Proceeding International Conference on Health Science
ocs.unism.ac.id/index.php/ICoHS
Vol. 1
Oktober 2021

POTENTIAL OF KEPOK BANANA PEEL (MUSAPARADISIACA.L.) ACTIVATED CARBON IN REDUCING AMMONIA LEVELS IN BARITO RIVER USING UV-VIS SPECTROPHOTOMETRY

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Abstract

The Barito River has an ammonia level of 0.340 mg/L to reduce ammonia compounds contained in river water, you can use activated carbon where the manufacture of activated carbon can be done using plants such as sugarcane, corn, coconut, and banana peels.Studying the potential of activated carbon from kepok banana peels to reduce ammonia levels in water samples from the Barito River and knowing the effect of contact time.This research was conducted using an experimental method of treatment on the sample and with a post test only control group research design and statistically analyzed with simple linear regression.The results of this study were the Barito River water contained an ammonia content of 0.340 mg/L after soaking with activated carbon for 30 minutes had a content of 0.176 mg/L or a decrease in ammonia levels of 48.23%, at 60 minutes it contained 0.167 mg/L. or a decrease in ammonia levels by 50.88% and at 120 minutes it contains 0.143 mg/L or a decrease in ammonia levels by 57.94%.Based on the results of the study, the activated carbon of the kepok banana peel was effective in reducing ammonia levels in the Barito River water.

Keywords: Adsorption, Kepok banana peel, Ammonia, Barito River, UV-Vis Spectrophotometry

Introduction

The Barito River is the largest and longest river in South Borner. Where the river is still used by the surrounding community as a source of life such as bathing, washing clothes, washing food ingredients to drinking water. Wisdom research results (2020)stated that in the Barito River, Pelambuan Village, West Banjarmasin, there is ammonia contamination where the contamination comes from around the rubber factory river water where at a distance of 2 meters around the rubber factory there is an ammonia concentration of 4,425 mg/L, at a distance of 5 meters around the rubber factory there is a concentration of 4.425 mg/L. ammonia is 3.198 mg/L and at a distance of 10 meters around the rubber factory there is an ammonia concentration of 1.135 mg/L.

NH3 or ammonia compounds have toxic properties if the amount of substances that enter the human body exceeds the amount that can be detoxified by the body. Ammonia levels of 400 – 700 mg/L in water can have short-term or acute effects that can irritate the respiratory tract, nose, throat and eyes.(Murti & Purwanti, 2014)

One way to reduce ammonia levels in water is to use activated carbon that has been activated, either using an acid or a base (Mirsa Restu Adinata, 2013).Activated carbon is a porous solid containing 85-95% carbon, produced from materials containing carbon by heating at high temperatures to obtain a large surface area, where the size is between 300-2000 m2/gr. Carbon structure provides the ability to absorb (Absorb)(Abdi et al., 2016). The results of other studies stated that sugarcane bagasse activated carbon can reduce the levels of ammonia contained in the tofu industrial wastewater in the city of Surabaya where the level of ammonia reduction is 51.8 to 84.6 (Solichah et al., 2018). Azwar Research (2016),states that activated carbon can reduce ammonia levels in tofu liquid waste in the Dama River, Samarinda City by 51.29%, activated carbon can be found in various plants such as sugar cane, corn, coconut and banana peels.

