UNIVERSITI TEKNOLOGI MARA

SURFACE MODIFIED MALAYSIAN CEIBA PENTANDRA (L.) GAERTN. AS NATURAL OIL ADSORBENT

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ABSTRACT

The risk of oil spills escalate as the petroleum industry growing and the toxic hydrocarbons released to the environment are harmful to both animals and living things. Producing a cost-efficient and environmental-friendly sorbent are fundamentals. Sorbent must not leave traces of harmful chemicals which may later on affect the nature. Adsorption technique by using kapok fiber has been proven to be the most promising method compared to the other oil-containment approaches. Kapok have an excellent hydrophobic-oleophilic structure. In this study, four-hour esterification of fatty acids (oleic acid and decanoic acid) at 50˚C±5˚C modified the surface characteristics of the kapok fiber to investigate the effects on the oil sorption and dynamic oil retention capacity using the standard F726-99 (ASTM, 1998c). This research focused on analyzing the sorption capacity of raw kapok and its modified versions in accordance to the variation of oil viscosity (diesel, engine oil, and light crude oil). In addition, the experimental results were compared with adsorption isotherms models which are Langmuir and Freundlich to identify the sorption behavior of the adsorbent. Raw, oleic grafted, and decanoic grafted kapok show high sorption intake for crude oil; 66.50g/g, 73.22g/g, and 79.27g/g respectively. Raw kapok shows highest sorption for diesel (50.41g/g) and engine oil (60.32g/g). However, the modified versions of kapok show better dynamic retention capacity compared to the raw kapok. Malaysian raw kapok and the modified versions all follows the Langmuir isotherm model.

TABLE OF CONTENT

CHAPTER ONE
INTRODUCTION

1.1 Research Background

Since the oil industry running our wheels of life for years, many positive and negative contributions have been seen. The industry stabilizing our economies and machineries as it kept on growing. However, there are several environmental concerns about the growing industries which is oil spill contamination. In the oil industry, risks of oil spill during producing, transporting, as well as refining processes are high. The oil spill contamination's concern and its study is not a strange discussion topic recently because a lot of major disasters happened in the past few years. In the event of oil spill, immediate action must be taken in order to prevent the hydrocarbons from devastating the environment and habitat. Numerous oil spill containment methods have been introduced to solve this problem and avoiding any further complications. Oil spill containment method by using natural sorbents caught an attention because it is reliable in terms of cost, ample in nature, bio-degradable, and high absorptivity whereas synthetic sorbents can be harmful to the environment. In addition, sorption technique is an extra efficient method to contain the oil spreads on the seawater (Wang et al., 2013). In the era of growing and competitive advanced technologies, engineers and scientists ought to find the best improvised natural sorbents.

Protecting the environment is the main duty and must be put to attention when it comes to the selection of sorbents because we need to reduce any additional risks from worsening the incident. Natural sorbents are good option and it comprises in various dimension, origin, and sorption capability. Studies shown that kapok fiber is the most suitable organic sorbent compared to the others due its unique surface characteristics'. Kapok fiber is a yellowish cellulosic-lignin fiber and can be found as the fruit pod of *Ceiba pentandra* which known as kapok trees. The tree grows in abundance mostly in South-East Asia, especially in the rainforests. Kapok fiber is light-weighted with good water repellence and was previously used as life-jackets filling. Kapok fiber has properties such as huge hollow lumen, high buoyancy, and hydrophobic-oleophilic structure (Zheng et al., 2014). These special characteristics made kapok fiber as an excellent candidate towards removing spilled light oils, crude