# The 8th International Conference on Water Resource and Environment (WRE 2022)

November 1-4, 2022
ONLINE via MS Teams

# Conference Program

I-SHOU UNIVERSITY

XI'AN UNIVERSITY OF TECHNOLOGY

# The 8th International Conference on Water Resource and Environment (WRE 2022)

## CONFERENCE PROGRAM

**November 1-4, 2022, China Standard Time (GMT+8)**

**Online by Microsoft Teams**

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# Part I Conference Schedule Summary

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# Part II Keynote Speeches

## Keynote Speech 1: Moving Bed Biofilm Reactor for Palm Oil Mill Effluent Treatment

***Prof. Hassimi Abu Hasan***
***Department of Chemical and Process Engineering, Faculty of Engineering and Built Environment, Universiti Kebangsaan Malaysia, Malaysia***

**Biography:** Hassimi Abu Hasan is an Associate Professor in the Department of Chemical and Process Engineering, Faculty of Engineering and Built Environment, Universiti Kebangsaan Malaysia (UKM). Currently, he is a head of Research Centre for Sustainable Process Technology (CESPRO) at Faculty of Engineering and Built Environment, UKM. He graduated from UKM with a Bachelor of Biochemical Engineering and Doctor of Philosophy (PhD in Chemical and Process Engineering). He was a Program Coordinator for Master of Engineering (Environment) from August 2015 – January 2021. He was a Young Water Representative for the Small Water and Wastewater System (SWWS) Specialized Group, International Water Association from November 2017 – October 2020. He was awarded UKM Excellent Young Academician 2018, UKM Excellent Young Researcher 2017. His research focuses on waste treatment and resource recovery using biofilm, phytoremediation, and phycoremediation technology. He innovated a new biofilm supporting media to hold microbial cells for the biofilm formation. This technology is proven to treat wastewater up to more effectively compared to the common activated sludge. His expertise in waste treatment has been recognized by PUBLON, Clarivate Analytics as “Top 1% Reviewer in Biology/Biochemistry” and “Top 1% Reviewers Environment/Ecology”. He was also awarded “Top Reviewer Award 2017 and 2018 in Top 1% journal - Bioresource Technology”.

**Abstract:** Palm oil mill effluent (POME) contains high chemical oxygen demand (COD) and ammonia-nitrogen (NH3-N), causing a big threat to the environment if being treated improperly. The treatment methods of this liquid waste into water resources are considered conventional that uses ponding system such as anaerobic, facultative, and aerobic ponds. This in turn has got the full attention of researchers improve the treatment efficiencies by adapting a biofilm treatment process in treating POME. This study aimed to treat POME using moving bed biofilm reactor (MBBR) which is one of the technology-based biofilm processes. The first objective of this study was to identify the operating parameters that affecting a laboratory-scale MBBR namely type of media, hydraulic retention time and media filling fraction before the optimization on the POME treatment. The performance of the pilot-scale MBBR was determined by manipulating COD loading and air flow rate using two different operating modes; batch and continuous. Based on the results obtained in first objective shows that the laboratory MBBR performed well at hydraulic retention time and media filling fraction of 69.4 hours and 29%, respectively, with 53.3% COD and 91.8% NH3-N removal. A pilot-scale MBBR performed well in continuous mode with removal of COD and NH3-N are 92.1% and 97.1% respectively. As conclusion, MBBR has a great potential to be used for POME treatment with average COD removal more 80% in continuous mode and can be used as a pretreatment prior to membrane filtration.

## Keynote Speech 2: Drainage and Wastewater Management in China from Ancient Time to Present Age

***Prof. Xiaoyun Zheng***

***Distinguished Professor, Hubei University, China; President of China Institute of Yangtze River Studies***

**Biography:** Dr. Xiaoyun Zheng, is a full distinguished professor in Hubei University, and president of China Institute of Yangtze River Studies. He is a human hydrologist and historian in the fields of the environment\water history of China and comparative studies globally. He is past president of International Water History Association (2012-2015). Currently, he is a scientific advisor of UNESCO' s Global Water Museum Network, vice president of Chinese Water Museum Alliance, academician of France Academy of Water. He was awarded the Honorary PHD by Aristotle University of Thessaloniki, Greece in 2017, Honorary Professor of Vietnam National Institute of Culture and Arts in 2009, etc. He has published 24 books and more than 200 papers in China and internationally. His research interests include the cultural dynamics of water management, rural water environment and sanitation, the history of urban water management, river water history, the comparative water history in global horizon.

**Abstract:** This presentation introduces the drainage and wastewater management in history of China and current urban wastewater management. It discussed the logic and practices of urban water system construction in the Chinese history. In the early history of urban development of China, the major rivers basin was strongly considered to be the site to building the city, all the influential ancient cities in China were built near the major rivers or canals, including a series of most influential ancient capital cities such as Anyang, Changan, Luoyang, Kaifeng, Nanjing, Hangzhou, Beijing, etc. Therefore, a logically urban water system including water supply and drainage was formed to matching with the natural condition and it was inherited from 1st century until 1950s almost in 2000 years of Chinese history. This presentation with cases of a series of ancient influential cities to understand unban drainage integrally as well as the situation in residential areas. Next, for understanding the current situation of urban wastewater management, this presentation with case of Wuhan City, a large city with population 15 million in number, to introduces the transformation, development and challenge of wastewater management and drainage in this city from 1950s to present day.

## Keynote Speech 3: Evolution of Water Quality Focusing in the Hellenic World Through the Centuries

***Prof. Andreas N. Angelakis***
***Honorary member and Distinguished Fellow of IWA; Greek Ministry of Agriculture, Agricultural School of Messara, Greece***

**Biography:** Andreas N. Angelakis is an Adjunct Professor at the Technical University of Crete, Chania (1989 -2008), Technical Consultant of the Hellenic Association of Municipal Water and Sewerage Companies (EDEYA) (1991 -2018), and Water Reuse Consultant in FAO (1996-2018). His research interests include wastewater treatment and waste reuse, small and decentralized water management systems, and water resources technologies in ancient civilizations.

He was President of the European Federation of National Water and Wastewater Services Associations (EUREAU) (2008-2009) and a member of the Board of Directors for 16 years (1993-2009). He also chaired the EUREAU Working Group (WG) on Wastewater Reuse (2001-2007). He was originally a member of the International Water Pollution Research Association (IAWPR) and thereafter of the International Water Pollution Research Association (IAWPR) from 1980 to 1999. Finally, he was member of the International Association on Water Quality (IAWQ), WG for Water Recycling and Reuse from 1991 to 2005.

He has been a member of International Water Association (IWA) since 2000. He was president of the IWA Specialist Group (SG) for Water in Ancient Cultures (WAC) (2005 -2019). In October 2019, he was elected President of the new Joint IWA-IWHA (International Water History Association) SG in Water Resources in Ancient Civilizations (WAC). He was also a member of the IWA Strategic Council (2016 to 2019). 2

He has been honored and accepted awards including the awarding of Honorary Member, Fellow and Distinguished Fellow by IWA (2010, 2012 and 2015, respectively). He is an Honorary Member of the Hellenic Water Association (HWA, 2011). Also, Member of the European Academy of Sciences and Arts (2018), Member of the French Academy of Water (2021), Honorary Professor of Hubei University, Wuhan, China (2019), and Honorary doctorate of the Agricultural University of Athens, Greece (2021).

Today he collaborates with international IWA members to highlight the timeless principles and practices of hydro-technology in ancient civilizations and to understand "what and how we could learn from the past". With a growing global awareness of the importance of water and wastewater management in ancient civilizations, IWA SG on WAC has organized more than a dozen international and regional symposia and workshops on hydro-technologies in ancient civilizations over the past decade.

He has authored or co-authored more than 550 publications, including articles in reputable international peer-reviewed journals, Greek and English books, book chapters and more, with more than 7,500 Google citations and i10-index 119. He has been invited / participated in more than 200 scientific events with corresponding lectures in Greece and abroad. Finally, he is the editor and member of the editorial boards of many international scientific journals.

More information, please see https://www.a-angelakis.gr/index.php

**Abstract:** Water quality is a fundamental issue for the survival of a city, especially on dry land. In ancient times,

water availability determined the location and size of villages and cities. Water supply and treatment methods were developed and perfected along with the evolution of urbanization. In Europe, after the fall of the Roman Empire, water supply and sewage systems went through fundamental changes. However, in medieval times, the lack of proper sanitation and low water quality increased the spreading and effects of epidemics. The importance of potable water quality was established during modern times. In Greece, the significance of water filtration and disinfection was not understood until the beginning of the 20th century. Moreover, the beneficial effects of water quality and sanitation on human health and especially on life expectancy are considered. In Greece and other countries, a dramatic increase in life expectancy mainly after the 2nd World War is probably due to the improvement of potable water quality and hygiene conditions. However, since the mid-20th century, new water quality issues have emerged, such as eutrophication, the improvement of water treatment technologies, as well as chemical and microbiological water pollution problems. This study, in addition to the historical evolution of water quality, highlights and discusses the current issues and challenges with regard to the management and protection of water quality, including global changes in population and urbanization, lack of infrastructure, use of nonconventional water resources, spreading of emerging pollutants and contaminants (e.g., antibiotics and microplastics), and climatic variability impacts. Against these, a review of the main proposed strategies and measures is presented and discussed to protect water quality and maintain water supplies for the future. Understanding the practices and solutions of the past provides a lens with which to view the present and future.

## Invited Speech 1: Global Resource Potential of Seasonal Pumped Hydropower Storage for Energy and Water Storage

Julian David Hunt

*International Institute for Applied Systems Analysis, Australia*

**Abstract.** Seasonal mismatches between electricity supply and demand are increasing due to expanded use of wind, solar and hydropower resources, which in turn raises the interest on low-cost seasonal energy storage options. Seasonal pumped hydropower storage (SPHS) can provide long-term energy storage at a relatively low-cost and co-benefits in the form of freshwater storage capacity. We present the first estimate of the global assessment of SPHS potential, using a novel plant-siting methodology based on high-resolution topographical and hydrological data. Here we show that SPHS costs vary from 0.007 to 0.2 US$ m−1 of water stored, 1.8 to 50 US$ MWh−1 of energy stored and 370 to 600 US$ kW−1 of installed power generation. This potential is unevenly distributed with mountainous regions demonstrating significantly more potential. The estimated world energy storage capacity below a cost of 50 US$ MWh−1 is 17.3 PWh, approximately 79% of the world electricity consumption in 2017.

**Keywords:** Pumped-storage, water management, energy storage.

## Invited Speech 2: Estimating Greenhouse Gas Emissions of Stratified Dam Reservoirs in Temperate Moist Climate Regions

Chung Sewoong*

*Department of Environmental Engineering, Chungbuk National University, South Korea*

**Abstract.** Reservoirs control the carbon cycle of terrestrial systems and are considered as important sources of greenhouse gases (GHGs), such as $CO_2$, $CH_4$, and $N_2O$, into the atmosphere. However, studies on estimating carbon emissions of dam reservoirs located in temperate wet regions are very scarce. This study aimed to estimate the GHGs emissions and footprints of stratified reservoirs in South Korea. The GHGs footprint evaluates the change in net carbon emissions considering the watershed environment before and after the dam reservoir. The G-res Tool developed by UNESCO/IHA was used to estimates $CO_2$ and $CH_4$ emissions by considering various pathways of emissions and to characterize changes in GHG fluxes over 100 years based on the expected lifetime of dams. As a result, it was found that most large-scale multi-purpose dam reservoirs with low power intensity (hydroelectric power generation capacity per unit area of the reservoir, $W/m^2$) are the source of GHG emissions to the atmosphere, but the emission intensity (GHG output per unit power, $gCO_2$-eq/kW) was significantly lower than that of fossil fuels. As the dam reservoir carbon footprint evaluation is essential for

the Clean Development Mechanism evaluation of hydroelectric power generation, continuous research is needed in the future. In particular, in order to reduce the uncertainty of the current estimate, experimental studies that can reflect changes in the characteristics of GHGs emissions by space and time is needed.

**Keywords:** GHG footprint, carbon emission, stratified reservoir, temperate climate.

**Acknowledgements:** This research has been performed as Project Open Innovation R&D (21-CP-001) and supported by K-water.

# Part III Oral Presentations

## Online Oral Presentation Guidelines

- Online Oral Presentation will be conducted via **Microsoft Teams Meeting**.
- All presenters are requested to reach the Oral Session Room prior to the schedule time and complete their presentation on time.
- All presentation times are shown in **China Standard Time (GMT+8:00).**
- If a presenter is not able to show up, the session chair/conference secretary will download and play the pre-recorded video presentation during his/her scheduled presentation time, if listeners have questions about the presentation, please contact the conference secretary to forward the questions.
- If a presenter cannot show up on time or have problem with internet connect, the session chair has the right to rearrange his/her presentation, and let the next presentation start.
- Signed and stamped electronic presentation certificate would be issued via e-mail after conference.

## Best Oral Presentations Selection

The session chair will select one best oral presentation from his/her session based on the following criteria:

- ✓ Research Quality
- ✓ Presentation Language
- ✓ Presentation Performance
- ✓ PowerPoint Design

## Best Oral Presentations Award

- ➢ **The Best Presenters will receive an official certificate and a free registration to the WRE 2023.**

## Oral Session 1: Marine Science, Ecology, and Geosciences

**Time: 14:40-17:20, November 2, 2022.** (China Standard Time GMT+8)

**Session Chair: Dr. Brisneve Edullantes, Department of Biology and Environmental Science, College of Science, University of the Philippines Cebu, Philippines**

**Session Room Link:** http://www.academicconf.com/teamslink?confname=wre2022

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|---|---|---|
| 14:40-14:55 | **WRE4698** | **Research Progress on the Effects of Droughts and Floods on Nitrogen in Soil-Plant Ecosystems**<br>*Ms. Wuxia Bi, China Institute of Water Resources and Hydropower Research, China* |
| 14:55-15:10 | **WRE4690** | **Trends of Marine Heatwave Events in the Philippines**<br>*Dr. Brisneve Edullantes, Department of Biology and Environmental Science, College of Science, University of the Philippines Cebu, Philippines* |
| 15:10-15:25 | **WRE4664** | **Study of the Population Structure of the Sea Cucumber Apostichopus Japonicas in Peter the Great Bay (Sea of Japan/Eastern Sea) Using Microsatellite and Mitochondrial Markers**<br>*Dr. Evgeniia I. Bondar, A.V. Zhirmunsky National Scientific Center of Marine Biology FEB RAS, Russia* |
| 15:25-15:35 | | **Coffee Break** |
| 15:35-16:00 | **WRE4678** | **Targeted Approaches to Implement Nature-Based Solutions in Aggitis Watershed, Greece with the Use of New Technologies**<br>*Dr. George N. Zaimes, Geomorphology, Edaphology and Riparian Areas Laboratory (GERi Lab), Department of Forestry and Natural Environment, International Hellenic University, Greece* |
| 16:00-16:25 | **WRE4565** | **Future Environmental Challenges of the Urban Protected Area Great War Island (Belgrade, Serbia) Based on Valuation of the Pollution Status and Ecosystem Services**<br>*Dr. Snežana Štrbac, University of Belgrade, Institute of Chemistry, Technology and Metallurgy, Serbia* |
| 16:25-16:50 | **WRE4663** | **STOKIS Project**<br>*Prof. Robert Zupan, University of Zagreb, Faculty of Geodesy, Croatia* |
| 16:50-17:05 | **WRE4714** | **The Power of Geographical Indications in Establishing Terriatorial Development Models**<br>*Prof. Filippo Sgroi and Dr. Federico Modica, Department of Agricultural, Food and Forestry Sciences, University of Palermo, Italy* |
| 17:05-17:20 | **WRE4674** | **Subsurface Geological and Engineering Geophysical Site Analysis for Foundation Construction Works Sustainability**<br>*Dr. O. Ademila, Department of Earth Sciences, Adekunle Ajasin University, Nigeria* |

