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PROCESSING CORN COB WASTE AS AN ALTERNATIVE FUEL USING CARBONIZATION AND BRIQUETING PROCESSES

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Abstract

The potential natural resources of Keerom Regency, Arso District, especially in the agricultural sector, are very abundant. Corn cob waste produced by farmers is a loss if it is not converted into something more useful. Corn cobs contain cellulose, hemicellulose, and lignin. This content will later be converted into smaller molecules through various treatments to be used as energy. This service aims to provide knowledge and skills to the farming community, on how to process corn cob waste as solid fuel or briquettes. The results of proximate testing or the composition of corn cob briquettes carried out in the Unhas Animal Husbandry Laboratory showed that at the highest temperature of 100oC, fixed carbon was obtained at 39.7, and at the lowest temperature of 60oC, fixed carbon was at 41.3. This can be stated as the amount of carbon contained in the remaining material after the volatile matter has been removed. Likewise, the higher the fixed carbon value, the quality of the corncob briquettes increases. Thus, the highest energy or heat pattern obtained is 5933 cal/gr, so corn cob briquettes can be used as briquette fuel energy. Utilizing corn cobs as fuel for briquettes can reduce dependence on fuel oil and can be used as a home industry business.

Keywords: Briquettes, Carbonization, Corncob Biomass, Calorific Value

INTRODUCTION

Corn is a food crop commodity that has an important and strategic role in national development, corn is included in cereal or grain crops that can live in tropical and subtropical climates, corn is not only used as food but also used as feed (feed) and industry, it has even started to be used as an alternative fuel (Biofuel).

Corn's position as a national food ingredient is the main staple food after rice, so it becomes a buffer for national food security. Improvements in the national economy, marked by an increase in per capita income, have shifted the proportion of corn as a food ingredient to become the main raw material for the animal feed industry. The main component (54 to 60%) in animal feed rations is corn (Sinjal, 2009). Most (55%) of national corn production is used as feed, the remaining 30% is for food consumption and 15% is for other industrial needs and seeds (Hadijah 2009, Suharjito, 2011). Corn cob waste is an agricultural waste that is often found in the Arso District area, which can be processed into an alternative fuel. Carbonization

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The Keerom Regency Government, through the Agriculture and Fisheries Service, has allocated a budget of IDR 7 billion for empowerment and economic recovery. Of the total budget, the Keerom Regency Agriculture and Fisheries Service focused on IDR 4.7 billion for a corn planting program covering an area of 1000 hectares (ha) involving 36 villages, 64 farmer groups, and 1128 farmers. This has borne fruit, where the Keerom Regency Government carried out the first corn harvest covering an area of 12 hectares in Arsopura, Skanto District, Keerom Regency. Source (Papua Utusanindo.Com). Technological innovations in corn cob processing machines have been developed to make charcoal briquettes to help farmers deal with waste and improve the farmer's economy

1. Corn Commodity

Corn is one of the short-lived agricultural commodities that does not rot easily and farmers at all levels can grow it. Farmers use superior corn seeds in planting activities, namely Nakula Sadewa. The production yield reaches around five tons per hectare

Figure 1. Post-harvest skanto corn

This corn development center is expected to attract corn investment in Eastern Indonesia. On this occasion, President Jokowi inspected the corn harvest which had begun to be planted 3 months ago, during his visit in March 2023. The location for the corn harvest review was in zone 9 with an area of around 39 hectares of corn planted. The President appreciated the reported harvest of 7 tons/hectare. Wambes Village is a pilot model for corn plantations that can be emulated by villages in the Keerom district because corn is a feed and food ingredient.

The President said that Keerom has fertile soil. This can be seen from planting corn which only takes three months, but can produce a harvest of up to 7 tons per hectare. This result exceeds the national standard corn harvest of 5.6 tons per hectare. He also said that the selling price of corn in Keerom is around IDR 5,000-6,000 per kilogram. Farmers can earn an income of up to IDR 42 million with a production output of 7 tons per hectare.

METHOD OF IMPLEMENTATION

Using firewood from corn cobs is one of the benefits that is very commonly used by farmers. Apart from reducing waste and dependence on oil fuel, this process can reduce the need for other energy such as gas or kerosene. Usually, people who have corn crops will use corn cobs as a substitute for firewood. Dried corn cobs can produce maximum heat.

The service method carried out in the Bibiosi Village Community of Arso District is a model of applying innovative technology, namely appropriate technology, starting from writing materials, tool modifications, printing equipment, pressing machines, and briquette media. One of the agricultural waste biomass in Bibiosi village is corn cobs, which are used as fuel for charcoal briquettes. Apart from that, the method applied is a model approach by providing knowledge and skills in the form of 1. Delivery of material, 2. Introduction to tools, 3. Training/Practice. Several stages carried out in this training activity are:

1. Preparation stage for tools and materials

The stage of introducing tools and how to use them, so that training makes it easier to carry out and prepare corn cobs which are cut into dice of 3 cm.