Banana peel is a waste material or waste from bananas, where banana peels are generally not used in real terms so that they are simply thrown away as organic waste or only used as animal feed (Lubis, 2012). The main components of banana peel are cellulose 75%, lignin 20.21%, and fiber 5.1%. Where lignin is a compound that contains relatively high carbon(Abdi et al., 2016). Banana peel can be used as an activated carbon material where the results obtained for the carbonation value reach 96.56% so that the banana peel can have the potential to absorb substances or as an adsorbent (Castro, 2011).). Research result(Jubilate et al., 2016), stated that activated carbon from kepok banana peels can reduce Fe levels contained in groundwater where the groundwater adsorption process is carried out using optimum conditions, namely 3 g activated charcoal mass with pH 4 and a contact time of 10 minutes, from the analysis results obtained adsorption efficiency of 88.47%. The results of another study stated that activated carbon powder from kepok banana peels can also reduce the levels of Cu2+ and Cd2+ where the results of the decrease in the levels of Cu2+ are 25.4% and for the decrease in levels of Cd2+ by 99.18%.(Judge A, Subekti S, 2016). In research from Musafira (2020),said that activated carbon from banana peel kepok is able to absorb mercury metal ions which the research was carried out by varying the contact time, pH and concentration of mercury. The contact times used were 10, 20, 30, 40, 50 and 60 minutes with pH 1, 2, 3, 4, 5 and 6 and with mercury concentrations of 10, 20, 30, 40, 50, and 60 ppm. The results obtained from Musafira's research, namely the equilibrium time in the adsorption process was achieved at a contact time of 30 minutes with an absorption percentage of 61%. 98% and the concentration of mercury obtained the optimum point with a concentration of 40 ppm where the percentage of absorption is 99%(Musafira et al., 2020). So based on the results of the

research above, the activated carbon from the skin of the kepok banana is able to absorb an element or substances that can contaminate water.

In the analysis of ammonia using the UV-Vis Spectrophotometry method where Spectrophotometry is a method that can determine an analyte in a quantitative and qualitative way based on the interaction between matter and light. The advantages of Spectrophotometry are that it is easy to use, has a high level of accuracy and precision and has a low detection limit (Fruit et al., 2017).

Based on the description above regarding the presence of ammonia compounds in the Barito River and the activity of activated carbon contained in banana peels, it is able to absorb these ammonia compounds. So that researchers are interested in conducting research "Potential of Kepok Banana Peel Activated Carbon in Reducing Ammonia Levels in the Barito River Using UV-Vis Spectrophotometry Method". activated carbon contained in the banana peel of kepok fruit, determine the percentage decrease in ammonia levels after being given activated carbon of banana peel kepok, and analyze the effect of time interval on the administration of activated carbon banana peel to reduce ammonia levels in river water.

Materials and Methods

The sampling location is on Jl. Barito Hulu, in Pelambuan Village, West Banjarmasin District, Banjarmasin City which contains ammonia which is precisely adjacent to a rubber factory. The research was conducted in November 2020 – August 2021. This research is an experimental study with the aim of seeing differences between groups or Post Test Only Control Group Design. The unit of analysis used in this research is banana tree bark and water in the Barito River. The variables used in this study were the level of ammonia in the water in the Barito River and the activated carbon substance in the kapok banana peel. The analysis used in this research is univariate analysis in the form of descriptive analysis and inferential analysis.

Results and Discussion

Banana Peel

The banana kepok material used is purchased directly at the traditional market after which it is separated between the skin and the fruit, which is used only the skin as much as 500.00 grams, then washed and separated from dirt, then cut into small pieces and dried in the sun until it dries and turns brown. The dried banana peel material is put into a stainless steel container and then put into a kiln for burning at 400°C for 2 hours after burning the activated carbon, weighed and obtained 80 grams, then cooled and mashed.

Chemical Activation

The chemical activation process is a process to increase the volume and enlarge the diameter of the pores of the activated carbon with the addition of chemicals so that the absorption capacity of the activated carbon is greater. Chemical activation plays an important role in the size and pore area of activated carbon (Saptati, 2018). From the chemical activation of this study, 500 ml of 1M HCl was used to soak 80 grams of activated carbon (Atmoko, 2012).

