



Recovery of Base Oil from Waste Sludge Using Ultrasonic Solvent Extraction Method

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Abstract

Nowadays, waste sludge is commonly treated using biological, chemical and physical processes such as land farming, land filling, and incineration. However, those methods consume a lot of time, energy and operating cost. Thus, this work targets to recover the base oil from waste sludge using ultrasonic solvent extraction method. It was done by determining the effect of ultrasonic power, extraction time and types of solvent used into the samples. The treatment of waste sludge using Hexane, Isopropyl alcohol (IPA) and Potassium hydroxide (KOH) as a medium solvent was conducted using ultrasonic bath (maximum power is 240W) at a different number of power scales, 0, 2, 4, 6, 8 and 9. The effects of treatment duration have been tested at different times which are 15, 30, 45, 60, 75 and 90 minutes. The types of solvent have been analyzed between the effect of Sodium chloride (NaCl) and Potassium hydroxide (KOH). The samples were then separated using a centrifuge machines in order to remove sludge particles at the bottom of centrifuges tubes. Based on the results obtained, it can be determined the optimum base oil recovery from waste sludge at 30 minutes with ultrasonic power at 53.3W which is on the power scale number 2 using KOH as a medium reagent. A characterization of waste sludge and recovered based oil such as viscosity, density, moisture content, flash point and ash content have been done using American Society for Testing and Material (ASTM) method. From the results, it can be conclude that ultrasonic treatment has been proved as an effective treatment of waste sludge and able to get high yield which was 65% of base oil recovery compared to the conventional treatment only achieved 30% which can save disposal cost, produce new valuable product of base oil as a raw material of lubricant oil and at the same time protect the environment.

Keywords: Waste sludge; solvent extraction; ultrasonic treatment; base oil recovery; ASTM

1. Introduction

Waste sludge means the residual waste oil products generated during the normal operation such as those resulting from the purification of fuel or lubricating oil for main or auxiliary machinery, separated waste oil from oil filtering equipment, waste oil collected in drip trays, and waste hydraulic and lubricating oils. Unfortunately, waste sludge ends up directly into the environment are due to general public discharging it onto the ground, drains and directly into landfills as a trash or burned in incinerator. Each year, every oil refinery plant in Malaysia is performing an inspection of their scheduled waste that controlled and monitored by Department of Environment (DOE) in order to comply with legal and regulations. Approximately, each tank will produce 100-200 tonne of sludge oil depend on the capacity of the tank. This scheduled waste emulsion is disposed to Kualiti Alam (Malaysia Waste Disposal Authorized Company) at RM

3,000.00 per tonne. From this situation, the industry need to spend lots of money to dispose their waste. Thus, to overcome this problem recycling helps to reducing the energy used, and minimizes the amount of fuel usage which is turn reduces the amount of harmful pollutants in the environment.

Nowadays, base oil produced by recycling waste sludge is an important aspect need to be considered in an oilfield industry. This is because majority an industry there faced major problems to manage their own facilities due to high cost to build waste treatment facilities and it contributes harmful to the people and environment. Currently, waste sludge is commonly treated using biological, chemical and physical processes such as land farming, land filling, and incineration. However, those methods have a lot of disadvantages such as to be time and high energy