International Journal of Research In Vocational Studies (IJRVOCAS)
Vol. 2 No. 4 (2023): IJRVOCAS – Special Issues – INCOSTIG – PP. 08~12
Print ISSN 2777-0168| Online ISSN 2777-0141| DOI prefix: 10.53893
https://journal.gpp.or.id/index.php/ijrvocas/index

Analysis of the Effect of Tapioca Flour Adhesive on the Characteristics of Palm Oli Empty Charcoal Briquettes

Muhammad Anhar Pulungan, Sihar Siahaan*, Siti Maretia Benu
Department of Mechanical Engineering, Politeknik Negeri Medan, Indonesia

Keywords:

Charcoal Briquettes
Oil Palm Empty Fruit Bunches
Tapioca Flour
Characteristics of Briquettes

ABSTRACT

Palm oil solid waste such as oil palm empty fruit bunches (TKKS) if not processedcan be explained by the environment. This study attempts to study the utilization ofoil palm empty fruit bunches as charcoal briquettes. Charcoal briquettes are one ofthe alternative fuels to replace fuel gas and firewood charcoal. The empty sign of the oil palm is burned so that it becomes charcoal, then the charcoal is ground and sifted, after being sifted it is given a mixture of adhesive, namely tapioca flour. Themixed charcoal is put into a briquette press. The research was conducted on a laboratory scale with a carbonization process at a temperature of 500°C, carbonization time of 3 hours. The process of drying briquettes at a temperature of100ºC for 1 hour. Comparison of the composition of 1000 grams of empty oil palm fruit bunches with 20% tapioca starch adhesive. From the results of the study, the briquette values obtained were as follows: 4775.18 cal/g, 6.96% water, 9.18% ash content, and 84 minutes of burning time. The empty bunches of charcoal briquetteswere tested according to the SNI No.1/6235/2000 standard, which is a minimum calorific value of 5000 cal/gram, a maximum water content of 8%, and an ash content of 8%. The parameters of water content and burn time have met the standard. The parameters of the ash content and calorific value of the samples takenand tested have not met the standard of SNI No.1/6235/2000. One of the steps thatcan be tried to improve the quality of the ash content and calorific value is to rearrange the composition of the adhesive.

Corresponding Author:

Sihar Siahaan,
Department of Mechanical Engineering,
Politeknik Negeri Medan,
Almamater Road No 1, Padang Bulan, Medan, North Sumatera, Indonesia.
Email: siharsiahaan@polmed.ac.id

1. INTRODUCTION

North Sumatra as one of the provinces that has a fairly large oil palm plantation area of around 441 399.52 Ha in 2020 certainly has the above sources in abundance. Charcoal briquettes are charcoal obtained by burning dry biomass with a little air (carbonization). Biomass is an organically derived material from living organisms, both plants and animals. According to Johannes (1991) examples of biomass are leaves, grass, twigs, weeds, as well as agricultural and livestock waste and peat. Charcoal briquettes can be used for daily alternative energy needs as a substitute for kerosene and LPG gas. Charcoal briquettes have many advantages, namely when packaged attractively they have more economic value than charcoal in traditional markets, charcoal briquettes have a higher heat, are odorless, clean and durable (Ignatius, et al., 2010).

The manufacture of empty palm fruit bunch charcoal briquettes uses a type of tapioca flour adhesive which is processed into starch glue to act as an adhesive for palm empty fruit bunch charcoal briquettes. According to the problems encountered, the purpose of this study was to determine the effect of using tapioca starch adhesive types in palm empty fruit bunch briquettes on briquette quality standards, to determine the effect of using tapioca flour adhesive types in oil palm empty fruit bunch briquettes on the characteristics of charcoal briquettes such as calorific value, content water and burning time.

2. RESEARCH METHOD

The research method used in this research is to use real experimental research methods (True Experimental Research). In this research there are several stages carried out, namely:

1. Raw material preparation stage.
2. Preliminary test phase.
3. Charcoal stage.
4. Printing and drying stage.
5. Analysis phase.

