Design and Constructions Preeing Machine Compost Block from Organic Waste with Hidraulic System

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Abstract. The problem of agricultural waste is a problem experienced by almost all people in all regions in Indonesia. The increasing population followed by the increasing need for food such as vegetables and fruits from agriculture has an impact on the amount of waste produced. Waste treatment is very necessary to overcome the existing problems so as to increase the use value of the waste. One of the efforts to manage organic waste from agricultural products is to use it as a planting medium in the form of block compost which has biodegradable properties so that it can decompose in the soil. Pressing block compost is needed to produce a planting medium that is dense and not crumbly, so technology is needed that can produce an optimal level of compost density. This study aims to design press machine compost block with hydraulic system, determine the performance of a block composting machine, and determine the efficiency of using a block composting machine. The results of the design press machine compost block are the dimensions of the block compost hydraulic press machine with a base table size of 50 cm; width 25 cm and frame height 100 cm. A block mold with a diameter of 16 cm and a height of 30 cm and a wall thickness of 5 mm. Hydraulic size with a diameter of 5 cm, a height of 30 cm and a wall thickness of 3 mm, the motor specifications use a single phase motor powered by electricity with a horse power of 0.25 HP with a current strength of 0.5 Ampere. The rotational speed of the driving motor is 1438.67 rpm and the oil pump motor rotation speed is 721.33 rpm. The hydraulic pressure strength of 70, 80, 90, and 100 psi can produce 1 compost block. The use of electric power on the hydraulic compression force of the compost block press machine of 100 psi with the hydraulic position in the up and down press requires an electrical power of 0.39 watts. At a pressure of 90 psi with the hydraulic position in an up and down state it uses an electrical power of 0.37 watts. The hydraulic pressure strength is 80 psi, in the up hydraulic position it can use 0.34 watts of electrical power and in the down hydraulic position it can consume 0.32 watts of electrical power. While the hydraulic pressure at 70 psi position with the hydraulic position up can consume 0.30 watts of electrical power and at the down hydraulic position it can consume 0.29 watts of electrical power. The hydraulic machine works by paying attention to the compatibility between the hydraulic compost block press machine and the machine operator at the standard Indonesian size with an average height of 150 cm to 180 cm.

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1 Introduction

The organic waste processing system becomes useful goods for the community that will provide the maximum benefit for prosperity by processing the organic waste. Organic waste is the residue of human daily activities or natural processes in solid form. Organic waste management is a systematic, comprehensive and sustainable activity that includes waste reduction and handling. (Law Number 18 of 2008). Organic waste is waste that is easily degraded so that it is easy to decompose. One of the current waste management efforts is placing organic waste in a final collection point, namely the TPA (Final Disposal Site). The final disposal site (TPA) of organic waste is a waste disposal site for residents of the city/village. To overcome this, it is necessary to find the right solution for handling organic waste so that it can provide convenience and added value in supporting the economy for the surrounding community. The solution offered is an organic waste processing system for making compost blocks which will be used as garden media for plants around tourism sites. Block compost is one of the processed products from the utilization of agricultural waste that can be used as a planting medium. In general, compost blocks are cylindrical in the form of a dense texture which are generally used as planting media and plant nurseries [1]. Planting media or seedling media from compost blocks have environmentally friendly properties compared to the use of polybags that are often used, so as to minimize the use of plastics that are difficult to decompose [2].

This organic waste processing block compost system must be supported by block molding equipment with a hydraulic pressing system to form the compost block into a solid. Press machine is a machine used to produce goods made of sheet metal using one or several press dies by placing sheet metal material between the upper and lower dies [3]. Press machines are generally designed with pneumatic, hydraulic, or mechanical power which serves to press an object and produce a new object that has a denser volume than the previous object [4]. Pressing machines with hydraulic systems are related to the laws that regulate fluid balance and motion and their application in various engineering fields [5].

