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Automation of Bricket Charcoal Press Machine to Increase Production Capacity in Kampoeng Oase Ondomohen Surabaya

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Abstract: *Kampoeng Oase, is one of the educational village tourist destinations located on Jalan Ondomohen Magersari V, Ketabang Village, Genteng District, Surabaya City. It is named the educational village because this village has succeeded in processing waste into something that has a high selling value. But behind the success in processing the waste, there are some problems in Kampoeng Oase, especially in producing charcoal briquettes. Problems related to the aspect of increasing production capacity have been carried out by automated tools for making charcoal briquettes using the latest technology. By using an automatic press machine, Kampoeng Oase can now produce charcoal briquettes with a minimal amount of labor and a shorter processing time compared to the manual production process. By utilizing waste in charcoal briquettes, it can solve problems related to waste management and protect the environment and help encourage a circular economy to improve welfare, especially for the people of Kampoeng Oase Ondomohen Surabaya.*

Introduction

The urgency of the urbanization challenge has been recognized by the objectives Sustainable Development (SDGs), which has been reflected in one of its main goals (11th goal) which is to make cities and dwellings inclusive, safe, resilient, and sustainable[1]. In the early period of the urbanization process, it is usually marked by an increase in the rate of population growth which is then usually followed by the simultaneous development of economic growth from the urbanization process, although then the rate

[1] Anita Dianingrum, *Perkembangan Program Perbaikan Kampung Dan Pemberdayaan Masyarakat Di Surabaya*, 2017.

of population growth will slow down in the following periods[2]. In connection with one of the main objectives of sustainable development to deal with urbanization problems is to empower the village community. This is what the Surabaya City Government has done to make several target areas. One of these areas is Kampoeng Oase Ondomohen in the city of Surabaya. Kampoeng Oase, Jalan Ondomohen Magersari V, Ketabang Village, Genteng District, Surabaya City is one of the village tourist destinations in the city of Surabaya. Giving the name Oase has a meaning, namely as a place for water to quench thirst, and calm, as well as a source of knowledge, and culture of local wisdom as a gathering place for people to interact with each other and learn all kinds of useful things.

Kampoeng Oase was inaugurated in November 2020, until now there have been many products produced by the people of Kampoeng Oase, including sofas, charcoal briquettes, hydroponic plants, to the use of waterways as ornamental fish and catfish cultivation ponds[3]. All raw materials for production come from household waste as well as organic waste from the surrounding environment. The waste management carried out by Kampoeng Oase is carried out with the 3R concept (Reduce, Reuse, Recycle), this management effort is very effective in reducing the amount of waste in the environment around Kampoeng Oase.

Figure 1. Charcoal Briquette Produced by Kampoeng Oase Surabaya [4]

The utilization of tree branches and dry leaves in the manufacture of charcoal

[2] Fadjar Hari Mardiansjah, Wiwandari Handayani, and Jawoto Sih Setyono, Pertumbuhan Penduduk Perkotaan Dan Perkembangan Pola Distribusinya Pada Kawasan Metropolitan Surakarta," *Jurnal Wilayah dan Lingkungan* 6, no. 3 (2018): 215.

[3] Kampoeng Oase Ondomohen, "Kampoeng Oase Ondomohen," *Website Resmi Kampoeng Oase Ondomohen*, last modified 2022, accessed August 26, 2022, https://kampoengoaseondomohen.com/.

[4] Christine Ayu Nurchayanti, "Warga Kampung Ondomohen Surabaya Bikin Briket Arang Dari Daun Kering, Masak Jadi Lebih Cepat & Hemat," TribunJatim.Com, last modified 2019, https://jatim.tribunnews.com/2019/08/19/warga-kampung-ondomohen-surabaya-bikin-briket-arang-dari-daun-kering-masak-jadi-lebih-cepat-hemat?page=2.

briquettes is a major focus in organic waste management. Briquette is a material in the form of small pieces of powder compacted by machine press with mixed adhesive so that it becomes a solid[5]. Charcoal briquettes are a source of energy alternative that potential and reliable for households[6]. In addition to these raw materials, Kampoeng Oase also utilizes waste charcoal from the Sate Klopo Ondomohen restaurant which is located near the location of Kampoeng Oase. According to the residents of Kampoeng Oasis, the smoke produced by the charcoal briquettes they produce is very little.

