

## **Abstract:**

There is very close association between efficient building design and a specific region. When we talk about efficient architecture design, it leads to energy used in building structures and environmental hazards emerges in light of the fact that energy consumption based critical arrangements are looked into to development of a building plan and fulfill its requirements for heating, cooling, air movement and electrification, cause extreme highest of valuable ecological system and lead toward a in efficient architecture design solutions. Structures planned with effective utilization of energy, pro culture with low working expense and in addition agreeable for clients can add to the fruitful condition incorporating well-disposed design. The paper is an endeavor to explore and assess the parameters on top of which the effectiveness of a building the warm and energy productivity of residential structures with reference to its regional ecology, cost effectiveness and client comfort level which lead to an efficient architecture design of that region. The scope of this research is to critically analyze the sustainability factor under the cultural and climatic bounds of the area of southern Punjab of Pakistan. This research based on a lot of survey, understanding, observation and take away from literature. However, the limited knowledge available in literature might have restricted this research to be not able to cover all the aspects of the impact factors and limited for the city of Uch, district Bahawalpur, south Punjab, but however, is able to paint a good picture of factors of great significance.

**Keywords:** Energy Efficient, Architecture, Uch Sharif & South Punjab.

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\* Corresponding Author: Dr. Saima Gulzar, Email: saima.gulzar@umt.edu.pk

# Water Treatment Plant Design for The City of Mithi, Tharparkar

**Satesh Kumar Devrajani\*, Javed Ali Dahri and Zubair Ahmed**

U.S-Pakistan Centre for Advanced Studies in Water, Jamshoro, Pakistan.

## **Abstract:**

The treatment of water is important in improving the water quality for drinking and domestic purposes. This study is focusing on the designing of water treatment plant for Mithi, district Tharparkar. The water from the Naukot canal, which is located near Naukot city is supplied to Mithi through a pipeline. Treatment plant is designed for 30 years with step-by-step calculations of all the treatment units of water treatment plant (WTP) and according to the water quality. The population was projected for Mithi city from 2025 to 2055 as 449,677.32 and for the projected population, the average discharge was estimated 210,448.8 m<sup>3</sup>/d. All the detailed calculations and drawings were displayed, the results of each unit of WTP were tabulated. It is suggested that this work can be taken as a reference to use it as a source for other units of the treatment plant to build. There are many factors like technical issues, political and economic conditions, water demand etc., which has great impact on the removal performance.

**Keywords:** Water Treatment, Water Quality, Treatment Plant, Mithi & Tharparkar.

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\* Corresponding Author: Mr. Satesh Kumar Devrajani, Email: satesh086@gmail.com

# The Disinfectant Properties of Suspensions of Herbal Extracts with Tannic Acid: An Antibacterial Study Against Escherichia Coli and Staphylococcus Aureus

**Bakhtawar Pirzada\*, Ayesha Tajammul and Zubair Ahmed**

U.S. Pakistan Center for Advanced Studies in Water,  
Mehran University of Engineering and Technology, Jamshoro, 76062, Pakistan.

## **Abstract:**

The disinfectant properties and their effect on some plant extracts were evaluated through the disk diffusion method against tested microbes isolated from the kitchen floor surface. E. coli and S. aureus were selected for this study. Three plant extracts were prepared using an aqueous solvent with tannic acid and zones of inhibition were evaluated. The results showed a potential effect on both microbes. For E. coli, the mixture of the plant (disinfectant 1) at the concentration of 1500  $\mu$ l showed 15mm of zones. For (disinfectant 2) maximum zones were observed at 750  $\mu$ l that is 12mm. For (disinfectant 3), we observed 16 mm zones at 3000  $\mu$ l concentration. 15 mm of zones were observed at 1500  $\mu$ l concentration for (disinfectant 4). For S. aureus 18 mm and 15 mm of zones were observed at 3000  $\mu$ l on disinfectants 1 and 2. For (disinfectant 3), 21 mm of zones were observed at 375  $\mu$ l. 17 mm of zones were observed at 3000  $\mu$ l concentration for (disinfectant 4). We can conclude that by comparison of E. coli and S. aureus, S. aureus shows more promising zones of inhibitions than E. coli. All of the disinfections showed promising properties against surface bacteria.

**Keywords:** Disinfectant, Aqueous, Zones of Inhibition, Disk diffusion & Extract.

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\* Corresponding Author: Ms. Bakhtawar Pirzada, Email: hina.pirzada65@gmail.com



# Comparative Study of Windrow and In-Vessel Composting of Solid Waste (A Cost-Effective Recycling and Reuse Strategy)

Fahad Saleem\*, Mehwish Anis and Ahsan Javed

## Abstract:

High generation rate and in-availability of economically feasible disposal sites have made the Solid Waste (SW) disposal and management a cumbersome issue. Composting reduces the volume of SW and serves as a source to earn revenue. The study was conducted to compare the performance of various composting techniques like windrow and in-vessel composting at household level. Maturity and quality of the prepared compost was estimated and then compared with the commercially available compost. The results showed that the prepared compost was fully matured in term of CO<sub>2</sub> evolution (between 2-8 ppm), volatile organic acid concentration (between 200-1000 ppm) and plant germination (between 80-90 %) for each windrow and in-vessel sample. Moreover, the quality of compost was better than commercially available compost in terms of organic content (60.88%, 64.65% and 51.89%) and carbon to nitrogen ratio (17.87:1, 19.81:1 and 17.46:1) for windrow 1 & 2 and in-vessel sample respectively. The time period for composting was reduced from 100 to 70 days by using in-vessel composting at household level.

