

# Design and Fabrication of Automatic Control Beans Drying Machine

Manthan Dhole<sup>1</sup> Ashutosh Chikhale<sup>2</sup> Sachin Chavan<sup>3</sup> Ram Rendalkar<sup>4</sup> Zaid Bagwan<sup>5</sup>,

Prof .S.V.Pandit<sup>6</sup> Prof .J.G.Shinde<sup>7</sup>

U. G. Students, Department of Mechanical Engineering, Bharati Vidyapeeth's College of Engineering, Kolhapur

Maharashtra, India<sup>1,2,3,4,5</sup>

Associate Professor, Department of Mechanical Engineering, Bharati Vidyapeeth's College of Engineering,

Kolhapur Maharashtra, India<sup>6,7</sup>

**ABSTRACT:** Agricultural products such as soybean, groundnut, sunflower, medical pills etc. content moisture. This is directly affected on product produce in farm. Also many product rates dependent on percentage moisture present in beans hence farmers cannot get actual market rate because of moisture present in beans. So to reduce that percentage of moisture they carry conventional processes. For reducing by conventional processes this moisture as per requirement but this process takes more time, man power as well as money. It requires sun rays which dependent on time and season. If we cut crops in rainy season it is very difficult to dry bean because of lack of sun rays and procedure adopted for this very sophisticated. Above problem was explained by ordinary farmer taken opinion from them and we have developed such automatic control bean drying machine. Hence we experienced that it need to develop machine which Overcomes above problems economically. This paper reveals the construction and Detail working of our developed moisture reducing machine and function of every Component. Benefits of such automatic soybean drying machine over conventional Drying processes explained in this paper. This paper reveals the construction and detail working of our developed automatic soybean drying machine and function of every component. Benefits of such soybean drying machine over conventional drying processes explained in this paper.

**KEYWORDS:** moisture, rotating drum, heating coil, feeder, variable speed motor, temperature controller, temperature sensor.

## I.INTRODUCTION

Most of agriculture product such as groundnut, soybean, sunflower, maize, etc. content moisture which affect on the rate. Most of product rates depend on the moisture present in beans. For eg.Soybean (Glycine max) is one of the most important food resources in Asian countries, due to high protein and oil content. Traditionally, soybeans are processed and served in many ways including tofu, soybean paste, and soybean sauce . The moisture content of soybean is an important factor for controlling the quality during storage and processing. Since the 20 to 25% postharvest moisture content is unsuitable for long term storage, solar or hot air drying is used to reduce the moisture content in soybeans. Solar drying is traditionally used due to its low cost of energy consumption. However, solar drying has several drawbacks including weather dependence that makes it difficult to control the soybean quality; low heat and mass transfer rate that causes a longer drying time and outdoor conditions that carry a risk of contamination by microorganisms and insects. The hot air drying method has advantages of short drying time and low labour cost. However, hot air drying has a fast drying rate due to high heat and mass transfer rate, which causes thermal damage to the soybeans.

So to reduce that high percentage of moisture they carry conventional process for reducing this moisture as per requirement but this process takes more time, man power as well as money. It requires sun rays which is dependent on

# International Journal of Innovative Research in Science, Engineering and Technology

(A High Impact Factor, Monthly, Peer Reviewed Journal)

Visit: [www.ijirset.com](http://www.ijirset.com)

Vol. 9, Issue 3, March 2020

time and season as well as it changes with day time. If we cut crops in rainy season it is very difficult to reduce moisture because of lack of sun rays. And procedure adopted for this very sophisticated. Above problem was explained by ordinary farmer we have taken opinion from them and find out that we can develop such machine. Hence we experienced that it need to develop machine which overcomes above problems economically.

### OBJECTIVES OF PROJECT

1. To design & manufacture moisture reducing machine.
2. To minimize the cost on labour for drying grains in a farms.
3. to produce beneficial & user friendly system.
- 4 To control moisture and eliminate spoilage of grains.
5. To minimize effort required by farmer to reduce moisture.
6. To design machine which produce output in short period of time in present days spoilage problems are increasing drastically and this is a biggest threat to the storage of grains. The main aim of this project is to control and eliminate the same happening in the storage systems in farms. Also there is a need of some advancement for farmers to sale their goods by their own and eliminate the losses they are suffering due to excessive storage of grains in farms. All these things necessitates preparation of such machine which is easy to operate and will be good for all the members of society. Hence this project theme stands best in achieving the above listed objectives.

