AGRICULTURE SEED DRYER

S SUBHANI SUHAIL[1], B SHASHANK[2], T SWETHA[3], M SUPRAJA[4], Dr G MEERIMATHA[5]

[1,2,3,4]UG students, Dept of EEE, Srinivasa Ramanujan Institute of Technology, Anantapur District - 515701, Andhra Pradesh, India.

[5]Associate Professor, Dept of EEE, Srinivasa Ramanujan Institute of Technology, Anantapur District - 515701, Andhra Pradesh, India

Abstract *The seed dryer plays an important role in a farmer's life. Whenever the farmer places the whole bag of seed or grains in an open area of their farms or outside of the godowns, the unexpected climate conditions cause the seed and grains to be wet. So in this case, the farmers lose the whole crop. In our project, an attempt will be made to tackle the problem of wet seeds with more efficiency as compared to the existing one. In this regard, we propose a "Seed Dryer" by using hydraulic cylinder connected to a source motor via DC Motor which can be operated by a switch. Water absorption materials such as sponges, fans, and so on are used inside the hydraulic cylinder to absorb water from seeds. When the DC Motor is operated by a source, it tends to rotate the hydraulic cylinder, and when the cylinder starts rotating, the centrifugal force acts on the cylinder and water comes out of the cylinder. The wet seeds inside the cylinder get dried and water can be absorbed by absorption materials. The dryer is supposed to be maintain desired relative humidity and air temperature.*

I. INTRODUCTION

Seeds and grains are an essential component of many agricultural systems, providing the nourishment and sustenance needed to sustain crops and livestock. However, these valuable resources can be damaged or destroyed by a variety of factors, including rain. While rain is essential for the growth and development of many crops, it can also pose a threat to seeds and grains if it falls in excessive amounts or at inappropriate times.

One of the primary ways in which rain can damage seeds and grains is by causing themto rot or become mouldy. This can occur if the seeds or grains are left in damp or humid conditions for extended periods of time, or if they are exposed to heavy rainfall that saturates the ground or storage containers. In addition to reducing the viability of the seeds or grains, this type of damage can also make them unappealing or even hazardous to consume.

Fig 1.1 Godowns

So to dry the wet seeds this is the common conventional method in which drying of the harvested crop is carried out in the field or threshing floor by the radiant energy of the sun. This does not involve any expenditure. To achieve uniform drying, the seed should be spread in thin layer. High moisture content seed with a moisture content of more than 17% should be dried first under shade / light to reduce

the moisture content less than 17% and then dried under heavy sun i.e. noon drying. Sun dried seeds should not be allowed to remain open in the floor during night, since seed will absorb moisture from air. 2-4 days are needed to reduce the moisture content to 10-12%. Direct sunlight also can adversely affect seed germinability owing to high temperature and ultraviolet radiation, especially if the moisture content of the seed is high.

The process of elimination of moisture from the seed is called drying. Seed drying should reduce the seed moisture content to safe moisture limits to maintain its viability and vigour during storage, which may otherwise deteriorate quickly owing to mold growth, heatingand enhanced microbial activity.

Seed drying also permits early harvesting, long term storage of seeds, more efficient use of land and manpower, the use of plant stalks as green fodder and production of high quality seed. Depending upon the climate and method of harvesting adopted the threshed seed may or may not be dry enough for safe storage. Under less favorable conditions, threshed seed needs further drying.

Surface moisture of the seed that initially removed by the drying air. The removal of the moisture in the surface cause an imbalance in the moisture potential in the surface of the seed and the inner portion of the seed which leads to the migration of moisture from the inner organ to the surface.

Elimination of moisture from the seed depends upon the relative humidity and temperature of the environment surrounding the seed. When RH of the atmosphere is less than the seed, moisture is eliminated from the seed. While drying, care should be taken to minimize /prevent oxidation and decomposition and volatilization. In this process there will be loss of dry weight of seed which is widened when the processes take place at high temperature. High moisture seeds should be dried at low temperature.

