Design of Coriander Splitting Machine

D.B Kale¹, R.C Kahandal² D.B Jadhav³, S.B Kale⁴, D.P Thorat⁵

¹BE Student, Mechanical, SND COE & RC, Yeola, Maharashtra, India
²³⁴BE Student, Mechanical, SND COE & RC, Yeola, Maharashtra, India
⁵Asst, Prof. Mechanical, SND COE & RC, Yeola, Maharashtra, India

Abstract: The splitting of coriander’s hand splitting process having large human efforts and also time consuming process. Sometime coriander seeds are crushed and this crushing seeds are not used in agriculture. Due to this coriander seeds are not effectively used in agriculture. To overcome this disadvantages instrument was developed and modified according to need. As it split coriander in proper proportion with in less consumption of time.

Key Words: Coriander, Coriander production, coriander splitting etc.

1. INTRODUCTION

Now days every instrument are developed and modified according to the need and so that in development takes place to fulfill the need of production. e.g. modification of some other part, modification in construction, shape and some operating methods. In the some way modification of coriander splitter with some ideas and combination in a compact form is our project. The project is compact and manufactured for agro-base field. The main advantage of project is space saving, easy to operate simple in construction and maintenance. Introducing low cost automation was to overcome problems with the current manual traditional method. The concept of the work is,
(1) Observe the manual methods to identify the important process variables.
(2) Quantify the important method.
(3) Develop a prototype automation system which could control over all of the process.
(4) Investigate all areas of automated forming.
(5) Produce a specification for a low cost automated system.
(6) Refined design of the machine & fabricate the machine, as this plays a major role in rural area.

The above considering point we design the semi-automated machine which replace manual process.

1.1 FLOW CHART OF METHOD IMPLEMENTATION

2. WORKING PRINCIPLE

Coriander splitter works on the various physical & mechanical properties of the coriander seeds. The seeds of coriander are required to be splitted into two halves before sowing for good seed germination and also processing it as mouth fresheners. Traditionally the seeds are splitted manually and this operation involves drudgery and more time besides post harvest losses in terms of seed damage. The mechanized operation is therefore essential.

A machine split coriander are designed and developed by us. The machine is powered by 20 kg-cm torque dc motor with capacity 20-25 kg/hr. The machine is equipped with two rollers of 163mm diameter and 482mm long. The differential speed is provided into two rollers so that coriander would break into two halves.

Machine is able to split the coriander at moisture content up to 14.2%.
3. DESIGN
3.1 Design of shaft:
Given Data:-

Material-Mild Steel (M.S.)
Syt=Yield Strength=170MPa
Sut=Ultimate tensile strength=290MPa

Torque=20Kg.cm=20*9.81*10=1962N.mm
Speed=100rpm
Weight of roller=10kg
Self-Weight of Shaft=6kg
Total weight=W=16kg=16*9.81=156.96N
Kb=combined shock & fatigue factor for bending=1.5
Kt=combined shock & fatigue factor for torsion=1.25

Applying A.S.M.E.Code,
\[ \sigma_{per} = \text{Permissible stress} \]
\[ \sigma_{per} = 0.3 \times \text{Syt} = 0.3 \times 170 = 51 \text{MPa} \]
\[ \sigma_{per} = 0.18 \times \text{Sut} = 0.18 \times 290 = 52.2 \text{MPa} \]
Selecting \( \sigma_{per} \) whichever is minimum

Considering effect of key-way reduces this value by 25%,
\[ \sigma_{per} = 0.75 \times 51 = 38.25 \text{MPa} \]

Maximum bending moment of simply supported shaft carrying central load,

\[ M_c = \frac{W L}{4} = \frac{(156.96 \times 672)}{4} = 26369.28 \text{N.mm} \]

We know that, the equivalent twisting moment,
\[ T_e = \sqrt{(K_b \times M_c)^2 + (K_t \times T)^2} \]

\[ T_e = \sqrt{(1.5 \times 26369.28)^2 + (1.25 \times 1962)^2} \]
\[ T_e = 2454.662 \text{Nmm} \]

Therefore,

We also know that, equivalent twisting moment,
\[ T_e = \frac{\pi}{16} \times \sigma_{per} \times d^3 \]

\[ 2454.662 = \frac{\pi}{16} \times 38.25 \times d^3 \]
\[ d = 17.42 \text{mm} \]

As factor of safety is selected=1.5
\[ d = 1.5 \times 17.42 = 26.13 \text{mm} \]

The standard size of shaft available is 30mm

Therefore,
\[ d = 30 \text{mm} \]

3.2 Design of Roller

Bending moment \( M_b = 16 \times 9.81 \times (672/2) \)
\[ = 52738.56 \text{N.mm} \]

We have,
Do=163mm & Di=158mm

Mass moment of inertia,
\[ I = \frac{\pi}{64} (D_o^4 - D_i^4) \]
\[ = \frac{\pi}{64} (163^4 - 158^4) \]
\[ = 406004.054 \text{mm}^4 \] ............................... (2)

\( y = \text{distance from outermost fiber} \)
\( = \frac{D_o}{2} = \frac{163}{2} = 81.5 \text{mm} \)

By using flexural formula,
\[ \frac{M_b \sigma}{I} = \frac{y}{y} \] .............................. (Ref. Page no.223 from Machine Design by V.B.Bhandari)

