UNIVERSITI TEKNOLOGI MARA

REGENERATION STUDY OF SPENT NICKEL CATALYST BY USING MICROWAVE TECHNIQUE IN OLEOCHEMICAL INDUSTRY

MOHD QAEDI FAIZ BIN ABDUL AZIZ
2016250216

BACHELOR OF ENGINEERING (HONS) CHEMICAL

July 2019

ACKNOWLEDGEMENT

Firstly, I wish to thank God for giving me the opportunity to embark on my Degree and for completing this long and challenging journey successfully. My gratitude and thanks go to my supervisor Zalizawati Abdullah, and Dr Siti Shawalliah.

My appreciation goes to the engineer and staff from Emery Oleochemical Sdn. Bhd. who provided the samples and assistance. Special thanks to my colleagues and friends for helping me with this project.

Last but not least, I owe my deepest gratitude to my beloved parents and family for always supporting me throughout the journey. They have always encouraged me to be patient and strong.

ABSTRACT

The presence of organic or inorganic residues, spent catalysts are classified as hazardous wastes which potentially pose a harmful effect on the environment and human health that requires compliance with stringent environmental regulations. Also the cost and demand of nickel has been rising significantly. Regeneration of spent catalyst is a method to revive the function of the spent catalyst same as fresh catalyst. In this research, regeneration technique is achieved by using microwave trough existence of oxygen. The objectives this study is to compare the characteristics between fresh and spent Nickel catalyst, and to study the regeneration of Nickel catalyst using microwaves technique. Microwave technique was used with existing of oxygen gas set at 1 L/min through all the experiment. The parameter that is investigated was power (300W, and 600W) and time (30 mins, and 60 mins). Characteristic of the fresh, spent and regenerated Nickel catalyst was investigated in term of its surface area and porosity distribution by using BET, BJH, Horvath-Kawazoe, Dubinin-Radushkevich and Dubinin-Astakhov. Also thermal characteristics using Thermal Gravimetric Analysis (TGA) and X-Ray Diffraction (XRD).

TABLE OF CONTENTS

Table of Contents

1. INTRODUCTION

Oleochemical industries in Malaysia are one of the important roles to fulfil the global need for oils and fats sustainably. Base on Malaysian Palm Oil Council (MPOC), Malaysia currently accmodate for 39% of world palm oil production and 44% of world exports. A unique characteristic of the palm fruit is that it able to produced two types of oil which are crude palm oil (CPO) from the fibrous mesocarp, and crude palm kernel oil (CPKO) from the seed or kernel. It is estimated that for every 10 tons of palm oil, about 1 tons of palm kernel oil is also obtained. Although both oils originate from the same fruit, palm oil is chemically and nutritionally different from palm kernel oil.

Palm oil is extracted from the mesocarp of the palm tree fruit. According to the statistics, Malaysian's palm oil contributes about 13% of total vegetable oil production in the world in 2011. Out of the main products of the palm oil industry, which crude palm oil (CPO) and crude palm kernel oil (CPKO), normally it undergoes processed by physical refining process, for example distillation and purification process, that will turned into more quality oil for further end use application. In addition, Palm oil has a composition of unsaturated and saturated fatty acids. This composition is edible oil that is suitable for use in a variety of food applications. Besides that, to separate this oils, fractionation process is required that will transfer oil into liquid and solid fractions. The result of fractionation is palm oil can be fractionated into liquid (olein) and solid (stearin) components.

Table 1.1: Fatty acid composition for Crude Palm Kernel Oil (CPKO) and Crude Palm Oil (CPO)

Fatty Acid Composition	Crude Pam Kernel Oil (CPKO)	Crude Palm Oil (CPO)
Lauric Acid (C12)	**47.6 – 50.0**	**0.2 – 3.6**
Myristic Acid (C14)	**14.6 – 18.6**	**1.0 – 2.5**
Palmitic Acid (C16)	**8.6 – 13.6**	**37.2 – 47.6**
Stearic Acid (C18:0)	**2.0 – 3.8**	**4.4 – 13.3**
Oleic Acid (C18:1)	**13.7 – 16.5**	**29.9 – 40.7**

(Suria & Yusoff, 2014)