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| Title: | Performance evaluation of the integrated hydroponics-microbial electrochemical technology (iHydroMET) for decentralized domestic wastewater treatment |
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| Abstract: | Here we report on the performance of the integrated drip hydroponics-microbial electrochemical technology (iHydroMET) for decentralized management of domestic wastewater at the household level. The study focused on optimizing the iHydroMET reactor components, followed by its performance evaluation for domestic wastewater treatment at different feed volumes. Based on the reactor components optimization work, granular activated charcoal:cocopeat (20:80) combination for bed matrix, 75% immersed cathode in effluent configuration, and Catharanthus roseus plant were selected for further experiments. The iHydroMET system with the optimized reactor components achieved efficient removal of organic matter (up to 93%) and turbidity (up to 98%) but minimal total nitrogen (<24%) and total phosphorous (<8%) removal after 24 h with 10 L of feed volume. It also removed the contaminants of emerging concern, such as sterols, at >95% efficiency. The UV-treated effluent (<2 MPN/100 mL) with considerable concentrations of N (~34 mg/L) and P (~5 mg/L) nutrients qualifies the standards for agricultural use and landscape irrigation purposes and contribute to lowering the burden on freshwater usage. The system also produced a power density of 30.3 mW/m2. Cultivation of evergreen C. roseus, a high aesthetic value ornamental and medicinal plant, further adds to ecological and environmental benefits of the iHydroMET technology. Further modifications in system operation like creating a saturation zone in the reactor units might improve the electric output and result in sufficient removal of nutrients, making the use of effluent for flushing and other purposes possible in households. |
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