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Solar Dryer

Saurabh Singh, Prasoon Rai, Vishal Singh, Avi Bhargav

Assistant Professor, Ug Student's
Department of Mechanical Engineering Raj Kumar Goel Institute of Technology, Ghaziabad,201003

ABSTRACT:

This paper presents the state of various kinds of solar dryers that are extensively used moment and about drying process that has been perform during drying of colorful food products and chance containing humidity in different food products. The circular, direct and mixed mode dryers that have shown implicit in drying agrarian products in the tropical and tropical countries are bandied. A side from relating the active and unresistant mode solar dryers, we also punctuate the environmental influence on solar energy(harnessing) that plays a vital part in the solar drying sector and says that the circular solar teetotaler is more suitable than other dryers and recirculation of air in an circular teetotaler can reduce the drying time of food product in comparison to normal circular solar dryers. The teetotaler having recirculation of air have further effectiveness than other dryers. Solar dryers can be made locally of any size and capacity and solar dryers are provident if cash crops are dried. The colorful design of the solar teetotaler is reported in the literature therefore far is presented.

Keywords: Solar dryers, environmental influence, food product, solar energy, agricultural products.

Introduction:

Drying is a complicated process involving contemporaneous heat and mass transfer. The needed quantum of energy to dry a particular product depends on numerous factors, similar as original humidity content, final humidity content, drying air temperature, relative moisture and haste. colourful fine models describing the drying gets of different food accoutrements have been proposed to optimize the drying process and design effective dryers. Modelling is profitable because full scale trial of different products and configurations of drying system is veritably time consuming and expensive. In order to ameliorate the quality, the traditional natural sun drying must be replaced by ultramodern drying styles. Drying characteristics of specific products should be determined to ameliorate the quality. Grains vegetables and fruits are agrarian products that are known for their rich vitamins, high attention of humidity and low fats. These are seasonal crops and are substantially available during the product season. The demand for vegetables by the growing population has not been met despite the increase. This is as a result of wastes that affect from natural and biochemical conditioning taking place in the fresh product and inimical storehouse conditions, hamstrung running, transportation, shy post crop structure and poor request outlets. Sun drying is still the most common system used to save agrarian products like grains and vegetables in utmost tropical and tropical countries. Advantages of Solar Drying System

1) More Quality of Products are attained

2) It Reduces Losses and Better request price to the products.

3) Products are defended against canvases , rain and dust; product can be left in the teetotaller overnight during rain, since dryers are leakproof.

4) help energy dependence and reduces the environmental impact

5) It's more effective and cheaper.

Disadvantages of Solar Drying System

1) Quality of products aren't attained in some cases.

2) Acceptable solar radiation is needed.

3) It's more precious Bear further time for drying

Methodology:

For the relative study of different drying processes, first the drying was carried out experimentally and also it was followed by retrogression analysis by different thin subcaste drying models.5.1.1 Experimental procedure Piper nigrum or generally called black pepper is considered for the study. Black pepper gathered is directly used in its raw form as well as bleached form for this purpose. Fresh mass is measured to determine the original humidity content(MC). The product were dried under six different conditions. These conditions were normal charger teetotaler , charger teetotaler with PCM and incipiently sun drying with bleached and fresh samples for each process. An original testing was conducted to validate the working of the teetotaler . The temperature inside the drying press with and without PCM are noted. This was done for 2 days and observed from9.00 am to4.00 pm.

