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Performance of a Single-Chamber Microbial Fuel Cell Degrading Phenol: Effect of Phenol Concentration and External Resistance

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Abstract The performance of a single-chamber microbial fuel cell (MFC) using wastewater containing phenol as the anodic fuel was evaluated. The evaluation was performed considering the effects of the presence of different phenol concentrations in the anodic fuel and the external resistance at which the cells were adapted. Maximum power and current densities of 49.8 mW m^{-2} and 292.8 mA m^{-2} were obtained, respectively. Microbial diversity on the anode surface remained relatively stable when the phenol concentration was increased. *Pseudomonas* sp. was the most abundant microorganism in the MFC, followed by the genus *Geobacter* and *Shewanella*. Phenol degradation was mainly conducted by bacteria present in the wastewater, and its presence did not affect the electricity generation. The operation of the MFC with a resistance different to the adaptation resistance produced lower current and power densities; however, the variation in external resistances did not adversely affect the phenol degradation.

Keywords Microbial fuel cell · Single-chamber · Microbial diversity · Phenol · External resistance · Floating cathode

Introduction

A microbial fuel cell (MFC) is a device that can convert the chemical energy from organic matter to electricity in a single step [1–3]. It has been proposed that operating an MFC, in a single-chamber, without an ion exchange membrane may lead to a significant internal ohmic resistance reduction [4]. Also, in a single-chamber air-cathode MFC, the mass transport loss is reduced due to the direct supply of oxygen from ambient air to the electrode, minimizing the energy required to drive the hydrodynamic flow. This design also makes the MFC structure relatively simple and compact, eliminating the inherent problems associated with the MFC

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