UNIVERSITI TEKNOLOGI MARA

EMULSION LIQUID MEMBRANE FOR COPPER AND CADMIUM REMOVAL

NURUL FADWAH BINTI MOKHTAR

Bachelor of Engineering (Hons)
Chemical

July 2019

ABSTRACT

ELM is a multiple water-in-oil-in-water (W/O/W) emulsion system that consists of three main phases, membrane phase, internal phase and external phase. The aim of this research was to remove cadmium and copper using ELM and to identify the best physical condition to achieve maximum solute removal using ELM. Three parameters involved are pH of external phase, stirring speed and phase ratio as function of extraction time. To prepare membrane phase, surfactant (Span 80), carrier (D2EHPA) and diluents (kerosene) were mixed and HCl was added as internal phase at varying ratio from 1:1, 3:1, 5:1 and 10:1 of membrane phase to internal phase. The mixture was then homogenized by using ultra-speed homogenizer at various speeds starting from 5000 rpm to 15000 rpm. This mixture was then mixed by using agitator with different time at speed starting from 300 rpm to 700 rpm. Each sample was collected and analyzed using Atomic Absorption Spectrophotometer (AAS) to determine the copper and cadmium concentration. The percentage of copper and cadmium removal was calculated using the data obtained. The best pH was at 4 and 400 rpm was identify as the best stirring speed with 1/3 as the best phase ratio. It took 20 minutes for copper and 10 minutes for cadmium to achieve highest removal.

ACKNOWLEDGEMENT

In the name of Allah S.W.T the Most Gracious and the Most Merciful, I hereby Nurul Fadwah binti Mokhtar would like to thank Allah S.W.T for his never-ending grace, mercy and provision for allowing me in completing this research project.

First of all, I would like to give an immense gratitude to my very amazing supervisor, Sir Meor Muhammad Hafiz Shah Buddin for his never-ending support, motivation and guidance besides sharing his knowledge and helping me for these past two semesters in completing this research project. His endless courage and kindness could not be repay and I pray for his success in future.

Next, I would like to express my gratitude towards my family especially my parents for their encouragement and support in helping me completing this project. Thank you for giving me strength and guidance and teach me how to be a better person in future.

Last but not least, I express my gratitude and give credits to my beloved friends for always there for me and help me throughout these years. Without them, it will be hard for me to complete this project. I hope that Allah S.W.T will give them endless blessing.

TABLE OF CONTENT

CHAPTER ONE
INTRODUCTION

1.1 Research Background

Heavy metal contamination in aquatic source or wastewater is one of the biggest concerned for a development country. There are many types of heavy metals which include lead, mercury, cadmium, chromium, copper, zinc and many more. However the release of high amount of heavy metals will create environmental problem and it will create a serious health problem if human body contaminated with heavy metals (Akpor et. al, 2014). Water contamination due to heavy metals is a serious environmental problem which needs to be analyzed and extensively discussed (Chiha et al., 2010). A huge amount of volume of waste water is discharged every year by many industries such as mining, metallurgy and smelting industries and this lead to a huge amount of heavy metal ions produced. For environmental and economic consideration, these metals ions should be recovered (Ma et al., 2017).

Hence a method is chosen to remove the heavy metal in a wastewater and it is emulsion liquid membrane. Emulsion liquid membrane for metal extraction is formed by forming water in oil (W/O) emulsion that stabilized by surfactant which the emulsion will contain the metal extractant(carrier) which is copper and having stripping acid in the internal phase.

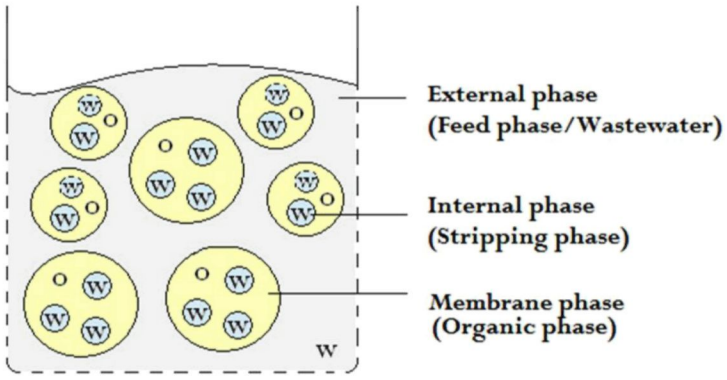

Figure 1.1 : Three phases that present in W/O/W emulsion where O =Oil and W = Water.(Martinelli et al., 2015)

The reason why ELM is used in extracting the copper is it will removed the equilibrium limitations of solvent extraction by combining extraction and stripping in