

Bacterio-Algal Microbial Fuel Cells for Sustainable Power Production, Wastewater Treatment, and Desalination

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Abstract : The Microbial fuel Cell (MFC) is a successful integrated technology for power production and wastewater treatment. MFCs are recognized for their dual function, but research in this field is still ongoing to increase efficiency and power output. One such effort is successful integration of phototrophic and autotrophic microorganisms to create bacterio-algal MFCs for sustainable electricity production along with wastewater treatment and algal biomass production. An MFC is typically configured with an anaerobic anodic chamber containing exoelectrogenic microorganisms separated by a cation exchange membrane from an adjacent aerobic cathodic chamber. The two electrodes are connected by an external circuit. This conventional MFC can be converted into a phototrophic MFC by introducing photosynthetic microorganisms into the cathode chamber. This study examines adding a third desalination chamber to a two-chamber bacterio-algal MFC. Successful results have been observed from these three-chamber MFCs demonstrating wastewater treatment in the anodic chamber, phototrophic algal growth in the cathodic chamber, and desalination in the middle chamber. The present article will summarize successful results of the bacterio-algal fuel cells and offer insights about the mechanisms involved. Tables summarizing the input substrate along with optimized operational conditions and output performance in terms of power production and efficiencies of water and wastewater treatment will be presented. The negative impacts and challenges will be discussed, along with possible future research directions. Results suggest that the three chamber bacterio-algal desalination cell has potential as a feasible technology for power production, wastewater treatment and desalination, but it needs further investigation under optimized conditions.

Keywords : bacterio-algal MFC, three chamber, microbial fuel cell, wastewater treatment and desalination

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