1. Raw material preparation stage.

This stage aims to prepare the materials to be used in the experiment so that they have a uniform shape and can be easily used in the next stage.

As for the preparation stage of the raw material for empty palm oil bunches, it is cleaned of dirt, this is intended so that the writing process can take place perfectly and is not disturbed by any impurities.

Figure 1. Collection of Raw Materials for Oil Palm Empty Bunches

2. Preliminary test phase.

This stage aims to determine at what temperature the carbonization produces the most optimum total carbon value. This optimum carbonization temperature is the basis of the carbonization temperature in the next stage.

3. Charcoal stage.

This stage aims to change the empty palm oil bunches of charcoal used in the next stage. The materials that have been prepared are charred by inserting them into the coking furnace with an average temperature of 200^0C for 5 hours. Empty palm fruit bunches are put into the coking furnace. After that, the empty palm fruit bunch charcoal is crushed by grinding it until it is smooth using a charcoal grinding machine. Then sieved. The sieving process using an ordinary sieve did not use a mesh sieve because the mesh size of the briquette material in this study was not measured for its parameters.

Figure 2. The Process of Making Oil Palm Empty Bunches

https://doi.org/10.53893/ijrvocas.v2i4.156

4. Printing and drying stage.

The empty coconut palm charcoal flour is mixed with tapioca flour adhesive which is processed into starch glue with a ratio of 20% of the total weight of the raw material. After mixing it is then printed using a screw system briquette printing machine, the printed briquettes will come out through the funnel out of the printing machine, then cut according to the desired size of the briquettes. The drying process is carried out in the sun for 5 days.

5. Analysis phase.

This stage aims to analyze the basic characteristics of the resulting charcoal briquettes. The basic characteristics include the calorific value, moisture content value, ash content value, and burning time of charcoal briquettes.

3. RESULTS AND ANALYSIS (10 PT)

In the following section, the research results will be displayed in the form of average characteristics of briquettes in the form of calorific value, moisture content and ash content of briquettes for adhesive variations using tapioca flour adhesive types. The results of this study can be seen in the following:

3.1. Calorific Value

In testing the calorific value, a bomb calorimeter was used, the computer results showed 19909 joules/gram, then it was converted to cal/gram in accordance with SNI to 4755.18 cal/gram.

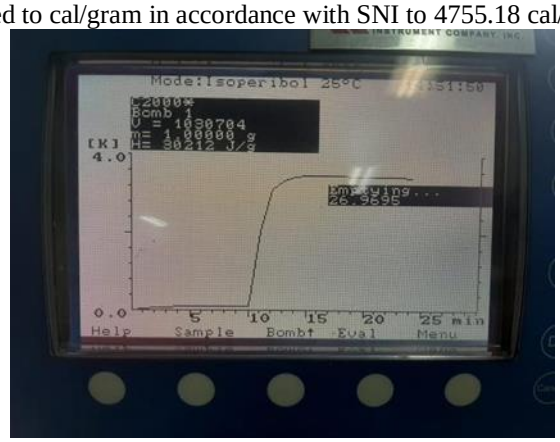

Figure 3. Bomb Calorimeter Testing

3.2. Water content

Formula:

$KA = \frac{M1-M2}{M} \times 100$

KA = Water Content
M = Sample mass
M1 = The mass of the cup + the mass of the sample
M2 = Mass after drying

Testing 1:

M = 1,0067
M1 = 37,1172
M2 = 37,0472

$KA = \frac{37,1172-37,0472}{1,0067} \times 100 = 6,95\%$

Testing 2:

M = 1,0007
M1 = 39,3449
M2 = 39,2749

$KA = \frac{39,3449-39,2743}{1,0007} \times 100 = 6,99\%$

Testing 3:

M = 1,0048
M1 = 37,7388
M2 = 37,6688

$KA = \frac{37,7388-37,6688}{1,0048} \times 100 = 6,96\%$

3.2. Ash Content

Formula:

