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Experimental Analysis of Seed Dryer Using Waste Heat from Air Conditioner

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ABSTRACT: Seeds require drying before storage, that is important for future requirements. The Sun Drying is the most widespread method of seed preservation in country like India. It has some problems and difficulties with it. So that we go for artificial drying. There, Instead of Sun for Heat Source of Drying, Waste Heat from the Air Conditioner may be used for the Seed Processing and that also reduces the global warming by air conditioner. There by, During Drying process, it Avoids the loses of seeds. We make system which recovers waste Heat rejected to atmosphere by condenser of air conditioner. Drying takes place with the principle of Fluidized bed combustion. Seeds get dried by the required moisture content suitable for storage that must be below 14% of seed weight.

I. INTRODUCTION

In agriculture field, the seed is to be stored at low temperature. Before storing, seed processing is the necessary one that is carried out for the better seed quality. Seed processing is divided into two main categories: seed cleaning and seed treating. Seed cleaning involves that removing the dirt particles in the seeds and make them cleaned by water. It will be fully dried before storage. Here drying will take place by means of sun shine. But make the drying process with waste heat.

Seed moisture content

Most important factor influences the storability. The amount of moisture in the seeds is the most important factor influencing seed viability during storage. Generally if the seed moisture content increases storage life decreases. If seeds are kept at high moisture content the losses could be very rapid due to mould growth very low moisture content below 4% may also damage seeds due to extreme desiccation or cause hard seediness in some crops.

Since the life of a seed largely revolves around its moisture content it is necessary to dry seeds to safe moisture contents. The sage moisture content however depends upon storage length, type of storage structure, kind / variety of seed type of packing material used.

PRINCIPLE OF SEED DRYING

The migration of moisture to the surface is slower than the evaporation and a moisture gradient is developed in the kernel. 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. Hence, greater the seed moisture content lesser should be the drying temperature and vice versa. The rate of drying depends mainly on-

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- Initial seed moisture content
- Depth of spread of seed
- The rate of air blow
- Atmosphere air temperature and relative humidity
- Static pressure
- Drying temperature

II. METHODS OF DRYING

Traditional sun drying:

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 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. Two to four 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 seed is high.

Mechanical drying

Mechanical drying is mostly done using forced air drying. In forced air drying, natural air or air supplemented with heat is blown through a layer of seed until drying is completed. Generally ordinary seed godowns are provided with two types of ventilators for free movement of air circulation. In modern godowns, provisions are to be made for forcible circulation of air with the help of an electronic blower. The outside air which is comparatively dry is circulated in the godown and thereby the seed get dried up in this process. This is possible only in dry months.

WASTE HEAT

The requirements of seed storage would be fulfilled with providing Air conditioner that causes the rejection of heat which is considered as waste. This can be utilized for seed drying

Waste heat is usually correlated with waste streams of air or water and it put in to environment. Recovery of waste heat is a hefty research area among majority of scientists.

It is an accepted fact that drying of the grain is essential grain can be ensured if the moisture content is within for its safe storage.

PRINCIPLE OF AIR CONDITIONING

The goal is to keep it more comfortable inside the house than it is outside. The control of these conditions may be desirable to maintain the health and comfort of occupant or to meet the requirement of industrial process irrespective of the external climatic condition.

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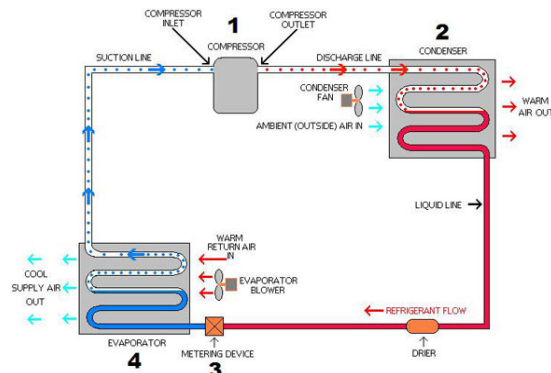


Fig 1.1

The above diagram is a simple air conditioner .inside an air conditioner system is a chemical refrigerant which is a chemical compound that easily changes the state from liquid to vapour and back again,

There are four main components in air conditioner

1. Compressor
2. Condenser
3. Expansion Valve
4. Evaporator.

III.WORKING METHODOLOGY

The principle by which this project working is that there a necessity of heat to dry the seeds, The heat supposed to dry is not quit large so that the waste heat rejected to the atmosphere from the air conditioner is quit enough to dry the seeds.

There is one setup that can recover the heat rejected by the condenser from the air conditioner. This does not affect seed's growing ability and other biological significant properties.

