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Thermal Performance Analysis Of Active Type Solar Dryer

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Abstract- Basiccrops drying by sunlight based vitality is of incredible financial significance the world over particularly in India where the greater part of the yields grain are lost to parasitic and microbial assaults Appropriate drying could without much of astretch forestall these wastages which upgrades stockpiling of yields and grains over significant stretches India is honored with plentiful sunlight based vitality all the all year removal of moisture significant and most vitality expending forms in the food preparing concoction printing texture biting the dust ventures and so forth In rancher level drying is being benefited on open yards without in any way sterile conditions For the most part warm vitality kept up between 40°C to 25°C relying upon the items and creation strategies An ordinary fuel like power kindling diesel heater oil lamp fuel and so on is creating that vitality The target of this task is to adjust plan of a constrained convection roundabout sun based dryer and its exhibition test on The framework comprises of an air warming segment The sun oriented dryer comprises of various segments for example sun based board battery warming component and blower The blower is accustomed to passing the hot air to the necessary spot with the goal that the dampness substance in the spot was expelled It offers a superior authority over drying and the item got is of preferable quality over sun drying Sunlight based dryer can be worked at higher temperature suggested for profound layer drying.

Keywords- Solar Dryer, Hybrid, Moisture Removal

I. INTRODUCTION

Sun oriented drying of food is a successful method for food safeguarding and is particularly helpful in creating regions where fuel assets are scant. Food drying jelly food by hindering the activity of chemicals, microorganisms, yeasts, and moulds [1]. Sun based drying has been utilized since ancient occasions to dry food sources like vegetables, organic products, fish, and meat just as different things like creature skins and soil blocks to construct homes . Traditional drying strategies that were created around the eighteenth century are as yet used in industry today. Today, crop drying is primarily done at modern levels in enormous food driers for mass business sectors. Normal dried food things incorporate oat grains, natural products, and grapes. Drying can likewise assist with forestalling waste by drying the pieces of the plant tossed out during cooking and transforming them into creature feed [2].

Tropical natural products can be saved through sun powered drying in regions like Haiti, where the sun is plentiful yet customary fuel assets are scant [3]. Breadfruit, a huge boring natural product that fills here, is a specific food of interest. It is a supplement thick food that is referred to as a food source with incredible potential to end hunger in the spaces it develops. Notwithstanding, breadfruit is quite possibly the most squandered food source in Borgne, Haiti as indicated by the KGPB ranchers bunch. Once gathered, it just endures 1-3 days before decay. During the gathering season, the business sectors are overwhelmed with breadfruit which drives down costs and prompts a great deal of squandered breadfruit. One approach to tackle this issue is to save the breadfruit by transforming it into flour. This will build the period of usability and make transportation simpler.

To transform the breadfruit into flour, the organic product should be dried which builds the period of usability and makes it simpler to granulate into little particles [4]. The rancher's bunch likewise referred to other tropical organic products, like bananas and mangoes, as a wellspring of food squanders. Drying can likewise assist with saving these organic products for ranchers nearby.

II.RESEARCH METHODOLOGY

The energy balance on the absorber is obtained by equating the total heat gained to the total heat loosed by the heat absorber of the solar collector. Therefore,

$$IA_c = Q_u + Q_{cond} + Q_{conv} + Q_R + Q_\rho, \quad (1)$$

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Where:

I = rate of total radiation incident on the absorber's surface (Wm–2);
Ac = collector area (m2);
Qu = rate of useful energy collected by the air(W);
Qcond = rate of conduction losses from the absorber (W);
Qconv = rate of convective losses from the absorber (W);
QR = rate of long wave re-radiation from theabsorber (W);
Q = rate of reflection losses from the absorber(W).
The three heat loss terms Qcond, Qconv and QRare usually combined into one-term (QL),

i.e., QL = Qcond + Qconv + QR. (2)

If is the transmittance of the top glazing andIT is the total solar radiation incident on the top surface, therefore,

$IA_c = \tau I_T A_c$ (3)

The reflected energy from the absorber is givenby the expression:

Q□ = □ □ ITAc(4)
Where □ is the reflection coefficient of the absorber. Substitution of Eqs. (2), (3) and (4) in Eq. (1) yields:

$$\tau I_T A_c = Q_u + Q_L + \rho\tau I_T A_c,$$

Or

$$Q_u = \tau I_T A_c (1 - \rho) - Q_L.$$

For an absorber $(1 - \rho) = \alpha$ and hence,

$Q_u = (\alpha\tau) I_T A_c - Q_L,$ (5)

Where □ is solar absorptance
QL composed of different convection and radiation parts. It is presented in the following form (Bansal et al. 1990):
QL = ULAc(Tc – Ta), (6)
where:
UL = overall heat transfer coefficient of theabsorber (Wm–2K–1);
Tc = temperature of the collector's absorber(K);
Ta = ambient air temperature (K).

