Available online at www.sciencedirect.com

ScienceDirect

APCBEE Procedia 9 (2014) 108 – 112

Procedia APCBEE

www.elsevier.com/locate/procedia

2013 5th International Conference on Chemical, Biological and Environmental Engineering (ICBEE 2013)
2013 2nd International Conference on Civil Engineering (ICCEN 2013)

SEM Study of Oil Adsorption on the Surface of Khaya Senegalensis Dried Leaves

Ziyad Said[a,*] and Habsah Alwi[b]

[a,b]*Faculty of Chemical Engineering, Universiti Teknologi MARA, 40450 Shah Alam, Selangor, Malaysia*

Abstract

Untreated produced water contains numerous substances that can cause harm to the environment such as dispersed and dissolved oil, heavy metals, and production chemicals. Dispersed oil content in produced water may vary with different oil wells. Dispersed oil in water is classified as toxicants to human beings and marine life. The focus of doing this research is to study the oil adsorption characteristics of dried Khaya Senegalensis leaves in produced water and to investigate the effect of temperature on oil adsorption efficiency of the dried leaves. Khaya Senegalensis dried leaves were chosen for the research because they are considered as natural waste that exist in abundance in the environment. The results from SEM analysis showed that adsorbed oil patches appeared on the surface of the leaves. This is due to the leaves' rich phytochemical constituents which is lipophilic in nature. However, an increase in temperature of the solution will result in the decrease in the number of adsorbed oil patches on the surface of the leaves. This is due to the leaching of these phytochemical constituents into the surrounding solution which reduces oil adsorption efficiency of the dried leaves.

Selection and peer review under responsibility of Asia-Pacific Chemical, Biological & Environmental Engineering Society

Keywords: Khaya Senegalensis dried leaves, surface morphology, scanning electron microscope (SEM), produced water, oil and grease, oil adsorption

1. Introduction

Petroleum is the main source of energy in today's society. The production of petroleum increases throughout the years as to cater the rise in global demand for oil and gas. However, petroleum is produced

* Corresponding author. Tel.: +60126810227.
E-mail address: ziyadtlb@gmail.com; habsahalwi@salam.uitm.edu.my

2212-6708
Selection and peer review under responsibility of Asia-Pacific Chemical, Biological & Environmental Engineering Society
doi:10.1016/j.apcbee.2014.01.020

with large amount of waste. Produced water contributes 80% of the liquid waste [1][2].

Oil and grease content in produced water can be divided into two types, which are dissolved oil and dispersed oil. Dissolved oils which consist of benzene, toluene, ethylbenzene, and xylene are the main organic compounds in produced water while dispersed oils are small droplets of oil suspended in liquid phase and they contain less soluble hydrocarbons [3][4]. These types of oil are very harmful to the surrounding environment and can cause physiological damage and cancerous effects to living creatures [5].

Over the years, numerous technologies have been established in order to treat produced water. As for the treatment of produced water using medium filtration, it will help reduce waste in the environment if natural waste was utilized as a filtration medium. Hence, this research focuses on using leaves of the common Khaya Senegalensis tree that exist in abundance all over Malaysia. To date, not much research has been carried out on the potential of Khaya Senegalensis active properties in adsorbing and eliminating dispersed oil and grease especially in produced water.

Khaya Senegalensis is sometimes called as African mahogany. The tree is categorized under the species of plant in the Meliaceae family and is found mostly in the African continent [6]. In Malaysia, this type of tree has been used as shade trees and has been planted throughout most major urban cities. These trees are crucial towards developing a greener environment in urban areas. As a major problem, the falling leaves of the trees become an abundant waste on the streets. As such, this research will focus on studying the useful characteristics of the leaves on adsorption of oil and grease from produced water, turning abundant waste into something useful.

2. Methods and Materials

2.1. Materials

Khaya Senegalensis trees are found almost everywhere around Universiti Teknologi MARA (UiTM), Shah Alam. The leaves of these trees were collected from the surrounding environment inside the university area. Approximately one kilogram of dried Khaya Senegalensis leaves was collected. The engine oil used was SAE40 PETRONAS Mach 5 Mineral Engine Oil. This engine oil was used because of its high flash point of 256°C [7]. A high flash point ensures that no oil will be vaporised when heating the solution.

2.2. Equipments

A Mamoth laboratory oven was used to dry the leaves. Retsch SM100 type grinder was used to grind the leaves. Scanning electron microscope (SEM) machine model Gemini was used to analyse the surface morphology of leaves. Prior to examination, the surface of the adsorbents was coated with gold approximately 30nm using Sputter Coater Polaron SC 515 due to the nonconductive characteristics of the adsorbents.

2.3. Preparation of Adsorbents

Khaya Senegalensis leaves were washed with deionized water to remove any impurities. Then, a Mamoth laboratory oven was used to remove moisture content in the leaves at 70°C for 24 hours. Dried leaves were then grounded using Retsch SM100 grinder to obtain 1mm size particulates.

2.4. Adsorption Process

500 ml of distilled water was placed in 3 quantities of 800 ml beakers. Then, 3ml of engine oil were added