Medical Laboratory Technology Journal
4 (1), 2018, 21-25
Received 2018-05-25; Received in revised form 2018-06-24; Accepted 2018-06-29
Available online at : http://ejurnal-analiskesehatan.web.id

POTENTION OF ACTIVE CHARCOAL FROM Musa paradisiaca AND Manihot utilissima SHELL IN DEGRADING RIVER CONTAMINATION

Nurlailah, Anny Thuraidah, Yayuk Kustiningsih

Department of Medical Laboratory Technology Poltekkes Kemenkes Banjarmasin
Mistar Cokrokusumo Street 4a Banjarbaru Indonesia.
e-mail: nurlailah874@gmail.com

Abstract: River water is one of type water surface which is a lot of finding in South Kalimantan. Generally, this water used by the citizen for cooking and bathing. But along with era growth, this river becomes as disposal of various industrial waste. The contamination of heavy metal like Fe, Mn, Pb, Cd, and turbidity enhance progressively and degrade the water quality. Some natural substance which can be used to improve river water quality is active charcoal from Musa paradisiaca and Manihot utilissima shell which is easy to get. Target research is determined to find optimum dose of active charcoal from Musa paradisiaca and Manihot utilissima shell that capable to degrade heavy metal contamination and turbidity in water river. It used experimentally with pretest and post-test with control group design. A result of research showed the optimum dose of active charcoal Musa paradisiaca shell was 15 gram , it could absorb Pb 28,8% and Mn 24,6%, but 10 gram can degrade turbidity until 83,8 %, while the optimum dose of Manihot utilissima shell to 25,4% Pb and degraded 77,5% of turbidity was 15 gram. Statistical test result with Kruskal Wallis got the p-value less than 0,05 it meant there was a difference between the treatment of active charcoal from Musa paradisiaca and Manihot utilissima shell in degrading the contamination. A conclusion is those active charcoal having a potential to enhance the water river quality. Suggested to use another activator to the potential like stirring, time of contact and the different mass.
Keywords: active charcoal, Musa paradisiaca shell, Manihot utilissima shell, contamination

INTRODUCTION

Fulfillment of clean water needs has become the common problem and can not solve in most parts of Indonesia in general, including in Kalimantan region. The island of Borneo, especially South Kalimantan, which is famous for its nickname of a thousand rivers, is also experiencing the same problem. The difficulty of citizens in the fulfillment of clean water is inseparable from the increase of human activity with the technological advances in various aspects of life.

One source of water that can be utilized by residents who live in the vicinity of river banks is river water that generally comes from peat soil. Peat river water is under standards for use for bathing, washing and especially for drinking and is further exacerbated by the entry of various types of waste, especially metal waste due to increased human activity aspects of life.

The difficulty of fulfilling the need for clean water will have an impact on the health of the community, namely the outbreak of various diseases such as diarrhea, topical diseases to cancer so it takes a simple water treatment effort that is easy to do by the community, cheap and environmentally friendly. The characteristic of polluted river water is marked by a murky color, causing dermatitis and uncomfortable aroma.

Carbon or activated charcoal is one of the alternatives that can be used to improve the quality of polluted river water. Activated charcoal is an adsorbent material that can absorb various contaminants such as heavy metals, lowering COD, BOD, turbidity and can eliminate the color and aroma that interfere. According to Jusmanizah(2011), activated charcoal is a type of carbon that can be enlarged surface area by way of activated first.

Some natural ingredients that have potential to make activated charcoal are *genjer*, coconut shell, corn cob, rice husk, Manihot utilissima shell, Musa paradisiacal shell, water hyacinth and others. Shell of Musa paradisiaca and Manihot utilissima is a natural waste that is environmentally friendly and available around us, including in the area of South Kalimantan. According to Castro et al. (2011) Musa paradisiacal shell that has been dried and then mixed with water, could clean water from metal cause metal attached to the charcoal of Musa paradisiaca. Adinata research result, M.R (2003), that the shell of Musa paradisiaca contains high enough carbon and after activated with 2N sulfuric acid having carbonization equal to 96,56%. While the results of Rajagukguk (2011) study revealed that Manihotut ilissima shell-activated carbon was able to decrease BOD waste from 1013,2 mg / l to 150 mg / 1 and TSS from 1722 mg / l to 56,4 mg / l with carbon weight active used as much as 1 gram in 200 ml of tofu waste. Jusmanizah (2011), Manihot utilissima shell contains 59.31% carbon that can be used as activated carbon to absorb various chemical compounds in water or liquid waste. Manihot utilissima shell charcoal that has activated with KOH (Yuningsih et al., 2016) or HCl (Supiati at. al., 2013) can improve its adsorption ability.

