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Business Development Strategy and Energy Analysis in The Manufacture of Agricultural Waste Bio-briquette In Post COVID-19 Pandemic

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Abstract

Objective: The existence of rice straw waste and wood sawdust is a potential that can be used as bio-briquettes to improve the community's economy. Agricultural waste is an environmentally friendly energy source that has contributed to one-tenth of primary energy consumption. Bio-briquettes have the opportunity to substitute fossil fuels by utilizing wasted biomass and increasing the economic empowerment of local communities. This research was conducted to examine business development strategies and energy produced by bio-briquettes from waste rice straws and wood sawdust.

Methodology: Business development strategy analysis is carried out by forming farmer groups and branding for their businesses, and the production of bio-briquettes is carried out by carbonation and gluing methods.

Results: Marketing and improvement of bio-briquette products are carried out by forming groups of farmers and creating their business names. This study found that the bio-briquette business has a positive influence on improving the local community's economy. The results of the research show that the bio-briquettes that have been made have the potential to become a business opportunity at the household level that has the quality that meets SNI 016235-2000.

Implication: This research focuses on developing the household economy with a cause marketing strategy and provides an overview of briquette product marketing efforts that have the opportunity to substitute fossil fuels by utilizing wasted biomass and increasing the economic empowerment of the local community. This research was conducted to examine strategies for developing household businesses that are useful for business start-ups after COVID-19.

Keywords: *Renewable Energy, COVID-19, Business Development Strategy, Bio-briquette, Agriculture Waste*

1. Introduction

Indonesia is an agricultural country that has abundant crops. One of the main and important sectors is agriculture. The agricultural sector is the backbone of the community's economic activities in general. Not only as a food source-producing sector but also as a source of foreign exchange (Kusumaningrum, 2019). The agricultural sector is growing every year and is a mainstay sector that supports the Indonesian economy. Professor of Economics at the Institut Pertanian Bogor (IPB) Prof. Dr. Muhammad Firdaus (2021) says that there are 30 million farmers with an average farmer age of 50-60 years. Rice is one of the leading food commodities most widely grown by Indonesian farmers. According to the Central Statistics Agency/ Badan Pusat Statistik (BPS) in 2021 the rice harvest area will reach 10.41 million hectares. BPS also projects rice production in the January-April 2023 period to increase by 0.56% or around 80 thousand tons to 13.79

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million tons compared to 2022 which was recorded at 13.71 million tons. This great potential should be maintained for the survival and welfare of the Indonesian people.

Apart from that, agricultural waste is a problem that needs attention. Agricultural waste is often allowed to accumulate and pollute the environment. Some agricultural wastes including straw, husks, crop residues, corn cobs, and wood sawdust are scattered and rotting. The most common agricultural wastes are rice husks and sawdust (Harahap, 2007). It is estimated that around 60% of the yield (yield) is produced, while 40% is in the form of waste. Many solutions are used to treat agricultural waste, one of which is by converting it into biomass energy. Biomass is an alternative energy that has great potential in Indonesia. The quality is quite abundant but has not been optimized for its use (Paduloh et al., 2019). Biomass energy is a renewable energy that is widely used because its raw materials are widely available in nature, easy to use, and do not require large costs (Kalsum, 2016). Biomass energy is also the forerunner of alternative fuels. There are quite a lot of renewable alternative energy sources in Indonesia, some of which are derived from biomass or organic waste materials. This is possible because agricultural waste contains carbon. One of the utilization of biomass energy from agricultural waste is by making briquettes. Briquettes are solid fuels that can be used as an alternative energy source that has a certain shape. Briquettes derived from biomass are referred to as bio-briquettes (Rahmayanti & Hamidah, 2017). The selection of the briquetting process must of course refer to the market segment to achieve optimal economic, technical, and environmental value (Dahdah et al., 2020). The shape of the briquettes resembles charcoal with a higher density. Briquettes are renewable energy that can be made simply in terms of both the raw materials used and the manufacturing process, so briquettes have the potential to be developed (Rahmayanti & Hamidah, 2017).

