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OPTIMIZING EFFICIENCY OF CONSTRUCTED WETLANDS (CWs) THROUGH INTEGRATED BIOCHAR-BASED SOLUTIONS

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Constructed wetlands (CWs) are nature based solutions, which provide a sustainable wastewater treatment by mimicking transformation processes occurring in natural ecosystems. In order to maximise their overall efficiency in treating complex water matrices, several key parameters are involved, including design, configuration, substrate material and integration with other treatment systems.
Two horizontal submerged flow constructed wetlands (HF-CWs), filled with gravel and planted with Phragmites australis, were designed with an active aeration system to make more intensive oxic microbial activity. Each CW was provided with vertical filtration systems filled with biochar (BC-VFS) as further treatment stage. The biochar, produced from co-pyrolysis of woody waste and biological sludge, provided a high environmental compatibility in terms of water leachable impurities, together with a remarkable specific surface area (about 120 m^2/g).
These hybrid systems have been tested as secondary and tertiary depuration stages to treat (i) the wastewater from the Scientific Campus of the University of Florence after Imhoff primary treatment and (ii) the effluent wastewater from the biological treatment of the Baciacavallo facility (Prato, Italy). Hybrid system influents and effluents from CWs and BC-VFSs were monitored for chemical oxygen demand (COD), nitrogen and phosphorus cycles, and UV-Vis absorbance (254-420 nm), the latter as rapid and reliable screening parameters for the removal of organic micropollutants.
Main results showed a high ammonia removal in both CWs (93% and 64% for secondary and tertiary treatment, respectively) and a remarkable reduction in absorbance after BC-VFS, compared to CWs, particularly for the hybrid systems working as secondary stage (removal percentage of about 85% for both wavelengths).

Keywords: Ammonia, Biochar, Chemical Oxygen Demand, Nitrate, Organic Micropollutants, Urban Wastewater

Biography

Michelangelo Fichera is currently pursuing a PhD in Chemical Sciences at the University of Florence and is expected to complete his studies by the end of 2024. His research interests primarily focus on Environmental Chemistry, Analytical Chemistry, Waste Management and Environmental Science. He is the author of n. 4 scientific papers that examine the reuse of waste biomass for a variety of applications.