Recycling Oil Contaminated Drilling Mud using Microbial Fuel Cell

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Abstract: In this study, the potential of using two-chamber Microbial Fuel Cell (MFC) to recycle the oil contaminated drilling fluid was investigated. In the anode chamber bentonite based drilling mud was used along with used vegetable oil and bacteria to produce bio surfactant. Surface tension of the solution was reduced from 60 to 47 mN/m and maximum power production was 7.23 mW/m2 with in eighteen hours of operation. The anode solution was analyzed by UV spectroscopy and results shown that the contaminated mud can be recycled using MFC.

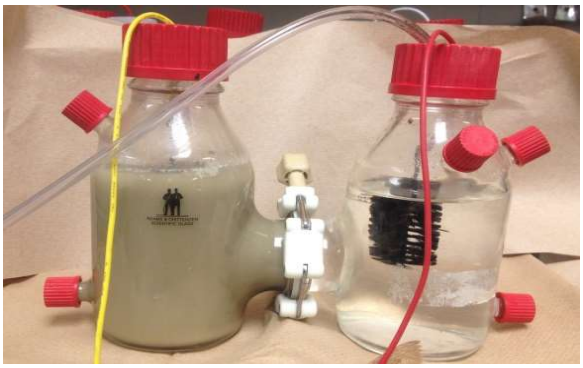
1. Introduction

In the oil and gas industry, after finishing drilling the mud has to be disposed to the environment in a safe way. Some of them dispose the mud in to the marine environment and it may cause several problems (Burke et al., 1995). One of the biggest problem is sea level increased and it was lead to hurricane. Other than this oil is floating above the sea water and become barrier to transport of oxygen in to the water. This can be affecting the survival of marine environment (Burke et al., 1995). Drilling mud disposal lead to migrate hydrocarbon and toxic pollutants into the landfills and this can be leached from landfills to groundwater. EPA greatly restrict the discharge of oil (Burke et al., 1995). So it is important to recycle the drilling mud and if possible it has to be reused to reduce environmental problems.

2. Objectives

The overall objective was to investigate that the microbial fuel cell can be used to recycle the oil contaminated drilling mud.

3. Material and methods



In this study, 4% bentonite based drilling mud was mixed with 10g/L vegetable oil and it was injected into the anode chamber. Anode and cathode volumes of MFC are 500 mL. Cathode solution contain 1g/L of K_2HPO_4, 0.5 g/L of KH_2PO_4, 0.5 g/L of $MgSO_4$, 0.1 g/L of KCl and 2 g/L ofNaNO3.Anode and cathode was separated by Cation Exchange Membrane and both electrodes are carbon fiber brush. Those electrodes are connected to the external resistance of 1 kilo ohm and voltage was monitored by multi meter by fifteen minutes interval for 18 hours. pH, resistivity and surface tension was monitored with time. Initial and final anode solution was analyzed using UV spectroscopy. Air is continuously injected into the cathode chamber and magnetic stirrer was inserted into the anode chamber and it was allow to continuous stirring.

4. Results and discussion

Maximum power production while recycling drilling mud was 7.23 mW/m^2. At the initial point Absorbance is maximum of 0.00506 at the wave length is 374 Nano meter and after 18 hours Absorbance is maximum of 0.002438 at the wave length of 371.3 Nano meter. Absorbance is directly proportional to the concentration of absorbing material. Using these details we can say concentration of absorbing material is

decreased with the time and the mud can be recycled using MFC.

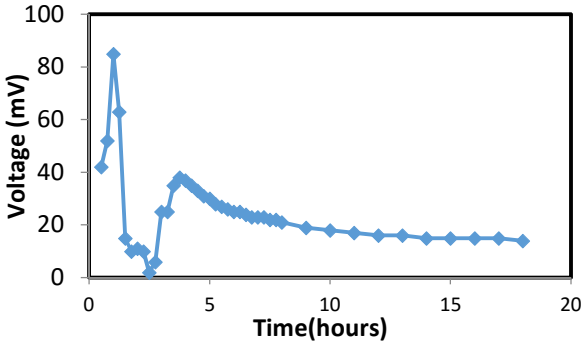
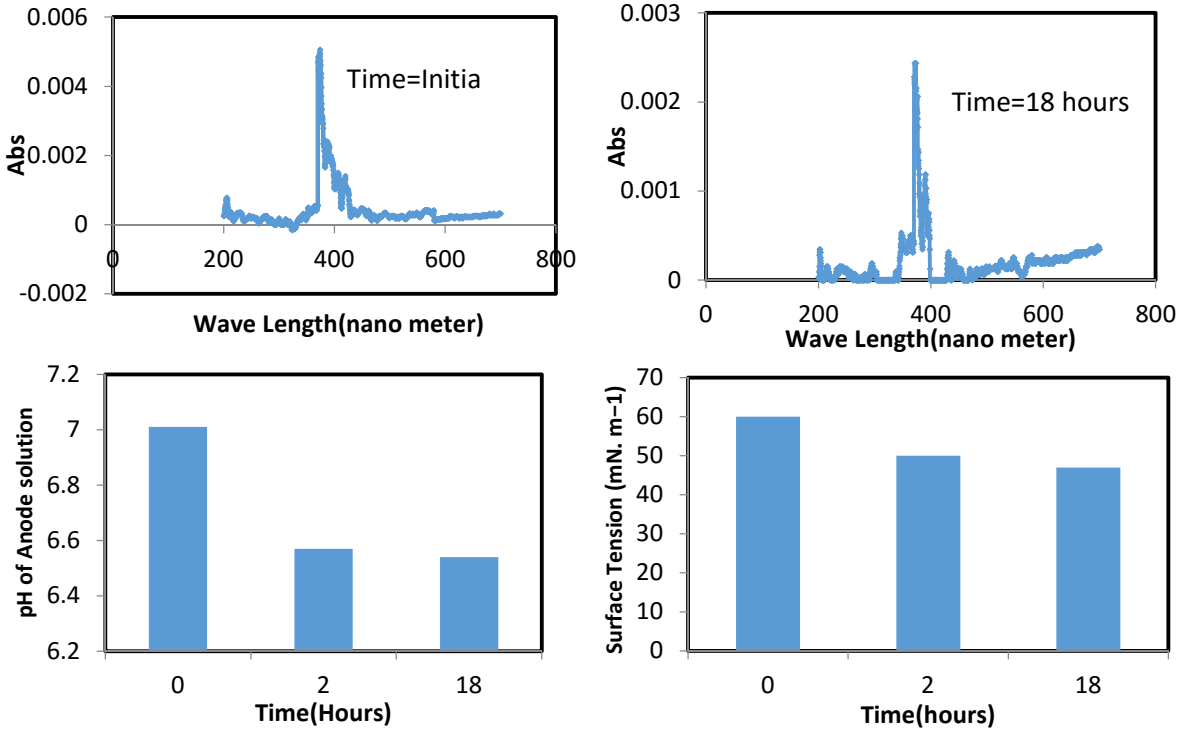


Figure 1. Variation of MFC Voltage with drilling mud



pH of anode solution decreased with time due to protons are transport from anode to cathode chamber and surface tension is decreased with time due to the production of bio surfactant and recycling drilling mud.

5. Conclusion:

MFC can be used to recycle the oil contaminated drilling mud while producing maximum electricity of 7.23 mW/m2.

6. Acknowledgement:

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7. Reference

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