Low-cost biosensors for continuous performance assessment of natural-based wastewater treatment systems

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Bioelectrochemical systems (BES) are devices that transform the chemical energy of organic and inorganic substrates into an electric current. BES represents a particularly interesting biosensor technology for monitoring the performance of remote/isolated wastewater treatment facilities (such as constructed wetlands). The work presented here aimed to assess the potential use of the electric signal produced by low-cost, membrane-less BES systems as an indicator of the operational conditions and treatment performance of natural-based wastewater treatment systems. For this purpose, several BES configurations and operation modes working under real domestic wastewater conditions were monitored.

Results showed that the electric current produced by the BES significantly correlates with key parameters in biological-based wastewater treatment systems such as microbial activity and biomass, water COD or solids accumulation. Therefore, our work demonstrates the feasibility of applying bioelectrochemical-based low-cost biosensors for the improvement and control of natural-based wastewater treatment systems.

Keywords: bioelectrochemical systems, wastewater, microbial activity, organic matter, low-cost, biosensor