EXISTING SYSTEM

Tunnel Dryer

Tunnel dryers are enhancement to the tray dryers, it makes the trays mobile. The material to be dried are fed from one end in the air heated tunnel for drying and collected from the other end. The name is derived due to its construction which looks like tunnel. In tunnel dryer based on the selection of technology the drying process can be completed while material transfers through tunnel. The source of heating can be of 1) Hot air circulation 2) Infrared 3) Microwave or 4) Radiofrequency

Tunnel Dryer

Tunnel dryer commonly used to get manufactured with the hot air for drying of material, however the advancement in the heating technology has enabled the tunnel dryer with advanced and faster drying techniques such as microwave/ RF/ Infrared. Typically tunnel consist of door at one end that opened as closes when material is to be fed, when trolley is pushed or travelled in tunnel then door get

closed and the hot air is circulated within tunnel with the help of fans, on completion of drying process the outlet gate opens and the material is collected. Air movement, circulation, and heating methods vary in tunnel dryers. Three different arrangements, namely, counter flow, parallel flow, and combined flow.

These type of driers consist of long insulated tunnel either square or rectangular. Tray loads of the wet material are assembled on trolleys which enter the tunnel at one end. The trolleys travel the length of the tunnel and exit at the other end. Heated air also flows through the tunnel, passing between the trays of food and/or through perforated trays and the layers of food. The air may flow parallel to and in the same direction as the trolleys. This is know as concurrent tunnel. Other designs featuring counter current, co-current and cross flow of air are available. For large operations, tunnel driers with elongated cabinets, through which carts pass, are used.

A main construction feature by which tunnel driers differ has to do with the direction of airflow relative to tray movement. In a counter flow, or countercurrent pattern the hottest and driest air contacts the nearly dry product, whereas the initial drying of entering carts gets cooler, moister air that has cooled and picked up moisture going through the tunnel. This means that the initial temperature and moisture gradient will not be as great, and the product is less likely to undergo case hardening or other surface shrinkage, leaving wet centers.

Further, lower final moisture can be reached because the driest product encounters the driest air. In contrast, co-current flow tunnels have the incoming trays and incoming hottest driest air travelling in the same direction. In this case, rapid initial drying and slow final drying can cause case hardening and internal splits and porosity at centers, which sometimes is desirable in special products

The Tunnel Dryers are specially designed for the cure of inks on various materials. This dryer is available in various dimensions due to the modular design. The specially developed airflow plate in this dryer ensures even heating over the whole drying area. It uses the latest burner technologies. Due to this technology and attention to fuel efficient design, these dryers have a proven record of low gas consumption. Optionally available with infrared, uv or electric elements. Besides that, the tunnel is easily accessible for cleaning because of the lifting hood which is equipped with gas spring.

It uses warmed air and high air flow to take surface moisture off smooth skinned produce. Produce is rolled through turbulent warm air inside the machine for even drying performance. A portion of air can be re-circulated of efficient use of heat.

Solar dryers

Solar dryers that are widely used today and about drying process that has been perform during drying of various food products and percentage containing moisture in different food products. The indirect, direct and mixed mode dryers that have shown potential in drying agricultural products in the tropical and subtropical countries are discussed. A side from identifying the active and passive mode solar dryers, we also highlight the environmental influence on solar energy (harnessing) that plays a vital role in the solar drying sector and says that the indirect solar dryer is more suitable than other dryers and recirculation of air in an indirect dryer can reduce the drying time of food product in comparison to normal indirect solar dryers. The dryer having recirculation of air have more efficiency than other dryers.

Drying is a complicated process involving simultaneous heat and mass transfer. The required amount of energy to dry a particular product depends on many factors, such as initial moisture content, final moisture content, drying air temperature, relative humidity and velocity. Various mathematical models describing the drying behaviour of different food materials have been proposed to optimize the drying process and design efficient dryers. Modelling is advantageous because full scale experimentation of different products and configurations of drying system is very time consuming and costly. In order to improve the quality, the traditional natural sun drying must be replaced by modern drying methods. Drying characteristics of specific products should be determined to improve the quality.