## Abstracts of Oral Session 1

### WRE4690: Trends of Marine Heatwave Events in the Philippines

Brisneve Edullantes[1*], Brenna Mei Concolis[1], Raven Quilestino-Olario[1], Dale Patrick Atup[1], Aiza Cortes[1], Aletta T. Yñiguez[2]

[1]*Department of Biology and Environmental Science, College of Science, University of the Philippines Cebu, Cebu City 6000, Philippines*

[2]*Marine Science Institute, College of Science, University of the Philippines Diliman, Quezon City 1101, Philippines*

**Abstract.** Marine heatwaves (MHW) are anomalously warm, discrete, and prolonged events on the ocean's surface, which have disruptive consequences on marine ecosystems, ranging from acute changes to persistent impacts on marine species, populations, and communities. Despite extensive research on these extreme events at global and regional scales, MHW remained understudied in the Philippines - a megadiverse country that is vulnerable to the impacts of these extreme events. In this study, a multi-year climatic sea surface temperature (SST) record was used to detect MHW events in the Philippine seas. MHW metrics such as frequency, duration, intensity, onset rate, and decline rate were estimated in each of the detected events. The magnitude and direction of the change of the MHW metrics over time were determined using linear trend analysis. The key findings showed that the Philippines (1) had more frequent and longer MHW in the last decade, (2) had increasing frequency and duration with rates higher than its neighboring waters, and (3) had similar intensities of MHW across years. The results also revealed the association of the highest SST anomaly with El Niño Southern Oscillation in the Philippine seas. Furthermore, MHW hotspots are mostly confined in the West Philippine Sea and the western tropical Pacific. The findings of the study contribute to the understanding of the distribution of MHW in a country situated between large warm tropical seas. Further research is needed to understand the physical mechanisms of the development of these extreme thermal events in the Philippine seas.
**Keywords:** Extreme events, sea surface temperature anomaly, global warming, marine heatwaves.
**Acknowledgements:** This work is part of the Survey of Heatwaves in the Philippine Seas (DOST Project No. 9615) funded by the Philippine Council for Industry, Energy, and Emerging Technology Research and Development – Department of Science and Technology.

## WRE4664: Study of the Population Structure of the Sea Cucumber Apostichopus Japonicas in Peter the Great Bay (Sea of Japan/Eastern Sea) Using Microsatellite and Mitochondrial Markers

Viktoriia Yagodina, Evgeniia I. Bondar
*A.V. Zhirmunsky National Scientific Center of Marine Biology FEB RAS, Vladivostok 690041, Russia*
**Abstract.** *Apostichopus japonicas* is an important commercial species in the northeast Asia that has the longest history of exploitation in this region. However, with the increase of the production scales and drastic decline of the natural resources over the last three decades, stocks of the wild populations of *A. japonicas* rapidly reduced. In the connection of the holothurian number decrease, reduction of the genetic variability is also possible. We analyzed genetic diversity and population structure of the Far East Sea cucumber in Peter the Great Bay (Sea of Japan) using partial sequences of COI and ten microsatellite loci. We have detected heterogeneity between holothurian populations and have identified two clusters without any geographical snap using microsatellite loci. COI results showed high gene flow between populations that by far can indicate non-equilibrium habitat conditions for *A. japonicas* with periodical population size change and bottle neck effect as a result of the recent colonization or population expansion. This is the first study of the genetic structure of *A. japonicas* populations in the Peter the Great Bay using molecular-genetics methods. Our data enable characterization of the genetic diversity and uniqueness of the species populations; provide recommendations for rational exploitation and cultivation of the most important commercial objects in present and future.
**Keywords:** Population genetics, sea cucumber, microsatellites, COI, molecular markers.

## WRE4678: Targeted Approaches to Implement Nature-Based Solutions in Aggitis Watershed, Greece with the Use of New Technologies

George N. Zaimes*, Paschalis Koutalakis, Georgios Gkiatas, Valasia Iakovoglou
*Geomorphology, Edaphology and Riparian Areas Laboratory (GERi Lab), Department of Forestry and Natural Environment, International Hellenic University, Greece*
**Abstract.** Watershed nonpoint sources pollutants that end up in closed seas can have a major negative impact on the riverine but also the marine ecosystem. Since the transport of sediment and nutrients in a natural watershed process, the goal is to mitigate accelerated erosion that is the result, typically of anthropogenic activities (e.g., cropping, grazing, logging, urbanization). At the same time, it is impossible to completely eliminate these anthropogenic activities so the most sustainable management practices are the implementation

of nature-based solutions. According to the IUCN these solutions leverage nature and the power of healthy ecosystems to protect people, optimise infrastructure and safeguard a stable and biodiverse future. These solutions are in complete harmony with the Green Deal that is a roadmap for Europe becoming a climate-neutral continent. The aim of this study was to identify and assess the contribution nonpoint sources pollutants and suggested the optimal nature-based solutions. Since the budgets for conservation are always limited the implementation of these solutions needs to be targeted. Specifically, areas that provide the greatest contributions of sediments will be targeted. The study area is Aggitis watershed in northern Greece. The focus is on surface and stream bank erosion. The methods at the plot scale, are runoff plots and Gerlach traps for surface erosion, pins and cross-sections for stream bank erosion, to provide accurate data to validate the hydrologic model and stream bank index. The last two methods are utilized for large scale areas. In addition, images from satellite and unmanned aerial vehicles (UAVs) are used to developed different indices (NDVI and NDWI). The use of UAVs for monitoring erosion is an innovation that provides cost-effective, accurate and at large scales datasets. The above methods will identify the main sources but also showcase the contributions of the different sources. The final step is the suggestion of nature-based solutions along with their optimal locations based on the results of the previous methods. Reducing nonpoint source pollutants should help improve the conditions of the riverine and marine ecosystems.

**Keywords:** Nature-based solutions, surface erosion, stream bank erosion, drones, hydrologic model, GIS, targeted approaches, nonpount source pollutants.

**Acknowledgements:** The activities presented from the Protect-Streams-4-Sea project (BSB963). The project is funded by the Joint Operational Programme Black Sea Basin 2014-2020; co-financed by the European Union through the European Neighbourhood Instrument and by the participating countries: Armenia, Bulgaria, Georgia, Greece, Republic of Moldova, Romania, Turkey, and Ukraine. This publication has been produced with the financial assistance of the European Union. The contents of this publication are the sole responsibility of the authors and can in no way be taken to reflect the views of the European Union.

## WRE4565: Future Environmental Challenges of the Urban Protected Area Great War Island (Belgrade, Serbia) Based on Valuation of the Pollution Status and Ecosystem Services

Milica Kašanin-Grubin[1], Snežana Štrbac[1*], Snežana Antonijević[2], Svetlana Đogo Mračević[3], Dragana Ranđelović[4], Jovana Orlić[5], Aleksandra Šajnović[1]

[1]*University of Belgrade, Institute of Chemistry, Technology and Metallurgy, Serbia*

[2]*Public Utility Company "Zelenilo Beograd", Serbia*

[3]*University of Belgrade/Faculty of Pharmacy, Serbia*

[4]*University of Belgrade/Institute for Technology of Nuclear and Other Mineral Raw Materials, Serbia*

[5]*University of Belgrade/Faculty of Chemistry, Belgrade, Serbia*

**Abstract.** The main objectives of this paper are to evaluate the potential impacts of pollution on ecosystem services of the Great War Island and to explore different scenarios for future urban development of the Great War Island that will have implications for human well-being. The aims of this paper are set up based on the evaluation of ecosystem services of the Great War Island and assessment of the pollution status of the Great War Island. In order to evaluate the pollution status of the GWI inorganic and organic composition of sediments were examined. Additionally, the content of microelements was determined in the leaves of the Salix alba L. Pollution indices indicate that all investigated sampling sites are polluted and correspond to high and very high degrees of contamination. Cd and Cu show a high to an extremely high degree of contamination while Sb has an extremely high degree of contamination. Content of As, Co, Cu, Ni, and Zn in leaves of Salix alba L. is insufficient to normal range, while the content of Cd is between the sufficient and excessive values generalized for various species. Typical oil distributions of terpanes and steranes and values of the corresponding maturity parameters clearly indicated that the sediments of the GWI, in addition to native organic matter, contained oil pollutants of anthropogenic origin. GWI provides provisioning, regulating, supporting, and cultural ecosystem services. In relation to ecosystem services two possible scenarios can be predicted: first - losing the status of a protected area due to urbanization; and second - increasing the degree of protection by admission into

international protection lists.

**Keywords:** Wetlands, urban area, ecosystem services, geochemistry, pollution indices.

**Acknowledgements:** The authors would like to thank the Ministry of Education, Science and Technological Development of Republic of Serbia (Grant No: 451-03-68/2022-14/200026) for financial support.

## WRE4663: STOKIS Project

Robert Župan

*University of Zagreb, Faculty of Geodesy, Kačićeva 26, 10 000 Zagreb, Croatia*

**Abstract.** The project started on October 21, 2019, lasted until today. To begin with, it should be noted that data (which can still be used in specifications to establish the STOKIS system) were previously collected in CAD format for each sheet separately. The first part of the STOKIS project refers to the development of product specifications that are the result of the STOKIS project, namely TK25 (Topographic Map 1:25 000), TK50, TK100 and TK250. The basic source of all topographic-cartographic data and products are photogrammetric mapping data (restitution data) and other originals. These data are topologically processed, classified according to the CROTIS data model, and finally stored in the TTB. Topographic data for individual topographic databases (TBP) of smaller scales are performed by performing model generalization, in such a way that for each subsequent TB of smaller scales, model generalization from previously established TB of larger scales is performed. The purpose of the Product Specification is to ensure the appropriate quality to produce topographic data (TP) mapped from in this case our TTB (Basic Topographic Database) but also from other originals. A comprehensive document describing the quality elements as well as the tolerances described in this specification are the basis for quality control. The product specification describes the technical characteristics of the topographic data, and how this data should be collected and processed. In addition to the technical characteristics, this document also describes the content and format for data delivery. The product specification should also reflect the requirements for the use of topographic data. User needs will be the basis for future development and changes in product specifications are focused primarily on user needs (and their changes in use reflected in the product) more efficient methods/processes in production (new technology) and according to international and OGC standards, DIGEST standards Everything serves to make these products easier to read, more up-to-date and more usable in practical application.

**Keywords:** STOKIS, TK25, TK50, TK100, TK200, Croatia.

## WRE4714: The Power of Geographical Indications in Establishing Terriatorial Development Models

Filippo Sgroi[1], Federico Modica[2]

[1]*Department of Agricultural, Food and Forestry Sciences, University of Palermo, Palermo, Italy*

[2]*Department of Agricultural, Food and Forestry Sciences, University of Palermo, Palermo, Italy*

**Abstract.** Geographical indications (GIs) are increasingly seen as a tool to support sustainable local development. This study focuses on how geographical indications can contribute to a territorial public system, and how this can be threatened by several market failures. Starting from the economic literature on public goods, this document highlights how geographical indications, and their legal protection, can guarantee a sustainable development model. This article aims to illustrate and develop new economic arguments that support a more comprehensive political approach to the contribution that Geographical indications make to sustainable development. The research is focused in Sicily on the production of Pachino Tomatoes with Geographical Indication. This production has an ancient tradition and is located in the center of the Mediterranean. Because of that, it is appreciated in food markets. The study, carried out through the application of the "successful entrepreneurial formula" model, was implemented through a telephone survey of the actors in the production system. The results of the study highlight how territorial public goods based on cohesion represent the vector for the resilience of the agricultural landscape and the growth of the entire region in which the agri-food product is developed. An important aspect, as demonstrated in the paper, is the role of information on the product and the territory. Nowadays, dominance at the competitive system level and social cohesion do not guarantee the

success of agri-food production. The study shows that the success of GIs depends on the role of communication that conveys information. This study is new compared to previous ones on the subject, as it applies the business economic approach of the successful entrepreneurial formula to a problem of business competitiveness and, in general, of the territory.

**Keywords:** Geographical indications, agricultural products, public goods, landscapes.

## WRE4674: Subsurface Geological and Engineering Geophysical Site Analysis for Foundation Construction Works Sustainability

O. Ademila[1*], J. O. Ademila[2]

[1]*Department of Earth Sciences, Adekunle Ajasin University, Akungba-Akoko, Nigeria*

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**Abstract.** Engineering geophysical investigation, an efficient step of characterizing subsurface geology of site for civil engineering works has been ignored hence, recent collapse of buildings with resultant loss of lives and valuables. Piqued by this frequency of structural failure globally has necessitated geophysical investigation in characterization of subsurface geology of site for engineering construction works. Combined very low frequency electromagnetic (VLF-EM) and electrical resistivity methods were used to provide detailed information on subsoil profile for documentation and references for durable and sustainable construction works. Thirteen (13) traverses were established from which geophysical data were acquired. Major conductive geological interfaces suspected to be faults/fractured zones were identified from the plots of VLF-EM data. These points serve as the fifty (50) sounding stations further investigated using Schlumberger vertical electrical sounding technique and electrical resistivity imaging using dipole-dipole array were employed on selected four traverses of the engineering site. The acquired data were processed, inverted and interpreted. The VLF-EM 2-D inverted models revealed conductive zones at some locations suggesting incompetent zones, responsible for structural instability. Saturated clayey subsoil and uneven bedrock topography with depressions at some points could cause differential settling which has negative impact on engineering structures. Structural failure may arise from existence of concealed geological structures, deep weathering/fractured bedrock, heterogeneous and structurally deformed (F1 – F16) subsurface geological setting. Thus, classified unstable sections are considered priority in structural design and construction to mitigate unforeseen challenges. Deep foundations in form of piers and piles are encouraged to avert structural failure. This study offers sufficient subsurface information for executing durable civil engineering works in a complex geological terrain. Documentation of these findings is recommended for foundation design, construction of the site and future development of other engineering sites. Thus, the techniques serve as invaluable tools efficient for subsurface characterization for sustainable structural development.

**Keywords:** Geophysical investigation, engineering site characterization, structural instability, subsoil profile, foundation design.

**WRE4698** To avoid repeatability issue, the abstract will be available after the full paper is published in the conference proceedings or other journal.

