Electricity generation form pretreated palm oil mill effluent using *Klebsiella Variicola* as an inoculum in Microbial Fuel Cell

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In this study, generation of electricity from pretreated palm oil mill effluent (POME) using *Klebsiella variicola* was investigated. POME wastewater with a COD value 68,360 mg/l was subjected to pretreatment with ultrasonication and used as a substrate. MFCs (Microbial Fuel Cell), enriched with pretreated palm oil mill effluent (POME) were subjected to generate electricity by using inoculation of *K. variicola,* collected from city wastewater. *K. Variicola* was isolated from city wastewater as well as from biofilm of MFC and identified using BIOLOG gene III analysis. The electrochemical activity and the performance of the MFC were evaluated by polarization curve measurement. The MFC showed average power density of 1648.70 mW/m^3 and 1280.56 mW/m^3 were obtained from ultrasonication pretrated POME and untreated POME respectively. The COD removal efficiency by *K. variicola* for POME with pretreatment was 74% and that for untreated was 48%. These results showed that the power output and COD removal efficiency can be raised in significant amount using pretreated POME in MFC.

Keywords—component; MFC, K. Variicola, Ultrasonication pretreatment.

I. INTRODUCTION

Microbial fuel cell is promising technology which can be utilize both simple and complex substrates by using fermentative microorganisms. The contemporary world is confronting two major problems i) energy crisis ii) wastewater generation, which can be solved by exploiting MFC technology. Malaysia is largest producer of palm oil in the world after Indonesia [1]. Palm oil predominant agricultural products of Malaysia and constitutes half of the total world production [2]. POME is a hazardous liquid waste that comes out extraction of palm oil which constitutes specific characteristics of high biological oxygen demand (BOD 25 g/L), chemical oxygen demand (COD 53.6 g/L), total suspended solids (TSS 19 g/L) and low pH (3.5–4.0) [3]. To reduce POME hazards, several methods are being investigated such as chemical, physical and biological treatment [4].

Application of MFCs to wastewater treatment and recovery of electricity appears potentially attractive alternative to traditional treatment processes in an optic of costs reduction. [5]. Energy needs are increasing day by day in contemporary world and in an effort to aid energy availability and also research efforts are being emphasized on substitute renewable energy sources. Conversion of biochemical energy to electrical energy using elctroactive microorganisms using MFCs is on of the most effective environmentally friendly renewable and sustainable technology [5,6] and carbon neutral energy sources [7]. MFC is a eco-friendly technology that is capable of utlizing chemical energy into electrical energy using bacteria as a biocatalyst. Apart from the generation of electricity MFC is an effective solution for different types of wastewater treatment and in line with domestic energy production [8].

Biological wastewater treatment has been used for bioelectricity generation due to chip production cost. Bioelectricity generation from wastewater using MFC is one of the environmentally friendly technologies which being improved continually to reduce high organic constituents. In MFC technology, microorganisms is used as a biocatalyst to oxidize organic contents through a biochemical process which generates certain amount of electricity. Pant et al. [9] used various substrates which can be used in MFC technology. The economic viability and also efficient waswatertreatment depend on the characteristics and components of the waste material [9]. The concentrations and chemical compositions of the wastewater that can be converted into products or fuels, which is major concern for establishment of potential bioelectrochemical systems [10].

The aim of this research is to study and compare the amount of electricity generated and potentiality of wastewater treatment using pretreated (sonicated) POME and untreated POME. In this present work, a fermentative facultative anaerobe *K. variicola* was collected from city wastewater, as the biocatalyst to construct MFC. COD removal is also compared between two types of pretreated substrates.