Characteristics of Kepok Banana Peel Activated Carbon

Water Content Test Analysis

Moisture content is a test of the water content in the material to be used, the water content test is to determine the quality of the charcoal produced. 5 grams of activated carbon from kepok banana peel was taken and then put in an oven at 105-110°C for 3 hours or until it got a constant weight. The results of this study have a water content of 2.47%

Calculation of the water content of activated charcoal using the standard SNI No. 01-2891-1992 with the formula:

$$\text{Water content} = = \frac{a - b}{a} \text{ x } 100\% \frac{24{,}2 \text{ gram} - 23{,}6 \text{ gram}}{24{,}2 \text{ gram}} \text{ x } 100\% = 2.47\%$$

a = initial weight of activated carbon (g)

b = final weight of activated carbon (g)

Ash Content Test Analysis

Ash content is also referred to as the residue from combustion which has no carbon and calorific value anymore. The ash content test was carried out by taking 5 grams of activated carbon from the kepok banana peel and then heating it at 800 °C for 1 hour, the ash content obtained was 8%. Calculation of the ash content of activated charcoal using the standard SNI No. 01-2891-1992 with the formula:

$$\text{Ash content} = = \frac{b}{a} \text{ x } 100\% \frac{0{,}4\ gram}{5\ gram} \text{ x } 100\% = 8\%$$

a = initial weight of activated carbon (g)

b = final weight of activated carbon (g)

Iodine Absorption Test

Iodine absorption test aims to determine the ability of activated carbon as an absorber of solutes. The results of the iodine absorption test result in a change in the color of the iodine solution: Iodine absorption test aims to determine how much activated carbon is absorbed to absorb dissolved substances. The activated carbon of the kepok banana peel was weighed as much as 1 gram and then soaked with 50 ml of iodine after soaking and then filtered then 10 ml was taken from the filter and titrated with sodium thiosulfate until the yellow color changed to faint then added 1 drop of starch and titrated again until the color became clear The results obtained from the iodine absorption test were 465.75 mg/gram.

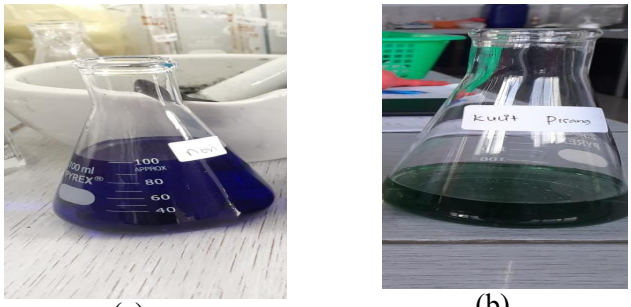
Table 1 Iodine absorption test

Normalitas Kromat	Kalium	Normalitas Natrium Thiosulfat	Volume (Blanko-Titran)	Hasil Iodium
0,1 N		0,1 N	(14ml-6,66ml)	465,75 mg/g

Methylene Blue Absorption Test

The absorption test of methylene blue was carried out to determine the ability of activated carbon to absorb methylene blue substances or dyes.

The result of the absorption test for methylene blue is a change in color to methylene blue.



(a) (b)

Figure 1. Methylene Blue Absorption Tes (a) Before giving activated carbon (b) After being given activated carbon

Quantitative Test

1) Ammonia Calibration Curve

   Determination of the ammonia curve is carried out using the standard series, namely 0.2; 0.4; 0.6; 1 and 1,2 of the ammonia mother liquor were added with phenol, sodium nitropuside solution and an oxidizing solution and then measured with a UV-Vis spectrophotometer at a wavelength of 634 nm. The following results were obtained

   Table 2 Concentration vs. Absorbance Calibrated Ammonia (NH3)

No.	Concentration	Absorbance
1.	0.2 ppm	0.158
2.	0.4 ppm	0.337
3.	0.6 ppm	0.522
4.	1 ppm	0.830
5.	1.2 ppm	0.975

(Prime source, 2021)

