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PLANNING AND MANUFACTURING OF TRANSMISSION OF CORN COB COUNTING EQUIPMENT USING 1 HP ELECTRIC MOTOR WITH A CAPACITY OF 2 KG PER 5 MINUTES

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ABSTRACT

Corn cobs are a cultural problem in the NTB region because they are very influential at post-harvest harvesting. Poor handling of post-harvest corn cobs is a very serious problem in the area. Where corn cobs are only used by the community in general, making corn cobs as a mosquito repellent, by burning corn cobs. Corn cobs are corn residues resulting from shelling seeds which contain potential compounds that can be biologically transformed into other compounds, namely lignin, cellulose and hemicellulose. For example, making corn cobs chopper as a tool in handling post-harvest results. The purpose of this plan is to produce an efficient corn cob chopping machine so that it is useful for the community in NTB. The results of observations from the previous tool and processing data will be used to make the design size of the corncob chopper according to the real conditions of the previous tool. The results of the calculation of the transmission system of the corn cob chopper showed that the rotation of the electric motor was 1 HP = 1400 rpm, the shaft diameter was 20 mm, the seat belt used type A with a length of 828.4 mm. The materials used in this corncob chopping knife are as follows: knife = stainless steel material, bearing = cast iron, vant belt = rubber, pulley = aluminum, shaft = S35C-D. From the results of testing the corn cob chopper, 2 kg was obtained in 5 minutes.

Keywords: corn cobs chopper; transmission system; 1 HP electric motor.

1. INTRODUCTION

Agriculture in Indonesia is quite abundant. Indonesia is one of the largest corn producers in the world. This depends a lot on the nature of the plant and the ability of farmers to handle their crops. For this reason, post-harvest handling of agricultural products must be maximized, with a view to reducing damage and shrinkage which is closely related to the quality and quantity of processed or final products to be marketed [1-5].

Along with the advancement of appropriate technology, many technological tools were found that were created to process these agricultural products before being marketed,

the aim was none other than to ease the work [6,7].

Corn cobs are corn residues resulting from shelling seeds that contain potential compounds that can be biologically transformed into other compounds. These complex compounds include lignin, cellulose and hemicellulose [8-10]. Corn cobs have low palatability which certain processing can be used as ruminant feed [11,12].

2. METHODS

This research was conducted with the following steps:

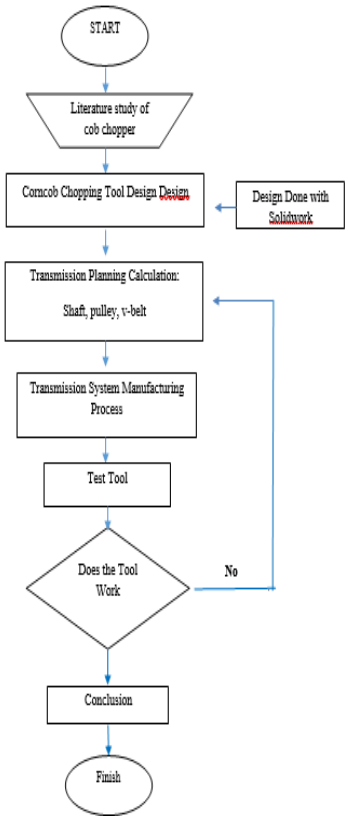

Figure 1. Process Flow Diagram

The hypothesis of this study is:

a. Research is carried out to reduce energy and time for remote communities.
b. Research conducted to utilize corn cobs, which usually people cannot use corn cobs, because of the limitations of appropriate tools.
c. Research conducted to find out how much capacity the corn cobs will produce.

3. RESULTS AND DISCUSSION

3.1 Design Corn Cob Cutter

Corn cobs chopper is a tool that serves to reduce corn cobs into small parts to be fed to animal feed, shown in the picture 2. This corn cob chopper has a capacity of 2 kg per 5 minutes.

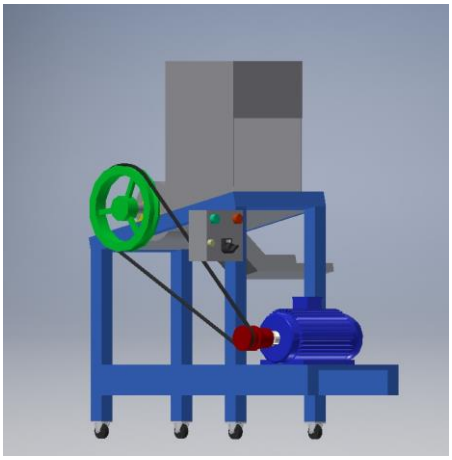

Figure 2. Corn Cob Chopper Design.

3.2 Load Calculation

To find out the load that will be received by the framework, on the corncob chopper it is necessary to calculate the frame data so that the load that occurs on the frame is known, on figure 2..

Figure 2. Corn Cob Cutter Machine.

Table 1. Frame Weight on Corn Cob

No	Name	Total	Weight (Kg)	Total Weight (Kg)
1	Main Frame	2	50	50
2	Electric motor	1	10	10
3	Axis	1	1	1
4	Chopping	1	1	1
5	Knife	1	1	1
Total Weight (Kg)				63

So, for the load that will be received by the frame is 63 kg.

