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EXPERIMENT ANALYSIS ON MODIFIED GREENHOUSE DRYER IN NO-LOAD CONDITIONS

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ABSTRACT

Solar greenhouse dryers are the devices used to reduce moisture content from the desired crop for their preservation. Enhancement in the warm temperature and reduction in relative humidity will increases the performance of greenhouse dryer and it will also lead to reduce payback period for patent analysis two greenhouse dryers, are inclined to the latitude of Bhopal city & one having roof top edge parallel to base have been developed. The north walls of both dryers have been covered with black plastic sheet to reduce heat losses. It is found that greenhouse dryer having roof top edge inclined the latitude of Bhopal city has higher temperature & lover relative humidity as compared to the other one.

Keywords:

Greenhouse Dryer, Solar Energy, Renewable Energy

INTRODUCTION

Crops are seasonal and needs to be preserved for. Food kept under constraint conditions to maintain its freshness, natural color, taste, ph and avoiding harmful and organism. It is essential to preserve product such as fruits, vegetables and food for keeping them for a long time without further deterioration in its quality. To preserve food products on an industrial scale, there are several technologies which are employed major ones are canning, freezing and dehydration. Especially for developing countries, drying is best suited among all those techniques with poorly established low-temperature and thermal processing facilities. To reduce postharvest losses and offset the shortages in supply solar drying offers a highly effective and practical means of preservation. Drying is simple process and energy intensive operation of moisture removal from a product in order to reach the desired moisture content.

Solar energy is being traditional used for drying of agricultural products. In drying process the moisture is removed and it is done for preservation of product. Basically drying was done can open ground. Drying of agricultural crops in the sun is traditional process. For agricultural products, drying is one of the most can improve post handling processes. It can improve quality of harvested products, extend shelf life to maintain relative constant price of products, improve the bargaining position of the farmer and reduces post harvest losses. This process takes most of the water out from the product, reduce the transportation cost, drying is directly done in open area.

Naturally ventilated polyethylene greenhouse has been proposed by Farthat et. Al [1] Experimental evaluation of was done by Kumar & Tiwari of convective mass transfer coefficient during of jaggery in the roof type even spane greenhouse dryer different shape and size. Two different sets of experiments with total quantity of jaggery as 0.75 kg and 2.0 kg. Were done for each dimension of jaggery pieces. The convective mass transfer coefficient more than the jaggery pieces with dimensions 0.03x0.03x0.02 m3 in natural convection mode than forced convection mode of the dryer [2]. ANFIS (Adaptive Neuro Fuzy Inference System) made was proposed by Prakash & Kumar to make soft computing prediction model for modified greenhouse dryer under active mode in no-load condition. ANFIS model was successfully validated with experimental data. This work highly useful for researcher to analysis without conducting the tedious experimental work [3].Solar dryer active and passive modes are evaluated under no-load in monsoon season. The data for the ambient temperature, relative moisture, wind velocity, radiation intensity were taken inside and outside the greenhouse dryer. It was concluded that drying condition is passive mode of greenhouse drying were not favorable as relative moisture inside the dryer was high. And in active mode relative humidity can be maintained through exhaust fan [4]. Maulana Azad

iJETRM
International Journal of Engineering Technology Research & Management

national Institute of Technology Bhopal, India, active greenhouse dryer with opaque northern wall was developed and tested. This dryer was tested under two conditions covered concrete floor and open floor covered floor conditions provide higher increase in temperature and decrease in relative moisture [5]. Design, development and testing of a modified greenhouse dryer under natural convection condition have been done by Prakash & Kumar. To minimize of the heat losses, the north wall was made opaque with help of a mirror [6]. Fabrication and testing of north wall insulated greenhouse dryer under natural convection mode in no- load condition was done. Two different case with & without solar collector were considered the thermal losses were reduced by the insulation of north wall using thermo cool sheet [7].Performance of simple and modified greenhouse dryer with inclined roof under convection [8]. Present works the performed study of simple and greenhouse dryer is evaluated and effort is made to increase the drying rate of greenhouse dryer [9].

EXPERIMENTAL SETUP

The proposed greenhouse dryer is of inclined roof even type which is made of rectangular iron pipes and covered with transparent plastic film. The bottom surface of the dryer is packed by black colored plastic sheet. The roof of dryer is inclined to latitude of Bhopal i.e.23 o such that one side central and wall height of the dryers are 48 cm and 32 cm. side central and wall height of the dryer are 72.7 cm and 88.7 cm respectively with floor area of 96 x 62.4 cm^2 . The drying tray is made of wire mesh with an effective area of 94 x 58 cm2. The tray is also inclined with respect to base and made black for absorbing maximum solar radiation. For entrance of air inside the dryer two circular holes of 10 cm are provided on the south wall below the tray position. One AC exhaust fan of 12 cm diameter with specification of 20W, 0.14A having 2600 RPM is used to remove the inside air. The velocity of air at exit is 3.5 m/s at the upper portion of north wall of dryer in forced convection mode. All parameters at same as for inclined roof greenhouse dryer. At the Fig.1 and Fig.2 shows the instruments used and the experimental setup.