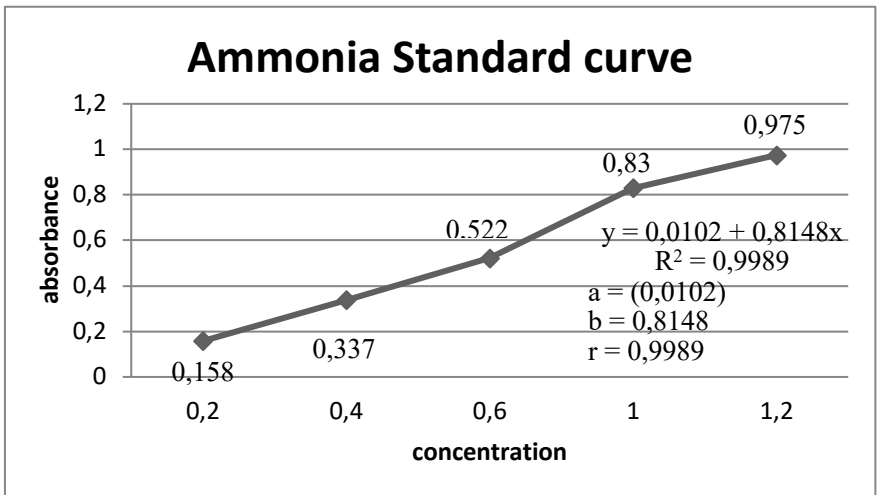


Figure 2. Ammonia Standard Curve

2) Ammonia Concentration (NH3)

Measurement of ammonia levels in river water before the addition of activated carbon and with the addition of chemically activated kepok banana peel activated carbon and calculation of sample concentrations before and after the addition of kepok banana peel activated carbon using the formula y = a+bx the following results were obtained:

Table 3 Results of measurement and calculation of concentration

No	Sample	Absorbance 1	Absorbance 2	Absorbance 3	Average	Concentration (mg/L)
1	0 (not given activated carbon)	0.288	0.289	0.288	0.288	0.365
2	30 minutes	0.154	0.154	0.155	0.154	0.201
3	60 minutes	0.147	0.148	0.147	0.147	0.192
4	120 minutes	0.127	0.127	0.128	0.127	0.168

Table 4 Percent decrease in ammonia levels

No	Giving time	% reduction in ammonia
1	30 minutes	44.9
2	60 minutes	47.3
3	120 minutes	53.9

Based on the results of the quantitative test, it was found that there was a decrease in ammonia levels, seen from the results of river water before adding activated carbon to the kepok banana peel had a concentration of 0.365 mg/L while the results after adding the activated carbon to the kepok banana peel with a time variation of 30 minutes decreased with the yield of 0.201 mg/L or about 44.9% decrease, with a time of 60 minutes it decreased with a yield of 0.192 mg/L or about 47.3% decrease, and with a time of 120 minutes it decreased with a yield of 0.168 mg/L or about 53, 9% decrease.

Statistical Test Data

Table 5 Results of Simple Linear Regression Time with concentration

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	,213	,002		108,454	,006
	Time	,000	,000	-,998	-15,011	.042

Discussion

Banana Peel

The material used is kepok banana peel which according to Adinata (2013)) stated that the kepok banana peel can be used as an activated carbon material which has a carbon value of 96.56. In a study from abdi (2015) stated that kepok banana peels can absorb Fe and Mn substances which can contaminate water. in another study also stated that kepok banana peels can absorb lead (Pb) and zinc (Zn) (Darmayanti, 2012).From the statement of the results of the study, researchers were interested in using activated carbon of kepok banana peels to reduce ammonia levels in the Barito River water where around the river there were rubber factories, traditional markets, residents' residences and public toilets so that there were levels of ammonia in river water.

