

AUTOMATED CHILLI SEED EXTRACTOR USEFUL FOR INDIAN FARMERS

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ABSTRACT

Till today chilli seeds are separated manually and there is no specific machine designed to separate seed from its pulp. The manual process is carried out by hammering chilli fruits with wooden stick, separating the husk using hand separator. This manual method is quite tiresome mainly due to the inhalation of fine particles of chilli fruits by labours. Its pungency results in continuous sneezing and irritation for labours. Hence, it is necessary to eliminate laborious work and time consumption. The automated process of chilli seed extraction will be the better solution for this problem, which helps farmers. This automated method can also be adopted by food industries for large scale extraction of chilli seed, as well.

1. INTRODUCTION

Farmers are the backbone of our country. One of the major occupations of people in India is agriculture. Two-third of population is dependent on agriculture directly or indirectly and hence it plays a vital role in basic foundation for economic development. Sapota, Pomegranate, Cotton, Sugarcane, Groundnut and many others are most commonly grown crops in Northern Karnataka. Chilli is one among them.

Chilli plants cannot be grown if chilli as a whole is sown directly in soil. It is better to sow the chilli seeds and it is in practice too. Moreover, various food, chemical and pharmacy industries may need either seed or pulp separately or may be both. Hence in such situations, it is important to separate chilli out of pulp.

A survey was carried out to find the basic requirements of society in chilli seed extraction process. The survey made in Horticulture University in Bagalkot and Agricultural University in Dharwad, it was found that the chilli seed extraction was hectic and the process demands less/no intervention of labours, automation. Agriculture is exciting and challenging field to work with. Agriculture field expects many more advancements in technology and research.

2. EXISTING METHOD

Chilli seeds are separated manually and there is no specific machine designed to separate chilli. The chillies are exposed to heavy sun light for two or three days such that chillies become hard with low moisture so that it can be crushed easily as shown in Fig. 1(a). Tractors are used to

crush the chillies in mass. To carry out crushing process tractor is made to roll on the dried chillies.



Fig.1 (a): Chillies being dried in sunlight



Fig.1 (b): Manual separation of seeds



Fig.1 (c): Separated seeds with minute pulp

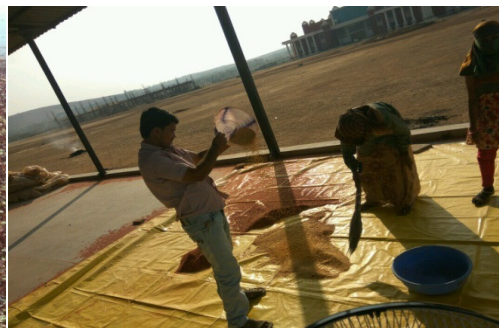


Fig.1 (d): Traditional blower mechanism

The mixture of pulp and seed are separated by using sieving screen as shown in Fig.1 (b). The larger pulps get separated from sieving screen whereas minute pulp remains along with seeds as shown in Fig.1(c). The remaining mixture of seeds and minute pulp are separated out using blower mechanism which uses natural air or fan. The mixture is blown against the air at a particular height from the ground level, so that high density particles collect nearer to the air source (fan). While low density particles collect relatively away from the air source. In the mixture of seed and minute pulp particles, seeds have relatively high density and hence seeds are collected near to air source and minute pulp particles are collected away from the air source as shown in Fig.1 (d). This mechanism or principle may not produce or provide exact method of separation and still pulp remains along with the seed. These are separated by hand picking process by the labours.

It belittles the immunity or creates health issues like skin etching and breathing problems for the labour. Even though it creates employment for labours, they feel uncomfortable to work manually due to above stated reasons. Therefore automatic process of chilli seed extraction is the better solution for this problem.

3. RELATED WORKS

The manual process was done by hammering chilli fruits with a wooden stick, separating the husk using hand separator. This method was quite tiresome mainly due to the inhalation of fine particles of chilli fruits. It's pungency results in continuous sneezing and irritation of labours [1-2]. This leads to the difficulty in getting labours for the work. Hence, the scarcity of labours

became severe on large scale viz., seed processing plants, seed companies, etc. The manual method resulted in low efficiency and low output.