Problems have arisen since the emergence of the Covid-19 pandemic in 2019. This virus can spread to humans and animals and usually attacks the respiratory tract in humans with the initial symptoms of the flu so that it can cause severe acute respiratory syndrome (SARS). The spread of this disease is through respiratory droplets from coughing or sneezing (Ren et al., 2020). Various multi-sectors have stopped due to the lockdown and the implementation of Work From Home (WFH). This epidemic spread in a short time in almost all countries in the world. This is certainly an obstacle for all parties in carrying out routines so that it hampers economic growth. The government limits people's mobility to reduce the spread of the virus. The government implements Large-Scale Social Restrictions and implements physical distancing, causing to break the chain of distribution of Covid-19, companies have to lay off several workers and even companies have to terminate employment unilaterally because they are no longer able to carry out their obligations by the provisions stipulated in the employment agreement (Syafrida et al., 2020). This causes many people to be unemployed and have no income. This research tries to provide insights and opportunities in utilizing available resources to increase income during Covid-19 or after.

Starting from the emergence of Covid-19 and the abundance of agricultural waste, it can be concluded that the community (especially farmers) can utilize agricultural waste into useful goods and have a selling value by making bio-briquettes. This step has the potential to be used as a business opportunity to increase farmers' income (Paduloh et al., 2019). Making bio-briquettes has advantages and disadvantages. The advantages of briquettes are that they are renewable, cheap raw materials, environmentally friendly, easy to pack, clean in the production process, and efficient in transportation. The downside is that it is less popular, and requires a furnace and fluctuating calorific value (Fitriana & Febrina, 2021).

2. Literature Review

2.1 Agricultural Sector in Indonesia

The agricultural sector is a large and major sector for Indonesia. The agricultural sector does have an important meaning for Indonesia, which is an agrarian country where most of the economy depends on the agricultural sector. Not infrequently every region in Indonesia is certainly enriched with various and different types of natural products so that the work of farmers in each region can certainly be used as a source of livelihood for some villagers. Food availability is highly dependent on this sector. According FAO (Food & Agriculture) says that 4 pillars of food security must be achieved, namely availability, access, physical and economic affordability, utilization, or diversity to stability or sustainability. Therefore, if viewed from this point of view, Indonesia, with its current natural wealth, accompanied by efforts to increase it together, certainly has a great opportunity to achieve Indonesia's vision of becoming a world food barn in 2045. The agricultural sector has an important and strategic role in national development. These roles include: increasing the country's foreign exchange earnings, providing employment, obtaining added value and competitiveness, meeting domestic consumption needs, domestic industrial raw materials, and optimizing sustainable management of natural resources. This is shown by the large contribution of the agricultural sector to the Gross Domestic Product (GDP), especially during the economic crisis experienced by Indonesia, the only sector that saved the Indonesian economy in 1997-1998 was only the agribusiness sector where agribusiness had positive growth (Kusumaningrum, 2019).

The development of long-term agricultural business fields is focused on processed agricultural products that provide added value to the national economy, such as the development of agro-industry. One of the agricultural business fields that are export-oriented and able to provide added value is the plantation sector. The GDP value of the agricultural sector has experienced better growth from year to year. If properly considered, the role of the agricultural sector can still be increased as an effort to improve the welfare of farming communities in Indonesia. Empirically, the advantages and roles of agriculture or agribusiness are quite clear. The first thing to look at is the important role of agribusiness (in the form of a contribution or relative share of the added value of non-oil and gas industries and non-oil and gas exports), which is quite high (Kusumaningrum, 2019). The role of the agricultural sector in the Indonesian economy is still significant, especially when viewed from several macroeconomic indicators such as Gross Domestic Product (GDP), economic growth, employment opportunities, and exports. BPS (2017) and the Ministry of Agriculture (2017) noted, in terms of GDP formation, in 2012 the agricultural sector contributed 13.37 percent (Rp. 1,152.262 billion), which is 2016 increased to 13.45 percent (Rp. 1,668.997 billion, during the 2012-2016 period there has been an average increase of 13.14 percent per year. As a contributor to added value to GDP during this period, the agricultural sector is the second largest contributor after the manufacturing sector. In terms of job creation, the agricultural sector is the main sector employed in Indonesia. Job opportunities in Indonesia note that during 2017 the agricultural sector absorbed a workforce of 37,770,165 people, while data from the Ministry of Agriculture (2017) recorded 35,088,823 people (Parmadi & Zulgani, 2018).

