ABSTRACT

Microbial fuel cell (MFC) is an emerging technology, which holds promise towards sustainable wastewater treatment along with direct electricity generation. In the present study, the effect of influent chemical oxygen demand (COD) concentration (1000-3000 mg/L), hydraulic retention time (HRT, 12-36 h) and feed pH (6.0-8.0) on COD removal efficiency and power generation was studied in dual chambered MFC treating synthetic wastewater. Statistical models were formulated based on these three variables to predict COD removal efficiency and power generation in MFC using a two-level full factorial design. The statistical models showed that the main effects of influent COD, pH and HRT influences the COD removal efficiency and interaction among these parameters showed insignificant effect. All the operating variables and the interaction between them significantly affected the power generation in the MFC. Average influent COD concentration of 2150-2350 mg/L, HRT of 22-24 h and feed pH of 8.0 was found to be optimum for getting optimal COD removal efficiency and power. Sludge loading rate is found to affect the performance of MFC significantly. Bacteria in suspension participated in electricity generation along with the bacteria attached to the anode in MFC.

An attempt has been made to produce low cost MFC from the commercially available earthen pots in India, without involving any costly membrane. The wall material of the earthen pot used is found to be effective for proton transfer. Earthen pot MFC demonstrated better performance in terms of electricity harvesting and COD removal than MFC using Nafion membrane, while treating rice mill wastewater. The earthenware up-flow cylindrical MFC demonstrated effective substrate degradation along with power generation under continuous mode of operation, offering economical MFC construction for efficient wastewater treatment and power generation. The thickness of earthenware affects the power generation in MFC producing higher power at lower thickness. The physical and chemical environment in the cathode chamber of MFC significantly affected the cathode performance and fuel cell power output. The presence of micronutrients such as Ni, Co and Mo in the feed wastewater favoured the growth of methanogens and hindered the power generation.

**Keywords:** Microbial fuel cell; Wastewater treatment; Power generation; Earthenware separator.