Many people tried various attempts to design chilli seed extractor to overcome human drudgery by manual process. M. Balakrishnan *et al.* shared excellent view about the same. As per the trials conducted, the author observed that their proposed method gave maximum seed extraction efficiency of 94 % and 92 % with 480 m/min peripheral speed as per the designed model. India is the largest producer of chillies in the world, accounting for over 45 % of the total area under cultivation. Germination of chilli seeds at different speed rates and peripheral speeds is also listed [3]. The statistics regarding chilli requirement and production is stated in table 1.

Table 1: Statistics of Chilli requirement and production

Data	Quantity (tonnes)
The annual production of chilli fruits in India	747,900
Required chilli seeds for plantation every year	1,400
Quantity of chilli fruits required to be processed	3,500

4. BLOCK DIAGRAM

Block diagram of this work consists of various hardware components such as 8051 microcontroller, relays, motors, sensors, power supply unit and chilli seed extraction unit. Chilli seed extraction machine has three separate units:

1. Sensing unit (Proximity Sensor)
2. Slicing unit
3. Separator (Grader)

Whenever power is supplied to 8051 Microcontroller, it checks for the presence of chilli using proximity sensor. If chilli is detected inside the hopper of the extraction machine, relay1 turns ON the motor to slice dry chillies and vibrator (separator) one after the other sequentially.

Dry red chillies are poured into the hopper which includes proximity sensor to sense the presence of chillies. Whenever proximity sensor detects the chillies in hopper then crushing mechanism is initiated, which cuts the chillies. Through this action, detaching the chilli pulp from its seeds is carried out. Crushing teeth are designed to crush the dry chillies without causing any damage to the seeds by maintaining particular minimum gap of 150 % of seed size about between interior stator surface and rotor teeth.

A sieve outlet collects the pieces of chilli pulp along with seeds from the chamber after being crushed. The mixture is desired to be poured on the vibrator at a 15 degree angle where its base is perforated so that the seeds pass through them due to gravitational force. Such various bases can be used for grading the seeds based on seed size.

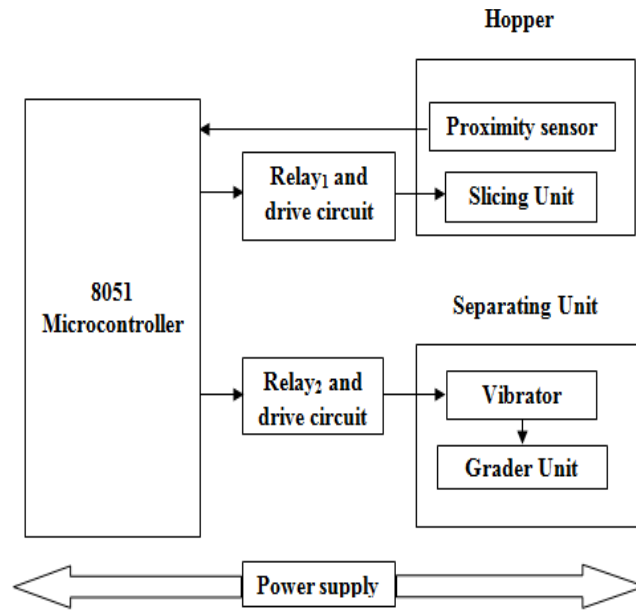


Fig. 2: Block diagram of the system

5. SOFTWARE DESCRIPTION

Proximity sensor is fixed in the hopper which checks for the presence of chillies in it and high signal is sent to microcontroller only if the chilli is detected. The system remains in turn ON condition until all the chillies gets crushed as soon as high signal is received and gradually crushing and grader unit turns OFF with particular time delay between them once started.