Solar Dryer

This technique involves the thin layer of product spread over large space to expose to solar radiation. This process for a long time until the products will dry to a required level. The surface floor made from the concrete or particular area of soil is making applicable for Outdoor direct sun drying. This type of drying method is useful for grains. Material is led on outdoor floor for a long time, usually 10– 30 days.

Indirect solar drying or convective solar drying is the new technique of product drying. It is very efficient method than the direct type of solar drying. In this method the atmospheric air is heated in flat plate collector or concentrated type solar collector. The heating process is either passive or active. This hot air then flow in the cabin where products are stored. Therefore moisture from the product may lost by convection and diffusion. This method of drying is used to avoid direct exposing to the solar radiation.

In this solar dryer a duct is provided from motor to drying chamber to recirculate the hot air from motor to the chamber so the losses gets reduces and the time taken in drying the food product is less than the time taken in normal indirect dryers and from experimental results the moisture removal rate is also increased in comparison to before its approximately 80 to become 10.5% instead of 13.5%.so an indirect faced solar dryer having recirculation of hot air is more suitable then others from the food preservation as well as time conservation and energy conservation also.

It is combination of direct and indirect solar drying method. Product may dry with both direct exposure to solar radiation and hot air supplier on it. Air may heated in solar energy collector first then pass to the chamber where products are stored. In this process product may dry according to convective moisture loss. The same chamber System is divided into three main components: an air-heater, drying chamber, and a chimney. Air-heater through which the drying air is heated as it flows over and under an absorber plate that is heated in turn by direct absorption of incident radiation. Crop to be dried is placed in drying chamber. The moist air flows through chimney and escapes into the surrounding is partially or totally covered with the transparent material to exposure the products to solar radiation.

Direct solar drying is mainly used in on farming sectors. It is also suitable for small farmers in rural areas, where electrical power is not available. This kind of dryer is more

efficient in drying small amounts of crops, fruits, and vegetables. A locally made indirect-type natural convection dryer is useful for drying fruits and vegetables in rural areas. A solar tunnel dryer can be used for drying jackfruit bulb sand leather. The mixedmode dryer is cheap, readily available, and can be easily made by local farmers. Tomatoes, mango slices, and grains can be dried using this dryer, which is driven by a fan .Therefore; agricultural products aredried within a short time at

ambient temperature. The natural convection dryer is more advantageous and applicable than other types. Mean while, the low-cost indirect-type natural convection solar dryers are used for drying cassava, bananas, and rough rice, among other products .The forced convection solar dryer is used in small Firms with limited financial support from large industrial sectors .This efficient dryer requires a short time to dry products and is built to last.

Solar dryers are used to eliminate the moisture content from crops, vegetables, and fruits. The solar dryer consists of a box made up of easily available and cheap material like cement, galvanized iron, brick, and plywood. The top surface of the dryer is covered by transparent single and double-layered sheets. The inside surface is colored black to absorb the incoming solar radiation. Since the box is insulated, the inside temperature of the box is raised. The air is ventilated through the small holes at the top of the box. As the inside air gets warm, it rises by the natural circulation process and removes the moisture from the fruits, vegetables, and the crops placed in trays inside the box. To fill the vacuum, fresh air comes in by a forced draught process and the process continues.

Solar dryers could be classified as direct or indirect types. The former involves directly exposing the material to the sun. While in the latter, the material is dried by circulating hot air over it without directly exposing the material to the sun. The merits of any solar dryer would depend upon the type and quantity of material to be dried. Sometimes a passive system incorporates a wind- driven fan for the air circulation.

PROPOSED SYSTEM

Rotary Dryer

To overcome the drawback of existing system we implement this method. In this method, the tunnel is rotating so that the grains are dried completely. Since we don't use furnace, this is a pollution free method. We are planning to do this proposed work.

Rotatory Dryer

A rotary dryer is a type of industrial dryer used to reduce or minimize the moisture content of the material it is handling by bringing it into contact with a heated gas. The dryer is made up of a rotating cylinder ("drum" or "shell"), a drive mechanism, and a support structure (commonly concrete posts or a steel frame). The cylinder is inclined slightly with the discharge end is lower than the material feed end so that material moves through the dryer under the influence of gravity. Material to be dried enters the dryer and, as the dryer rotates, the material is lifted up by a series of fins (known as flights) lining the inner wall of the dryer.