The shell waste of Musa paradisiaca and Manihot utilissima has not been fully utilized by the local people so this waste is only a pile of waste that is not useful. It is necessary to further explore the utilization of these wastes as an alternative in reducing the level of river water pollution present in Kalimantan, especially in South Kalimantan by making a formula of active concentration of Musa paradisiacal shell and Manihot utilissima shell which is optimal in reducing heavy metal pollution levels, turbidity, pH, color and odor in water. The purpose was to determine the optimum weight of Musa paradisiaca shell active charcoal in reducing heavy metals and turbidity in river water. Determine the optimum weight of Manihot utilissima shell active charcoal in reducing heavy metals and turbidity in river water.

MATERIALS AND METHODS

The type of this research is the experiment with research design using pretest and post-test with a control group. This study has measured heavy metal, turbidity, pH, and river water odor levels before being treated and after being treated with a shell of Musa paradisiaca and Manihot utilissima with the dose of 5gr, 10gr and 15 gr in 250 ml water river. Stirring with contact time between water and carbon for 2 hours, repetition has been done 3 times.

The sample has been burned to charcoal at a temperature of 500^{o}C, sieved with a mesh size of 100 mesh. Activation has been performed using HCl 1 N. Neutral carbon has been dried in an oven temperature of 110oC for 3-4 hours. Water and absorption test against iodine have tested.

The Activated Carbon of Musa Paradisiaca and Manihot utilissima were performed in 3 groups (5gr, 10gr, 15gr) each with 3 repetitions plus control group. The treatment has used 250 ml of river water containing heavy metals (Pb, Cd, and Fe) in contact with activated charcoal for 2 hours. The filtered water has checked for heavy metals parameters (Fe, Mn, Cd and Pb) using the Automatic Absorption Spectrophotometer (AAS) (Shimazu AA-7000), turbidimeter using turbidimetry Lovibond Water Testing, pH using pH meter Horiba D-54 and odor done by directly kissing the aroma of water manually.

RESULTS AND DISCUSSION

The examination material used to test the absorption ability of the shell Musa paradisiaca and Manihot utilissima is river water in Pekauman Martapura with water characteristic as follows:

Table.1 Result of organoleptic examination and pH

Parameter	Contact with Musa paradisiaca and Manihot utilissima shell	
	Before	After
pH	Base (pH : 7,0 – 7,1)	Acid (pH:1,4 – 3,5)
Smell	Fishy	Normal
Color	Cloudy	Clearer

Table 2. Water and Ash Content of the charcoal

Parameter	Analysis results		SNI No.06-3730-1995
	Active charcoal Musa paradisiaca shell	Active charcoal Manihot utilissima shell	
Water	12,4 %	25,3%	Max. 15%
Ash	22,8 %	20,1%	Max. 10%

Table 3. Average metal content and turbidity of river water samples after treatment with Active charcoal Musa paradisiaca shell

Parameter		Content Parameter (mg/L)		
		5gr	10gr	15gr
Fe	Treatment	18,5	16,6	15,4
	Control	18,4	18,4	18,4
Mn	Treatment	11,7	11,9	10,1
	Control	13,4	13,4	13,4
Cd	Treatment	1 1,4	10,9	11,8
	Control	11,2	11,2	11,2
Pb	Treatment	18,8	16,2	13,6
	Control	19,1	19,1	19,1
Turbidity	Treatment	14,3	5,6	9,2
	Control	34,6	34,6	34,6

Table 4. Average metal content and turbidity of river water samples after treatment with Active charcoal Manihot utilissima Shell

Parameter		Content Parameter (mg/L)		
		5gr	10gr	15gr
Fe	Treatment	17,7	16,5	15,9
	Control	18,4	18,4	18,4
Mn	Treatment	11,8	10,5	10,0
	Control	13,4	13,4	13,4
Cd	Treatment	10,7	10,8	10,6
	Control	11,2	11,2	11,2
Pb	Treatment	19,0	17,8	16,1
	Control	19,1	19,1	19,1
Treatment	Treatment	12,3	8,7	7,8
	Control	34,6	34,6	34,6