## Oral Session 2: Water Resources, Water Pollution, and Wastewater Treatment

**Time: 08:30-12:00, November 3, 2022.** (China Standard Time GMT+8)

**Session Chair: Dr. Ashanendu Mandal, Energy Expertise and International Speaker, India**

**Session Room Link:** http://www.academicconf.com/teamslink?confname=wre2022

| | | |
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| 08:30-08:45 | **WRE4682** | **Polymeric Hydrogel Sorbent-Based Hybrid Nanocomposites Materials as a Strategy for Water Remediation Treatment Applications**<br>*Dr. Baigorria Estefanía, São Paulo State University (UNESP), Institute of Science and Technology of Sorocaba (ICTS), Brazil* |
| 08:45-09:00 | **WRE4577** | **Application of Bioaugmentation in the Collection System of a Municipal WWTP to Enhance BNR and Avoid Decommissioning of the WWTP**<br>*Mr. Dimitris Chrysochoou, TradeWorks Environmental Inc., Canada* |
| 09:00-09:15 | **WRE4581** | **Modeling Fractured Rock in 3D for Groundwater Flow Analysis**<br>*Dr. Goodluck Ofoegbu, GNO Modeling Research, USA* |
| 09:15-09:30 | **WRE4608** | **The Prediction of Hydrometeorology Variables Using the Method of Recurrent Neuronal Networks**<br>*Dr. Jimena Alexis Díaz León, Facultad de Ingeniería Civil Universidad Peruana de Ciencias Aplicadas, Perú* |
| 09:30-09:45 | **WRE4701** | **Study on Fish Swimming Behavior Affected by Obstacles Based on Machine Learning**<br>*Ms. Yi Zhou, China Agricultural University, China* |
| 09:45-10:00 | **WRE4705** | **Adaptability Analysis of Water Pollution and Advanced Industrial Structure in Jiangsu Province, China**<br>*Dr. Yang Kong, Business School, Hohai University, China* |
| 10:00-10:15 | **WRE4706** | **Industrial and Agricultural Water Use Efficiency and Influencing Factors in the Process of Urbanization in the Middle and Lower Reaches of the Yellow River Basin, China**<br>*Dr. Qianxi Liu, School of Soil and Water Conservation, Beijing Forestry University, China* |
| 10:15-10:30 | | **Coffee Break** |
| 10:30-10:45 | **WRE4699** | **Treatment of Leachate Using Tannin Based Coagulant: Isotherm and Kinetics Studies**<br>*Ms. Azreen Ibrahim, Faculty of Engineering, Universiti Malaysia Sabah, Malaysia* |
| 10:45-11:00 | **WRE4703** | **Spatial and Temporal Development of Microorganisms Within an Up-Flow Sand Filter and the Effect of Clogging**<br>*Dr. Farhana Abd Lahin, Membrane Technology Research Group, Material and Mineral Research Unit, Faculty of Engineering, Universiti Malaysia Sabah, Malaysia* |
| 11:00-11:15 | **WRE4621** | **Water Pollution Havens Hypothesis in a Dynamic Agglomeration Model with Fisheries Resource Management**<br>*Dr. Yoshihiro Hamaguchi, Department of Management Information, Kyoto College of Economics, Japan* |
| 11:15-11:30 | **WRE4312** | **Clogging in Vertical Flow Constructed Wetlands: Causes for Clogging and Influence of Decontamination**<br>*Dr. Qiaoling Xu, Department of Resources & Environmental Engineering, Anshun University, China* |
| 11:30-11:45 | **WRE4627** | **A New Method for Determining Water Flooding Fronts Using Dynamic and Static Data** |

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| | | *Dr. Lei Song, National Engineering Laboratory for Low Permeability Oil and Gas Field Exploration and Development, China* |
| 11:45-12:00 | **WRE4657** | **Removal of Phenol from Wastewater Using Waste Materials as Adsorbents**<br>*Dr. Ashanendu Mandal, Energy Expertise and International Speaker, India* |

## Abstracts of Oral Session 2

### WRE4682: Polymeric Hydrogel Sorbent-Based Hybrid Nanocomposites Materials as a Strategy for Water Remediation Treatment Applications

Baigorria Estefanía[1,2*], Alvarez Vera A[2], Fraceto Leonardo F.[1]

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**Abstract.** Contamination of water basins is a global concern and is the 2nd leading cause of pollution-related deaths worldwide and is responsible for about 1.8 million deaths per year. Among the aqueous contaminants with the highest incidence in aqueous matrices are toxic metals (arsenic - As), and pesticides (carbendazim - CBM and paraquat - PQ). Adsorption is widely used for the remediation of aqueous pollutants due its versatility, low-cost, eco-friendly, and sustainable method to be used for this purpose. Polymer networks or hydrogels have been successfully applied as a technology for removing aqueous pollutants using adsorption strategies. In this work, we present various hydrogels sorbent-based hybrid nanocomposite materials (HNMs) of the polymeric matrix as a strategy for remediation of As, CBM, and PQ remediation from water. HNMs composed of different structure nanoclays and eco-friendly polymeric matrix were synthesized by simple methodologies. Also, the NMHs were characterized by aqueous absorption capacity, differential scanning calorimetry, thermogravimetric analysis, infrared spectroscopy, X-ray diffraction, and microscopic and texture techniques. Besides, their performance in the removal of As, CBM, and PQ from aqueous systems was studied in batch tests under different conditions. The results showed that the addition of nanoclay to the polymeric matrices generated positive changes in their structure, increasing their stability and stiffness. As, PQ, and CBM adsorption studies showed a high removal efficiency (> 99 %) using HNMs. In addition, the reusability studies showed good performance of the sorbents during several re-cycles. To summarize, the development HNMs formed with low-cost and eco-friendly raw materials to be applied in technologies for the remediation of aqueous pollutants such as As, and pesticides have been achieved. The obtained results exhibit these novel biomaterials as promising sorbents of aqueous pollutants, with biodegradable and environmentally friendly properties, as a sustainable and profitable solution to obtain drinking water, for a real problem in society.

**Keywords:** Adsorption, arsenic, nanoclays, pesiticides, polymers, water remediation.

**Acknowledgements:** National Scientific and Technical Research Council (CONICET), São Paulo Research Foundation (FAPESP - 2017/21004-5), Nacional Council for Scientific and Technological development (CNPq - #405623/2018-6), Ministry of Science, Technology, and Innovations - Financier of Studies and Projects (MCTI/FINEP - # 0080/21), and Coordination of the training of higher-level personnel (CAPES - #88887.572861/2020-00) are acknowledged for the financial support this work.

### WRE4577: Application of Bioaugmentation in the Collection System of a Municipal WWTP to Enhance BNR and Avoid Decommissioning of the WWTP

Dimitris Chrysochoou

*TradeWorks Environmental Inc., Canada*

**Abstract.** A Rotating Biological Contactor [RBC] wastewater treatment plant was facing challenges with meeting the effluent ammonia criteria. It is a 4,500 m3/day [1.2 MGD] wastewater treatment plant located in a residential area in Nova Scotia region. It utilizes screening, primary clarification, 2 parallel RBC trains,

secondary clarification, and disinfection prior to discharge. The wasted sludge from the system is co-thickened in the primary clarifier and pumped into the anaerobic digester [AD]. Waste sludge from the anaerobic digester is hauled away for further processing and disposal. Due to the challenges, the facility was scheduled to be decommissioned and be used as a lift station to divert the flow to another facility nearby. The facility has different effluent ammonia criteria for the winter and summer seasons [5mg/l and 3mg/l respectively]. For this project it was suggested that the ideal solution would be to apply the bioaugmentation in the wastewater collection system. This way, the sewage conveyance system is leveraged to precondition the wastewater prior to its introduction into the treatment plant, which is also enhanced by the microbial addition. The project was started as a 4-month full scale demonstration, and it was proceeded on an ongoing basis based on success, until it eventually completed 1 full year of application. After completing 1 year, it was decided to integrate the bioaugmentation permanently as part of their standard operations. The primary objective of this project was to enhance nitrification. Secondary objectives of the application included the general optimization of the facility. During the first year of application, it was demonstrated that the bioaugmentation assisted with enhancing the nitrification of the system, which was able to meet the ammonia effluent criteria and have the primary objective satisfied. As the system has different effluent criteria for winter and summer seasons, for the period of November 1st, 2019, to April 30th, 2020 [before the bioaugmentation] the average effluent ammonia values were 4 ppm, while for the period of November 1st, 2020, to April 30th, 2021 [after bioaugmentation] the average ammonia effluent values were 1.75 mg/l. Furthermore, for the period of May 1st, 2020, to August 31st, 2020 [before bioaugmentation] the average effluent ammonia was 2.92 mg/l, and for the period of May 1st, 2021, to August 31st, 2021 [after bioaugmentation] the average effluent ammonia values were 1.38 mg/l. Also, the ammonia uptake rate of system (removal rate) increased from 56kg/day to 72kg/day of NH3-N which results in a 28% increase in the daily ammonia removal. Secondary objectives included optimization of the system in various stages. It was shown, that after bioaugmentation application the biogas production was increased compared to the same months the year prior to the application, by 20-50%. The application of the bioaugmentation in the collection system was able to provide a sustainable solution to the wastewater authority saving their facility from being decommissioned while also optimizing their system and process.

**Keywords:** Bioaugmentation, biological nutrient removal, BNR, WWTP, RBC, nitrification, cold climate, biogas increase, biogas, sludge reduction, collection system.

## WRE4581: Modeling Fractured Rock in 3D for Groundwater Flow Analysis

Goodluck Ofoegbu

*GNO Modeling Research, USA*

**Abstract.** Groundwater flow in fractured rock involves matrix flow and fracture flow but fracture flow usually is dominant. When fracture flow is dominant, the directions and magnitude of flow are controlled by clusters of flow pathways formed by fracture intersections. The fracture intersections and resulting flow pathways can be simulated numerically using a representation of the 3D fracture network and hydrologic modeling of flow through the individual fractures. Given a numerical representation of the 3D fracture network, modeling groundwater flow through the fractured-rock system requires capability to model explicitly both the fracture network and flow through the individual fractures. Furthermore, because 3D fracture network models typically include uncertainties, the hydrologic modeling calls for capability to vary the fracture-network model in order to evaluate the effects of such uncertainties on the calculated hydrologic response. We describe analyses conducted using a computer code that provides both capabilities. The code captures the complexity of groundwater flow pathways by modeling individual fractures explicitly; while using a continuum framework for storage of fracture and rock-matrix characteristics. Fracture geometry stored as continuum properties is used internally to generate geometrical parameters needed to model the individual fractures explicitly. Thus, the code models the fracture network (fracture orientation, intensity, length, and aperture) and flow through fractures and matrix explicitly; while using a continuum framework for storage that incorporates the 3D fracture distributions seamlessly. A user need only provide fracture data in a familiar format available from geologic analysis. Further, the code can model several realizations of a statistical fracture distribution using the same domain grid, by changing values of fracture properties stored in the continuum framework. Thus, multiple cases can be analyzed

as needed to support probabilistic assessment. We provide analysis results for water flow into an open-pit in fractured rock. The analysis uses two examples of fracture-distribution modeling: one based on ubiquitous fractures, whereby one fracture of the same orientation occurs everywhere; and the other based on stochastic fractures, whereby three fractures with spatially varying orientations occur everywhere. The water-flux patterns calculated using the ubiquitous-fracture models manifest the fracture orientation but are dominated by the pattern of hydraulic gradients due to the applied perturbation of the hydrologic system. In contrast, water-flux distributions calculated using the stochastic-fractures model form a pattern of clusters related to a statistical property of the modeled fracture distribution. We use results from the stochastic-fractures models to make a case that the computer code models flow through individual fractures explicitly and captures both matrix flow and fracture flow appropriately.

**Keywords:** Fracture flow, groundwater, modeling, statistical fracture distribution, stochastic, three-dimensional.

## WRE4705: Adaptability Analysis of Water Pollution and Advanced Industrial Structure in Jiangsu Province, China

Yang Kong[1], Weijun He[2], Thomas Stephen Ramsey[2], Dagmawi Mulugeta Degefu[3]

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[2]*College of Economics and Management, China Three Gorges University, Yichang 443002, China*

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**Abstract.** The advanced development of industrial structure is the inevitable way to alleviate a regional water quality crisis. The adaptability analysis of advanced industrial structure (AIS) and water pollution can provide important enlightenment for regional differentiation policy making, which is conducive to simultaneously realizing water sustainability and high-quality economic development. However, the adaptability between water pollution and advanced industrial structure remained unrevealed. Therefore, taking Jiangsu Province as a case study, firstly, this study objectively assessed the status of water pollution during the years 2013-2019 through quantitatively analyzing the grey water footprint (GWF) and grey water footprint intensity (GWFI). Secondly, the level of AIS is measured to analyze the characteristics and evolution of the industrial structure. Finally, the Tapio decoupling elasticity coefficient was introduced to analyze the adaptability between GWF and AIS degree, and between GWFI and AIS degree. The main results showed that: (1) From 2013 to 2019, the overall decrease of GWF in Jiangsu Province reached 27.77%, presenting a change trend of fluctuation, while the GWFI strictly declined. In addition, agriculture was the largest sector of regional GWF from 2003 to 2016, and domesticity replaced agriculture as the largest water pollution source from 2017 to 2019. (2) The overall industrial structure of Jiangsu Province showed an expected evolution trend of "the proportion of primary and secondary industries declined, while that of tertiary industry increased". However, the level of AIS was not significantly improved, and the secondary industry was still in a leading position. (3) In terms of the total amount and intensity, water pollution in Jiangsu Province was well adapted to the AIS from 2003 to 2019. Among them, the strong decoupling adaptation (SDA), ideal adaptation state, was achieved between the GWF and the AIS in 75% of the year, while there has always been SDA between the GWFI and the AIS in Jiangsu Province. Therefore, regional policies aiming at achieving effective water pollution control through industrial optimization should be rationally formulated based on the findings of adaptability analysis. This study proposes an analytical framework for exploring the adaptability of water pollution and industrial structure, which should be applied to regional zoning management and is conducive to promoting sustainable support of the water environment for industrial development.

**Keywords:** Grey water footprint, adaptability analysis, water sustainability, economic growth, optimization of industrial structure.

**Acknowledgements:** The authors sincerely thank the anonymous referees for their meaningful suggestions on a previous draft. This work was supported by the Fundamental Research Funds for the Central Universities (No. B220203012), Postgraduate Research & Practice Innovation Program of Jiangsu Province (No. KYCX21_0445), Major Program of National Social Foundation of China (No.19ZDA089), the National Natural Science

Foundation of China (No.71874101, 72104127, 72004116), the Ministry of Education (MOE) of China, Project of Humanities and Social Sciences (No.20YJCGJW009).

## WRE4706: Industrial and Agricultural Water Use Efficiency and Influencing Factors in the Process of Urbanization in the Middle and Lower Reaches of the Yellow River Basin, China

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**Abstract.** Improving water utilization efficiency can effectively alleviate the contradiction between water shortage and water demand in the process of rapid urbanization. The middle and lower reaches of the Yellow River Basin, China, are characterized by water shortage. In order to improve water use efficiency, taking the 43 prefecture-level units in this region as the study area, industrial and agricultural water use efficiency is calculated based on the undesired SBM-DEA model. Then, the Tobit model is used to explore their influencing factors. The results show that the regional average agricultural water use efficiency is greater than the industrial water use efficiency. The temporal trend indicates that the agricultural water use efficiency shows a fluctuating upward trend, while industrial water use efficiency has a fluctuating downward trend. The gravity center of industrial water use efficiency moves from northwest to southeast in a "Z" shape, while the gravity center of agricultural water use efficiency moves westward as a whole. From the perspective of spatial patterns, the standard deviation ellipse of industrial water use efficiency shows that the industrial water use efficiency is higher in the east–west direction, while the agricultural water use efficiency is higher in the northwest–southeast direction. The improvement of urbanization level is conducive to the improvement of industrial water use efficiency; however, the development of urbanization has a significant inhibitory effect on improving agricultural water use efficiency.

**Keywords:** Water use efficiency, urbanization development, the middle and lower reaches of the Yellow River, DEA, Tobit regression.

