NUMERICAL ANALYSIS of VARIOUS COMPONENTS of PULVERIZING MILL

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Abstract:

Dal and chili milling industry is one of the major agro processing industries. dal and chili is the major part human diet. This paper is about the fabrication of multi pulverising mill which pulverise grains and chillies. In human life, the chilli powder is main ingredient in daily life. Chilli powder is use in daily food in every day. Grains are also use in daily life. In ancient time, humans are used stone crusher to crush grain. These methods are fully manually. In this method maximum two people are required to crush the grains. In traditional method of grinding grains are the grinding done by the beating the grain and second is the grinding done by rubbing the grain in between two stone. But after invention of flour mill, the human power is reduce. In this project we made pulverising mill which use to pulverise grain and also chilli in only one crusher mill. But for these two processes we use two blades for each operation. This research presents the improvement of design of flour milling machine. It is very low cost and two in one machine with very cheap to maintain.

Keyword- Pulverizing mill, Chilli Powder, Grains, Hammer Blade.

I. INTRODUCTION

Pulveriser or grinder is a mechanical device for grinding of many type materials. For example, pulveriser is used to pulverise the coal for combustion, dal crush for daily diet, chilli powder for daily food and many more.

There is some type of pulverisers.

Types of Pulverisers

1) Coal pulverisers
   1.1) Low Speed
   1.2) Medium Speed
      1.2.1) Ring and ball mill
   1.3) Vertical spindle roller mill
   1.4) Bowl mill
   1.5) High Speed
      1.5.1) Attrition
2) Beater Wheel Mill
3) Hammer Mill
4) Demolition pulveriser

India is the large producer of pulses around 14.5 million tons annually as known as pulses are more important component of both vegetarian as well as non-vegetarian in India pulses commonly known as the dal is the main source of protein in daily Indian diet dal is important component of food in India for the diet Channa, Mung, Masur, Urad and Ture dal are the different verities of pulses. Milling process is the main process of conversion of pulse grains into dal. Where in pulse grains are split into smaller size and then rendering it convenient for the cooking.
Also chilli is the main ingredient in daily food. India is also main producer of dry chilli and chilli powder. The people are makes delicious and spicy food by using of dried chillies. In traditional process, the chilli powder make by beating the chilli in between two stone and make powder of it. But in now day the milling machine is used to make powder of chilli.

In this research work, the machine is modified from old design. In milling machine we used electric motor for driving the crushing blade by the used of v-belt and pulleys which is mounted on both shaft. Here we pulverise the chilli and dal by different blades. Here, we used two blades i.e. chilli crusher and hammer blade. Also use two sieves for both operations.

II. WORKING PRINCIPLE

The metal blade is design to operate on a shaft which is mounted on the two pulleys. The both blade are with same bore diameter is use for these two operation i.e. chilli and dal. The both blade are not fully fixed on the blade attachment. Blade is hanging on it.

III. METHODOLOGY

This pulverizing mill are actually a kind of crusher mill, which crushing the chillies and converted into chilli powder. Also shear the grains into the pulses. Both are these operation are in same machine. i.e. making chilli powder and shear grains.

In this pulverizing mill we use the 1.5 hp electric motor which can develop the required power to crushing the chillies
and shearing the grains into dal. The speed of motor is adjustable by shifting the belt as per required condition. When electric motor is start to rotate then crushing blade is also rotate help through the v-belt. The grains are added from the hopper and its take up in crushing chamber. In crushing chamber, crushing blade is rotate continuously with high speed and because of centrifugal force the blade throws away from shaft centre. The grains are hitting to the blade and shear in two part as we required. Also same as the chilli is crushed in finest powder and then winnow by sieve. In this way the machine is work.

