International Journal of Scientific Research in Engineering and Management (IJSREM)
Volume: 04 Issue: 05 | May -2020 ISSN: 2582-3930

Design and Development of Solar Dryer

Hardip Patel[1], Harsh Patel[2], Dixit Monpara[3] , Nishith Suthar[4] , Vikram Vanara[5]

[1]Mechnical Department
Shree Swami Atmanand Saraswati Institute Of Technology

Internal Guide:- Dr. Jignesh Vaghasia

Head of Department (Mechanical), Shree Swami Atmanand Saraswati Institute Of Technology

---

Abstract - The most basic solar dryer is the cabinet dryer. It is use for commercial purpose like grain drying, fruit drying etc., because it has very high drying capacity up to 47-50 degree Celsius there for we make a solar cabinet dryer for better understanding of solar dryers like cabinet dryer, green house dryer, force convective dryer, etc. we make a new design of solar cabinet dryer. It is the combination of solar cabinet dryers and active dryers.

Key Words: Solar dryer design, Application of solar dryer

1.INTRODUCTION

There are many types of dryers available in the market. Solar dryers are most effective and economical dryer. Solar dryers are work on direct as well as global or diffuse solar radiation. We have come across an idea that if we use parabolic concentrator in solar dryers. It is improve more efficiency of solar dryers. This concept is the main reason for this project.

Solar dryers use for removing the moisture content available in grain, fruit and any other food. But process of drying generally to costly so we can design and developed solar dryer which is affordable and can test practicalities of the concept of solar dryers.

There are three major objective of the solar dryer which are given below:
1 Design and development of solar cabinet dryer to study the temperature and timing of drying process.
2 Basically dryer are used for removing the moisture content in any grain and fruit. Our aim behind making dryer to improve efficiency of solar cabinet dryer.
3 By the process of drying we can improve the storage life of any kind of food or grain.

2. LITERATURE REVIEW

[1]Solar dryers are specialized devices that control the drying process and protect the food from damage by insects, pests, dust and rain. They have been developed and used to dry agricultural products in other to improve their shelf life (Esper and Muhlbauer, 1996).
4

It is a process of moisture removal due to simultaneous heat and mass transfer (El-Sebaii and Shalaby, 2012). Agricultural products, especially fruits and vegetables require a temperature range of (45-60℃) for safe drying. Products like fruits such as apple, vegetable grains beverage crops, fish; meat, timber, etc. [2] By designing the grain dryer we can make best use of solar energy. We also overcome the difficulties in drying grain by traditional method. This method is fast, dust free. It required less space.[3](i) The drying time for both beans and peaswasreduced from 56 hours for natural drying to 12–14 hours for solely solar drying and to 8-9 hours for mixed (solar plus auxiliary) drying.
(ii) An increase of 25% to 40% in the efficiency of the auxiliary supplemented drying system was found compared to that of the solely solar drying system.
(iii) The drying time was reduced by 33% and 36% for peas and beans respectively due to the use of the auxiliary heat accompanied by increase in the energy required by 22% for peas and 30% for beans.

3. Working and New Things

In our solar dryer we make this dryer different according to all dryers. We use design of cabin from literature review [1]. In this the design of cabin is passive type the slope is provided 21° according to latitude angle of our location. We provide one side slope at the top of the roof. We provide heat exchanger at the top surface of the cabin and it is colored by the black lacquer paint. And the design of the heat exchanger is taken from [3]. We also add the parabolic concentrator for heating of the pre heated water which is comes from heat exchanger and it was increase the temperature of working fluid. We use water as a working fluid.[2]

First of all the water is contained in the isolated tank. By using of pump the water is entered in the heat exchanger and in it the water is pre heated by the direct solar radiation which is emitted by the sun. and after that this pre heated water is entered in the parabolic concentrator and then it was entering in the internal coil of the cabin at that time the temperature of the water is rise up to 58-60° c . So the copper pipe is heated this heat entering in the cabin by the force convection by using of fan.

