# ANALYSIS OF ACTIVE CARBON OF RICE HUSK AND BANANA KEPOK SKIN AS ADSORBENT MEDIA IN REDUCING HEAVY METALS IRON (Fe), TSS AND pH ATKUNDUR RIVER IN SOUTH SUMATRA

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**ABSTRACT:**River water is a natural resource that is a necessity for living things, but until now there has been a lot of pollution caused by industrial activities. Kundur river water pollution occurs because the disposal of industrial waste that is managed ineffectively and the river becomes a place for accumulation of waste disposal from all human activities, causing pollutants to enter the river before finally being channeled into the sea or lake, and at a certain point when the river's capacity for If the pollution load has reached its limit, what will happen is river pollution. So we need a way that can reduce this pollution by using various adsorbents, one of which is activated carbon from rice husks and banana peels. The aims of the study were to determine the quality of activated carbon from rice husks and kepok banana peels with different weight variations, to determine the effect of the effectiveness of activated carbon from rice husks and kepok banana peels, to determine the decrease in levels of heavy metals iron (Fe), TSS and pH, after Adsorption was carried out with activated carbon from rice husks and adsorption with activated carbon from kepok banana peels. This research was conducted by preparing raw materials, carbonization, activation, and absorption of river water content with activated carbon. The results showed that activated carbon of kepok banana peels with a concentration of 20% H3PO4 could reduce iron (Fe) levels from an initial value of 0.52 mg/L to 0.00 mg/L, TSS levels decreased from an initial value of 180.3 to 0.46 mg. /L., and the pH of the acid solution from the initial value of 5.4 to neutral with a value of 7.2. The conclusion is that the activated carbon of banana peel kepok is better than rice husk activated carbon to reduce the content of heavy metal iron (Fe), TSS and neutralize pH.

**Keywords**: *Pollution, Activated carbon, Rice husk, Kepok banana peel, River water.*

## 1. Introduction

Rivers have many roles to support human activities. River water resources can be used as a source of water to meet the needs of daily human life such as bathing, washing, and even drinking water. The river can also be used as a power plant, as a place for tourism, and transportation. Along with the rate of development and population growth, rivers have turned into a place for accumulation of waste disposal from all human activities, especially in urban

areas. This causes the pollutant to enter the river before finally being channeled into the sea or lake, and at a certain point when the river's capacity for the pollution load has reached its limit, what will happen is river pollution which will cause new problems (Aini et al. , 2020).

Aquatic ecosystems that hold water are rivers. Rivers are influenced by many factors, such as human activities around the watershed (DAS) and natural factors. River flows play an important role in life, such as being used as a source of clean water for the domestic and industrial sectors, tourism and water sources to irrigate agricultural land in villages. Watershed as an open ecosystem, the water flows into the sea, receiving various inputs from the outside, both from the highlands to the estuary. The inputs are household waste, industrial waste, agricultural activity waste, soil erosion and landslides (Hahagia et al., 2020).

Recently, it is difficult to get clean water. The cause of the difficulty of obtaining clean water is water pollution caused by industrial, household and agricultural wastes. In addition, the development and looting of forests is the cause of the reduced quality of springs from the mountains because a lot of it is mixed with mud which is eroded by river water. As a result, clean water is sometimes a scarce item (Nugroho et al., 2017).

The Kundur River is a tributary of the Musi River in South Sumatra Province, which is located in Banyuasin I District, Banyuasin Regency. The Kundur River is a small river with a length of approximately 4 km which empties into the Musi River and has an important role, both ecologically and socially. Ecologically, this river contributes greatly to the habitat of various aquatic biota, both in terms of microbiota and macrobiota. Socially, the Kundur river provides many benefits for the community, starting from the upstream to the most downstream, the river is used by the surrounding community for household activities, such as bathing, washing, and latrines (MCK) (Kartika et al., 2015).

Based on the initial analysis carried out at the Chemical Engineering Laboratory of the Sriwijaya Poly Engineering (POLSRI) on April 1, 2021, it was found that the water condition of the Kundur River, Banyuasin 1 District, Banyuasin Regency, South Sumatra Province is for iron (Fe): 0.59 mg/ L , TSS : 180.3 mg/L , and pH : 5.4 river water is acidic.
That the iron content in water can be reduced by using activated carbon as a filter medium. Activated carbon is a kind of absorbent (absorbent), black in color, in the form of granules, rounds, pellets or powder. Charcoal can be used to remove odors and colors in water. Charcoal is a porous solid containing 85-95% Carbon, produced from materials containing Carbon (Aini et al., 2020).

