Adsorption Organic Matter in Peat Water By Mass Variation of Kepok Banana Peel

Mahwar Qurbaniah[1*], Nurdianti Awaliyah[2*]

[1]Program Study of Biology Education, Education Department, Muhammadiyah University Pontianak
*email : mahwar_qurbaniah@yahoo.com
[2]Program Study of Chemistry Education, Education Department, Muhammadiyah University Pontianak
*email : pinkvenusia@yahoo.co.id

Abstract

Kepok banana peel (*Musa acuminate* L.) can be identified functional groups that act as adsorbent are -OH, -COO, and -NH. Products in the form of a biological charcoal adsorbent from kepok banana peel can increase the economic value of a banana peel. This research aims to study the using of the kepok banana peel sour as adsorbent for reducing the content of organic matter in peat water. Parameter observed was the mass of adsorbent. Kepok banana peel that has been obtained from industrial waste bananas fried in Pontianak burned to charcoal. Activated charcoal that has been obtained with a solution of 0.1 M NaOH, washed with 0.1% HCl and distilled water and then dried to constant weight. Furthermore, biological charcoal from kepok banana peels used as adsorbent to reduce the content of organic matter in peat water measured by the decrease in the color intensity of peat water (absorbance measurement) using a UV-VIS spectrophotometer at a wavelength of 254 nm. The results showed a decrease in organic matter content in 70 mL of water peat obtained in 1 gram of adsorbent. This results showed that the adsorbent of kepok banana peel can reduce water content of organic matter in peat water.

Keywords: adsorbents, kepok banana peel (*Musa acuminate* L.), peat water

Introduction

Water is a substance that presence is vital in supporting life and human activity. Need for clean water continues to increase in line with population growth and industry. If this increase is not offset by new sources of supply will lead to a clean water crisis. The condition of water resources in each region varies, depending on the state of nature and human activity were found in the area. In the peat areas, surface water generally available as a source of raw water is still difficult to use for everyday life. This is because the surface of the area colored yellow or brown and contain high organic matter as well as the acidic so it needs special processing before it is ready for use (Darmayanto, 2009)

Peat water in the State of Indonesia is one of the water resources are still abundant, the study Center for Geological Resources Ministry of Energy and Mineral Resources reported that by 2006 the resources of peatland in Indonesia covers an area of 26 million hectares spread across the island of Borneo (± 50 %), Sumatra (± 40%) while the rest are spread in Papua and other islands. Indonesia's peatlands occupy the position of the 4th largest in the world after Canada, Russia and the United States (Tjahjono, 2007).

Based on the above data, the peat peat in Indonesia state quantitatively very potential to be managed as a water resource that can be processed into clean water or drinking water. However, the use of peat water are still many obstacles. One problem is the color yellow or brownish red so it is not feasible to use as clean water or drinking water. The reality faced by people who live in peat areas, especially in the city of Pontianak, West Kalimantan. People living in areas still use peat moss peat water for daily use without prior processing.

In the water treatment process, color is one of the physical parameters used as good quality requirements for drinking water or clean water. The principle that applies in the determination of this parameter is to separate the first substance or dissolved materials that cause turbidity (Effendi, 2003). Studies on water treatment peat that has been done such as coagulation using coagulant-coagulant such as protein moringa seeds, clay or loam (clay) while processing the adsorption of materials that have been used as adsorbents are activated carbon, resins, zeolites and eggshell (Darmayanto, 2009).

Several studies have shown that the coagulation and adsorption is an effective way, it is relatively easy and inexpensive to do to reduce the intensity of the color of peat water. According to Effendi (2006) the main content in the water of peat are a group of humic compounds, namely humic acid, fulvic acid, and humin. The humic compounds that cause the characteristic color of the peat water yellow to reddish brown. The color intensity of peat water is closely linked to the concentration of the compound humatnya, when the color intensity is decreasing the concentration of the compound humatnya reduced. Visually it is characterized by a distinctive color fade peat water up to the colorless state.

Attempts to decrease the color intensity of peat water can be done either by the utilization of waste. Based on this, researchers will try to use the waste from the skin kepok banana (Musa acuminate L.) to be used as an alternative material as adsorbent in the form of bio-active charcoal (Biocharcoal). So far, only a banana peel waste underestimated and not fully utilized. Based on the above, the banana skin kepok will be made into bio-active charcoal and then be used as adsorbent humic substances in peat water.

