WWW.IJRPR.COM

International Journal of Research Publication and Reviews

Journal homepage: www.ijrpr.com ISSN 2582-7421

Model Design of Active Charcoal Powder Mixing Machine as Briquet Raw Material

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A B S T R A C T

Energy is the main human need, research in the field of energy must of course continue to be done. Moreover, the current situation where energy demand continues to increase, along with the growth of various industrial sectors, meanwhile fossil fuels as the main source of energy continue to run out. Biomass in the form of briquettes is one of the renewable energies with abundant availability and low production costs. The briquette production process goes through several stages, all of which must be processed properly, in order to get briquettes according to the standard. The main briquette processing process includes the process of stirring or mixing activated charcoal powder with adhesive. Mixing must be according to the measure of size and thoroughly mixed. This research is based on field surveys and technical calculations, then formed in a graphic design concept. The results of this study obtained a graphic design of a charcoal powder mixer machine with a capacity of 25 kg/hour, electric motor drive, vertical stirrer type.

Keywords:Energy, briquettes, mixing machine

1. Introduction

The population of Indonesia continues to increase so that the demand for energy is increasing. One of the main sources of energy consumed by humans is natural resources derived from fossils. This energy source was formed millions of years ago, so it will gradually run out. The problem of reducing energy sources encourages people to make savings and look for alternative energy sources. Therefore, it is necessary to strive for new and renewable sources of raw materials and raw materials that are easy to obtain. One example of such energy sources, such as energy derived from biomass, is briquettes.

In Indonesia itself, rice husks are very abundant because Indonesia is an agricultural country and until now only a small amount is used for burning and making bricks. Other activities using rice husks are to make husk charcoal for plant media and a little activity to process rice husks into alternative fuels by making briquettes(Ravsanzanni, 2017; Vuspayani, 2017).

Briquettes are a renewable fuel. The raw materials for briquettes are various, namely coal, coconut shells, tea dregs, sawdust and so on. The process of making briquettes goes through stages to achieve good results. Each stage that is passed has a significant effect on the quality of the briquettes. Poor processing will reduce the quality of the briquettes. Briquette processing begins with the selection of raw materials, drying/drying, carbonation, flouring/refining, mixing of adhesives, printing, drying and finally packaging for distribution to users. The demand for briquettes both domestically and internationally is always there and the volume is increasing. However, the fulfillment of this export demand is sometimes constrained by the results of the briquettes, which sometimes do not meet the approved standards. This is due to many things, one of which is the result of mixing charcoal briquette flour with tapioca flour as an adhesive dissolved in water. Mixing imperfections cause the briquettes to become less dense and sometimes break when burned, because the content of the mixture is one of the most important parameters in determining the quality of charcoal briquettes. Therefore, a mixer is needed that can maximize the results of the mixture so that the quality of the charcoal briquettes is maintained. The purpose of this research is to design a briquette mixing machine that can homogenize activated charcoal flour and adhesives in a sustainable manner, so that the quality of briquettes can be maintained and reliable, so that sales volume increases(Maharani, 2018; Setyoningsih, 2018).

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The design is done in graphic form, at this stage all input from the user of this machine is processed into a technical drawing using the Autodesk Inventor software. Software Inventor is a widely used product of Autodesk Corporation in terms of engineering design as well as drawing design. Inventor advantages when compared with other software, which has an attractive and real appearance, because the material provided is more and more complex. Software inventor is Very good software used for analyzing structural materials, thermal as well Genre. The software is compatible with CAD applications, allowing designers to use CAD-specific tools such as AutoCAD or Solidworks throughout the process design. The result of the analysis is an approach using numerical analysis, and the implications for modeling are significant (Defianti, 2016; Vuspayani, 2017)

2. Research Method

The research was carried out using Autodesk Inventor software, to draw machine designs, while the parameters used referred to data obtained from consumers, in this case briquette producers.

Departing from the background of the existing problems, it can be drawn several formulations of the problem as follows:

- How to design and build a briquette dough mixer machine with a planned capacity and power. The problem limitation regarding the planning and
- design of this briquette dough mixer machine is as follows:
- Stirring fin planning
- Capacity and power planning.
- Shaft planning.
- Bearing planning.
- Pulley and V belt planning and reducers.

2.1. Capacity Planning

$$V = V_p + V_1 \; Q = \rho \times V / t \qquad (1)$$

Where :

ρ = Material Density (kg/m3)

V = Volume (m3)

t = stirring time (jam)

2.2. Volume Planning

$$V = V_p + V_1 \qquad (2)$$

Where:

V = Volume total (m^3)

Vp = Volume square (m^3)

Vl = Volume square (m^3)

2.3. Fin cross-sectional area planning

$$A = D_{out} - D_{in} \qquad (3)$$

Where:

D_{out} = Outer fin diameter (m)

D_{in} = Inner fin diameter (m)

2.4. Fin Rotation Speed

$$V = 2 \times \pi \times r_{\text{Outer fin}} t \quad (4)$$

Where :
V = m/s
r = outer fin radius (m)
t = time (s)

2.5.Fin Tangential Force

$$F_t = M_{fin} \times gravity \quad (5)$$

Where:
Ft = Tangential force(N)
M_{fin} = stirrer fin weight (kg)
V_{fin} =The volume of the fin experiencing the tangential force (m^3)
G = acceleration due to gravity (m/s^2)

