

Treatment of Retting pond water and generation of electricity using Microbial Fuel Cells

Iqbal M. I. Ismail

Department of Chemistry, and Centre of Excellence in Environmental Studies, King Abdulaziz University, Jeddah 21589, Saudi Arabia.

Abstract

Microbial Fuel Cell (MFC) is a promising technology for wastewater treatment since it utilizes microbial catabolic activity to generate electricity from organic matter. MFC consists of an anode chamber, cathode chamber and proton exchange membrane (PEM). Perfluorosulfonic acid (Nafion) and polytetrafluoroethylene (PTFE) are commonly used proton exchange membrane (PEM). Carbonaceous materials like carbon paper, graphite sheets and carbon cloth are commonly used as anode material. Gold and titanium can also be used as anode material in MFC. Electricity generation in MFC is accomplished by microbial catabolism. In anode chamber, microorganism undergoes Extracellular Electron Transfer (EET) to oxidize the organic matter and generate electrons and protons. The protons produced in the anode chamber are transferred to cathode by diffusion through proton exchange membrane (PEM). Surface coating materials such as carbon nanotubes (CNT) and polypyrrole are used to increase the performance of anode materials. Ferricyanide and platinum are used as catalyst. Retting denotes the process of decomposition of tissues surrounding the vegetable fibres brought about by the pectinolytic activity of the bacteria and fungi liberating large quantities of organic substances. For the retting process, coconut husks are immersed in retting ponds for about four months. The retting wastewater released from the coconut retting pond has high concentration of phenol, organics and low pH which causes river pollution and several damages to the brackish and marine water animals. The present study is focused on the treatment of retting pond wastewater and electricity generation by MFC. MFC with a working volume of 600 mL of coconut retting pond wastewater is treated for phenolic, COD (Chemical Oxygen Demand) removal and current production. Based on MFC design and electrode materials used, COD removals and power density can differ. Therefore compared with other wastewater treatment technology, MFC act as ecofriendly technology with high energy conversion rate and no gas processing.