This study aims to decrease the color intensity of peat water using biological charcoal from banana peels kepok. Products in the form of a banana peel kepok adsorbent is expected to increase the economic value of a banana peel kepok.

Research Methods

Equipment and Materials

Tools:

Centrifuges, sieves, basins, drum (tool making charcoal), magnetic stirrer, trays, analytical balance, oven, glassware in the laboratory, and uv-vis spectrophotometer.

Materials used:

Peat water, distilled water, banana peels kepok, 0.1 M NaOH solution, and a solution of HCl 0.1%.

Procedurs

Charcoal making banana skin

Banana skin as much as 20 kg cleaned of debris with clean water, then dried by the sun. Banana skin was clean and dry inserted into the drum (tool making charcoal) is then burned to charcoal. Once into charcoal, charcoal was allowed to cool to form a banana peel.

Activation of a banana skin biological charcoal

Charcoal that has been obtained in the preceding stage is dried in an oven at a temperature of 105 ° C to remove the water content, and then pulverized with a size of 100 mesh, and then activated with 0.1 M NaOH solution by soaking for 1 hour. Then reheated in the oven at 100 oC. After washing with cold 0.1% HCl and distilled water and dried repeatedly until a constant weight is obtained.

Determination of the optimal volume of water peat

A total of 40 mL water sample peat incorporated into a glass beaker and added 1 gram of charcoal biological banana peel, stirring with a magnetic stirrer and then centrifuged, the supernatant obtained absorbance is measured by uv-vis spectrophotometer at a wavelength of 254 nm. In the same way done for 50, 60, and 70 mL of water samples of peat and measured each with uv-vis spectrophotometer.

Results and Discussion

Preparation of Adsorbent Banana Skin Kepok

In the manufacture of activated carbon, the basic material selection is one of the major factors that can affect the formation of pores, surface area and chemical properties of activated carbon produced. Selection of banana peel as the base material which is to reduce the volume of waste banana peel, and because it has a high cellulose content.

Preparation of activated carbon banana skin begins with the carbonization process, In this process, hydrogen and oxygen which is a non-carbon elements in the material is converted into a gaseous form. In this process also occurs decomposition of the base material and the process of disposing of non-atoms of carbon from the base material. Organic material of the base material is thermally be volatile and carbon atoms will form again (realign) randomly arranged crystal structure resulting from the provision of carbonization temperature (Chowdhury, et al, 2013).

In general, carbon formed by the carbonization process has a coarse pore size with the size is not so large that it can affect the adsorption capacity. Carbon resulting from the carbonization process is easily oxidized when carbon reacts with air, causing pores formed will be enclosed by a gas O2. In addition, the presence of air resulted in the formation of ash in the activated carbon, thereby reducing the quality and quantity of carbonization. Banana skin weighing 20 kg cleaned of feces and dried for ± 5 days, after dried banana skin is burned / carbonized to become active biological charcoal kepok banana peel. Further weighing the biological active charcoal kepok banana skin as much as 78 g of charcoal and then put in the oven at 105oC temperature to remove the water content. After the charcoal is smoothed by using a 200 mesh sieve

Activation Adsorbent Banana Skin Kepok

To increase the adsorption capacity, the size and number of pores in activated carbon, then the activation stage. The activation process is done in two stages, namely the activation of chemistry and physics. Chemical activation of carbon preceded by soaking in a solution of sodium hydroxide (NaOH) 0.1 M for 1 hour. The addition of chemical activators in the activation could damage elements of the non-carbon (contaminant substances) are still present in the carbon covering the surface pores (Affandi, 2011).

