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Analysis of Moisture Absorption of Wheat using Solar Dryer

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Abstract - *Drying of grains in the open sun is a very common practice. For commercial purpose required to increase the drying efficiency, maintaining quality of the grain by reducing the space requirement and manage drying operation during the available sunny period. These requirements cannot be met by the ordinary open sun drying method, to obtain the uniform drying by means of device known as solar dryer which use energy from the sun.*

Key Words: Solar Dryer, Wheat, Moisture, Collector, suction fan

1. NTRODUCTION

Solar dryer is designed to use the energy of the sun to heat the air, that flows over the grains for drying. In heated air, relative humidity decreases, so it is able to hold more moisture. In this solar dryer, experiments have been conducted to find the removal of moisture for safe storage of wheat. This solar dryer was designed and fabricated with collector area of 0.405m^2.All non-renewable energy resources like coal, oil etc, may not be available in future for our requirement. At that time, we have to go for non-conventional energy sources. One of the source is solar energy. Scientists and technologies are doing so much research for utilizing solar energy in various forms.

1.1 Description of Solar Dryer

Solar dryer is designed to use the energy of the sun to heat the air, that flows over the grains for drying. It consists of Collector, Suction fan, Drying chamber are the main parts additionally solarimeter and digital thermometer are used for measuring the solar radiation and temperature of collector and drying chamber. The solar collector collects the solar radiations through the glass and the convex lenses. It is insulated with wood and it is coated with black paint to observe more heat. Two openings are provided for inlet and outlet of air. It is made up of Galvanized iron sheet. It has a door on one side for loading and unloading of grains inside the chamber. Drying chamber has inlet opening for air at the bottom and outlet opening at the top of the chamber. Suction fan is used for sucking the atmospheric air through the solar collector and flexible pipe to the drying chamber. Then it is allowed to flow to the atmosphere. Digital thermometer is used for measuring the temperature in various places such as inlet and outlet temperature of air in solar collector, inlet of the drying chamber, above the tray and at the outlet of the drying chamber.

1.2 Principle of Working

The dryer is a passive system in the sense that it has no moving parts. It is energized by the sun rays entering through the collector top plate (Glass with convex lenses). The heat from the solar rays is observed by the inner surface of the collector (G.I sheet) which is painted black and the rays heats the air inside the collector. The atmospheric air at room temperature enters through the inlet opening in the collector. Therefore, atmospheric air at a temperature T_a enters through the inlet opening of the collector and the hot air at a temperature T_c leaves through the outlet opening of the collector. The solar intensity was measured by means of a solarimeter placed at an inclination of 10^o facing north. When the suction fan runs, the hot air from the collector is sucked through the outlet opening in collector and then forced in to the drying chamber.

The dryer was loaded with wheat and its weight was measured at the starting. Then the hot air is allowed to flow through the flexible pipe to the drying chamber and it flows over the grains which are placed on the trays. At that time the hot air removes the moisture content from the wheat grains and it is dried. The initial weight and the final weight of wheat grains are measured for every half an hour. The weight loss was used to calculate the moisture removed in Kg of wheat. The dryer performance was evaluated using the drying rate and collector efficiency. The air with moisture content flows out to the atmosphere through the outlet opening in the drying chamber.

2. TESTING REPORT

The required parameters such as time, solar intensity, room temperature, Collector inlet temperature, outlet temperature, weight of grain before drying, after drying can be measured. The amount of moisture removed from wheat grain can be calculated using the following equation Amount of moisture contain to be removed from per Kg of Wheat

$$(M_w) = \frac{Mp(Mi - Mf)}{(100 - Mf)}$$

Where M_p - Initial mass of product, M_i – Initial moisture content, M_f – Final moisture content

Table -1: Tabulation for removal of moisture content

Tabulation					
S. No	Loading Time (hrs)	Un Loading Time (hrs)	Weight of the grain before drying (w_1) Kg	Weight of the grain after drying (w_2) Kg	Moisture content removed $w=(w_1-w_2)$ Kg
1	11.00	11.30	2	1.926	0.074
2	11.30	12.00	2	1.932	0.068
3	12.00	12.30	2	1.930	0.07
4	12.30	13.00	2	1.924	0.076
5	13.00	13.30	2	1.932	0.068
6	13.30	14.00	2	1.921	0.079
7	14.00	14.30	2	1.923	0.077
8	14.30	15.00	2	1.922	0.078
9	15.00	15.30	2	1.932	0.068
10	15.30	16.00	2	1.932	0.068
11	16.00	16.30	2	1.931	0.069
12	16.30	17.00	2	1.930	0.07
Avg. removal of moisture for every half an hr					0.072

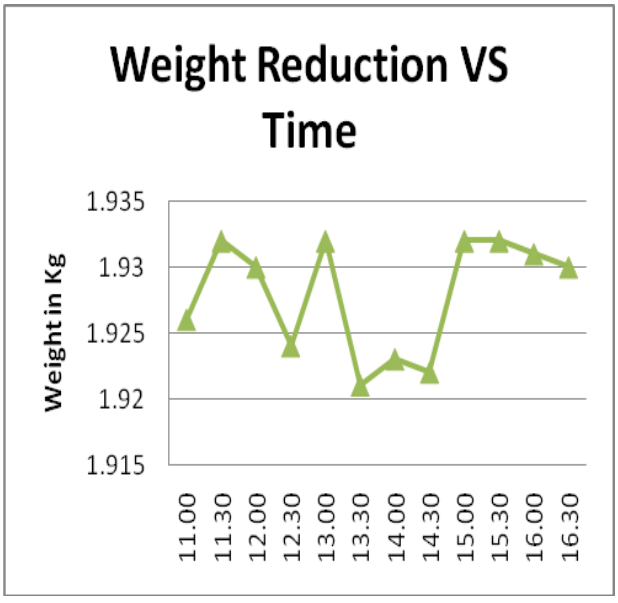

Chart -1: Weight Reduction

Chart 1 shows the weight reduction of wheat over the period of observed time from 11.00 am to 4.30 pm for 2 Kg of wheat

3. CONCLUSION

A simple and inexpensive solar drier was designed and fabricated using locally sourced materials. The temperature rise in the solar collector was up to 72° C. The drying rate, collector efficiency & percentage of moisture removed for drying wheat where 173 KJ/sec, 76.5% and 0.072 kg/half an hr and respectively for the collector tilt angle 10°. If the tilt angle is varied the above value decreases. The drier executed sufficient ability to dry grains reasonably rapidly to a safe moisture level and simultaneously it ensures a superior quality of dried product. Now this modifying concept of our project is very vital which is used for drying grains is quicker in operation with small period of time at an economic cost. The tilting angle of the collector is not constant. The angle may vary, depends on the solar radiation.

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BIOGRAPHIES

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