The largest average contribution of the agricultural sector in Indonesia in the formation of the province's Gross Regional Domestic Product (GDP) for the 2013-2017 period is in Gorontalo, West Sulawesi, Central Sulawesi, East Nusa Tenggara, Lampung, Bengkulu, Jambi, and Aceh. However, employment in the agricultural sector tends to decline. The number of workers in the agricultural sector decreased from 39.9 million in 2013 to 35.8 million in 2017 or experienced a decline in the workforce in the last five years 4.1 million people, as well as what happened to employment in the agricultural sector. Almost all provinces in Indonesia have experienced a decline in employment in the agricultural sector, except for Bangka Belitung, West Sulawesi, and Daerah Istimewa Yogyakarta (BPS, 2019). The agricultural sector tends to become one of the economic base sectors in several provinces in Indonesia, this can be seen from its contribution to the formation of Indonesia's GDP and in the formation of the provincial GRDP. Even though the contribution of the agricultural sector tends to decrease in the period 2013 to 2017, the workforce absorbed in this sector is still high. This shows that the agricultural sector has a share of the economy. This condition is the basis for research on the effect of the share of the agricultural sector and employment opportunities in the agricultural sector on labor productivity in Indonesia.

Indonesia's agricultural sector is increasingly increasing its productivity in line with the use of technology to fund and update several regulations. This certainly makes it easier for farmers to further develop crop yields. Agricultural equipment has developed and made it easier for farmers. Types of Agricultural Machinery Indonesia is an agrarian country where most of the population work as farmers. The support of weather and climate, as well as the sunshine that is available throughout the year, makes Indonesia a very suitable place for farming regardless of the type of plant. This agricultural activity was carried out from ancient times until now and has experienced rapid development to increase agricultural yields, the use of machine technology in agriculture is used and is the right solution to agricultural problems. These technologies are made to be able to help farmers and make it easier for farmers to carry out their farming activities, save labor, and provide better results as well.

Modern agricultural equipment is divided into three categories according to the functions and processes to be carried out, including agricultural tools used before planting, planting, fertilizing, and maintenance, and agricultural tools for harvesting. Equipment commonly used by farmers in Indonesia to save time includes 1) Tractors (one of the main machines that farmers rely on to cultivate agricultural land). 2) Rotavator (soil processing before planting. The first stage of land preparation is soil treatment by cutting, chopping, and turning the soil over. The second stage of soil preparation is the treatment of tidying up the soil, removing weeds, and improving the water system). 3) Cultivator (secondary tillage is assisted by a tool called a cultivator. Secondary tillage is the activity of removing weeds by stirring and destroying lumps of soil (aeration). Cultivators work by using teeth that stick slightly into the ground and are pulled by a tractor driver). 4) Rice Planter Machines (Modern planter machines that have been on the market so far are those that can be used to grow corn, rice, and potatoes). 5) Harvester Machine (Types of plants that can be harvested with this tool are sugar cane, potatoes, and peanuts). 6) Sprayer (This tool is usually used to spread and spray liquid fertilizers, herbicides, pesticides, and other liquids on agricultural land as pest and disease control, as well as plant fertilizers such as liquid fertilizers).

Not only in the development of the equipment used, but the agricultural sector is also developing in the digital field. The adoption of digital technology in the Indonesian agricultural sector needs to be accelerated to improve its quality and productivity. The use of digital agricultural technology can provide positive changes for farmers. McKinsey data (2020) estimates that the use of modern technology in the agricultural sector can increase economic output by up to US$6.6 billion per year. The presence of digital agricultural technology can connect farmers directly with consumers to shorten the supply chain. Farmers can also reduce their dependence on middlemen. So far, farmers have mostly sold agricultural

products in large quantities to middlemen. This causes farmers to not have the strong bargaining power to determine producer prices. In addition, farmers also have access to accurate and transparent commodity price information on the market. A strong understanding of the dynamics of agricultural commodity prices can help farmers to determine producer prices more measurably.