The factors that determine the combustion characteristics of a briquette are the burning speed, calorific value, specific gravity and the amount of pollution or volatile compounds produced[7]. The charcoal briquettes produced by Kampoeng Oase have passed a lab test conducted by Dinas Kebersihan dan Ruang Terbuka Hijau (DKRTH) – Surabaya City Government. From the results of the lab test, the contents of the briquette charcoal produced by Kampoeng Oase include water content: 5.5%, ash content: 23.5, volatile matter: 23.6%, fixed carbon: 47.4, calorific value: 6.1977. Result No. Registration of Charcoal Briquettes based on DKRTH lab testing is 1337/WMO5/T/2019.

Currently, the manual process of making charcoal briquettes is a problem for Kampoeng Oase in producing charcoal briquettes in large quantities. The process of producing charcoal briquettes in Kampoeng Oase is shown in Figure 2.

Figure 2. Charcoal Briquette Production Process

The briquette pressing process is carried out one by one using simple tools, so it takes a long time to produce the charcoal briquettes. The use of tools that are still manual

[5] Ardina Ningsih, "Analisis Kualitas Briket Arang Tempurung Kelapa Dengan Bahan Perekat Tepung Kanji Dan Tepung Sagu Sebagai Bahan Bakar Alternatif," *JTT (Jurnal Teknologi Terpadu)* 7, no. 2 (2019): 101–110.

[6] Yuliati Yuliati et al., "Prospek Bisnis Briket Daun Kering Dalam Kegiatan Pendampingan Dan Pemberdayaan Masyarakat Surabaya Menuju Ekonomi Sirkular," Jurnal Ilmiah Pangabdhi 7, no. 2 (2021): 99–104.

[7] Briket Batubara and Siti Jamilatun, "Sifat-Sifat Penyalaan Dan Pembakaran Briket Biomassa, Briket Batubara Dan Arang Kayu," *Sifat-Sifat Penyalaan dan Pembakaran Briket Biomassa, Briket Batubara dan Arang Kayu* 2, no. 2 (2012): 37–40.

causes a lot of labor to be involved. This causes in the production process there are still many shortcomings and the need for automation of tools to increase production output and reduce the number of workers involved. In producing charcoal briquettes manually, 6-8 people are needed with a production yield of 3 kg/day.

In addition to the production process, other problems faced by Kampoeng Oase are related to the marketing strategy of the briquette charcoal production. Knowledge in determining product packaging development strategies will determine the success or failure of a business actor in marketing their products to increase sales volume[8]. The marketing carried out requires branding that can attract buyers so that it becomes a "characteristic" of Kampoeng Oase. The packaging currently exists, still seems minimalist, and is what it is by using ordinary plastic and cannot be recycled. Charcoal briquette packaging is currently one of the products of the Kampoeng Oase as shown in Figure 3.

Figure 3. Charcoal Briquette Packaging

Method

To increase the production of charcoal briquettes, an automatic press machine was designed. The automatic briquette charcoal press machine consists of a milling machine and a press machine. A milling machine is a tool used to crush the residues of sate klopo charcoal, tree branches, and dry leaves to produce a dough that will be used to print charcoal briquettes. A press machine is a tool used to press the dough that has been prepared to become charcoal briquettes with the desired shape. As the main driving force in running the two machines, a diesel engine with diesel fuel is used.