2.6. Torque

$$T = F_t \times D_{outerfin} \quad (6)$$

Where:
T = Torque (Nm)
Ft =Tangential force (N)
D =outer fin diameter (m)

2.7. Stirring Power

$$P = F_t \times s \quad (7)$$

Where:
P = power required (watt)
Ft = Tangential force(Nm)
s = time (s)

After searching the data for the calculation process and making the concept, it can be planned the machine elements (dynamic parts) of the design and manufacture of charcoal powder mixer machine as raw material for briquettes. Planning and design is the first step in making machines, planning for making this machine must be done properly so that the machine that is made later can work optimally

All tables should be numbered with Arabic numerals. Every table should have a caption. Headings should be placed above tables, left justified. Only horizontal lines should be used within a table, to distinguish the column headings from the body of the table, and immediately above and below the table. Tables must be embedded into the text and not supplied separately. Below is an example which the authors may find useful.

3. Results

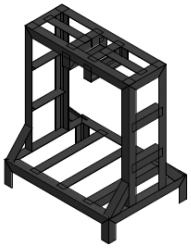
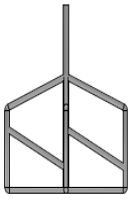
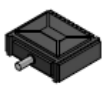
The following are the attributes desired by respondents based on the results of interviews and questionnaires distributed in table 1 Attributes of the New Tool Design:
Table 1 Attributes of the Design of the New Coconut Shell Briquette Mixer

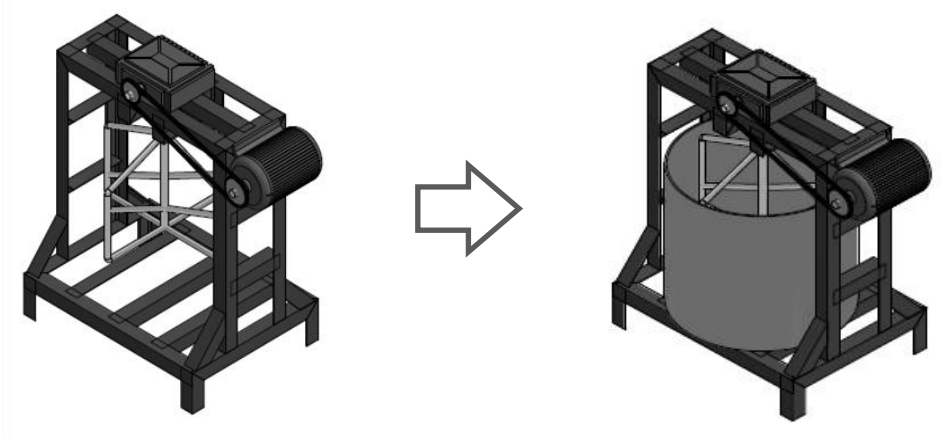
Table 1 - Attributes of the Design of the New Coconut Shell Briquette Mixer.

No	New Tool Design Specification
1	Easy to operate
2	Speed up the work process
3	Easy to clean
4	Tools to maintain material quality
5	Durable and long lasting
6	Ergonomic tools
7	Good mix results
8	Low operating costs

Determination of the design model, the specifications of the tools used are all calculated based on equations (1) – (7), then the machine is designed in graphic form using autodesk inventor software.

Table 2 - Machine components

Component	Function
	The engine frame, supports the engine and its components so that they can work according to their function
	Material container, its use is for a place to stir or mix ingredients until homogeneous
	Stirrer, made of a sturdy object so that it is able to stir until homogeneous
	Electric motor, serves as a source of power that drives the stirrer to stir the briquette raw materials
	speed reducer is used to convert rotational speed into stronger torque



a b

Fig. 1 - (a) Isometric projection machine without container; (b) Isometry projection complete machine

a b

Fig. 2 - (a) top view of the machine; (b) front view of the machine

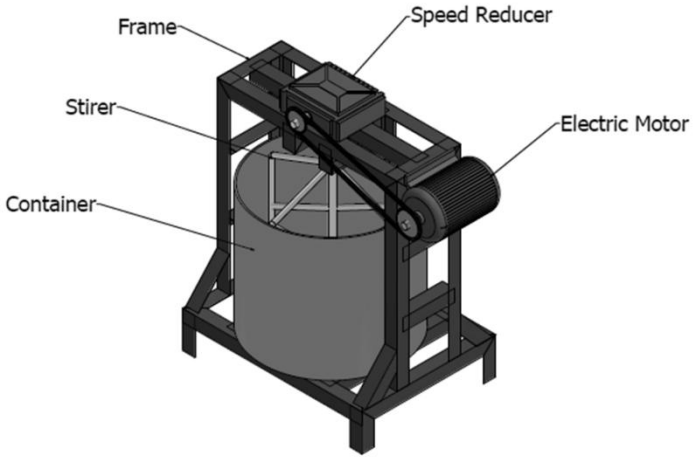


Fig. 3 - Description of the name of each component.

4. Conclusion

From the results of the analysis and calculations, the machine design in graphic form is obtained as follows:

- The capacity of the briquette mixing machine is 25 kg/hour
- The driving force uses an electric motor with a motor power transmission using a sprocket
- The shaft material used is S30C with tensile strength (σB) = 48
- kg/mm^2. Diameter of 1 fin shaft used is 30 mm, diameter of 2 shaft
- for 25 mm fin shaft pulley and 500 mm shaft length.
- The bearings used to support the shaft are spherical radial bearings

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