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

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Abstract

Activated carbon is carbon that has been activated by a chemical substance so that it has a higher absorption capacity compared to ordinary carbon. This research aims to determine the use of pineapple crown waste as raw material for making active carbon which is then used as an adsorbent in the Crude Palm Oil (CPO) adsorption process. 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 an activation time of 1 hour and data analysis using SEM-EDX analysis. This research includes the physical and chemical characterization of the activated carbon produced, as well as assessing the ability of activated carbon to absorb CPO. The research results show that activation time has 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, as well as opening up opportunities for developing environmentally friendly adsorbents in the palm oil processing industry.

Keywords: *pineapple crown, activated carbon, waste, Sodium hydroxide*

1. Introduction

Human standards of living develop along with the development of economic growth in society. This economic growth is marked by the increase in the industrial sector in the region, but the negative impacts that arise due to the development of the industrial sector are environmental pollution caused by industrial waste. One of the industrial wastes that has a big impact on the environment is industrial liquid waste. The impacts arising from this industrial liquid waste include eurofication, death of fish and plankton, accumulation in fish flesh, especially if the liquid waste contains pollutants such as As, Pb, Cr, Cu, Ni, Zn, NH4 +, etc.

Pineapple (Anenas comosus (L) Merr) is a member of the Bromeliaceae (monocot) family and consists of around 200 species with annual production worldwide of more than 14 million tons. Pineapples originate from Brazil and have spread to various tropical and subtropical countries throughout the world. Agricultural waste is a renewable resource and can be used for biotechnology with the characteristics of being non-toxic, in large quantities, can be regenerated, is cheap and is able to support biomass growth. Pineapple canning factories produce almost 67% waste from pineapples, consisting of 41% skin, 6% core, 20% crown which can cause environmental pollution. Activated carbon is a porous solid that contains 85%-95% carbon. Materials that contain carbon elements can produce activated carbon by heating them at high temperatures. These pores can be used as an absorbing agent (adsorbent). Activated carbon is carbon that has been used

undergoes activation, so the surface area becomes larger because the number of pores is greater. Activated carbon has an amorphous structure with a surface area of 300-35000 m2 /g. Activated carbon with a large surface area can be used for various applications, namely as a color remover, flavor remover, odor remover and purifying agent in the food industry. Apart from that, it is also widely used in the water purification process, both in the drinking water production process and in waste handling.

Industrial waste is a major pollution problem because it contains heavy metals which have toxic properties, and is not biodegradable, so heavy metal waste requires special handling. Adsorption as a liquid waste processing method is more widely used because it is cleaner, more efficient and cheaper. Adsorption occurs from the interaction between the surface of the adsorbent and adsorbate molecules. Silica gel and activated carbon adsorbents have good adsorption capacity but are relatively expensive. Efforts to find cheaper alternative adsorbents have recently increased, especially alternative adsorbents originating from nature or bioadsorbents.

Bioadsorbent is a solid substance that can be used to absorb certain components from a fluid phase. Bioadsorbents can be made from materials containing carbon. One of the wastes that can be utilized is pineapple fruit waste in the form of pineapple crowns. Pineapple production in South Sulawesi in 2015 was 14,071 tons/year. The average weight of pineapple fruit is 1.5 kg/fruit, 1 fruit contains 17% pineapple crown. The composition of the crown consists of 69.5-71.5% cellulose, 4.4-4.7% lignin, 17.0-17.8% pentosans and 0.71-0.87% ash and other substances (proteins etc.) up to 4.5-5.3%.

CPO has chemical contents that can be used as fuel

alternative for making biofuel. The process of making this biofuel can use the catalytic cracking method. The process uses an active carbon catalyst which has good pores for the catalytic cracking process. The catalytic cracking process can break complex hydrocarbons into simpler molecules and can also improve product quality and quantity.

2. Method
This research employs an experimental methode based on existing journals. There are several stages in the production of activated carbon from pineapple crown waste, as follows:

2.1. Preparation of Sample
The samples were cut into 2-3 cm pieces and cleaned with water. Subsequently, the samples were dried in sunlight until they were completely dry. The dried samples were further dried in an oven at 105°C for 60 minutes. The result was dried pineapple crown samples.

2.2. Carbonization
The Samples of dried pineapple crowns were weighed and their weight recorded. The samples were carbonized at 300°C for one hour, and the weight after carbonization was recorded. The sample was then sieved using a 100 mesh sieve.

2.3. Activation
The carbon sample was activated using 1M NaOH solution with a sample to solution ratio of 1:10. Activation is carried out for 1 hour. The samples were then washed with distilled water until a neutral pH was reached, followed by drying at 105°C for 12 hours.

3. Results and Discussion
Activated carbon will be tested using proximate analysis, which includes testing for moisture content, ash content, fixed carbon content, volatile matter content, and iodine number. Proximate analysis of activated carbon involves several critical parameters to assess its quality according to reference standards such as SNI (Indonesian National Standard) 06-3730- 1995 [12]. The maximum moisture content for activated carbon is 15%. The maximum ash content of 10%. The minimum volatile matter content should be 25%. The minimum fixed carbon content is 65%. And the minimum iodine number should be 750 mg/g. Additionally, the activated carbon will be characterized using several instrumental techniques, including BET, SEM-EDX, FTIR and XRD.

3.1.1. BET (Brunauer-Emmet-Teller) Test
The BET (Brunauer-Emmet-Teller) test is common method used to measure the specific area of a material, including activated carbon. Generally, the higher the BET surface area, the greater the microporosity of the activated carbon. Microporosity is a desirable property in activated carbon because these microscopic pores can efficiently capture target molecules [13].

3.1.2. SEM-EDX (Scanning Electron Microscopy-Energy Dispersive X-Ray)
Scanning Electron Microscopy (SEM) is a microscopic technique used to observe the surface morphology of the adsorbent derived from pineapple crown waste. SEM is used to examine the surface of a specific material with the aim of obtaining a more detailed understanding of its structure, both at the micro and macro levels [14]. Energy Dispersive X-Ray (XRD) is an

analytical method typically integrated with SEM. EDX is used to identify the chemical elements present in a sample [15]. By combining SEM and EDX, it is possible to analyze the surface morphology of the sample and identify the elements present in the sample.

3.1.3. FTIR (Fourier-Transform Infrared Spectroscopy)

The FTIR analysis is used to examine activated carbon to identify the functional groups present in the sample and any functional groups that may be lost or altered during the carbonization and activation process. FTIR is an infrared spectroscopy technique that measures moleculer interaction with infrared radiation [16].

3.1.4. XRD (X-Ray Diffraction)

The XRD analysis is a method used to identify crystalline phases in a material. This method works by exposing the sample to X-Rays and measuring how far the X-Rays are diffracted by the crystal lattice structure of the sample. Therefor, XRD can provide information about the crystal structure parameters, such as interatomic distances and lattice plane angles. Additionally, XRD can provide information about particle size within the sample and determine the mineral composition of the sample [17].

From the results of the proximate analysis and characterization tests mentioned above, a comparison of the quality of activated carbon from three different treatments will be evident. These findings are expected to be valuable considerations for future applications. Pineapple crown waste-derived activated carbon can be applied in various fields, such as heavy metal adsorption and palm oil purification.

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