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DESIGN OF A MACHINE FOR CHOPPING COCONUT FIBER INTO COCONUT POWDER (COCOPEAT) WITH A CAPACITY OF 70 KG/HOUR

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Abstract
The coconut fiber shredding machine is a tool in the production sector that plays an important role in the process of chopping coconut fiber into coconut fiber, so that it can be used as several useful products. The objectives to be achieved in designing this coconut fiber shredding machine are: Knowing the manufacture of a coconut fiber shredding machine with a capacity of 70 kg / hour. Can design and calculate the components of a cocopeat machine that can chop coconut fiber quickly and with greater capacity. Knowing the power of the driving motor used. For the development of knowledge and applying it in the form of design and research. The design of a coconut fiber shredding machine with a capacity of 70 kg/hour, the following conclusions were obtained: Shaft diameter 25 mm, Pin size l = 7 mm, t = mm, p = 20 mm, Bearing number 6005, Motor pulley 50.8 mm (2 inches), Shredder knife shaft pulley 254 mm (10 inches), Belt length 1473 mm (58 inches) type A, Gasoline motor type with 5.5 Hp power, 3600 rpm rotation.

1. INTRODUCTION

In today's technological era, modern progress prioritizes appropriate, multifunctional and economical technology .

In the field agriculture on specifically , Which is Wrong One sector featured and the livelihood of most of the public Indonesia. Need tools are developed that can simplify and increase agricultural industry output both during the pre-harvest and post-harvest periods.

One of the leading crops is the coconut. Coconut is a plantation crop cultivated by the local people due to its high economic value. Furthermore, it has extensive uses in the food industry. Furthermore, coconuts offer added value through their husks.

Coconut fiber, which is largely discarded and considered trash, actually has added value and is very useful for the benefit of the entire community. While raw coconut fiber may only have a few uses, processed and shaped coconut fiber offers far more.

Coconut fiber's potential for use in mattresses, carpets, vehicle seats, pillows,

and rubberized fibers offers significant potential for the future. Partner industries are facing challenges in producing quality products. This caused by Because tool manual unraveling produces fiber rough, dirty and short - short so that the product goods Which produced not enough Good.

Time required long enough so that No effective And efficient For do product in amount many . Goals from manufacturing tool This is make machine decomposer fiber coconut For can increase quality And quantity production Which more efficiency And economical . With existence machine decomposer fiber coconut this product goods obtained become more quality , fiber more fine so that price sell become more tall .

2. LITERATURE REVIEW

The coconut fiber machine is a technological tool that facilitates the processing of shredded coconut fiber into fine coconut powder, thus producing more coconut fiber powder with fine results and in a short time.

Process enumeration on processing fiber coconut aim For separating coconut fiber fiber from coconut fiber powder, where each type of material is has functions and its own selling value. The processed product consists of fiber and powder that has been broken down, However, the products are still mixed together. However, certain shredding machines can produce only coconut fiber powder.

Method Work fiber shredding machine coconut that is axis main engine (motor) drives the chopping shaft by being connected by a pulley and V belt. The raw materials that have been processed by the machine will come out by themselves after smooth. The cause of the raw material coming out by itself is due to the influence of wind pressure fins blade in the room rotary counter produce wind Which pressing the raw materials out through the filter that is installed inside machine enumerator.

The calculation process for designing a coconut fiber shredding machine uses the following equation:

a. Determine the counter rotation

$$n = \frac{\frac{Q}{Qc} n_{proses}}{t}$$

Where :

n = counter rotation (rpm)
Q = engine capacity (kg)
Qc= inlet funnel capacity (kg)
t = process time (minutes)

b. Calculating the chopping power

$$P = F \times v$$

Where :

P = chopper power (kw)
F = cutting force (N)
V = cutting speed (m/s)

C. Calculating the shaft diameter

$$d_s = \left[\frac{5,1}{\tau_a} K_t C_b T\right]^{1/3}$$

Where :

d_s = shaft diameter (mm)

τ_a = permissible shear stress (kg/mm ^{2})

K_t = correction factor

C_b = bending factor

T = torque (kg.mm)

d. Diameter of the chopper pulley

$i = n_1 / n_2$

Where :

i = ratio

n_1 = Turns pulley driving force (rpm)

n_2 = Round pulley Which moved (rpm)

e. Calculate the length of the belt

$$L = 2C + \frac{\pi}{2}(d_p + D_p) + \frac{1}{4C}(D_p - d_p)^2$$

Where :

L = Long belt *(mm)*

C = Distance axis axis *(mm)*

d_p = Diameter pulley driving force *(mm)*

D_p = Diameter pulley which is driven *(mm)*

3. IMPLEMENTATION METHOD

3.1 Literature Study

This literature study was conducted by conducting data studies on literature books, journals, articles, about coconut fiber shredding machine components as well as internet searches about related matters.

3.2 Data Analysis

After conducting a literature study, the data obtained was analyzed to continue designing a coconut fiber shredding machine.

