MAKING ACTIVATED CARBON FROM PINEAPPLE PEEL AS CRUDE PALM OIL (CPO) ADSORBENT WITH AN ACTIVATION TIME OF 0,5 HOURS USING NAOH AND TEMPERATURE VARIATIONS AND ADSORPTION TIME

Anggia Dwi Lestari [1),] Nazarudin 2 [*2)]

Corresponding author
https://orcid.org/0000-0002-8404-5999

[1)]*Chemical Engineering, Jambi University, Indonesia*
[2)]*Agricultural Technology, Jambi University, Indonesia*

nazarudin@unja.ac.id

Abstract

Pineapple peel has potential as a raw material for activated carbon because it has high cellulose levels. The purpose of this study is to examine the effect of NaOH concentration, activation time, temperature variation and adsorption time on pineapple peel activated carbon skin as Crude Palm Oil (CPO) adsorbent. The manufacture of this adsorbent is carried out with 3 stages, namely, carbonation of pineapple peel, chemical activation using NaOH solution, and carbon adsorption. The variables of the study were adsorption times of 15 minutes, 30 minutes, 45 minutes, 60 minutes and 75 minutes. And the adsorption temperature is 30°C, 40°C, 50°C, 60°C, and 70°C. Done as 3 repetitions. The results of this study showed an improvement in the quality of Crude Palm Oil (CPO) after being applied to activated charcoal pineapple peel. The longer the adsorption time and adsorption temperature, the better the adsorbent performance produced.

Keywords: *Pineapple peel, Adsorbent, Crude Palm Oil (CPO)*

1. Introduction

Pineapple fruit *(Ananas comosus* (L). Merr) is one type of tropical fruit that grows a lot in Indonesia whose distribution is evenly distributed. Pineapple fruit is usually used by the public for direct consumption or made various kinds of processed foods and drinks. Based on data from the Central Bureau of Statistics 2018, pineapple fruit production in 2018 was 1,805,499 tons. According to (Nurhayati and Berliana, 2014) the waste generated from pineapple fruit production is as much as 27% of the total pineapple fruit production.

According to (Chaokaur, et. al., 2009). Pineapple peel contains 23.39% cellulose; hemicellulose 42.72%; and lignin 4.03%. Where the content of pineapple skin in the form of cellulose, hemicellulose and liginine has the potential as a natural adsoreben. Activated carbon is carbon that undergoes further processing, namely the activation process either physically or chemically so as to make the carbon pore open and increase its surface area but depends on temperature, activator and length of activation time used (Pari, 2007).

Activated carbon is an amorphous compound or solid that is porous and has a large surface area, usually activated carbon is produced from materials containing carbon by heating with high temperatures (Na'fiah, 2016).

The manufacture or development of activated carbon raw materials has been widely carried out, for example the manufacture of activated carbon from coconut shells, various kinds of wood and bamboo, coal, and also materials that have a fairly high carbon content (Miranti, 2012). Making activated carbon consists of two stages, namely the carbonization stage and the activation stage.

Carbonization is the process of burning a biomass using a pyrolysis device with limited oxygen while activation is a process of removing impurities contained in the pores and opening the carbon pores that are covered by carbonization residues. In principle, the activation process of an activated carbon can be done in two ways, namely physical activation and chemical activation (Pari, 2007).

Activated carbon can absorb chemical compounds or gases or its adsorption properties depend on the size or volume of pores, the number of poropory of activated carbon and the surface area of activated carbon. The pore structure of activated carbon is related to the absorption or adsorption of activated carbon, where the more pores and the larger the pore size of an activated carbon, the higher the absorption of activated carbon.

Adsorption is the process of absorption by a solid or an adsorbent on a substance that occurs on the surface of the adsorbent, absorption occurs due to the attraction of atoms or molecules on the surface of the adsorbent (Atkins, 1999).

The absorbency of activated carbon to adsorbate components in a solution or gas is influenced by surface conditions and pore structure. In addition to being influenced by the above factors, activated carbon can also be influenced by the way it is made and how activation is used. There are 2 ways to activate activated carbon, namely physical activation and chemical activation. Physical activation is by flowing CO2 gas or water vapor, while chemical activation is an immersion process using chemicals or called activators. Commonly used activators include ZnCl2, KOH, NaCl, H2SO4 and H3PO4.

2. Research Methods

2.1 Tools and Materials

The materials used in this study were pineapple peel, CPO, aquades, NaOH, label paper, tissue and plastic wrap. The tools used in this study were analytical scales, filter paper, 100 mesh sieves, beakers, measuring cups, ovens, baking sheets, measuring flasks, magnetic stirrrers, hot plates, blenders, pH meters, stirring rods, separator funnels, vacuum pumps, furnaces and laptops.

2.2 Work Procedure

2.2.1 Pineapple Skin Sample Preparation

The pineapple skin obtained was sorted first by choosing good, good and pest-free pineapple skin to be used as a research sample. Pineapple peel samples that have been selected, washed thoroughly using running water and cut into small pieces. After the pineapple skin waste sample is clean, drying is done in the sun and continued with the drying process using an oven at 105°C to achieve dry pineapple skin.

