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APPLICATION OF MICROBIAL ELECTROCHEMICAL TECHNOLOGIES IN THE WASTE WATER TREATMENT AND BIOSENSOR DEVELOPMENT

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In the circular economy framework the reuse and treatment of water is a main component. By the use of MET's the current framework established for water treatment meets the demand for a waste free environment and production of clean energy. The advance of Microbial Fuel Cells makes use of natural, cost efficient materials scalable from the single home use to industrial waste water treatment and energy production. Hydrogen and electrical energy are the main byproducts by conversion of the energy in the organic matter in the substrate, using electrochemically active bacteria such as *Shewanella* and *Geobacter*. Advances in cathode and anode design has reached the stage of inexpensive carbon fiber material, easy to mold into shape and size, this optimizes the hydrogen and electricity production. Use of MFC's as a biosensor to detect different types of toxicity is a main advantage, short response times and online monitoring is possible. Different pollutants require the use of different microorganisms in the detection of heavy metals, organic waste, pesticides etc. The current rise in environmental awareness has developed the use of biosensors and biomonitoring. In wastewater the removal of BOD in a main factor, conventional BOD monitoring is not suitable for use due to the long response time (up to 5 days). With the use of MFS biosensor the response time can be reduced at a fraction of 3 to 6 hours, with a grater dynamic range and accuracy and using a multi stage coupled MFC system. The use of a multi-stage MFC system allows for precise differentiation of BOD and toxicity, with possibility of online monitoring. The different types of application of MET (Microbial Electrochemical Technologies) results in a wide range of possible determinations in and off situ. Variations of MET's include: microbial desalination cells, microbial electrolysis cell, microbial electrosynthesis system, microbial fuel cell, sediment microbial fuel cell (benthic) and microbial methanogenesis cell. The advancements, potential and scalability of Microbial Electrochemical Technologies and systems are the purpose of the current study and aim to bring the technology as a feasible option for small and industrial scale operations.

Keywords*: Waste water treatment, algae technology, microbial fuel cell, circular economy, bioelectrochemical systems, biosensor development*

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