2.2 Developing Alternative Energy in Indonesia

Today, many industries choose to use alternative fuels to replace fossil fuels (petroleum). This transition was made considering the depletion of fossil fuel supplies. The Indonesian government is targeting that by 2025 the contribution of oil will be around 20%, natural gas 30%, and renewable energy 17%. The level of the primary energy mix in Indonesia is still dominated by fossil energy at 88.8 percent. The Director General of New and Renewable Energy of the Ministry (ESDM), Dadan Kusdiana (2021) stated that the use of renewable energy is still low, or around 11.2% of the total. He also explained in the webinar Refinery in Energy Transition, Roadmap for refinery and petrochemical development, green fuel and product downstream, coal still dominates by 38 percent of the primary energy mix. Followed by oil at 31.6%, and natural gas at 19.2%. The use of renewable energy recorded its best new historical record in 2018. This is as written in a report entitled Renewable Power Generation Cost in 2018. In the report, the existence of renewable energy does not only have a positive impact on world energy transformation but also in terms of prices becoming cheaper. Notes from the International Renewable Energy Agency (IRENA) report state that the average cost of using solar energy has decreased by up to 26%. The same goes for bioenergy up to 14%, and water energy up to 12%. Meanwhile, geothermal and wind energy in offshore areas has decreased by up to 1%.

The Indonesian government is carrying out various programs to reduce dependence on petroleum. Several industries use briquettes from coal and biomass for their production processes, apart from being economical, briquettes are practical, easy to obtain, and environmentally friendly. Among the several types of briquettes that tend to be the safest are briquettes made from natural materials and not coal. This is because coal briquettes can cause toxic and highly concentrated smoke which is not good for the surrounding environment. The need for fuel consumption that continues to increase is not in line with the diminishing availability of fossil fuels. Therefore it is necessary to develop alternative energy such as solar, wind, geothermal, and biomass energy. Biomass energy is an energy source that needs to get priority in its development. Biomass is an alternative energy that has great potential in Indonesia (Paduloh et al., 2019).

Biomass energy is the energy obtained from organic compounds. Organic compounds contain carbon and hydrogen which can be used to produce energy. Biomass energy sources can be plants, algae, organic waste, and other organic compounds. This makes biomass energy a renewable energy that will never run out because it is always available in nature. Organic compounds in this case also include agricultural waste. Biomass energy can be an alternative to fossil fuels because of its advantageous nature, which is renewable. In addition, biomass energy is also able to increase the efficiency of forest utilization as well as agriculture (Ndraha, 2009).

Biomass is any type of organic material available in a renewable form, which includes plant and agricultural waste, wood and forest product waste, animal waste, aquatic plants, and domestic and industrial waste. Biomass energy means chemical energy stored in organic matter and derived from solar energy through photosynthesis (Kalsum, 2016). The way to make briquettes is relatively easy, cheap, and doesn't take a long time, the heat power generated from making briquettes is not inferior to fossil fuels. In addition, briquettes have a good ability to spread coals of fire, are not easily extinguished, and do not require other energy to make burning stable (Almu et al., 2014). These various advantages are the background for the emergence of business opportunities for farmers. Biomass briquettes/ bio-briquettes have a sale value and have the potential to be made into a new business if managed properly. At this time the price of fuel oil such as kerosene and gas is very expensive and not affordable by the lower middle class. Therefore, making bio-briquettes is a solution that can be tried.

