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Abstract

The present study aimed to basically understand the bioanodic function over microbial power generation and energy distribution under applied external resistance in a microbial fuel cell (MFC). External load resistor optimization was carried out to determine the maximum power point (MPP). Long term operation was carried out wherein the MFC closed with that resistor at MPP resulted in a maximum power density (114 mWm^{-2}). This observation was further supported by the anode potential profile that being lowest at MPP and resulting in highest coulombic efficiency with 80% of substrate utilization. The energy distribution revealed that only a fraction (~16%) of the overall chemical energy input is actually converted into net electrical energy and the energy losses were traced by polarization slope analysis. Voltammetric profiles depicted the biocatalyst activity in terms of direct electron transfer to anode as function of applied resistance.

Keywords: anode potential, bioelectrochemical, electron transfer, external resistance

1. Introduction

Microbial fuel cells (MFC) is a representative of new bio-catalyzed green treatment technology at the nexus of water and energy crisis [1, 2]. Nevertheless, it is mandatory to look upon the sustainable energy yields prior to valorization of MFC in an effluent treatment plant. Proper understanding of energy issues during bio-electrochemical treatment of wastewater is crucial for identifying suitable application niches and for further advancement of technology [3]. The most significant barrier to MFC exploitation lies in that the process is inherently sensitive to losses, which become dominant during scale-up. A grave issue is the spatial arrangement of electrodes and various other losses viz., ohmic, activation and mass transfer [4, 5].