Experimental set up the teetotaller. 29 The sample size was 150 g and the values of mass were taken upto 3 integers perfection. A digital importing balance is used for this purpose. The parameters considered for this trial are temperature, solar radiation intensity and mass. A datalogger is used for recording the compliances. For measuring the temperature, T- type thermocouples and Resistance Temperature Sensors (RTDs) were used. Each set are placed inside the normal charger teetotaller and teetotaller with PCM. Also, thermocouples were used to measure the ambient temperature and temperature variation inside the PCM. For measuring the variation of solar radiation intensity, pyranometer was used. The observation was noted from9.00 am to04.00 pm for five successive days. Drying kinetics analysis in statistical modelling, retrogression analysis is a statistical process for estimating the connections among variables. It includes numerous ways for modelling and assaying several variables, when the focus is on the relationship between a dependent variable and one or further independent variables (or' predictors'). More specifically, retrogression analysis helps one understand how the typical value of the dependent variable (or' criterion variable') changes when any bone of the independent variables is varied, while the other independent variables are held fixed. utmost generally, retrogression analysis estimates the tentative anticipation of the dependent variable given the independent variables – that is, the average value of the dependent variable when the independent variables are fixed. lower generally, the focus is on a quartile, or other position parameter of the tentative distribution of the dependent variable given the independent variables. In all cases, the estimation target is a function of the independent variables called the retrogression function. In retrogression analysis, it's also of interest to characterize the variation of the dependent variable around the retrogression function which can be described by a probability distribution. A affiliated but distinct approach is necessary condition analysis (NCA), which estimates the outside(rather than average) value of the dependent variable for a given value of the independent variable(ceiling line rather than central line) in order to identify what value of the independent variable is necessary but not sufficient for a given value of the dependent variable. Retrogression analysis is extensively used for vaticination and soothsaying, where its use has substantial imbrication with the field of machine literacy. Retrogression analysis is also used to understand which among the independent variables are related to the dependent variable, and 30 to explore the forms of these connections. In defined circumstances, retrogression analysis can be used to infer unproductive connections between the independent and dependent variables. still, this can lead to visions or false connections, so caution is judicious; for illustration, correlation doesn't indicate occasion. numerous ways for carrying out retrogression analysis have been developed. Familiar styles similar as direct retrogression and ordinary least places retrogression are parametric, in that the retrogression function is defined in terms of a finite number of unknown parameters that are estimated from the data. Nonparametric retrogression refers to ways that allow the retrogression function to lie in a specified set of functions, which may be horizonless- dimensional.5.1.2.1 Nonlinear Retrogression Nonlinear retrogression is a retrogression in which the dependent or criterion variables are modelled as anon-linear function of model parameters and one or further independent variables. There are several common models, similar as asymptotic retrogression/ growth model, etc. The reason that these models are called nonlinear retrogression is because the connections between the dependent and independent parameters aren't direct. The analysis is done by using the SOLVER function of the spreadsheet program Microsoft Excel, which employs an iterative least places fitting routine to produce the optimal virtuousness of fit between data and function. As a first step to assaying data using a wind fitting protocol it's necessary to determine the virtuousness of fit. Basically, this means estimating how well the wind (i.e. the function) describes the data. The most generally used measure of the virtuousness of fit is least places. This is grounded on the star that the magnitude of the difference between the data points and the wind is a good measure of how well the wind fits the data. In this work, ten thin subcaste drying models.

Thin layer drying models

Serial No.	Model Name	Model Equation	References
1	Newton	$MR = e^{(-kt)}$	O`Callaghan et al. (1972)
2	Page	$MR = e^{(-kt^n)}$	Page et al. (1949)
3	Modified Page	$MR = e^{(-(kt)^n)}$	Overhults et al. (1973)
4	Henderson and Pabis	$MR = ae^{(-kt)}$	Henderson and Pabis et al. (1969)
5	Modified Henderson and Pabis	$MR = ae^{(-kt)} + be^{(-gt)} + ce^{(-\mathrm{h}t)}$	Henderson and Pabis et al. (1971)
6	Logarithmic	$MR = ae^{(-kt)} + c$	Togrul et al. (2004)
7	Two-term	$MR = ae^{(-k_o t)} + be^{(-k_1 t)}$	Erbay and Icier et al. (2009)
8	Two-term Exponential	$MR = ae^{(-kt)} + (1-a)e^{(-kat)}$	Yaldiz et al. (2001)
9	Diffusion Approach	$MR = ae^{(-kt)} + (1-a)e^{(-kbt)}$	Akpinar and Midilli et al. (2003)
10	Midilli and Kucuk	$MR = ae^{(-kt^n)} + bt$	Midilli et al. (2002)

Objective:

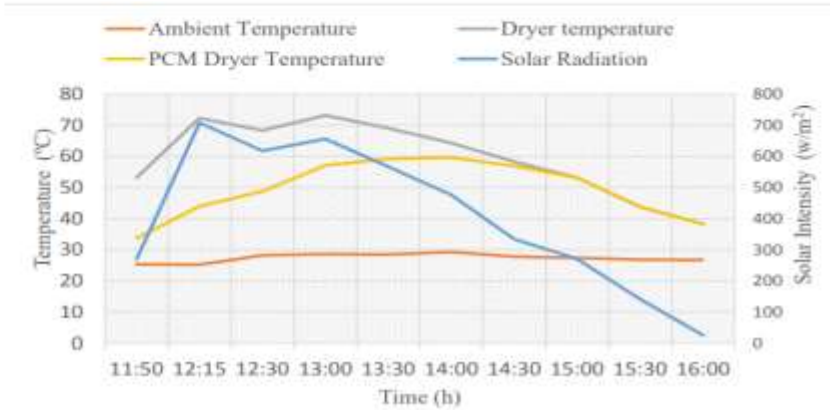
1.To carry out a comparative study of the performance of the Solar Box Type Tray dryer with and without latent heat storage material.

2.To study drying behavior of treated and untreated black pepper dried in a box type solar dryer with and without latent heat storage device (LHS).

3.Quality analysis of dried product.

