

PRODUCTION OF PALM-BASED BIOMASS BRIQUETTES

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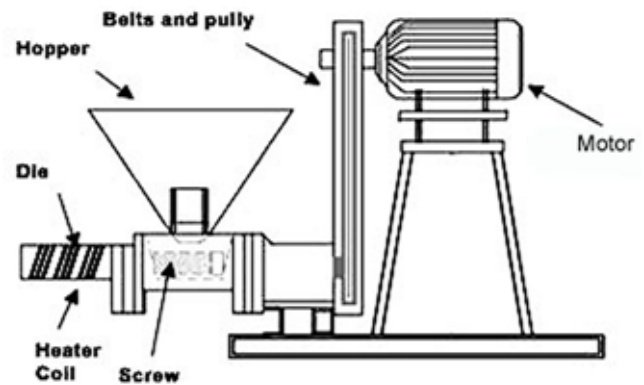
Empty fruit bunch (EFB) is the main solid waste obtained from milling process. However, due to its poor characteristics, it has limitation to be used as fuel. Therefore, the EFB needs to be upgraded and processed into briquettes via a proven technology.

TECHNOLOGY

Briquetting is the process of compacting loose organic materials into a higher density and uniform solid fuel. The process improves the physical, chemical and combustion properties over those of the raw material and is also easier to handle. There are two ways for briquetting - screw extrusion and piston pressing - both of which can be done with or without binder. For lower cost and to retain the energy content of the fuel, palm-biomass briquettes are prepared by screw extrusion which is also used to briquette sawdust. In this process, the biomass is driven by a screw to extrude continuously through a taper die heated externally. The process has been found suitable for producing binderless briquettes from EFB powder without any major problems in terms of the process and product quality. However, to use EFB fibre, it has to be blended with at least 50% sawdust to produce a better quality product. The pressure and temperature applied are 7 MPa and 150°C-250°C. The typical screw extrusion technology and the process is illustrated in Figures 1 and 2.

PRODUCTS

Treated EFB fibre and powder forms and sawdust are the raw materials used for production of palm biomass briquettes (Figure 3). No binder is added. Two types of briquettes can be produced: 100% palm briquettes from EFB powder and palm-based



Source:www.ait.ac.th

Figure 1. A typical commercial screw extrusion set-up.

briquettes EFB in fibre or powder and at least 50% sawdust. The products are shown in Figure 4. The products are made as logs 490 mm long and 55 mm in diameter, weighing 1.1 kg at bulk density of 1300 kg m⁻³. However, the length of the products can be customized into 5 or 10 kg packs. The surface of the briquettes is partially carbonized for easy ignition and to minimize the absorption of moisture. The product is designed with a hole through the centre for better air circulation during combustion. The properties of the palm biomass briquettes are given in Table 1.

Palm-based biomass briquettes are ideal for household use such as open fires (camping), stoves, BBQ, and to provide industrial energy as well (Figure 5). They can be turned into charcoal briquettes by carbonization. The products offer two times more combustion stability and heat output than their raw materials due to lower moisture content and higher energy content. The average combustion rate is 0.43 g min⁻¹, producing a minimum of 0.13 kW heat.



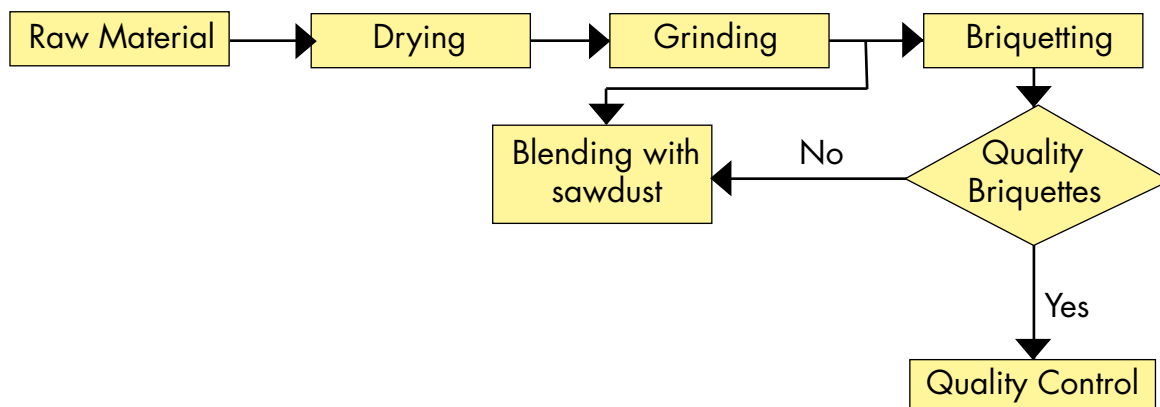


Figure 2. Palm-based biomass briquetting process.

TABLE 1. PROPERTIES OF THE RAW MATERIALS AND PALM-BASED BIOMASS BRIQUETTES

Raw materials/products	Calorific value, kJ kg ⁻¹	Moisture content (%)	Ash content (%)	Compressive strength (MPa)	Elasticity (MPa)
Pulverized EFB (PEFB) < 212 μ m	1 7 000	12.0	2.41	-	-
EFB fibre (2.5 mm)	1 6 641	14.0	4.60	-	-
Sawdust (SD) < 500 μ m	1 8 506	10.0	2.31	-	-
100% EFB powder briquettes	1 7 823	7.39	2.85	7.5	0.34
EFB powder + sawdust briquettes (50:50)	1 8 273	7.22	1.63	7.5	0.52
EFB Fibre + sawdust briquettes (40:60)	1 8 775	7.32	2.99	6.5	0.24
Sawdust briquettes (control)	1 8 936	6.81	1.63	7.8	0.80



EFB Powder (<200 μ m)



EFB Fibre (2-3 mm)



Sawdust (<500 μ m)

Figure 3. Raw materials for production of palm-based biomass briquettes.



EFB Powder Briquettes



EFB Powder + Sawdust
Briquettes (50:50)



EFB Fibre + Sawdust
Briquettes (40:60)

Figure 4. Binderless briquettes made from oil palm-based biomass and sawdust.



Charcoal Briquettes



Space Heating



BBQ & Cooking

Figure 5. Applications of palm-based biomass briquettes.

COMMERCIAL BENEFITS

The properties of the palm-based biomass briquettes are comparable to those of commercial sawdust briquettes. With the decreasing sawdust supply and increasing global interest in renewable fuels, palm biomass is a potential raw material to be used in briquette production. The production cost would depend on the raw material used as the major cost is pre-treatment of the EFB. Therefore, it is recommended the EFB treatment and briquette plants be integrated in palm oil mills to make the project more economically viable. By this approach, the cost for raw materials, treatment process, transportation and utilities can be obtained at very minimal cost. The processing cost is estimated at

RM 150 per tonne and the selling price for export market at RM 600 to RM 700 per tonne.

NOVELTY OF THE INVENTION

Due to the increasing cost of the fossil fuels and environment concern over their use, palm biomass briquettes can be an alternative fuel for energy production especially for the industrial sector. The process improves the oil palm biomass properties in many ways over those of raw materials, and are suitable burning in larger / thermochemical devices. Briquetting would turn a waste to be disposed off into extra profits for the oil palm industry.

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