Int. J. New. Chem., 2023, Vol. 10, Issue 4, pp 236-241.

International Journal of New Chemistry

Published online in http://www.ijnc.ir/.

Open Access

Print ISSN: 2645-7236

Online ISSN: 2383-188x

Original Research Article

Eco-Energy Innovation Of Charcoal Briquettes With Palm Oil Fronds And Stems As Raw Materials

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Received: 2023-09-09 *Accepted: 2023-12-11* *Published:2023-12-30*

ABSTRACT

The population has increased and resulted in an increase in the demand for energy sources and various types of waste. Palm oil fronds and stems are a type of solid waste which numbers are increasing rapidly due to the expansion of palm oil agriculture. Eco-energy can be used by knowing the water content and ash content. Therefore, the purpose of this study is to determine the water content and ash content of the fronds and stems of palm oil as eco-energy briquettes. The method of this research is an experimental research method starting from the collection of raw materials, drying, testing the water content and testing the ash content. From the results of the study it was found that with a ratio between fronds and palm oil stems, namely 1:1, the water content is 0.21% and the ash content iss 0.30%; a ratio of 1:2 means a water content of 0.23% and an ash content of 0.27%; a ratio of 1:3 means a water content of 0.20% and an ash content of 0.25%; a ratio of 2:1 means a water content of 0.22% and an ash content of 0.29%. All of the briquettes comply with SNI (Indonesian National Standard) where the water content of the briquettes according to SNI (SNI 01-6235-2000) is a maximum of 8% and a maximum briquette ash content of 8%.

Keywords: eco-friendly energy, briquettes, palm oil, charcoal, briquettes

Introduction

Palm oil plantations have increased from year to year. Processing of palm oil is widely used for daily needs such as making soap, cooking oil, butter, and others. However, there is also a lot of

waste from palm oil. Because of that, various studies regarding the processing of palm oil waste have been carried out [1;2]

One of the utilization of waste treatment is for biomass. Increasing energy problems, namely regarding energy raw materials from fossil fuels whose availability is dwindling, has made various countries look for solutions by looking for alternative fuels (biomass). Biomass energy which is used as an alternative fuel (renewable energy source) is expected to be easily obtained, more economical and environmentally friendly. Biomass in the form of lignocellulose was investigated to be used as raw material for bioethanol [3], abundant availability in nature and does not compete with food sources. One of the sources of lignocellulose is the waste of palm oil fronds and stems. The wider spread of palm oil plantations has resulted in an increase in palm oil fronds and stems [4]. Therefore, the use of fronds and stems of palm oil as material for making briquettes can overcome the problem of waste.

The quality of bio charcoal of briquettes is determined by the ingredients that are made so that it affects the quality of the calorific value, water content, ash content, volatile matter content and bound carbon content in the briquettes. According to SNI (Indonesian National Standard) the water content of a good briquette is a maximum of 8% and a maximum briquette ash content of 8%. In the process of making briquettes, an additional material is used, namely adhesive, because the use of adhesives has better results than without using adhesives [5]. The type of adhesive used is starch adhesive because it has a low water and ash content and a higher carbon content (**jurnal**). Therefore, in this study, adhesives were used in the manufacture of charcoal briquettes and were only tested for water content and ash content.

Method of Research

This type of research method is an experimental research method [6] by conducting experiments to compare the water content and ash content of fronds and palm oil trunks. The research procedures carried out were starting with drying raw materials, carbonization, milling and screening, mixing with adhesives, printing, drying with ovens, and testing the quality of briquettes (water and steam content).

Research Result

a. Results of Briquettes Produced from Variation in Weight of Raw Materials

Making charcoal briquettes from palm oil fronds and stems using variations in the weight (grams) of raw materials, which can be seen in the following table:

Table 1. Composition of Charcoal Briquettes from Palm oil Fronds (PKS) and Palm oil Stems (BKS)

NO	Sample	Weight (gr)	The yield of the resulting briquettes (gr)
1.	**PKS: BKS = 1:1**	**150:150**	**6.95**
2.	**PKS : BKS = 1:2**	**75:150**	**10.51**
3.	**PKS : BKS = 1:3**	**50:150**	**8.91**
4.	**PKS : BKS = 2:1**	**150:75**	**7.91**

b. Charcoal Briquettes Water Content Test Results

Water content is the percentage of water content in a material which can be expressed in terms of wet weight or based on dry weight. Data on measuring the water content of charcoal briquettes obtained in each treatment can be seen in the following table:

Table 2. Water Content of Charcoal Briquettes

No	Sample	Weight Before Heating (gr)	Weight After Heating (gr)	Water Content (%)
1.	**PKS:BKS = 1:1**	**8.82**	**6.95**	**0.21**
2.	**PKS:BKS= 1:2**	**13.64**	**10.51**	**0.23**
3.	**PKS: BKS= 1:3**	**11.21**	**8.91**	**0.20**
4.	**PKS:BKS=2:1**	**10.22**	**7.91**	**0.22**

c. Charcoal Briquette Ash Content Test Results

Determination of ash content by placing charcoal briquettes in a porcelain cup in an oven at 105^0C for 1 hour, cooling in a desiccator and then weighing.

