Design And Fabrication Of A Solar Drying System For Food Preservation

Dilip Prajapati [1], Devendra Doda[2]
Department of Electrical Engineering
[1,2] Poornima College of Engineering Jaipur, India

Abstract- *Drying crops by solar dryer is of extraordinary monetary significance the world over, particularly in India where the vast majority of the yields and grain harvests are lost to parasitic and microbial assaults. Legitimate drying could undoubtedly keep these wastages, which upgrades stockpiling of harvests and grains over extensive stretches. India is honored with copious solar energy all the all year. Drying is one of the critical and most energy expending forms in the nourishment handling, concoction, printing, texture kicking the bucket ventures, etc. In rancher level drying is being benefited on open yards without in any way sterile conditions. For the most part thermal energy, kept up between 42 0C to 28 0 C relying upon the items and creation techniques. A traditional fuel like firewood, furnace oil, kerosene, diesel, electricity, etc is delivering that energy. The objective of this project is to modify design of a forced convection indirect solar dryer and its performance test on Grapes. The system consists of an air heating area. The sun based dryer comprises of various parts, for example, solar panel, battery, heating component and blower. The blower is accustomed to passing the sight-seeing to the required spot, with the goal that the dampness substance in the spot was evacuated. It offers a superior authority over drying and the item acquired is of preferred quality over sun drying. Solar Dryer Can be worked at higher temperature, suggested for profound layer drying.*

Keywords- Solar energy, Solar dryer, Grape drying, Agriculture produce, Optimum temperature.

I. INTRODUCTION

Energy is the most essential need of the present society and economy. Our work, relaxation, and our financial, social and physical welfare all rely upon the adequate, continuous supply of vitality. The vitality request keeps on developing, after quite a long time after year. Drying is one of the techniques used to save nourishment items for longer periods. The warmth from the sun combined with the breeze has been utilized to dry nourishment for safeguarding for a few thousand years.

Sun drying is still the most common method used to preserve agricultural products in most tropical and subtropical countries. However, being unprotected from downpour, wind-borne earth and residue, pervasion by bugs, rodents and other creature, items might be truly corrupted to the degree that occasionally turned out to be unpalatable and the come about loss of nourishment quality in the dried Products may have unfriendly financial consequences for domestics and global markets.

Solar thermal technology is an innovation that is quickly picking up acknowledgment as an energy sparing measure in farming application. It is wanted to other elective wellsprings of energy, for example, wind and shale, since it is rich, unlimited, and non-contaminating. Sun powered air warmers are basic gadgets to warm air by using sunlight based energy and it is utilized in numerous applications expecting low to direct temperature underneath 85°C, for example, crop drying and space warming.

In antiquated occasions, the sun and wind would have normally dried sustenances. Proof demonstrates that Middle East and oriental societies effectively dried nourishments as right on time as 13,000 B.C. in the hot sun. Later societies left more proof and each would have techniques and materials to mirror their nourishment supplies—fish, wild amusement, household creatures, and so on.

However, a PV based sun powered dryer is a self-supported sunlight based dryer. This sort of dryer does not require some other energy amid activity. Subsequently, this dryer may turn into a progressively appropriate suggestion for the rustic division and different zones in which power is rare and sporadic supply. A PV based sun based dryer is planned and created and introduced at Manav Rachana College of Engg. (MRCE) at Faridabad, Haryana. It comprises of an air radiator and drying chamber with smokestack and a supporting stand. The photovoltaic (PV) based sun oriented dryer has been created for rustic applications where framework power does not reach and sufficient supplies of non-renewable energy source to drive a fan or blower are inadequate. The dryer in this examination has been intended to utilize a D.C. fan controlled by straightforwardly coupled photovoltaic. A techno-financial investigation of the above dryer has likewise been done.

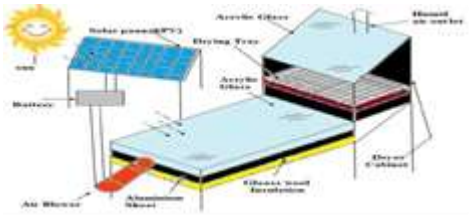

Fig 1.1 over view of solar dryer

II. MATERIALS USED

The following materials were utilized for the development of the household latent sun powered dryer:

- Wood - as the bundling (lodging) of the entire system; wood was picked being a fair defender and decently more affordable than metals.
- Glass - as the sunlight based gatherer spread and the spread for the drying chamber. It allows the sun based radiation into the framework however opposes the stream of warmth energy out of the frameworks.
- Mellow steel sheet of 2mm thickness (estimation 120cm × 60cm) painted dark with tar – for ingestion of solar radiation.
- Net material (cheesecloth) and wooden housings for building up the plate. Nails and glue as catch and bonds.
- Glass fleece protection. Paint (dark).

