UNIVERSITI TEKNOLOGI MARA

ATTACHMENT OF *PSEUDOMONAS AERUGINOSA* NR.22 (Ps.NR.22) ON CERAMIC MEMBRANE FOR FILTRATION OF CRUDE OIL-WATER MIXTURE

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ABSTRACT

Pseudomonas aeruginosa NR.22 (Ps.NR.22) has a gram negative rod shaped bacteria was subculture from pure strain isolated by Nik Raikhan and Khairul Izwan that has a potential to degrade the crude oil which consisted of SARA component. Crude oil from Dulang Field was homogenized by using ultrasonic homogenizer. As to meet the first objective, Ps.NR.22 was attached to a ceramic membrane by using dead-end method. The second objective was observed and analysed by using comparison method between oil-water mixture that was filtered with no bacteria and with the presence of bacteria. The result was further examined by using ultraviolet-visible (UV-VIS) spectroscopy which degrade only by 22.4 % for the filtration without attachment of bacteria while percentage of degradation of hydrocarbon for the presence of bacteria is 77.6 %. As for the percentage between both product of filtration is 70.8 %. Another result was analysed by Fourier transform infrared spectroscopy (FTIR) which resulting in increment of degradation of crude oil from three bond to six bond for the filtration with the presence of bacteria. On the other hand, the morphological membrane characterization was done by using digital microscope as it is revealed that the bacteria were actually degraded the crude oil and thus, the surface of membrane was clearer compared to the product of ceramic membrane without bacteria. In conclusion, the oil-water mixture filtered with presence of bacteria was clearer compared to the product of ceramic membrane without bacteria. To achieve precise result, various species of bacteria need to be attached to the ceramic membrane in order to filter the crude oil to get the clearer water.

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CHAPTER ONE
INTRODUCTION

1.1 Research Background

Nowadays, the conventional method such as gravity separation, air flotation and coagulation are frequently used to treat the oily wastewater. However, this method was unable to solve this issues when dealing with the oil droplets diameter lesser than 20 μ (Azhdarpoor et al., 2014; Nik Raikhan & Khairul Izwan, 2017). In addition, the chemical treatment will contribute to lots of negative side effect to the environment. For that reason, filtration of crude oil by using membrane is spreading extensively due to its capability to remove oil from oil water mixture in the wastewater (Petrinic & Lykkegaard, 2014).

Membrane fouling is one of the limitation in membrane assisted separation processes (Orooji et al., 2018) which is the main challenge in application of membrane technology. Frequently the most common method to reduce the fouling of membrane is unfortunately focusing on membrane adjustment and pollution elimination like backwashing (Li et al., 2018). The method used still contain a lot of limitation since the usage of chemical involved. For that reason, biological approach was introduced to solve the problem by attached the bacteria on the ceramic membrane filtration to lower the fouling.

Ceramic membrane was chosen because it shows various benefit compared to the polymeric membrane such as it has high mechanical strength, can withstand high temperature and has great chemical resistance (Zhu et al., 2015). Even though it is expensive compared to other membrane, it is suitable to filter the component such as crude oil that contain high toxicity towards the environment.

Crude oil are mixture of thousand compound which 50-98% is consist of petroleum hydrocarbons (Al-dhabaan, 2018). Oil polluted water come from a variety of sources such as oil refining, oil and gas production, petroleum utilization and accidental oil spillage and leakage (Nie et al., 2016). The spillage and leakages of crude oil triggered to carcinogenic, neurotoxic, mutagenic and immunotoxic pollutants to living beings (Varjani & Upasani, 2016). The oil that present at the surface of water usually