**Keywords:** Solid Waste, Composting, Windrow, In-vessel & Maturity.

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\* Corresponding Author: Mr. Fahad Saleem, Email: fsaleem660@gmail.com

# Geohazards Induced by Earthquakes and Their Mitigation

**Sohail Kibria\* and Saad Kibria**

National Engineering Services Pakistan (NESPAK), Lahore

## **Abstract:**

The ground that we live upon, seems to be, for the most part, stable and static. However, in reality, it is dynamic and in a continual state of flux as the lithosphere adjusts to the molten core of the planet earth, bringing about sudden movement of tectonic plates and release of tremendous amount of seismic energy. Besides, several other factors including stress transfer due to natural or anthropogenic reasons, quick groundwater changes, climate change, geothermal, blasts etc. also cause earthquakes. The seismic activity on our planet triggers a wide variety of geohazards as well as their secondary effects. This keeps happening in Pakistan as well as around the globe. The notable geohazards induced by earthquakes include land sliding, tsunamis, volcanic eruptions, liquefaction, soil structure collapse, ground subsidence, geo-environment issues, surface fault ruptures, rockfalls, avalanches, damage to aquifers, dam break, reservoir delta flow etc. Pakistan has a complex geology and high seismicity zones are present here. It is worthwhile to determine the causes of earthquakes and the expected geohazards as a consequence, in a particular region and evolve suitable mitigation as well as restoration strategies, accordingly. This paper highlights various notable geohazards triggered by earthquakes and discusses appropriate strategies for their mitigation and restoration, for the guidance of geotechnical engineers of Pakistan.

**Keywords:** Geohazards, Earthquakes & Mitigation.

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\* Corresponding Author: Mr. Sohail Kibria, Email: [sohaikibria18@yahoo.com](mailto:sohaikibria18@yahoo.com)

# Innovative Architecture and Industrialization Building System in Construction Industry of Pakistan

Sania Rehman Memon<sup>1\*</sup>, Furqan Javed<sup>2</sup> and Zoya Gul Kaka<sup>1</sup>

<sup>1</sup>Department of Architecture, Mehran-UET, Jamshoro, Sindh, Pakistan

<sup>2</sup>Department of Architecture, DUET Karachi, Pakistan.

## Abstract:

As a sustainable construction method, industrialization building system (IBS) construction is increasingly being adopted worldwide to enhance productivity and to alleviate the adverse environmental and social effects as a result of conventional construction activities. In addressing management issues of prefabricated construction, an impressive number of studies have been published by internationally renowned journals related to construction management over the past decades. However, it seems that a systematic summary on the research development in the management of prefabricated construction (MPC) discipline is lacking. This paper discusses and evaluates the best practice of prefabrication implementation. Their adoption of prefabrication, construction methods and cost effectiveness are investigated. Discussions on effective implementation, industry prospect", development and application, performance evaluation, environment for technology application, and design, production, transportation and assembly strategies. The findings provide ameliorated understanding on the best practice of prefabrication and provide courage for further improvement and implementation for the industry.

**Keywords:** Industrialization Building System (IBS), Management of Prefabricated Construction (MPC) & Innovative Architecture

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\* Corresponding Author: Ms. Sania Rehman Memon, Email: sania.memon@admin.muet.edu.pk

# Microbial Assessment of Water, Meat, and Meat Contact Surfaces for the Presence of Hygiene Indicator Bacteria and Antibiotic Resistance Salmonella

Naveed Ahmed\* and Sadaf Tagar

U.S. Pakistan Center for Advanced Studies in Water,  
Mehran University of Engineering and Technology, Jamshoro, 76062, Pakistan.

## Abstract:

Food-borne pathogens are a major cause of illnesses, death and expenses. The broiler meat is an important source of Salmonella, Shigella and E. coli. The occurrence of food-borne pathogens in meat is considered a global health issue. The aim of writing this paper is to determine the prevalence of antibiotic resistance Salmonella in 38 poultry slaughtering settings of Hyderabad (25) and Jamshoro (13) district of Pakistan. A total of 191 samples were collected during study time period, apparently including 39 water, 38 meat, 38 butchers' hand, 38 Knife and 38 chopping board samples. Isolates of Salmonella, Shigella and E. coli were identified on the basis of their morphological characteristics and were enumerated. Isolates of Salmonella were further confirmed by two biochemical tests, i.e., Triple sugar Iron Agar test and Urease test and were tested for their antimicrobial susceptibility against nine antibiotics following Disc diffusion test. Presence of E. coli, Salmonella and Shigella was found in 171 (92%), 100 (88%) and 22 (22%) samples with the contamination level of 0 to >2000 CFU/ml and CFU/Sq. Inch. The meat samples shown highest (97%) prevalence of all their pathogens. E coli shows highest (100%) prevalence in Butchers' hands samples, while Shigella shows highest (97.36%) prevalence in Meat and butchers' hands samples. All the Salmonella isolates exhibits resistance to more than one antibiotics. Resistance to Ampicillin, Neomycin, Sulfamethoxazole, Streptomycin, Erythromycin and Cefotaxime were evident 90.09%, 35.05%, 63.63%, 54.54%, 40.80% and 34.48% respectively. In addition, resistance to Gentamicin (27.27%) and Ampicillin (4.5%) was observed but none of the isolates showed resistance to ceftazidime. It has been found from this study that meat samples and meat contact surfaces have high microbial load of Salmonella, Shigella and E. coli because of poor personal hygiene and lack of proper sanitation of work area.