Rice husks and banana peels are waste materials or waste that is quite large in number. Generally, banana peels have not been processed in real terms, only disposed of as organic waste or to feed livestock such as goats or cows while rice husks are usually used for fertilizer. The number of banana peels is quite a lot or about 1/3 of an unpeeled banana. Banana peels are also waste from the banana processing industry but can be used as technology in water purification (Aini et al., 2020).
The purpose of this study was to determine how the quality of activated carbon from rice husks and kepok banana peels with different weight variations in degrading heavy metal content of iron (Fe), TSS and pH in Kundur river water.

## 2. Literature Review

Research conducted (Nurhayati, et.al 2021) Adsorption with a flow rate of 100 ml/minute can reduce total Fe by 99.94% from 1.768 ± 1.14 mg/L to 0.98 ± 0.03 mg/L and total chromium 99, 07% from 48.35± 0.49 mg/L to 0.39±0.00 mg/L, COD 99.17% from 35,485 ± 2.1 mg/L to 286±1.4 mg/L, BOD 99% from 15,052 ± 13.5 mg/L to 149.5±2.1 mg/L, pH 7.05 – 7.25.
(Nurhayati et al., 2020).

Research conducted (Nugroho, et.al 2017) Contact time affects the decrease in heavy metal levels of Pb. The longer the contact time, the higher the decrease in heavy metal content. Contact times of 35 minutes, 75 minutes, and 115 minutes using 10% HCl activator resulted in a decrease to reduce the content of heavy metal Pb by 74.37%, 91.07%, 91.36%. Contact times of 35 minutes, 75 minutes, and 115 minutes using 10% ZnCl2 activator resulted in a decrease in the content of heavy metal Pb waste by 82.76 %, 92.51%, 92.47%.(Nugroho et al., 2017).

Research conducted by (Muhrinsyah Fatimura, et.al 2020) Optimum results were obtained at the composition of 40gr Carbon with 60% NaCl concentration in 500 ml. With the results of the analysis of water content of 10.7%, ash content of 9.55%, volatile matter content of 13.8%, absorption of iodine at 1516.45 mg/gr and pure activated carbon content of 76.65 % then This activated carbon from banana peel waste has met the requirements for activated carbon standards according to SNI 06 3730 1995 (Fatimura et al., 2020).

Research conducted by ((Adeko & Mualim, et.al 2020) Reduction of Fe levels using variations in the thickness of the combination of rice husk waste and kapok skin waste 20 cm is 1.77167 mg/l (63.32%). the thickness of the combination of rice husk waste and kapok skin waste 30 cm was 0.58333 mg/l (87.92%). The decrease in Fe levels using variations in the thickness of the combination of rice husk waste and kapok skin waste 50 cm was 0.44650 mg/l (90 ,75%) (Adeko & Mualim, 2020).

The main compounds of rice husk cell walls are polysaccharides, namely crude fiber, or cellulose, lignin, and hemicellulose which have hydroxyl groups that can play a role in the adsorption process. The -OH groups of cellulose in rice husks are able to react with groups in river water, so that the substances present in river water can be bound to rice husks. In addition, rice husk charcoal is a material that has a high absorption capacity, so that rice husk charcoal can be used as a filling material for the absorption of heavy metals iron, TSS and pH. (Aniska et.al, 2016).

## 3. Research Method

The materials used in this study, namely: rice husks, kepok banana peels, Kundur river water, phosphoric acid solution (H3PO4). The equipment used in this study, namely furnace, grinding, ball mill, evaporating dish, sieving, pH meter, spatula, stirrer, analytical balance, rubber ball, filter paper, desiccator, burette, analytical balance, conductor, oven, magnetic stirrer, desiccators, a set of AAS instruments, and glassware commonly used in laboratories.

The process of making activated carbon consists of three stages, namely the process of preparation, carbonization and activation. Preparation Process: Rice husks and banana

peels are taken as much as 1500 grams and then heated in the sun to dry. After that, the process of reducing the size of the raw materials in rice husks and banana peels aims to produce pores in the activated carbon that will be produced in order to obtain activated carbon with a high surface area. Carbonization Process: Rice husks and kepok banana peels are put into a container and put in a *furnace* to be carbonized. This carbonization process takes place at a temperature of 450oC for ± 50 minutes. After that cool it at room temperature. Then grinded and disieving at 100 mesh. Activation Process:
Rice husk charcoal and kepok banana peel were activated using 20% H3PO4 as much as 20, 25, 30, 35, and 40 gr, stirred for 10 minutes and allowed to stand for 24 hours, then the mixture was filtered and the cake was washed with distilled water. The pH is close to neutral and then dried in an oven at a temperature of about $117^0$C and cooled in a desiccator.