2.3 The Development of Biobriquette Business in Indonesia

The main ingredient for briquettes in Indonesia is still dominated by coconut shells. However, some other agricultural wastes such as corn cobs, rice husks, and sawdust are also being used. Coconut charcoal briquettes are a commodity that is in demand in various countries. The high-calorie content of charcoal briquettes from Indonesia, which is 6,700-7,100 kilocalories (kcal), also speeds up the burning process. Chairman of the Indonesian Coconut Charcoal Entrepreneurs Association (Perpaki), Y Abimanyu (2019) proposed that the government encourage the growth of the household-scale coconut briquette industry. Currently, national briquette production ranges from 280-295 thousand tons per year. Coconut charcoal consumption ranges from 322-340 thousand tons per year. Meanwhile, coconut charcoal production ranges from 800 thousand to 1 million tons per year. As a result, coconut charcoal is widely exported with a growth of around 4% per year. in 2016, Indonesia produced 14.5 billion coconuts, until 2018 it is estimated that this number has not changed much. If this number is converted, it becomes 457.41 thousand tonnes of raw material charcoal. Based on this amount, 273.11 thousand tonnes (40.97%) of charcoal was exported raw, which was of low value. The remaining 40.95 thousand tons of

charcoal is absorbed by domestic consumption such as satay exchanges and Padang stalls, as much as 135.55 thousand tons of charcoal is absorbed by the domestic activated carbon industry, 217 thousand tons is absorbed by the domestic briquette industry, which has a very high value.

Making briquettes from rice husks and sawdust is used as raw material for briquettes to reduce the amount of agricultural waste and turn it into objects that have a sale value. Rice husk has an ash content of 29.8367% and a calorific value of 3341.9467 cal/g (Rianawati et al., 2021). Sawdust has an ash content of 14.22% and a calorific value of 3481 kcal/kg (Rahmayanti & Hamidah, 2017). Based on the results of the calorific value test, rice husks, and sawdust have the potential to be used as bio-briquettes. Rice husk is a hard layer covering the caryopsis which consists of two parts called lemma and palea which are interlocked. In the rice milling process, rice husks are separated from the grains of rice and become waste materials or milling waste, rice husks are categorized as biomass which can be used for various needs such as industrial raw materials, animal feed, and energy or fuel. From the rice milling process, husks are usually obtained around 20-30%, sudden between 8-12%, and milled rice between 50-63.5% of initial grain weight data (Dahdah et al., 2020). The amount of sawdust produced from the exploitation/harvesting and processing of logs is very large. Indonesia's total production of sawn timber reaches 2.6 million m3 per year, assuming that the amount of waste formed is 54.24% of the total production. Therefore, sawmill waste generated as much as 1.4 million m3 per year and this figure is quite large because it accounts for about half of the sawn timber production. Waste sawdust creates problems in its handling, namely being allowed to rot, stacked up, and burned, all of which harm the environment.

Bioarang/biomass briquettes have several advantages over ordinary/conventional charcoal, namely: 1) The heat generated by biomass briquettes is relatively higher compared to ordinary wood and the calorific value can reach 5000 calories. 2) Bioarang briquettes when burned do not cause smoke or odor, so, for economically weak people who live in cities where housing ventilation is insufficient, it is very practical to use briquettes. 3) Biomass briquettes do not need to be fanned after burning (turning into coals). 4) The technology for making biomass briquettes is quite simple and does not require large areas of land. 4) No need for the addition of other chemicals.

3. Materials and Methods

3.1 Materials and Methods of Agricultural Biobriquette

All chemicals were used without purification and were purchased from commercial suppliers. sawdust and straw have been obtained from agricultural waste in Sidoarjo-Indonesia. Equipment that has been used includes glassware, burners, sieves, analytical balances, and cylindrical molds with a diameter of 4.5 cm and a height of 6 cm.

The material preparation is carried out by drying and carbonating the biomass waste, then cooling it and reducing the particle size to 100 mesh. Starch flour is added as much as 10% as an adhesive, the adhesive was previously prepared by mixing it with water. Next, the ready-made briquettes are formed with a cylinder with a diameter of 4.5 cm and a height of 6 cm. The forming process has been carried out by pressing. The briquettes were then dried and subjected to the proximate-ultimate test. The analysis was carried out with a predetermined standard, namely the water content test with ASTM. D 3302, Volatile matter by ASTM. D 3175, ash content according to ASTM. D 3174, fix carbon with different, flame test with Limn High Therm VMK 135, and calorific value with ASTM. D 5865.