The press machine has a high production rate, this is due to the operating time which is the need for one pounding step plus the time needed to fill product stock. This process can reduce production costs [6]. The press machine consists of various supporting components that work according to their function [7]. The parts of the press machine, including the tool frame that functions as a support for the entire tool component, screw jack which functions as a source of pressure from the press, an electric motor that functions as a driver for the system to work by converting electrical energy into mechanical energy, pressure plate serves as a successor of pressure from the jack to all parts, the gearbox serves to increase torque and reduce the speed of rotation which will rotate the screw on the jack, and a counterweight bearing which functions as the movement of the pressure plate when it gets pushed from the screw jack so that the pressure plate can press evenly [8]

The hydraulic pressing system is designed according to the needs of the model, dimensions, ergonomics, aesthetics and other supporting capacity as well as the environmental conditions of the community around the place. The hydraulic system is usually applied to obtain a force greater than the initial applied force. This conducting fluid is increased in pressure by the pump which is then forwarded to the working cylinder through the pipelines and valves. The translational movement of the piston rod from the working cylinder caused by fluid pressure in the cylinder chamber is used for forward and backward motion as well as up and down according to the cylinder installation, namely horizontal and vertical directions [9]. The hydraulic system press machine consists of several supporting components, including a cylindrical pressing chamber, pressure plate, hydraulic jack, handle, and pressure plate [10].

Compost block hydraulic press is an effective technology that can be used by the community to reduce the volume of piles of garbage that keeps increasing all the time. The advantages of the block compost hydraulic press machine are that it can produce large amounts of block compost by using a few people, the quality of the results is better than using a manual system, so this machine is very appropriate to be used in producing effective and efficient block compost.

This study aims to: 1). Designing a block compost press machine with a hydraulic system; 2). Knowing the performance of the block composting hydraulic press machine; 3). Knowing the use of electric power and the composition of the compost block material. The benefits of the research are: 1) Practical application of technology for community users of block composting machines; 2). Obtaining specific information related to the design of the block compost press with a hydraulic system; 3). As additional information for further researchers.

2 Research Methods

Research Methods: This research was conducted in several stages, namely observing waste management activities and collecting data directly in the field, designing a hydraulic system press machine, and testing the performance of a hydraulic system press machine.

Research Materials and Tools: Materials needed to support this research include: Compost from organic waste, adhesive from starch, and water. The tools used are hydraulic system block press machines, digital calipers, pressure manometers,

3 Results and Discussion

3.1 Results of Block Compost Press Machine Design

The designed press machine that has been made is first tested to determine the performance of the machine. According to [11], testing the performance of the pressing machine is done by testing the workpiece using compressive power, so that the desired product can be produced. The dimensions of this machine are the size of the machine

frame starting from the foot to the top end which consists of: the size of the base table is 50 cm long; width 25 cm and frame height 100 cm. A block mold with a diameter of 16 cm and a height of 30 cm and a wall thickness of 5 mm. Hydraulic size with a diameter of 5 cm, height 30 cm and a wall thickness of 3 mm. The motor specifications for this block compost hydraulic press machine are using a single phase motor powered by electricity with a horse power of 0.25 HP with a current strength of 0.5 Ampere, equipped with a double rotary capacitor so that it can be used to move clockwise (Clockwise) as well as counterclockwise (Unti clockwise). The driving motor is connected to an oil pump (Oil pump) to flow fluid into the hydraulics so that it can push and pull the pistons in high pressure hydraulics. The on-off-on switch handle is an electrical device for connecting and disconnecting the electric current when starting the hydraulic engine in the press position and turning on the hydraulic engine in the pulling position so that the driving motor can rotate clockwise and counterclockwise. clockwise) or rotating back and forth. Then the on-off switch is a switch that is used to turn on and off the driving motor according to the pressure requirements of the hydraulic press machine.

3.2 Electric Power Usage

The system of using electric power in the motor driving the oil pump on the block compost press machine is calculated by means of the electric voltage multiplied by the current divided by the time of use. The electric power used during hydraulic pressing and pulling results in almost the same amount of electrical power consumption. Electrical power usage data can be seen in Figure 1 below.

