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"STUDY AND DESIGN OF SEMI-AUTOMATIC PULSES DRYER"

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ABSTRACT:-

The purpose of the paper is to Design the grain dryer to remove the moisture from the grain. The paper gives you the detail about the storage of the grains for long time by removing moisture, which can adversely affect the grains and its quality. By accomplishing the aim of the project one can store the grains for longer time also which can be easily acceptable in the market. If the moisture content is present in the grain then it is not suitable for long time storage and further process. If the grains have lot of moisture content then it can spoil the grains. This paper gives the solution for the limitation of natural sun drying or natural air drying which is time consuming process. The sun drying or natural air drying is a conventional method to remove the moisture from the grain, as it takes much time, more space and more labor. In the dryer, the heated air from the blower is passed through grain-bed, the warm air at limited temperature provided and moisture is reduced from the grain. After that the dry grain is to be transferred automatically in collector. If the grain become dry it can be protected from grain spoilage, it is portable unit so that it can be moved from one location to another location, and it is most helpful for farmers.

Keywords – conventional method ,Blower , grain dryer.

01. INTRODUCTION-

India produces about 260 million tons of food grains per year. The major components of production are 95 million tons of wheat, 105 million. Tons of rice, and 18 million tons of pulses, Cereals (Anon. 2015). Due to technological advances in agriculture and the introduction of high-yielding varieties, this may increase. From this production, an average 10% is lost during post-harvest operations between the field and the. This means that about 15 million tons of food Grain, valued at about Indian Rupees 2400 million goes to waste. The major share of the loss occurs during consumer's storage of surplus stock. Among the various causes of losses, the most important one is improper drying before storage. The preservation of agricultural produce by drying is a long established technique. Sun drying in the open, on mud plastered or concrete floors, is the conventional method of drying grain and also cash crops like

chilies, and plantation and horticultural crops. The drying time required in the open sun for these crops ranges from 5 to 45 days depending upon the crop to be dried. Unfavorable weather conditions are likely to occur during the drying period and degradation in quality of the final produce therefore becomes unavoidable.

Annual postproduction losses by crop in India, expressed as a percentage of total production, are estimated to be as follows: wheat, 8%; pulses, 9.5%; and all food grains, 9.3%. It is well-known that deterioration in quality caused by improper drying cannot be eliminated until improved drying systems based on mechanical dryers have been adopted. However, for many reasons, these systems have not been adopted. The main reason that is encountered is a lack of organizational or government incentive to the farmer to deliver a quality product that might command a premium price. This result in not only a negative attitude, but also leads to the overall quality of the product gathered at market points being alarmingly poor. A second important reason for not using dryers is their high initial costs. Most of the commercially available dryers are designed to suit the needs of the processing industry and their output capacity is therefore far above the needs of individuals, or even of farmer groups. An awareness of availability of dryers and of their use and advantages in drying food grain for better storage and marketing is lacking among crop growers This paper describes the use of various types of dryers in the Indian food industry and the efforts of research and development organizations to devise dryers suitable for individuals or small groups in the rural population. However, even with properly dried grain, scientific storage remains important and recent advances in developing various storage structures are also described.

02. LITERATURE REVIEW

Literature review reveals that the use of hot air dryer at farmer level, commercial level and at big storages can useful in reducing the loss of grain quality due to moisture. Use of dryer in rural areas by farmers can be useful to farmers to reduce the moisture content in grains for the better price of the grain in the market. The use of dryer at the rural areas can also be useful to decrease the time required for the drying of the grain by conventional methods. Use of this hot air dryer in dal mills can be useful for drying the grains at faster rate as compare to conventional methods. It can be cost saving attempt for the dal mills and farmers also the huge capacity dryer can be used in big storage facilities like Food Corporation of India (FCI) and grain storage bank where the grains are stored in huge quantity.