2. Processing

- Dry the corn cobs in the sun for 2 or 3 days until they are completely dry.
- Clean and sort first, don't let any materials get involved or mixed up

3. Authoring

- Put the dry corn cobs into the reactor, fill it until it is full, then compact it, then put in the pipe hole in the middle of the reactor pieces of wood or corn cobs as triggers for the burner, pour a little kerosene on to speed up the burning process.
- If combustion has formed in the form of thick white smoke, this indicates that the combustion process has occurred and closed the reactor so that not a lot of air gets mixed in
- Wait for the combustion process in the reactor until the white smoke is no longer visible coming out through the chimney.
- Check whether the corn cobs are all burned or have formed carbon or charcoal. If you have sprayed it with water so it doesn't turn into ash, then remove it from the reactor and cool it.

4. Smoothing and Mixing

- The corn cobs that have been charcoaled are then crushed using a grinding machine or manually pounded with a mortar.
- Weigh 1 kg of fine charcoal, and pour it into the prepared basin
- Weigh 100 grams of tapioca, then put it in the pan
- Put water into a saucepan measuring 1000 ml
- Turn on the stove until the flame is a stable blue color, raise the pan on the stove to be ready to cook it into a paste. And during the adhesive-making process, it is always stirred so that it turns into a clear color
- If the adhesive has changed to a clear color, remove it from the stove and let it cool.
- Pour the adhesive into the basin containing the charcoal powder until it is mixed well while stirring

5. Printing

- The result of mixing the charcoal powder with adhesive or in the form of a mixture is put into a briquette mold
- Place the base plate on the gearbox press mold, and lock the piston by inserting the pin into the construction hole
- Print by turning on the press machine

RESULTS AND DISCUSSION

About the implementation of practical training in making briquettes from corn cobs, the results achieved or obtained include:

a. Drying corn cobs

The corn cobs obtained from the corn kernel processing process are cut into 2-3 cm pieces and then dried in the sun or dried in the sun until they are dry or the water content is no longer there. With the aim that when it is burned in a reactor, the burning process is faster and produces good, black, and shiny carbon that is easy to break.

Figure 2. Drying corn cobs

b. Authoring Innovation Technology

The carbonization or carbonization process is carried out using a compressor tube. This tube is modified into a reactor tube and a chimney, air hole, checking hole, and carbon exit door are designed. To determine the heat or temperature of the manufacturing process, a thermocouple device can be installed

Figure 3. Carbonization of Corn

c. Smoothing

The cobs of corn that have been roasted are crushed using a grinding machine or pounded manually then screened or sifted using a standard size sieve.

Figure 4. Smoothing corn cob

d. Mixing with Adhesive

1 kg of ground corn cob carbon, put in a container then mix it with tapioca adhesive, stir until evenly mixed, and the two combine or form a chewy

Figure 5. Mixing with Adhesive

e. Briquetting

The press machine used to print briquettes is a gearbox system that works, the piston is moved from bottom to top by a jack then the top piston holds. If the piston is stuck, the mold can be removed by releasing the top base, and then moving the piston upwards again until the briquettes come out.

Figure 6. Briquette Printing

f. Drying of molded briquettes

The molded briquettes are dried in the sun for 3 to 4 days or can also be dried using an electric oven, for this tool the temperature can be set to 100^{O}C to 1000^{O}C. But in drying briquettes, a temperature of 100 ^{O}C is used for 24 hours