**Keywords:** Salmonella, Poultry, Hygiene, Meat, and slaughter

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\* Corresponding Author: Dr. Naveed Ahmed, Email: naveed.uspcasw@faculty.muett.edu.pk

# Hydrological Modeling of Pishin-Lora Water Basin, Balochistan

**Rabia Liaquat Ali\*, Abdul Latif Qureshi and Arjumand Z. Zaidi**

U.S. Pakistan Center for Advanced Studies in Water,  
Mehran University of Engineering and Technology, Jamshoro, 76062, Pakistan.

## Abstract:

Water scarcity, climate change, and inadequate water management are some of the issues Pakistan faces nowadays. Some regions of the country, such as Balochistan province, are intensely affected by these issues. Balochistan, the largest province of Pakistan, has 18 river basins of which Pishin-Loral Basin (PLB) has limited freshwater resources. In Pishin, severe loss of orchards, vegetation, and groundwater had adverse effects on people's lives. Quetta, the capital of Balochistan, also lies in this basin. Quetta city is known to have a variety of fruit orchards. Quetta will lose its unique identity as the "Fruit Garden of Pakistan" if damages to valuable orchards continue. The most useful approach to address such problems is the water balance study. For the economic and social development of any nation, water management plays an important role. This study integrates geographical information system (GIS), remote sensing (RS) data, and hydrologic modeling. The US Army Corps of Engineers Hydrologic Engineering Center's hydrologic model HEC-HMS and its ArcGIS extension HEC-GeoHMS were used for watershed modeling. Raster tiles of Shuttle Radar Topography Mission (SRTM) one arc-second digital elevation model (DEM) were downloaded and processed to derive watershed slope, stream network, watershed boundaries, and other characteristics of the PLB. For Land use/cover (LULC) classification, Sentinel 2 and Landsat 8 images were used. Soil type was identified from the Food and Agriculture Organization (FAO) soil database. The rainfall data of the study area for the last 30 years were obtained from the regional meteorological department of Quetta. The developed model simulated and evaluated the hydrological response to various storm return periods. The results of this study will help to develop management strategies such as water resources management, mitigation of floods and droughts, and land use planning.

**Keywords:** Balochistan, GIS and Remote Sensing, HEC-HMS and GeoHM, Pishin-Lora & Watershed Modeling.

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\* Corresponding Author: Ms. Rabia Liaquat Ali, Email: rabiabajoi12@yahoo.com

# Assessment of Groundwater Quality of Tando Allahyar-II Distributary Command Area

**Ghazanfar Mujtaba<sup>1\*</sup>, Abdul Latif Qureshi<sup>1</sup> and Shafi Muhammad Kori<sup>2</sup>**

<sup>1</sup>U.S. Pakistan Center for Advanced Studies in Water,  
Mehran University of Engineering and Technology, Jamshoro, 76062, Pakistan.

<sup>2</sup>Civil Engineering Department,  
Mehran University of Engineering and Technology, Jamshoro, 76062, Pakistan.

## Abstract:

Groundwater is an essential source of water resources all over the world. Many people around the globe depend on groundwater for survival. Hence, groundwater quality is very imperative to the community. Therefore, the aim of this research work was to assess the quality of the available groundwater and to determine its impact on the livelihood of the people of Tando Allahyar-II distributary. A total of 30 groundwater samples has been analyzed. 18 samples from tube wells and 12 samples from handpumps were collected and Water Quality Index (WQI) was computed. WQI value for samples varied from 38 to 220.54. It was observed that the quality of tube well water is better than the quality of handpump water as they are extracting the groundwater from an aquifer below 30m which is of good quality. Where the handpumps in the study area are above 30m depth which is most unsuitable. The WQI value indicated that 50% of the samples are poor in quality while 43% of the samples showed good quality water. Only 7% of samples had excellent water. Furthermore, it was discovered that the groundwater quality near the canal is superior to the water quality tested at a distant location from the canal. Overall, it can be concluded that the groundwater of Tando Allahyar-II distributary needs treatment before being utilized by the citizens.

**Keywords:** Groundwater, Water Quality Index, Tando Allahyar & Pakistan.

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\* Corresponding Author: Mr. Ghazanfar Mujtaba, Email: ghazanfermujtaba80@gmail.com

# Soil Salinity Mapping of District Badin Using Remote Sensing Techniques

**Noman Irshad\*, Shafique Ahmed and Arjumand Z. Zaidi**

U.S. Pakistan Center for Advanced Studies in Water,  
Mehran University of Engineering and Technology, Jamshoro, 76062, Pakistan.