IV. CAD MODEL

![Assemble view](image1.png)

![Dissemble view](image2.png)

V. DIMENSIONS AND MATERIALS

![Dimension of mill](image3.png)

Inner casing dia: 27.5 cm

Outer casing dia: 29.3 cm

Total height: 108 cm

Shaft dia. = 30 mm

Material = SAE 1976 (low carbon steel)

Bearing details

d= 30 mm

D= 62 mm

B= 16 mm

![Bearing Dimension](image4.png)

Bearing no. 1206/H (H=housing)
Pulley details

Material iron and steel

Here used 3 pulley

Material = cast iron

Motor pulley dia. = 63.5 mm

Chilli crushing pulley dia. = 152.4 mm

Grain crushing pulley dia. = 203.2 mm

VI. DESIGN CALCULATION

Here, we take 1.5 hp electric motor for driver.

\[ P = 1.5 \text{ hp} \]
\[ P = 0.746 \text{ KW} \]

Motor torque on power

\[ T = 7.42 \text{ N-m} \]

Speed of motor N = 1440 rpm

\[ N_1 = 1440 \text{ rpm} \]

Design of v-belt for chilly crusher,

\[ P_r = 1.119 \text{ KW} \]

\[ N_1 = 1440 \text{ rpm} \]

Motor dia. \(D_1 = 63.5\) mm

Chilli cutter pulley dia. \(D_2 = 152.4\) mm

1) Design power

\[ P = 1454.7 \text{ W} \]
\[ V_p = 4.78 \text{ m/s} \]
\[ P_B = 0.733 \text{ KW} \]

9) No. of belts

No. of belts = 1.55 ≈ 1 belt

10) Length of belt

\[ L = 780.08 \text{ mm} \]

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**Design of \( v \)-belt for grains crusher,**

\[ P_r = 1.119 \text{ KW} \]
\[ N_1 = 1440 \text{ rpm} \]

Motor dia. \( D_1 = 63.5 \text{ mm} \)

Chilli cutter pulley dia. \( D_2 = 203.2 \text{ mm} \)

1) Design power

\[ P_d = 1454.7 \text{ W} \]

2) Cross section of belt

As per suggestions of power range we select ‘A’ section belt.

Width \( W = 13 \text{ mm} \)

Thickness \( T = 8 \text{ mm} \)

Centrifugal tension \( K_c = 2.52 \)

3) Speed of pulley

Assume negligible slip

\[ V_{\text{driven}} = V_{\text{driver}} \]
\[ N_2 = 450 \text{ rpm} \]

4) Centre distance

\[ C = D_1 + D_2 \]

\[ F_1 \]
\[ F_2 = 11.07 \text{ N} \]

5) Angle of lap

\[ \theta_1 = \pi - \frac{D_2 - D_1}{C} \]

\[ \theta_1 = 2.61^\circ \]

6) Coeff. Of friction

\[ \mu_1 = \mu_2 = 0.3 \text{ (usually)} \]

7) Belt tension ratio

\[ F_1 = F_2 \times e^{\mu_0/\sin (\theta/2)} - 1 \times V_p \]

8) Power rating per belt

\[ P = (F_w - F_c) \times e^{\mu_0/\sin (\theta/2)} - 1 \times V_p \]

\[ F_w = \text{ working load} = w^2 = 169 \text{ N} \]

\[ F_c = \text{ centrifugal tension} = 3.21 \text{ N} \]

\[ V_p = 4.78 \text{ M/s} \]

9) No. of belts

No. of belts = 1.60 ≈ 1 belt

10) Length of belt

\[ L = 970.62 \text{ mm} \]

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**VII. PROPOSED COST of the MACHINE**

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<tr>
<th>S.N.</th>
<th>Material</th>
<th>Quantity</th>
<th>Cost</th>
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<td>1</td>
<td>Main chassis frame</td>
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<tr>
<td>2</td>
<td>Main shaft</td>
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<tr>
<td>3</td>
<td>Bearing with housing</td>
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<tr>
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<td>Item Description</td>
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<td>5</td>
<td>Driven pulley</td>
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<td>Driver pulley</td>
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<td>Belt A section</td>
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<td>Total cost</td>
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</table>

VIII. RESULT and DISCUSSION

The crushing machine was successfully fabricated and the machine was tested. This machine crushed grains and chillies simultaneously with ease both during electric motor and we got specific material you want.

IX. CONCLUSION

The crusher is constructed in such a way that it can operate it without much effort. It is made efficient and the cost of production of this crusher is very less. The crusher has been designed accordingly keeping in mind about the minimum power requirement and minimum effort. This crusher upon fabrication would serve it’s the small scale industries.

X. REFERENCES


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