*International Journal of Engineering Inventions*
*e-ISSN: 2278-7461, p-ISSN: 2319-6491*
*Volume 14, Issue 6 [June. 2025] PP: 283-287*

# Analysis of the influence of different types of adhesives and variations in the composition of briquette raw materials on the ignition time and boiling time of biocharcoal briquette products.

**M. Wijana[1)], I.W. Joniarta[2)]**
[1)] *Industrial Dept. of Engineering, Faculty of Engineering, Mataram University, Lombok, Indonesia*
[2)] *Mechanical Dept. of Engineering, Faculty of Engineering, Mataram University, Lombok, Indonesia*
*Corresponding Author: wijana.md@unram.ac.id*

***ABSTRACT****: The world's current problems are mainly in the energy sector, the need for energy which increases every year along with the increase in human activities will use fuel oil. The increase in oil prices and the difficulty of obtaining oil will continue because of its non-renewable nature. Therefore, an alternative is needed to overcome all of that. Alternative energy that can be produced is briquettes with waste materials found in the surrounding environment, including using a mixture of cow dung waste and coconut shell charcoal which has an energy content above the fuel requirements, only the ignition time and boiling time are obstacles to its use. The method used in this study is the experimental method by making biorangan briquettes consisting of a mixture of cow dung charcoal and coconut shell charcoal with adhesive. The variables used are cow dung charcoal and coconut shell charcoal and the composition used in this study is 75%: 25%, 50%: 50%, and 25%: 75% and using 2 types of adhesives, namely sago flour and tapioca flour. Testing includes ignition time and boiling time. he results of the study are the ignition time value obtained the best results from briquettes with sago adhesive at a percentage of 25% cow dung and 75% coconut shell charcoal with a value of 8.41 minutes with a sample weight of 8 grams. Furthermore, for the boiling time value, the best results were obtained from briquettes with sago adhesive at a percentage of 25% cow dung and 75% coconut shell charcoal with a value of 8.08 minutes with a sample weight of 16 grams*

***Keywords****: Charcoal briquettes, ignition time, boiling time*

---

Date of Submission: 14-06-2025 Date of acceptance: 29-06-2025

---

## I.INTRODUCTION

Our country has many natural energy sources, both renewable and non-renewable energy sources. The world's current problems are mainly in the energy sector, the need for energy which increases every year along with the increase in human activity will use fuel oil. The increase in oil prices and the difficulty of oil will continue because of its non-renewable nature. Therefore, an alternative is needed to overcome all of that. Alternative energy that can be produced is briquettes with waste materials found in the surrounding environment, including using a mixture of cow dung and coconut shell waste. Cow dung waste is one of the unused wastes that has been a problem for the environment, which causes a decrease in environmental quality through area contamination and disrupts health [1]. From this problem, to utilize cow dung waste so that it is useful, so it is used as a mixture of briquette making materials. Cow dung contains chemical elements including nitrogen 0.4-1%, phosphorus 0.2-0.5%, potassium 0.1-1.5%, water content 85-92%, and some other contents [2].

The community that makes the most traditional charcoal is located in West Lombok Regency, East Lombok, Central Lombok such as in: Pringabaya Village, East Masbagik, Poh Gading, Terros, Tanjung, Bajur Village, Kota Raja Kateko Suralaga by absorbing hundreds of workers. The charcoal furnace is made from used drums, but most of the furnaces are integrated with the ground (in-ground furnace). The length of time needed for the charcoal process ranges from 1 - 3 days, depending on the amount of raw materials processed [3].

The majority of the population or community's work is still working on rice fields, and also raising animals, including cattle. Cattle farming businesses in Indonesia until now still prioritize livestock productivity and have not considered environmental aspects or the impact of activities on the environment [4].

Apart from being a livestock farmer, one of the plantation/rice field products in West Lombok Regency is the large production of coconuts, where only the fruit flesh is used as the main product, while by-products such as leaves, roots, stems and coconut shells are often neglected and thrown away as waste, thus causing environmental pollution [5].

The making of charcoal briquettes with biomass has been done by several researchers before, using biomass and different types of adhesives, what has never been done is the making of charcoal briquettes from coconut shells and cow dung using variations in the types and percentages of tapioca flour and sago flour adhesives [6]. Based on the background above, several researchers who have conducted research using cow dung and coconut shells as charcoal briquettes have not yet been maximized in the final results obtained. Therefore, in this study, to maximize the results obtained, the researcher conducted a study on the Effect of Variations in Adhesive Types and Mixture Variations on Briquettes from Cow Dung and Coconut Shell Charcoal on the duration of ignition and boiling time of the briquettes produced [7], with the hope of obtaining quality and perfect briquette charcoal results by paying attention to the characteristics of the briquettes, including the boiling time value, ignition duration, and other properties in order to achieve the maximum quality standards for briquette charcoal.