Making Kepok Banana Peel Activated Carbon

The dried banana peel material was put into a stencil container and then put into a kiln for combustion at a temperature of 400°C for 2 hours after which it was sifted with a 20 mesh sieve. The use of a temperature of 400 °C is pyrolysis which means combustion without contact with outside air where pyrolysis generally begins at a temperature of 200 °C and lasts around a temperature of 450 °C - 500 °C (Sheth and Babu, 2006 in Danarto, et al 2010). This pyrolysis process aims to break down chemical compounds in the kepok banana peel during the pyrolysis process, the presence of heat energy that encourages oxidation so that complex carbon molecules decompose and form carbon or charcoal (Sani., 2008).The process of carbonization or combustion is changing from raw materials to black carbon with a closed space in limited air (Marsono, 2008). The combustion time on activated carbon varies depending on the type of material being processed, for example coconut takes 3 hours, candlenut shells 1 hour and banana peels 2 hours (Kurniati, 2008).The use of a sieve is to reduce the diameter of the size in this study using a 20 mesh sieve, where the smaller the size of the adsorbent, the larger the surface area of the activated carbon so that the absorption will be more effective. (Hidayah et al., 2012)

Chemical Activation

Chemical activation aims to open the charcoal pores which are closed when carbonization is carried out by residual substances during combustion, so that chemical activation will increase the absorption of activated carbon (Atmoko, 2012). From the activation causes an increase in the pores formed from the addition of an activator where the activator will lift impurities from residual compounds from the combustion process, these impurities are wasted during washing. (Jubilate et al., 2016). In this study, the activator used is 1M HCl where HCl acts as an organic mineral solvent so that the surface of activated carbon from banana peels becomes wider. The concentration of activator where the greater the concentration, the stronger the solution to bind tar compounds from the remaining carbonization in the carbon pores so that the absorption capacity is greater but if the concentration is too high it can cause damage to the structure of the activated charcoal pores so that it can result in the presence of organic mineral content. and will reduce the quality of the charcoal (Atmoko, 2012).

Characteristics of Kepok Banana Peel Activated Carbon

a. Water Content Test Analysis

   Moisture content is a test of the water content in the material to be used. The water content test is to determine the quality of the charcoal produced. The determination of the water content test is aimed at knowing the amount of water content contained in the activated carbon produced after going through the activation process contained in the activated carbon. affect the quality of the activated carbon (Novita,2020). The water content test aims to determine the hygroscopic nature of

activated carbon, the hygroscopic nature of which causes activated carbon to be used as an absorbent (Ladiana, 2016). Generally the determination of the moisture content test is carried out by drying in an oven at a temperature of 105-110°C for 3 hours or until a constant weight is obtained. The results of this study have a water content of 2.47%, the results still meet the Indonesian National Standard (SNI 06-3739-95) a good water content in activated carbon is not more than 15%. If the water content in activated carbon exceeds 15%, the smaller the surface area on the activated carbon so that the adsorption capacity will be smaller, activated carbon which has hygroscopic properties which easily absorbs moisture from the air so that if the activated carbon has a high water content it can reduce the quality the absorption of the activated carbon(Susmanto et al., 2020).

b. Ash Content Test Analysis

Ash content is the combustion of materials and ashing at optimal temperatures. The measurement of ash content aims to determine the high mineral content of the material, making the ash by heating 800°C in a kiln, making ash content at a temperature of 800°C for kepok banana peels if the temperature is below 800°C then the ash is not formed properly and also if the temperature exceeds 800 ° C then the ash is lost. Ash content is also referred to as the residue from combustion which has no carbon and calorific value anymore(Novita,2020). Ash content can affect the quality of activated carbon, the presence of excessive ash on activated carbon can clog the pores of activated carbon so that the surface area of activated carbon is reduced (Ladiana, 2016).The ash content test is carried out by heating at a temperature of 800°C for 1 hour, the ash content obtained is 8%, the results still meet the standards where the Indonesian National Standard (SNI 06-3730-95) for ash content in activated carbon is not more than 10% .