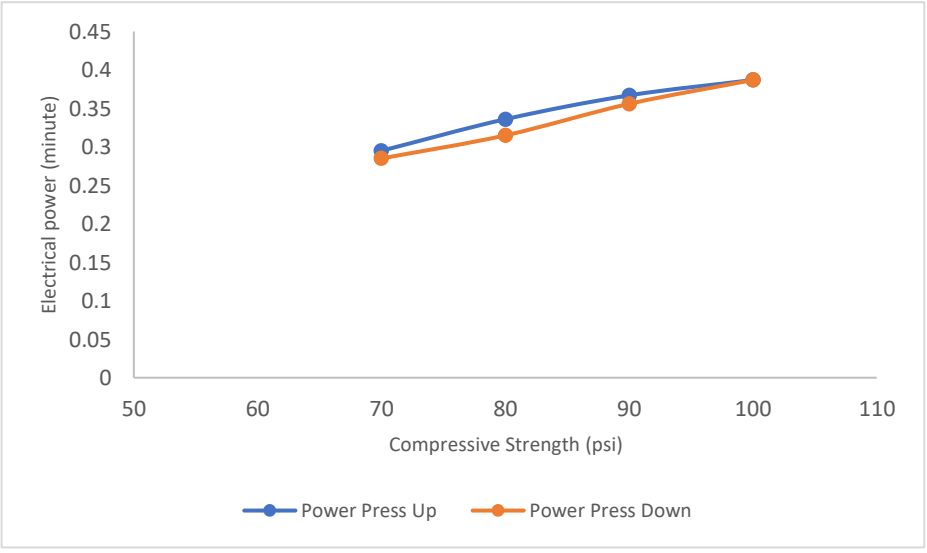

Fig. 1. Analysis of electric power usage.

Based on the results of the calculations presented in Figure 2, the use of electric power at the pressure strength of the hydraulic press machine compost block of 100 psi with the hydraulic position in the press up and down requires an electrical power of 0.39 watts. The electrical power used at a pressure of 90 psi with the hydraulic position in an up and down state uses an electrical power of 0.37 watts. The hydraulic pressure strength is 80 psi, in the up hydraulic position it can use 0.34 watts of electrical power and in the down hydraulic position it can consume 0.32 watts of electrical power. While the hydraulic pressure at 70 psi position with the hydraulic position up can consume 0.30 watts of electrical power and at the down hydraulic position it can consume 0.29 watts of electrical power. From the results obtained, it can be concluded that the greater the pressure used, the greater the power required.

3.3 Analysis of the Motor Rotation Speed with the Oil Pump Motor

Table 1. Calculation results for the rotational speed of the driving motor and oil pump motor (rpm), as well as electric power (watts).

Compressive Strength (psi)	Motor rotation speed (rpm)	Oil pump motor rotation speed (rpm)	Electrical power (watt)
100	1438.67	721.33	0.38
90	1438.67	721.33	0.40
80	1438.67	721.33	0.38
70	1438.67	721.33	0.37

Based on the data in Table 1, the results of the analysis of the rotational speed of the driving motor on average 1438.67 rpm with an average oil pump motor rotation speed of 721.33 rpm in producing compost blocks at a pressure strength of 100 psi with an average power of 0.38 watt. The average rotation speed of the driving motor is 1438.67 rpm with an average oil pump motor rotation speed of 721.33 rpm in producing compost blocks at a pressure strength of 90 psi with an average power of 0.40 watts. While the results of the analysis of the rotational speed of the driving motor on average 1438.67 rpm with an average oil pump motor rotation speed of 721.33 rpm in producing compost blocks at a pressure strength of 80 psi with an average power of 0.38 watts. Then the results of the analysis of the rotational speed of the driving motor on average 1438.67 rpm with an average oil pump motor rotation speed of 721.33 rpm in producing compost blocks at a pressure strength of 70 psi with an average power of 0.37 watts.

