Improvement the Efficiency of Rotary Cotton Seed Dryer

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Abstract— In a simple manner drying means remove the excessive solvent. Generally drying is a net movement of mass travel from one location to another that means drying is a mass transfer process and they remove water or another solvent by evaporation process from three phases like solid, liquid and semi solid. Drying is may be an old technology in a process industry and in the process of cotton seeds for removing the cottonseed oil and then produce cotton seeds in powder form for other use. As per cotton seed types or quality, the cotton seeds contain 25-30% of moisture by weight and it should be dried approximately or practically 8-9% of moisture is achieve. For fulfill the above purpose, the heating type of dryer is used that is called Rotary cotton seed dryer and performance and effect of the driver is only depends on mass flow rate of oil (used as oil medium) inlet temperature, ratio of volume changes to the moisture content changes above the shrinkage limit (shrinkage ratio), specific energy consumption and fresh efficiency.

Keywords: Cotton Seed Dryer, Moisture Content

I. INTRODUCTION

Many agricultural experts and researchers believe that cotton is a valuable wealth for human life and they take-off and support the country economy which means cotton boosts and plays important role in economics and social sectors.

For a successful growing of cotton required moderate rainy season and basically from 700mm to 1100 mm, gently heavy soil is required. This all upper conditions are met in dry tropics and subtropics in north and South hemisphere. Asia is the producer of cotton. The two developing country like India and China is a largest producer of cotton. In India Gujarat, Maharashtra, Andhra Pradesh and Madhya Pradesh are largest producer of cotton.

Cotton is generally available in textile industry, they produces large amount of textile products. Rotary dryer are mainly and simply used in chemical as well as industrial processing unit to dry powder material in large scale Rotary dryer is also used in cement industry. Cotton seed which endure after the cotton is done ginned process and then cottonseed used to produce cottonseed oil after refining process and then also produce cattle foods.

II. LITERATURE REVIEW

A. S. P. Yeole performance analysis of rotary cotton seed dryer with one and three segment flights. Research Journal of Engineering Science.

In this research paper, the study is convey on the research based on the rotary cotton seed dryer. This thesis paper is specially focus on the study of the performance analysis of rotary cotton seed dryer. The performance of dryer was evaluated by checking effect of operating variable on weight loss of dried products, specific energy consumption and pick up efficiency.

B. Saleh, I. Badran, Modelling and experimental studies on a domestic solar dryer, Renewable Energy 34, 2009, pp. 2239-2245.

In this research paper, the study is based on domestic solar dryer. This research paper mainly study on renewable energy source. This paper is mainly focus on hybrid drying systems are designed. The drying of different products require different temperature range and to maintain the product quality as well as color.

C. By G. SCOTT SHAW, cotton technologist, and Gerald N. FRANKS, agricultural engineer, Agricultural Engineering Research Division, Agricultural Research Service.

In this research paper, the study is based on pure cotton seed drying and storage at cotton gins. This research about cotton seed drying and methods is very initial stage, but the research is only about industrial cotton ginning machines, research is about drying methods, time consuming factors of dryers. They also study in humidifiers. This research is only focus on cotton ginning industries as industrial and agricultural use.

D. Lamnatou Chr., Papanicolaou E. Belessiotis V. and KYRIKS N. Experimental investigation and thermodynamic performance analysis of solar dryer using an evacuated-tube air collector, Applied Energy, 94 232243(2012).

In this research paper, the study is convey on the research and experimental investigation and thermodynamic performance analysis of solar dryer using an evacuated tube air collector. In this research paper, the drying experiments for applies carrots and apricots were conducted. This research paper mainly focus on solar dryer systems in terms of thermodynamic.

III. METHODOLOGY

The main objective is to increase the efficiency of rotary cotton seed dryer. Performance of rotary dryer is only depends on number of flights, speed of rotations of drum, mass flow rate of oil an inlet temperature of oil.

