APPLICATION OF ACTIVATED CARBON FROM PINEAPPLE CROWN WASTE AS CRUDE *PALM OIL* (CPO) ADSORBENT WITH ACTIVATION TIME VARIATION USING NaOH 1M

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ABSTRACT - This research aims to examine the use of pineapple crown waste as raw material to produce active carbon, which is then applied as an adsorbent in the absorption of Crude Palm Oil (CPO). Pineapple crown waste is a potential source that has not been utilized optimally, while CPO is an oily material that often pollutes water. Activated carbon is produced through activation using 1M NaOH with varying activation times (1.5 hours, 2 hours, 2.5 hours). This research includes physical and chemical characterization of the activated carbon produced, as well as assessing the ability of the activated carbon to absorb CPO. The results showed that activation time had a significant effect on the properties of activated carbon, including surface area and adsorption strength on CPO. This research makes a positive contribution in managing pineapple crown waste and reducing environmental pollution due to CPO, while also

opening up opportunities for the development of environmentally friendly adsorbents in the palm oil processing industry.

Keywords: activated carbon, adsorbent, *Crude Palm Oil* (CPO)

1. INTRODUCTION

Indonesia was the largest producer of crude palm oil (CPO) in the world in 2012, producing around 25.4 million metric tons. Most of the CPO, around 65%, is exported as raw materials, while the remaining 35% is used for domestic needs, such as the manufacture of cooking oil, margarine, shortening and biodiesel. CPO has a main composition of triglycerides as much as 94%, with minor content including tocopherol, sterols, pospatides and carotenoids which are one of the important components in CPO [1]. Some techniques that can be used to extract carotenoids from Crude Palm Oil (CPO) include extraction using supercritical fluids [2] and adsorption using adsorbents [3]. Adsorption is the most widely used method of bleaching because it tends to be faster and easier to do. In this method, the carotenoids contained in CPO will interact with adsorbents used to bind carotenoids without a chemical reaction so that the CPO used does not change chemically. In addition, the adsorption process can be carried out at room temperature so that it does not require large energy consumption. A number of types of adsorbents have been tested to absorb β-carotene from CPO, including the use of rice husk ash, silica gel, alumina, clay, palm shells, and activated carbon.

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types of adsorbents have been tested to absorb β-carotene from CPO, including the use of rice husk ash, silica gel, alumina, clay, palm shells, and activated carbon [4].

Activated carbon is one of the most common types of adsorbents used in adsorption processes. This is because activated carbon has a higher adsorption ability and a larger surface area when compared to other adsorbents [5]. One type of waste that can be used as raw material for making activated carbon is pineapple waste in the form of pineapple crowns. Pineapple (Ananas comosus L. Merr) is a plant that has optimal growth in tropical and sub-tropical regions. Usually, people use pineapple fruit to be consumed directly or process it into various types of food and drinks.

Pineapple plantations usually produce solid waste in the form of kuluts, leaves, and crowns which are often unused and only become a source of waste around them. According to[6], pineapple crown contains components such as cellulose around 69.5-71.5%, pentosan around 17.0-17.8%, lignin around 4.4-4.7%, and ash around 0.71-0.87%, as well as proteins and other substances. These components allow pineapple crowns to be processed into activated carbon through activation and carbonization processes, and have the ability to be adsorbents. Therefore, the use of these components is a good alternative to reduce the waste produced by pineapple crowns.

This research aims to examine the use of pineapple crown waste as raw material to produce active carbon, which is then applied as an adsorbent in the absorption of Crude Palm Oil (CPO).

2. RESEARCH METHOD

2.1 Materials and Tools

The tools used in this research Furnace, Magnetic stirer, Funnel buncher, Erlemeyer, Measuring cup, Hot plate, Vacuum pump, Beaker glass, Oven, Blender, Analytical balance, Burette, Stative, pH indicator, Volume pipet, Desiccator, Trya pan, Filter paper, Sieve 100 mesh, Stirring rod, Suction rubber, Stop watch.

The materials used in this reseacrh Crude palm oil (CPO), NaOH, Aquades, and Pineapple crown fiber.