## **Abstract:**

Soil salinization is becoming a major limiting factor for agricultural productivity and plant growth. There are various reasons behind it, including excessive use of poor-quality groundwater for irrigation purposes. In certain climatic conditions, such as in arid and semi-arid regions, evaporation exceeds precipitation causing soluble salts to accumulate in the soil. In Pakistan, extensive agricultural land in the Sindh province is being impaired by soil salinity. In this study, remote sensing techniques are used to map salinity affected regions in the Badin district of Sindh. In saline soils, the spectral reflectance varies, differentiating salt features from vegetation. Various soil salinity indices are commonly used to evaluate this response. Different salinity levels may also be identified using spectral index-based threshold technique. In this study, literature derived threshold values of normalized difference salinity index (NDSI) were examined to ascertain whether previously defined classes of saline soils are also applicable for our study area or not? Sentinel-2 images were used to derive NDSI values. The actual field was visually examined, and soil conditions at 12 survey locations and their coordinates were recorded. The NDSI at all sample locations gave low negative values even at places where salinity was high. This situation is not in agreement with the general notion that saline soils have higher positive NDSI values.

**Keywords:** GIS, NDSI, Remote Sensing & Soil Salinity.

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\* Corresponding Author: Mr. Noman Irshad, Email: 20fmsiwr03@students.muuet.edu.pk

# Hydrodynamic Groundwater Study of Muhammad Khan Distributary Command, The Sub-Region of LIB, Sindh, Pakistan

**Abdul Rehman Kori<sup>1\*</sup>, Abdul Latif Qureshi<sup>1</sup> and Shafi Muhammad Kori<sup>2</sup>**

<sup>1</sup>U.S. Pakistan Center for Advanced Studies in Water,  
Mehran University of Engineering and Technology, Jamshoro, 76062, Pakistan.

<sup>2</sup>Civil Engineering Department,  
Mehran University of Engineering and Technology, Jamshoro, 76062, Pakistan.

## Abstract:

This study has been carried out in the command area of Muhammad Khan distributary, which is off taking from Rohri main canal at RD 1038. This region is in its tail, where the surface water is scarce due to climate change issues, and do not meet the crop water requirement. Irrigation demand is increasing as agriculture becomes more intense, due to the continued population growth. Therefore, farmers are extracting more groundwater to meet the requirements. The walk-through survey, and meeting with farmers provided information on groundwater depletion and saltwater intrusion into fresh aquifers through continuous groundwater pumping without looking at groundwater scientific extraction principles. So, for this study two tube wells were selected, one at head and another at tail of the distributary command, to cover groundwater behavior. This paper focuses specifically on the calibration and validation of the groundwater model MODFLOW for future estimation of the hydrodynamic performance of designated tube wells to develop operational management strategies for optimal groundwater strategies. The total simulation time was divided into two stress periods, first stress period was used for calibration of each tube well while the second stress period was used to validate the model. The simulation results indicate that the models' calibrated and validated values are in good agreement with the observed field data.

**Keywords:** Groundwater, MODFLOW, Muhammad Khan Distributary, LIB & Rohri Main Canal.

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\* Corresponding Author: Abdul Rahman Kori, Email: alqureshi.uspcasw@faculty.muett.edu.pk



# Biosynthesized Gold/Titanium Oxide (Au/TiO<sub>2</sub>) Metal/ Metal Oxide Nanoparticles and Their Photocatalytic Degradation in Dyes

**Mehran Ali Qureshi\*, Syeda Sara Hassan and Zubair Ahmed**

U.S. Pakistan Center for Advanced Studies in Water,  
Mehran University of Engineering and Technology, Jamshoro, 76062, Pakistan.

## **Abstract:**

The main objectives of this research is to synthesized gold/titanium oxide (Au/TiO<sub>2</sub>) M/MO NPs catalysts with nitrogen doping and chitosan (Cs) as the support by sol gel method in first phase and in second phase to check the material chemistry, morphology, stability, homogeneity, binding energy and adsorption properties of the M/MO NPs: N doped/Cs catalysts using some advanced analytical techniques such as SEM technique confirmed the average sizes of nanoparticles in between 250 nm, in XRD technique the two sharp peaks on 38.2 and 44.1 at angles (2θ) in XRD patterns are mostly due to slow transformation of anatase crystalline to rutile phase at 340–500 °C calcinated temperature, FT-IR confirmed the functional group interaction of reducing agent with metal salts, Zeta potential analyzer confirmed the negative charges of nanoparticles and in UV-Visible spectrophotometer strong absorption peak was measured at 280nm having larger band gap 4.43 eV and surface area confirmed the 98% degradation efficiency of dyes in half hour with breaking strong covalent bonds and produces hydroxyl radical and finally in third phase to check the photo-catalytic activity of M/MO NPs: N doped/Cs used as photocatalysts and measure their degradation concentration of synthetic organic azo dyes on laboratory scale and then apply on real water application on dyes effluent of side areas of Hyderabad textile industries and measure their degradation concentration before and after discharges into environment/water bodies, The water treatment catalyst developed through this work, will contribute considerably to the economies by cutting down the cost of analysis and treatment processes. In such perspective application of economically prepared cheap catalyst for fast environmental degradation processes, is the need of country housing textile industries, in Pakistan.