Literature review also reveals that the use of wood and agricultural waste (white coal) are beneficial for the burning in the hot air generator. As the cost and availability of the wood and white coal are reasonable as we use this dryer in rural areas and industries. The emissions due to other fuel like diesel are more hazardous to the environment as compare to the wood and white coal. The use of electric dryer

can be costlier process and since we are also using this dryer in rural areas where the supply of electricity is intermittent. So the wood fired and white coal fired dryer are favorable to be used.

Sapto et al. designed tray dryer in solid work and analysis and simulation was performed using Ansys Fluent i.e. a computational fluid dynamics software. He analyzed heat transfer and temperature distribution, pressure, air flow and turbulence to predict the efficiency of the tray dryer.

Sachin Ghanchi ,Avdhoot Jejurkar,Devendra Pareek,Vikas Verma calculated that the developed biomass combustor cum hot air generator based drying system was capable of producing continuous and adequate hot air supply for drying of herbs, fruits and vegitables. Maximum efficiency of combustor observed was 47.2% at fuel feeding rate 4 kg/hr at air flow rate 620 m3/hr. maximum hot air temperature observed was 1580C at 12 kg/hr at air flow rate 350 m3/hr.

03. METHODS OF GRAIN DRYING -

So far drying systems have not been classified systematically However drying methods can be broadly classified on the basis of heat transfer to the wet solid. According to mode of heat transfer drying method can be divided in to: (a) Conduction drying (b) Convection drying and (c) Radiation drying. There are other methods of drying also, namely dielectric drying, chemical or sorption drying, vacuum drying, freeze drying.

Of them convection drying is commonly used for drying of all types of grain.

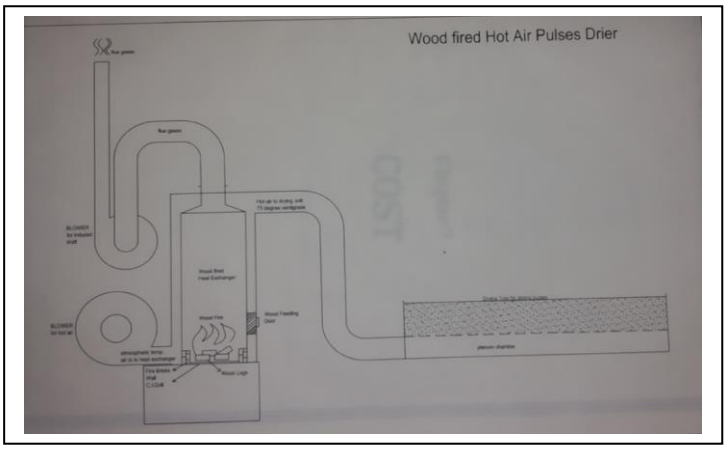
CONVECTION DRYING:

In this drying, the drying agent (hot gases) in contact with wet solid is used to supply heat and carry away vaporized moisture and the heat is transferred to the wet solid mainly by convection. The characteristics of convection drying are:-

a) Drying is dependent upon the heat transfer from drying agent to wet material.

b) Stream heated air, direct flue gases of agricultural waste, etc. can be used as drying agent;

c) Convection drying is most popular in again drying .It can be carried out either continuously or batch wise.



04. DESIGN PROCEDURE OF GRAIN DRYERS-

The heated air grain dryer can be divided into three major groups.

1) Static deep bed batch dryers.

2) Continuous –flow-Batch dryer. (Either mixing or non-mixing type) and

3) Continuous Dryers.

Grain dryer mainly consist of –

a) Drying chamber.

b) Air distribution system.

c) Direct or indirect air heating system.

d) Blower.

e) Air filter

f) Control system

g) Grain conveying system (for flow dryer)

The following important factor are taken into consideration in design of heated grain dryer

DRYER FACTOR:-

a) Size shape and type of dryer

b) Grain feeding rate;

c) Total drying time;

d) Air flow pattern and air distribution system;

e) Depth of grain bed in dryer; and

f) System of cooling grain (if any).

AIR FACTORS:-

a) Velocity and air flow rate per unit mass of the grain.

b) Temperature and relative humidity of the heated air and exhaust air.

c) Static pressure of the air at which it is blown and

d) Average ambient conditions.

