Bioelectricity Generation through Microbial Fuel Cell: Opportunities and Challenges

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Extended Abstract

Microbial Fuel Cells (MFCs) are bio-electrochemical transducers that convert microbial reducing power (generated by the decomposition of organics) into electrical energy (Allen and Bennetto, 1993, Logan et al. 2006). They are an alternative to conventional methods of generating electricity for small scale applications. Energy in any form plays the most important role in the modern world. Also, reduction and recycling of waste are very serious problems all over the world due to the limitation of final disposal sites and decreasing environmental loads (Moqsud et al. 2015). From the characteristic analysis of the solid waste of developing countries it is found that the major portion (more than 80%) of the total solid waste comprises of organic waste, which does not usually get much attention for recycling or resource recovery (Moqsud et al. 2015). The annual organic waste generated from the food industries and kitchen waste in Japan is about 20 million tons per year (Koike et al. 2009). Most of this waste is directly incinerated with other combustible waste, and the residual ash is disposed of in landfills. However, incineration of this water-containing waste is energy-consuming.

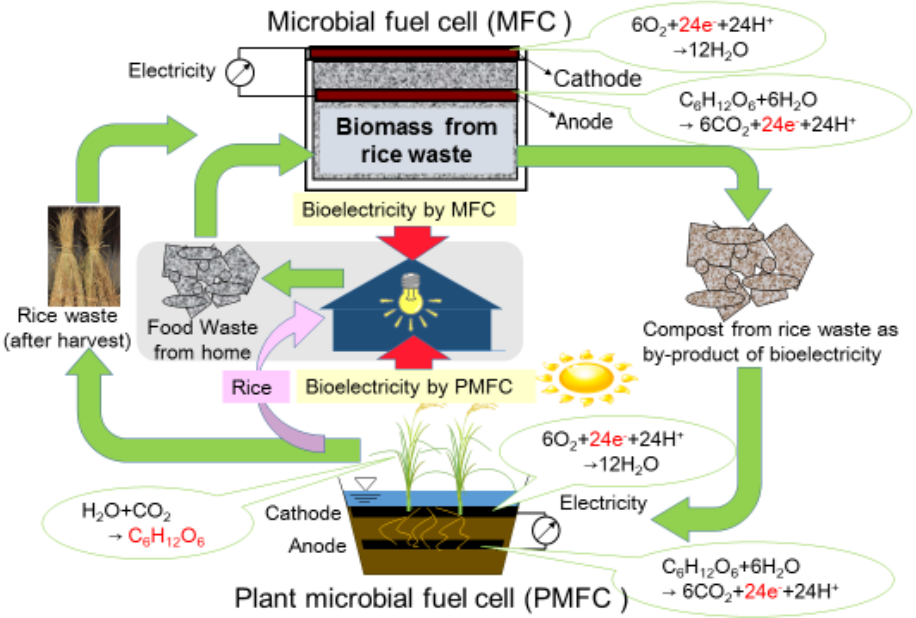

Figure 1: Schematic diagram of MFC and Plant Microbial Fuel cell (PMFC) for Bioelectricity generation

Figure 1 illustrates the schematic diagram of the combined system of MFC and PMFC. In this study the MFC was developed by using the organic waste and the by-products of the bioelectricity was compost. That compost had been used as nutrient to the PMFC for the further electricity generation. The compost can add nutrients to the soil which will help to the plants as well as the geo bacteria. Figure 2 illustrates the variation of voltage with time and the influence of solar radiation on voltage generation. It was observed that when the PMFC was added compost then the amount of voltage generation was increased.

Bucket 3 and Bucket 4 in the figure were used compost for bioelectricity generation and it was observed that the amount of voltage was more when the compost was used 1% and 3 %, respectively.

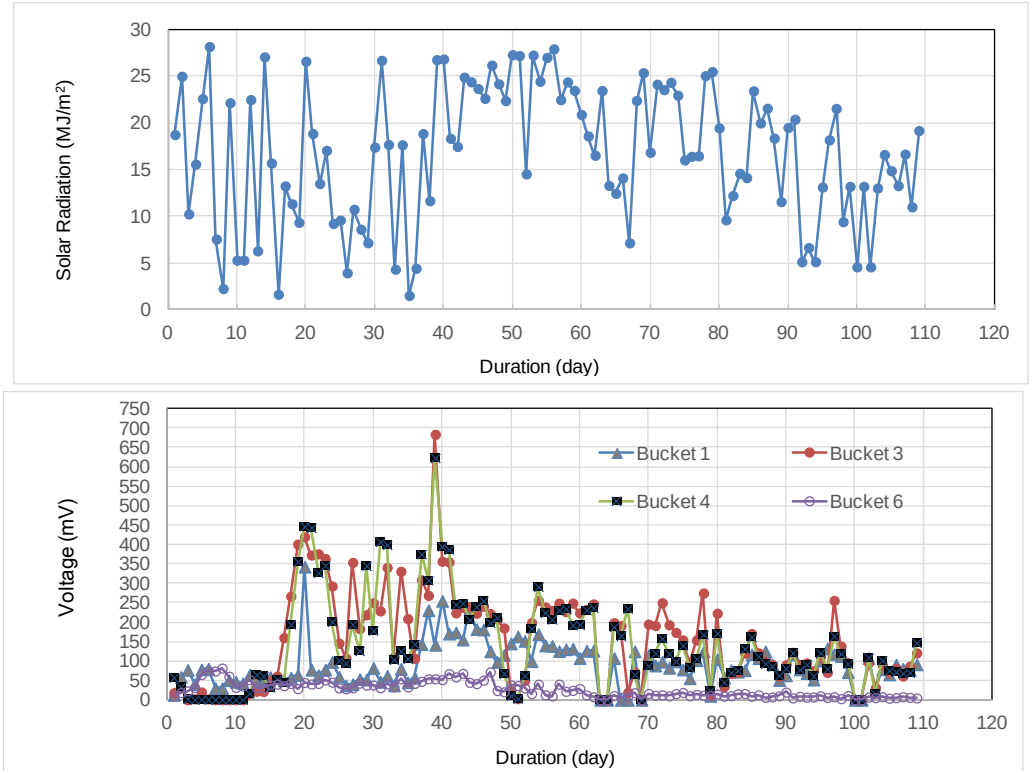

Figure 2: Variation of voltage generation with time and influence of solar radiation

In this study, compost was used in PMFC for bioelectricity generation by using paddy. The voltage generation in this PMFC was around 700 mV with the rice plants when compost was mixed with the soil. The power density has become 3 times higher when compost was used .The organic content added by compost has given additional capacity to generate bioelectricity. This amount of voltage was almost 5 times higher than previously reported results (Moqsud, 2015). The growth of the rice was also reasonable and the maximum length was around 100 cm. So, the additional bioelectricity harvesting did not give any bad influence to the growth of the plant life. The paddy MFC can be used for bioelectricity generation both in developed countries as well as electricity-scarce developing countries. The organic waste can be recycled as compost generation and can be used for enhancing the voltage generation in paddy MFC. The PMFCs by using compost is proved to be a good way for green electricity generation as well as to recycle organic waste to maintain a healthy and pollution free environment. Though the amount of electricity is smaller in PMFC by using compost however, it is very much needed for the future green energy era as we should not needlessly damage any food products for bio-energy as we used to do with bio-ethanol or biodiesel from corn and soybean in the background of millions of people in the world who cannot get food every day.

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