Table 5. Average of Percentage decrease in metal content and turbidity of river water after contact with Musa paradisiaca and Manihot utilissima Shell

Parameter	Average decrease content (%)					
	5 gr		10 gr		15 gr	
	Musa	Manihot	Musa	Manihot	Musa	Manihot
Fe	-0,54	3,8	9,8	10,3	16,3	13,6
Mn	12,7	11,9	11,2	21,6	24,6	25,4
Cd	-1,8	4,5	2,7	3,6	-5,4	5,4
Pb	1,6	0,5	15,2	6,0	28,8	15,7
Turbidity	58,6	64,0	83,8	74,8	73,4	77,5

Table 5 shows that turbidity parameter is the highest decreases, in 10gr of charcoal Musa paradisiaca shell(83,8%) and 15gr shell of Manihot utilissima (77,5%). While Fe, Mn, and Pb having the highest decreases in 15 g Manihot sp and Musa sp. Cd decreased by Manihot sp. From the normality test results obtained data that not normally distributed because of the significance of the results = 0,000 < 0.05. The data distributed followed by Kruskal Wallis test and got significance value < 0,05 meaning that there is the significant difference in treatment with a shell of Musa paradisiaca and Manihot utilissima.

Furthermore, to know the difference between 2 groups done by Mann-Whitney U different test, ie, in treatment group with active charcoal Musa paradisiaca shell and active charcoal Manihot utilissima shell at all doses (5, 10 and 15gr) showed significant difference of Fe, Mn, Cd, Pb, and turbidity to group without treatment but on treatment with active charcoal Musa paradisiaca shell between 5gr and 10gr for Mn metal content no significant difference. While in the treatment group with active charcoal Manihot utilissima shell only between 5gr and 10gr, 5gr and 15gr, 10gr and 15gr did not show any significant difference in Cd content. (table 4)

Based on the results of the study (table 5) it is known that both Musa paradisiaca active charcoal and Manihot utilissima shell active charcoal have similar ability in reducing heavy metal contamination and turbidity in water even though the decrease is not optimum yet. The metal content and turbidity in water due to absorption ability of Musa paradisiaca leather and Manihot utilissima leather.

Absorption ability of Musa paradisiaca and Manihot utilissima shell caused by their contains high enough carbon element. To optimize the absorption capacity of carbon in the of Musa paradisiaca and Manihot utilissima, several steps must be taken, among others, carbonization or carbon formation with characteristics of a very small pore space and then activation process with the aim of increasing or increasing the pore diameter of carbon with oven at temperature in order to eliminate the water content that may still exist in the. The ability of active charcoal absorption is also affected by the speed of stirring, contact time and warming. According to Syauqiah I., Amalia M., Kartini H.A. (2011) the of contact time and the heating of the shell used decrease water content and increases the adsorption.

Based on table 3 it can be seen that the dosage of active charcoal sample of Musa paradisiaca and Manihot utilissima shell which has the highest absorption ability of metal is at 15gr active charcoal Musa paradisiaca shell (28.8%), with Pb 28.8%, followed by Mn metal of 24.6%. While for active charcoal Manihot utilissima shell, the highest absorption of occurs at 15gr doses of active charcoal Manihot utilissima shell (25.4%) and 10gr (21.6%). So the higher dose of charcoal given the more absorbs the metal contained in water.

The negative value on the results showed that the Musa paradisiaca shell charcoal that has added to the treatment gives effect of adding heavy metals to the examined water. That is, the treatment with 5gr active charcoal Musa paradisiaca shell gives a higher yield of Fe content of 18.5 ppm compared with no 0gr active charcoal Musa paradisiaca shell) that is 18,4 ppm with percentage value decreased -0,54%. Similarly, at 5gr of active charcoal Musa paradisiaca shell give a result of the increase of the metal content of Cd from 11,2 ppm to 11,4 ppm with the value of decrease percentage -1,8 %.

The variation in the ability of shell charcoal of Musa paradisiaca and Manihot utilissima which differs in absorbing the pollutant metal in this research can cause by the heating temperature, type, and concentration of activator materials used and the polarity of the charcoal. According Jamilatun, Setiawan, 2014 temperature is one factor that can affect the ability of active charcoal absorption. In this study used heater furnace for carbonization of charcoal with temperature 400 C for 2 hours. Similar studies using 700oC for shell carbonization Manihot utilissima has a greater ability to absorb Fe metals in water (Ar Yani et al., 2017). The activator used in this study is 0.1 N HCl which may have been contaminated by heavy metals thereby reducing the ability of active charcoal Musa paradisiaca and Manihot utilissima shell to absorb contained in water. Also, the use of HCl as an activator in this study caused the pH of the treated water become acidic, thus affecting the process of metal absorption on the shell of Musa paradisiaca and Manihot utilissima.