Classification of Solar Dryer

Solar dryers are open in an extent of size and plan and are used for drying of various cultivating things. Various types of Dryers are available in the market as per need of farmers. Generally all the drying systems are requested dependent on their working temperature broadens that is High Temperature sun controlled dryer and Low Temperature Solar dryer. Following criteria's are required for the request of solar dryer :-

1. Air movement mode
2. Insulation exposure
3. Air flow direction
4. Dryer arrangement
5. Solar contribution
6. Type of fruit to be dried

Direct Solar Dryer

It is a kind of dryer in which sun situated radiation is explicitly devoured by the thing to be dried. it is furthermore called as trademark convection agency dryer since the daylight put together radiation is clearly fall with respect to the thing ,the nature of thing is diminished. This dryer contains a drying chamber that is verified by a clear spread made of glass or plastic. The drying chamber is typically a shallow, secured enclose with air-holes it to empower air to enter and exit.

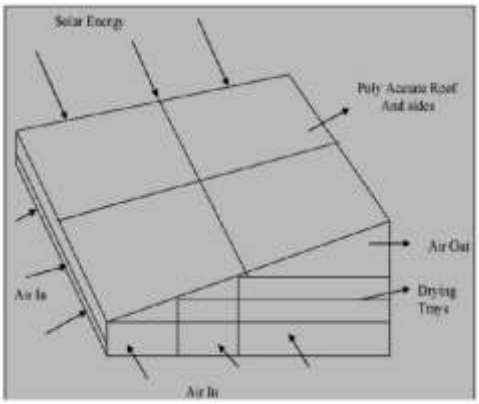

Fig. 2 Direct solar drying

Indirect Solar Dryer

The solar radiation grabbed by the structure is utilized to warm the air which courses through the thing to be dried in this dryer. In this of dryer nature of thing improved anyway drying rate extended. Warmed air is blown through the drying chamber . At the most astounding purpose of drying chamber vents are give through which moistness is cleared. In indirect kind of sun situated drying systems a better expert over drying is cultivated. Fig. depicts another standard of circuitous daylight based drying which is ordinarily known as conventional dryer.

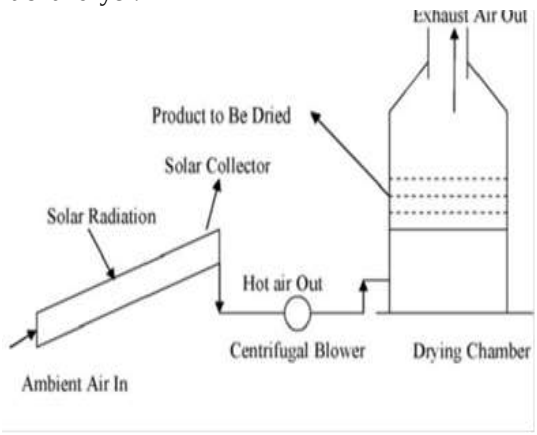

Fig. 3- Indirect solar dryer

Forced Convection and Natural Convection Solar Dryer

Constrained convection-In this kind of dryer air is constrained through a sunlight based authority and the item

bed by a fan or a blower, regularly alluded to as dynamic dryer.

Normal convection – In this dryer common development of air happens along these lines called as detached dryers.The warmed wind stream is instigated by thermal gradient.