2.2 Research Procedure

This research procedure begins with the preparation of raw materials to be used by separating them from the dirt attached to the pineapple weevil. Then proceed with the manufacture of activated carbon, namely by carbonizing pineapple weevils to get activated carbon after which pineapple crown carbon activation is carried out using activators, namely NaOH (Sodium Hydroxide), and CPO adsorption is carried out with activated pineapple weevil activated carbon that has been activated.

2.2.1 Preparation of Raw Materials

Preparation of raw materials begins with the sampling of pineapple crown waste. Then carry out the washing process on the pineapple crown sample and pineapple crown cutting which aims to remove dirt attached to the pineapple crown. After the pineapple crown waste sample is clean, drying is carried out first using sunlight and continued with the drying process using an oven at 105oC to ensure the pineapple crown has dried.

2.2.2 Pineapple Crown Carbonization

The stages of carbonization are carried out by means of a dried pineapple crown weighed as much as 100 grams. The pineapple crown sample is filled into the rector and put into *the furnace* for carbonization process at a temperature of 300ºC with a time of 1 hour. The results of the carbonization process are cooled and smoothed using a *chopper*.

2.2.3 Carbon Activation

The activation carried out in this study is chemical activation. Performing chemical activation, 2 grams of carbon or pineapple crown charcoal were soaked in 20 ml of NaOH solution with a concentration of 1M (ratio 1 : 10) with time variations of 1.5 hours, 2 hours, 2.5 hours. Pineapple crown is put into NaOH (Nartrium Hydroxide) solution and continued with stirring using a *hot plate* and *nagnetic stirrer* for 1 hour. Stirring is carried out so that the solution becomes homogeneous. Then the washing process is carried out using filter paper and aquades solution with the help of a vacuum

pump until the washing pH 7 (neutral) is obtained. After washing, proceed with the drying process using an oven at a temperature of 105ºC with a time of 12 hours so that it becomes activated carbon.

2.2.4 Adsorption Test

For the first step, prepare activated carbon and Crude Palm Oil (CPO) in a ratio of 1: 5 in a beaker glass. After that, the mixture is heated using a hot plate to reach a temperature of 60ºC and then homogenized using an electric motor at a constant speed of 12 rpm. After reaching the desired temperature and homogenization, the mixture is taken periodically every 2 minutes until it reaches an equilibrium state. The last step, the sample is filtered using filter paper.

In β-carotene, the adsorption process is carried out in a beaker glass with a weight ratio between activated carbon and palm oil of 1:3. Next, the mixture is heated using a hot plate to reach a temperature of 40ºC and homogenized by using an electric motor at a speed of 120 rpm for 2 hours. After that, the mixture is filtered using filter paper. After the filtering process is complete, the mixture is transferred into a container for analysis.

3. RESULTS

The quality of edible oil is determined by several factors, among others, peroxide number, free fatty acid content and oil color [7]. Therefore, the analysis carried out is the analysis of free fatty acid levels, peroxide number and oil color.

3.1 Carbon Activated

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Figure 1. Activated Carbon

3.2 Adsorption

The adsorption test was carried out using a hot plate and glass beaker with a ratio of 1: 3 for 2 hours at a speed of 120 rpm at a temperature of 40^{o}C.

Figure 2. Adsorption

The presence of carotenoids produces a red-yellow color. Carotenoids are highly oil-soluble compounds and have many unsaturated bonds. When oil is hydrogenated, a hydrogenation reaction occurs in carotenoids resulting in a reduced red color. In addition, heating can also reduce the color of these pigments because carotenoids are unstable at high temperatures. These pigments tend to oxidize easily, which can cause the oil to become rancid.

4. CONCLUSION

This research includes physical and chemical characterization of the activated carbon produced, as well as assessing the ability of the activated carbon to absorb CPO. The results showed that activation time had a significant effect on the properties of activated carbon, including surface area and adsorption strength on CPO. This research makes a positive contribution in managing pineapple crown waste and reducing environmental pollution due to CPO, while also opening up opportunities for the development of environmentally friendly adsorbents in the palm oil processing industry.

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