## 4. Results And Discussion

Table 1. Characterization of Kundur river water before adsorption

| | Parameters (units) | Score |
|---|---|---|
| 1. | pH | 5,4 |
| 2. | TSS (mg/L) | 180,3 |
| 3. | Besi (mg/L) | 0,5255 |

*( Source : Analysis in Chemical Engineering Laboratory,Polsri 2021 )*

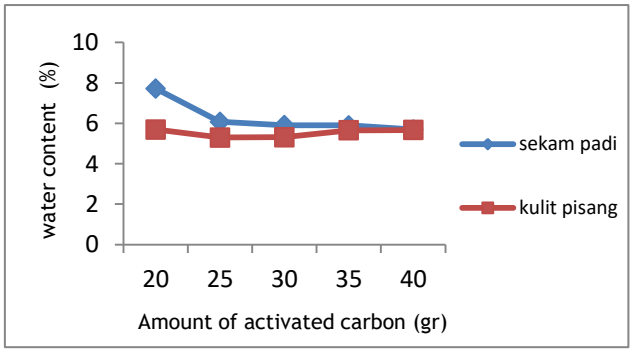


Figure 1. Graph of the relationship between the amount of activated carbon and water content

We can observe from graph 1, is that as the amount of adsorbent increases, the water content decreases. Rice husks have a greater water content than banana peels. This difference is caused by the water content bound to the banana peel has evaporated a lot from the rice husks. Based on SNI 06 – 3730 – 1995, the standard requirement for activated carbon quality standard is a maximum of 15%. Of the ten activated carbons above are below the quality requirements of activated carbon. The low water content indicates that the free water content and bound water contained in the material have evaporated during the carbonization process.

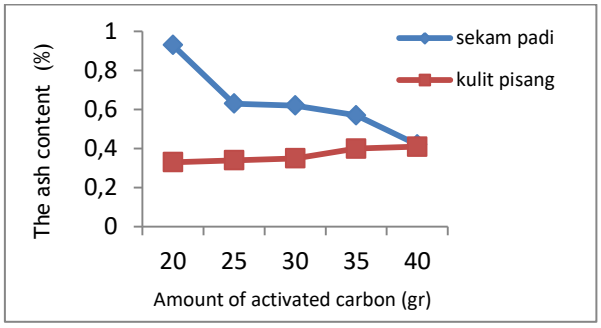


Figure 2. Graph of the relationship between the amount of activated carbon and ash content

In graph 2, we can observe that
The ash content of 20-40 grams of rice husks reaches 0.93-0.42%, while the ash content of banana peels reaches 0.33-0.41%. Based on SNI 06 – 3730 - 1995 the standard requirement for activated carbon quality standard is a maximum of 10%. Judging from the two activated carbons above, they are below the established standard. The ash content is desired as low as possible so that ordinary liquid adsorption takes place properly. This is because the mineral content in the ash such as calcium, potassium, magnesium, and sodium can spread in the activated charcoal lattice and cover the active center and reduce the ability of activated carbon to absorb gas or solution.

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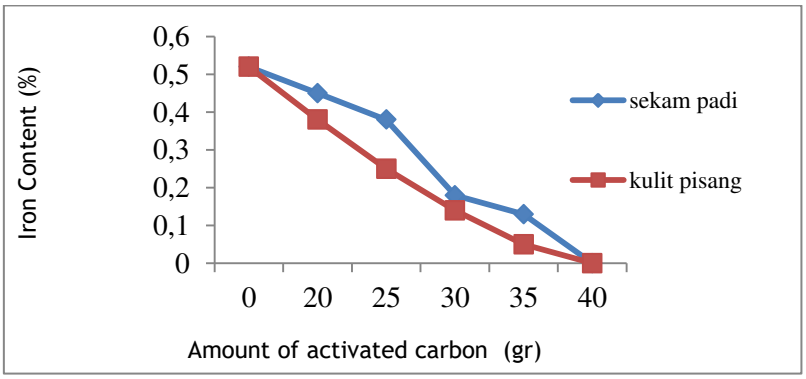


Figure 3. Graph of Analysis of Iron content in Kundur River Water from Activated Carbon After Adsorption

In graph 3, it can be explained that it can be seen that there is a decrease in the iron content of the Kundur river water. The adsorption results are either by using activated charcoal of rice husks or with activated charcoal of banana peels. Rice husk activated charcoal decreased iron from 0.52 to 0.08. And on the adsorption of kapok banana peel, iron decreased from 0.52 to 0.00. This is because the composition of activated carbon in rice husks and kapok banana

peels has been able to reduce the iron in the water of the Kundur River. iron content decreased after being treated with activated carbon, because rice husk activated charcoal contains main components such as cellulose which has the adsorption ability to increase surface molecules so that the carbon undergoes changes in physical and chemical properties which are able to activate high enough metal ions so that it can reduce iron levels.