Figure 7. Electric oven drying

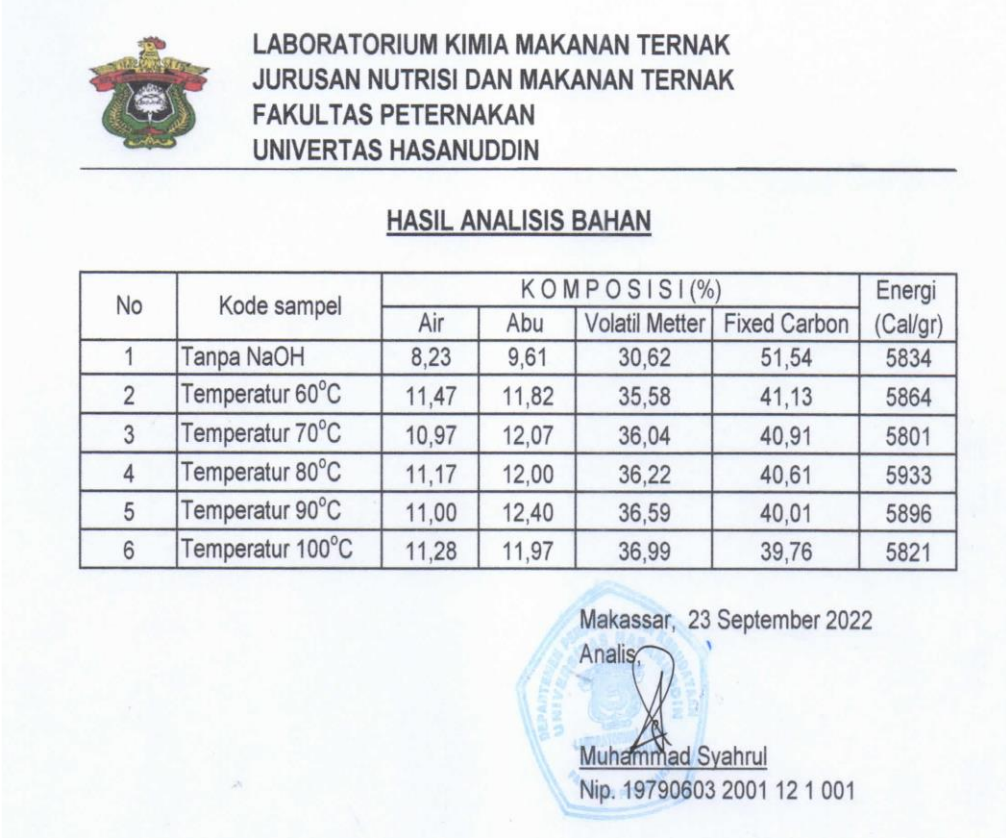
g. Production result

Charcoal briquettes that have been dried can be used for fuel needs or can be commercialized so that they can be used as a UKM scale home industry. The benefits are increasing economic income, reducing dependence on fuel oil, dealing with agricultural waste, saving household expenses

Figure 8. Charcoal briquette products

h. Laboratory Test Results

The briquettes that have been produced can be used in households and if they are to be marketed or commercialized, laboratory testing needs to be carried out to determine whether the material composition meets national standards or not.



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HASIL ANALISIS BAHAN

No	Kode sampel	KOMPOSISI (%)				Energi
		Air	Abu	Volatil Metter	Fixed Carbon	(Cal/gr)
1	Tanpa NaOH	8,23	9,61	30,62	51,54	5834
2	Temperatur 60°C	11,47	11,82	35,58	41,13	5864
3	Temperatur 70°C	10,97	12,07	36,04	40,91	5801
4	Temperatur 80°C	11,17	12,00	36,22	40,61	5933
5	Temperatur 90°C	11,00	12,40	36,59	40,01	5896
6	Temperatur 100°C	11,28	11,97	36,99	39,76	5821

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CONCLUSION

1. The application of carbonization and briquetting technology innovations through training knowledge and skills has greatly influenced the impact of change on the community, especially corn farmer participants in Bibiosi village, that corn cobs which are considered agricultural waste can be processed into charcoal briquette fuel for household needs besides being used commercially, or marketed to provide economic value.
2. The results of proximate testing of carbon content composition at the highest temperature of 100ºC obtained fixed carbon 39.7 and the lowest temperature of 60ºC obtained fixed carbon 41.3. It can be stated that the amount of carbon contained in the remaining material or briquettes after the volatile matter is removed, likewise that the higher the fixed carbon value, the quality of the corncob briquettes will increase
3. Application of innovative briquetting technology using a hydraulic jack system connected via a belt to the gearbox is very practical and can be reached by farmer groups so that corn cobs which are waste can be processed into fuel energy

REFERENCES

Agustinus, 2011, Pemanfaatan Sekam Padi sebagai Bahan Bakar Briket dengan menggunakan alat pres dongrak hidrolik untuk Skala Industri dan rumah tangga, laporan hasil penelitian Proyek CASINDO dan Fakultas Teknik Universitas Cenderawasih

Agustinus & WWF Merauke 2014. Pelatihan pembuatan bahan bakar briket dari limbah sekam padi, gergaji dan pembuatan Kompor briket.

Agustinus & Inques Konsultan. 2015. Skenario Alternatif Pengembangan Energi Terbarukan, WWF, Indonesia.

Agustinus,2014, Tungku hemat energi berbahan bakar briket Ampas Sagu yang ramah lingkungan, Laporan Penelitian, Fakultas Teknik Universitas Cenderawasih

Denitasari, N.A., 2011. Briket Ampas Sagu sebagai Bahan Bakar Alternatif., IPB

De Fretes, E.F., Wardana, I.N.G. and Sasongko, M.N., 2013. Karakteristik Pembakaran dan Sifat Fisik Briket Ampas Empulur Sagu Untuk Berbagai Bentuk dan Prosentase Perekat. *Rekayasa Mesin*, *4*(2), pp.169-176

Hadijah, Suharjito, 2011. Produksi jagung nasional sebagai pakan

Kemas ridhwan, Dwi irawan, 2020, Energi Pirolisis ISBN 978-623-7311-73-7.

Marsono & Oswan Kurniawan. 2008. Superkarbon Bahan Bakar Alternatif Pengganti Minyak Tanah dan Gas, Jakarta.