MICESHI Proceeding
Available online at: https://ojs.unimal.ac.id/mijeshi/MICESHI
Vol. 1, No. 1, Januari 2024,

Process Of Manufacturing Brickets Based On Cendelnut Shell Aleurites (Moluccanus)

*Corresponding author: sulhatun@unimal.ac.id

Sulhatun[1*], Taufiq[2], Faisal[3], Suryati[4], Fitrianingsih[5], Ariken Subandi[6], Topansyah[7], Oloruntoyin Sefiu Taiwo[8]

[1 2 3 4 5 6 7] Universitas Malikussaleh, Aceh, Indonesia
[8] World University of Leadership and Management, Nigeria
E-mail: Taufiqstmt@unimal.ac.id
faisal.tm@unimal.ac.id
suryati@unimal.ac.id
fitriyaningsih.190140131@mhs.unimal.ac.id
ariken.190140025@mhs.unimal.ac.id
topan.190140075@unimal.mhs.ac.id
oloruntoyin86@gmail.com

ABSTRACT

Briquettes are an energy source derived from biomass, which can be alternative fuel. Candlenut shells contain holocellulose and lignin, which have a high potential as materials for making briquettes. This research aims to determine the effect of density, combustion rate, and heating value on the addition of tapioca adhesive in the manufacture of candlenut shell-based briquettes. The manufacture of candlenut shell briquettes carried out using a pyrolysis process using a temperature of 500oC, particle sizes of 50, 60, 80, and 100 mesh, and tapioca flour adhesive with an adhesive content of 10%, 12.5%, 15%, and 17.5%. These candlenut shell briquettes were tested by analyzing their heating value, burning rate, and density. From the research results, it can concluded that the best results are in briquettes with a particle size of 80 mesh, an adhesive content of 10%, a density value of 0.657 gr/cm3, a combustion rate value of 0.167 g/minute, and a calorific value produced of 6903.25 call/g.

Keywords: Briquettes, Calorific Value, Adhesive, Candlenut Shell

1. INTRODUCTION

Biochar coal l briquettes are defined as regular-shaped blocks or irregular blocks made from organic waste charcoal that have been molded to have a high calorific value (Jain, 2014). Briquettes are a flammable material that is formed from the process of pressing or compressing the material into a solid form and is used as fuel, where the resulting briquettes must have strong properties and adhere to each other so that the briquettes are not easily destroyed (Urgel, 2014). One of the raw materials that can be developed as a briquette material is candlenut shell charcoal, which is waste from the processing of the liquid smoke industry.

2. LITERATURE REVIEW AND HYPOTHESIS

Candlenut shells are an alternative energy used to reduce dependence on fuel oil so that the use of fuel oil is reduced (Ministry of Agriculture, 2012). The stiff and intricate texture of the candlenut shell is because the candlenut shell contains 49.22% holocellulose and 54.46% lignin (Lempang et al., 2011). The high lignin content has the potential to make charcoal, which produces high calorific value. Several researchers have researched candlenut shell briquettes (Wijaya Kusuma et al., 2008), (A Sry Iryani, 2017), (Hermanto et al., 2022). The researcher took the initiative to carry out research that had never been tried, namely making candlenut shell-based briquettes. In contrast, previous research only used variable press pressure loads in molding briquettes. This research carried out experiments again with the raw materials of candlenut shell charcoal and tapioca adhesive and then added variables, namely particle sizes of 50, 60, 80, and 100 mesh with adhesive content of 10%, 12.5%, 15%, and 17.5%. With several tests, namely the density test, combustion rate test, and heating value test.

3. RESEARCH AND METHOD

Materials and Methods

Equipment needed for this research includes a bomb calorimeter, mesh 50, 60, 80, 100, bio briquette printer, desiccator, pressing machine, digital balance, oven, crusher, hotplate, water, candlenut shells, tapioca flour. This research has two stages, namely weighing tapioca flour according to the specified composition. Then mixed with water and heated. The solution mixture is heated on a hotplate until clear and thickened. The second step is to grind the candlenut shells with a crusher to reduce the size of the candlenut shell powder, then sift it with a mesh size of 50, 60, 80, and 100. Then, weigh it and mix it with starch adhesive. It is printed manually using a biobriquette printer until it is solid and takes the form of a biobriquette. The biobriquettes were subjected to an oven at 105 ˚C for an hour. Subsequently, various tests are conducted to evaluate their characteristics and quality, including water content, ash content, density, volatile matter, fixed carbon, and a calorific value of 17.5% the tests comprised density test, combustion rate test, and heating value test.