Charcoal briquettes are weighed in a porcelain cup and then put into an ashing furnace at a temperature between 750^0C to 900^0C until the sample becomes ash, then cooled in a desiccator. After cooling, then weighed to get the ash content. The following are the results of the ash content test:

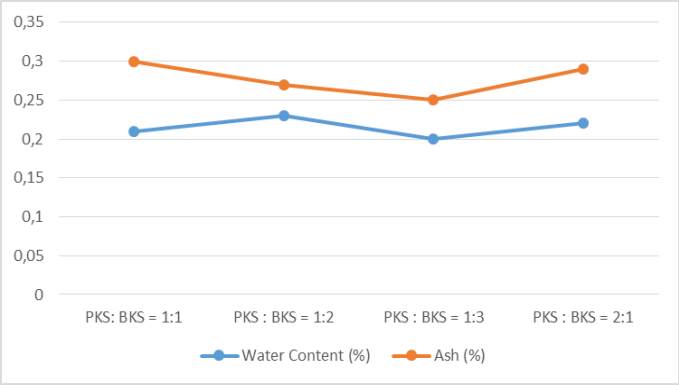
Table 3. Charcoal Briquette Ash Content Test Results

No	Sample	Weight before turning to ashes (gr)	Heavy After turning to ashes (gr)	Ash Content (%)
1.	**PKS:BKS = 1:1**	**6.95**	**0.21**	**0.30**
2.	**PKS:BKS= 1:2**	**10.51**	**2.84**	**0.27**
3.	**PKS: BKS= 1:3**	**8.91**	**2.22**	**0.25**
4.	**PKS:BKS=2:1**	**7.91**	**2.29**	**0.29**

Discussion

Processing palm oil waste is a solution to the problem of waste and can be a renewable eco-friendly energy. Palm oil fronds, which are generally waste when harvesting palm oil, contain 24% hemicellulose, 5% lignin and 58% cellulose. [7]. Because of this content, palm oil frond waste is used as animal feed. However, this cannot be a complete solution in dealing with waste, as well as for palm oil trunks. Therefore, the use of waste for other functions such as alternative fuels is carried out.

In this study, briquettes were produced to obtain samples to be used for testing the water content and ash content in terms of testing the quality of briquettes made from palm oil fronds and stems. In the process of making briquettes, there is the addition of adhesive from starch with the same composition in each sample. Starch which is an organic adhesive can produce high adhesive strength. The composition of the raw materials for palm oil fronds and stems varies, with a ratio of 1:1, 6.95 gr briquettes are obtained; 1:2 obtained 10.51gr; a ratio of 1: 3 obtained 8.91 gr briquettes; a ratio of 2:1 obtained 7.91 gr. This shows that the ratio of the composition of the palm oil frond to twice the number of palm oil stems produces the most briquettes. The research results on the water content and ash content of the briquettes in this study are in accordance with the SNI quality standards (maximum 8%).



Graph 1. Water Content and Ash Content of Briquettesket

The water content greatly affects the quality of the resulting charcoal briquettes. The lower the water content, the higher the calorific value and combustion power of the briquettes. The water content obtained from this research is around 0.20% - 0.23%. Briquettes containing a high water content will reduce the heating value because the heat provided is used to evaporate the water in the briquettes so they break down easily. The lowest water content of 0.20% is in the ratio of fronds and stems of palm oil as much as 1:3.

The remaining combustion products are called ash. The ash content in this study was around 0.25% - 0.30%. High ash content can reduce the heating value because it can form scale and make it difficult to ignite. The lower the ash content, the better the quality of the briquettes. The lowest ash content is 0.25% in the composition ratio of fronds and stems of palm oil as much as 1:3.

From testing the water content and ash content, it shows that the briquettes produced from palm oil fronds and palm stems comply with quality standards. This is in line with the research of Kahariayadi, et al [8] who examined the water content and ash content in briquettes mixed with palm oil stems and sawdust according to quality standards. Saputra, et al [9] stated that the water content and ash content in the palm frond briquettes also have the quality standards.

Conclusion

From the results of the research and discussion it can be concluded that the ratio between the fronds of the palm oil and the stem of the palm oil is 1:3 which produces the lowest water content and ash content. The results of mixing raw materials from fronds and palm oil stem waste produce water content and ash content according to SNI quality standards. In subsequent studies, heating value and color variables can be added to improve the briquette quality test.

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HOW TO CITE THIS ARTICLE

Maulidna, Anna Angela Sitinjak, Dimas Frananta S., Rosmiati, **"Eco-Energy Innovation Of Charcoal Briquettes With Palm Oil Fronds And Stems As Raw Materials"** International Journal of New Chemistry. 10 (4) 236-241 (2023). DOI: 10.22034/ijnc.2023.1986810.1322