$Ac = \frac{Mc-Mb}{Ma}$ x 100

Ac = ash content
Ma = Initial mass of briquettes before burning
Mb = Mass of porcelain cup
Mc = Mass of the cup plus ashes

Testing 1:

Ma = 2,0075
Mb = 42,4143
Mc = 42,6016

$Ac = \frac{42,6016-42,4143}{2,0075}$ x 100 = 9,33%

Testing 2:

Ma = 2,0077
Mb = 40,6363
Mc = 40,8120

$Ac = \frac{40,8120-40,6363}{2,0077}$ x 100 = 8,77%

Testing 3:

Ma = 2,0083
Mb = 37,4919
Mc = 37,7877

$Ac = \frac{37,7877-37,4919}{2,0083}$ x 100 = 9,44%

3.3. Burn Time

1. Prepare a furnace as a combustion medium.
2. Weigh 4 grams of briquettes, then record the time it takes for all the briquettes to burn (the embers go out).
3. Burn 3 times for each adhesive.

Test 1 = 82 minutes
Test 2 = 86 minutes
Test 3 = 84 minutes

The composition ratio of raw materials and adhesives in the process of making this briquette is 1 kg of empty palm oil bunches charcoal and 20% tapioca flour adhesive. The results of the quality calculation based on several parameters can be seen in Table 1.1

Table 1.1 Average Result of Palm Oil Empty Bunch Briquette Analysis Using Tapioca Starch Adhesive

Composition		Parameters Tested		
Tapioca (g)	Tapioca (g)	Calorific Value (kal/kg)	Water content (%)	Ash content (%)
100	20	4755.18	6,96	9,18

4. CONCLUSION

In this study, briquettes were made from empty palm oil bunches with a ratio of 200 grams of tapioca flour adhesive and 1000 grams of shell charcoal. The quality or characteristics of the briquettes studied were calorific value, moisture content, ash content and burning time. The characteristics of the briquettes obtained from the study were compared with SNI standards, the results of research for shell charcoal briquettes. Based on the results of data analysis from the study, the following conclusions were obtained:

1. From the results of research on empty palm oil bunches with an adhesive content of 20%, the results obtained were a calorific value of 4775.18 cal/gram, a moisture content value of 6.96%, an ash content of 9.18%, and a burning time of 84 minutes with a large mass of charcoal. burnt is 500 grams.

https://doi.org/10.53893/ijrvocas.v2i4.156

2. The tested palm empty fruit bunch charcoal briquettes refer to the SNI standard No.1/6235/2000, for the parameters of moisture content and burning time, they comply with SNI No.1/6235/2000. The calorific value and ash content have not met. One way to increase the calorific value and burn time is to use a variation of adhesive below 20%. The addition of adhesive causes the calorific value to decrease because the adhesive has thermoplastic properties and is difficult to burn and carries a lot of water so that the heat generated is used to evaporate the water in the briquettes first.

ACKNOWLEDGEMENTS

The author would like to thank all parties who supported the writing of this research:

1. Abdul Rahman, S.E., Ak., M.Sc., Director of the Medan State Polytechnic
2. Dr. Abdi Hanra Sebayang, S.T., M.T., as Head of the Mechanical Engineering Department at the Medan State Polytechnic
3. Selvie Diana, S.T M.T. As Head of Chemical Engineering Testing Laboratory Lhokseumawe State Polytechnic.
4. Syafari, S.T., M.T as Laboratory analyst Lhokseumawe State Polytechnic.