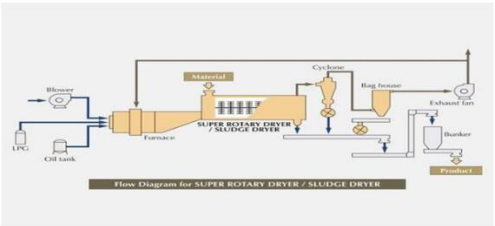
Rotary Dryers have many applications but are most commonly seen in the mineral industry for drying sand, stone, soil, and ore. They are also used in the food industry for granularmaterial.

WORKING MODEL

In this seed drying method, a steel drum is used to dry the wet seeds. The wet seeds are poured into the steel drum, the ac motor is started, which converts electrical energy into mechanical energy. The motor and the drum are coupled by a coupler. The motor should attain certain speed to rotate the drum. The speed is controlled by regulators. The wet seeds are rotated in the drum for particular time based on the weight of the seeds. The temperature in the drum is specified by temperature sensor and humidity is specified by humidity sensor. After the particular time the seeds get dried. The dried seeds are taken out of the drum through the outlet of the drum.

The wet product is supplied in the inlet port, gets gradually dried in the bed shell and when the moisture content reaches a required level, the dry product gets discharged in the outlet port. The repetition of lifting and dropping of the product with the lifters installed on the heating pipes possibilities a better contact of the product with the heating pipe bundle enabling a stably drying of the product.

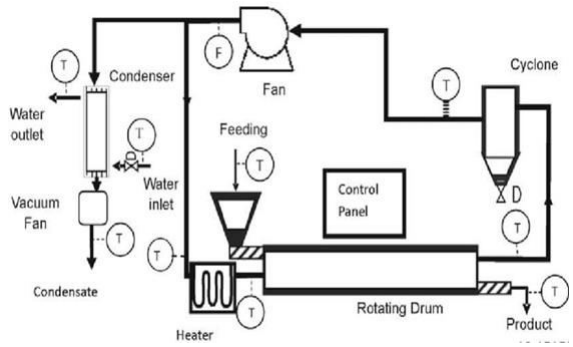
The wet product is supplied in the inlet port, gets gradually dried in the bed shell and when the moisture content reaches a required level, the dry product gets discharged in the outlet port. The repetition of lifting and dropping of the product with the lifters installed on the heating pipes possibilities a better contact of the product with the heating pipe bundle enabling a stably drying of the product.



Working model

PROCESS FLOW DIAGRAM

The experiment was conducted in a horizontal pilot plant drum dryer . The operating conditions of the drying system were as follows: 100% steam drying medium, steam temperature around 40 ±5o C, feed flow rate programmed at 0.5 kg/min, recycled steam speed at 1.5 m/s, and drum rotation speed fixed at 40-50 rpm. These conditions were selected based on some preliminary experiments and a modelling study carried out by the author for the same rotary drum dryer11.



Flow Diagram

Due to the closed and recycling system, the water evaporated from the materials created an over-saturated drying medium. For this reason, 10% of the steam was extracted from the system using an air pump at a speed of 1.2 m s–1, the diameter of the pipe connected to the pump was five cm. This was turned on for five minutes every half hour. The preliminary experiments showed that extraction of some of the steam from the system is important to prevent decline in the drying efficiency due to condensation when the steam becomes over- saturated. Subsequently, the drum was heated for an hour before the experiment was started, and water was sprayed into the drum for five minutes to generate steam following

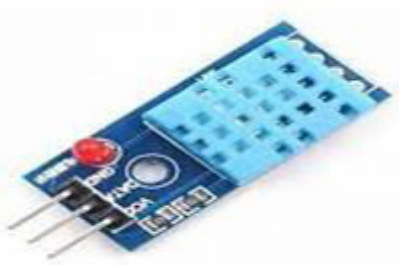
preheating of the drum. The feed was started when the drum reached the required operating conditions.