Iodine Absorption Test

Iodine absorption test aims to determine how much activated carbon absorbs dissolved substances, where the greater the number of iodine absorption, the greater the ability of activated carbon to absorb dissolved substances (Ladiana, 2016). The activated carbon from the kepok banana peel was precipitated with iodine solution for 1 hour after which the titration was carried out, namely iodometric titration. After the activated carbon has been precipitated, the kepok banana peel is then filtered. After filtering, the iodine solution is titrated with sodium thiosulfate, where the function of sodium thiosulfate is that it is used as a titrant. Titration is carried out until the yellow color in the solution is slightly faint, then starch is added as an indicator when the solution changes color. After that, the titration with sodium thiosulfate is carried out again until the solution becomes clear(Laos et al., 2016). The normality of potassium chromate is 0.1 N, and the normality of sodium thiosulfate is 0.1N after which the iodine absorption is calculated which results in 465.75 mg/g the results obtained are not in accordance with the quality requirements of activated carbon for iodine solution. ie a

minimum of 750 mg/g (SNI 06-3703-1995). Factors that influence the results are the presence of impurities during filtering, less time in immersion so that the absorption of activated carbon against iodine is not perfect.

Methylene blue Absorption Test

The methylene blue absorption test has the same purpose as the iodine absorption test, which is to find out how much absorption of activated carbon from kepok banana peels on dissolved substances. (Laos et al., 2016). The methylene blue solution was given activated carbon and soaked for 1 hour after 1 hour the solution was filtered. The results showed that the absorption of activated carbon from kepok banana peels was not good for methylene blue because the color of methylene blue only changed to turquoise, did not change to clear factor. which affects the results are the presence of impurities when dissolving methylene blue and the less time of immersion.

Quantitative Test

Quantitative data is data related to numbers either from measurement results or the value of a data that is converted from qualitative data to quantitative data such as test scores (Notoatmodjo, 2010). The first quantitative test is testing the level of ammonia (NH3) which determines the wavelength of ammonia which is carried out at the Laboratory of Pharmaceutical Chemistry, University of Sari Mulia Banjarmasin which is carried out by Laboratory Laborers using the UV-Vis Spectroquan 300 Spectrophotometry instrument. From the screening aims to determine the wavelength of ammonia which used a standard solution of 1000 ppm ammonia made by the researcher, the result was 634 nm, which then was used to measure the absorbance of the test sample.

Ammonia testing using the phenate method was carried out because the determination of the level of ammonia which reacts with hypochloride (OCl) then forms a compound (NH2Cl) and also reacts with phenol (C6H5OH) catalyzed by sodium nitropuside (C5FeN6Na2O2) which will produce a blue color of indophenol which forms a blue color. aims to be easily identified using a UV-Vis Spectrophotometer (Murti, 2014)

The results obtained, namely the greater the concentration, the higher the absorbance results, then entered in the excel system which aims to determine the linearity value of the a value curve (0.0102), the value of b is (0.8148) and the value of r namely (0.9899). The equation value of a straight line between concentration and absorbance is that it has a correlation coefficient (r) of 0.9989, where a good r value is a value close to 1

Kepok banana peel activated carbon that has been chemically activated is weighed as much as 5 grams each then put into an erlenmeyer containing 20 ml of river water then allowed to stand for 30 minutes, 60 minutes and 120 minutes manually stirred, after that filtering is then added 1 ml phenol, 1

ml of sodium nitropuside and 2.5 ml of oxidizing solution were left for 1 hour and then measured with a UV-Vis Spectrophotometer. The results of the calculation of the test sample using the formula y = a+ bx obtained results before being given activated carbon that is 0.340 mg/L and after being given activated carbon with a time of 30 minutes that is 0.176 mg/L or as much as 48,23%, with a time of 60 minutes that is 0.167 mg/L or as much as 50,88% and with a time of 120 minutes the results were 0.143 mg/L or as much as 57.94%.