## II. STUDIES OF METHOD

The stages carried out in this study include literature studies, preparation of tools and materials, research and testing, after testing, data processing, analysis and discussion of test result data are carried out. The variables tested in this study include variations in the composition of a mixture of cow dung and coconut shell charcoal with a ratio of 75%: 25%, 50%: 50% and 25%: 75% and variations in the type of adhesive, namely sago flour and tapioca flour with a composition of 15% adhesive mixture.

**Scope of Study**

In this study, the tests carried out were the briquette ignition time test and the boiling time test.

**Tools used in research**

The tools used in this study were an extruder machine to print briquettes, stationery for recording data, a stopwatch to measure time, a scale to measure weight, a measuring cup to measure the volume of water needed, a pan and stirrer to make briquette dough, a stove to cook briquette dough, a laptop to process data, and a camera for documentation.

**Materials used in research**

The materials used in this researc were water, sago flour, tapioca flour, cow dung charcoal and coconut shell charcoal obtained from farmers and coconut plantation owners.

## III. RESULTS AND DISCUSSION

**Ignition time test**

The ignition time test aims to determine how long it takes to ignite cow dung briquettes and coconut shell charcoal until they ignite perfectly, the study was conducted at the Production Process Laboratory of the Faculty of Engineering, University of Mataram, Jl. Majapahit No. 62, Gomong, Kec. Selaparang, Mataram City, Nusa Tenggara Bar. 83115. The average ignition time of the test results can be seen in table 1

Table 1. Average ignition time of test results

| Adhesive Variations | Ignition Time (Minutes) | | |
|---|---|---|---|
| | 75 %: 25 % | 50 %: 50 % | 25 %: 75 % |
| Sago Flour | 10,36 | 9,15 | 8,42 |
| Tapioca Flour | 11,41 | 10,21 | 9,16 |

Composition: KS : TK in % weight
Note: KS : Cow Dung, TK : Coconut Shell

Based on the data in table 1, statistical calculations can be carried out with 2-way ANOVA as follows:

Table 2. 2-way ANOVA test. Ignition time of cow dung briquettes and coconut shell charcoal with sago adhesive and tapioca adhesive.

| *Source of Variation* | *SS* | *df* | *MS* | $F_{count}$ | *P-value* | $F_{tablet}$ |
|---|---|---|---|---|---|---|
| Adhesive Variations | 1,35375 | 1 | 1,35375 | 81,79758 | 0,012006 | 18,51282 |
| Composition Variations | 4,4221 | 2 | 2,21105 | 133,5982 | 0,00743 | 19 |

| | | | |
|---|---|---|---|
| Error | 0,0331 | 2 | 0,01655 |
| Total | 5,80895 | 5 | |

From the Fcount and Ftable values obtained, it is known that for adhesive variations, the Fcount value (81.79758) > Ftable (18.5128) so it can be concluded that H0 is rejected and H1 is accepted, this means that there is a significant influence between the adhesive mixture on the ignition time of the briquettes, while for the variation of the mixture composition, the Fcount value (133.5982) > Ftable (19) so it can be concluded that H0 is rejected and H1 is accepted, this means that there is a significant influence between the variation of the mixture composition on the ignition time of the briquettes.

The following is a graph of the relationship between the variation of the adhesive mixture and the variation of the mixture composition on the magnitude of the ignition time of the briquettes:

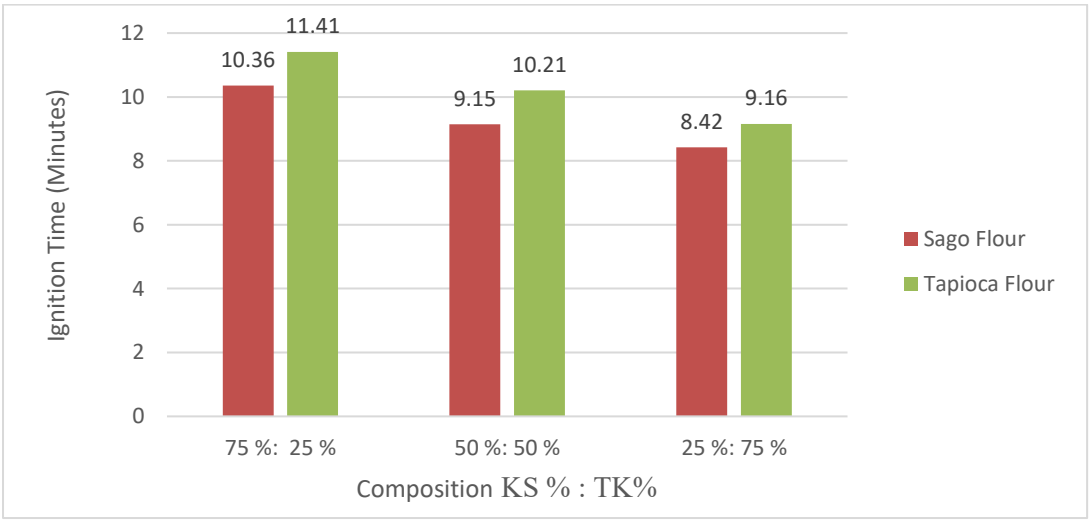


Figure 1. Effect of variations in adhesive mixture and briquette mixture composition on ignition time

