World Academy of Science, Engineering and Technology
International Journal of Environmental and Ecological Engineering
Vol:18, No:02, 2024

Electrochemistry Analysis of Oxygen Reduction with Microalgal on Microbial Fuel Cell

Authors : Azri Yamina Mounia, Zitouni Dalila, Aziza Majda, Tou Insaf, Sadi Meriem

Abstract : To confront the fossil fuel crisis and the consequences of global warning, many efforts were devoted to develop alternative electricity generation and attracted numerous researchers, especially in the microbial fuel cell field, because it allows generating electric energy and degrading multiple organics compounds at the same time. However, one of the main constraints on power generation is the slow rate of oxygen reduction at the cathode electrode. This paper describes the potential of algal biomass (Chlorella vulgaris) as photosynthetic cathodes, eliminating the need for a mechanical air supply and the use of often expensive noble metal cathode catalysts, thus improving the sustainability and cost-effectiveness of the MFC system. During polarizations, MFC power density using algal biomass was 0.4mW/m², whereas the MFC with mechanic aeration showed a value of 0.2mW/m². Chlorella vulgaris was chosen due to its fastest growing. C. vulgaris grown in BG11 medium in sterilized Erlenmeyer flask. C. vulgaris was used as a bio-cathode. Anaerobic activated sludge from the plant of Beni-Messous WWTP(Algiers) was used in an anodic compartment. A dual-chamber reactor MFC was used as a reactor. The reactor has been fabricated in the laboratory using plastic jars. The cylindrical and rectangular jars were used as the anode and cathode chambers, respectively. The volume of anode and cathode chambers was 0.8 and 2L, respectively. The two chambers were connected with a proton exchange membrane (PEM). The plain graphite plates (5 x 2cm) were used as electrodes for both anode and cathode. The cyclic voltammetry analysis of oxygen reduction revealed that the cathode potential was proportional to the amount of oxygen available in the cathode surface electrode. In the case of algal aeration, the peak reduction value of -2.18A/m² was two times higher than in mechanical aeration -1.85A/m². The electricity production reached 70 mA/m² and was stimulated immediately by the oxygen produced by algae up to the value of 20 mg/L.

Keywords : Chlorella vulgaris, cyclic voltammetry, microbial fuel cell, oxygen reduction
Conference Title : ICEEPD 2024 : International Conference on Environmental Electrochemistry and Pollution Detection
Conference Location : Dubai, United Arab Emirates
Conference Dates : February 12-13, 2024