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Design of Coriander Splitting Machine

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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.

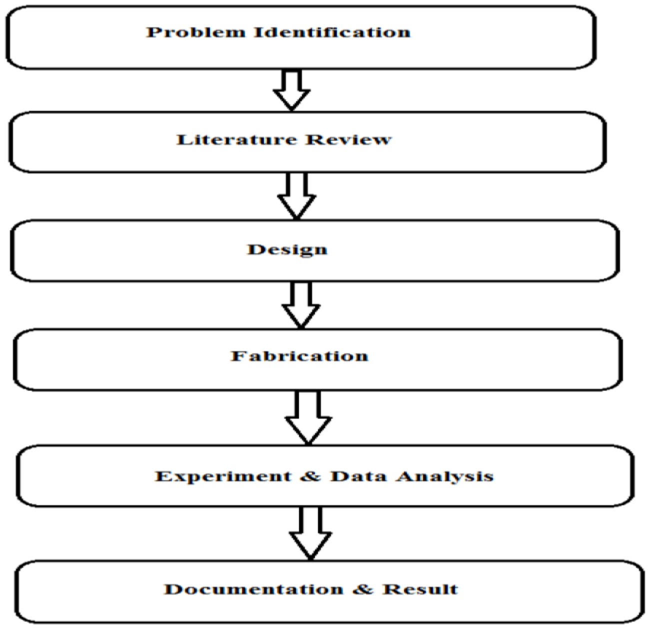
1.INTRODUCTION

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

…… (Ref. Table 2.5 in Machine Design by R.S.Khurmi & J.K.Gupta)

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

…………. (Ref. Table 4.2 in Machine Design by V.B.Bhandari)

Applying A.S.M.E.Code,

Ʈper=Permissible stress

Ʈper=0.3*Syt=0.3*170=51MPa

Ʈper=0.18*Sut=0.18*290=52.2MPa

Selecting Ʈper whichever is minimum

……… (Ref. Page no.226 from Machine Design by V.B.Bhandari)

Ʈper=51MPa (selected)

Considering effect of key-way reduces this value by 25%,

Ʈper=0.75*51=38.25MPa

Maximum bending moment of simply supported shaft carrying central load,

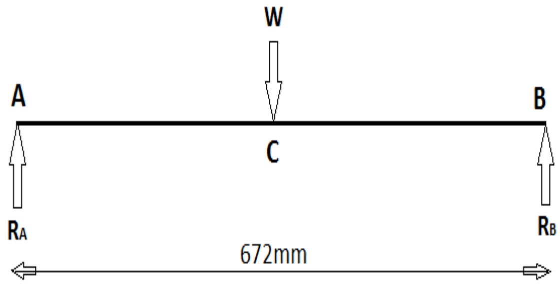


Fig.8 Vertical loading diagram of shaft

Mc = $\frac{WL}{4}$ =(156.96*672)/4=26369.28N.mm

We know that, the equivalent twisting moment,

Te= $\sqrt{(Kb * Mc)\ \text{^}2 + (Kt * T)\ \text{^}2}$

Te= $\sqrt{(1.5 * 26369.28)\ \text{^}2 + (1.25 * 1962)\ \text{^}2}$

Te=2454.662Nmm

Therefore,

We also know that, equivalent twisting moment,

Te= $\frac{\pi}{16}$*Ʈper*d^ …….. (Ref. Page no.226 from Machine Design by V.B.Bhandari)

2454.662= $\frac{\pi}{16}$*38.25*d^3

d=17.42mm

As factor of safety is selected=1.5

d=1.5*17.42=26.13mm

The standard size of shaft available is 30mm

Therefore,

d=30mm

3.2 Design of Roller

Bending moment =Mb=16*9.81*(672/2)

=52738.56N.mm ……………………………….(1)

We have,

Do=163mm & Di=158mm

Mass moment of inertia,

$$I=\frac{\pi}{64}(Do^4-Di^4)$$

$$=\frac{\pi}{64}(163^4-158^4)$$

=406004.054mm^4 .... (2)

y=distance from outermost fiber

=Do/2=163/2=81.5mm

By using flexural formula,

$$\frac{Mb}{I}=\frac{\sigma}{y}$$ ...... (Ref. Page no.223 from Machine Design by V.B.Bhandari)

Therefore, bending stress in roller is,

$$\sigma=\frac{Mb}{I}*y$$

= (52738.56/406004.054)*81.5

=10.586N/mm^2 .... (A)

For allowable stress:-

Material= mild steel (M.S.)

Syt= 170N/mm^2

Assuming, factor of safety=3

σall=170/3=56.667N/mm^2 ....(B)

From equation (A) & (B),

σ<σall.............(Design of roller is safe)

