RECOVERY OF SPENT BLEACHING CLAY FOR REUSE IN WATER TREATMENT

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DEDICATION

Buat ibubapaku dan ahli keluargaku yang tercinta di
seluruh Malaysia Barat, abang-abang angkatku yang tersayang
di Sekudai, Batu Pahat, Kuantan, Kota Kinabalu dan Kuching,
serta murid-muridku di KUKTEM
yang kuibaratkan satria kerjayaku…

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ABSTRACT

The objective of this research is to reuse spent bleaching clay for treating polluted water, instead of disposing it. The spent bleaching clay is disposed by all palm oil refineries after the completion of crude palm oil bleaching process, which gives negative effects to economy and environment. In this research, three steps are practiced as its experimental methodology to recover the clay, which are the oil extraction from the clay by using alcohol for 1 hour, the excess gum removal from the extracted clay by using hot water for 1 hour and finally burning the clay by using pyrolysis method for half an hour, with the temperature range from 400 ^{0}C to 650 ^{0}C. The combusted clay was then tested using polluted water from river and lagoon pond as reagent. In this experiment, the untreated spent bleaching clay was used as control, and the distilled water was used as standard pure water. The parameters used for this experiment are the adsorption performance for the clay and the quality of the polluted water. The findings of the experiment were investigated from the pH and ultra-violet spectrometry results obtained from the polluted water; and the output was, the recovered clay neutralizes polluted water (from pH 4.0 to pH 6.5; and from pH 9.0 to pH 7.5; which the safe range of water: $6.5 \leq$ pH of water ≤ 7.5) and decolorizes it (from dirty water to clean colourless water); and improves the quality and usage safety of the polluted water. Thus, the recovered spent bleaching clay is applicable in water supply treatment.

ABSTRAK

Objektif kajian penyelidikan ini ialah untuk mengguna semula tanah lempung peluntur terpakai untuk merawat air tercemar, di sebalik melupuskannya begitu sahaja. Tanah lempung peluntur terpakai ini dilupuskan oleh kilang-kilang penapisan minyak sawit setelah selesainya proses pelunturan minyak sawit mentah, yang memberi kesan negatif kepada ekonomi dan alam sekitar. Dalam kajian ini, tiga langkah telah dilaksanakan sebagai metodologi eksperimen untuk merawat tanah lempung tersebut, iaitu pengekstrakan minyak dengan menggunakan alkohol selama 1 jam; penyingkiran pepejal gam minyak dengan menggunakan air panas selama 1 jam dan membakar tanah lempung tersebut secara pirolisis selama ½ jam, dengan suhu di antara 400 ^{0}C hingga 650 ^{0}C. Tanah lempung tersebut diuji dengan menggunakan reagen air tercemar dari sungai dan kolam lagun. Dalam eksperimen ini, tanah lempung peluntur terpakai dijadikan sampel kawalan, manakala air suling dijadikan sebagai air tulen piawai. Parameter yang digunapakai dalam eksperimen ini ialah prestasi penjerapan tanah lempung tersebut dan kualiti air tercemar. Hasil eksperimen tersebut ditentusahkan daripada keputusan ujian pH dan spektrometri ultra-ungu yang diperolehi untuk air tercemar; dan hasilnya ialah tanah lempung yang telah dirawat itu meneutralkan air yang tercemar (pH 4.0 kepada pH 6.5; dan pH 9.0 kepada pH 7.5; dengan tahap selamat untuk air: $6.5 \leq$ pH air ≤ 7.5) dan menyahwarnakan air tersebut (air kotor kepada air jernih tanpa warna), dan seterusnya memperbaiki dan mempertingkatkan kualiti dan keselamatan penggunaan air berkenaan. Maka, tanah lempung peluntur terpakai yang telah dirawat ini boleh digunakan dalam perawatan bekalan air.

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CHAPTER 1

INTRODUCTION

1.1 Introduction

Spent bleaching clay is one of the waste materials, which is disposed at palm oil refineries in Malaysia. Spent bleaching clay treatment brings benefits for both vegetable oil refining process and for environmental protection. The treatment process for spent bleaching clay is carried out in Pasir Gudang, Johor, where spent bleaching clay supplied is treated with hexane as solvent, using solvent extraction method. However, the treatment cost for clay is high because of hexane supply.

This study introduces the alternative way for recycling spent bleaching clay, instead of using organic solvents, which are expensive and have a high risk usage.

1.2 Research Background

1.2.1 Spent Bleaching Clay Disposal

Spent bleaching clay is usually disposed into landfills by palm oil refineries. The accumulated spent bleaching clay disposal in big scale for a long term period may cause the following problems:

(1) Overspill landfills
(2) Reduce supply of clay
(3) Increase the cost of clay to be used by refineries

Figure 1.1 shows the statistics of spent bleaching clay that is disposed annually by Delima Oil Products Sdn. Bhd., a palm oil refinery company in Selangor. Meanwhile Figure 1.2 shows the cumulative spent bleaching clay disposal by the same company for five years, from 1998 to 2002 [108].