### II.RELATED WORK

#### LITERATURE SURVEY

Sr.no.	Paper title	Author	Paper outcome
1	Drying characteristics of soybean ( <i>glycine max</i> ) using continuous drying and intermittent drying	Hyeon Woo Park, Won Young Han, Hang-Won Kang Won Byong Yoon(d)	The continuous drying and intermittent drying were applied to investigate the drying characteristics of Soybean with 22.0% ( $\pm 0.8$ ) initial moisture content. To describe the drying kinetics of soybean, the Madill- Kucuk model showed the best fit among the thin layer models.
2	Effect of two drying processes about soybean seed quality	Daniela Laoretani, Maria Cristina Gely , Susana Nolasco	In this work were analysed two drying processes. About soybean seed quality. The quality variables analysed were breaking tegument and germinating power .And processes analysed were dry-aeration and conventional drying. In the dry-aeration processes were analysed two drying temperatures and two tempering
3	Drying of Soybean Seeds in Fluidized Bed: Experimental and Scale-up Simulation in Continuous Operation Mode	SlametPriyanto and Ratnawati	The drying curve of the soybean seed obtained experimentally was similar to that of other materials presented in literature. The drying rate curves as a function of moisture content showed only the decreasing rate period, concluding that the limiting factor of the process is moisture migration from the interior to the surface of the solid.

# International Journal of Innovative Research in Science, Engineering and Technology

(A High Impact Factor, Monthly, Peer Reviewed Journal)

Visit: [www.ijirset.com](http://www.ijirset.com)

Vol. 9, Issue 3, March 2020

## STRUCTURE AND WORKING PRINCIPLE

It is driven by electric motor the driving of rotating net drum by using belt. The speed of motor is controlled by dimmer stat.by percentage of moisture present in soybean we decide the speed and temperature of heater. Feed the soybean by use of hopper. Drying the soybean by use of heating coils.

## III.DESIGN AND CALCULATION

### SELECTION OF MOTOR

$$T = I \times A$$

Where,

I = moment of inertia

A = acceleration

$$I = m \times R^2$$

Where,

M = mass of net drum + mass of soybean present in drum = 25Kg

R = radius of net drum = 0.15m

Therefore,

$$T = 25 \times 0.15^2$$

$$0.5625 \text{ Kg/m}^2$$

$$A = R\omega^2$$

$$N = 20 \text{ rpm}$$

$$\omega = \frac{2\pi n}{60}$$

$$= 2.09 \text{ rad/sec}$$

$$A = 2.09^2 \times 0.15$$

$$= 0.655 \text{ m/sec}^2$$

Now Torque,

$$T = 0.5625 \times 0.655$$

$$= 0.3684 \text{ Nm}$$

Now calculating power required

$$P = \frac{2\pi n T}{60}$$

$$= 0.77 \text{ Kw}$$

$$= 770/746$$

$$= 1.06 \text{ HP}$$

Here we choose 1.5 HP motor.

### SELECTION OF BEARING

Assume bearing life = 30000hrs

1. Expected life =  $L_{10} \times h$
2. Selected rpm = 50
3. Million revolution( $L_{10}$ ) = 90
4. Radial load on bearing

$$P = x.f_r + y.f_a$$

$$= 1 \times 5000 + 0$$

$$P = 5000 \text{ N}$$

$$C = P \times (L_{10})^{1/3}$$

$$= 22407$$

$$C = 21600 \text{ as per standard}$$

## International Journal of Innovative Research in Science, Engineering and Technology

(A High Impact Factor, Monthly, Peer Reviewed Journal)

Visit: [www.ijirset.com](http://www.ijirset.com)

Vol. 9, Issue 3, March 2020

### SELECTION OF SOLID BAR

Syt. = 250 N/mm<sup>2</sup>

Fs. = 5

Torsional moment = mt = 0

1) Reaction calculation

Taking moment at A

$$r_B * 2700 = 30 * 1800 + 10 * 1200 + 350 * 600$$

$$r_B = 102.2 \text{ N}$$

$$r_A + r_B = 390$$

$$r_A + 102.2 = 390$$

$$r_A = 287.8 \text{ N}$$

Shear force diagram:-

$$f_A = 287.8 \text{ N}$$

$$f_C = 287.8 + 350 = 62.2 \text{ N}$$

$$f_D = 287.8 + 350 + 10 = 72.2 \text{ N}$$

$$f_E = 287.8 + 350 + 10 + 30 = 102.2 \text{ N}$$

$$f_B = 102.2 \text{ N}$$

Bending moment diagram

$$m_A = 0$$

$$m_C = (287.8 * 600) = 172680 \text{ Nmm}$$

$$m_D = (287.8 * 1200) - (350 * 600) = 135360 \text{ Nmm}$$

$$m_E = (287.8 * 1800) - (350 * 1200) - (10 * 600) = 92040 \text{ Nmm}$$

$$m_B = 0$$

Bending moment at C is maximum that is 172680 N

$$\begin{aligned} \tau_{\max} &= \frac{0.5syt}{f_s} \\ &= \frac{0.5 * 250}{5} \\ &= 25 \text{ N/mm}^2 \end{aligned}$$

But

$$\tau_{\max} = \frac{16}{\pi d^3} \sqrt{m_B^2 + m_T^2}$$

$$\begin{aligned} 25 &= \frac{16}{\pi d^3} \sqrt{(172680)^2 + 0} \\ d &= 32.76 < 50 \text{ mm} \end{aligned}$$

So design is safe.