Based on research results from Fauzi in 2020 investigated the Reduction of Ammonia Levels by Using Activated Charcoal of Coffee Grounds where samples were taken from tofu factory wastewater and then tested for ammonia levels before activated carbon which had a concentration of 90.69 mg/L then samples were given activated carbon with variations in time and amount of absorbent. The time used is 30 minutes, 60 minutes, 90 minutes and 120 minutes and the amount of adsorbent is 0.2 grams. 0.4 grams, 0.6 grams, 0.8 grams from these results obtained the best optimum conditions are at a time of 120 minutes with the amount of adsorbent 0.8 grams achieving a decrease in ammonia levels of 97.34%.

In Franciska's research (2016) The Effect of Activation of Charcoal from Kepok Banana Peel Waste as an Iron (II) Adsorbent in Groundwater states that water is the most abundant chemical compound in nature and plays an important role in the cycle of living things. In a study conducted by Franciska that the water used is shallow groundwater. Well water or ground water generally has dissolved cations and anions compounds, one of which is Fe compounds. Changes in water quality in the presence of high Fe content in water can be seen in the physical state of the water, namely from the color and smell. The results obtained from the analysis show that the Fe content in groundwater is 2.8553 mg/L. The adsorption process in groundwater was carried out using activated carbon from kepok banana peels with a mass of 3 g of activated charcoal with a pH of 4 and a contact time of 10 minutes.

The results that have been obtained are then entered into the SPSS system (Statistical Packege For The Social Sciences) with the Simple Linear Regression method to determine the significant difference in the results obtained of 0.042, which means that the value of H0 < 0.05, which means that there is a significant effect on giving time variations in addition of activated carbon of kepok banana peel to decrease ammonia levels. Activated carbon from kepok banana peels can reduce ammonia levels where the longer the time the ammonia levels produced are also lower, the longer the contact time allows the diffusion process and the attachment of the absorbed solute to be better. In this study, the level of ammonia in Barito River water is 0.365 mg/L, which results already meet the standard for ammonia levels, which in Government Regulation no. where the permissible level of ammonia in river water is 0.5 mg/L.

Based on the results obtained indicate that the activated carbon of the kepok banana peel can reduce ammonia levels in the water of the Barito River which is located on Jl. Barito Hulu, in Pelambuan Village, West Banjarmasin District, Banjarmasin City.

Conclusion

Quantitative test using UV-Vis Spectrophotometry the results obtained are activated carbon from kepok banana peels can reduce ammonia levels in the Barito River where before adding activated carbon the ammonia content is 0.364 mg/L after being given activated carbon for 30 minutes there is a decrease in levels of 0.201 mg/L or as much as 44.9%, at 60 minutes the decrease in ammonia levels was 0.192 mg/L or 47.3% and at 120 minutes the reduction in ammonia levels was 0.168 mg/L or as much as 53.9%, and carbon The active kepok banana peel in this study had a saturation time of 150 minutes. In these results, the ammonia in Barito River water does not exceed the standard threshold for ammonia levels, which in Government Regulation no. 82 of 2001 where the permissible level of ammonia in river water is 0,5 mg/L.

Acknowledgments

The author would like to thank Allah SWT because of the abundance of His grace and gifts so that the author can complete this research, not forgetting to also send greetings and sholawat to the Great Prophet Muhammad SAW. The author also expresses his deepest gratitude to Tuti Alawiyah, as supervisor I and to Winda Ayu Fazraningtyas as supervisor II who have provided guidance, direction, and input for this research to completion.

References

Abdi, C., Khair, R. M., & Saputra, M. W. (2016). PEMANFAATAN LIMBAH KULIT PISANG KEPOK (Musa acuminate L.) SEBAGAI KARBON AKTIF UNTUK PENGOLAHAN AIR SUMUR KOTA BANJARBARU :Fe DAN Mn. *Jukung (Jurnal Teknik Lingkungan)*, *1*(1), 8–15. https://doi.org/10.20527/jukung.v1i1.1045

Buah, E., Merah, N., Hylocereus, K., & Uv-vis, R. S. S. (2017). *UJI AKTIVITAS ANTIOKSIDAN DAN PENETAPAN KADAR VITAMIN C EKSTRAK BUAH NAGA MERAH KEUNGUAN (Hylocereus lemairei (Hook.) Britton & Rose) SECARA SPEKTROFOTOMETRI UV-Vis*. *9*(1).