**Keywords:** Gold/Titanium oxide (Au/TiO<sub>2</sub>) M/MO NPs, Photocatalytic Degradation & Dyes.

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\* Corresponding Author: Mr. Mehran Ali Qureshi, Email: mehranaly084@gmail.com

# Assessment of Suitability of Groundwater Quality for Drinking and Irrigation Purposes, and Its Impact on Soil Fertility of Muhammad Khan Distributary Command Area

Ali Raza Mallano<sup>1</sup>, Shafi Muhammad Kori<sup>2\*</sup> and Abdul Latif<sup>1</sup>

<sup>1</sup>U.S. Pakistan Center for Advanced Studies in Water,  
Mehran University of Engineering and Technology, Jamshoro, 76062, Pakistan.

<sup>2</sup>Civil Engineering Department,  
Mehran University of Engineering and Technology, Jamshoro, 76062, Pakistan.

## Abstract:

In this study, the suitability of groundwater quality for drinking and agricultural purposes in the Muhammad Khan distributary command area was evaluated considering Water Quality Index (WQI) and Irrigation Indices. To check the impact of groundwater on agriculture, the soil samples have been collected to check the secondary salinization. Total 30 groundwater samples were collected from hand pumps and tube wells. The physio-chemical parameters regarding for drinking water quality, viz: TDS, pH, Cl, SO<sub>4</sub>, Ca, Mg, Na, K, TH and As, and the parameters for irrigation water quality including Ca, Mg, CO<sub>3</sub>, HCO<sub>3</sub> and Na were determined. According to WHO standards, WQI results for drinking purposes are 20% groundwater samples in the excellent category, 23.33% good, 26.67% poor, and 30% very poor i.e., unsuitable for drinking. According to FAO guidelines, the analyzed irrigation water indices: Sodium adsorption rate which lies in the range of 0.80 to 7.89, residual sodium content ranges from -4.817 to 0.452, and Magnesium Hazard Index ranges from 27.5 to 49.38, all indices are appropriate. The results of analyzed eight soil samples reveal that the soil quality is suitable for agriculture in terms of extracted electrical conductivity ranges 1.39 to 2.27 ms/cm, pH ranges 7.5 to 7.7, SAR ranges from 3.48 to 4.09 and exchangeable sodium percentage ranges from 3.53 to 4.36 as per FAO limits.

**Keywords:** Groundwater quality, Muhammad Khan Distributary, Water Quality Index (WQI) & Irrigation Indices.

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\* Corresponding Author: Dr. Shafi Muhmmad Kori, Email: safi.kori@faculty.muet.edu.pk

# Production of Standard Quality Biofertilizer from Underutilized Waste Biomass for Crop and Land Application

**Tanveer A. Gadhi\***, Tayyab Ahmed, Abdul Manan, Sanam Bhatti,  
Najeebullah Channa and Rasool Bux Mahar

U.S. Pakistan Center for Advanced Studies in Water,  
Mehran University of Engineering and Technology, Jamshoro, 76062, Pakistan.

## Abstract:

Around 82 million tons of crop residue and 365 million tons of livestock manure are produced in Pakistan. Most of this waste is either burnt, openly dumped, or sent to landfills, creating nuisance and pollution problems. The generated waste can be potentially used to produce value-added products like biofertilizers and biofuels using composting, pyrolysis and other techniques. This study optimized and increased biodegradation of agriculture biomass waste and livestock to transform into standard quality biofertilizers by adding mixed microbial inoculants for crop and land application. Different set of composting set-ups using Banana Waste (B.W), Livestock Manure (L.M), Press Mud (P.M), and Poultry Waste (P.W) were made. Three different setups were studied to obtain high-quality biofertilizer from them i.e., C1 (B.W+L.M), C2 (B.W+L.M+P.M), C3 (B.W+L.M+P.W). The moisture content of all the batches was maintained. The batches matured 40 days faster than the traditional biodegradation methods due to mixed fungal, yeast, and microbial inoculant to speed up the biomass degradation process. The temperature of all the batches was monitored regularly, and it was in the range of 60-65 °C during the initial three weeks of decomposition stage and gradually dropped to ambient during curing and maturity stages. The increased temperature in the initial phases resulted from using mixed microbial, fungal, and yeast strains. The analyses of three batches indicated that the C/N ratio of all the batches was between 6-8, total Nitrogen in the range of 5-6%, Phosphate-Phosphorus 2-3%, Potassium 0.3-0.5% and a near-neutral pH 7-8. Meanwhile, all the batches contain traces of Micro-nutrients as Ca, Mg, K, and Na. These results confirmed that waste biomass could be biodegraded with improved kinetics and converted into standard quality biofertilizer, i.e., mixed inoculants' synergic combination..

**Keywords:** Biofertilizer, Biomass Reuse, Bioconversion, Composting & Biodegradation.

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\* Corresponding Author: Dr. Tanveer Ahmed Gadhi, Email: tanveer.uspcasw@faculty.muet.edu.pk

# Controlled Carbonization of Agriculture Waste to Produce Standard Biochar

**Tanveer A. Gadhi\*, A. Manan Memon, Tayyab Ahmed, Rasool Bux Mahar**

U.S. Pakistan Center for Advanced Studies in Water,  
Mehran University of Engineering and Technology, Jamshoro, 76062, Pakistan.