$Q_g = A_c F_R[(\alpha\tau) I_T - U_L A_c (T_c - T_a)].$

The thermal efficiency of the collector is defined as (Itodo et al. 2002):

IT is the total solar radiation incident on the top surface Qg composed of different convection and radiation parts

$$n = \frac{Q_g}{A_c I_T} \quad (12)$$

The drying cabinet together with the structural frame of the dryer was built from well-seasoned woods which could withstand termite and atmospheric attacks. An outlet vent was provided toward the upper end at the back of the cabinet to facilitate and control the convection flow of air through the dryer. Access door to the drying chamber was also provided at the back of the cabinet. This consists of three removable wooden panels made of 13 mm plywood, which overlapped each other to prevent air leakages when closed. The roof and the two opposite side walls of the cabinet are covered with transparent glass sheets of 4 mm thick, which provided additional heating.

III. EXPERIMENT AND RESULT

As we mentioned in the working section, we aim to convert the energy coming from the sun into two parts thermal energy and electrical energy and this converted energy is being used to reduce the moisture content of the food item. To test its ability to perform all these tasks, the solar dryer made by us is observing the information received from it.

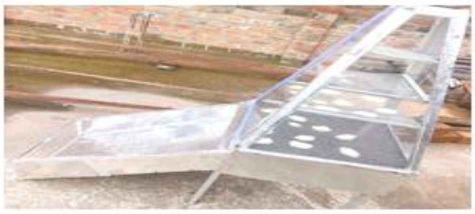

Figure 1 view of solar dryer.

Figure 2 Potato chips drying in solar dryer.

3.1 First Section Result
Temperature reading of the solar dryer in February month

Feb Month 09-02-2021	Temperature At first Stage (in degree Celsius)	Temperature At (11) second stage (in degree Celsius)
10:15AM	42	36
11:15 AM	53	42
12:15PM	58	46
01:15 PM	59	49
02:15 PM	58	48
03:15 PM	56	43
04:15 PM	53	39
05:15 PM	46	37

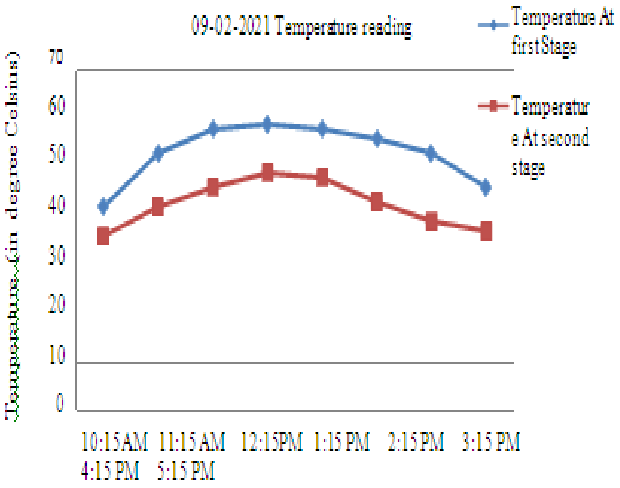

Figure 3 Drying Temperature reading.