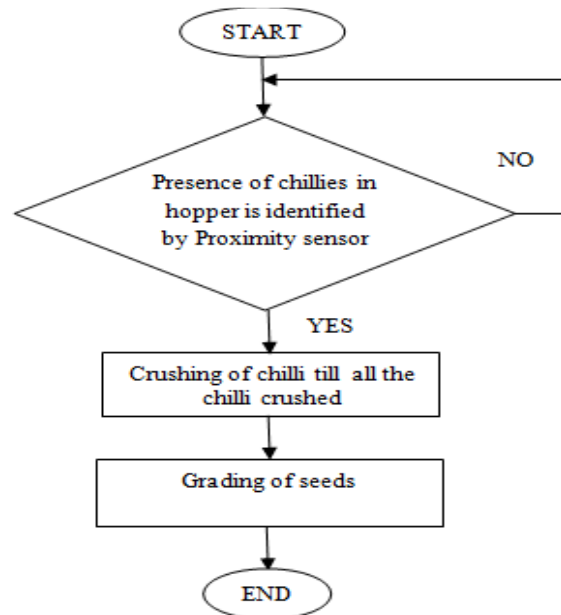


Fig. 3: Flow chart of the system



Fig. 3.1: Crushing unit



Fig. 3.2: Grader unit



Fig. 3.3: Helical shaped shaft

Figure 3.1 shows crushing unit of the proposed system. It consists of hopper in to which the dry chillies are poured. Hopper also has an option for placing IR proximity sensor for checking the presence or absence of chilli. As shown in Fig. 3.2 grader unit has two separate screens for grading. The upper screen separates seed out of pulp where only pulp remains in the screen whereas all the seeds fall down into the second screen. Second screen has a smaller sized sieve that separates two different qualities of seeds. The seeds collected at second screen will have large size compared to bottom collected seeds. Figure 3.3 shows helical shaped shaft. Helical shape of the shaft helps in crushing the dry chillies without affecting the health of the seeds. It also helps to move the crushed mixture towards outlet.

ADVANTAGES:

1. **Mobility:** Since the machine is of light weight, it is easy to carry the machine wherever we want and can be set up anywhere.
2. **Crusher and grading units amalgamated in a single machine:** In present days, crusher and grader are large separate units where human intervention is required. Proposed project eradicates the unnecessary need of human presence
3. **Cost effective:** Separate machines of crusher and grader costs more while proposed amalgamated machine costs less.

4. **Reduces human effort:** Human need not look after the machine all the time since the turning OFF and ON is automatic and hence he/she can involve himself/herself in any parallel work.
5. **Time consumption is less:** When compared with manual process, the proposed method is faster since the time gap between crushing mechanism and grading mechanism is nullified
6. **One time setup:** If the system is installed once, there is no necessary of maintenance.

APPLICATIONS:

1. **Farmers:** Farmers need not go to shopkeeper to buy seeds. He can have one such system arrangement setup in his field so that he cannot be fooled by shopkeeper from malnutrition
2. **Oleoresin extraction:** Oleoresin is the concentrated liquid from the chilli seed. Spice oleoresins find wide application in a number of industries for their strong flavor and aroma and mainly as a flavoring agent in the food processing industry. The oleoresins and spice oils are preferred because of their microbiological advantages, uniformity in flavor and pungency, ease of storage and transport.
3. **Pharmacy industries:** Chilli seed oil is used as one of the contents of pain relieving ointment
4. **Entrepreneurial opportunities:** By having one such setup in his field, he can sell the separated chilli seeds to the neighboring farmers and can earn money.

6. CONCLUSION

The developed system is suitable that satisfies major features in a single unit. It exceeds its advantages with other chilli seed separator machines by having additional intelligence like grading mechanism and power saving mode since the proposed method is automatic, it turns ON and OFF by itself based on the presence or absence of chilli respectively and hence the unnecessary power consumption is nullified. Therefore, the farmers gets attracted to this product as the human intervention in between the processes is minimized / nullified. The cost of proposed system is economically affordable.

The proposed method may be extended its features in having blower mechanism to dry the chillies to overcome natural drying in sunlight which may take days together. Moisture sensor can be used to measure the moisture content in chillies and it is continuously compared with set point value. Until moisture reaches desired value, blower will be turned ON. As soon as it reaches the set point value, blower turns OFF followed by turning ON of Crushing unit and hence thereby days' together time can be saved and the same work can be done within few hours or in a single day.

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