3.3 Design

This design is a description before the design and construction, namely about:

1. chopping knife
2. Motor
3. Axis
4. Stake
5. Bearings

6. Pully
7. belt

3.4 Discussion

After getting the necessary references and getting an idea of the availability of materials and components needed in planning a coconut fiber shredding machine, the next step is to carry out calculations and the results of these calculations are used as a reference for determining the specifications of the materials and sizes of the components to be used.

3.5 Images

This is a 3D model of a coconut fiber shredding machine.

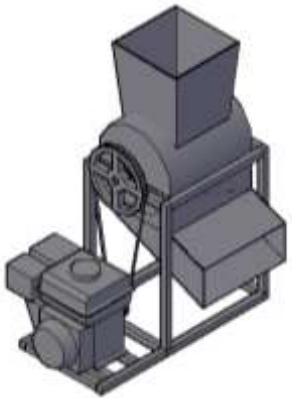

Figure 1. Coconut fiber shredding machine

4. RESULTS AND DISCUSSION

In designing a coconut fiber shredding machine, several design considerations and calculation analyses were carried out, where this aims to produce the required tool.

4.1 Counter rotation

To determine the number of rounds of counting required, you can use the following equation:

$$n = \frac{\frac{Q}{Qc} n_{proses}}{t}$$

$$n = \frac{\frac{50}{1,1} x\ 800}{50}$$

= 727 rpm

4.2 Chopping power

To calculate the power on the chopping knife (p) you can use the equation:

P = F x v

= 179.2 x 11.57

= 2073.34 Nm / s

= 2073.34 Watts

= 2.07 kW

4.3 Shaft diameter

For knowing the shaft diameter knife enumerator can known with use equality :

$$d_s = \left[\frac{5,1}{\tau_a} K_t C_b T\right]^{1/3}$$

For voltage permissible sliding τ_a can be known with the formula:

$\tau_a = \sigma_B / (Sf_1 \text{ x } Sf_2)$
= 42 / (6 x 2)
= 3.5 kg/mm ^{2}

So :

$d_s = \left[\frac{5,1}{3,5}\ 1,5\ x\ 2\ x\ 3322,6\right]^{1/3}$
= 24.399 mm ≈25 mm

4.4 Diameter of chopper pulley

To calculate the diameter of the chopper pulley D_p, it can be determined by the reduction ratio.

$\frac{n_1}{n_2} = i = \frac{D_p}{d_p}$
$i = n_1 / n_2$
= 3600 / 727
= 4.95

So the ratio for the small pulley and the large pulley is 1: 4.95

So the pulley diameter for the chopper shaft is

$D_p = d_p \text{ xi}$
= 50.8 x 4.95
= 251.46 mm

Because the 251.46 mm pulley is not available on the market, a 254 mm or 10 inch pulley was chosen.

4.5 Belt length

To calculate the length of the powder, the following formula can be used:

$L = 2C + \frac{\pi}{2}(d_p + D_p) + \frac{1}{4C}(D_p - d_p)^2$
$= 2 \text{ x } 431.8 + \frac{3,14}{2}(50.8 + 254) + \frac{1}{4\ x\ 431,8}(254 - 50.8)^2$
= 1469.05 mm

Judging from the following table, there is no suitable price, so the price closest to that value is chosen, namely 1473 mm (58 inches).

5. S conclusion

The results of designing a coconut fiber shredding machine with a capacity of 70 kg/hour, the following conclusions were obtained:

1. Shaft diameter 25 mm.
2. The size of the dowel is l = 7 mm, t = mm, p = 20 mm.
3. Bearing number 6005.
4. Motor pulley 50.8 mm (2 inches).
5. 254 mm (10 inch) chopper blade shaft pulley.
6. Belt length 1473 mm (58 inches) type A.
7. This type of gasoline engine has a power of 5.5 hp and a rotation speed of 3600 rpm.

6. Bibliography

Awang, L, Salleh, Z., Yusop , MYM, Roslee , A A, Sweep SM, & Isaac , MR, 2012, "Mechanical Properties and Microstructure of Cocos Nucifera (Coconut)Coir Fibers , *Conference Proceedings* .

German , 1985, *Machine Design Theory,* Collier Macmillan International Editor, London.

McDonald's. 2010. *Introduction to Fluid Mechanics 5th edition* . New York : John

Willey & Sons. Nagpal G. , 2000, *Tropical Natural Fiber Composites, Manufacture and Application* , Khanna Publishers, New Delhi .

RC, Hibbeler R. 2000. *Engineering Mechanics Dynamics.* NewYork : Prentice Hall.

Rattanapaskorn S., 2008 , *Design and development of semi-automatic cutting machine for young coconut,* Mj . Int. J. Sci. Tech .

Sularso And Kiyokatsu Suga , (2004) *Base Planning And Election ElementMachine* . Jakarta: PT. Pradnya Paramita .