From the figure 1 above, it can be seen that the briquettes using sago adhesive with a composition of 25% KS: 75% TK have the shortest ignition time of 8.42 minutes and with a percentage of 75% KS: 25% TK have the longest ignition time of 10.36 minutes. This explains that the greater the composition of the coconut shell charcoal (TK) mixture used in the bioarang briquettes, the shorter the ignition time. While the briquettes using tapioca adhesive with a composition of 25% KS: 75% TK have the shortest ignition time of 9.16 minutes and with a percentage of 75% KS: 25% TK have the longest ignition time of 11.41 minutes. This explains that the greater the composition of the coconut shell charcoal (TK) mixture used in the bioarang briquettes, the faster the ignition time of the briquettes.

**Boiling time testing**

The boiling time test aims to determine how long it takes for cow dung briquettes and coconut shell charcoal to heat water to boiling at a temperature of 85°C, the study was conducted at the Production Process Laboratory of the Faculty of Engineering, University of Mataram, Jl. Majapahit No.62, Gomong, Kec. Selaparang, Mataram City, NTB. 83115. The average boiling time of the test results can be seen in table 3

Table 3. Average boiling time of test results

| Adhesive Variations | *Boiling Time* (Minutes) | | |
|---|---|---|---|
| | 75 % : 25 % | 50 %: 50 % | 25 %: 75 % |
| Sago Flour | 12,2 | 10,4 | 8,08 |
| Tapioca Flour | 13,49 | 11,21 | 9,34 |

Composition: KS : TK in % weight
Note: KS : Cow Dung, TK : Coconut Shell

Based on the data in table 3, statistical calculations can be carried out using 2-way ANOVA as follows:

Table 4. 2-way ANOVA test of boiling time of cow dung briquettes and coconut shell charcoal with sago adhe**sive** and tapioca adhesive

| *Source of Variation* | *SS* | *df* | *MS* | $F_{count}$ | *P-value* | $F_{table}$ |
|---|---|---|---|---|---|---|
| Adhesive Variations | 1,8816 | 1 | 1,8816 | 52,04979 | 0,018676 | 18,51282 |
| Composition Variations | 17,09923 | 2 | 8,549617 | 236,5039 | 0,00421 | 19 |
| Error | 0,0723 | 2 | 0,03615 | | | |
| Total | 19,05313 | 5 | | | | |

From the Fcount and Ftable values obtained, it is known that for adhesive variations, the Fcount value (52.04979) > Ftable (18.5128) so it can be concluded that H0 is rejected and H1 is accepted, this means that there is a significant influence between the adhesive mixture on the boiling time of the briquette, while for the variation of the mixture composition, the Fcount value (236.5039) > Ftable (19) so it can be concluded that H0 is rejected and H1 is accepted, this means that there is a significant influence between the variation of the mixture composition on the boiling time of the briquette.
The following is a graph of the relationship between the variation of the adhesive mixture and the variation of the mixture composition on the magnitude of the briquette boiling time:

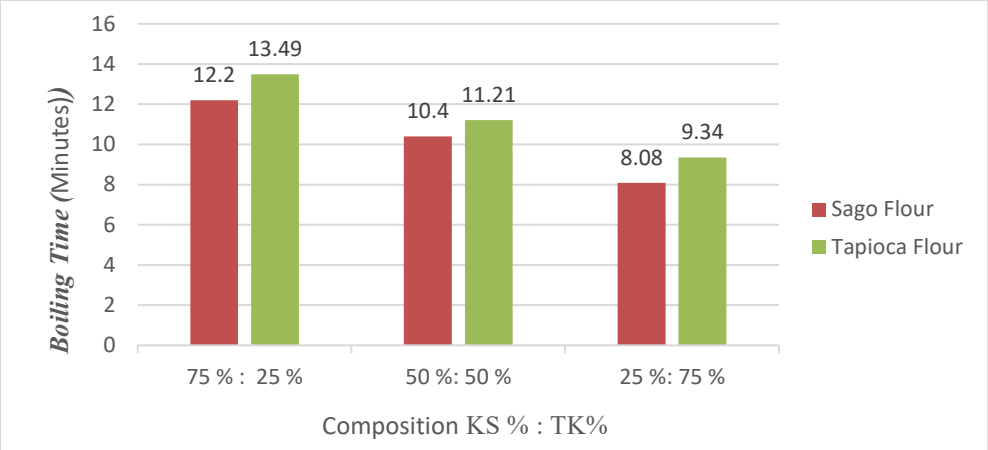


Figure 3. Effect of variations in adhesive mixture and briquette mixture composition on boiling time