Table -1&2: Experimental Result

Day 1 (without insulation)

Sr. No.	Time	Temp.c	Weight (gm) (m_{grp})	Moisture Removed (%)	Temp.c	Weight (gm)(m_{chh})	Moisture Removed (%)
1	10:00	31	250	0	31	250	0
2	11:00	35.7	241	3.6	39.7	244	2.4
3	12:00	41	236	5.6	41	239	4.4
4	1:00	48	229	8.4	48	231	7.6
5	2:00	53	219.1	12.396	53	227	9.2
6	3:00	58	212.14	15.144	58	222.23	11.108

Table 1. Experimental result of Day

Day 2 (With insulation)

Sr. No.	Time	Temp.c	Weight (gm)(m_{grp})	Moisture Removed (%)	Temp.c	Weight (gm)(m_{chh})	Moisture Removed (%)
1	10:00	32.2	212.14	0	32.2	222.23	0
2	11:00	38.5	203.04	4.3	38.5	213.2	4.06
3	12:00	46	191.2	9.8	46	206	7.3
4	1:00	55	174.2	17.8	55	194	12.7
5	2:00	62	166.2	21.7	62	183	17.65
6	3:00	67.8	153.71	27.54	67.8	172.3	22.46

Table 2. Experimental Result Day 2

Above both the table are show the experimental result with insulation and without insulation Day 1 results are without insulation and result of day 2 are with insulation. In both condition temperature are increasing but the rate of value of temperature increasing is different. The actual setup of working model is as below