Components required of Rotatory Dryer

Motor

The main function of this motor is to convert electrical energy to mechanical energy. The operation of this motor mainly depends on the electromagnetic principle. Whenever the magnetic field is formed approximately, a current carrying conductor cooperates with an exterior magnetic field, and then a rotating motion can be generated. We use series motor in the process of drying seeds. Series motor has an characteristic of high starting torque. Due to its high starting torque it can bear heavy loads.

Humidity Sensor

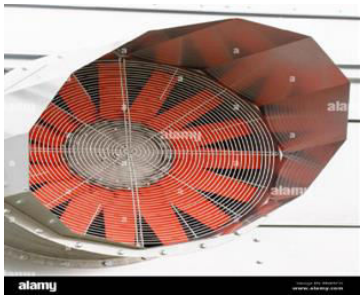


Humidity sensors are used to measure and monitor the amount of water present in the surrounding air. These sensors are widely used in industries such as semiconductor, biomedical, textiles, food processing, pharmaceuticals, meteorology, microelectronics, agriculture, structural health monitoring, and environment monitoring.

Humidity sensors work by detecting changes that alter electrical currents or temperature in the air. There are three basic types of humidity sensors: capacitive, resistive and thermal. All three types will monitor minute changes in the atmosphere in order to calculate the humidity in the air.

Humidity sensors are used for several applications for measuring humidity. Capacitive relative humidity sensors are used in HVAC (heating, ventilation, and air conditioning) systems, automobiles, food processing systems, printers, and domestic appliances such as refrigerators, ovens, and laundry machines.

Blower



The air from blower helps to maintain the moisture, temperature, and oxygen content of a crop at levels that prevent growth of harmful bacteria and fungi and excessive shrinkage. It is used to develop enough pressure to overcome the resistance and circulate air through the crop. Blower is equipment or a device which increases the velocity of air or gas when it is passed through equipped impellers. They are mainly used for flow of air/gas required for exhausting, aspirating, cooling, ventilating, conveying etc. Blower is also commonly known as Centrifugal Fans in industry.

Control panel

It is used to operate the machine i.e., to turn on or turn off of the machine.It also displays the values of the sensors and speed of motor.

Hydraulic Drum

They were used in drying almost all liquid food materials.

Drum drying is one of the most energy efficient drying methods and is particularly effective for drying high viscous liquid or pureed foods.

Shield

The Shield is used to avoid sprinkling of water drops around the drum. Stainless Steel is used as shield to minimize the corrosion. It is cost efficient and robust.

CONCLUSIONS

Drying plays an important role in improving the quality of agriculture seeds by improving the storage conditions and increasing the storage life. In some circumstances, the seeds should be stored at different moisture conditions, if the seeds get wet due to unclimatic conditions, the seeds will decompose and cannot be used them for further uses. At present horizontal seed dryer is used to dry that wet seeds, but the seeds cannot be dried completely. This causes more loss for farmers and there will be shortage of seeds which causes inflation. The Agriculture Rotatory seed dryer eradicates the problems of horizontal seed dryer.

We had gone through the reference papers specifying about speed ,hot air temperature, moisture content of materials and effects of change in such parameters and variations of hot air temperature of entrance to the rotary dryer, rotational speed and inclination. We had collected the components required for this project and we had completed the project which satisfies the objective of drying the wet seeds.

REFERENCES

[1]. Zhigang Huang and Hui Zhu, Xue Huang, Ling Yan College of Material and Mechanical Engineering Beijing Technology and Business University Beijing, China

[2]. Chayan Kumer Saha Bangladesh Agricultural University Phd, BAU Department of Farm Power and Machinery

[3]. Dr.A.I.Khan Mechanical Engineering,Priyadarshini College Of Engineering, Nagpur, India

[4]. Li Shizhuang, Cao Shukun, Meng Wenjing School of Mechanical Engineeri,ng, University of Jinan, Jinan 250022, China