Fig. 1. Instruments use

For the measurement of solar intensity solar power meter TM-207,for temperature measurement six channel digital indiator DTI-101 with J – Type thermocouple manufactured by Tenmmar, Taiwan with temperature range of 0 to 199^{o} C. have been used For measurement of relative humidity calibrated humidity meter HT-305 manufactured by Lutron has been. For measurement of wind velocity digital anemometer AM-4201 manufactured by Lutron has been used.

The experimentation were conducted in no-load condition on 23 February 2017 at Radharaman Institute of Technology & Science (Bhopal, India) located at 23.15^{o} Nlatitude, 77.25^{o} E longitude and 500 m altitude. Experiments were conducted only during the day time hours from 11 A.M. to 4 P.M.

Fig.2 Experimental setup

RESULTS AND DISSCUSSION

Figure 3 shows the variation of solar radiation with respect to time on 23 February 2017 The solar radiation varied from 1025 W/m2 to 1236 W/m2 .Fig 4 shows variation in temperature with time at various locations. Solar radiation has direct effect on temperature. When the solar radiation increases temperature increase .When temperature decreases, the solar radiation also decreases. Higher temperature was found out to be for ground. It is found that the modified greenhouse dryer room temperature is always higher than greenhouse dryer room temperature which means faster drying rate.

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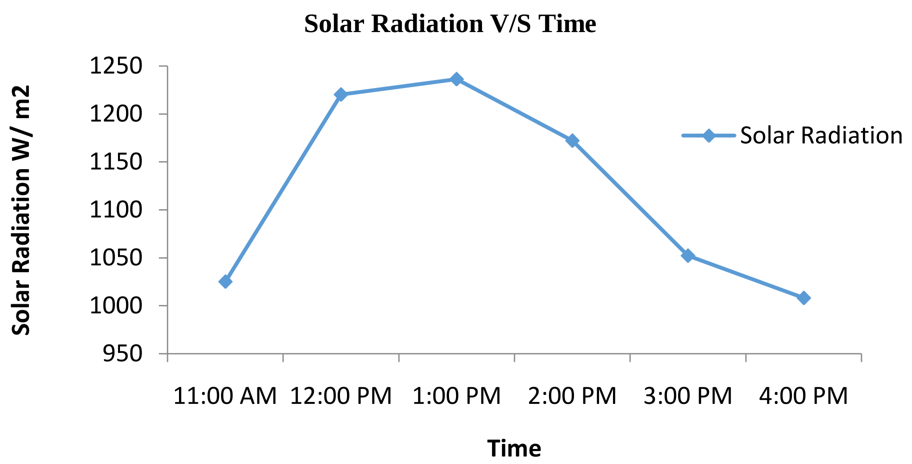

Fig. 3.Variation in solar radiation with time

At the initial stage the temperature increases slowly because the energy may be absorbed by various greenhouse dryer components higher temperature modified greenhouse dryer may be due to the reason that the sun rays fall perpendicular on the drying tray which is not in the case of conventional greenhouse dryer.

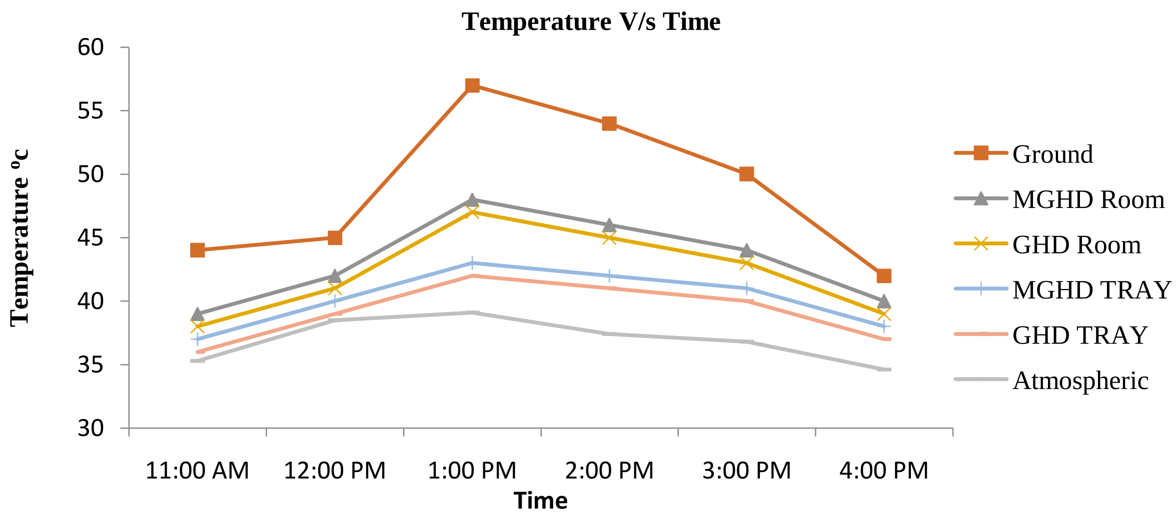

Fig. 4.Variation in temperature with time

From Fig.5 shows the variation of atmospheric relative humidity with time. The atmospheric relative humidity variation is from 16.7 to 21.4 %. The relative humidity modified greenhouse dryer varies from 12.5 to 20.6 %. The greenhouse dryer relative humidity varies from 14.6 to 12.1 %. It was observed that relative humidity in modified greenhouse dryer is always less than in greenhouse dryer relative humidity. The reason for this can be that hot air rises up and is in dined dryer air is easily able to get out of the dryer.