2.2.2 Pineapple Skin Carbonation

Carbonation was carried out referring to the research of Ogata (2011) and Kyzas (2012)[7][8]. Dried pineapple skin samples, characterized by a change in color to brownish-yellow. Then, it is carbonized in a kiln at 3000C for 1 hour. The resulting pineapple peel charcoal is cooled and the yield is calculated by comparing the sample weight before and after carbonization.

2.2.3 Pineapple Skin Carbon Activation

The activation carried out in this study is chemical activation using NaOH activator. First weighed 10 grams of pineapple peel carbon soaked in a solution of 100 ml of NaOH solution with a concentration of 1M (ratio ratio 1:10) for 1 hour. Next, the pineapple peel is put into the NaOH solution and stirred using a magnetic stirrer on a hot plate for 1 hour to make it homogeneous. Then the washing process is carried out using filter paper and aquades solution with the help of a time pump until a neutral pH is obtained from the washing results. After that, drying using an oven at a temperature of 105 ° C 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. After that, the mixture is heated using a hot plate to reach a temperature of 60oC and then homogenized using an electric motor with a constant speed of 12 rpm. Upon reaching the desired temperature and homogenization, the mixture is periodically taken every 2 minutes until it reaches a state of equilibrium. The last step, the sample is filtered using filter paper. In β-carotene, the adsorption process is carried out in a beaker with a weight ratio between activated carbon and palm oil 1:3. Furthermore, the mixture is heated using a hot plate to reach a temperature of 40oC and homogenized 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. RESUTL AND DISCUSSION

3.1 Activated Carbon

The results show that the higher the concentration of the activator and the longer the contact time of the adsorbent with waste, the better the adsorbent performance. Cellulose contained in pineapple skin can be applied into activated carbon because this material can bind metal materials. Cellulose in pineapple peel has three reactive hydroxyl groups and has repeating units that form intramolecular and intermolecular hydrogen bonds.

3. 2 Adsorption Test

Done using a hot plate and beaker glass with a ratio of 1: 3 for 2 hours at a speed of 12rpm at 40 ° C.

4. CONCLUSION

Pineapple peel waste can be used as an adsorbent of liquid domestic waste. The higher the concentration of NaOH used during activation, the more concentrated and dense the adsorban texture produced. There is an improvement in the quality of liquid waste (used cooking oil) after contact with durian bark activated charcoal adsorbents. The higher the concentration of the activator and the longer the contact time of the adsorbent with waste, the better the adsorbent performance.

References

Atkins, P.W. (1999). Physical Chemistry. 4th edition. Irma IK translator, Jakarta: Erlangga. Terjemahan dari: Physical Chemistry

Chaokaur, A., Laikhonburi, Y., Kunmee, C., Santhong, C., Chimthong, S. (2009). Evaluation of nutritive value and sugar carbohydrate of pineapple residue. *Journal Khon Kaen Agr*. 42: 301-306. Columbia University Press. New York.

Chaokaur, A., Laikhonburi, Y., Kunmee, C., Santhong, C., Chimthong, S. (2009). Evaluation of nutritive value and sugar carbohydrate of pineapple residue. Journal Khon Kaen Agr. 42: 301-306. Columbia University Press. New York.

Ibrahim, Hemorrhoids et al. 2015. The Use of Fermented Pineapple Skin in Rations Containing Weeds is Efficacious for Drugs against Fat and Cholesterol of Broiler Chickens. *Journal Agripet* ,Vol. 15, No. 1, p. 20-27.

Joy, pp. 2010. *Benefit and uses of pinaple.* Vazhakulam. India

Mayangsari, N.E., Apriani, M. and Veptyan, E.D. (2019). Utilization of Pineapple Leaf Waste (Ananas Cosmosus) as Cu Heavy Metal Adsorbent. *Journal of Research and Technology*, 5(2): 129-138.

Mejia, danilo. 2005. *Pineapple post harvest operations*. Food and agliculture organization.

Miranti, S., T., Sudibandriyo, M., (2012). Making activated carbon from bamboo by controlled activation method using activating agent H3PO4 and KOH, *research report,* Department of Chemical Engineering, Faculty of Engineering, University of Indonesia.

Nafi'ah, R. (2016). Kinetics of Pb(II) adsorption with activated charcoal adsorbent from Siwalan coir. *Journal of Pharmaceutical Science and Practice*, Vol. I, No. 2, Semarang College of Pharmaceutical Sciences.

Nurhayati, N., &; Berliana. (2014). Changes in protein content and crude fiber of pineapple peel fermented with plain yogurt. *Scientific Journal of Animal Sciences, 15(1)*

Pari G. (2007). Manufacturing Technology and Quality Test of Charcoal, Charcoal Briquettes, and Activated Charcoal. *Seminar of Technical Personnel of HHBK Examiners*. Palembang: Center for Research and Development of Forest Products

Setiawan, A.A., Shofiyani, A. and Syahbanu, I. (2017). Utilization of Pineapple Leaf Waste (Ananas Comosus) as a Basic Material for Activated Charcoal for Fe (II) Adsorption. JKK, 6(3): 66 - 74.

Syauqi, A and Inasari, S.S. (2020) Utilization of Pineapple Skin Waste (Ananas Comosus L.) into Bioethanol with the Addition of Different Yeast (Saccharomyces Cerevisiae). *LOUPE Bulletin*, 16(2).