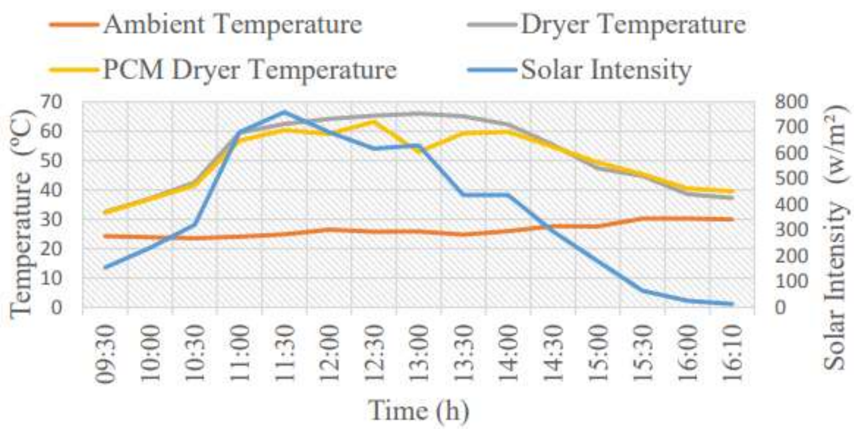
Results

The section contains details about the initial testing followed by final experimentation for the comparative study. Initial testing The dryer developed was tested before final experiment under no load condition. The variation in solar radiation intensity and temperature was measured. The data collected are plotted in Fig. The plot of solar radiation intensity and temperature variation for different drying conditions for the 1 st day of initial testing is shown-



Variation in solar intensity and temperature w.r.t. time during the 1 st day

The plot of solar radiation intensity and temperature variation for different drying conditions for the 2nd day of initial testing is shown in Fig



Variation in solar intensity and temperature w.r.t. time during the 2 nd day

Final experiment

During the final experiment for drying Black pepper , the variation of solar radiation intensity and the moisture content

of the product are taken into consideration.

Intensity and temperature variation

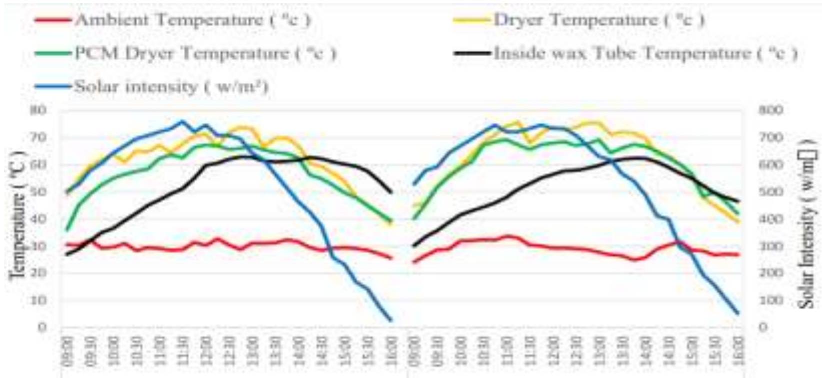
The plot below shows the variation of solar radiation Intensity and Temperature during the daytime, having interval duration of 1 hour. The temperatures are measured at the following location using thermocouples –

1.Ambient Temperature

2.Inside the tray dryer cabinet

3.Inside the tray dryer cabinet with PCM

4.Temperature of the PCM The plot of solar radiation intensity and temperature variation at different locations for the whole drying period is shown in Fig.



Time(h)

Variation of solar intensity and temperature v/s time

From the graph colluded, it's veritably clear that the maximum temperature was attained by the normal charger teetotaler in comparison to the teetotaler with PCM. The temperature inside the press of the teetotaler with PCM was in the optimum range i.e. 60 – 70 º C. But for the normal teetotaler the inside temperature exceeded the optimum range and was beyond 70 º C. A high temperature variation was observed in the normal in comparison to the teetotaler with PCM. A better temperature regulation was achieved in the teetotaler with PCM. At the end part of the day when the solar intensity radiation was low, a near about constant plot was achieved for teetotaler with PCM. This is in fact due to the release of idle energy due to the phase change of PCM from liquid to solid. This establishes the introductory motive behind the design**.**

Conclusion

After the study of colorful type of dryers, an circular foced solar teetotaler having recirculation of hot air is more suitable also others from the food preservation as well as time conservaration and energy conservation also because there's no threat of proper sun light as that in direct solar teetotaler and losses of air in that type of circular solar teetotaler where there's no recirculation of air and takes further time in drying process in comparision to air recirculating solardryer.the direct driers are substantially stylish for those areas where the proper coffers(similar as electricity and other fabricating material which is used the fabrication of circular and mixed mode teetotaler) are not available.

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