3.2 Strategy Model Bussines and Bio-briquette Making

The business strategy in this study was carried out in several stages:

1. The business strategy begins with forming groups consisting of several farmers whose houses are close to each other. This is done to facilitate communication and speed up the process of making bio-briquettes.
2. Preparation of an organizational structure consisting of a chairman, secretary, and treasurer in one group. This is done to regulate the course of business and archive the required data. All expenses and income will be recorded and used as an evaluation for the next sale.
3. Marketing techniques are carried out directly and indirectly/online (using e-commerce).
4. Creation of trade names for branding. This is done to provide product identity so that it can be widely known by consumers.

Making bio-briquettes is done in several steps as follows:

1. Agricultural wastes such as rice husks and sawdust are collected in a dry place for storage. After the amount meets the target to be used as bio-briquettes, the agricultural waste is dried in the sun for 3 days.
2. The material is crushed in a crusher machine until smooth and puts in a furnace or heating furnace at 390^{O}C for 90 minutes (Hartanto & Alim, 2011)
3. Make adhesive from a mixture of 7.5 grams of tapioca and 90 ml of water, then stir until mixed while heating until the tapioca flour solution thickens and changes color to clear.

4. The material that has been heated is then filtered through a 100-mesh sieve. The powder that does not pass through the 100-mesh sieve is used as the basis for charcoal briquettes. Furthermore, the charcoal powder is mixed according to the variations (75:25, 50:50, and 25:75) mixed with adhesive, and then printed using a briquette mold and compressed using a briquette press machine.
5. The resulting charcoal briquettes are dried in an oven at 60 degrees Celsius for 24 hours. After that, it was left alone and packed.

4. Discussion

4.1 Business Development Opportunities in The Alternative Energy Sector

The capital used to start a bio-briquette business is not too large so it is suitable for medium to low businesses. Abundant agricultural waste is used as raw material so that no money is spent. However, the equipment and materials for making bio-briquettes such as furnaces, molds, and adhesives require capital. The market potential of bio-briquettes is very large in foreign markets such as Europe and East Asia. Therefore, a lot of bio-briquettes are exported because the quality of Indonesia's bio-briquettes is one of the best in the world. In these countries, briquettes are widely used for cooking, baking, and other needs. According to the Central Statistics Agency (BPS) in 2019, exports of briquettes in Indonesia reached 188,050 tons with an export value of USD 145.09 million. The most exported destination countries are China, Brazil, Germany, Lebanon, Malaysia, the Netherlands, Russia, Saudi Arabia, Sri Lanka, and Vietnam. The Ministry of Home Affairs released the first export of one container of briquette products worth USD 19.2 thousand to Japan. Overall, it is estimated that Indonesia produces coconut charcoal briquettes of approximately 30,000 tons per month. It is because of this production, even during a pandemic like today, Indonesia's foreign exchange has reached ± Rp. 6.8 trillion per year.

4.2 Energy Analysis of Biobriquette from Agricultural Waste

Biomass briquettes of rice straw and sawdust have been successfully made with the addition of starch and water adhesives of 10% each. Starch has a high calorific value and is flammable (Rahmayanti and Hamidah, 2017), so it has been chosen as an adhesive. Factors that affect the quality of briquettes include the type of adhesive and the moisture content of the material so in the process of making briquettes it is necessary to add adhesive and carbonation process. The biomass waste used was obtained from agricultural waste in Sidoarjo-Indonesia. The selected biomass is rice straw and sawdust. As is known, rice straw and sawdust have been used as raw materials for briquettes and good results have been obtained, namely, calorific values of 3.562 and 3.481 Kcal/kg, respectively (Hamidah dan Rahmayanti, 2018). The combination of the two is expected to improve the quality of the briquettes that have been produced. The ultimate and proximate test results can be seen in Table 1. The results showed that the best combination was produced in the ratio of straw charcoal and sawdust (75:25) with the highest calorific value of 3541 Kcal/kg. The more straw used, the better the quality of the briquettes produced. Judging from the value of the volatile matter that has been produced, it also produces the same pattern. The more straw the better, and the volatile matter value reaches 20.85%. The combustion of volatile matter determines the perfection of combustion and the intensity of the flame. Volatile matter is a substance that can evaporate as a result of the decomposition of compounds contained in briquettes outside of carbon, water, and ash. The quality of the briquettes has also been reviewed for their ash content. The ash content in biomass is a residue from combustion because it is difficult to burn, this is because the ash does not have carbon elements so it has no calorific value. High ash content is avoided in briquettes. The best ash content was found in straw biomass briquettes: sawdust (25:75), namely 16.14%. In this variation, biomass briquettes also have the lowest moisture content, namely 2.40%. Moisture content is avoided in briquette products because it inhibits combustion. The quality of briquettes is also determined by the fixed carbon, fixed carbon is the amount of carbon contained in a material. Its value will be correlated with the calorific value produced, high fixed carbon will be followed by the calorific value as well. The results of the flame test on the three samples showed results that were not significantly different, the results of the flame test of the biomass briquettes that had been made ranged from 270-286 °C.