Milling Machine

The charcoal briquette milling machine used here uses a modified FFC-23 machine so that this machine can function to crush coconut shells. And for the press machine, has

[8] David H M Hasibuan, "Analisis Strategi Pengembangan Kemasan Produk Terhadap Volume Penjualan," *JURNAL ILMIAH RANGGAGADING* 5, no. 1 (2005): 37–44.

been adjusted to produce the desired shape of charcoal briquettes. The mechanism of this coconut shell milling machine uses steel teeth which are used to chop coconut shells into flour. This machine is divided into 3 parts, namely funnel, mill body, and outlet. When coconut shell charcoal is inserted into the funnel, the charcoal will enter the mill body and will be crushed by the rotating steel serrations. After that, it is filtered to the desired size, and the flour comes out of the outlet.

Figure 4. Milling Machine

Press Machine

The mechanism of this press machine has two stages, namely blending and pressing. Blending is the process of kneading charcoal dough to pulverize the ingredients to produce a soft, smooth, and perfect press quality. This blending process is done 2-3 times. After the ingredients are mixed evenly, then put them into the briquette mold. After pressing, cut the charcoal briquettes as desired.

Figure 5. Press Machine

Result

The Surabaya urban community empowerment activity in this case Kampoeng Oase related to the utilization of waste into charcoal briquettes will not be realized and successful without good cooperation and collaboration between institutions and partners. From the analysis of the situation and identification of needs, this activity is expected to increase the knowledge and skills of the community in environmental management and processing of organic waste as a product that has a high selling value. The basic ingredients for making charcoal briquettes consist of tree branches and charcoal waste available around residential areas, as well as tapioca flour and water as adhesives[9].

Dissemination activities have been carried out as a form of information delivery activities related to the results of innovations from machine production. This activity was attended by participants, namely Kampoeng Oase residents and resource persons from the community service team. With the presence of this automatic charcoal briquette press machine innovation, it received a positive response and residents were very enthusiastic to find out more about the process of making charcoal briquettes which had been done manually.

(a) (b)

Figure 6 (a), (b). Charcoal Briquette Automation Tool Dissemination Activities

In the direction of make it easier to operate this automatic charcoal briquette press machine, a manual book was made can be seen in the following figure 7. The manual book contains an explanation of the specifications, how it works, how to use it, and how

[9] E Saptutyningsih and B P Kamiel, "Pemanfaatan Sampah Organik Untuk Pembuatan Briket Arang Dalam Meningkatkan Kapasitas Ekonomi Masyarakat," *Prosiding Seminar Nasional ...* (2019): 1033–1047.

to maintain the automatic charcoal briquette press machine.

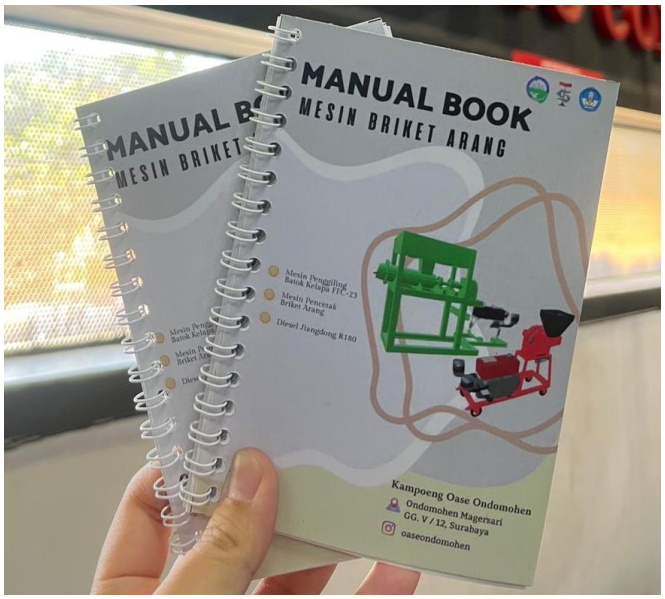

Figure 7. Manual Book for Automatic Charcoal Briquette Press Machine

The results of charcoal briquettes using an automatic machine can be seen in the following figure 8. Based on variations in shape, cylindrical briquettes require a faster combustion time than box-shaped briquettes[10].

