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Entitled

REMOVING CRUDE PETROLEUM OIL FROM EMULSIONS USING MICROALGAE

by

Mohamed Shafi

Faculty Advisor

Dr. Sulaiman Al-Zuhair, Department of Chemical and Petroleum Engineering

College of Engineering

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Abstract

Crude petroleum oil spills are among the most important organic contaminations, which result from uncontrolled releases and spillages during transportation or storage. The separated oils on that accumulate on top of the water can be removed by various conventional skimming methods. However, the emulsified portions that remain within the water phase are more difficult to remove and pose significant threats to the environment and could tamper the tertiary treatment in a wastewater treatment plant. Biological treatment, using bacteria, have proven to be an effective method in the removal of the emulsified oils. However, the biomass produced in this case does not have any significant remunerative value, and in most cases the used bacteria are pathogenic. In this work, microalgae have been proposed to be used, instead of bacteria, to combine the emulsified oil remediation with the microalgae potential as biofuel feedstock, which enhances the economic and environmental benefit of the process. A freshwater strain of Chlorella vulgaris was grown in water containing different concentrations of emulsified crude oil, up to 275 mg/L, at different temperatures. To enhance the removal of the emulsified oils, chemotrophic cultivation conditions was applied keeping the emulsified oils as a sole carbon source. The degradation was monitored by measuring the total organic carbon in the water. The specific growth rate of the microalgae at each initial oil concentration was determined and the results were fitted to a modified Monod kinetics model that takes specific interfacial area as the influential substrate, rather than the actual concentration. The microalgae growth was found to increase with the increase in temperature, in tested range, with µmax increasing from 1.17 to 1.48 day^{-1} as the temperature increased from 30 and 40 ^{o}C, and the activation energy was found to be 19.05 kJ/mol. However, the increase in the microalgae growth with temperature did not result increase on the oils removal and the yield of oil removal per biomass growth was found to decrease with the increase in temperature.

Keywords: Crude Oil-water emulsion; Bioremediation; Microalgae; Specific interfacial area, *Chlorella sp*., Kinetics model.