3.1 Density Test: The following graph shows the results of the density test for candlenut shell briquettes. As shown in Figure 3.1,

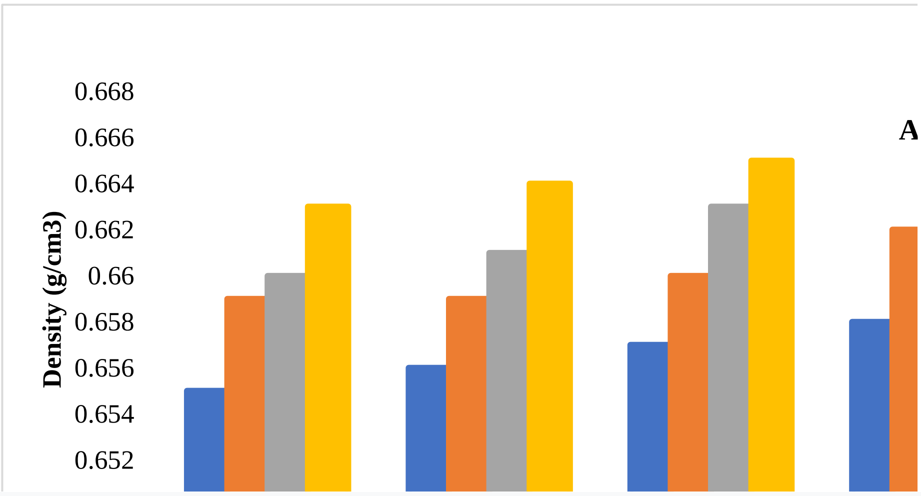
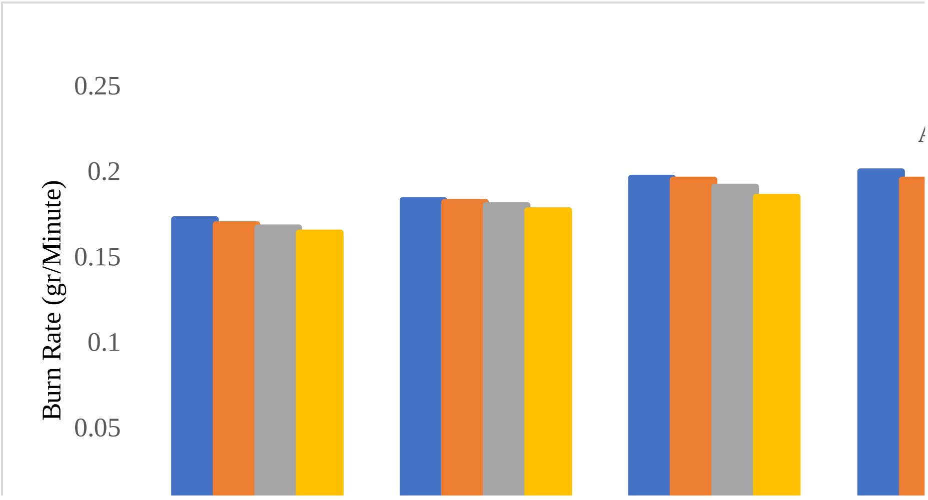


Fig. 3.1 Graph of Density Analysis

According to the research findings, the lowest density was achieved when using 50 mesh particle size and 10% adhesive content, resulting in 0.655 gr/cm3. On the other hand, the highest density was recorded when using 100 mesh particle size and 17.5% adhesive content, yielding 0.666 gr/cm3. These results support the previous study by Basuki et al. (2020), which highlights that the size of charcoal powder plays a crucial role in determining the density of briquettes. It found that larger powder size leads to lower density due to poor binding of the particles.

The Burning Rate test Results

The graph in Figure 3.2 displays the burning rate test results for candlenut shell



3.2 Burn Rate Test The following graph shows the results of the burning rate test for candlenut shell briquettes, which can be seen in Figure 3.2.

The following graph shows the test results for the value of candlenut shell briquettes in Figure 3.3. Calorific Value Test

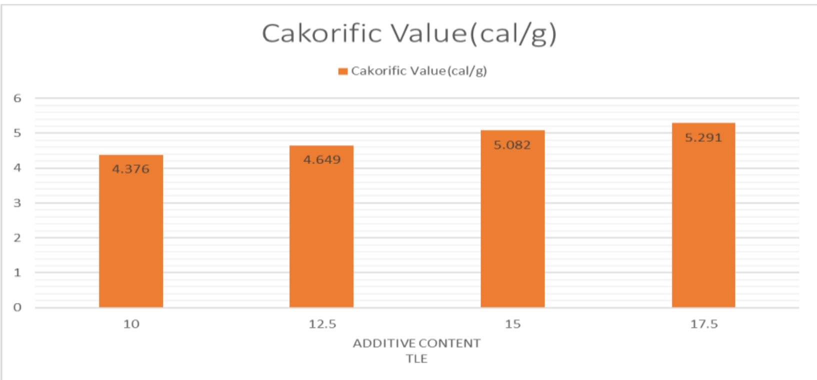


Fig 3.3 Graph of Calorific Value Analysis of Briquettes at 80 Mesh Particle Size

Related reseach of the lowest burning rate analysis was obtained at a particle size of 100 mesh with an adhesive content of 10%, namely 0.164 gr/minute, and the highest value was obtained at a particle size of 50 mesh with an adhesive content of 17.5%, namely 0.2 gr/minute. This follows research by Iriany et al. (2016), which states that the greater the combustion rate, the shorter the briquette flame and vice versa. The burning rate is also influenced by the density of a briquette, where the denser the briquette, the longer the burning rate, so it takes longer for the briquette to burn out. 3.3 Calorific Value Test The following graph shows the test results for the value of candlenut shell briquettes, as shown in Figure 3.3