3.4 Calculation of Working Time of Block Compost Hydraulic Press Machine

The rotational speed of the driving motor produced after testing the performance of the tool is an average of 1438.67 rpm. The compressive strength used in the hydraulic press machine is 70 psi, 80 psi, 90 psi, and 100 psi. The difference in the magnitude of the compressive strength will affect the length of pressing time required. The relationship

between compressive strength and the length of time for pressing block compost can be seen in Figure 2 below.

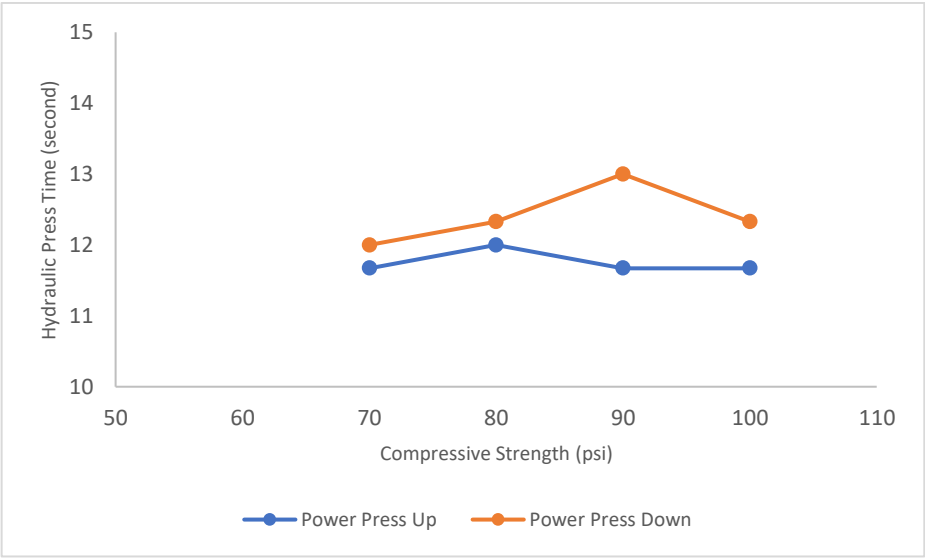

Fig. 2. Calculation Results of Compost Block Hydraulic Press Machine Working Time.

Based on Figure 2, it can be seen that with the power of the compost block hydraulic press at the hydraulic pressure position up (up) by 70 psi, it takes an average press time of 11.67 seconds, while at the hydraulic pressure position down (down), it takes time. an average of 12.33 seconds. The power of the compost block hydraulic pressing machine at the up (up) hydraulic pressure of 80 psi requires an average press time of 11.67 seconds, while at the downward (down) hydraulic pressure position, it takes an average of 13.00 seconds. The power of the hydraulic compression block compost machine at the hydraulic pressure position up (up) by 90 psi requires an average press time of 12.00 seconds, while at the hydraulic pressure position down (down), it takes an average of 12.33 seconds. The power of the hydraulic compression block compost machine at the hydraulic pressure position up (up) by 100 psi requires an average press time of 11.67 seconds, while at the hydraulic pressure position down (down), it takes an average of 12.00 seconds. From the three compressive strength treatments, one block compost product was produced each. Based on these data, it can be seen that the greater the compressive strength used, the faster the time needed to press the compost block. The engine performance is said to be optimum if it is able to provide maximum compressive strength without experiencing flow leakage [12].

4 Conclusion

The results obtained from the analysis and calculations in the construction of a hydraulic compost block press machine with a machine table size of 50 cm long; width 25 cm with engine frame height 100 cm. The size of the block composting tub with a diameter of 16 cm and a height of 30 cm and a printer wall thickness of 5 mm. The specifications for the motor that drive the block press machine oil pump is a single phase electric motor with a horse power of 0.25 HP and a current strength of 0.5 Ampere equipped with a double rotary capacitor to adjust the rotation clockwise (clockwise) and counter-clockwise (unti clockwise). which can be adjusted via the on-off-on switch handle. The greater the compressive strength used, the faster it will take to press the compost block. The greater the pressure used, the greater the power required. The greatest power is obtained at 100 psi pressure treatment with the hydraulic position in the press up and down, which requires an electrical power of 0.39 watts.

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