GRAIN FACTOR:-

a) Type, variety and condition of grain.

b) Initial and final moisture of grain.

c) The usage of dried grain and

d) Latent heat of evaporation of grain moisture.

HEATING SYSTEM:-

a) Type of fuel rate of fuel supply.

b) Type of burner (for liquid fuel) or type of furnace (for solid fuel)and

c) Type of heat exchanger (for indirect heating system)

SIZE SHAPE AND TYPE OF DRYER:-

Size or capacity of dryer is decided by the amount and verity of grain to be dried per day or for the whole seasons. The size of dryer are express either in terms of holding capacity of amount of grain to be dried per unit time or the amount of grain passing through the dryer per unit time.

Thickness of grain layer exposed to be heated air is generally restricted to room

For continuous flow dryer. *The designs of the continuous flow dryer are based on thin layer drying principles* **whereas** *static batch are designed in deep bed drying principles.*

05. SEMI-AUTOMATIC DRYER

The operational cost of conventional grain drying is still high because it still uses a lot of human labor in the process. Therefore, it is necessary to automate the tool, the process of monitoring several parameters such as voltage, humidity, current and temperature. In this research, researchers will conduct research on the Design of Control Panel for Automatic Grain Dryer for Farmers. This research is also in accordance with the road map for the superior development of the Electrical Applied Bachelor study program, namely Automation in the Agricultural and Mechanical field.

The problems to be studied in this research are formulated as follows:

a) Designing a control panel on the grain drying process

b) Designing monitoring of grain dryers

c) Making control and monitoring of automatic grain drying sensors and process.

In Drying using a machine that does not depend on the weather is needed to be an alternative solution to the problem of drying grain. Controlling temperature, moisture content and appropriate humidity is the key in the drying process using this dryer. Therefore, the application of sensor and dryer technology with low operating costs is very important. The grain dryer made is as shown in Figure as follows:

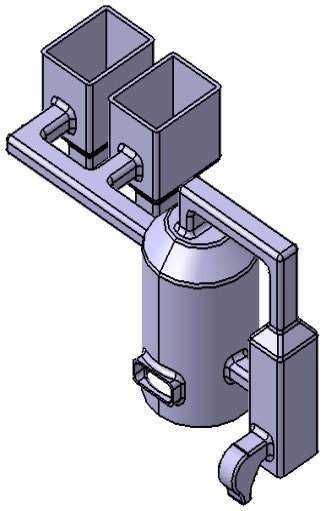


Figure. Design and Construction of On-Off Grain Dryer Control Panel (source: Syahid, 2020)

At the top of the reservoir there is a proximity switch to detect the height of the grain in the reservoir. When the grain is full in the reservoir, the proximity switch will detect the grain and start working. When the proximity switch works, blower 1, and blower heater will start working. When the blower heater is working, the PT100 temperature sensor will also measure the temperature in the reservoir. If the temperature in the reservoir reaches 60°C, then the blower heater will turn off and blower 2 will turn on. Blower Heater will turn on and blower 2 will turn off again when the temperature in the reservoir reaches = 40°C.

When PB_ON Blower is pressed, blowers 1 and 2 will work, when PB_ON Blower is released, Blowers 1 and 2 will stop. When the PB_ON Blower Heater is pressed, the blower heater will work, when the PB_ON Blower Heater is released, the blower heater will stop. When the blower heater is working, the PT-100 temperature sensor will also measure the temperature in the reservoir.

06. CONCLUSION:

There is heavy loss of grain on field which can be avoided by providing simple and low cost dryer design to the farmers.

The loss of 10,800 million rupees per year during harvesting of grains can be saved. It is observed that number of dal millers are using local made dryers of low performance which are not suitable for their purpose. But they are helpless at the cost of reputed company driers. Hence the semi-automated model and design which we have suggested is high performance with On off Grain dryer, best suited, comparatively low cost and within reach of average dal miler and farmers.

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