(a) (b)

Figure 8 (a), (b). The Results of Charcoal Briquettes Using An Automatic Printing Machine

In addition to dissemination, this activity also carried out repairs on packaging from charcoal briquettes. Previously, charcoal briquettes were only packaged in plastic containers and were considered lacking in attracting the purchasing power of the public and tourists who wanted to buy charcoal briquettes[11]. After the design process and

[10] Setyaningtyas Rusdiana and Artiyani Anis, "STUDI VARIASI KOMPOSISI BAHAN DASAR BRIKET DARI SAMPAH ORGANIK PASAR," *Jurnal Rekayasa Infrastruktur Hexagon* 15, no. 2 (2016): 1–23.

[11] Khodijah Amiroh et al., "Peningkatan Branding Penjualan Arang Briket Oleh Kelompok Masyarakat Kampung Oase Ondomohen," *Amaliah: Jurnal Pengabdian Kepada*

considering the size of the packaging, currently, the charcoal briquettes produced by Kampoeng Oase have better packaging and are expected to increase sales. The briquette charcoal packaging that has been designed can be seen in the following figure 9.

Figure 9. Latest Charcoal Briquette Packaging

Discussion

The process of making charcoal briquettes from organic waste and coconut shells produces charcoal briquettes which can be used as alternative fuels. The charcoal briquettes produced can be said to be environmentally friendly because they are free of smoke and do not cause an odor[12]. Charcoal briquettes do not cause smoke because they are in a dense cylindrical shape because of the pressing process using a tool that has been designed, so there are no voids, and they last a relatively long time when used.

The process of making briquettes is described in Figure 10. The first process in making briquettes is the chopping of raw materials. The process of enumerating this raw material uses a chopping machine with diesel fuel. After the raw materials are chopped into powder then it is mixed with tapioca flour and water. The next process in making briquettes is the blending process using a blending and printing machine. This process is carried out so that the briquette mixture is evenly and well mixed. After the dough is well mixed, the dough can be directly printed using the same machine. The mold is then cut manually into small pieces. The result of the briquette pieces is then dried for two days with heat before being packaged.

Masyarakat 6, no. 1 (2022): 135–139.

[12] R S Budi, S Napid, and P P Warsodirejo, "Pemanfaatan Sampah Tumbuh-Tumbuhan Menjadi Briket Arang Sehat Di Desa Mitra Uisu Desa Pematang Kuala Kecamatan Teluk Mengkudu Kabupaten Serdang Bedagai," *Jurnal Pengabdian Mitra Masyarakat (JURPAMMAS)* 1, no. 2 (2022): 7–13.

