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Exploitation and optimization of a microbial fuel cell for the treatment of whey wastewater and the power generation

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ABSTRACT

The dairy industry like most other agro-industries generates strong wastewaters with high biological and chemical oxygen demands representing the high organic content. The let out of untreated wastewater may cause serious problems in terms of organic load on the local municipal sewage treatment systems. The study examined the mediator-less microbial fuel cell (MFC) for the treatment of whey wastewater with simultaneous current generation in the presence of *E. coli*. The maximum current generated using whey wastewater was 3.019–6.99 W/m^2/d with a constant resistance of 10 Ω with 0.1 N potassium permanganate as catholyte with carbon and graphite as electrodes respectively. The graphite electrodes were able to produce more current when compared to the carbon electrodes. During the study a biomass concentration of 3.042 g/l with a CO_2 production of 13–20 mg/l as $NaCO_3$ and H_2 production of 20–25 ml/d respectively were obtained. The distance between the electrode and the Proton Exchange Membrane (PEM) and the distance between the electrodes in case of the dual electrodes also played an important role in the power generation. SEM image evidences the bio-film formation on the electrodes that supported the power density and a COD removal of 91–98% was also obtained. This phenomenon could be utilized to design an inexpensive autonomous system consisting of graphite or carbon electrodes, an electrical load and a recordable voltmeter to track energy generation due to *E. coli* fermentations. In the near term, these fuel cells could be utilized as a research tool for metabolic studies where the current response of microbial fuel cells would be extremely useful.

Keywords: Microbial fuel cells; Whey wastewater treatment; Current generation; Hydrogen production

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