Development and Experimental Analysis of a Solar Cum Electrical Food Dryer

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ABSTRACT

The most preferred method for preserving food or related products for a long time period is drying. In various countries of the world, the utilization of solar thermal systems in the field of agricultural for conserving fruits, vegetables, coffee and other related crops has revealed to be economical, practical, and environmental friendly. Solar heating systems to dry food and other crops can improve the quality of the product, while reducing wasted produce. This paper deals with development of solar cum eclectically operated food dryer. The fabrication of hybrid dryer is carried out which will be used for the drying process. The amounts of solar radiations are collected through transparent sheet or glass and they are entered in to dryer. Then, amount of heat will get generated in dryer and it will be circulated through fan in dryer itself which will be suitable for drying purpose. The experimentation is also carried out on two foods related to drying process at normal temperature and using this dryer obtained temperature. After experimentation it has been observed that there is difference in temperature at outside the dryer and inside the dryer. The temperature generated inside the dryer is sufficient for drying purpose. So, the developed food dryer can be used for drying the foods as per requirement.

Keywords: Solar, Hybrid, Dryer, Food, Temperature.

1 Introduction

The most preferred method employed for preserving the foods for extended period of time is drying. Drying of different products related to agricultural by means of solar energy which is one of the mostly used renewable energy source is eco-friendly. The Solar thermal technology is speedily recognising as the most reliable energy saving method for various applications related to agriculture. There are mainly two types of dryers i.e. natural convection and forced convection solar dryers.

This study deals with development of solar cum eclectically operated food dryer. The fabrication of hybrid dryer is carried out which will be used for the drying process. The amounts of solar radiations are collected through transparent sheet or glass and they are entered in to dryer. Then, amount of heat will get generated in dryer and it will be circulated through fan in dryer itself which will be suitable for drying purpose. After experimentation it has been observed that there is difference in temperature at outside the dryer and inside the dryer. The temperature generated inside the dryer is sufficient for drying purpose. So, the developed food dryer can be used for drying the foods as per requirement.

2 Solar Dryer Components

The various components are used for the fabrication of this solar dryer are the drying cabinet, the air heater (Collector) and the drying trays.

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3 Fabrication of Solar Dryer

By using the above components and basic fabrication process we have fabricated the solar dryer which is basically used for food drying purpose. The mixed-mode solar dryer with box-type absorber collector was fabricated employing the materials which are simply available from the local market, is shown by figure 1 below. The transparent material is located at top side through which the solar radiations are entered in it. Once radiations are entered in dryer the rate of heat get increases with increase in inside temperature of dryer. Then this high temperature heat is getting circulated inside the dryer using fan and will be suitable for drying the foods. Also, arrangement is made to keep the drying trays inside the dryer at top and bottom side shown in figure 1 below.

Figure 1: *Hybrid Solar Dryer*

4 Experimental Testing Food using Hybrid Solar Dryer

The experimentation is also carried out on two foods related to drying process at normal temperature and using this dryer obtained temperature. The dryer showed adequate capability for drying of items rationally quickly to a secure level of moisture and concurrently the better quality of the dried product is also ensured. After experimentation it has been observed that there is difference in temperature at outside the dryer and inside the dryer. The temperature generated inside the dryer is sufficient for drying purpose. So, the developed food dryer can be used for drying the foods as per requirement.

The details of removed moisture throughout drying both in inside and outside chamber are presented in table1. Also, different samples of Potato and Rock Candy are taken. The readings were recorded for every hour in a day.

Table 1: *Experimental Temperature reading using Solar Dryer*

Food Sample	Atmospheric Temp.	Inlet Temp.	System Temp.	Time (In Hr. or Min.)
Potato	34.8º	40.3º	53.2º	55Min.
Raw Sugar	36.5º	48º	55.6º	2Hrs.25Min

The total % of removed moisture for every hour is presented in Figure 2. As there is limitation of maintaining constant temperature in the solar drying due to climatic circumstances; hence, the removed moisture percentage differ inconsistently with respect to time and diverse temperature.

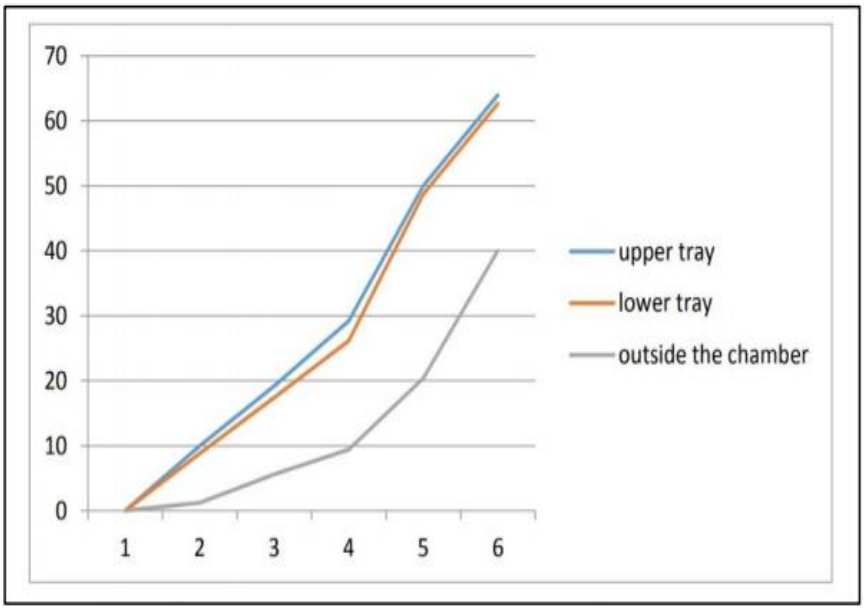

Figure 2: *Drying Rate at different conditions*

5 Result and Discussions

After this detailed experimental analysis, it is observed that the heat given by the solar dryer is more than three times as compared to that that for the outside temperature. Constant drying below the same climatic condition and similar time, 28.73 % (the higher tray) and 27.28 % (bottom tray) content of moisture is removed from inside chamber potato while at outside only 12.75 % content of moisture was removed. The one day average efficiency of the dryer is noted to be 64% even as the content of moisture for a variety of samples like vegetables, fruits, and other product were found 58%, 64%, and 60% respectively.

6 Conclusions

From this detailed study on Solar Dyer the following conclusions are drawn:

1. The solar dryer can lift up the ambient air temperature to a substantial high value for raising the agricultural crop drying rate. The fewer attentions are required for the product inside the dryer.
2. The capital cost concerned in the solar dryer construction is much lesser as compared to a mechanical dryer.
3. As per experimental analysis, the highest peak temperature inside the drying chamber is approx. 68°C-70°C during midday (3pm) and in an average approximately 60°C-62°C in a full sunny day (10:00AM to 03:00PM).

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