Research Article

Biomass Modification Using Cationic Surfactant Cetyltrimethylammonium Bromide (CTAB) to Remove Palm-Based Cooking Oil

Amira Satirawaty Mohamed Pauzan [iD] **and Normala Ahad**

Faculty of Resource Science and Technology, Universiti Malaysia Sarawak, 94300 Kota Samarahan, Sarawak, Malaysia

Correspondence should be addressed to Amira Satirawaty Mohamed Pauzan; mpasatirawaty@unimas.my

Adsorption based on natural fibre seems to widely used for oily wastewater recovery due to its low cost, simplicity, feasibility, easy handling, and effectiveness. However, oil sorbent based on natural fibre without modification has low adsorption capacity and selectivity. Thus, this paper proposes chemical modification of sago hampas to improve its adsorbent efficiency for the removal of palm-based cooking oil. The chemical modification was performed using a cationic surfactant, cetyltrimethylammonium bromide (CTAB). The chemical and surface properties of both unmodified and modified sago hampas were characterized by Fourier-Transform Infrared (FTIR) and Scanning Electron Microscopy (SEM). Parameters studied for the removal of cooking oil using modified sago hampas were sorption time, adsorbent dosage, and initial pH. The removal capacity was also compared using unmodified sago hampas. The results showed that additional functional groups were introduced on the surface of modified sago hampas. Modified sago hampas also showed a greater porosity than unmodified sago hampas. These properties enhanced the adsorption of palm-based cooking oil onto the surface of modified sago hampas. Modified sago hampas shows better removal of palm-based cooking oil than unmodified sago hampas, where 84.82% and 68.08% removal were achieved by modified and unmodified sago hampas, respectively. The optimum adsorption of palm-based cooking oil was identified at 45 min sorption time, pH 2, and 0.2 g adsorbent dosage.

1. Introduction

Oily wastewater is a big issue in the world since it is a persistent environmental pollutant [1]. Oily wastewater can come from a number of different sources such as waste cooking oil that enter the water from kitchen. River and lake contaminated with oil can have devastating effects on the water environment. Many methods have been introduced to reduce and minimize oily wastewater but the quality of the water seem to be far from satisfactory and contribute to serious physical effect to ecology. Oil is dispersed over the water surface and form oil layer. It could reduce oxygen supply to the water and eventually lead to death of aquatic life forms. There are a few methods that have been developed to reduce and minimize oil contaminant in water including physical, mechanical, biological and photochemical recovery, and filtration but these methods are not very efficient in removing different types of oil and slow in removal of oil, and it is of high cost [2].

Adsorption process have been reported as the most efficient method since it does not require additional chemical and large amount of energy particularly adsorption by activated carbon. However, activated carbon is difficult to regenerate due to its strong interaction with adsorbed molecule [3].

A new method has been introduced which is adsorption using natural fibres for oily wastewater where the method is very effective, simple, and low cost [4]. Many natural fibres have been utilized as oil sorbents such as sugarcane baggase, sawdust, barley straw, rice husk, wool, kapok, and grass [5–8]. These natural fibres are the best oil sorbent since it is low cost, sustainable, and abundant compared to the other sorbent.

Sago hampas is a natural fibre scientifically known as *Metroxylon sagu*. It is the main commodity crop of Sarawak, Malaysia, and potentially can be used to remove oil [9]. Sago