

Assessment of Wastewater Treatment Technologies and Promotion of Smart Irrigation Systems in the MENA Region Using an Eco-friendly Gum [MENARA]

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ABSTRACT

Wastewater treatment facilities in Morocco and Palestine serve solely residential communities, and lack design considerations for the treatment of industrial wastewater discharges. This urges the local municipalities to connect the industrial discharges to public sewerage networks with ultimate treatment in central wastewater treatment plants (WWTPs). These current practices lead to negative impacts on WWTPs efficacy with associated environmental, economic and socio-political impacts. Considering water-energy-food nexus, climate change, water scarcity and limited access to available water resources in the MENA region, use of reclaimed water for agricultural irrigation forms a core element within an integrated water resources management. How achieve sustainable WWTPs with safe reclaimed water suitable for agricultural application is the main goal of this research project. A cutting-edge irrigation system using a Superabsorbent Polymer Technology [SPT], an eco-gum manufactured at bench scale, will be used for the removal of selective heavy metals and organic pollutants of industrial origin. We argue that SPT can help local municipalities find environmentally sound solutions to reduce organic and inorganic residues from reclaimed water. Policy makers can integrate research results within the national guidelines aiming at fostering the adoption of integrated (waste)water management for smart agricultural irrigation, environmental and public health improvement within the MENA region.

RESEARCH OBJECTIVES

- Assess chemical, microbiological contamination and water productivity of using different types of reclaimed water for agricultural production in pilot reuse schemes
- Prepare hydroretents polymer (HRP) materials, a superabsorbent polymer technology, suitable for water storage and pollutants adsorption during irrigation trials
- Support a techno-economic optimization of wastewater treatment facilities and their management pertaining to compliance with national reuse guidelines fit for safe irrigation practices in agricultural sector

SOLUTIONS/CONTRIBUTION TO WATER SCARCITY DEBATE

- Locally produced eco-gum can improve the quality of reclaimed water and increase agricultural productivity while reducing pollution loads to receiving environment and public health; water scarcity is not limited to volumes but also to characteristics of reclaimed water destined for agricultural irrigation
- Policy makers can integrate research results into national reuse guidelines through adoption of smart post-treatment technologies aiming at reducing the potential impacts and fate of inorganic and organic residues of industrial origins; eco-gum can adsorbed selective heavy metals otherwise reducing agricultural productivity and causing soil degradation
- Tailor-made training for farmers, school farms, NGOs, agricultural engineers, and policy makers on smart irrigation systems, sources and fate of potential pollutants of various origins can increase awareness raising, acceptance and improve technical skills of local communities in the MENA region
- Research findings are applicable and relevant outside our case study to other countries in MENA region conditional that eco-gum is feasible to produce considering socio-economic context and cost-effectiveness at local market
- Reducing knowledge gab via community outreach, publication of results, upgrading laboratories with adequate equipment and tools are necessary to ensure replication and widespread of obtained results at national and international levels including decision support for policy makers.

RESULTS

Envisaged outcomes:

The intellectual merit of the proposed research envisage the following outcomes:

- Technical and decision support to policy makers and local communities towards techno-economic optimization of wastewater treatment facilities. This shall narrow the knowledge gab and improve profession skills to sustain operational management of sanitation services. Considering socio-economic conditions, acceptance and optimized water and land management are core issues behind efficient water use for agricultural production.
- Production of superabsorbent gum containing hydrogel and application for irrigation of agricultural land using reclaimed water. Scale-up of best synthesis recipes from bench-scale to pilot and large-scale production based on well-defined parameters gathered through extensive molecular and macroscopic level characterization of the prepared hydrogels.
- Enhancing laboratory infrastructure by adding cutting-edge equipment to support research on advanced technologies to ensure long-term return-on-investment of broader benefits to other researchers at partners' institute.
- Contribute to the development of partner institutes financial resources by producing these larger quantities of hydrogels in our semi-pilot then pilot scale for external sale.
- Establishment of Research and Technical Development (R&D) group to create new knowledge regarding scientific and technological topics for the purpose of uncovering and enabling development of new products, processes, and services.

CONCLUSIONS

TBD

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