REFERENCES

[1] Darvina, Y., & Nur, A. (2011). Upaya Peningkatan Kualitas Briket Dari Arang Cangkang dan Tandan Kosong Kelapa Sawit (TKKS) Melalui Variasi Tekanan Pengepresan.
[2] Arbi, Y., & Irsad, M. (2018). Pemanfaatan Limbah Cangkang Kelapa Sawit Menjadi Briket Arang Sebagai Bahan Bakar Alternatif. CIVED, 5(4).
[3] Aritonang, D. 1986. Perkebunan kelapa sawit sebagai sumber pakan ternak di Indonesia. Jurnal Penelitian dan Pengembangan Pertanian V(4): 93−99.
[4] Asip, F., Anggun, T., & Fitri, N. (2014). Pembuatan briket dari campuran limbah plastik LDPE, tempurung kelapa dan cangkang sawit. Jurnal Teknik Kimia, 20(2).
[5] Aziz, M. R., Siregar, A. L., Rantawi, A. B., & Rahardja, I. B. (2019). Pengaruh Jenis Perekat Pada Briket Cangkang Kelapa Sawit Terhadap Waktu Bakar. Prosiding Semnastek.
[6] Badan Pusat Statistik Provinsi Sumatera Utara diakses dari https://sumut.bps.go.id/ diakses pada tanggal 15 Juni 2022 pada jam 20.20 WIB.
[7] Erivianto, D. (2018, September). Kajian ekonomis pemanfaatan tandan kosong kelapa sawit sebagai bahan bakar PLTU biomassa. In Seminar Nasional Royal (SENAR) (Vol. 1, No. 1, pp. 417-422).
[8] Moeksin, R., Pratama, K. A. A., & Tyani, D. R. (2017). Pembuatan briket biorang dari campuran limbah tempurung kelapa sawit dan cangkang biji karet. Jurnal Teknik Kimia, 23(3), 146-156.
[8] Mulia, A. (2007). Pemanfaatan tandan kosong dan cangkang kelapa sawit sebagai briket arang.
[9] Paranita, D. (2020). Kombinasi Campuran Pelepah Kelapa Sawit Dan Kulit Kacang Tanah Sebagai Bahan Baku Pembuatan Biobriket. Jurnal Al Ulum LPPM Universitas Al Washliyah Medan, 8(2), 45-53.
[10] Rantawi, A. B. (2019). Mengetahui Kualitas Briket Cangkang Kelapa Sawit Menggunakan Perekat Arpus sebagai Energi Alternatif. Jurnal Citra Widya Edukasi, 11(3), 217-222.
[11] Susanto, A., & Yanto, T. (2013). Pembuatan Briket Bioarang Dari Cangkang Dan Tandan Kosong Kelapa Sawit. Jurnal Teknologi Hasil Pertanian, 6(2).
[12] Wicaksono, W. R., & Nurhatika, S. (2019). Variasi Komposisi Bahan pada Pembuatan Briket Cangkang Kelapa Sawit (Elaeis guineensis) dan Limbah Biji Kelor (Moringa oleifera). Jurnal Sains dan Seni ITS, 7(2), 66-70.
[13] Widodo, I. G., & Widagdo, E. (2010). Upaya Penerapan Teknologi Pengolahan Arang Tempurung Kelapa Untuk Meningkatkan Nilai Tambah Petani di Kecamatan Sei Raya Kabupaten Bengkayang. Jurnal IPREKAS – Ilmu Pengetahuan dan Rekayasa, Mei 2010, 8-13
[14] Wiranata, L. C., Hamzah, F., & Restuhadi, F. (2017). Pemanfaatan cangkang kelapa sawit dalam pembuatan briket dengan penambahan pelepah kelap sawit (Doctoral dissertation, Riau University).
[15] Anugrah, R. A., & Wisnujati, A. (2021). Rancang Bangun Alat Cetak Briket Berbahan Dasar Kotoran Sapi. Bina Teknika, 17(1), 16-22.

How to Cite

Pulungan, M. A., Siahaan, S., & Benu, S. M. (2023). Analysis of the Effect of Tapioca Flour Adhesive on the Characteristics of Palm Oli Empty Charcoal Briquettes. International Journal of Research in Vocational Studies (IJRVOCAS), 2(4), 8–12. https://doi.org/10.53893/ijrvocas.v2i4.156