## Abstract:

As an agricultural country, Pakistan faces the challenges of improving food security, managing agricultural waste, enhancing crop water productivity, maintaining soil health, and protecting the environment. Conventionally agricultural residues are dealt with environmentally unhealthy practices like underutilization, disposal of in piles, or open burning; hence the nutrient contents they possess are not being recycled. In this study, a carbonization unit (CU) was designed and fabricated for controlled pyrolysis. This unit can gasify agricultural biomass residues on smallholder farms and produce biochar, promoting nutrient recycling and potentially lowering the environmental costs of conventional agricultural practices. Around 170 million tons of agriculture-based underutilized waste biomass (UWB) have been generated annually in Pakistan. This study collected UWB abundantly available in the vicinity of Hyderabad and made their biochar in a controlled environment of the CU. Waste agricultural biomass was carbonized in the designed and fabricated CU of 88cm height and 57cm diameter. The CU houses an inner retort (carbonization chamber), 77cm in height and 49cm diameter, which is kept concealed and controlled to prevent oxygen intrusion and allow only the originated syngas (during the carbonization process) to pass through. The efficiency of CU was maintained by controlling the secondary air passage, designed and placed on outer retort (housing to provide carbonization energy). Three different UWB were selected, and their biochar was produced using the CU. The selected UWB includes cotton stalks, rice husk, and banana leaves. Biochar Production yield measured was 33%, 28%, and 25%, respectively. Pyrolysis temperature was measured to be between 600-750 °C. It was observed that the mass reduction of the biomass varies according to its density. The denser the biomass is, the weightier the biochar produced. Hence, the designed CU successfully carbonized the UWB under controlled conditions, which has further potential to recover nutrients from the waste biomass.

**Keywords:** Agriculture Biomass, Carbonization, Biochar & Nutrient Recovery.

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\* Corresponding Author: Dr. Tanveer Ahmed Gadhi, Email: tanveer.uspcasw@faculty.muet.edu.pk

# Automated Processing of Satellite Data to Map Temporal Water Extents and Water Surface Levels at Tarbela Reservoir Using ArcGIS Model Builder

Jasra Rehman<sup>1\*</sup>, Arjumand Zaidi<sup>1</sup> and Sumaira Zafar<sup>2</sup>

<sup>1</sup>U.S. Pakistan Center for Advanced Studies in Water, Mehran University of Engineering and Technology, Jamshoro, 76062, Pakistan.

<sup>2</sup>Department of Environmental Engineering and Management (EEM), Asian Institute of Technology (AIT), 12120, Thailand.

## Abstract:

Inland water bodies such as lakes, streams, and reservoirs are essential freshwater sources. Their surface elevations provide critical information for long-term management in seasonal and climatic variations. Monitoring inland water bodies is a vital and fundamental application of remote sensing in hydrology. Together, optical images from Sentinel-2 and radar altimeter data from Sentinel-3 satellites have made significant advances in calculating water levels, monitoring variation in water levels, and water storage capacity of inland water bodies. This study aims to calculate water surface levels of the Tarbela reservoir from 2016 to 2018 using ArcGIS Model Builder. Time-series altimetry data from Sentinel-3 obtained from Grid Processing on Demand (G-POD) were used to compute water levels at the Tarbela reservoir. Also, optical data from Sentinel-2 were acquired from Earth Explorer to extract water extent using the Normalized Difference Water Index (NDWI). The water extent was used to filter out the pulses placed outside the reservoir water surface. The NDWI derived water surface extents were calculated for 27 different images corresponding to Sentinel-3 satellite passes. This technique is simple, and GIS models saved much of the processing time.

**Keywords:** ArcGIS Model Builder, NDWI, Remote Sensing, Satellite Radar Altimetry, Sentinel 2 and 3, Tarbela Reservoir & Water Surface Levels.

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\* Corresponding Author: Ms. Jasra Rehman, Email: jasrarehman@yahoo.com

# Total Organic Carbon Removal from Formaldehyde Containing Wastewater Through Electrocoagulation

Tamt ul Nisa Soomro\*, Uzma Imran, Waheed Ali Khokhar

U.S. Pakistan Center for Advanced Studies in Water,  
Mehran University of Engineering and Technology, Jamshoro, 76062, Pakistan.

## Abstract:

Urea-Formaldehyde and melamine-formaldehyde are extensively used in the medium density fiberboard lamination industry. These compounds can create issues in transportation due to settling and consuming dissolved oxygen from water, harming aquatic life. Most industries discharge this effluent directly into water bodies without proper treatment, which is toxic to the environment. Many researchers used different techniques to treat this effluent. This study focuses on electrocoagulation treatment for the removal of total organic carbon (TOC). Experiments were conducted in batch mode in a 500mL Pyrex glass beaker. Reaction time from 0-240 minutes was studied at a constant electrode gap of 10 mm, current of 0.5 A, and mixing speed of 60 rpm. The maximum removal of TOC was observed at 120 minutes from 139 mg/L to 118 mg/L.