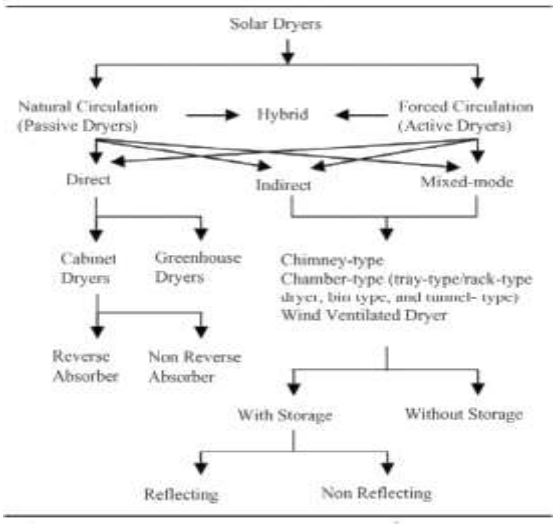

Fig. 4- Classes of solar dryer and their drying methods

III. LITERATURE REVIEW

Crop drying is the most energy expending process in all procedures on the ranch. The motivation behind drying is to expel dampness from the farming produce so it tends to be handled securely and put away for expanded periods. Harvests can likewise dry before capacity or, amid capacity, by constrained course of air, to forestall sudden ignition by hindering aging. It is assessed that 25% of the world's grain creation is lost after reap in view of inefficient dealing with and poor execution of post-accumulate advancement, says Hartman's (1990). Grains and seeds are normally procured at a clamminess level some place in the scope of 20% and 41% depending upon gather. These must be dried to an element of 8% to 14% dependent upon application and market need. At the point when an oat crop is assembled, it may should be secured for a period before it might be publicized or used as feed. The time distribution a grain can be safely secured will depend upon the condition it was gathered and the kind of storeroom being utilized. Grains set away at low temperature and sogginess substance can be repelled for longer period before its quality will disintegrate. A part of the oats that are customarily secured fuse maize, rice, beans. show that two sorts, dynamic and dormant mode, can describe sun fueled dryers. Disengaged dryers can be moreover isolated into prompt and underhanded models An immediate daylight based dryer is a structure in which the sustenance is explicitly exhibited to the sun arranged radiations just in which the material to be dried are placed in a clear fenced in territory of glass or plastic or with reflected radiations, for instance, box dryer. Reflected radiations are used to fabricate the temperature in the compartment dryer. In direct solar dryers, the air hotter contains the grains and daylight based energy, which experiences a clear spread and is devoured by the grains. Fundamentally, the glow required for drying is given by radiation to the upper layers and coming about conduction into the grain bed.

Be that as it may, in an unusual sun situated dryer, sun based radiation don't falls explicitly onto the thing being dried, yet gatherer is used to raise the touring temperature in the dryer chamber. in abnormal dryers, solar energy is assembled in an alternate sun situated specialist (air radiator) and the warmed air by then experiences the grain bed, while in the mixed mode sort of dryer, the warmed air from an alternate sun fueled gatherer is experienced a grain bed, and meanwhile, the drying agency absorbs sun based energy direct through the clear dividers or the housetop.

Energy is basic for the nearness and progression of humanity and is a key issue in widespread administrative issues, the economy, military status, and technique. To diminish the impact of ordinary energy sources on the earth, much thought should be paid to the improvement of new energy and supportable power source resources. Daylight based energy, which is condition very much arranged, is unlimited and can fill in as a supportable energy source.

Advantages

- Significantly less time is required for drying when contrasted with direct drying in light of dark body.
- Security of the drying items from creepy crawlies yet in addition from birds, dogs, particularly to dry meat and fish.
- The item is clean since microorganisms, bugs and flies are slaughtered.
- Protection of rain.
- Protection of pollution by dust etc.
- Assurance of the wind which can blow away the food.

Limitation

- Not serviceable around evening time.
- Efficiency declines to an expansive degree on shady days.
- Overheating may happen if standard consideration isn't paid.

- Due to overheating, it can decrease the nature of sustenance.
- Change in taste and kind of sustenance may happen if customary checking isn't finished.
- We can't get the precise measure of sun beams and warmth.

IV. CONCLUSION

Solar sustenance dryer can worked by charging the battery by solar or control.

In a country like India where 310 days out of 365 days are brilliant have a colossal asset of solar energy. Government is in like manner propelling the use of supportable wellsprings of energy like solar energy by giving appointments on solar siphons, solar water radiator, solar sheets, solar lights, etc kid we should abuse these plans.

Usage of solar energy costs us nothing basically simply solar board, sunshine is free of cost and sun is a non-finishing wellspring of energy.

Pretty much consistently there are updates on spoiled sustenance grains in paper, which makes an enormous misfortune ranchers yet on the off chance that we plan those go downs on the idea of dark body, at that point such condition will happens.

FUTURE SCOPE

This undertaking is done so as to get outside learning and include in down to earth applications past in our everyday scholastic examinations under in the module of "cutting edge topics in Mechanical Engineering". Structuring of the solar dryer limiting deficiencies related with than low effectiveness, cost not compact solar dryer. Assessing the size of solar food dryer.

The first structure of our solar nourishment dryer is for daytime as it were. In future we will endeavor to make it that, it very well may be for evening by including air warmer and furthermore in light of solar board mounting manufacture the dryer estimate increases, so in future we will try to make it.

REFERENCES

[1] Brian A. Nummer, Ph.D. National Center For Home Food Preservation May 2002

[2] Solar Drying - A Technology for Sustainable Agriculture and Food Production R.J. Fuller Principal Fellow, IDTC, Department of Civil and Environmental Engineering, University Of Melbourne, Australia.

[3] Xie, W.T., Dai Y.J., Wang, R.Z., Sumathy, K., 2011. Concentrated Solar Energy Applications Using Fresnel Lenses: A Review Renewable & Sustainable Energy Reviews, Vol. 15(6), Pp. 2588 – 2606.

[4] Sharma, A., Chen, C. R., Vu Lan, N., 2009. Solar- Energy Drying Systems: A Review. Renewable and Sustainable Energy Reviews, Vol.13, Pp. 1185-1210.

[5] Design & Development of Indirect Type Solar Dryer with Energy Storing Material , C.V.Papade , .A.Boda, Mechanical Engineering Department, Solapur University. N.K.Orchid College of Engg. and Tech., Solapur, Maharashtra, India, ISSN: 2349-2163,Volume 1 Issue 12 (December 2014)

Books Reference

[6] Solar Energy Utilization by G.D.Rai and Published By Khanna Publishers.

[7] Solar Energy Principle of Thermal Collection and Storage (Third Edition) By S.P.Sukhatme and J.K.Nayak and Published By Tata McGraw Hill Education Private Limited.