## WRE4699: Treatment of Leachate Using Tannin Based Coagulant: Isotherm and Kinetics Studies

Azreen Ibrahim[1*], Abu Zahrim Yaser[2]

[1]*Faculty of Engineering, Universiti Malaysia Sabah, Malaysia*

[2]*Faculty of Engineering, Universiti Malaysia Sabah, Malaysia*

**Abstract.** High humic substances remaining after biological treatment led to high colour values in landfill leachate which require treatment to make it dischargeable into the water stream. In this work, the effectiveness of removing the colour from biologically treated landfill leachate (BTLL) via coagulation-flocculation process was studied. A tannin-based coagulant, Organofloc (OF) was used as coagulant with the aid of anionic polyacrylamide (APAM) and cationic polyacrylamide (CPAM) as flocculant. Jar test experiments were conducted with a varying dosage of OF followed by tests with different values of APAM and CPAM dosages to find out the optimum condition for colour removal. The optimum dosage of OF was found to be 400 mg/L resulting in 89% of colour removal. The addition of 400mg/L OF and 20 mg/L CPAM yielded 91% colour removal while with addition of 400 mg/L OF and 1 mg/L APAM yielded 86% colour removal. The isotherm with only addition of OF followed Freundlich model, while addition of OF-CPAM and OF-APAM both followed the Langmuir model. OF and OF-CPAM coagulation exhibited pseudo first-order kinetic behaviour while OF-APAM followed pseudo second-order. Coagulation flocculation system of OF as tannin-based coagulant with CPAM as flocculant showed the promising result in decolourisation of BTLL.

**Keywords:** Biocoagulant, tannin, organofloc, polyacrylamide, leachate.

**Acknowledgements:** This work was supported by Universiti Malaysia Sabah under the UMSGreat fund (GUG0198-1-2018).

## WRE4703: Spatial and Temporal Development of Microorganisms Within an Up-Flow Sand Filter and the Effect of Clogging

F. A Lahin*, R. Sarbatly, C. K. Chiam

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**Abstract.** Up-flow sand filtration is an excellent alternative to point-of-use treatment system that can be utilized for rural water provision. The microorganism development during the commissioning of up-flow sand filter was studied in terms of its spatial and temporal growth based on dissolved oxygen (DO) consumption and FE-SEM imaging. The effect of its configuration and microorganism growth towards clogging was also investigated through pressure drop monitoring. The result showed that the DO consumption differed between the 50 cm sand bed layers. An average of 8.5% reduction was seen at 10 cm height (4.05 mg/L), 17.48% at 30 cm height (3.71 mg/L), and 4.02% (4.04 mg/L) at 50 cm height. This pattern continued until 34 days of operation before the reduction changed significantly. From Day 35 onward, a further decrease in DO concentration was observed at 10 cm height. The average reduction of DO was 27.2%. The concentration of DO was at 3.4 mg/l as compared to 4.0 mg/L for the first 34 Days. The value drops even more after day 46 until day 58 ranging at 2 – 3.3 mg/L. at 30 cm height, the DO concentration dramatically decreases to 0.8 mg/L after day 35 with average reading of <1 mg/L until the end of the commissioning period. The lowest reading was 0 mg/L on days 46 and 55. Meanwhile, the DO concentration at 50 cm height decreased to 0.3 mg/L on day 46 and stayed at a lower concentration until day 60. FE-SEM images confirm the finding as the growth of microorganisms was observed on the samples taken from 10 cm height after 4 weeks of commissioning period. At eight weeks of operation, substantial growth was seen on samples taken both from 10 and 30 cm height. Lesser growth was seen on samples from 50 cm height. The pressure drops results showed no significant increase in pressure drop indicating clogging did not occur during the operational period. The up-flow configuration has aided in preventing bio-clogging in sand filtration which reduces maintenance requirements.

**Keywords:** Up-flow sand filter, sand filter clogging, sand filter microorganism growth.

**Acknowledgements:** This research has been financially supported by Universiti Malaysia Sabah through UMSGreat Research Grant (GUG0247).

## WRE4621: Water Pollution Havens Hypothesis in a Dynamic Agglomeration Model with Fisheries Resource Management

Yoshihiro Hamaguchi

*Department of Management Information, Kyoto College of Economics, Japan*

**Abstract.** Individual transferable quota (ITQ) systems have been introduced in the context of global competition for fisheries resources. However, rent-seeking for the quota is occurring as a potential rent and the resource protection function is being undermined. In addition, economic globalisation may create a water pollution havens hypothesis through the location behaviour of fish processing firms, which drain polluted water in their production processes. The task of this study is to demonstrate this hypothesis by using an R&D-based growth model with rent-seeking for ITQ and firms' location. The South, which relies on exports of fish catches and fish products, seeks to increase exports through raising catch quotas. This policy increases the production of fish products and leads to the deterioration of fisheries resources through polluted wastewater. This increase in profits from the fish processing industry prompts the firms draining polluted water to relocate from the North to the South. Loose fishing quotas in the South compared to the North lead to the deterioration of fisheries resources through increased polluted water. Consequently, this implies the water pollution havens hypothesis. In this study, the government in the North can avoid this hypothesis by lowering its catch quota in response to the South's raised quota. The results suggest that a cooperative fisheries policy is important for international fisheries resource management.

**Keywords:** ITQ, FDI, rent-seeking, waste water, pollution havens hypothesis.

**Acknowledgements:** The author acknowledges the financial support for Early Career Scientists from the Japan Society for the Promotion of Science No. 22K13409; this work was supported by JSPS KAKENHI Grant

Number JP22K13409. The author is responsible for all errors in this paper.

## WRE4312: Clogging in Vertical Flow Constructed Wetlands: Causes for Clogging and Influence of Decontamination

Qiaoling Xu[1,2], Li Wang[1], Ping Wang[1], Xueyuan Wen[1], Feng Zhang[1]

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[2]*College Rural Revitalization Research Center of GuiZhou, Anshun, China*

**Abstract.** With the continuous operation of constructed wetlands, substrate clogging is issue. In order to solve the problem, there is practical significance to understand the causes for clogging in constructed wetlands. Two pilot-scale vertical flow constructed wetlands were established, namely, CW-B and CW-C. By studying the relationship between the accumulation of different substances and the banked-up water area, it was found that the accumulation of non-filter substances and total solids was an important reason for the clogging of the substrate, and the accumulation degree of non-filter inorganic substances was more obvious than that of non-filter organic substances, and the blockage was mainly located in the 10-20 cm layer. In the vertical flow constructed wetland with river sand as the main substrate, water accumulation will occur when the content of total solid and non-filter substances exceeds 67.233 g and 101.228 g per cubic meter of substrate, respectively. Therefore, it is important to pay attention to the substrate particle size matching of 0-20 cm layer to reduce the clogging in the vertical flow constructed wetland. The clogging has little effect on chemical oxygen demand (COD) removal, but great effect on total phosphorus (TP) removal. Compared with the control wetland (CW-C), the biomass content in the CW-B with biochar increased by 334.26 nmol P/g, which can improve the removal efficiency of total nitrogen (TN) and total phosphorus (TP), but also increase the risk of clogging in the vertical flow constructed wetland. Future research should try to combine the anti-blocking research results of biochar constructed wetlands to improve the purification effect, which is of great significance to promote the sustainable development of constructed wetlands.

**Keywords:** Substrate clogging, vertical flow constructed wetland, substances accumulation.

## WRE4627: A New Method for Determining Water Flooding Fronts Using Dynamic and Static Data

Siyi Wang[1,2], Lei Song[1,2], Xiqun Tan[1,2], Jing Wang[1,2], Shuo Song[1,2]

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[2]*Changqing Oilfield Exploration and Development Research Institute, Xi'an 710018, China*

**Abstract.** Using the classical two-phase flow seepage theory, a mathematical model of the water flooding front is established, and the approximate solutions of the model are obtained in stages. According to these solutions, the position of the water flooding front in different time periods in all directions in the well group can be calculated. Three factors of threshold pressure gradient, fracture and water injection effective utilization rate were added to the calculation model, and the influence of reservoir heterogeneity on water flooding front was fully considered, and the mathematical model was revised and improved. Finally, the inspection well was used. data to verify the research results. The results show that compared with the previous methods, this method is more accurate and practical. It can further improve the water flooding effect in this area and provide a basis for the adjustment of oil reservoir development. It also has certain reference significance for the development of similar ultra-low permeability reservoirs.

**Keywords:** Two-phase seepage, well test data, water flooding front, effective utilization rate of water injection, inspection well.

## WRE4657: Removal of Phenol from Wastewater Using Waste Materials as Adsorbents

Ashanendu Mandal

*Energy Expertise and International Speaker, India*

**Abstract**. This research aims for adsorptive removal of phenol from industrial wastewater by four bio-

adsorbents viz. guava tree bark, rice husk, neem leaves, activated carbon from coconut coir and four industrial waste adsorbents viz. rice husk ash, red mud, clarified sludge from basic oxygen furnace, activated alumina. The adsorbents are characterized by SEM, XRD, FTIR and BET analyzers. The experiments of phenol removal are carried out with the variation of initial phenol concentration (5-500 mg/L), initial pH (2-12), adsorbent dose (0.10-20 gm/L), temperature (25-50°C) and contact time (30-600 min). The maximum removal obtained is 97.50%. The kinetics shows that the pseudo-second order model is best fitted for all adsorbents except red mud. The kinetic modeling shows that the adsorption mechanism is supportive of film diffusion, intra-particle diffusion and chemisorption for all adsorbents. The isotherm analysis suggests that Freundlich isotherm model is best supportive for guava tree bark, rice husk, neem leaves, activated carbon, red mud and activated alumina, whereas Langmuir and D-R isotherm are best supportive for rice husk ash and clarified sludge respectively. The thermodynamics shows the spontaneity, randomness and endothermic/exothermic nature of the adsorption processes. The ANN modelling using two popular algorithms viz., Levenberg-Marquardt and Scaled Conjugate Gradient establishes that the experimental and predictive data are within allowable range. The scale-up designs have been performed for their commercial applications, The regeneration and the safe disposal of used adsorbents are also studied for checking their wider applicability. The research concludes that the toxic phenol can be removed from wastewater effectively using waste materials as adsorbents.

**WRE4608, WRE4701** To avoid repeatability issue, the abstracts will be available after the full papers are published in the conference proceedings or other journals.

## Oral Session 3: Water Management, and Environmental Pollution

**Time: 14:00-18:00, November 3, 2022.** (China Standard Time GMT+8)

**Session Chair: Dr. Nicole Nawrot, Department of Sanitary Engineering, Gdansk University of Technology, Poland**

**Session Room Link:** http://www.academicconf.com/teamslink?confname=wre2022

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| 14:00-14:15 | **WRE4677** | **In Bangladesh Improving Water Resource Management**<br>*Mr. Haragobinda Baidya, Executive Director of Minority Self-Empowerment Foundation (MSEF) NGO, Bangladesh* |
| 14:15-14:30 | **WRE4672** | **A Review on Heavy Metal Pollution in Water: Efficient Methods to Eliminate Their Toxicity**<br>*Dr. Kosar Hikmat Hama Aziz, Department of Chemistry, College of Science, University of Sulaimani, Iraq* |
| 14:30-14:45 | **WRE4683** | **Using the Potential Energy Anomaly Equation to Analyze the Mixing and Stratification in the Suances Estuary**<br>*Mr. Jagoba Lupiola, Team Ingeniería y Consultoría S.L., Parque Científico y Tecnológico de Bizkaia, Spain* |
| 14:45-15:10 | **WRE4648** | **Coupling Photocatalysis and Cold Plasma for Water Decontamination: Process Intensification and Applications**<br>*Prof. Francesco Parrino, Department of Industrial Engineering, University of Trento, Italy* |
| 15:10-15:35 | **WRE4572** | **Membrane Bioreactor for Domestic Wastewater Treatment: Energetic Assessment and Reuse**<br>*Prof. Sarra Kitanou, Ibn Tofail University, Laboratory of Advanced Materials and Process Engineering, National High school of chemistry, Morocco* |
| 15:35-15:50 | **WRE4693** | **Rainfall-Runoff Modelling in the Kouilou-Niari Catchment Area in South-West of Congo-Brazzaville**<br>*Assoc. Prof. Christian Tathy, Marien Ngouabi University of Brazzaville, Congo* |
| 15:50-16:00 | | **Coffee Break** |
| 16:00-16:15 | **WRE4702** | **Optimization of the Design of a Drinking Water Distribution Network Using a Metaheuristic Algorithm**<br>*Dr. Boussahia Mounir, LRHYA Laboratory, Faculty of Technology, University of BATNA 2, Algeria* |
| 16:15-16:30 | **WRE4700** | **Pesticide Residue Levels in Vegetables and Surface Waters at the Central Rift Valley (CRV) of Ethiopia**<br>*Dr. Kumelachew Mulu Loha, Department of Environment & Health, Vrije Universiteit, The Netherlands* |
| 16:30-16:45 | **WRE4675** | **Removal Efficiency of Nutrients and Potentially Toxic Elements (Cd, As, Pb, Cd) by Temperate Climate Characteristic Species in Floating Treatment Wetland**<br>*Dr. Nicole Nawrot, Department of Sanitary Engineering, Gdansk University of Technology, Poland* |
| 16:45-17:00 | **WRE4687** | **Enhanced Solar Degradation of Cyanide Using Low-Grade $Mno_2$ Ore from Nsuta as a Catalyst**<br>*Mr. Kenneth Mensah, Environmental Engineering Department, Egypt-Japan University of Science and Technology, Egypt* |
| 17:00-17:15 | **WRE4695** | **Pesticide-Nitrate Vulnerability Mapping in a GIS Based Environment, a Case Study** |

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| | | *Dr. Omonona Victor Olufemi, Department of Geology/Geophysics, Alex Ekwueme Federal University, Nigeria* |
| 17:15-17:30 | **WRE4711** | **Evaluation of Climate and Coastal Vulnerability of Urban Areas: An East Asian Perspective**<br>*Dr. Komali Kantamaneni, Faculty of Science and Technology, University of Central Lancashire, UK* |
| 17:30-17:45 | **WRE4631** | **Phytoremediation of Stormwater by Floating Treatment Wetland**<br>*Mr. Md Nuruzzaman, School of Civil and Mechanical Engineering, Curtin University, Australia* |
| 17:45-18:00 | **WRE4724** | **Water Pollution and Ocean Acidification-Challenges and Lessons from Environmental Scientists and Journalists**<br>*Dr. Soufiane Haddout, Department of Physics, Faculty of Science, Ibn Tofail University, Morocco* |

## Abstracts of Oral Session 3

### WRE4677: In Bangladesh Improving Water Resource Management

Haragobinda Baidya
*Executive Director of Minority Self-Empowerment Foundation (MSEF) NGO, Bangladesh*

**Abstract.** The natural rivers flow of water decreasing and some disaster period and rainy season increasing in Bangladesh. The management of water resources has become a critical need in Bangladesh because of growing demand for water and increasing conflict over its alternative uses. As populations expand and make various uses of water, its growing scarcity becomes a serious issue in developing countries such as Bangladesh. Water can no longer be considered a totally free resource, and plans must be developed for its efficient use through better management and rules that preserve everybody's access to it and interest in its development. Because it is a common resource, its development and management should involve all beneficiaries. The government's role in this process is to establish the ground rules for water use and conservation through a policy and legal framework and a monitoring system that ensure its continued safety of supply to and responsible use of water by every sector and user in the economy. National water policy must set the ground rules for allocation to different users, water rights, pricing, and environmental safety. Bangladesh's water strategy should start with a national water policy that spells out key objectives such as priority of use by critical economic sectors, approaches to water pricing and cost recovery for development, and shared public- and private-sector water management. An apex public planning organization is needed to perform overall planning for water resources and to advise the National Water Counsel on policy and legislation. Also needed are agencies to implement public water plans for the development of infrastructure, the monitoring of water regimes, and the enforcement of regulations. This paper a product of the Agricultural and Natural Resources Division, South Asia, Country Department I is part of a larger effort in the department to analyze the major issues in managing land and water resources and developing a strategy to improve the management of these vital resources of the economy.

