

Microbial Fuel Cell: Novel Bioenergy Production Technology

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A microbial fuel cell (MFC) is a microbial device converting chemical energy into the form of electricity through the catalytic activity of microbes. To facilitate the electron transfer from the electrochemically inactive microbial cell to an electrode, mediators have been used in the conventional MFCs. The mediators are toxic phenolic compounds. For this reason MFCs have been applied in very limited areas. We have shown that an model strain of Fe(III) reducing bacterium, *Shewanella oneidensis* is electrochemically active, and metabolizes lactate in a fuel cell-type electrochemical cell in the absence of electron acceptors with concomitant electricity generation. Based on this finding MFCs were used to enrich electrochemically active microbes using various fuels. MFCs enriched using different fuel showed different microbial populations. Various fuel cell-type reactors were developed including one without using membrane to treat wastewater. The MFC system has shown that its COD removal rate was almost same as that of activated sludge process with concomitant electricity generation. This indicates that MFC system has feasibility as wastewater treatment process.

The MFC research will provide an unprecedented insight into the function of electrochemically active bacteria in microbial fuel cell directly associated with practical needs of the Environmental protection. Investigation into the potential for recovery of electricity from organic matter including wastewater with electrodes is clearly in its infancy and the studies described here should rapidly accelerate the development of this environmentally friendly strategy for harvesting energy from waste biomass. In addition to these practical considerations, MFC study will significantly contribute to develop novel biomaterials (biosensor) as well as to create new research fields that combined in Environmental Technology, NanoTechnology and BioTechnology.