Journal of Oil and Gas Research

Editorial Open Access

Comparative study of effects of electrode materials and catholyte on simultaneous generation of bioelectricity and waste water treatment

Editorial

Improvement of the parameters which limit the harvest of energy in microbial fuel cell (MFC) is paramount to increase its output and promote commercial application of the technology. Six dual chamber MFCs with either potassium permanganate or potassium ferricyanide as electron acceptor and various combinations of carbon and copper rods as electrodes produced maximum open circuit voltage (OCV) of 0.97V, 1.23V, 1.34V, 0.75V, 1.03V and 0.63V. The power density (at Rext =1000?), which increased with decreasing external resistance until 200? beyond which it decreased, peaked at 79.27mW/m2 (105.7mA/ m2), 156.32mW/m2 (148.4mA/m2), 92.29mW/m2 (114.0mA/m2), 60.94mW/m2 (92.6mA/m2), 39.94mW/m2 (75.0mA/m2) and 14.21mW/m2 (44.70mA/m2) for the MFCs. Similarly, Coulombic efficiency (CE) were 69%, 84%, 74%, 76%,72% and 5.10%, while COD removal were 65%, 51%, 47%, 83%, 48% and 49%. Above results indicated that potassium permanganate outperformed potassium ferricyanide, while use of carbon as both electrodes was better than other blends copper and/or carbon used in the study. Lactobacillus spp., Corynebacterium spp., Streptococcus spp., Proteus mirabilis, Enterobacter spp., Escherichia coli, Pseudomonas spp., Bacillus spp., Aeromonas spp., Micrococcus lyteus, Corynebacterium spp., Cladosporium, Aspergillus versicolour, Candida albicans, A. flavus, Aspergillus nidulans, Trichoderma spp. and Aspergillus fumigatus were microorganisms isolated from the piggery wastewater. Further studies using cheaper, more sustainable materials with better effects on the setup are necessary.

The need for renewable source of energy cannot be overemphasized, in view of the devastating impacts of continued dependence on fossil fuel on man and the environment on one hand, and the ever increasing human population with attendant demands for increased supply of energy for both social and economic development [1, 2, 3, 4, 5, 6]. Fortunately, innumerable reports have affirmed that microbial fuel cell (MFC) is a promising technology in both generation of bioelectricity and waste water treatment [7, 8]. MFCs can generate electrical energy from oxidation of organic matter through the catalytic activity of electrochemically active bacteria [9]. Although diverse substrates, including waste water, have been used to generate bioelectricity in MFC, currently, the output however is still very low to allow economic application of the technology [10, 11, 12]. The output of MFCs is limited by several parameters including the amount of oxidation and electron transfer to the anodes by microorganisms, loading rate, the nature of

substrate, the nature of proton exchange membrane (PEM), proton transfer through the membrane to the cathode chamber, oxygen supply in the cathode, the nature and type of electrodes, circuit resistance, the nature of the catholyte

In recent years, there has been a significant accumulation of waste in the environment, and it is expected that this accumulation may increase in the years to come. Waste disposal has massive effects on the environment and can cause serious environmental problems. Thus, the development of a waste treatment system is of major importance. Agro-industrial wastewater and waste residues are mainly rich in organic substances, lignocellulose, hemicellulose, lignin, and they have a relatively high amount of energy. As a result, an effective agro-waste treatment system has several benefits, including energy recovery and waste stabilization. To reduce the impact of the consumption of fossil energy sources on our planet, the exploitation of renewable sources has been relaunched. All over the world, efforts have been made to recover energy from agricultural waste, considering global energy security as the final goal. To attain this objective, several technologies and recovery methods have been developed in recent years. The microbial fuel cell (MFC) is one of them. This review describes the power generation using various types of agro-industrial wastewaters and agricultural residues utilizing MFC. It also highlights the techno-economics and lifecycle assessment of MFC, its commercialization, along with challenges.