Hakim A, Subekti S, S. N. E. N. (2016). STUDI PENURUNAN LOGAM BERAT Cu2+ dan Cd2+ DENGAN MENGGUNAKAN LIMBAH KULIT PISANG KEPOK (Musa acuminate). *Jurnal Biosains Pascasarjana*, *18*(1), 24–36.

Hidayah, N., Deviyani, E., & Wicakso, D. R. (2012). ADSORPSI LOGAM BESI (Fe) SUNGAI BARITO MENGGUNAKAN ADSORBEN DARI BATANG PISANG. *Konversi*, *1*(1), 19. https://doi.org/10.20527/k.v1i1.83

Jubilate, F., Zaharah, T. A., & Syahbanu, I. (2016). Pengaruh aktivasi arang dari limbah

kulit pisang kepok sebagai adsorben besi(II) pada air tanahJubilate, F., Zaharah, T. A., & Syahbanu, I. (2016). Pengaruh aktivasi arang dari limbah kulit pisang kepok sebagai adsorben besi(II) pada air tanah. Jurnal Kim. *Jurnal Kimia Khatulistiwa*, *5*(4), 14–21.

Laos, L. E., Masturi, M., & Yulianti, I. (2016). *Pengaruh Suhu Aktivasi Terhadap Daya Serap Karbon Aktif Kulit Kemiri*. *V*, SNF2016-MPS-135-SNF2016-MPS-140. https://doi.org/10.21009/0305020226

Lingkungan, D., & Dan, H. (2020). *Verifikasi metode uji amoniak (nh 3) dalam air sungai secara spektrofotometri uv-visible di dinas lingkungan hidup dan kehutanan yogyakarta*.

Mirsa Restu Adinata. (2013). Lembar Pengesahan Pemanfaatan Limbah Kulit Pisang Sebagai Karbon Aktif. *Media Ilmiah Teknologi Pangan*, 30–31.

Murti, R. S., & Purwanti, C. M. H. (2014). Optimasi waktu reaksi pembentukan kompleks indofenol biru stabil pada uji n-amonia air limbah industri penyamakan kulit dengan metode fenat. *Majalah Kulit, Karet, dan Plastik*, *30*(1), 29. https://doi.org/10.20543/mkkp.v30i1.121

Musafira, Dzulkifli, Fadrinah, & Qadrini, L. (2020). Penyerapan Ion Logam Merkuri Menggunakan Arang Aktif Limbah Kulit Pisang Kepok (Musa paradisiaca Formatypica). *KOVALEN: Jurnal Riset Kimia*, *6*(1), 39–44. https://doi.org/10.22487/kovalen.2020.v6.i1.15043

Solichah, A., . R., & Rokhmalia, F. (2018). PEMANFAATAN AMPAS TEBU SEBAGAI KARBON AKTIF TERHADAP PENURUNAN KADAR COD DAN AMONIA (NH3) (Studi Pada Limbah Cair Industri Tahu Dinoyo Kota Surabaya). *Gema Lingkungan Kesehatan*, *16*(3). https://doi.org/10.36568/kesling.v16i3.894

Susmanto, P., Yandriani, Y., Dila, A. P., & Pratiwi, D. R. (2020). Pengolahan Zat Warna Direk Limbah Cair Industri Jumputan Menggunakan Karbon Aktif Limbah Tempurung Kelapa pada Kolom Adsorpsi. *JRST (Jurnal Riset Sains dan Teknologi)*, *4*(2), 77. https://doi.org/10.30595/jrst.v4i2.7309