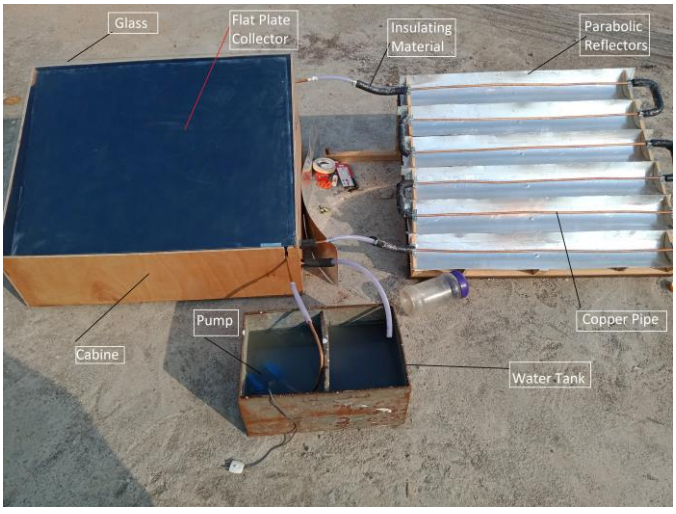
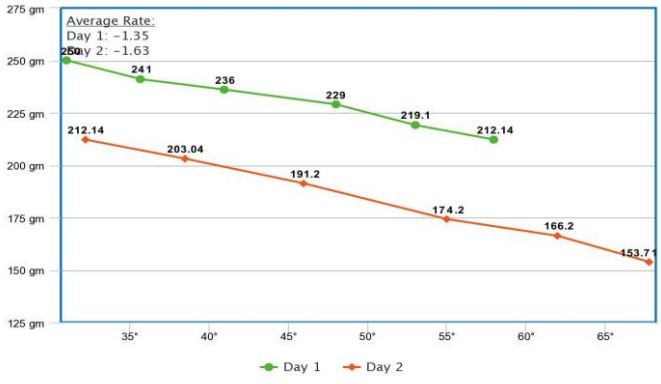
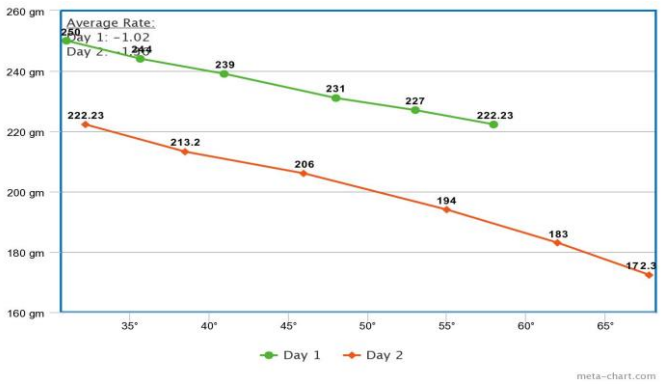
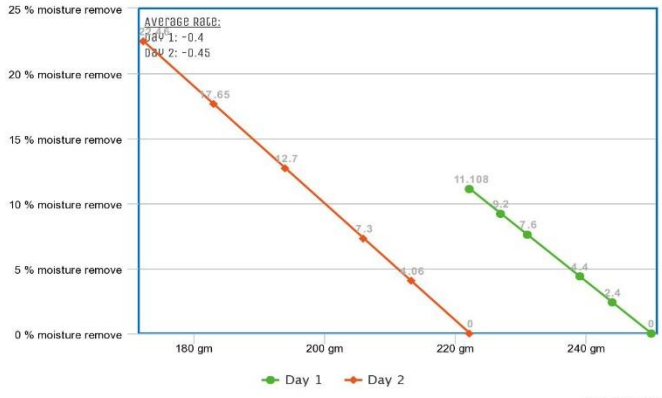
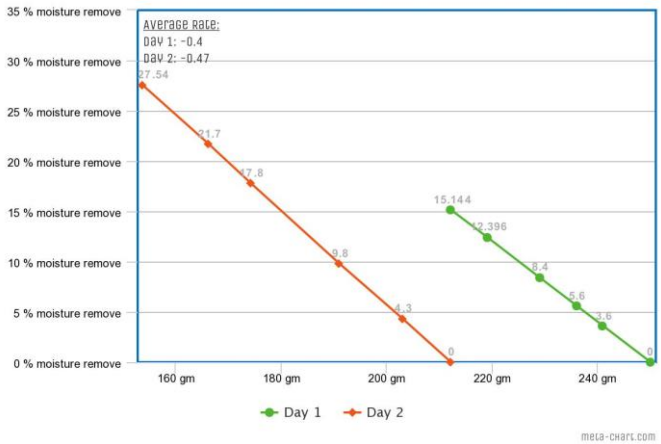


Fig -1: Figure









Moisture remove vs Weight (Grapes & Chili)

Chart

Weight vs Temp (Grapes & Chili)

3. CONCLUSIONS

From the experiment we get some result according to result our dryer is use only for some vegetable or fruit drying purpose. The temperature range of dryer is 58 – 67.8° C. According to Result we find that because of water the temp. Rise up to 67 to 68 degree Celsius we are trying to make All-purpose dryer but we can make only for fruits and grapes. If we use Freon In place of water at that time we get high amount of temperature. Drying time of our dryer is approximately 2.5 days.

REFERENCES

[1] Ikrang E G, Onwe D N and author Ikrang E G DEVELOPMENT OF A DIRECT PASSIVE SOLAR DRYER FOR CRAYFISH (PROCAMBARUS CLARKII) publish in Int. J. Engg. Res. & Sci. & Tech. 2015

[2] Mankarnika Mane asst. professor D.Y. patil college of engineering akurdi, pune ,india. Publish paper on STUDY AND DESIGN OF SOLAR GRAIN DRYER which is publish from Mane, International Journal of Advanced Engineering Technology

[3] Abdul Jabbar N. Khalifa,1 AmerM.Al-Dabagh,2 andW.M.AlMehemdi2 An Experimental Study of Vegetable Solar Drying Systems with and without Auxiliary Heat it is o Accepted on 6 June 2012