4. RESULTS AND DISCUSSION

The materials and equipment used in this research include candlenut shells, starch adhesive, water, crusher, briquette printer, digital scales, oven, 50, 60, 80, and 100 mesh sieves, hot plates, and bowls. This research consists of 2 stages, namely making starch adhesive and printing briquettes. Making starch adhesive is done by mixing tapioca flour and water in a ratio of

1:2. Then, heat it using a hotplate until it thickens. Stage 2 is printing briquettes by mixing starch adhesive with sifted candlenut shell charcoal powder with particle sizes of 50, 60, 80, and 100 mesh. Then, it is printed with a briquette printer until it forms a solid briquette. Next, the briquettes are tested by analyzing the burning rate, density, and heating value. Based on the research results, the lowest density analysis was obtained at a particle size of 50 mesh with an adhesive content of 10%, namely 0.655 gr/cm3, and the highest value was obtained at a particle size of 100 mesh with an adhesive content of 17.5%, namely 0.666 gr/cm3.

The previous research conducted by Basuki et al. (2020) states that the size of the charcoal powder greatly influences the density of the briquettes. The larger the powder size, the lower the resulting density because it will be difficult for the briquette powder to bind the particles together.The graph above displays the results of heating value analysis based on the research conducted**.** show that at a particle size of 80 mesh with an adhesive content of 10%, it is 6903.25 cal/g, at a particle size of 80 mesh with an adhesive content of 12.5% it is 6312.13 cal/g, at a particle size of 80 mesh with an adhesive content of 15% it was 5770.63 cal/g. At a particle size of 80 mesh with an adhesive content of 17.5%, it was 4989.58 call/g. In the test results, candlenut shell briquettes meet quality standards for charcoal briquettes. (SNI 1/6235/2000). Briquettes with a particle size of 80 mesh with an adhesive content of 10% have the highest heating value compared to briquettes with a particle size of 80 mesh with an adhesive content of 12.5%, 15%, and 17.5%. According to research by Sutiyono (2010), the reduction in water contained in the briquettes will cause the heat produced from combustion and used to evaporate the water contained in the briquettes to decrease so that the heat produced by the briquettes will be tremendous. Rahmawati stated (2013), the quality of briquettes is good if they produce a high calorific value so that the selling price will be high. The heating value influences density; if the density is high, then the heating value will be high because the charcoal particles stick together well.

From the results of this research, we obtained an analysis of the best density, combustion rate, and heating value in the 80 mesh particle size treatment with 10% adhesive so that the resulting briquettes meet SNI standards, where the heating value is a minimum of 5,000 cal/g (SNI 01-6235 -2000).

5. CONCLUSION

1. The best heating value of candlenut shell briquettes was obtained at a particle size of 80 mesh and an adhesive content of 10% with a heating value of 28,883 J/g or 6903.25 cal/gr.
2. The calorific value at a particle size of 80 mesh and 12.5% starch adhesive is 26,409 J/g or 6312.13 cal/g, and at a particle size of 80 mesh and 15% starch adhesive is 24,144 J/g or 5770. The 63 cal/g obtained complies with SNI 01-6235-2000.

6. ACKNOWLEDGEMENT

This research was supported/partially supported by [Dana Hibah Penelitian PNBP 2023, Grant maker, Donor]. We thank our colleagues from [Malikussaleh of University] .

6. REFERENCES

Basuki, Revelation Day. 2020. “Pecan Shell (Aleurites trisperma).” Journal of System Science, 03(4), pp: 626-636.

Lempang, Mody, Wasrin Syafii, and Gustan Pari. 2011. "Structure and Components of Charcoal and Candlenut Shell Activated Charcoal." Forest Products Research 29, no.3: p. 278-294.

Muhammad, Ishak, Nani Lidia, 2017. Utilization of Rumbia Sap as an Adhesive in the Process of Making Coconut Shell Charcoal Briquettes. Unimal Journal of Chemical Technology, 6:1 20-32.

Sry Iryani, 2020. Making briquettes from pyrolysis-produced candlenut shell charcoal. Chemical Engineering, Fajar University, Makassar.

Sawdust with the Addition of Palm Oil Shell Charcoal. Forestry Department Thesis. Faculty of Agriculture. University of North Sumatra.

Wibowo Rianto. 2019. Thermal Analysis of the Calorific Value of Sugarcane Bagasse and Sawdust Briquettes. Muria University Mechanical Engineering. Kudud. PP 9-15.

Wijayanti, D.S. 2009. Characteristics of Charcoal Briquettes from