The ability to decrease turbidity is one of the parameters tested in this study. The result of turbidity measurements after the river water contacted with active charcoal Musa paradisiaca shell and active charcoal Manihot utilissima shell with various dose variations showed better turbidity absorption ability compared to the absorption ability of heavy metals. The absorption of turbidity in both active charcoal Musa paradisiaca shell and active charcoal Manihot utilissima shell increased with increasing dosage and decreased after 15gr of active charcoal Musa paradisiaca shell to 73.4% from 83.4% (10gr).

Differences in absorption capacity by active charcoal Musa paradisiaca shell and active charcoal Manihot utilissima shell based on doses can caused by differences in the amount of activated carbon and the water content contained in the two charcoal. Based on the result of water level inspection on active charcoal Musa paradisiaca shell and active charcoal Manihot utilissima shell, the water content of active charcoal Musa paradisiaca shell is 12,4%, and active charcoal Manihot utilissima shell is 25,3%. With an active charcoal Musa paradisiaca shell water content of 12.4% allows the active charcoal Musa paradisiaca shell to absorb more suspended materials, colloids and water-smoother particles than the active charcoal Manihot utilissima shell in the same dose (Khopkar, 2003).

CONCLUSION

The optimum weight of Musa paradisiaca active charcoal in reducing metals in water was 15gr (28.8%), and turbidity was 10gr (83.8%). The optimum weight of Manihot utilissima active charcoal in reducing metals in water is 15gr (25.4%), and turbidity is 15gr (77.5%).

REFERENCES

Adinata, M. R. (2003). *Pemanfaatan Limbah Kulit Musa paradisiaca sebagai Karbon Aktif*. Universitas Pembangunan Nasional Vetran Surabaya.

Ariyani, et al. (2017). Pemanfaatan Kulit Manihot utilissima sebagai Bahan Baku Arang Aktif dengan Variasi Konsentrasi NaOH dan Suhu. *Konversi*, *6*(1).

Castro et al. (2011). Bananapeel applied to thesolid phase extraction of copper and lead from river water preconcentration of metal ions with a fruit waste. *Industrial and Engineering Chemistry Research*.

Jamilatun, S., & Setyawan, M. (2014). Pembuatan Arang Aktif dari Tempurung Kelapa dan Aplikasinya untuk Penjernihan Asap Cair. *Spektrum Industri*, *12*(1).

Juzmanisah. (2011). *Efektivitas Karbon Aktif Kulit Manihot utilissima dalam Menurunkan Kadar Besi (Fe) dan Mangan (Mn) Air Sumur Gali di Desa Amplas Kecamatan Percut Sei Tuan, Kabupaten Deli Serdang, tahun 2011*. Fakultas Kesehatan Masyarakat, USU.

Khopkar, S. M. (2003). *Kimia Analitis*. Jakarta: UI-Press.

Rajagukguk, F., H. (2011). *Efektifitas Karbon Aktif Kulit Manihot utilissima untuk Menurunkan Kadar Biologycal Oksygen Demand (BOD) dan Total Suspended Solid (TSS) Air Limbah Pabrik Tepung Tapioka*.

Supiati, Yadi, M., & Chadijah, S. (2013). pengaruh konsentrasi activator asam chloride (HCl) terhadap kapasitas adsorpsi arang aktif kulit durian (*Durio zibethinus*) pada zat warna methanol yellow. *Al Kimia*, 53–63.

Syauqiah I, Amalia M, Kartina H. . (2011). Analisis Variasi Waktu dan Kecepatan Pengaduk pada Proses Adsorpsi Limbah Logam Berat dengan Arang Aktif. *Jurnal Info Teknik*, *12*(1).

Yuningsih, L. M., Mulyadi, D., & Kurnia, A. J. (2016). Pengaruh Aktivasi Arang Aktif dari Tongkol Jagung dan Tempurung Kelapa Terhadap Luas Permukaan dan Daya Jerap Iodin. *Jurnal Kimia Valensi*, *2*(1), 30–34.