Bio-active charcoal activated next banana skin using a solution of NaOH 0.1 M. The purpose of this activation is to enlarge the pore that is by breaking the bonds of hydrocarbons or oxidize molecules so that the surface of the biological active charcoal kepok banana skin changes either physics or chemistry, namely surface area increase in size and influence on the adsorption capacity. Through several processes, namely heating at a temperature of 1050C for 60 minutes, then washing with a solution of 0.1% HCl and distilled water, the purpose of laundering using a 0.1% HCl solution is to dissolve the metals, while the washing using

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distilled water for eliminating impurities, and drying the biological active charcoal kepok banana skin repeatedly in the oven (Darmayanti., et al., 2012)

Determination of Optimum Volume

Absorbance of ultraviolet (UV) is used as an indicator of the concentration of organic matter. Correlation between UV absorbance at 254 nm and the concentration of organic material produces a good linear relationship (Benjamin et al., 2005). Characterization of organic materials adsorbed iron oxide coated sand was analyzed using a UV-vis spectrophotometer at a wavelength of 254 nm by measuring the absorbance of peat water before and after adsorbed. A wavelength of 254 nm been at this wavelength fractions of organic materials which consist of groups chromophore absorbs light at 254 nm. The parameters used to determine the optimum pH and optimum mass is the largest percentage that can be achieved after treatment according to the formula:

$$\% \text{ Decrease } (\% \Delta) = \frac{A_0 - A_1}{A_0} \text{ X } 100\ \% \quad (1)$$

Where : A0 = absorbance values agitation without adsorbent
A1 = absorbance values after treatment with an adsorbent

Table 1. Determination of Optimal Water Volume Peat

Volume (mL)	**Awithout adsorbent**	**Awith adsorbent**	**Δ A**	**% Δ A**
40	0,878	0,892	-0,014	1,594
50	0,878	0,729	0,149	16,970
60	0,878	0,756	0,122	13,895
70	0,878	0,690	0,188	21,412

Based on Table 1. It is seen that the largest decrease in absorbance at a volume of 70 mL water the peat that is equal to 21.412%. This means that the optimum concentration of organic substances that can be absorbed by the adsorbent kepok banana skin on the state of peat 70 mL of water. Furthermore, the optimum adsorbent mass measurement and the optimum time shaking

The determination of optimum adsorbent mass

A decrease in absorbance at a wavelength of 254 nm to 70 mL of peat water with 0.1 grams of kepok banana skin can be seen in Table. 2

Table 2. Decrease in absorbance with a variety of adsorbent mass

Mass (g)	**A_{pre}**	**A_{post}**	**∆ A**	**% ∆ A**
0,5	0,890	0,782	0,108	12,135
1,0	0,890	0,473	0,417	46,854
1,5	0,890	0,779	0,111	12,472
2,0	0,890	0,564	0,326	36,629
2,5	0,890	1,283	+0,393	+44,157
3,0	0,890	1,416	+0.526	+59,101

Based on Table 2. Can be seen that the largest decrease in absorbance at 1 gram adsorbent with volume of 70 mL peat water, while at 2,5 and 3,0 gram adsorbent occurred increased of absorbance.

Conclusion

This research was conclused the optimum concentration of organic substances that can be absorbed by the 1 gram adsorbent kepok banana skin on the state of 70 mL of peat water

References

Affandi, F., Hadisi, H. (2011): *Pengaruh Metode Aktivasi Zeolit Alam sebagai Bahan Penurun Temperatur Campuran Beraspal Hangat*. Pusat Litbang Jalan dan Jembatan. Bandung

Benjamin, M. M.; Chang, Y. J.; Li, C. W., 2005, Use Of Iron Oxide-Coated Media For NOM Sorption And Particulate Filtration, Dept. of Civil Enginering, University of Washington

Chowdhury, Z.K., Summers, R.S., Westerhoff, G.P., Nowack, K.O., and Corwin, C.J. (2013): *Activated Carbon: Solutions for Improving Water Quality*. American Water Works Association. USA.

Darmayanti, Nurdin Rahman, & Supriadi, 2012, Adsorpsi timbale (Pb) dan zink (Zn) dari larutannya menggunakan arang hayati (biocharcoal) kulit pisang kepok berdasarkan variasi pH, *Jurnal Akad*. Kim. Vol.4 : 159-165, Palu

Darmayanto, 2009, Penggunaan serbuk tulang ayam sebagai penurun intensitas warna air gambut, *Tesis*, Sekolah Pascasarjana, Universitas Sumatera Utara

Effendi, Hefni., 2003, Telaah kualitas air, Kanisius, Yogyakarta : 61-62

Tjahyono, Eko., 2007, Kajian potensi endapan gambut Indonesia berdasarkan aspek lingkungan. Departemen Energi dan Sumber Daya Mineral (ESDM). Jakarta : 6-14