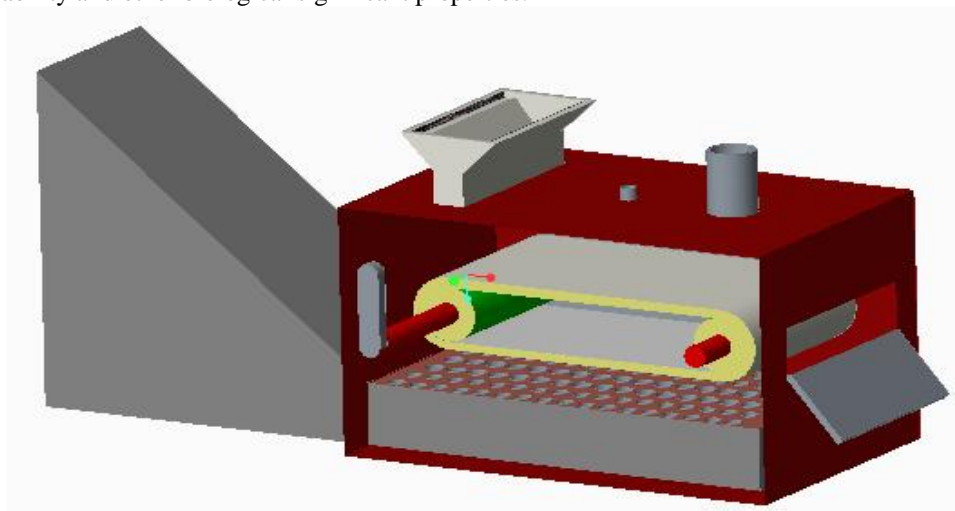


Fig 3.1: 3D Design drawing

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Recovery of heat

The heat removed from storage room is rejected to the atmosphere that is recovered with duct. Duct makes the path by which heat is going to travel. Duct carries the heat to the drying part where seeds get dried. Heat enters into the dryer through bottom by the perforated holes made on the sheet metal.

Hopper

The Hopper that is placed at top of the drier, through which seeds fall into the drier in which one belt conveyor setup is placed. The seeds are rest on the belt conveyor. The hopper is in the shape of frustum. At bottom of frustum one metal sheet is placed that spread the seeds over the width of the belt.

Belt Conveyor

Belt conveyor is used to carry the seeds from one side of drier to another side. The seeds are farmed as thin layer on the belt material. At other end of drier, the seeds are collected by bucket. Pulley getting contact with the belt conveyor is rotated by hand power.

Seed drier

It is the assembly of duct, hopper and belt conveyor in the box made by sheet metal. The seeds may dry on the fluidized bed that is made by upward flow of the heat. The heat enters into the drier box by the perforated holes on sheer metal which is bottom plate of box. That increase the velocity of the heat too. There is one vertical pipe provided at the top of the box. That's for the natural draught of the fluid.

Seeds are collected at the other end of the box where seeds would be at the required moisture content which is enough to storage.



Fig 3.2: seed dryer

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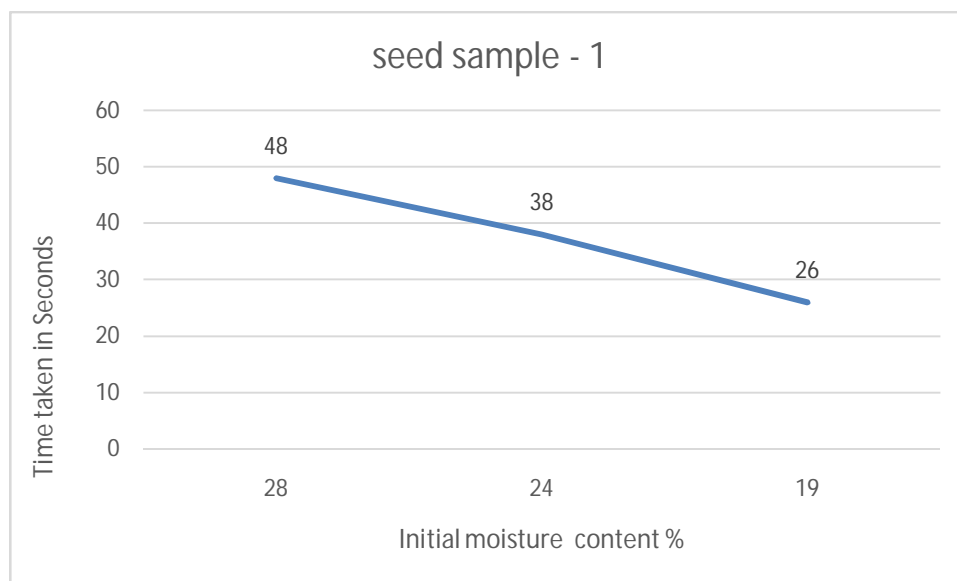
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Theoretical analysis of drying Seed sample - 1

S.No	Mass of Wet Seed (g)	Initial moisture content in percentage	Mass of dried Seed (g)	Percentage of water removed	Retained moisture content in percentage	Time Taken (seconds)
1	250	28	203	18.7	9.3	48
2	250	24	213	15	8.9	38
3	250	19	225	10	9	26

Graphical Representation



IV. CONCLUSION

Thus we make the conclusion of seeds may be dried with the waste heat of energy. Waste heat recovery reduces the fuel consumption, which leads to reduction in the waste heat. This results in reduction in equipment sizes of waste heat handling equipment such as fans, stacks, ducts, burners, etc. 3.52 kg of water can be removed from the seeds per hour.

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