

**UNIVERSITI TEKNOLOGI MARA**

**REMOVAL OF OIL AND HEAVY  
METALS FROM WASTEWATER  
SLUDGE USING SURFACTANT-  
ENHANCED OIL REMOVAL (SEOR)  
FROM PLANT-BASED**

**NUR AMALINA BINTI MOHD  
SULONG**

**MSc**

**November 2021**

## AUTHOR'S DECLARATION

I declare that the work in this thesis was carried out in accordance with the regulations of Universiti Teknologi MARA. It is original and is the results of my own work, unless otherwise indicated or acknowledged as references work. This thesis has not been submitted to any other academic institution or non-academic institution for any degree or qualification.

I, hereby, acknowledge that I have been supplied with the Academic Rules and Regulations for Postgraduate, Universiti Teknologi MARA, regulating the conduct of my study and research.

Name of Student : Nur Amalina Binti Mohd Sulong

Student I.D. No. : 2017812156

Programme : Master of Science in Chemical Engineering (By  
Research) – EH 750

Faculty : Chemical Engineering

Thesis : Removal of Oil and Heavy Metals from Wastewater

Title : Sludge using Surfactant-Enhanced Oil Removal  
(SEOR) from Plant-based

Signature of Student : *@malina*  
.....

Date : November 2021

## ABSTRACT

Petroleum is the most significant energy source and raw material for the chemical industry. The increasing trends of petroleum industries and the high demand of the production capacity directly leads to the oil pollution generation problems as well as environmental problems which accumulated a large volume of oily wastewater sludge due to high content of petroleum hydrocarbon (PHC). In order to overcome the oily wastewater sludge problems generated, the initiative study was developed to minimize this issue by treating the oily wastewater sludge in terms of oil and heavy metals removal using plant-based surfactant in surfactant-enhanced oil removal (SEOR). In this study, the sodium lauryl sulfoacetate (SLSA) and cocamidopropyl betaine (CAPB) plant-based surfactant derived from palm oil were used for SEOR process. Based on the research finding, oily wastewater sludge has significant amount of volatile matters (32.22 wt%) which consists of hazardous polycyclic aromatic hydrocarbons (PAHs) that needs to be removed from oily wastewater sludge. The critical micelle concentration (CMC) of SLSA and CAPB plant-based surfactant was 125 mg/L and 33 mg/L via simplified colorimetric method and conductivity method. The treatment of oily wastewater sludge showed that the significant amount of oil removal observed in SLSA and CAPB plant-based surfactant at concentration of 1000 mg/L with 85.40% and 87.26% respectively. Moreover, it deduced that the CAPB surfactant illustrated the significant amount of metal removal on mercury (Hg) and lead (Pb) that rangely about 38.46% and 26.91% respectively as compared to SLSA surfactant (3.53% and 6.95% respectively) at plant-based surfactant concentration of 1000 mg/L. This finding shows the potential of CAPB surfactant in enhancing the oil and heavy metals removal from oily wastewater sludge. The SLSA and CAPB plant-based surfactant clearly distinguished the best operating condition at reaction temperature of 50°C for 20 minutes in terms of oil and heavy metals removal. These results obtained for SLSA and CAPB plant-based was verified by using statistical data analysis via Polynomial Regression.

## ACKNOWLEDGEMENT

All praise to the Almighty Allah S.W.T, first and foremost I would like to take this opportunity to dedicate my endless gratitude, sincere appreciation and profound regards to my supervisor, Dr Siti Wahidah Binti Puasa and my co-supervisor, PM Dr Kamariah Noor Binti Ismail and Dr Putri Nadzrul Faizura Binti Megat Khamaruddin for the advice, guidance and motivation in insisting me with this project. The research opportunity I had was a great chance for learning and professional development. Therefore, I consider myself as a very lucky individual as I was provided with an opportunity to be a part of it. Without their support and sharing the knowledge, I would not be able to complete this project successfully.

Furthermore, I would like to express my deep appreciation to Mr. Mohd Nazmi Mukelas, and Mrs. Roswati Hasim as laboratory assistants for their careful and precious guidance which were extremely valuable for my study both theoretically and practically. Their mentorship was truly appreciated. I would like to take this chance to deliver my appreciation to the staffs of Chemical Engineering for providing all sorts of service and guidance during my research period for taking part in useful decision & giving necessary advice and guidance and arranged all facilities to make life easier. Hence, I would like to send my pleasure and appreciation to my friends for giving me a lot of advice and guidance when I was conducting my research project.

Lastly, I would like to thank and express my greatest pleasure to my parents for their love and moral support during my research period. I perceive as this opportunity as a big milestone in my career development. I will strive to use gained skills and knowledge in the best possible way, and I will continue to work on their improvement, in order to attain desired career objectives. I had done my best and I am grateful to have a chance to have a meaningful moment and experience during the research period.

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