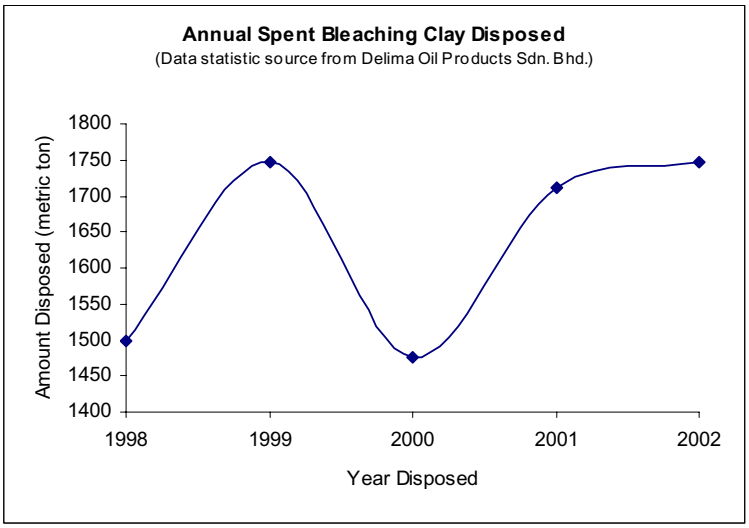

Figure 1.1: Annual spent bleaching clay disposed from 1998 to 2002 at Delima Oil Products Sdn. Bhd., a well-known palm oil refinery [108].

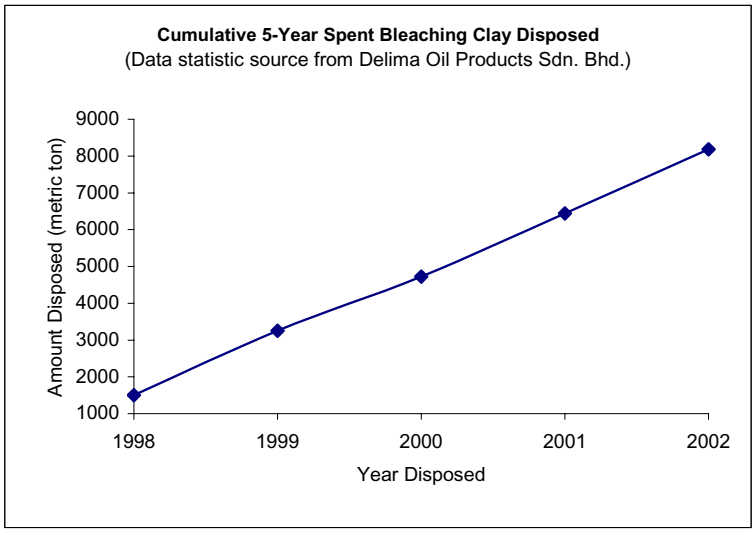

Figure 1.2: Cumulative spent bleaching clay disposed within 5 years at Delima Oil Products Sdn. Bhd., a well-known palm oil refinery [108].

According to both figures, the amount of disposed clay increases as time goes on. For example, in 1998 the palm oil refinery disposed 1,500 metric tons of spent clay. After 5 years operation, in 2002, the total of disposed spent clay reached 8,184 metric tons. Although the ratio of the spent clay to the bleached crude palm oil is quite small (1 kg clay to 154.11 kg bleached palm oil), the continuous spent clay disposal will have a negative impact on the palm oil industry itself and also on the environment.

In 1999, a research group from the Malaysian Palm Oil Board (MPOB) reported that the residual palm oil wastes obtained from the spent bleaching clay contain valuable substances that can be used in health, automotive and medical sectors [109]. Based on the group's research paper presented, it was recommended that spent bleaching clay should be recycled, with a certain treatment method, which is simple, practical and applicable.

1.2.2 The Importance of Bleaching Clay in Palm Oil Industry and Its Relationship with Research

Bleaching clay is a bleaching agent in the crude palm oil bleaching process, which is the second stage of the palm oil refining process. In the bleaching process, the reddish cloudy and colloidal crude palm oil is bleached to produce a red or golden transparent palm oil. Bleaching clay plays an important role in oleochemical industries, because it has an important property; the voids or pores. The pores of the clay attract certain components of crude palm oil to 'stay' and trap inside them. Continuously, the crude palm oil is bleached and decolorized from colloid to transparent. For this reason, the clay is categorized as bleaching clay because of its natural bleaching function, and it is used widely in oleochemical industries.

In this study, the spent bleaching clay was treated first and then tested for its adsorptivity inside the laboratory. The first experiment on the treated spent bleaching clay had been carried out. Methylene blue indicator was used as standard adsorptivity analysis for activated carbon, so this indicator would be applied to bleaching clay to observe its availability on the clay. It was found that the indicator was available for testing clay. However, the cost of methylene blue indicator is high, so it was replaced with river water, in doing an extended study and a follow-up experiment. River water was used as reagent in this study, instead of methylene blue indicator because of a correlated current study of Selangor River water. The study of Selangor River water had found that water quality from several locations alongside the river was acidic, because of presenting residual wastes from palm oil industries.

1.3 Objectives

The objectives of this study are:

(1) To reuse spent bleaching clay from palm oil refineries for treating polluted river water
(2) To reduce bleaching clay disposal problem

1.4 Scopes

The scopes of this study are as follows:

(1) The sampling works of spent bleaching clay from a palm oil refinery, river water from Selangor River, and lagoon sludge from a palm oil mill factory.
(2) The practical technique of treating spent bleaching clay using cheap materials and simple treatment method.
(3) The comparison between the two-step treatment method (a. Wash spent bleaching clay with hot water; b. Burn the clay in closed system vessel) with the three-step treatment method (a. Extract residual oil from spent bleaching clay with solvent; b. Wash the clay with hot water; c. Burn the clay in closed system vessel).
(4) The performance of the recycled spent bleaching clay for treating polluted river water.
(5) The acidity and clarity of the river water after being treated by recycled bleaching clay.

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