ASSESS THE MECHANISMS AND ADSORPTION CAPACITIES OF TEN BIOCHAR TYPES FOR THE REMOVAL OF MICROPOLLUTANTS FROM WASTEWATER EFFLUENT

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Although global treated wastewater reuse standards are stringent, yet there are no established thresholds for emerging contaminants, specifically those originated from pharmaceuticals and pesticides. Hence, there is a significant challenge for reusing treated wastewater in irrigated agriculture without further treatment, which leads to sever public health, economic and environmental impacts. Thus, the goal of this study is to assess the efficacy of various biochar types in removing micropollutants from aqueous treated wastewater effluent in order to ensure safe reuse schemes and improve treated wastewater and soil quality. The biochar used in this study comes from a variety of biomass sources, including bagasse, coffee husk, softwood, and sewage sludge, through a natural draft gasifier, an indirect draft gasifier, and pyrolysis. The treated wastewater is sourced from a municipal wastewater treatment plant located in Delft, the Netherlands, and contains the 15 micropollutants within the scope of the study that are derived from organic pharmaceutical residues and pesticides. The experimental campaign began with a preliminary investigation for the various biochar types under constant operating conditions of reaction time of 3 hours, micropollutant concentration of 5000 ng/l, biomass load of 0.1 g, and 150 rpm. This approach allowed identifying two biochar types demonstrating the highest removal efficiencies. This followed by Response Surface Methodology (RSM) study, which is used to investigate the interactive effects of operating variables on the removal of micropollutants from treated wastewater effluent using the two identified biochar types. The RSM was a based on a full factorial central composite design (CCD) with four axial points, eight factorial points, and six center points; furthermore, three independent variables were chosen: X1 (reaction time); X2 (biochar loads); and X3 (micropollutant concentrations), with the response Y (micropollutant removal percentage %). Following that adsorption isotherms were investigated for micropollutants removal in a batch adsorption system employing of the two identified biochars, which will allow the determination of adoption capacity and the examination of various adsorption models. The findings of this study would enable the development of a low-cost technology for removing micropollutants from treated wastewater and ensuring safe reuse practices. It is worth noting that biochar would be also used in agriculture fields as an adsorbent in order to reclaim the fields and remove the accumulated micropollutants that hinder the field productivity. This research is related to the conference theme: Bio-char applications: soil amendments, adsorbents, catalysts, composite fillers, and electronic applications.

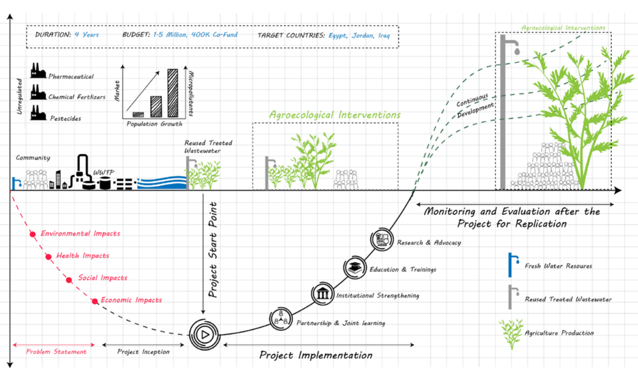

Figure 1 – Graphical Abstract for the Project and Biochar will be used as one of the Agro-ecological Interventions

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