Therefore, bending stress in roller is,
\[ \sigma = \frac{M_b y}{I} \]
\[ = \frac{(52738.56/406004.054)*81.5}{10.586N/\text{mm}^2} \]
\[ = 10.586 \text{N/mm}^2 \] .............................. (A)

For allowable stress:-
Material= mild steel (M.S.)
Syt= 170N/\text{mm}^2
Assuming, factor of safety=3
\[ \sigma_{all} = \frac{170}{3} = 56.667 \text{N/mm}^2 \] .............................. (B)

From equation (A) & (B),
\[ \sigma < \sigma_{all} \] .............................. (Design of roller is safe)

3.3 Design of Bearing:-

Given data:-

For measurable stress:-
T=Torque=20 Kg.cm=20*9.81*10=1962 N.mm

Total span=L=672

From Vertical Loading Diagram,
\[ R_a + R_b = 156.96 \text{N} \] ..............................(1)

\[ Ma = 0 \]

\[ R_b * 672 = 156.96 * 336 \]

\[ R_b = 78.48 \text{ N} \]

\[ R_a = 78.48 \text{ N} \]

Rating Life:-
Bearing life corresponding to 99 % reliability under given operating condition and material is,
\[ L_{10} = \frac{L_{h10} * 60 * n}{10^6} \] .............................. (Ref. Page no.599 from Machine Design by V.B.Bhandari)
\[ L_{h10} = 8000 \text{ Hrs.} \]

\[ L_{10} = \frac{800 * 60 * 100}{10^6} \]

\[ L_{10} = 48 \text{ million rev.} \]
Selection of bearing at A & B:

\[ P_{ea} = R_a \times K_a = 78.48 \times 1.5 \]

\[ = 117.72 \text{ N} \]

Now,

\[ L_{10} = \left( \frac{C_a}{P_{ea}} \right)^{a/3} \]

\[ 48 = \left( \frac{C_a}{117.72} \right)^{1/3} \]

\[ C_a = \left( \frac{48}{(1/3)} \right) \times (117.72) \]

\[ C_a = 0.427 \text{ KN} \]

\[ C_b = 0.427 \text{ KN} \]

Bearing no. 6006 (d = 30 mm) with basic dynamic capacity = 13.80 KN is selected.

\[ \ldots \ldots \text{(Ref. Page no.601 from Machine Design by V.B.Bhandari)} \]

### 3.4 Design of Motor:

Speed = N = 1440 rpm

Torque = 20 Kg-cm = 20 \times 9.81 \times 10^{-2} \text{ N-m}

Angular Velocity = \( \omega = \frac{(2 \times \pi \times N)}{(60)} = \frac{(2 \times \pi \times 1440)}{(60)} \)

\[ = 150.796 \text{ rad/sec} \]

Power = P = T \times \omega = 1.962 \times 150.796

\[ = 295.862 \text{ watt} \]

Therefore, we selected 300 watt D.C. stepper motor.

<table>
<thead>
<tr>
<th>Speed (RPM)</th>
<th>Quantity (gm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>100</td>
<td>360</td>
</tr>
<tr>
<td>200</td>
<td>720</td>
</tr>
<tr>
<td>300</td>
<td>1080</td>
</tr>
</tbody>
</table>

**Table - 1: By Electrical Operated**

<table>
<thead>
<tr>
<th>Time (Min.)</th>
<th>Rpm</th>
<th>Quantity (gm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>50</td>
<td>250</td>
</tr>
<tr>
<td>10</td>
<td>50</td>
<td>2500</td>
</tr>
<tr>
<td>60</td>
<td>50</td>
<td>15000</td>
</tr>
</tbody>
</table>

**Table - 2 By Hand Operated**

**4. Design of Model**
5. Future Scope:

1. With proper arrangement other than Coriander various legumes can also be split such as Chickpea, gram, etc.
2. This machine can be run by various power sources such as Manual (Hand operated) or Electric motor.
3. Solar power which is a clean power source can also be utilized in future scope.
4. Automation system can also be implemented for less human effort and high quality product.

3. CONCLUSIONS

Proper evaluation of the design will be performed and created something even better instead of simply manually operated operations. Finally we conclude that atomize machine is a better option to use farmer instead of manually operated. While designing this machine farmer and other customers are also considered. Purpose of fabrication of the Splitter was to determine the suitability of machine for farmer’s use. Therefore on the completion of this project, we conclude that the “Advanced Coriander Splitter Machine” will save the tremendous time, energy manpower and save financial input of the project, reducing the cost and time considerably which is the backbone of the present world economy.

ACKNOWLEDGEMENT

This is to acknowledge and thank all individuals who played defining role in shaping this project. Without their constant support, guidance and assistance this project would have not been completed. Without their coordination and reviewing, this task would have not been completed.

We would personally like to thank PROF. BHAMARE SIR, HOD OF DEPARTMENT OF MECHANICAL ENGINEERING at SRES COE KOPARGAON who, with his undying interest reviewed and endorsed the project. We take this opportunity to thank PROF. THORAT D.P, our guide for his generous assistance and being guiding light to us and for his valuable guidance and time to time attention. We would also like to thank teachers and staff members of Mechanical department, for their valuable co-operation.

We would also like to thank our honorable principal DR. KUDAL H.R, who had created a healthy environment for all of us to learn in best possible way.

REFERENCES