3.3 Design of Bearing:-

Given data:-

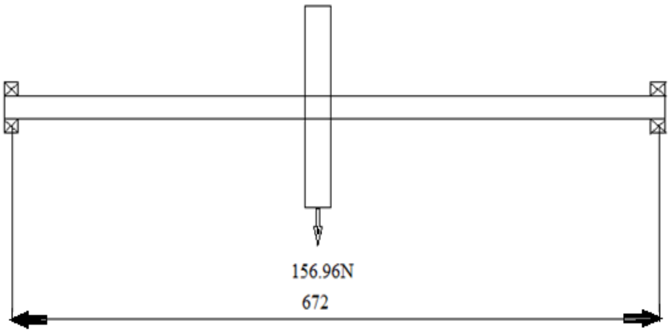


Fig.9 simply supported shaft with roller between two bearings

T=Torque=20 Kg.cm=20*9.81*10=1962 N.mm

Total span=L=672

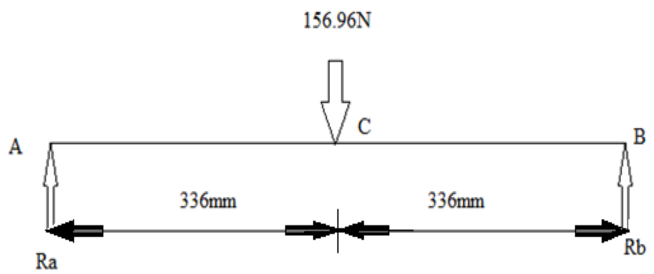


Fig.10 Vertical loading diagram of shaft

From Vertical Loading Diagram,

Ra+Rb=156.96N ....(1)

Ma=0

Rb*672=156.96*336

Rb=78.48 N

Ra=78.48 N

Rating Life:-

Bearing life corresponding to 99 % reliability under given operating condition and material is,

Rating life in million revolution = L10

L10 = (Lh10*60*n) / (10^6)

...... (Ref. Page no.599 from Machine Design by V.B.Bhandari)

Lh10 =8000 Hrs.

.... (Ref. Table 9.3 from Machine Design by V.B.Bhandari)

L10 = (800*60*100) /(10^6)

L10 = 48 million rev.

Selection of bearing at A & B:-

Pea = Ra*Ka =78.48*1.5

=117.72 N

Now,

L10 = (Ca/Pea) ^a

48 = (Ca/117.72) ^3

Ca = [(48) ^ (1/3)]*(117.72)

Ca = 0.427 KN

Cb = 0.427 KN

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

……… (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*9.81*10^-2

=1.962 N-m

Angular Velocity =ω= (2*π*N)/ (60) = (2*π*1440)/(60)

=150.796 rad/sec

Power =P = T*ω =1.962*150.796

=295.862 watt

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

Table -1: By Electrical Operated

Speed (RPM)	Quantity (gm)
100	360
200	720
300	1080

Table- 2 By Hand Operated

Time (Min.)	Rpm	Quantity (gm)
1	**50**	**250**
10	**50**	**2500**
60	**50**	**15000**

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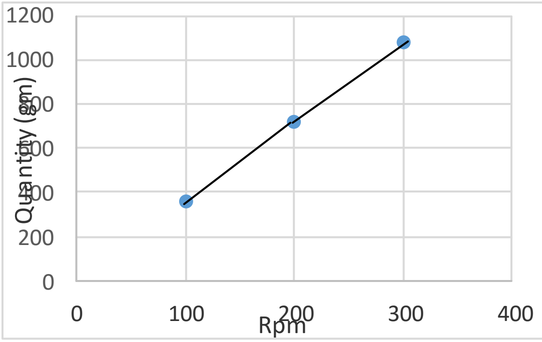
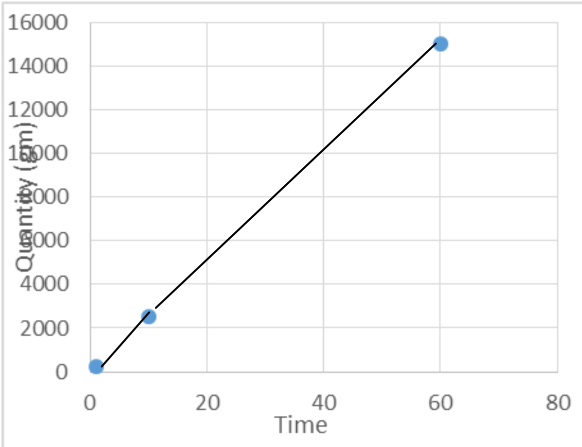


Graph -1: Quantity Vs Rpm



Graph -1: Quantity Vs Time

4. Design of Model-

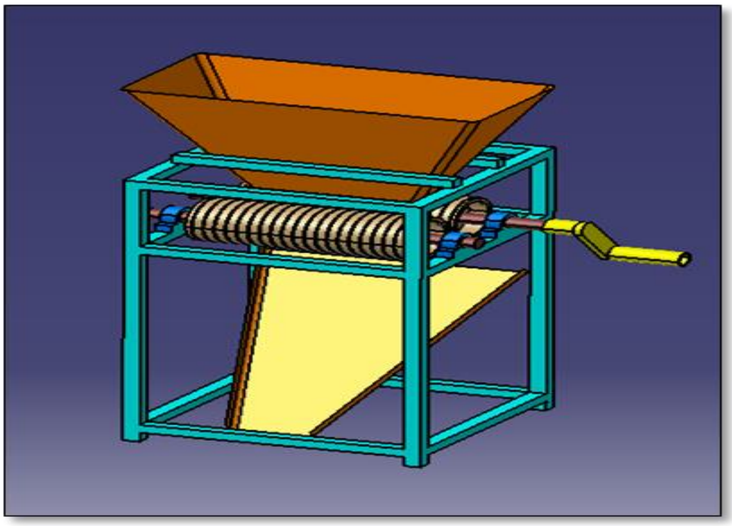


Fig -1: **3D view of coriander machine**

5. Future Scope:

1 With proper arrangement other than Coriander various legume 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 chip 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 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.

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