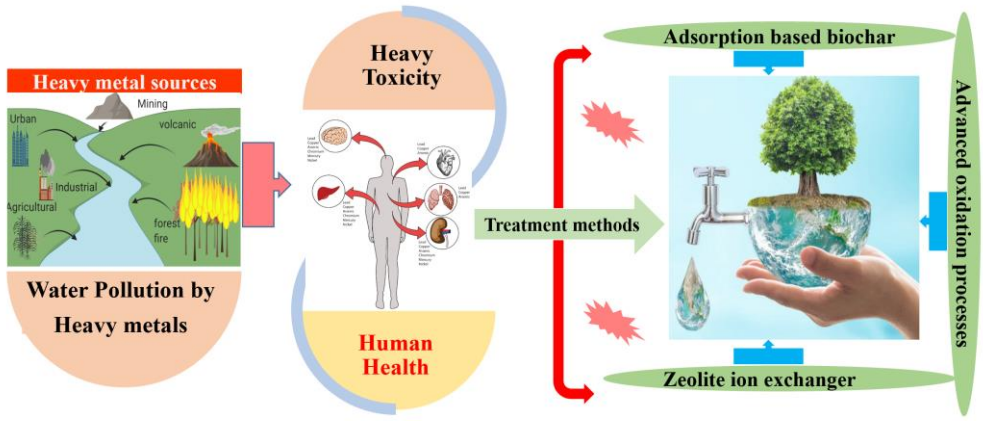
**Keywords:** Water, disaster, efficient, environmental, agriculture.

### WRE4672: A Review on Heavy Metal Pollution in Water: Efficient Methods to Eliminate Their Toxicity

Kosar Hikmat Hama Aziz[1,2*], Fryad Saeed Mustafa[1], Khalid M. Omer[1]
[1]*Department of Chemistry, College of Science, University of Sulaimani, Qlyasan Street Sulaimani City 46001, Kurdistan Region, Iraq*
[2]*Laboratory of Atmospheric Chemistry and Air Quality, Brandenburg University of Technology (BTU Cottbus-Senftenberg), D-12489 Berlin, Germany*

**Abstract.** Water pollution by heavy metal ions has emerged as one of the most significant environmental issues worldwide, posing serious threats to the aquatic ecosystem and human health. Water pollution is uncontrollable

as a result of industrialization, climate change, and urbanization and it has become of great concern due to the adverse effects on the ecosystem. Mining wastes, landfill leachates, municipal wastewater, urban runoff, industrial wastewaters, and natural causes such as weathering, abrasion of rocks, and volcanic eruptions can all introduce heavy metals into the aquatic system. Most heavy metal ions are toxic, carcinogenic, and have a high proclivity for bioaccumulation in living organisms. Even at extremely low concentrations, they can cause multiple organ harm, including damage to the nervous system, liver, lungs, kidneys, stomach, skin, and reproductive systems. Neurodegenerative disorders and diseases, such as Alzheimer's and Parkinson's, can also be caused by them. Removal of heavy metals from water is a hot topic in environmental remediation due to their toxic, non-biodegradable, and persistent nature. Various strategies for removing heavy metals from wastewater have been intensively investigated in recent years. In this review, the main sources of heavy metals, the essential issues surrounding their presence in water, biological and chemical transformation, and the health impacts on humans are all summarized. In addition, the recent approaches for eliminating heavy metal toxicity from polluted water are also reviewed and evaluated. These methods include physicochemical Adsorption by biochar derived from natural biomasses, zeolite ion exchanger, and advanced oxidation processes for decomposition of heavy metal complexes in water. Finally, their justifications, advantages, applications, challenges, and prospects are all presented and discussed separately. Future efforts should focus on selecting environmentally friendly technology and scaling up for practical heavy metal removal applications efficiently and cost-effectively. The graphical abstract for this review is presented in the figure below:




**Keywords:** Water pollution, heavy metal removal, adsorption, toxicity, water treatment.

## WRE4683: Using the Potential Energy Anomaly Equation to Analyze the Mixing and Stratification in the Suances Estuary

Jagoba Lupiola[1,2,*], Javier F. Bárcena[2], Javier García-Alba[2], Andrés García[2]

[1]*Team Ingeniería y Consultoría S.L., Parque Científico y Tecnológico de Bizkaia, 207C, 48170, Zamudio, Spain*

[2]*IHCantabria - Instituto de Hidráulica Ambiental de la Universidad de Cantabria. Isabel Torres, 15, Parque Científico y Tecnológico de Cantabria, 39011, Santander, Spain*

**Abstract.** Estuaries are ecosystems rich in biodiversity in which complex physical mixing processes occur due to the confluence of fresh and salt waters. This study aims to analyze the different processes driving the mixing and stratification of the water column in shallow estuaries with large intertidal areas, typical of the Northern Atlantic coast of Spain, by using the potential energy anomaly and its derivate. For this purpose, the Suances estuary (Spain) will be analyzed with a 3D hydrodynamic model during the year 2020. This estuary displays an approximate length of 7.5 km, 150 m average width, an area of 339.7 hectares, where intertidal areas occupy 76% of its surface, and the main channel depth varies between 1 and 8 meters. In order to carry out this study, continuous measurements of water level, temperature and current velocity were taken at different depths over

several months in the estuary to calibrate and validate a high-resolution horizontal and vertical 3D model. The application showed that there is great variability in the vertical structure of the estuary, with the tide having a great influence. The mixing zone in the Suances estuary is located between kilometers 4 and 8 of the estuary most of the time, varying by the tidal flood and ebb. However, when a high runoff from river flow is occurring, the tide takes a secondary role and the fluvial contribution moves the water from the estuary to the mouth, locating the maximum stratification in this area. In addition, the derivative of the potential energy anomaly, which allows the stratification to be decomposed into the different effects that produce it, has been used. With this derivative, it has been found that tidal straining, advection and non-mean straining are the main processes governing the stratification in the Suances estuary.

**Keywords:** Estuarine stratification and mixing, potential energy anomaly ($\phi$), field observations, 3D hydrodynamic modelling.

**Acknowledgements:** The work described in this paper is part of the reference project RTI2018-095304-B-I00 financed by MCIN/AEI/10.13039/501100011033 and by FEDER a way of making Europe. Moreover, this study was also financed by the 2i program of the Provincial Council of Bizkaia (Spain) with expedient number 6/12/2i/2019/153.

## WRE4648: Coupling Photocatalysis and Cold Plasma for Water Decontamination: Process Intensification and Applications

Francesco Parrino

*Department of Industrial Engineering, University of Trento, via Sommarive 9, 38123, Trento, Italy*

**Abstract.** Photocatalysis and cold plasma are emerging technologies for water treatment. However, mechanistic investigation is still needed to understand the extent and the nature of synergistic effects possibly arising when they are acting simultaneously, both in terms of bacterial deactivation and degradation of organic pollutants. Our recent results reveal that when these processes occur in plasma activated water in the presence of irradiated $TiO_2$ as the photocatalyst, the efficiency of the integrated process is lower than the sum of the two processes acting separately, even if higher that the efficiency of the single technologies. On the other hand, synergistic effects are arising by simple UV-A irradiation of the plasma activated water, due to the presence of in situ generated photo-active species. This finding is of interest as a chlorine-free approach for water purification of industrial effluents in food industry.

**Keywords:** Photocatalysis, cold plasma, process intensification.

## WRE4572: Membrane Bioreactor for Domestic Wastewater Treatment: Energetic Assessment and Reuse

S. Kitanou, M. Taky, A. Elmidaoui

*Ibn Tofail University, Laboratory of Advanced Materials and Process Engineering, National High school of chemistry, P.O. Box: 1246, Kenitra, Morocco*

**Abstract.** Water recycling and reuse is an effective measure to solve the water stress problem. The sustainable use of water resource has become a national development strategy in Morocco. A key aspect of improving overall sustainability is the potential for direct wastewater effluent reuse. However, membrane bioreactors (MBR) have been identified as an attractive option for producing high quality and nutrient-rich effluents for municipal and domestic wastewater treatment. Currently, with the evolution of wastewater treatment projects in Morocco, the MBR process can be used as a technology treating different types of wastewater and to produce effluent with suitable quality for reuse. However, the energetic consumption of this process is a great concern, which can limit the development and implementation of this technology. In this investigation, the electric energy consumption of an ultrafiltration membrane bioreactor process in domestic wastewater treatment is evaluated and compared to some MBR installations based on literature review. Energy requirements of the MBR are linked to operational parameters and reactor performance. The analysis of energy consumption shows that the biological aeration and membrane filtration are more energy consuming than the other components listed as feed and recirculation pumps. Biological aeration needs 53% of the overall energetic consumption and the

specific energy consumption for membrane filtration is about 25%. However, aeration is a major energy consumer, often exceeding 50% share of total energy consumption. The best results obtained on the MBR system (pressure p = 1.15 bar), hydraulic retention time (15 h) showed removal efficiencies up to 90% in terms of organic compounds removal, 100% in terms of suspended solids presence and up to 80% reduction of total nitrogen and total phosphorus. The effluent from this MBR process could be considered as qualified for municipal reuse in Morocco, showing its potential application in the future.

**Keywords:** Membrane bioreactor, ultrafiltration, wastewater treatment, energy consumption.

## WRE4702: Optimization of the Design of a Drinking Water Distribution Network Using a Metaheuristic Algorithm

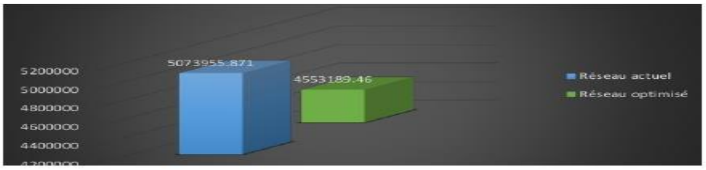
Boussahia Mounir[1], Messaid Belkacem[2], Dahmani Saad[3]

[1]*LRHYA Laboratory, Faculty of Technology, University of BATNA 2, Algeria*

[2]*LRHYA Laboratory, Faculty of Technology, University of BATNA 2, Algeria*

[3]*Laboratory LPM3E, Faculty of Sciences and Applied Sciences, University of Bouira, Algeria*

**Abstract.** Drinking water distribution systems, as vital components of water supply systems, represent one of the largest distribution systems in the world. The economic aspect has become indispensable in the design, construction and operation of these networks. The choice of pipe diameters from a set of standard diameters available on the market is dependent. It plays a major role in increasing the cost of building these networks. Usually, designers make this choice manually arbitrarily by performing several functional simulations using the appropriate software. Through attempts to change the configuration, they try to find a compromise between a technical aspect ensuring good operation (good pressure distribution, flow speeds, etc.) and an economic aspect ensuring a minimum or relatively minimal (reasonable) cost. The objective of this work is to use the meta-heuristic optimization algorithm known as the Gravitational Search Algorithm (GSA) in conjunction with the multilinear method algorithm for the balancing of AEP networks, to automate the sizing step and achieve cost-effective networks that respect the constraints of network operation. The application of this approach has been further tested on the BATNA city EPA network to assess its applicability and to evaluate the performance of the GSA algorithm in the search for a better configuration of the network diameters. This methodology made it



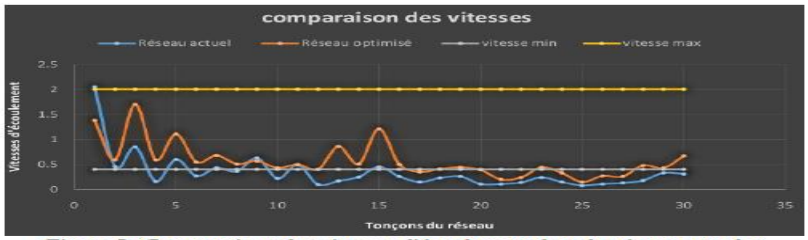




*Figure 2: Comparaison des vitesses d'écoulement dans le réseau actuel et optimisé*

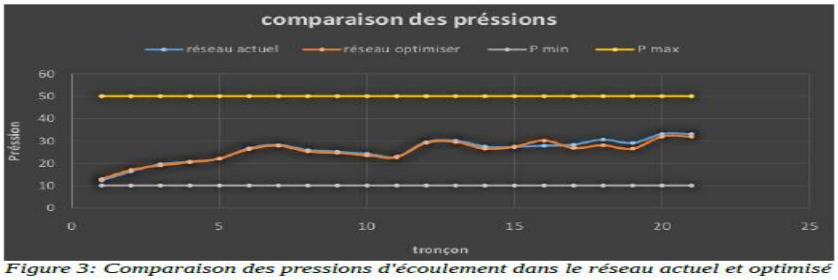



*Figure 3: Comparaison des pressions d'écoulement dans le réseau actuel et optimisé*

possible to reduce the cost of construction by 10.3% compared to the current network (Fig.1) and to improve

almost all the flow speeds (Fig.2) by maintaining an adequate distribution pressure over the entire studied network (Fig.3).

**Keywords:** Pressure, flow, gravitational search algorithm, simulation, multilinear method.

## WRE4700: Pesticide Residue Levels in Vegetables and Surface Waters at the Central Rift Valley (CRV) of Ethiopia

Kumelachew Mulu Loha*[1,2], Marja Lamoree [1], Jacob de Boer[1]

[1]*Department of Environment & Health, Vrije Universiteit, De Boelelaan 1085, 1081 HV Amsterdam, The Netherlands*

[2]*Department of Chemistry, Hawassa University, Hawassa, Ethiopia*

**Abstract.** Seven pesticides, profenofos, metalaxyl, λ-cyhalothrin, 4,4′-DDT, 4,4′-DDE, and α- andβendosulfan, were determined in vegetables (tomato, onion) from 20 locations and surface waters from 12 locations in the Central Rift Valley (CRV) of Ethiopia. Quick, Easy, Cheap, Effective, Rugged, and Safe (QuEChERS) and solid phase extraction (SPE) methods were used for the vegetables and water, respectively. In 2.5% of the tomato samples, profenofos was detected above European maximum residue limits (MRLs), in 12.5% of the samples metalaxyl, and in 2.5% α- andβ-endosulfan. In 5% of the onion samples, profenofos was detected above European MRLs, in 7.5% of the onion samples metalaxyl, and in 5% λ-cyhalothrin. In surface water, profenofos was detected at the highest concentration of 2300 µg/L in the Bulbula River, 890 µg/L near the agricultural land north of Lake Ziway (ANLZ-1), 1700 µg/L in the floriculture effluent (FE-1), and 900 µg/L in tap water at the Batu Drinking Water (BDW) supply. These results show that the levels of pesticides are in several cases substantially elevated, and emphasize the need of regular pesticide monitoring programs for surface waters and vegetables in the Ethiopian CRV.