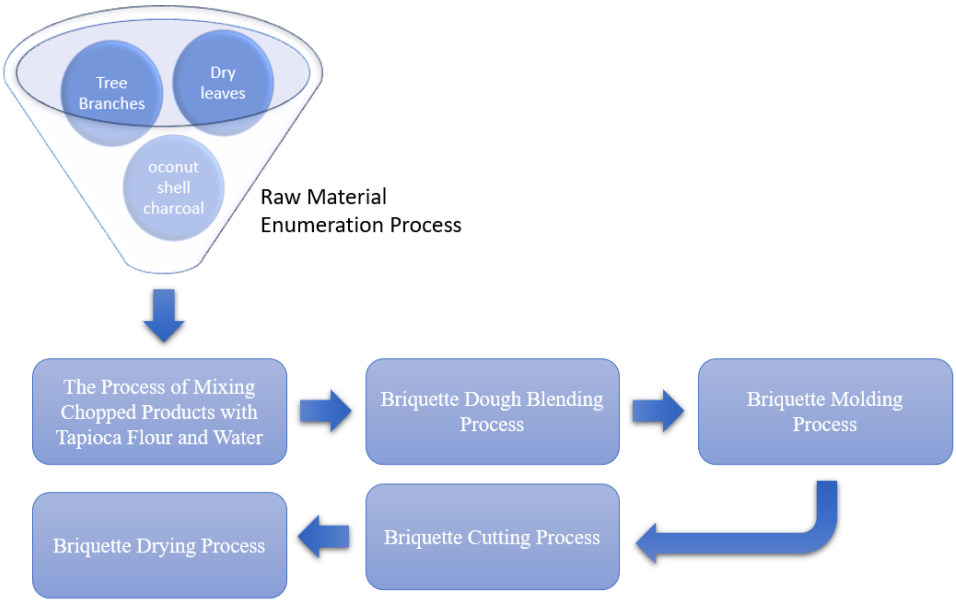

Figure 10. Charcoal Briquettes Production Process

The production of charcoal briquettes using this automatic machine can increase the amount of production and use of labor and a more efficient length of time. The automatic briquette press machine has a production capacity of 50 kg/week. The following table compares the production of manual and automatic charcoal briquettes for a total production of 30 kg.

Table 1. Production Process Comparison per 30 kg

Item	Manual Production	Automatic Production
Labor needs	6 – 8 people	2 – 4 people
Production time	10 hours	5 hours

It can be realized that with this automatic charcoal briquette press machine increases production and streamlines the amount of labor needed and production time. This increase in production is expected to be able to increase marketing to increase the sales volume of charcoal briquettes by the people of Kampoeng Oase.

The items that are the initial investment in this production are the items needed to start a business activity[13]. The costs acquired for the automation process of the charcoal briquette press machine are as follows in Table 2.

[13] Kemas Ridhuan, Dwi Irawan, and Yulita Zanaria, "Kajian Tekno-Ekonomi Produksi Reaktor Pirolisis Dalam Menghasilkan Bioarang Dan Asap Cair," *Turbo : Jurnal Program Studi Teknik Mesin* 8, no. 2 (2020): 219–225.

Table 2. Investment Cost Production[14]

No	Machine/tools	Amount	Price	Total
1	Milling Machine	1	Rp12,500,000.00	Rp12,500,000.00
2	Press Machine	1	Rp18,000,000.00	Rp18,000,000.00
3	Wheel	3	Rp.200,000.00	Rp600,0000.00
4	Tray	1	IDR 10,000.00	IDR 10,000.00
5	Pot	1	IDR 70,000.00	IDR 70,000.00
6	Scales	1	Rp85,000.00	Rp85,000.00
7	Stove	1	Rp260,000.00	Rp260,000.00
8	Big Round Tub	1	Rp37,5000.00	Rp37,5000.00
9	Big Barrel	1	Rp.200,000.00	Rp.200,000.00
10	Small Barrel	1	Rp100,000.00	Rp100,000.00
11	License	1	IDR 2,500,000.00	IDR 2,500,000.00
12	Knife	6	IDR 50,000.00	Rp300,000.00
			Total Investment Cost	**Rp34,772,5000.00**

Considering the capital cost of producing charcoal briquettes and some economic analysis calculations, Kampoeng Oase can sell charcoal briquettes for Rp. 10,500.00 for each 0.5kg (one package).

Conclusion

Utilization of waste that is around the community if done properly can produce a product that has economic value. By utilizing the technological aspect, it is proven that producing charcoal briquettes using an automatic machine can increase the amount of production, as well as reduce the amount of labor and the length of production time. The current production increase can reach 50 kg/week with the number of employees needed only 2-4 people within 5 hours to produce 30 kg charcoal briquettes. Sustainable development and efforts in utilizing organic waste in charcoal briquettes can encourage a circular economy and improve welfare for the people of Kampoeng Oase by selling charcoal briquettes for Rp. 10,500.00/one package.

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[14] R A Zunaidi et al., "Financial Feasibility Study of Briquette Production from Used Charcoal and Tree Branches in Kampung Oase Ondomohen Surabaya," in *IOP Conference Series: Earth and Environmental Science*, vol. 1151 (IOP Publishing, 2023), 12041.

Surabaya always actively participate so that this activity can be carried out properly.

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