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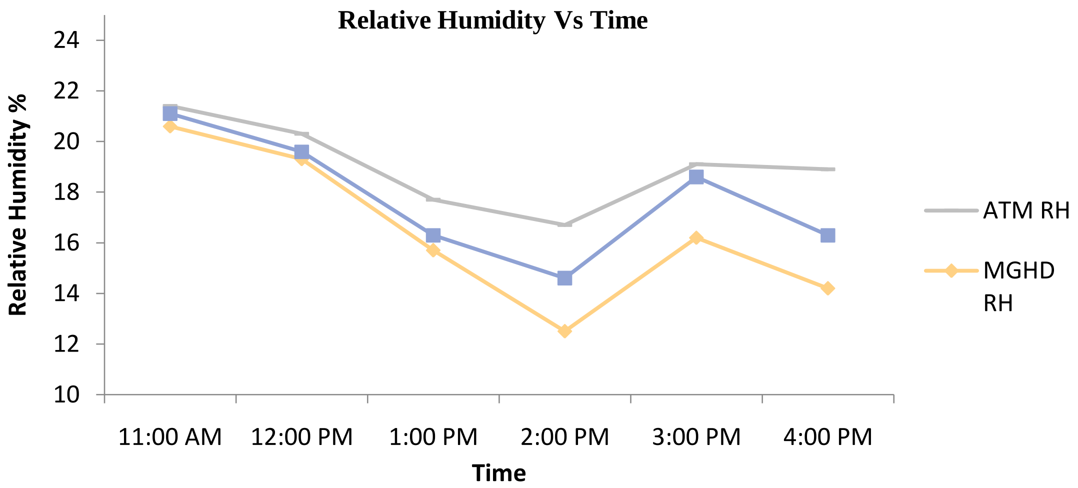

Fig.5.Variation in relative humidity with time

Fig. 6 shows the variation in atmospheric wind velocity with time. The atmospheric wind velocity variation is from 0.1to 0.6 m/s. The moisture removed in any dryer and inlet & exit wind velocity in depends upon the atmospheric wind velocity also. Wind velocity also affects the atmospheric temperature, greenhouse dryer and modified greenhouse dryer room temperature. It is also observed that high atmospheric wind velocity leads to reduction in atmospheric temperature, greenhouse dryer temperature and modified greenhouse dryer room temperature.

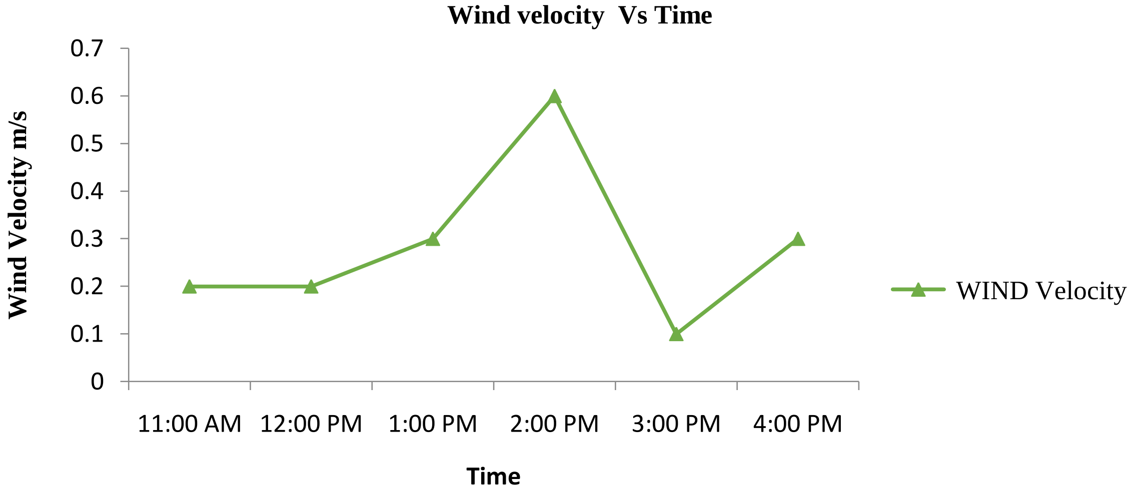

Fig. 6.Variation in wind velocity with time

CONCLUSIONS

Two greenhouse dryers one with roof inclined to latitude of Bhopal & one with roof not inclined to latitude of Bhopal have been investigated. In both the dryers, north wall is kept black in color to reduce heat losses at no load conditions. It is found out that higher temperature and lower relative humidity is for modified greenhouse dryer. The findings of this experiment would be beneficial for drying faster drying rate of agriculture produce.

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