**Keywords:** Pesticide residue, Central Rift Valley, maximum residue limits (MRLs), vegetables, surface waters.

## WRE4675: Removal Efficiency of Nutrients and Potentially Toxic Elements (Cd, As, Pb, Cd) by Temperate Climate Characteristic Species in Floating Treatment Wetland

Nicole Nawrot[1*], Ksenia Pazdro[2], Jolanta Walkusz-Miotk[2], Ewa Wojciechowska[1]

[1]*Department of Sanitary Engineering, Gdansk University of Technology, EcoTech Center, Narutowicza St. 11/12, 80-233 Gdańsk, Poland*

[2]*Institute of Oceanology of the Polish Academy of Science, Sopot, Poland*

**Abstract.** Floating treatment wetlands (FTWs) are a widely used bioremediation technology that captures and removes nutrients and potentially toxic elements. Wetland plant sections submerged in the water play a major role in FTW treatment processes (Lynch et al., 2015). FTWs as an emerging “best management practice” have been proven to improve the water quality, however still several aspects regarding the uptake and translocation of elements within FTW vegetation are limited. Therefore, we proposed a project focused on assessing and comparing the efficiency of selected native macrophytes (*Phragmites australis, Iris pseudacorus, Typha latifolia., and Alisma plantago-aquatica*) in microscale in treatment of urban and agricultural runoff regarding nutrients and metal(-loid) (Cd, Cu, Pb, As) removal. In brief, eight 35L reactors were fed synthetic effluent containing nutrients (N, P) as well as a mixture of Cd, Cu, Pb, and As. Four control reactors were fed only nutrients (control reactors), while four others were additionally fed potentially toxic elements (PTEs) (operational reactors). One control and one operational reactor were kept for each species. The best biomass development was achieved by *Phragmites australis* and *Alisma plantago-aquatica.* Within species, PTE concentrations in plant tissues varied (in mg/kg d.w.): 0.29-512 for Pb, 3.13-1003 for Cu, 0.30-788 for Cd, and 0.08-36.6 for As. PTE accumulations (µg) were highest in belowground plant parts (roots and rhizomes), for example, 13350 µg of Pb, 23866 µg of Cu accumulated by *Alisma plantago-aquatica*, 15862 µg of Cd, and 1665 µg of As accumulated by *Phragmites australis*. Both species have fibrous root matrices; *Phragmites australis* is also semi-rhizomatous. These characteristics may increase PTE and nutrient uptake. Because PTE translocation from roots to shoots was poor, all species exhibited primarily phytoextraction properties for immobilising contaminants from waters.

**Keywords:** Floating treatment wetland, nutrients, metal & metalloid, potentially toxic elements, wastewaters, phytoremediation.
**Acknowledgements:** This work was supported by the National Science Centre Poland under the Preludium 18 research project [2019/35/N/ST8/01134].

## WRE4687: Enhanced Solar Degradation of Cyanide Using Low-Grade $Mno_2$ Ore from Nsuta as a Catalyst

Kenneth Mensah[1*], Gideon Mensah-Sackey[2], Aboagye Samuel[2], Emmanuel Owusu Obeng[2], Kwaku Ohene Nimako[3], Hassan Shokry[1], Mahmoud Samy[4]
[1]*Environmental Engineering Department, Egypt-Japan University of Science and Technology, Egypt*
[2]*Minerals Engineering Department, University of Mines and Technology, Ghana*
[3]*Assay Lab and Metallurgy Department, Ghana Manganese Company Limited, Ghana*
[4]*Department of Public Works Engineering, Faculty of Engineering, Mansoura University, Egypt*

**Abstract.** Tailings from gold extraction contain cyanide which is highly poisonous if exposed to the environment without proper treatment. Cyanide can form stable metal complexes that can persist in soil and water if not degraded quickly. Previous studies have used expensive chemicals and materials to accelerate cyanide degradation. In this work, we investigated a cheap and green approach to utilizing low-grade pyrolusite ($MnO_2$) ore from Nsuta as a catalyst for enhanced photocatalytic oxidation of cyanide. The goal is to harness the photocatalytic ability of $MnO_2$ in the low-grade ore to rapidly degrade cyanide in the tailings from gold mining companies in Ghana. $MnO_2$ has a narrow bandgap energy of 1~2 eV and thus, is highly likely to be driven by visible, ultraviolet and infrared radiation from sunlight. The morphological, chemical and structural properties of the $MnO_2$ ore were investigated using SEM, EDX, XRD, and XRF analyses in our previous work. Preliminary tests showed that the effective $MnO_2$ particle size range was -425 +212 μm. Control experiments revealed that cyanide degradation was favoured at MnO ore with sunlight. Response surface methodology with a central composite design was used to optimize the initial cyanide concentration, $MnO_2$ dose and contact time to achieve maximum cyanide degradation at pH 11. ICP-MS was used to monitor the metal ion leaching rate during the process. The mechanism of photocatalytic degradation was studied by scavenging experiments to identify the main radical and non-radical oxidative species, and the degradation pathway was proposed. The optimum operating parameters were used to test the cyanide degradation for real tailings from gold mining industries in Ghana. Complete cyanide degradation in the industrial tailings was attained within 5-15 min. The outcome of our study shows that adding extremely low-grade $MnO_2$ ores to cyanide-containing tailings in sunlight can rapidly degrade cyanide to harmless $CO_2$ and $NO_2$ gases.
**Keywords:** Photocatalysis, reactive oxygen species, cyanide, gold extraction, manganese ore.

## WRE4695: Pesticide-Nitrate Vulnerability Mapping in a GIS Based Environment, a Case Study

Olufemi Victor Omonona[1*], Ayuba Rufai[2] Michael Olawale Okanlawon[3], Nuhu Degree Umar[4]
[1]*Department of Geology/Geophysics, Alex Ekwueme Federal University, Ndufu Alike, Nigeria*
[2]*Department of Geology, Kogi State University, Ayingba, Nigeria*
[3]*Department of Mining, National Examination Council, Minna, Nigeria*
[4]*Department of Geology, Federal University, Lafia, Nigeria*

**Abstract.** Nitrate is one of the most widespread and problematic of the whopping number of potential groundwater contaminants. Elevated nitrate concentrations in groundwater used for domestic purposes can pose a health hazard to humans. To ensure a continuous supply of potable water, the aquifer must be constantly monitored and managed. The purpose of this study was to assess the aquifer vulnerability to nitrate pollution in the central agrarian region of Nigeria using the P-NSRD index and GIS technology. The P-NSRD index employs four parameters (pesticide-nitrate use, soil texture, net recharge, and depth to groundwater) to characterize the hydrogeological property and to evaluate aquifer vulnerability. The pesticide-nitrate use data was obtained through a well-structured questionnaire distributed among farmers in the area. Soil texture was evaluated through the soil map of the Food and Agricultural Organization, net recharge was obtained using the chloride

mass balance method, and depth to groundwater data was determined during the field survey exercise. The P-NSRD index varied from 58.0 to 138.5, with a mean value of 107.1. The entire study area is classified into three categories of aquifer vulnerability, namely low (12%), medium (32%), and high (56%) susceptibility to groundwater pollution by nitrate. The aquifer vulnerability map and the associated maps were produced using ArcGIS 10.2 software. The model validation was carried out using measured nitrate concentrations in groundwater from the study area, and the result revealed a strong correlation between the nitrate concentration and the P-NSRD index. It is opined that groundwater management and protection practices are concentrated most in the areas that are most susceptible to nitrate contamination.
**Keywords:** Aquifer, GIS, nitrate, Nigeria, P-NSRD index, vulnerability.

**WRE4693, WRE4711, WRE4631, WRE4724** To avoid repeatability issue, the abstracts will be available after the full papers are published in the conference proceedings or other journals.

## Oral Session 4: Climate Change, Soil, and Aquatic Ecology

**Time: 08:30-12:00, November 4, 2022.** (China Standard Time GMT+8)

**Session Chair: Prof. Yuzhen Zhou, Jiangsu Key Laboratory for Eco-Agricultural Biotechnology Around Hongze Lake and Jiangsu Collaborative Innovation Centre of Regional Modern Agriculture and Environmental Protection, School of Life Sciences, Huaiyin Normal University, Huai'an, China**

**Session Room Link:** http://www.academicconf.com/teamslink?confname=wre2022

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| 08:30-08:45 | **WRE4708** | **What Can In-Situ Bioindicators Tell Us About an Ecosystem?**<br>*Dr. Subhomita Ghosh Roy, Northern Kentucky University, USA* |
| 08:45-09:00 | **WRE4694** | **Land Use Effect on Surface Runoff and Soil Loss: Results of Plot-based Experiment Along East-west Gradient in Subtropical China**<br>*Dr. Benzhi Zhou, Research Institute of Subtropical Forestry, Chinese Academy of Forestry, China* |
| 09:00-09:15 | **WRE4696** | **Environmental Assessment of Freshwater Lake Ereen in Great Lake Depression of Mongolia**<br>*Dr. Munguntsetseg Ganbat, Department of Environmental and Forest Engineering, National University of Mongolia, Mongolia* |
| 09:15-09:40 | **WRE4692** | **Floodplain Plant Community Response to the Climate Change, Orkhon-Selenge River Basin, Mongolia**<br>*Dr. Soninkhishig Nergui, Department of Biology, National University of Mongolia, Mongolia* |
| 09:40-10:05 | **WRE4656** | **Nitrate and Ammonia Uptake and Expression of Major Nitrogen Assimilation Genes in Duckweed**<br>*Prof. Yuzhen Zhou, Jiangsu Key Laboratory for Eco-Agricultural Biotechnology Around Hongze Lake and Jiangsu Collaborative Innovation Centre of Regional Modern Agriculture and Environmental Protection, School of Life Sciences, Huaiyin Normal University, Huai'an, China* |
| 10:05-10:15 | | **Coffee Break** |
| 10:15-10:40 | **WRE4649** | **Molecular Organization and Evolution of Ribosomal DNA in Aquatic Plants Spirodela Polyrhiza, Spirodela Intermedia (Lemnaceae) and Pistia Stratiotes (Araceae)**<br>*Prof. Nikolai Borisjuk, Jiangsu Key Laboratory for Eco-Agricultural Biotechnology Around Hongze Lake and Jiangsu Collaborative Innovation Centre of Regional Modern Agriculture and Environmental Protection, School of Life Sciences, Huaiyin Normal University, Huai'an, China* |
| 10:40-11:05 | **WRE4676** | **Effects of Chloropicrin Fumigation Combined with Biochar on Soil Bacterial and Fungal Communities and Fusarium Oxysporum**<br>*Dr. Yuan Li, Institute of Plant Protection, Chinese Academy of Agricultural Sciences, China* |
| 11:05-11:20 | **WRE4615** | **A Comprehensive Investigation of the Impacts of Pesticides in Water Resources on Aquatic Plants Genotoxicity**<br>*Ms. Veerapas Na Roi-et, Faculty of Public Health, Thammasat University, Thailand* |
| 11:20-11:45 | **WRE4570** | **Sustaining the Crop Productivity with Water and Nutrient Management Strategies Under Changing Climate Scenario**<br>*Dr. U. Surendran, Land and Water Management Research Group, Centre for Water Resources Development and Management, India* |

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| 11:45-12:00 | **WRE4722** | **Assessment of Resilience in Maize Suitable Planting Areas Under Drought Stress**<br>*Dr. Lanshu Jing, State Key Laboratory of Simulation and Regulation of Water Cycle in River Basin, China Institute of Water Resources and Hydropower Research* |

## Abstracts of Oral Session 4

### WRE4708: What Can In-Situ Bioindicators Tell Us About an Ecosystem?

Subhomita Ghosh Roy
*Northern Kentucky University, USA*

**Abstract.** Rapid population growth has created issues to maintain the integrity of aquatic ecosystems globally. Identifying "biological response signatures" to characterize complex patterns of ecological responses from stress factors has been in focus for a long time. Organisms living (or *in-situ* organisms) in a disturbed ecosystem have the potential to act as "biological response signatures" in response to stress factors. This research focuses on identifying some potential bacterial and macroinvertebrate bioindicators living within stressed ecosystems. The study location is primarily across wetland ecosystems, located in a riparian watershed (Pike River basin, WI, USA) undergoing rapid urbanization and land cover changes. Investigations in these wetland ecosystems have identified some potential *in-situ* bacterial bioindicators suitable to act as response signatures related to specific stress factors such as metals and nutrients. In another study (based on the Ohio river, USA) some *in-situ* macroinvertebrates have been identified as potential response signatures in relation to water quality parameters.

**Keywords:** Biological response signatures, bioindicators, *in-situ.*

### WRE4694: Land Use Effect on Surface Runoff and Soil Loss: Results of Plot-based Experiment Along East-west Gradient in Subtropical China

Benzhi Zhou
*Research Institute of Subtropical Forestry, Chinese Academy of Forestry, China*

**Abstract.** Surface runoff and soil loss were monitored in six land use types: secondary broadleaved mixed forest (BL), coniferous plantation (CF), extensively managed bamboo plantation (EB), intensively managed bamboo plantation (IB), economic forest (EF) and farmland (FL) in the east (Fuyang, Zhejiang Province), central (Pingjiang, Hunan Province) and west (Muchuan, Sichuan Province) of China. The results showed that (1) there were significant differences of surface runoff among the land use types. The surface runoff and runoff coefficient of FL ranked highest, followed by EB, then CF, IB and EF, with BL as the lowest. The surface runoff and runoff coefficient of FL was about 2-7 times of that of BL. (2) the effects were similar of land use type on the soil loss: the BL had the lowest soil loss, followed by CF, EB, IB and the highest in FL. (3) The characteristics of soil erosion for different land use types were significantly different along the gradient from east to west. The surface runoff coefficient and soil loss on the eastern China was significantly lower than that on the west, which may be attributed to the different natural conditions, social and economical development stage and the resources investment into soil and water conservation.

**Keywords:** Land use, surface runoff, soil loss, subtropical China.

### WRE4696: Environmental Assessment of Freshwater Lake Ereen in Great Lake Depression of Mongolia

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**Abstract.** Ereen lake is one of the lakes in the Great Lakes depression which is seen as a major freshwater basin of Mongolia and contains important wetlands of Central Asia. Due to climate change and construction of Taishir hydroelectric power plant, changes in discharge of Zavkhan river occurred and therefore the adjacent lakes including Ereen lake were negatively impacted for the recent decade. This paper aims to define pollution types and levels in Ereen lake based on water quality, chemical composition of lake sludge, soil, aquatic and shore plants, inhabitants, and planktons. pH of the lake was 8.4±0.4 (n=34) and temperature was 22.1±1.5 (n=24). Dissolved oxygen was in the range of 2.9-12.4 mg/dm$^3$ (saturation level: 34.8-139.8%). Sulphate and chloride were prevailing in anion composition and sodium-potassium were dominating in cation composition. Ammonium concentration was in the range of 1.4-3.6 mg $NH_4^+$/L which was higher than the limit of MNS 4586:1998 (Mongolian standard for aquatic ecosystem). Lake bottom is fully covered by aquatic plants *Phragmites communis* and *Myriophyllum sibiricum.* Organic carbon content in bottom sediment samples was 0.07-1.24%, amount of potentially mobile phosphorus was -3.28-3.48 mg/100g, potassium 6 mg/100g, Ca: Mg ratio was 7-14 meq/100g and therefore nutrient availability was moderate. Ten species of rotifer (*Polyarthra longiremis, Asplanchna priodonta, Brachionus quadridentatus, B. urseus, Keratella quadrata, K. cochlearis, Testudinella patina, Filinia longiseta, Lecane luna, L. cornuta, L. bula, L. rotunda, Euchlanus dilatata, Trichotria pocillum)* and two species of water flea (*Bosmina longirostris, Ceriodaphina quadrangula*) lived in Ereen lake were obtained and which indicated lake water was organically polluted. Moreover, 22 species of 19 genus were discovered from algae samples. Results of algae identification show that eutrophication was taking place. Overall, based on the results, Ereen lake is highly polluted by heat and organic pollution and therefore subsequent changes in plant and lake inhabitants occurred as well as drop in fish population and increase in aquatic plants. These findings indicate that effective ways to remediate water pollution shall be sought urgently.
**Keywords:** Environmental assessment of lake, water quality, baseline study of lake.

