Vijay Samuel, Pollut Eff Cont 2016, 4:2(Suppl)
http://dx.doi.org/10.4172/2375-4397.C1.002

Reduction of heavy metals in tannery effluent using microbial fuel cell technology

Vijay Samuel[1, 2]
[1]Dr MGR Educational and Research Institute University, India
[2]VIT University

A Microbial Fuel Cell (MFC) is a bioreactor that converts chemical energy in the chemical bonds in organic compounds to electrical energy through catalytic reactions of microorganisms under anaerobic conditions. It has been known for many years that it is possible to generate electricity directly by using bacteria to break down organic substrates. The recent energy crisis has reinvigorated interests in MFCs among academic researchers as a way to generate electric power or hydrogen from biomass without a net carbon emission into the ecosystem. MFCs can also be used in wastewater treatment facilities to break down organic matters. They have also been studied for applications as biosensors such as sensors for biological oxygen demand monitoring. Power output and Couloumbic efficiency are significantly affected by the types of microbe in the anodic chamber of an MFC, configuration of the MFC and operating conditions. Currently, real-world applications of MFCs are limited because of their low power density level of several thousand mW/m^2. Efforts are being made to improve the performance and reduce the construction and operating costs of MFCs. Bio-electrochemical systems (BESs) are emerging technologies which use microorganisms to catalyze the reactions at the anode and or cathode. BES research is advancing rapidly and a whole range of applications using different electron donors and acceptors has already been developed. In this mini review, we focus on technological aspects of the expanding application of BESs. We will analyze the anode and cathode half-reactions in terms of their standard and actual potential and report the over potentials of these half-reactions by comparing the reported potentials with their theoretical potentials. When combining anodes with cathodes in a BES, new bottlenecks and opportunities arise. For application of BESs, it is crucial to lower the internal energy losses and increase productivity at the same time. Membranes are a crucial element to obtain high efficiencies and pure products but increase the internal resistance of BESs. The comparison between production of fuels and chemicals in BESs and in present production processes should gain more attention in future BES research. By making this comparison, it will become clear if the scope of BESs can and should be further developed into the field of bio-refineries. This research is carried out to check the heavy metal reduction in tannery effluent using conventional MFC and packed bed/fluidized bed reactors depending on the suitability. In addition to this, water treatment and electricity production studies are carried out too.

Biography

Vijay Samuel is a hardworking and sincere Academician, Researcher and Entrepreneurship Educator with adequate industrial experience in Wastewater Engineering, Bioremediation, Renewable Energy Technologies and Entrepreneurship Mentoring Activities. He is currently carrying out collaborative research work with VIT University and Anna University (College of Engineering Guindy) Labs and Consultancy Projects with Mumbai based Environmental Engineering and Biotechnology Industry. He holds double Master's degree in Biochemical Engineering and Environmental Engineering. Presently he is pursuing Doctoral degree in Bio-electrochemical Engineering.

vijaysamjuly@gmail.com

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