### BASE FRAME

The Length of base is = 2400mm

Width of base at bottom = 335mm

Width of base at top = 200mm

Height between bottom and top of base = 605mm

### COVER DRUM

Diameter = 406 mm

Length = 1840mm

# International Journal of Innovative Research in Science, Engineering and Technology

(A High Impact Factor, Monthly, Peer Reviewed Journal)

Visit: [www.ijirset.com](http://www.ijirset.com)

Vol. 9, Issue 3, March 2020

## SELECTION OF BELT

P= 1.5 kw and faster speed 240 rpm chart gives 'B' section belt. As losses in between pulley arrangement is considered, i.e. such that belt pulley power transmission efficiency is 85-95%

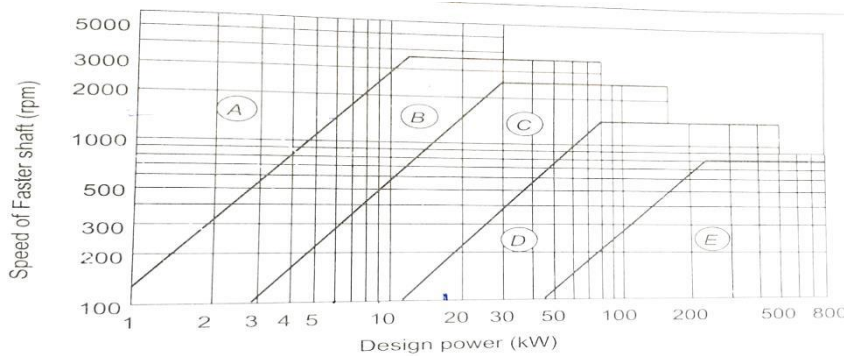


Fig1 Selection of cross section of v- belt

Length:

$$L_i = \frac{\pi}{2} \times [d_2 + d_1] + 2c_1 + (d_2 - d_1)^2 / 4c$$

$$L_i = 1590.83 \text{ mm}$$

For pulley (3) and (4) length of belt

$$L_i = 958.19 \text{ mm}$$

## MACHINE COMPONENT

Part No.	Part name	Material	Quantity
1	Motor	Standard	1
2	Dimmer-stat	Standard	1
3	Fixed sheet metal drum	G.I.	1
4	Shaft	M.S.	1
5	Rotating metal net drum	M.S.	1
6	Bearing	White metal	2
7	Hopper feeder	M.S.	1
8	Coupler	M.S.	1
9	Bolt	M.S.	10
10	Screw	Alloy	6





# International Journal of Innovative Research in Science, Engineering and Technology

*(A High Impact Factor, Monthly, Peer Reviewed Journal)*

Visit: [www.ijirset.com](http://www.ijirset.com)

**Vol. 9, Issue 3, March 2020**

## V.CONCLUSION

In this way our automatic control bean drying machine is effective and simple from ease of operation for reducing moisture at any time any season with less time, Manpower and money. It is also affordable to all farmers Unskilled worker can operate the machine easily. It substitute for conventional process of grain drying. Hence it is reliable system. Automatic control bean drying machine used for drying of soybean, cashew nuts, ground nut, sunflower, various beans which need to dry etc. we have reduced moisture.

By using this machine we control the moisture rate and also control the temperature of system.

By using this machine we reduce moisture rate and achieve high benefit.

## REFERENCES

1. Al-Muhtaseb, A.H., McMinn, W.A.M., Magee, T.R.A., 2004. Water Sorption Isotherms of Starch Powders. Part 1: mathematical description of experimental data. *Journal of Food Engineering* 6, 297–307.
2. Armstrong, P. R., Casada, M. E., Lawrence, J., 2012. Development of Equilibrium Moisture Relationships for Storage Moisture Monitoring of Corn. *Applied Engineering in Agriculture* Vol. 28(5), 677-683
3. ASAE, 1995. Moisture Relationship of Plant-based Agricultural Products. ASAE Standard D245.5. St. Joseph, Michigan.
4. Basu, S., Shivhare, U.S., Mujumdar, A.S., 2006. Models for sorption isotherms for foods: a review. *Drying Technology* 24, 917–930.
5. Bell, L.N., Labuza, T.P., 2000. Practical Aspects of Moisture Sorption Isotherm Measurement and Use, 2nd ed. AACC Egan Press, Egan, MN, 22–26.
6. Brunauer, S., Deming, L.S., Deming, W.E., Teller, E., 1940. On a theory of the Van der Waals Adsorption of Gases. *Journal of the American Chemical Society* 62, 1723–1732.
7. Da-Wen Sun, C. Byrne, 1998. Selection of EMC/ERH Isotherm Equations for Rapeseed. *Journal of Agricultural Engineering Research* Volume 69 (4), 307-315.