## WRE4692: Floodplain Plant Community Response to the Climate Change, Orkhon-Selenge River Basin, Mongolia

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**Abstract.** The annual average temperature of Mongolia has increased by 2.24°C since 1940, which is three times faster than the global average. The rising temperatures and increased potential evaporation resulted in the decreased runoff in the Mongolian part of the Selenge basin. Relatively severe runoff decrease is reported in the second interval (1996-2015) of the whole study period (1978-2015). The decrease in runoff throughout the study area was most likely caused by an increase in potential evapotranspiration (and not reduced precipitation or land use changes). Annual maximum runoff has also strongly decreased suggesting reduced flooding and consequently reduced floodplain vegetation cover which is the main pasture and hey source in the country. In order to check floodplain vegetation change, seven sites along the Orkhon and South Tamir Rivers floodplains were selected for a plant community analysis in the summer of 2016. Plant community structures were compared with data gathered in the early 70s using the same Braun-Blanquet techniques. The occurrence and cover of the hydrophytes and mesophytes decreased while the xerophytes increased. The average NDVI from 1991 to 2015 with 5-6 years intervals decreased continuously from 0.51 to 0.27. More detailed primary results will be presented.
**Keywords:** Floodplain, vegetation, NDVI, climate change, Selenge river basin, Mongolia.

## WRE4656: Nitrate and Ammonia Uptake and Expression of Major Nitrogen Assimilation Genes

**in Duckweed**

Yuzhen Zhou

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**Abstract.** Here we present our data on the utilization of two major sources of inorganic nitrogen, nitrate and ammonia, by six duckweed species *Spirodela polyrhiza*, *Landoltia punctata*, *Lemna aequinoctialis*, *L. turionifera*, *L. minor* and *Wolffia globosa*. Taking advantage of the available sequence of the *S. polyrhiza* genome, we monitored the expression levels of six genes involved in nitrogen assimilation using real time quantitative PCR and performed bioinformatic analysis of promoter sequences of the nitrogen assimilation genes. Integration of the nitrogen utilization data with the gene expression patterns has revealed the follows: **(**1) All six analyzed duckweed species can grow using both $NO_3^-$ and $NH_4^+$ as a single nitrogen source. Duckweeds grew well on $NO_3^-$ supplied at high concentrations up to 30 mM, while the $NH_4^+$ concentrations greater than 2 mM caused rapid drop in the medium pH and required additional buffering to support duckweed growth. (2) When $NO_3^-$ and $NH_4^+$ were present in the medium together, all duckweed species first used $NH_4^+$, and started using $NO_3^-$ only when $NH_4^+$ concentration dropped below 2.1 μM. **(**3) The expression of genes encoding nitrate reductase (NR) and nitrite reductase (NiR) increased about 10-fold when $NO_3^-$ was supplied and decreased when $NH_4^+$ was supplied. $NO_3^-$ and $NH_4^+$ induced the glutamine synthetase (GS) genes *GS1;2* and *GS2* by 2- to 5-fold, respectively, but repressed *GS1;1* and *GS1;3*. $NH_4^+$ and $NO_3^-$ upregulated the genes encoding ferredoxin- and NADH-dependent glutamate synthases (2-2.5 times for Fd-GOGAT and 8-11 times for NADH-GOGAT). **(**4) A survey of nitrogen assimilation gene promoters suggested complex regulation of nitrogen assimilation genes, with major roles for NRE-like and GAATC/GATTC *cis*-elements, TATA-based enhancers, $(GA/CT)_n$ repeats, and G-quadruplex structures. The presented data shed new light on the mechanisms of nitrogen assimilation in aquatic duckweed plants and paves ground for further investigations of the involved gene network and the regulation of plant nitrogen metabolism at molecular level.

**Keywords:** Duckweed, *Spirodela polyrhiza*, nitrogen assimilation, nitrate reductase, nitrite reductase, glutamine synthetase, GOGAT, gene expression.

## WRE4649: Molecular Organization and Evolution of Ribosomal DNA in Aquatic Plants Spirodela Polyrhiza, Spirodela Intermedia (Lemnaceae) and Pistia Stratiotes (Araceae)

Nikolai Borisjuk

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**Abstract.** Because of their function to produce the RNA components required for assembling ribosomes, the riboprotein structures responsible for protein synthesis, ribosomal DNA (rDNA) plays a pivotal in all eukaryotic cells. Plants typically have two types of rDNA loci: 35S rDNA loci containing clusters of tandemly repeated units composed of conserved sequences encoding three linked rRNA genes (18S-5.8S-25S) separated by more diverse intergenic spacers (IGSs), and 5S rDNA loci containing tandem copies of 5S rRNA genes separated by non-transcribed spacers (NTS). Due to its high copy number, conserved coding sequence, and more rapidly evolving spacer sequences, the rDNA has become a favorite subject for studies related to plant systematics, evolution, and biodiversity. Our research on rDNA in aquatic duckweed plants (Lemnaceae) and water lettuce, Pistia stratiotes (Araceae), showed a number of specific features. Genome surveys of two ancient duckweed species, Spirodela polyrhiza and Spirodela intermedia revealed a very low representation of 35S and 5S rRNA genes, at around 100 copies per genome, compared to the thousands of copies usually present in land plants. Molecular cloning and nucleotide sequencing of 35S rDNA of all three species displayed molecular architecture typical for other plants with high conservation of the sequences coding for 18S, 5.8S, and 25S rRNAs and significant divergence of large intergenic spacer (IGS) region. Comparative analysis of the IGS in two duckweed species demonstrated relatively low intra- and inter-genomic heterogeneity, high GC content, and an unorthodox

molecular structure of usually conserved rRNA transcription initiation site (TIS). The latter finding is intriguing considering that the TIS in other characterized duckweed species representing two younger genera (Lemna and Wolffia), as well as in Pistia stratiotes has a canonic TATAGGGG signature typical for the majority of land species. Characterization of 5S rDNA revealed two major length variants of the gene repeat units in genomes of S. polyrhiza, S. intermedia, and Pistia stratiotes. Analyses of 5S rDNA in twenty S. polyrhiza ecotypes from five continents showed that European ecotypes contain a predominant NTS type of about 1060 bp, whereas the Asian and American ecotypes predominantly have a 400-bp NTS. The two NTS length variants differ in their cis element repertoire, which may influence transcription of the linked 5S rRNA genes. Comprehensive analysis of 5S rDNA units in Pistia stratiotes demonstrated an unusual, mosaic arrangement of genes with different types of NTS within the locus, further challenging the postulated homogenization of rDNA repeats within the rDNA loci. In summary, our findings put duckweeds in the spotlight for research on the molecular evolution of the rDNA, promising new insights into basic principles of organization and regulation of rRNA genes in plants.
**Keywords:** Duckweed, Lemnaceae, pistia stratiotes, araceae, rDNA, gene organization, molecular evolution.

## WRE4676: Effects of Chloropicrin Fumigation Combined with Biochar on Soil Bacterial and Fungal Communities and *Fusarium Oxysporum*

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**Abstract.** Chloropicrin (CP) can cause long-term damage to beneficial microbes which reduces soil health. Biochar (BC) can mitigate against the effects of CP by reducing the time for beneficial microbes to recover after CP fumigation. In this study, we used Real-Time Quantitative PCR to determine the effects of different rates of BC added to CP-fumigated soil on the speed of recovery of bacteria and fungi population and on changes to gene copy number of the target pathogen *Fusarium oxysporum*. And then we compared the structure and composition of the beneficial microbial community in the different treatments soil by using High throughput Illumina sequencing. As the results shown, adding 1 or 3% BC after CP fumigation accelerated the recovery of bacterial and fungal populations without increasing *F. oxysporum* abundance. BC also promoted the recovery of beneficial bacteria *Rokubacteria* and *Latescibacteria* damaged by CP. And these two bacteria may be related to the immunity of soil to *F. oxysporum*. In CP-fumigated soil, BC improved the disease resistance of the soil by increasing beneficial microbes, such as *Steroidobacter*, *Sphingomonas*, *Purpureocillium* and *Mortierella*. This combination of CP and BC is a new concept that could encourages the development of a healthy and sustainable soil ecosystems while controlling plant pathogens.
**Keywords:** Real-time quantitative PCR, Illumina high-throughput sequencing, microbial community structure, Rokubacteria, Latescibacteria.

## WRE4615: A Comprehensive Investigation of the Impacts of Pesticides in Water Resources on Aquatic Plants Genotoxicity

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**Abstract.** The influence of pesticides on the functioning and integrity of aquatic ecosystems is a global issue that should be examined and regulated by all relevant stakeholders. It may not be possible to predict the consequences of the combination of contaminants found in aquatic ecosystems based just on chemical analysis. In addition, genotoxic assays were utilized to determine the ratio of DNA damage in aquatic plants. This study examined the influence of pesticides on water resources by focusing on the persistence-related toxicity of pesticides. The GC-MS/MS technique was used to quantify 87 pesticides in total. With the presence of diffuse chemical pollution and ecotoxicological effects at the sampling point, genotoxic effects have also been detected using various plant species, comprising *Ceratophyllum demersum* L., *Eichornia crassipes* (Mart.) Solms, *Ipomoea aquatica* Forsk, and *Salvinia cucullata* Roxb.ex Borr. The chemical studies indicated that pesticides are widespread in water resources, despite very modest quantities. DNA fragmentation increased at varied rates as pesticide exposure

rose, according to the results. The single cell gel electrophoresis (SCGE) assay can be used to identify DNA migration rates at low pesticide concentrations in the environment.
**Keywords:** Bioindicator, genotoxicity, single cell gel electrophoresis (SCGE) assay, pesticide, aquatic plants.

## WRE4570: Sustaining the Crop Productivity with Water and Nutrient Management Strategies Under Changing Climate Scenario

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**Abstract.** Continuous intensive agriculture without adequate attention on rational soil management poses serious threat to the sustainability of agro-ecosystems. One of the consequences of irrational soil management under intensive cropping is the decline in soil fertility. Low crop productivity associated with high production costs is a great concern in agriculture. Additional stresses come from climate disruption, variability and change, resulting in impacts on water availability and temperature regimes over time and space. This paper describes about the Best Management Practices (BMPs) available. over time and space. This paper describes about the Best Management Practices (BMPs) available. To assess climate change related impacts on crop suitability and agro-ecologically attainable yield, the study applied the Agro Ecological Zonation (AEZ) methodology, which is jointly developed by Food and Agriculture Organization (FAO) and the International Institute for Applied Systems Analysis (IIASA). Range of scenarios for crop productivity for years 2041–2070 (2050s) and 2071–2100 (2080s) using the climatic condition based on four RCPs (2.6, 4.5, 6.0, and 8.5) adopted by the Intergovernmental Panel on Climate Change (IPCC) were generated using AEZ simulation modeling. Major crops grown in Kerala are coconut, arecanut, rubber, black pepper, coffee, tea, cardamom, paddy, tapioca, cashew and vegetables. The AEZ analysis for these crops showed that for ensemble mean of RCM outputs, under rain-fed conditions, yields of banana, arecanut, rubber, coffee, and black pepper show declines between 2.89 and 86.18 %. However, coconut and rice, under rain-fed conditions, show very minor increases of 3.17 and 0.99 % respectively. Under irrigated conditions, yields of coconut, arecanut, coffee, and black pepper show a decline between 3.83 and 86.18 %. However, if we look at all the models and different RCPs, results show that with few exceptions in most of the cases yields tend to decline with climate change. Drip fertigation was chosen as one of the BMPs and it was demonstrated across Kerala. Results from the project showed that the application of nutrients through drip fertigation improved the crop yield of all the demonstration plots and the increase in yield over control. Investments in climate smart agriculture, micro-irrigation practices especially drip fertigation, improved water conservation practices, development and management of natural resources through watershed and afforestation activities, conservation of crop biodiversity, etc. needs to be given focus to improve the production from farms. Besides, strategies need to be adopted for improving the water and nutrient use efficiency were also discussed.

# Part IV Poster Presentations

## Online Poster Guidelines

Online Poster Presentations will consist of two parts:

- **Poster Presentations:** A collection of posters in PDF format (with/without audio) will be available at conference website for attendees to view.
- **Poster Q&As:** Attendees could type the questions in the chat box on MS Teams or leave questions in the note box below the posters on the conference page. Presenters will answer the questions as soon as they can.
- Signed and stamped electronic presentation certificate would be issued via e-mail after conference.

## List of Posters

**Time: 11:30-12:00, November 2, 2022.** China Standard Time (GMT+8)
Online Posters will be updated on the official website:
http://www.academicconf.com/poster?confname=wre2022
***Should you have any questions on the online posters, please feel free to write down in the note box of each poster at WRE2022 official website. The organizer will forward your questions to the presenters.***

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| WRE4064 | **Study on the Impact of the Change of the Main Land-Based Pollutants in Xiangshan Bay**<br>*Dr. Lin'an Ye, Ningbo Marine Environment Monitoring Center, China* |
| WRE4562 | **Speciation Distribution Characteristic and Ecological Risk of Heavy Metals in Surface Sediments of Cascading Hydropower Dams in Lancang River**<br>*Assoc. Prof. Jinpeng Li, China Waterborne Transport Research Institute, China* |
| WRE4563 | **Ultrasonic Disintegration as a Fast and Simple Method for Chemical Fractionation of Heavy Metals in Sewage Sludge-A Preliminary Study**<br>*Dr. Malwina Tytła, Institute of Environmental Engineering, Polish Academy of Sciences, Poland* |
| WRE4568 | **Cost Effectiveness Ratio in Fluoride Removal from Water Using Electrochemical, Coagulation and Combined Electro-Coagulation Processes**<br>*Dr. Salem Atieh, Department of Environmental Health Engineering, Faculty of Health, Kashan University of Medical Sciences, Iran* |
| WRE4569 | **Model of Environmental Communication over the Citarum River**<br>*Assoc. Prof. Suwandi Sumartias, Faculty of Communication Sciences, Padjadjaran University, Indonesia* |
| WRE4584 | **Biodiversity of Zooplankton Communities in Lakes of High Salinity in the Forest-Steppe Zone of the Southern Urals, Russia**<br>*Prof. Irina Mashkova, Department of Chemistry, Institute of Natural Sciences and Mathematics, South Ural State University, Russia* |
| WRE4586 | **Features Phytoplankton Biodiversity in South Ural Saline Lakes**<br>*Prof. Anastasiya Kostryukova, Department of Chemistry, Institute of Natural Sciences and Mathematics, South Ural State University, Russia* |
| WRE4589 | **Electrocoagulation Degradation of Real Textile Wastewater: Effect of Operating Parameters**<br>*Dr. Sameh Jallouli, Laboratoire Génie de l'Environnement et Ecotechnologie (GEET), Université de Sfax, Ecole Nationale d'Ingénieurs de Sfax (ENIS), Tunisie* |

