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Performance evaluation of a hybrid system for efficient palm oil mill effluent treatment via an air-cathode, tubular upflow microbial fuel cell coupled with a granular activated carbon adsorption

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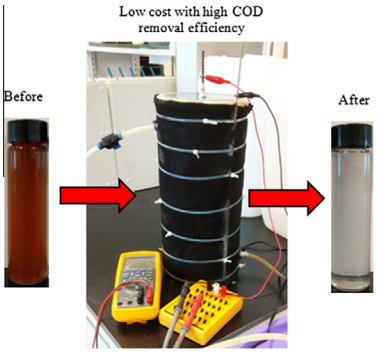
HIGHLIGHTS

- A novel MFC-GAC adsorption hybrid system for POME treatment and bio-energy.
- The hybrid able to overcome the problems faced by the conventional POME treatment method.
- The hybrid effectively reduce pollutants COD, BOD, TOC, TS, turbidity, color and conductivity.
- Low cost materials were used for manufacturing of the system aims for near future application.

GRAPHICAL ABSTRACT



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ABSTRACT

An air-cathode MFC-adsorption hybrid system, made from earthen pot was designed and tested for simultaneous wastewater treatment and energy recovery. Such design had demonstrated superior characteristics of low internal resistance (29.3 Ω) and favor to low-cost, efficient wastewater treatment and power generation (55 mW/m^3) with average current of 2.13 ± 0.4 mA. The performance between MFC-adsorption hybrid system was compared to the standalone adsorption system and results had demonstrated great pollutants removals of the integrated system especially for chemical oxygen demand (COD), biochemical oxygen demand (BOD_3), total organic carbon (TOC), total volatile solids (TVS), ammoniacal nitrogen (NH_3-N) and total nitrogen (TN) because such system combines the advantages of each individual unit. Besides the typical biological and electrochemical processes that happened in an MFC system, an additional physicochemical process from the activated carbon took place simultaneously in the MFC-adsorption hybrid system which would further improved on the wastewater quality.

1. Introduction

A hybrid energy system usually consists of two or more energy sources/methods combined together, via suitable energy conversion techniques, to provide fuel savings, energy recovery, increase overall system efficiency or make use of available energy resources

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