Comparison Of Thermo Gravimetric Characterization Of Active Carbon Analyzer Rice Husk With Rice Husk Implementation

Masdania Zurairah¹, Edy Syahputra Saragih², Misdawati³
¹Prodi Teknik Industri Fakultas Teknik Universitas Al Azhar, Sumatera Utara, Indonesia
²Prodi Teknik Mesin Fakultas Teknik Universitas Al Azhar, Sumatera Utara, Indonesia
³Prodi Teknik Mesin Fakultas Teknik Universitas Alwashliyah, Sumatera Utara, Indonesia

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ABSTRACT

Research has been done on rice husks. Rice husk is carried out in the carbonization process which is then carried out by the activation process. Furthermore, from the activation process, the impregnation process is carried out. Characterization using a thermo gravimetric analyzer (TGA) showed that the residue of impregnation of rice husk activated carbon was 61.83% and rice husk activated carbon was 89.72%.

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Corresponding Author:
Misdawati,
Prodi Teknik Industri Fakultas Mesin,
Universitas Alwashliyah, Sumatera Utara, Indonesia
Jl. Garu II A No.93, Sitirejo III, Kec. Medan Amplus, Kota Medan, Sumatera Utara 20147
Email: misdawatikasmi@yahoo.com

1. INTRODUCTION

Rice husk is a waste from rice milling, because the grain shape is not so fine (± 3 mm) and light weight, this waste storage requires a large area. Rice husk (husk) is one of the residual materials from the rice processing process which is often considered as waste. Based on BPS data, rice production in Indonesia in 2014 reached 69.87 million tons of milled dry grain (GKG), which can produce rice husks between 20 - 25%, bran between 8 - 12% and milled rice between 50 - 63.5% of the total weight of the grain. The unique chemical property of rice husks is that the silica-cellulose content of rice husks is very different from that of other plant by-products. This high silica content will not decompose even through complete combustion. The main components of rice husk are cellulose, hemicellulose and lignin. In terms of chemical composition data, rice husk contains several important chemical elements, such as 1.33% Carbon, 1.54% Hydrogen, 33.64% Oxygen, 16.98% Silica, 25% Lignin, 20% Cellulose, and organic components such as oil and protein by 3.51%. From this composition and the high percentage of husks produced annually, it can certainly cause environmental problems if not utilized properly. Therefore,
now starting to develop the utilization of rice husk into activated charcoal, and used as a media support or buffer for the growth of carbon nanotubes (CNT).

The process of impregnation of the catalyst on activated carbon is carried out in several stages starting with dissolving the catalyst using acetone to dissolve the salt and minerals then mixing it with a number of weights of activated carbon whose size depends on the catalyst you want to use. Mixing the catalyst with activated carbon is homogenized by sonification, dried at a temperature above 100 °C so that the solvent can be lost, the next step is to make the active core in activated carbon by calcination and reduction processes (Najma, 2012), (Sivakumar et al., 2011). Activated carbon impregnated on the catalyst will help maintain the size of Fe nanoparticles as the active core. Calcination is a heating process to remove impurities so that Fe$_3$O$_4$ will be formed, then hydrogen gas is reduced to remove oxides on the catalyst so that only the active core of the Fe catalyst remains and to strengthen the structure of gravity (Siregar et al., 2015). After the catalyst is prepared with activated carbon, this mixture can be used as a medium for growing CNTs using methane gas (Snoeck, 1997) (Khopkar & Saptorahardjo, 2003). TGA can also function as a reactor to analyze the mass of reacting materials under certain operating conditions (Mopoung, 2011). One example is in research to find the right catalyst to burn soot (carbon particles contained in diesel engine exhaust fumes), which is done by mixing soot with catalyst and put in TGA if the temperature is raised and air is circulated there will be a combustion reaction that will occur reduce the mass detected by TGA (Ulrich, 2006), (Najma, 2012). It can be seen on the TGA graph that at temperatures around 100 °C, 200 °C and 500 °C there was a significant weight loss which was most likely due to the loss of water, volatile elements and carbon respectively (Mopoung, 2008), (Rahardja et al., 2020).

2. RESEARCH METHOD

2.1. Rice Husk Activated Carbon
300 g of rice husks were cleaned, put into a container and put in the oven for 2 hours at 110°C to remove the existing water content (Siregar & Ansari, 2020), (Triyana & Sarma, 2003). Then carbonized at 400°C for 2.5 hours in the furnace. The charcoal was activated with 7% H$_3$PO$_4$ at a ratio of 1:10 (w/w), stirred for 30 minutes, soaked for 24 hours, filtered, and dried in an oven at 120 - 150 °C for 24 hours (Fu & Wang, 2011), (Roy, 1994), (Jankowska et al., 1991). The charcoal is heated at 600 °C for 2.5 hours in the furnace, then washed with 5N HCl to remove the chloride element, washed with hot distilled water to neutral pH, washed with cold aquadest to remove phosphorus, dried in an oven at 120-150 °C, crushed, and blended, then filtered using a 400 mesh sieve, so that it is obtained in the form of activated charcoal or activated carbon of rice husk (Snoeck et al., 1997).

2.2. Rice Husk Carbon Impregnation
50 g of rice husk activated carbon was calcined for 4 hours at 400 °C. Fe(NO$_3$)$_3$$\cdot$9H$_2$O catalyst was dissolved with 0.09 M acetone (Lartey et al., 1999), (Marsh & Rodriguez-Reinonso, 2006). Impregnation was made between Fe catalyst and calcined activated carbon by mixing 500 mL of Fe solution into 50 g of activated carbon (Siregar & Ansari, 2020), (Sitorus, 2009). Sonicated for 1 hour by heating 60-70 °C until all the solvent evaporated (Mat, 1995). After that, it was dried at a temperature of 60-70 °C in an oven for 12 hours (Cheremisinoff & Ellerbusch, 1978), (Clague et al., 1999).

3. RESULTS AND DISCUSSIONS

3.1. Characterization Results of Rice Husk Activated Carbon TGA
In the rice husk sample (activated carbon), the first decomposition occurred in the temperature range of ±100 °C where there was a weight loss of 2.965% due to water loss (Tan et al., 2012).
In the rice husk sample (activated carbon), the first decomposition occurred in the temperature range of ±100 °C where there was a weight loss of 2.965% due to water loss. The second decomposition occurs at a temperature of 200-300 °C where there is a weight loss of 1.685% due to loss of volatile compounds (a type of cellulose) and has a low boiling point. The third decomposition occurs at a temperature of 400-600 °C where there is a weight loss of 5.609% due to the breakdown of lignin elements. The remaining residue is 89.72%.

3.2. Results of TGA Characterization of Rice Husk Activated Carbon Impregnation
In the impregnated rice husk samples, the first decomposition occurred in the temperature range of ±100 °C where there was a weight loss of 5.233% due to water loss.
The second decomposition occurs at a temperature of 200-300 °C where there is a weight loss of 11.54% due to loss of volatile compounds (a type of cellulose) and has a low boiling point. The third decomposition occurs at a temperature of 400-600 °C where there is a weight loss of 11.56% due to the breakdown of lignin elements. The remaining residue is 61.83%.

4. CONCLUSION
The TGA characterization showed that the residue of activated carbon impregnation was 61.83% less than rice husk carbon, which was 90.34%.

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