Table 1. Results of ultimate and proximate analysis of biomass briquettes.

Parameter	Unit	Result			Analytical Method
		Straw: Sawdust (75:25)	Straw: Sawdust (50:50)	Straw: Sawdust (25:75)	
Water content	%	2.85	3.05	2.40	ASTM. D 3302
Volatile matter	%	20.85	18.81	16.54	ASTM. D 3175
Ash content	%	20.50	18.22	16.14	ASTM. D 3174
Fix. Carbone	%	55.80	59.92	65.01	By different
Flame test	°C	272	286	270	Linn High Therm VMK 135
Calorific value	Kcal/kg	3541	3523	3502	ASTM. D 5865

4.3 Kesesuaian Kualitas Bio-Briket Berdasarkan SNI 01-6235-2000

Indonesia has a briquette quality standard, namely the Indonesian National Standard/Standard Nasional Indonesia (SNI) 01-6235-2000 Wood Charcoal Briquettes. Although the materials used in this study came from rice husks and sawdust, this standard was used as a comparison for the quality of the briquettes produced. This standard was prepared based on the results of discussions in a technical meeting, namely the pre-consensus meeting on October 28, 1999, at the Samarinda Industrial Center, and finally discussed at the National Consensus Meeting held in Jakarta on November 25, 1993, and was attended by representatives from Producers' Associations, Institutes of Science and Technology as well as related Government Agencies. The SNI for Wood Charcoal Briquettes was compiled by Balai Penelitian dan Pengembangan Industri, Departemen Peindustrian dan Perdagangan Samarinda.

The following is the result of the parameter test for rice husk and sawdust bio-briquettes compared to SNI 01-6235-2000. The sampling method is following SNI 19-0428-1998. Briquettes are declared passed if they meet the requirements. Methods of packaging and conditions for marking briquettes are also regulated in this standard. Briquettes are packaged in tightly closed containers that are not affected affect the contents and are safe during storage and transportation. Information on the packaging must contain: 1) the name of the producer, 2) the name of the goods, and 3) the net weight.

Table 2. Comparison of the Quality of Rice Husk and Sawdust Bio-briquettes with SNI 01-6235-2000

Parameter	Unit	Result			SNI 01-6235-2000
		Straw: Sawdust (75:25)	Straw: Sawdust (50:50)	Straw: Sawdust (25:75)	
Water content	%	2.85	3.05	2.40	≤8
Volatile matter	%	20.85	18.81	16.54	≤15
Ash content	%	20.50	18.22	16.14	≤8
Calorific value	Kcal/kg	3541	3523	3502	≥5000

Based on the test results obtained, the water content of the rice husk and sawdust bio-briquettes in all the various ratios met the standard, namely ≤8 (water content), but the volatile matter did not meet the standard (exceeding 15%). Only Straw: Sawdust (25:75) whose results are close to the standard, namely 16.54%. Ash content also does not meet the standard (exceeding 8%) but Straw: Sawdust (25:75) has a value that is closest to the standard, namely 16.14%. The calorific value does not meet the standards and the one with the highest value is Straw: Sawdust (50:50) which is 3523 Kcal/kg.

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