From figure 3 above, it can be seen that in briquettes using sago adhesive, at a composition variation of 25% KS: 75% TK has the shortest boiling time of 8.08 minutes and with a percentage of 75% KS: 25% TK has the longest boiling time of 12.2 minutes. This explains that the greater the composition of the coconut shell charcoal (TK) mixture used in the bioarang briquettes, the faster the boiling time of the briquettes. While in briquettes using tapioca adhesive, at a composition variation of 25% KS: 75% TK has the longest boiling time of 13.49 minutes. This explains that the greater the composition of the coconut shell charcoal (TK) mixture used in the bioarang briquettes, the faster the boiling time of the briquettes.

## IV. CONCLUSION

Based on the results of the study, it can be concluded that variations in the type of adhesive and variations in the composition of cow dung and coconut shell charcoal have a significant effect on the ignition time and boiling time values of biochar briquettes. In the ignition time test, it can be seen that the briquettes using sago adhesive with a composition of 25% KS: 75% TK have the shortest ignition time of 8.42 minutes and with a percentage of 75% KS: 25% TK have the longest ignition time of 10.36 minutes. While the briquettes using tapioca adhesive with a composition of 25% KS: 75% TK have the shortest ignition time of 9.16 minutes and with a percentage of 75% KS: 25% TK have the longest ignition time of 11.41 minutes. Meanwhile, in the boiling time test, it can be seen that in briquettes using sago adhesive, in the composition variation of 25% KS: 75% TK has the shortest boiling time of 8.08 minutes and with a percentage of 75% KS: 25% TK has the longest boiling time of 12.2 minutes. While in briquettes using tapioca adhesive, in the composition variation of 25% KS: 75% TK has the longest boiling time of 13.49 minutes.

## REFERENCE


[1]. Joniarta, I.W., Wiratama,I.K., Wijana, M.,. Sujita,(2024), Pengaruh variasi besar butir dan variasi komposisi bahan terhadap kinerja briket arang tempurung kelapa dan sekam padi, Dinamika Teknik Mesin, 14 (2) (2024) 210-217.

[2]. Saputra, W. R. (2023). Pengaruh Campuran Kotoran Sapi, Ampas Tebu Dan Batok Kelapa Terhadap Performa Arang Briket Sebagai Energi Alternatif (Doctoral dissertation, Universitas Muhammadiyah Ponorogo).

[3]. Triadi, A. A. A., Mulyanto, A. A., Joniarta, I. W., Wijana, M., & Nuarsa, I. M. (2022). Penerapan Teknologi Briket pada Pengusaha Arang Tempurung Kelapa Tradisional. Jurnal karya pengabdian, 4(1), 53-58.

[4]. Kastolani, W., Setiawan, I., & Nurazizah, G. R. (2021). Pelatihan Pembuatan Briket Kotoran Segar Sapi Untuk Mengurangi Pencemaran Lingkungan Dan Mendukung Pertanian Berkelanjutan Di Desa Sukajaya Kecamatan Lembang Kabupaten Bandung Barat. Jurnal Abmas, 21(2), 58-65.

[5]. Ratnaningsih, Indrawati, D., Rinanti, A., dan Wijayanti, A. (2020). Training For Fasilitator (Tff) Desa Bersih dan Pengelolaan Sampah 3r (Bank Sampah) di Desa Cibodas, Kecamatan Pasirjambu, Kabupaten Bandung. Jurnal AKAL: Abdimas dan Kearifan Lokal. 1(1): 58-68.

[6]. Milya, C., Kurniawan, E., Hakim, L., Dewi, R., & Muhammad, M. (2023). Pembuatan Briket Cangkang Kelapa Sawit Menggunakan Variasi Jenis dan Persentase Perekat Tepung Tapioka dan Tepung Beras. Chemical Engineering Journal Storage (CEJS), 3(4), 505-516.

[7]. Joniarta, I.W., M. Wijana, M., (2018). Pengaruh variasi besar lubang dan tebal plat terhadap boiling time, lama nyala dan laju pembakaran pada desain kompor biomassa tongkol jagung, Dinamika Teknik Mesin, 8 (1) (2018) 46-51.