In the adsorption capacity that occurs, it can be seen that the adsorption capacity can increase with the number of doses of activated carbon. According to Chairul (2016) the decrease in the amount of adsorbate was caused by a decrease in the total surface area and an increase in diffusional which caused a decrease in the amount of adsorbate.

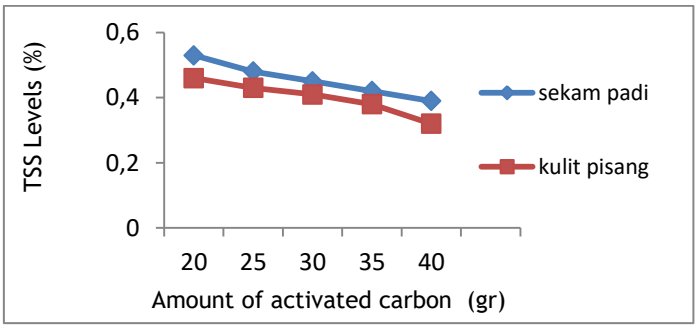


Figure 4. Graph of Analysis of Kundur River Water TSS Levels From Activated Carbon After Adsorption

From Figure 4, we can explain that on the surface of the water, the TSS value decreases after treatment with activated carbon has met the river water quality standards. The lower the TSS value, the clearer the water by suspended solids is closely related to the turbidity of the water so that activated carbon is more effectively used in decreasing the TSS value.

The results of adsorption using both activated charcoal of rice husks and activated charcoal of banana peels were that the activated charcoal of rice husks was able to absorb TSS levels from 0.53 to 0.39. And on the adsorption of banana peel kepok able to absorb TSS levels from 0.46 to 0.32. This is because the composition of activated carbon in rice husks and kepok banana peels has been able to reduce the TSS of Kundur river water.

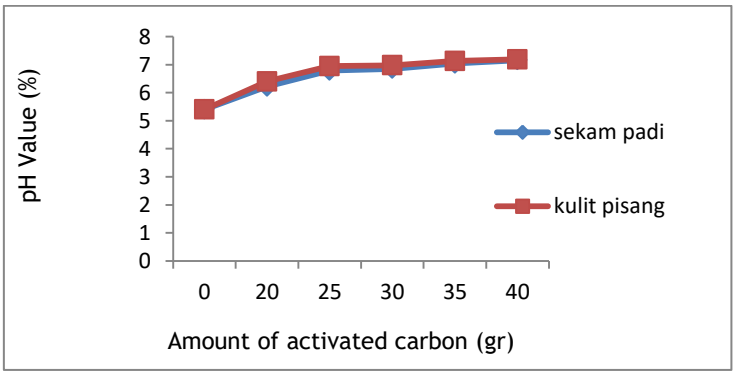


Figure 5. Graph of Analysis of the pH value of Kundur River Water from Activated Carbon After Adsorption

In graph 5, it can be explained that the results of adsorption of pH values using either rice husk activated charcoal or kepok banana peel activated charcoal can change the pH value from 5.4 to 7.16. And the adsorption of kapok banana peel can change the pH value from 5.4 to 7.29. This is because the composition of activated carbon in rice husks and kepok banana peels is able to neutralize the pH value of the Kundur river water, thus meeting the Quality Standards of South Sumatra Governor Regulation No. 16 of 2012 which is a pH value of 6-8.

## 5. Conclusion

Raw materials, operating conditions at the carbonization stage, and the concentration of activator used greatly affect the quality of the activated carbon produced.

Based on the research that has been done, it is found that: The best quality of activated charcoal comes from kepok banana peel which is activated with 20% H3PO4 as much as 20 grams at a carbonization temperature of 450$^{o}$ C can function as an adsorbent in Kundur river water treatment.

The mass of activated charcoal banana kepok 20 grams as an adsorbent in Kundur river water treatment can absorb TSS levels from 180.3 to 0.46 mg/L, iron content from 0.52 to 0.38 mg/L while the pH value can change from 5.4 to 6 ,4.

The mass of activated charcoal from rice husks and banana peels as adsorbents in Kundur river water treatment at a concentration of 450$^{o}$C with H3PO4 0.1N 20% activator as much as 20 g has the characteristics of activated carbon, namely water content 5.27%, ash content 0.33%. For the quality requirements of SNI activated charcoal (06-3730-1995) a maximum moisture content of 15% and a maximum ash content of 10% can be seen from the water content & ash content according to SNI.

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