DESIGN AND FABRICATION OF MULTI-GRAIN MINI DAL MILL

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ABSTRACT

The dal milling industry is one of the major agro processing industries of our country. From an annual production of 13.19 million tonnes pulse in the country, 75% of these pulses are processes by dal mill. Due to various application of pulses in food industry the demand of dal is growing day by day, to meet this demand various changes are to be brought in their processing methods. The raw material i.e., whole pulses grown in the farmland and transported to the processing mills and industrial units to make desired final products. Prior to industrialization, these raw grains used to conventionally process at house-hold levels or in cottage type units, mostly located in rural areas in the vicinity of farm lands. A low cost milling machine can be used in dal mills which would help to reduce the product cost. In this project we have presented one such low cost machine which can be useful for multiple grains.

Keyword: *- design, mini dal mill, fabrication, experimentation.*

1. INTRODUCTION

India is the largest producer of pulses around 14.5 million tonnes annually. Pulses commonly known as the dal in India are an important component of both the vegetarian as well as the non-vegetarian in India. Pulses consists one of the main source of protein in the Indian diet. It is an important component of food for diet in India. There are different varieties of pulses namely Chana, Mung, Masur, Urad and Tuvar dal. The conversion of pulse grains into dal is done by the process of milling. Wherein dal is split into smaller sizes, rendering it convenient for cooking.

This mini dal mill is simple in construction and easy to operate and maintain. It has been developed for de-husking and splitting of food legumes, is consist of horizontal tapered grinding stone is covered with emery coating surrounded by screen through which husk powder is discharged. The shelled dal pass through grinding stone on oscillating sieve unit where appropriate grinding of dal is done.

The vibratory sieves are provided with different size holes to match the requirements of the type of dal being processed. The removal of the outer layer of husk and splitting the grain into two equal halves is known as milling of pulses. Basic processes in dal milling are grading, de husking, splitting and separation. Major variation is involved with de husking process only. The various advantages of these mini dal mills are:

- Value addition of the product
- Cost of transportation saved
- Additional income through sale of seed coats as cattle feed
- Improved yield of 'dal' due to use of improved milling technology
- Easier operation & less maintenance cost construction

2. PROBLEM STATEMENT

In traditional technology mills, there were some problems arising in the previous available dal mill, are listed as bellow:

1. Power consumption
2. Early wear of rubber disk
3. Non-uniformity of gap
4. Separation of product
5. Poor recovery rate
6. Need of large ground space
7. Difficulty in milling different types of pulses

2.1 Objectives

The objectives of this project are as follows-

1. To design & fabricate a dal mill machine for various types of pulses (i.e. chana, tuvar, moong etc.)
2. To improve recovery rate.
3. To reduce human effort.
4. To reduce Power consumption and required ground space.

3. CONSTRUCTION AND WORKING

We have designed a mini dal mill which consist of a hopper, two emery stone, shaft, bearings, 1 HP motor, pulleys, belts also a screening mechanism in addition for the grading of Dal. When the motor is turned on, the motor produces power. This power provides the motion to center shaft via belt and pulley arrangement. Now, the shaft starts rotating as the shaft is fixed to the movable emery stone the stone also starts to rotate.

The next step is to pour grains into hopper, from hopper the grains are feed to the fixed emery stone, there is a channel gate provided at the bottom of the hopper to control the feed rate of grains passing into grinding stone. A hole is provided at the center of the stationary emery stone to pass the grains down on the rotating emery stone.

At that moment, due to the rotation motion of the emery stone splitting and dehusking of grains occurs, this process is known as milling process and the splited grains are called dal. The dal is expelled out from the stone into the disc. Dal collected in disc are pushed into the screening machine with the help of rubber bush. Due to the thro and fro motion of the screening machine the dal get settle down into the base of machine through the different layer of screeners. Due to the use of screener different fraction of dal is obtain in the screener such as shell of pulses are obtain at one layer and the fine dal is obtain at the another layer. The motion to the screening machine is obtained from box mechanism. Box mechanism contains pulley on which a dumble shape rod is attached away from the center due to this arrangement a reciprocating motion is generated into the rod this motion is then given to the screening machine. A lever mechanism is also attach to the central shaft to adjust the gap between the two grinding stone. As we tight the lever the central shaft tends to move upward which results in the reduction of the gap between the grinding stone and when the lever is loose the center shaft move downward due to which the gap between the grinding stone is increase. The gap between the grinding stone is decided according to the grains to be milled.

When this splited grains come out from the outlet of grinding machine the dal falls on screening machine where the dal is graded into 3 sections.

• The actual dal has been separated in I st section,

• The small pieces of dal separated in II nd section,

• We got the powder of grains in III rd section, which can also be used in food products.

Figure 1: - Actual Fabricated Model

4. DIMENSIONS OF COMPONENTS

Table 1:- Dimension of components

NAME OF COMPONENTS	DIMENSIONS
1. Centre shaft	Diameter of shaft: 30 mm Length of shaft: 500 mm
2. Grinding stone	Diameter: 304.8 mm Width: 101.6 mm Weight: 7kg Material: Asbestos (emery)
3. Pedestal bearing	Diameter: 30 mm
4. Metal panel (disc)	Bottom diameter: 560 mm
5. Motor	Power: 1 HP RPM: 1440
6. Pulley	Diameter of smaller pulley: 70 mm Diameter of medium pulley: 200 mm Diameter of bigger pulley: 260 mm
7. Belts	Material: Rubber Type: V-belt Smaller: B780Lp/B29 Bigger: B1034Lp/B39
8. Doctor blade	Length: 100 mm Height : 40 mm
9. Hopper	Length : 410 mm Width : 410 mm (Top), 120 mm(Bottom) Length : 120 mm
10. Bearing (center shaft)	60 mm
11. Bearing (Side shaft)	50 mm

5. TESTING RESULTS

This project was devised to develop a machine in respect of pre-milling treatments, finished product recovery and energy requirement. The project attempts to make improvements in the process and machine parameters in order to make the mill more effective for pulse milling in terms of quality and quantity of finished product recovery, cost of processing and energy consumption.
By evaluating the trial of the machine the following results were obtained:
1. In an hour the output of chana & tur is 60 kg/hr. Wastage in chana & tur dal is found to be 20%. .

2. For moong dal output is 55 kg/hr.

3. Power consumption of the dal mill was successfully reduced to 1 HP from 1.5 HP.

4. Use of Emery stones in place of rubber disk lead to less wear in grinding stone.

5. Use of a lever mechanism has help to maintain the uniformity of gap between the emery stones, so as different type of pulses can be dehusk.

6. Due to introduction of screening machine, uniform separation of milled fraction of dal is achieved at different layer.

6. CONCLUSIONS

We have constructed a multi-grain mini dal mill machine which is compact in size, less power consuming and comparatively cheaper from other available dal mills. It also consists of screening mechanism for the grading of Dal. This machine offers dust free operation, does not cause pollution, retains proteins, natural shine etc. Motor is provide with a pulley and is mount at the bottom of the stand with v-belt to drive it. The motor requirement is of 1 HP single / three phases.

7. REFERENCES

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