**Keywords:** Formaldehyde, Electrocoagulation, Total Organic Carbon & Wastewater.

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\* Corresponding Author: Ms. Tamt-UI-Nisa Soomro, Email: tamatulnisa@gmail.com

# Treatment of Reverse Osmosis Membrane Reject Water Through Combined Adsorption Distillation Technique

**Tanveer A. Gadhi\*, Sajad Ali Balal, Najeebullah Channa, Rasool Bux Mahar**

U.S. Pakistan Center for Advanced Studies in Water,  
Mehran University of Engineering and Technology, Jamshoro, 76062, Pakistan.

## Abstract:

The rejected water is the concentrated by-product of the reverse osmosis (RO) membrane, and its handling is a major environmental problem and has adverse impacts on the environment due to high salts and metals concentration. In this study, the rejected water of the textile industry has selected for treatment, and a combined adsorption distillation (CAD) technique was adopted. The lab-scale experiments were conducted using a configured distillation set-up to separate the distillate from concentrated salts, minerals, and elements. Initially, Membrane rejected water was characterized for TDS, Hardness, chloride and selected metals such as calcium, magnesium, sodium. The results indicated that RO membranes rejected water having TDS 14900 mg/l was collected from the textile industry. The experiments were performed initially in the lab-scale distillation set-up, with the treatment of one liter of the collected sample was heated at different temperatures (105, 110, and 120°C), time (2hr, 2.5hr, 3hr) and dosage (2g/l, 5g/l and 10g/l) of composited adsorbent media (CAM) made of 80% sieved and washed sand and 20% commercial Biochar. The maximum TDS removal (97%) was recorded at 110°C. By varying dosages of CAM (2g/l, 5g/l and 10g/l). The optimum results were obtained at 110°C by using 10g/l adsorbent media. After optimizing the lab-scale conditions, a pilot-scale CAD unit of 60 liters capacity was designed and fabricated (including adsorption-distillation bed, heating coils, condenser and water inlet and outlet fitting). The fabricated pilot-scale unit was operated at textile industry facilitated using the boiler waste heat for energy needs and achieved 99% removal efficiency of rejected water TDS. Meanwhile, the addition of adsorbent media increased the salts removal efficiency. Which showed that this adsorption distillation process could be used for RO rejected water and highlight the future research area for RO rejected water treatment..

**Keywords:** Adsorption, Distillation, Reverse osmosis, Rejected Water & Textile industry.

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\* Corresponding Author: Dr. Tanveer Ahmed Gadhi, Email: tanveer.uspcasw@faculty.muet.edu.pk

# Sustainable Handling of Textile Wastewater Sludge Through Organic Waste Co-Digestion and The Biogas Production

**Tanveer A. Gadhi\*, Bahadur Ali, Najeebullah Channa, Rasool Bux Mahar**

U.S. Pakistan Center for Advanced Studies in Water,  
Mehran University of Engineering and Technology, Jamshoro, 76062, Pakistan.

## **Abstract:**

The textile wastewater treatment generates a huge amount of sludge, a complex mixture of toxic organic and inorganic substances. Textile sludge is expected to remain a permanent waste problem for the environment regarding air and water pollution and requires an appropriate solution. This study is part of the HEC funded research project in collaboration with a Textile industry, deals with anaerobic co-digestion and stabilization of textile sludge with organic waste (livestock dung) to produce renewable biogas as a renewable energy source and compost for agricultural and diverse environmental applications adheres to the circular economy principle. The textile sludge was collected from the textile industry, running 25 million Gallons per day of the textile wastewater treatment plant. The collected sludge was characterized by ultimate and proximate analysis. The bio-methane potential (BMP) tests were performed at different sludge and organic livestock dung ratios. The sludge characterization result shows that textile sludge has 96% moisture, 4% of total solids and 73% volatile solids, whereas a lower amount of sulfur i.e., 1.1% was observed. The BMP analysis recorded improved Biogas production at 60% sludge and 40% livestock dung ratio (V/V) and a collective 60% organic carbon removal at 16 days of hydraulic retention. Further, the obtained quality of digested slurry (i.e., after sludge co-digestion) revealed stabilized toxicity of Nickel, Cadmium and other organic substances as compared to initial characteristics of the sludge i.e., before co-digestion and stabilization with livestock dung. These preliminary results helped optimize the operating condition of the 500 liters capacity pilot-scale anaerobic co-digestion reactor currently treating 500 Liters of a mixed slurry of textile sludge and livestock dung with 40 liters daily feed 15 days of hydraulic retention.

**Keywords:** Anaerobic Digestion, Co-digestion, Textile Wastewater Sludge & Organic Waste.

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\* Corresponding Author: Dr. Tanveer Ahmed Gadhi, Email: tanveer.uspcasw@faculty.muet.edu.pk



# A Review of the Oil and Water Separation by the Modified Membranes

Zuhaib Ali<sup>1\*</sup>, Uzma Imran<sup>1</sup>, Zeeshan Khatri<sup>2</sup> and Mujahid Mehdi<sup>2</sup>

<sup>1</sup>U.S. Pakistan Center for Advanced Studies in Water, Mehran University of Engineering and Technology, Jamshoro, 76062, Pakistan.

<sup>2</sup>Textile Engineering Department, Mehran University of Engineering and Technology, Jamshoro, 76062, Pakistan.