Determining the Load
Where the equation used is
W= FxS
W = 53 Kg/mm^2 x 828,4 mm
= 0,0053 x 8,284
= 0,043 N

3.3 Shaft Calculation

If it is known that the shaft material used is S35C-D, then the maximum tensile strength of the shaft material is 53 Kg/mm2, then the calculation to determine the diameter of the shaft is:

Determining the design power on the shaft

To take fc (correction factor) using table 2 as follows:

Table 2. Correction Factor

Power to be transmitted	fc
Average power required	1,2-2,0
Maximum power required	0,8-1,2
Normal power	1,0-1,5

Is known:
f_c =1,4
P = 0,75 Kw
Asked:
Pd =…?
Information:
Pd = Design power
c = Normal power correction factor
Solution:
$P_d = f_c\ P$ (1)
P_d = 1,4 x 0,75 Kw
P_d = 1,05 Kw

Determining the Twisting Moment on the Shaft

Where:
T = design moment (kg.mm)
Pd = design power
N1 = shaft rotation (rpm)
Solution: $T = 9{,}74 \times 10^5 \frac{Pd}{n1}$ (2)
$T = 9{,}74 \times 10^5 \frac{1{,}05}{1400}$
T = 730,5 kg.mm

In determining the shaft material to be used in the corncob chopper, consideration must be given to obtaining the required strength.
In selecting the shaft material, cold-finished steel with the symbol S35C-D is used.

3.4 Pulley Planning

Pulley is a mechanical device that is used as a belt to run a groove power that serves to deliver a power. Pulley used with type-A with a pulley for the motor with a diameter of 40 mm as much as one piece. With the V-Belt type A data obtained the following data:

Calculation of Determining Pulley Speed

Where:
Electric motor rotation speed = 1400 rpm
Ratio of drive motor pulley to shaft =1.4
So, get:
The speed of the shaft pulley is
$n_2 = \frac{1400}{4}$ = 350 rpm

Calculation of Determining the Diameter of the pulley on the shaft

To determine the calculation of the pulley diameter on the shaft, you can use the following equation:

Where:
η_1 = Motor speed = 1400 rpm
d_p = Motor pulley diameter = 40 mm
Π_2 = Rotation on shaft pulley = 350 rpm
D_p = Diameter of the shaft pulley?
So that:

$$\frac{n_1}{n_2} = \frac{D_p}{d_p} \quad (3)$$

$$D_p = \frac{n_1}{n_2} . d_p$$

$D_p = \frac{1400\ rpm}{350\ rpm}$ x 40 mm

D_p = 160 mm

So, the pulley that will be used on the shaft to transmit power from the electric motor to the drive shaft is 160 mm.

3.5 V Belt Planning

The v-belt transmission is used to continue or transfer the rotation of the electric motor that has been regulated by the pulley to the shaft for the production process. In the design of this machine is a v belt. The selection of the belt aims to minimize the possibility of slippage when transmitting power to the rotation of the electric motor.

Known planning data as follows**:**

V-Belt Speed

Is known:
dp= 40 mm
n = 1400 rpm
V?

$$V = \frac{dp.n1}{60x1000} \quad (4)$$

$$V = \frac{40.1400}{60x1000}$$

= 0,93 m/s.

V-belt length calculation

After knowing the speed at which the belt rotates, the next step is to determine the length of the belt circumference. It is known that the planned axis distance (C) is 250 mm, Dp = 160 mm and dp = 40 mm.
Is known:
C =250 mm

Π =3,14

Dp =160 mm

dp =40 mm

L ?

$$L = 2C+\frac{\pi}{2}(dp+Dp) + \frac{1}{4cp}(Dp - dp)^2 \quad (5)$$

$$= 2 \text{ x } 250+\frac{3,14}{2}(40+160) + \frac{1}{4X250}(160 - 40)^2$$

= 828,4 mm.

From the results, the required belt length is 828.4 (mm), from table 5.3 the V-belt standard is 838 mm, or 33 inches.

Experimental Data

The data obtained from the corn cob chopper is 2 kg, as in table 3.

Table 3. Experimental Data

No.	Time	Corn Cob Weight
1	One 5 Minute Trial	2 kg
2	Second Trial 10 Minutes	5 kg
3	Third Trial 7 Minutes	3 kg
4	Fourth Trial 4 Minutes	1,5 kg
5	5th Trial 6 Minutes	2,5 kg
6	6th Trial 8 Minutes	3 kg
7	Seventh Trial 2 Minutes	0,5 kg
8	The Eighth Trial 4 Minutes	2 kg
9	9th Trial 9 Minutes	3,5 kg
10	Tenth Trial 5 Minutes	2 kg

4. CONCLUSION

Based on the results of the analysis and discussion of the data, the authors obtained conclusions that can be drawn from research on "Design And Construction Of Corn Cob Counter Using 1 Hp Electric Motor With 2 kg Capacity Per 5 Minutes".

The design for planning and manufacturing the transmission of a corncob chopper using an electric motor, this design is based on the results of the previous machine. The results of

the calculation of the transmission system. This corncob chopper uses a 1 hp electric motor with a capacity of 1400 rpm and is forwarded to the drive shaft at a speed of 350 rpm with a ratio of 1:4 where n1 = 40 mm and n2 = 160 mm. The materials used in the transmission system of this corn cob chopper are as follows: shaft = S35C-D, knife chopper = stainless steel plate, pulley = aluminum, bearing = cast iron, v-belt = rubber. From the test results of this corncob chopper, the capacity obtained is 2 kg in 5 minutes.

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