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The Use of Cellulose from Palm Oil Empty Bunches for Water Filters

SajaratudDur, Abdul Halim Daulay
Faculty of Science and Technology, Universitas Islam Negeri Sumatera Utara, Medan, Indonesia
*Corresponding Author: sajaratuddur@uinsu.ac.id

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Abstract:*This study aims to obtain water that is suitable for use in bath water or industrial water. This research utilizes natural resources, namely empty palm oil bunches from palm oil plantation waste.The location of palm oil plantations is in North Sumatra. The water sample is use which the water from the canal in the Medan Johor in Medan Subdistrict area. Invertigation did in Laboratory of Base Chemistry Faculty of Mathematics and Scientific Universitas Sumatera Utara for 3 months in 2018. Empty palm oil bunches used are empty bunches that are not from palm oil mills but from empty bunches that fail to have fruit. This was chosen so as not to go through the process of separating palm oil. The sample water was analyzed before treatment and analyzed after treatment. Analysis of the quality and quantity of water consists of the content of Mg, Fe, and Cu. The empty palm oil bunches of palm are processed to produce alpha cellulose. Cellulose is tested with FTIR. The results of this study are expected to meet water quality standards for bath water and industrial water. Cellulose is able to filter canal water that has not been contaminated by industrial wastewater into proper water for bath water and industrial water.*

Keywords: *Cellulose, empty palm oil bunches, and water filter.*

INTRODUCTION

The use of raw materials from nature rather than synthetic raw materials is a long-standing environmental issue. This is related to some of the advantages of natural raw materials such as being more environmentally friendly and of considerable potential and renewable. The 25-year-old palm plantations will be rejuvenated to cause organic waste from oil palm trees. To reduce and also add value to these empty palm oil bunches various efforts have been made. If the palm oil is burned it will pollute the air and can cause an increase in global warming. The purpose of this study is to obtain cellulose from empty palm oil bunches as a water filter and obtain water analysis before and after water purification.

The solid waste of palm oil trees in the form of palm oil trees / trunks and palm oil fronds are 2,257,281 and 514,480 tons / year respectively. In 2006-2010 there was an increase in the area of palm oil plantations that were rejuvenated, namely the annual average of 89,965 ha (Ridwansyah, 2006).

The particle size is directly related to the surface per gram of filler. The smaller the particle size the higher the interaction between filler and polymer matrix (Ismail, 2000). The surface area can be increased by the presence of porous surfaces on the filler surface so that the polymer is able to penetrate into the porous surface during the mixing process (Kohls and Beaucage, 2002). Surfaces that have pores and non-uniform shapes can increase binding capacity (Hanafi et al. 2005).

Cellulose derived from empty palm oil bunches contained lignocellulose with the main components of cellulose (49.95%), lignin (16.46%), and hemicellulose (22.84%). Empty palm oil bunches is a palm oil processing industry waste of 10 million tons / year in Indonesia (Loebis, 2008). Cellulose is insoluble in water, provides a rigid structure to the walls of wood cells, and its fibers are more resistant to hydrolysis than starch. Cellulose reactivity depends on the structure (Baumann and Conner, 2003). The properties contained in cellulose include good mechanical properties, low density, and the ability to decompose depending on the nature of cellulose used (Zimmerman, et al., 2005).

METHODS

The research procedure has 3 stages, namely the stage of cellulose supply, filtering, and characterization. Cellulose is provided from the leaching process of empty palm oil bunches. The empty palm oil bunches are cleaned and soaked with water then dried. Then cut into pieces with a size of about 10 cm, soaked with 2% NaOH in a 1000 ml beaker glass for 24 hours. Then in it 2% NaOH was added and evaporated using autoclave for 2 hours at 130ºC and a pressure of 180 kPa. Pressure is released suddenly. Then the beaker glass is removed from the autoclave and the sample in the beaker glass is washed to a neutral pH. Then the sample was bleached using 10% H_2O_2 while heated at 70ºC for 3 hours. Then the sample is filtered and washed with water to a neutral pH. Then the sample is dried in an oven at 60ºC and is called cellulose fiber and characterized using FT-IR.

River water screening using cellulose fiber is the volume of river water measured as much as 600 ml and poured into a beaker glass. Cellulose fiber is weighed with variations of 2, 8, and 14 grams respectively. Cellulose fiber is placed on filter paper No. 1 and river water is passed through the cellulose fiber and stored in erlenmeyer. River water is characterized (analyzed) the levels of Fe, Mn, and Cu using an atomic absorption spectrophotometer (AAS).

RESULTS AND DISCUSSIONS

The results of this study are presented as follows. Cellulose produced from processing empty palm oil bunches has been tested by FT-IR as follows.

TABLE 1: Functional Groups of FT-IR Cellulose Spectrum from Empty Palm Oil Bunches

Wave Numbers (cm-1)	Function groups
3000-3400	O-H
2900	$C\text{-}H_{metil}$
1650-1700	C=O
1300	C-O

Fig 1: Empty Palm Oil Bunches that have been cleared.

Fig 2: Filtering sample water (river water) using alpha cellulose

In the above process it is expected that impurities and other compounds in the water sample can be bound to cellulose according to their functional groups (O-H, C-H, C = O, and C-O).

The following shows the results of the water analysis of several sample variations. In the table it can be seen that there are differences in the amount of Fe, Mn, and Cu metals in the sample as in table 4.2 below.

TABLE 2: Water Analysis

No	Sample name	Amount of Fe (mg/L)	Amount of Mn (mg/L)	Amount of Cu (mg/L)
1	River water	1,523	0,283	<0,008
2	AS 2	0,753	0,137	0,009
3	AS 8	0,756	0,096	0,009
4	AS 14	0,904	0,125	0,010

Information:

AS 2 is river water with 2 gram cellulose filtration.

AS 8 is river water with 8 gram cellulose filtration.

AS 14 is river water with 14 gram cellulose filtration.

The sample above was analyzed qualitatively. This is done before and after the treatment of absorption and purification. The results can be seen there are differences in the number of impurities that can be reduced from the absorption and purification process. In the results of the water analysis in table 4.2 it is shown that the water sample that has the best or optimal metal content is a sample of AS 8 (river water with filtration of 8 grams of cellulose).

But when showed from the color of the water sample, the sample has undergone a change in color so that the color that has been absorbed has been attached to cellulose. This research has succeeded in absorbing the color of the sample so that the sample becomes clearer in plain show.

CONCLUSSIONS AND SUGESTIONS

The conclusions obtained are on the following: Alpha cellulose obtained from oil palm empty bunches as a water filter, obtained from cellulose functional group test results, optimal water analysis is on the use of 8 gram cellulose.

The sugestion obtained are on the following: The results of the research can be used and need to be studied further to reduce costs.

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