## Abstract:

Oil spills and the dumping of oily effluents into water bodies had resulted in significant water contamination that causes severe damage to the environment. Therefore, oil and water separation become a big challenge. Membrane technology is the popular method for separating oily from water because of its greater removal efficiency. Still, fouling of the membrane is the biggest challenge due to the high adhesive properties of the oil. Surface Modification of membrane is the recent and advanced method to increase antifouling and self-cleaning properties of the membrane. This review study highlights the fouling and antifouling properties of ceramic membranes, polymeric membranes, and modified membranes. This review study also highlights the separation efficiency, wetting, and de-wetting effect on oil and water separation membrane. Moreover, the upcoming challenges and advancements in membrane technology for future research are also discussed for oil and water separation.

**Keywords:** Oily Wastewater, Modification, Membrane & antifouling.

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\* Corresponding Author: Mr. Zohaib Ali, Email: zohaibnawaz522@gmail.com

# Rainwater Harvesting in Semi-Arid Areas of Karachi

Farah Diba\*

## Abstract

With the abrupt increase in population, water demand is also increasing. Ground water, major source of fresh water for settlements far away from water bodies is under stress due to lesser recharge being a function of rainwater which is effected due to the climate change. This is mostly observed in arid or semi-arid areas. Therefore, awareness of available water management to lower the risk to human lives is ahead of us. Rainwater harvesting is a management technique that has been implemented by several countries where precipitation is low during dry seasons, but maximum in wet seasons. The city of Karachi is a populated city which is blessed to have monsoon seasons. The aim of this study is to assess the potential of harvesting rainwater in arid areas like Karachi with focus on a newly built residential project in the city Karachi. The potential to collect rainwater in large natural ponds similar to dams is assessed and its sustainability from natural factors like evaporation, infiltration is assessed. The anticipated results by this study are quantification of the harvestable rainwater to be used by the residential project, it's availability over the year pertaining to the losses like evaporation and infiltration and a proposal for it usage so that such projects may become self-sustainable rather than putting stress on the existing water supply network. The analysis is done using hydrological modeling to quantify the rainwater generation and then water balancing using reservoir operation techniques to quantify the losses due to evaporation and infiltration finally providing water availability from rainwater over the year.

**Keywords:** Rainfall Harvesting, Semi-Arid Areas & Karachi

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\* Corresponding Author: Ms. Farah Diba, Email: farabadruddin@gmail.com

# An Analysis of Rooftop Solar Photovoltaic Potential and Carbon Emissions Reduction

Khubaib Zafar\*

## Abstract

Today solar energy is one of the most popular renewable energy resource. Solar Photovoltaic (PV) is rapidly gaining popularity in recent years because of the cost reduction. Its deployment requires a large area of land nevertheless the urban households of Karachi city provide sufficient rooftop area and significant solar potential availability throughout the year. We considered 536 residential houses of precinct 12 of Bahria Town for calculation of rooftop potential. This report proposed a manual technique for the extraction of a useful rooftop area of 19100 m<sup>2</sup>. Shading analysis was also done to extract unshaded area by using Revit 2019. Factors of global insolation, PV module placement and module efficiency were also considered to calculate PV power generation and it was estimated about 5055 MWh per year which is approximately 4 times the consumption demand which is 1554 MWh per year. Another perspective of this research work is to highlight one of the most influencing environmental issues in terms of greenhouse emission due to burning of fossil fuels for the production of electricity. Carbon dioxide emissions can be avoided by installing PV system and it results in 989,516 kg per year CO<sub>2</sub> reduction as compared to baseline electricity consumption. We restricted our calculation for 536 houses but this calculation can be done for the entire Bahria town as well.

**Keywords:** Green Energy, Solar Photovoltaic Potential, Carbon Emission Reduction & Renewable Energy

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\* Corresponding Author: Mr. Khubaib Zafar, Email: khubaibkhubi5@gmail.com

# **(Green Energy) Future to Sustainability: Power Generation Through Piezoelectricity**

**Azadi Memon\***

## **Abstract:**

This paper presents the idea of power generation by utilizing the kinetic energy captured by motion of vehicle and pressure, such energy is in the form of vibration and can be utilized to generate power. The vibrational energy can be harness by using piezoelectric sensors, beneath the surface of roads or walking paths, that will result in reduction of greenhouse gases and also helps in reducing energy requirement from the grid. Piezoelectricity is not only the source of energy, but it is also a clean and green form of energy. However, the penetration of kinetic energy from surface of the road depends on the structure and quality of Piezoelectric transducers embedded beneath surface. The phenomena can be used at beneath the flooring tiles of walkways and stairs, gym, underneath the surface of roads and speed breakers and at other different place where there is public or vehicular traffic. The aim of this research is to propose the idea of Piezoelectricity to Mehran University of Engineering and Technology Jamshoro Pakistan, to install piezoelectric walkways within the premises of university and to work better for environment sustainability.

**Keywords:** Green Energy, Sustainability & Piezoelectricity









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\* Corresponding Author: Ms. Azadi Memon, Email: azadimemon96@gmail.com



WE'RE WORKING TOWARDS GLOBAL GOAL NO.  CLEAN WATER AND SANITATION | BY 2030 EVERYONE WILL HAVE SAFE WATER TO DRINK

## 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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