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| WRE4605 | **Pollution Assessment and Source Identification of Heavy Metal Elements for Surface Sediments in the Northern South China Sea**<br>*Dr. Yuming Wang, School of Civil Engineering, Center for Water Resources and Environment, SunYat-SenUniversity, China* |
| WRE4616 | **Investigation of the Effect of Polyphosphate Filtration on Scaling and Corrosion Indices of Household Water**<br>*Dr. Fathollah Gholami-Borujeni, Department of Environmental Health Engineering, Mazandaran University of Medical Sciences, Iran* |
| WRE4632 | **Research on the Effect of Charge and Applied Electric Field on Fog Water Collection**<br>*Prof. Jiawei Li, International Joint Research Laboratory of Magnetic Confinement Fusion and Plasma Physics, State Key Laboratory of Advanced Electromagnetic Engineering and Technology, School of Electrical Engineering and Electronics, Huazhong University of Science and Technology, China* |
| WRE4641 | **Corona Discharge Fog Water Collector with Collection Mesh Array: A Study of the Effects of Wind Speed and fog Concentration on Water Collection Efficiency**<br>*Ms. Dingchen Li, International Joint Research Laboratory of Magnetic Confinement Fusion and Plasma Physics, State Key Laboratory of Advanced Electromagnetic Engineering and Technology, School of Electrical Engineering and Electronics, Huazhong University of Science and Technology, China* |
| WRE4697 | **A Review: Are the Current Water Tariffs for Households in China Appropriate?**<br>*Ms. Xiaohua Lin, Department of Civil Engineering, Xi'an Jiaotong-Liverpool University, China* |
| WRE4715 | **Analysis of Response Law of Rainstorm Under Different Microtopography Conditions**<br>*Mr. Jun Guo, State Grid Hunan electric power company limited disaster prevention and reduction center, China* |

## Abstracts of Posters

### WRE4064: Study on the Impact of the Change of the Main Land-Based Pollutants in Xiangshan Bay

Lin'an Ye
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**Abstract.** Based on the monitoring data from 2010 to 2019 at Xiangshan Bay, the annual and monthly changes of chemical oxygen demand (COD), total nitrogen (TN), total phosphorus (TP) of main pollutants are analyzed and discussed, Through the comprehensive analysis of the content and flux of the main pollutants into the sea and their influencing factors, and the evaluation method of the ecological environment impact of the adjacent sea area of the main estuary was studied. Research shows: The main pollutants COD, TN and TP in 2010-2019 showed a general downward trend, relatively high mainly in November and January March of autumn and winter season. Although annual and monthly changes fluctuate, the flux to the sea has a certain decreasing trend in the overall trend. COD is mainly affected by soil erosion and domestic pollution, and TN and TP land-based pollution sources are mainly affected by agriculture and soil erosion. The ecological environment of the nearby sea area is greatly affected, so it is suggested to strengthen the management of the sewage outfalls from land sources into the sea.

**Keywords:** Xiangshan Bay, interannual variation, monthly variation, flux into the sea, land-based pollution, ecological environment.

### WRE4568: Cost Effectiveness Ratio in Fluoride Removal from Water Using Electrochemical, Coagulation and Combined Electro-Coagulation Processes

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[4]*Social Determinants of Health (SDH) Research Center, Kashan University of Medical Sciences, Kashan, Iran*
**Abstract.** Different methods are used to remove high concentration of fluoride or decrease it to the standard level. In this study the cost-effectiveness ratio of fluoride removal by coagulation, electrochemical and co-application of electro-coagulation processes was investigated. The research was done in a batch system on polluted water samples containing 5, 12.5, and 20 mg. L-1 of fluoride. First the optimum condition to reach the Iran standard for fluoride in drinking water was determined. In coagulation, electrochemical and combined processes; six dosages of alum, four electrical current intensity and optimum values of coagulation and electrochemical processes was studied respectively. Then the cost for each gr. of removed fluoride was calculated in US$ and compared. Also, the electricity and chemicals are the main operating parameters that affect the total cost. Our findings showed that the electrochemical process alone is economically better than coagulation and combined electro-coagulation processes. In the later, adding alum to electrochemical process could improve the removal efficiency about 3-6%, or will reduce the run time if WHO drinking water guidelines for fluoride concentration is aimed.
**Keywords:** Water treatment, fluoride, cost.

## WRE4569: Model of Environmental Communication over the Citarum River

Suwandi Sumartias, Lukiati Komala, Rosnandar Romli
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**Abstract.** The article purpose to elaborate: attitudes, behaviour and understanding of Citizen's Citarum River, especially at Cieunteung and Linggar Villages Bandung Regency which are often exposed to floods, waste and rubbish through the perspective of "bottom up" environmental communications. The research method used is descriptive approach with qualitative data analysis technique. The results indicate that still low attitudes and understanding of citizens about the condition of a healthy river (air and water); Lack of awareness and communication activities between citizens, formal and informal community leaders in finding the right solution; The low participation of citizens and community leaders in seeking sustainable solution; Lack of supervision and law enforcement of the environment. Recommendation: The importance of advocacy movement, participation and assistance from and by citizens of the citarum river (Bottom-up Communication); The importance of forming groups or communities of citizens at the Citarum river area; The importance of communication and coordination is done intensively and sustainably; Local government interventions need to involve formal and informal leaders; The importance of supervision and law enforcement seriously and professional.
**Keywords:** Environmental communication, citarum river, community, lack of awareness, advocacy.

## WRE4584: Biodiversity of Zooplankton Communities in Lakes of High Salinity in the Forest-Steppe Zone of the Southern Urals, Russia

Irina Mashkova [1*], Anastasiya Kostryukova[1], Viktor Trofimenko [2]
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[2]*Department of Philosophy and Culturology, South Ural State Humanitarian Pedagogical University, Russia*
**Abstract.** There is little information on the functioning of ecosystems of increased salinity in the forest-steppe zone of the Southern Urals. This interferes with the management of these objects. There is not enough literature data to assess the development trends of the zooplankton community. The article considers the current state of the zooplankton community in three reservoirs of the Chelyabinsk region (Russia). The species composition and quantitative characteristics of the zooplankton community of water bodies in 2020–2021 were studied. The

ratio of the main groups of zooplankton was studied. The patterns of decrease in the species composition of zooplankton under the influence of environmental factors are noted. Changes in species diversity depending on eutrophication and salinity of the reservoir were noted. Analytical methods were used to assess the state of reservoirs by the zooplankton community: assessment by taxonomic structure; multimetric assessment using environmental and biological indicators. The results of the study showed that the proportion of Cladocera in mesotrophic water bodies is higher than in eutrophic ones. Unlike Cladocera, the Rotifera group is more numerous in eutrophic water bodies than in mesotrophic ones. Copepoda were common to all water bodies, as they are widely distributed Palearctic or cosmopolitan.

**Keywords:** Zooplankton, taxonomy, saprobic index, ordination, canonical correlation analysis (CCA).

## WRE4586: Features Phytoplankton Biodiversity in South Ural Saline Lakes

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[1]*Department of Chemistry, Institute of Natural Sciences and Mathematics, South Ural State University, Russia*

[2]*Department of Philosophy and Culturology, South Ural State Humanitarian Pedagogical University, Russia*

**Abstract.** Species composition of the phytoplankton communities in saline lakes poorly known currently. But saline water bodies have unique organisms' community as its species composition as diversity. Many species are not able to live in a salty environment, and therefore the species variety can adapt to an elevated salinity is limited. The biodiversity study of these ecosystems is very important. There are saline lakes (mineralization is more than 3 g/l) in the Chelyabinsk region. The phytoplankton biodiversity living in these lakes is not yet been studied. For the first time the phytoplankton species composition in saline lakes of the Chelyabinsk region (Chuchkala, Salamatka, Treustan) was studied in this work. The phytoplankton community features of the salt lakes such as biomass and species number were revealed. A decrease in species diversity is observed for the studied reservoirs compared to freshwater ecosystems. 24 algae species were identified. The study results showed the highest values of abundance and biomass were noted for Cyanobacteria and Chlorophyta. Bacillariophyta is much rarer.

**Keywords:** Phytoplankton, saline lake, biodiversity, taxonomy.

## WRE4589: Electrocoagulation Degradation of Real Textile Wastewater: Effect of Operating Parameters

Sameh Jallouli[1, *], Mohamed Ksibi [2]

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[2]*Institut Supérieur de Biotechnologie de Sfax, Université de Sfax, Route de Soukra, Tunisie*

**Abstract.** The use of electrocoagulation process is still frequently employed technique in textile wastewater treatment. Its main advantages include environmental compatibility, amenability to automation and cost effectiveness. In the present study, an attempt has been made to evaluate the electrocoagulation (EC) treatment for the remediation of real textile effluent and to study the effect of parameters such as current density and EC time on COD, sulphate and color removal efficiency. The results of physicochemical characterization of the real textile effluent revealed that wastewater contained higher concentration of COD (1123,75 mg. L-1), Sulfate (1,7 g.L-1), and Chloride (1,65 $g.L^{-1}$), conductivity (7,5$mS.cm^{-1}$). All these values are higher than the permissible limits for effluent discharge as indicated by the Tunisian norm (NT. n° 2018-315(2018)). Removal of COD performances was well below the prescribed permissible limits for effluent discharged and the increase of applied voltage didn't increase the COD removal efficiency of electrocoagulation process the values. In contrary, 10.35%, 36.2% and 38.46% sulfate removal efficiency were obtained using the aluminum electrode for 5V, 7V and alternating between 5V and 7V respectively. By considering the performance and power consumption, 5V was considered as optimal for COD removal and 7V for sulfate removal for treated real textile wastewater.

**Keywords:** Electrocoagulation, textile wastewater, sulphate removal.

**Acknowledgements:** Sameh Jallouli acknowledges the University of Sfax for providing financial support her internship at the University of Salerno in Italy.

## WRE4605: Pollution Assessment and Source Identification of Heavy Metal Elements for Surface Sediments in the Northern South China Sea

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**Abstract.** The particle sizes and the heavy metal elemental patterns (As, Cd, Cr, Cu, Ni, Pb, V, Zn, Sc) were investigated for thirty samples from the surface sediments to trace the provenance and assess the potential contamination in the northern South China Sea. Our data show that the surface sediments are characterized by sand, silt and sandy silt. The Zn, V, Cr, Ni, Pb, Cu and Cd contents are positively correlated with Al, Sc and particle size (Mz/φ), suggesting their supply from congenetic terrigenous debris by fluvial transportation. The spatial patterns of Cd and As are mainly interfered with by the anthropogenic involvement rather than the hydrodynamic and geomorphological conditions on the basis of the PCA, HCA and EMA analyses. The EF and Igeo assessments demonstrate that the heavy metal elements in the surface sediment are relatively more enriched along the Mojang estuary-NE Hainan and the Han estuary than those in other sea domains. However, the contents of Cr, Cu, Ni, Cd, V, Zn and Sc are below the reference level of ecological pollution. Arsenic is insignificantly correlated with the sedimentary particle size due to its weak migration ability, thus, it might be a sensitive element with the reflective of human pollution in the northern South China Sea.

**Keywords:** Heavy metal elements, particle sizes, marine surface sediments, provenance identification, contamination assessment, Northern South China Sea.

## WRE4616: Investigation of the Effect of Polyphosphate Filtration on Scaling and Corrosion Indices of Household Water

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**Abstract.** One of the most important measures for water quality assessment is measuring scaling and corrosion indices. Corrosion and scaling are major problems in water distribution systems that may cause economic, health and hydraulic problems. Therefore, the aim of this study was to Investigation of the effect of polyphosphate filtration on scaling and corrosion indices of household water and this study examined the stability indices of Langelier, Reisner, Pocorius and Aggressive. In this study, a polyphosphate filter that is directly connected to municipal water was used to moderate scaling and corrosion indices. All parameters (pH, turbidity, electrical conductivity, TDS, total alkalinity, total hardness, scaling and corrosion indices) were tested in water samples before and after (at 5 different flow rates) of the polyphosphate filter. All parameters were analyzed according to standard methods for the examination of water and wastewater. Descriptive parameters (mean, standard deviation and frequency) were used to describe data. Also, Linear regression analysis was used to determine the relationship between "flow rate" and "scaling and corrosion indices". Inlet water to polyphosphate filter had the following characteristics of temperature (22.7 °C), pH (7.29), turbidity (3.35 NTU), electrical conductivity (766 $\mu s.cm^{-1}$), TDS (497.9 mg/l), total alkalinity (308 mg/l as $CaCO_3$) and total hardness (480 mg/l as $CaCO_3$). Also, mean parameters of temperature, pH, turbidity, electrical conductivity, TDS, total alkalinity and total hardness in the samples taken after polyphosphate filter were 23.27 °C, 7.3, 0.92 NTU, 768.86 $\mu s.cm^{-1}$, 499.76 mg/l, 289.86 and 428 mg/l as $CaCO_3$, respectively. In this study, Langelier, Ryznar, Puckorius and Aggressive indices were calculated. The average of the mentioned indices in the inlet water to the filter was 0.34, 6.60, 9.006, 9.94, respectively. Also, the average of the mentioned indices in the lowest flow rate (0.0030 l/s) after the filter was 0.15, 7.09, 8.81, 10.02, respectively, and in the highest flow rate (0.0588 l/s) after the filter was -0.20, 7.49, 9.14, 9.69, respectively. The samples (in the lowest and highest flow rate) after polyphosphate filter were scaling and

corrosive in terms of langelite indices, corrosive in terms of Ryznar and Puckorius indices and moderately corrosive and corrosive in terms of Aggressive index, respectively. Therefore, it can be concluded that Polyphosphate filters used in Iran, reduce the scaling potential, can cause corrosion in pipes and have negative effects.

**Keywords:** Polyphosphate filter, corrosive, scaling, water stability, water quality parameters.

### WRE4632: Research on the Effect of Charge and Applied Electric Field on Fog Water Collection

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**Abstract.** Fog water collection by corona discharge has been highly studied recently due to its economic and efficient. The main progress consists of the effect of charge and electric field on water collection. A fog chamber, which can separate the charge and electric field, is established to study the impact of charge and electric field on water collection. The results show that electric field can promote the fog water collection and the charge can inhibit the effect of fog water collection. These results can be attributed to the effect of electrostatic force induced by applied electric field on droplets and the electric field force of charged droplets in electric field. The results and theory in this paper can be used to optimize electrode design in fog water collection.

**Keywords:** fog water collection, corona discharge, electric field, force analysis, electrostatic force

### WRE4641: Corona Discharge Fog Water Collector with Collection Mesh Array: A Study of the Effects of Wind Speed and fog Concentration on Water Collection Efficiency

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**Abstract.** Atmospheric water is an effective freshwater resource, and fog is a type of atmospheric water. Collecting fog can effectively alleviate the shortage of freshwater resources in foggy and less rainy areas. This study proposes a novel corona discharge fog water collector with a collection mesh array. The fog water collector mainly includes a discharge electrode and a collection mesh array. In this study, the effects of factors such as voltage, wind speed, fog concentration, and number of electrode layers on fog water collection efficiency were investigated. The results show that the collection efficiency of the novel fog water collector increases with voltage, and can reach a maximum collection efficiency of 90%. The higher the wind speed, the more layers of collection mesh are required for efficient collection. The core electrode structure in the fog water collector can not only be used to collect fog water in the natural environment, but also can recycle waste water in industrial flue gas, promote water circulation, and improve the utilization rate of water resources.

**Keywords:** Fog water collection, corona discharge, collection efficiency, collection mesh array.

**WRE4562, WRE4563, WRE4697, WRE4722** To avoid repeatability issue, the abstracts will be available after the full papers are published in the conference proceedings or other journals.

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