In this newly developed rotary seed dryer, oil enter into a small pipe through inlet. But first is that the oil is heated with the help of furnace and furnace is placed outside the rotary plant for safety purpose. Oil is required 1400 degree Celsius heat and furnace is fulfill this requirement. Oil is continuously in in flowing action because it is reversible process. This oil gets reverted from a stopper in inside big diameter pipe. The oil flow is reversed at stopper inside main rotating pipe and hence by flowing a reversed direction Path comes out from outlet. The main means large pipe is fixed supported on rotating on to pedestal bearings. Inspection hole is provided on chamber for visual inspection

chamber. Here five curvature pipes are welded on small pipe and is 5 curvature pipes are provided to find oil a way to outlet. Once the inlet- outlet flow of oil it started fluently, the oil is heated using furnace temperature. This whole oil pulling operation is only possible because of "Rotary Union". Cotton seeds is feeder to the system through a feeder provided at top.

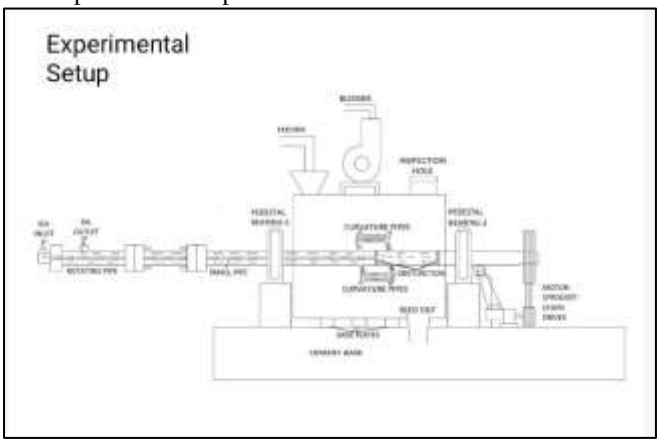

Fig. 1: Rotary Dryer

Fig. 2: Actual Rotary Dryer

A motor pulley belt arrangement is provided to elevate cottonseed to feeder. Due to rotation of motor, the main pipe and hence curvature pipe start rotating and shovel-lifter arrangement fitted inside chamber keeps Seed in movement and mix thoroughly. The blower is used to remove dust, impurities and vapor pressure from Chamber. This leads to uniform distribution of heat conducted by oil to cotton seed inside chamber. Due to continuous heat distribution, the moisture of seeds get uniformly reduced because of internal heat transfer on cotton seeds and efficiency increases because of rotary dryer system used oil medium that's the reason of improvement the efficiency of rotary cotton seed dryer.

The process DE moisturized seed exit from exit hole. 3 pole motor of 3.7 HP 1440rpm and is used to drive the whole system 60% moisture is reduced from 23 % to 8% at 8 RPM approximately.

IV. EQUIPMENT/PLATFORM

A. Rotary Union:-

Rotary union is the heart of this system because oil flowing (inlet-outlet) process is only depends on rotary union. Rotary union includes shaft,bearing,seals,housing,retaining ring. This below rotary union used graphite seal because graphite is heat resistant.

Fig. 3: Rotary Union

This union that allow for rotation of all united parts. It is thus device that provides seal between steady supply and movable part to permit the flow of oil in or out of the rotating part,assembly line basically prefer rotary union.

B. Drive Mechanism:-

Chain drive mechanisam plays a important role in system. The main big diameter pipe is mounted on this mechanism so that the whole system is depends on big diameter pipe and chain drive mechanism. High lubrication is requried for chain and sprokets.