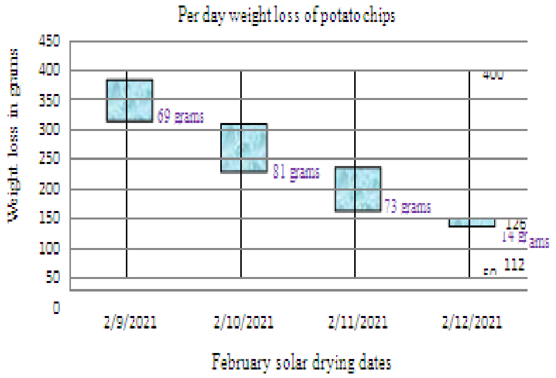

Figure7 per day weight loss of potato chips in February

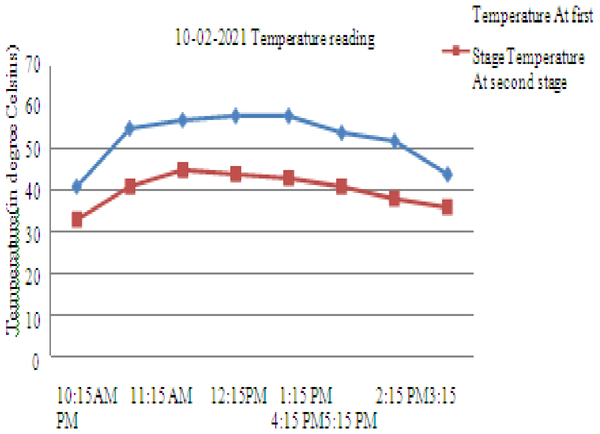

Figure 4 Drying Temperature reading

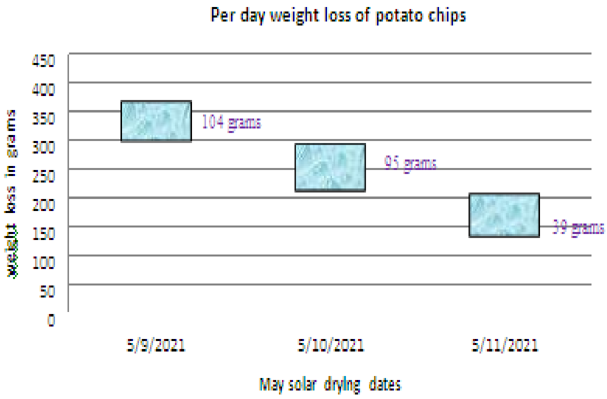

Figure 8 per day weight loss of potato chips in May.

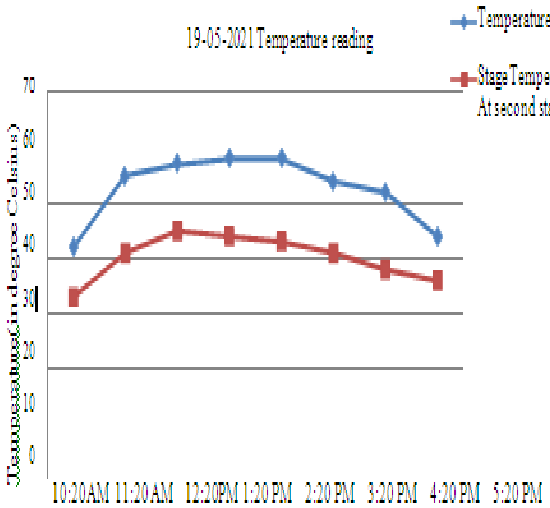

Figure 5 Drying Temperature reading

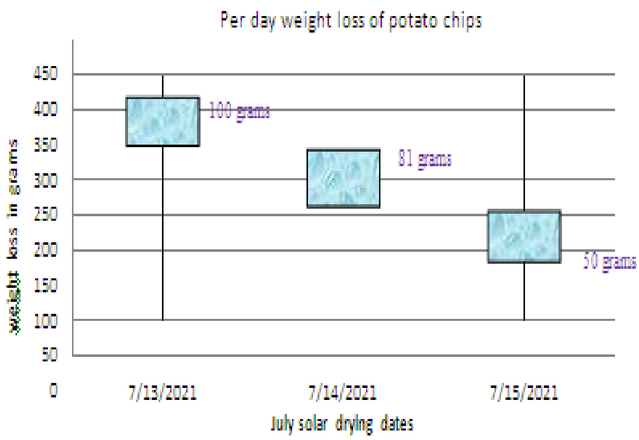

Figure 3.9 per day weight loss of potato chips in July

IV.CONCLUSION

Solar food dryers can work by charging the battery with solar or power. In a country like India which has 300 bright days out of 365 days, there is a huge resource of solar energy. The government is also promoting the use of permanent wells of energy like solar energy by giving grants on solar siphons, solar water radiators, solar boards, solar lights etc., we should take advantage of these schemes. The use of solar energy does not cost us anything just the solar board, daylight is cost-free and the sun is an incomplete well of energy. In this research, we can conclude that the performance of the solar dryer was better in almost all seasons and 70-78% moisture has been removed in it in the first 2 days. It can also be seen from this that the increase in the internal temperature of solar dryers has also been around 40-60%.

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