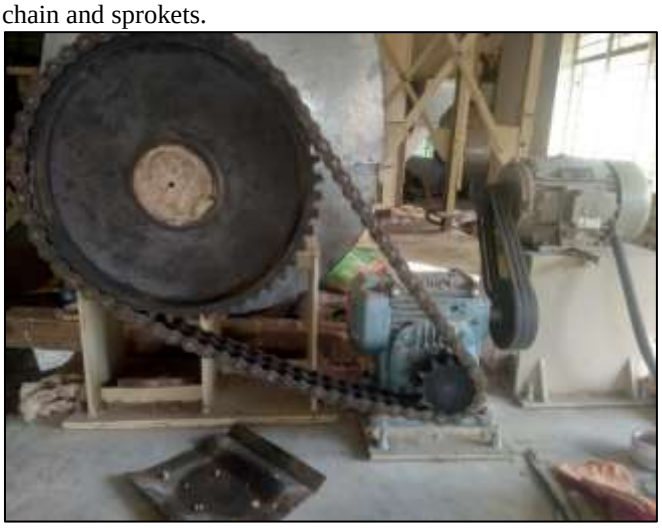

Fig. 4: Drive Mechanism

C. Temperature/Moisture Indicator:-

Fig. 5: Temp. Indicatotr

This temperature indicator is very useful for cotton seed .They measures moisture content of seeds before working and after working. Indicator are very useful for rotray union because they are quickly indicate variable temp in cotton seeds.

V. CALCULATION

- Initial temperature of seeds:- 25-30℃
- Initial moisture of seeds:- 20-25%
- After heat is transfer from seeds with the help of heated oil,then final temperature is
- Final tempeature of seed :- 65℃
- Final moisture of seed :- 10%
- Then temperature and moisture difference is
- Temperature difference :-35℃
- Moisture difference:- 15%
- Designed capacity :- 10 tonns/hr
- Moisture removal :- 1500kg of vapour or moisture per hour.
- Heat required to heat cotton seed and evaporate moisture is

  Heat required:- McpΔT

  Cp of cotton seed :- 0.3cal/g℃ =0.3× $1000\frac{\text{cal}}{\text{kg}}$℃

  Cp= 300cal/kg℃

  M=10 tonns/hr

  HEAT= 10,000× 300 × 400

  =120× 10^6 kg/hr×cal/kg× cal/kg ∘ c

  =120×10^6cal/hr

  =120×10^6×10^{-3}kcal/hr

  =120000 kcal/hr

  HEAT= 2 Lakh kcal/hr
- Heat calculation using % moisture remove
- Initial Conditions = 5 bar preesure,temp=150 ∘ c
- Hg= 2746 kj/kg
- Temp =90∘ c

  =2746-2660

  =86× $\left(\frac{431\text{kg}}{\text{hr}}\right)$

  =37066kj/hr
- Heat calculation using % moisture remove
- At , 5 bar = 151.9∘ c
- Hg =2749

  Ta =25

  Ti =65

  =20%
- 2 lakh kcal/hr

  431kg/hr

  2749× 431

  =11848119kj

Oil Temp.	Actual seed temp.	Actual moisture content	Temp. of seeds (after oil transfer heat from seed)	Moisture content after trasnfer heat from seeds	Drying time
			50 ∘ C	20%	15 min
1400∘ c	25-30∘ c	20-25%	55∘ C	17%	10 min
			60∘ C	13%	9 min
			65∘ C	10%	8.5 min

VI. RESULT & CONCLUSION

Rotray dryer is useful for agricultural by-products so that improvement of heating efficiency increase because of use in oil medium.This heating efficiency is improve with the help of oil medium. Oil is flow in this rotary union and they heated at 1400 degree celcius and heat provides in oil with help of furnace.This oil cotinously flow in chamber also chamber is continously heated and head is tranfer from seeds and remove excessive moisture in seeds as per requirement.

VII. CONCLUSION

- Deplation ratio raised with raise in mass flow rate of oil.
- Deplation ratio raised with raised in inlet temperature of oil.
- Specific energy consumption raised with raise in mass flow rate of oil.
- Specific energy consumption raise with raise in inlet temperature of oil.
- Humidifying efficiency raised with raise in mass flow rate of oil.
- Humidifying efficiency reduced with raise in inlet oil temperature.

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