

## SOLAR ONION DRYER

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### ABSTRACT

*In this experiment by using natural convection method and with help of solar energy onion are dried. An attempt has been made to design and fabrication solar onion drier which is not required electricity. The study is made by taking the harvested onion. A comparative study is done between convectional drying and drying with solar onion drier. The temperature, moisture and for particular place experiment is done.*

**Key words:** solar heater, Drying chamber, Temperature, and Density.

### INTRODUCTION

In this world more than 6 billion and about 800-900 million people they do not have food to eat. There is some method to solve the problem. Like increasing food production, reducing loss in harvesting and reduce population growth. It has been estimated that around 20-30 % grains and 30-50% vegetables are lost before reaching to the consumer.

In this onion is one of the more important agricultural vegetable that can use daily life. The onion is cultivated for 500 years or more in the Chinese. It is estimated that around 9000000 acres of onion grown annually in world. In this world 170 countries cultivate onions for domestic use and 8% of global production. Some of the countries producer of onion on 2012 data

**Table-1:** onion production in countries

COUNTRIES	PRODUCTION RATE IN TONS
CHINA	20507759
INDIA	1372100
UNITED STATES	3320870
EGYPT	2208080
IRAN	1922970
PAKISTAN	170110
RUSSIA	1536300
KOREA	1411650

### 1.1 CONTENTS IN ONION

**Table-2:** Nutritional value per 100g

CARBOHYDRATE	9.34g
SUGAR	4.24g
DIETARY FIBER	17g
FAT	0.1g
PROTEIN	1.1g
WATER	89.1g
THIAMINE	0.046g
RIBOFLAVIN	0.027g
NIACIN	0.116g
PANTOTHENIC	0.123g
VITAMIN B6	0.12g
FOLATE	19mg
VITAMIN C	7.4mg
CALCIUM	23mg
IRON	0.21mg
MANGANESE	10mg
MANGANESE	0.129mg
PHOSPHOROUS	29mg
POTASSIUM	146mg
ZINC	0.17mg
FLUORIDE	0.1mg

### 1.2 RENEWABLE ENERGY AND ITS IMPORTANCE

Energy is important for the existence and development for any type industries. Today all the application or equipment's working on electricity that is produced by the convectional energy sources. Convectional energy sources are limited in the nature because increasing the energy sources in the world. For reducing the convectional energy sources only one way that is non-convectional energy sources like solar energy, Bio-mass energy, ocean energy, wind energy and tidal energy sources.

Among all energy Non-convectional energy sources solar energy is the one of the best energy source. It has importance because it is available free of cost and it does not release any type of gases to environment for environment pollution. In the present world all equipment works on solar energy. All most all agricultural equipment works on solar energy because in

some place not possible to supply the electricity in that places solar energy is the one of the best way. In olden days solar energy widely used for drying harvested grains in agricultural filed

## **2. LITERATURE SURVEY**

### **FEYZA AKARSLAN [1] “SOLAR –ENERGY DRYING SYSTEM”**

Solar energy is free environmentally clean, and therefore is recognized as one of the most promising alternative energy sources options. In near future the large scale introduction of solar energy, directly converting solar radiation into heat, can look forward. This energy widely used in the drying systems.

### **H.S.ABDEL-GALIL AND R.I.A MOURAD [2] “A SOLAR DRYER PERFORMANCE OF ONION SLICE UNDER FAYOUM CLIMATIC CONDITION”**

The unit consists of a solar collector which oriented and tilted with an optimum tilt angle and attached with drying chamber. The drying experiment were carried out to extreme the effect of onion slice thickness and air flow rate on onion slice drying rate.

### **M.MOHANRAJ AND P. CHANDRASEKAR [3] “PERFORMANCE OF A FORCED CONVECTION SOLAR DRIER INTEGRATED WITH GRAVEL AS HEAT STORAGE MATERIAL FOR CHILI DRYING”**

An indirect force convection solar drier integrated with different sensible heat storage maternal has been developed and tested its performance for drying chili under metrological condition of pollachi, India. The system consists of flat plate solar air heater with heat storage unit.

### **SOLAR ENERGY RESEARCH INSTITUTE (SERI) UNIVERSITY KEBANGSAAN MALAYSIA [4] “PERFORMANCE OF SOLAR DRYING SYSTEM WITH ROTATING RACK FOR MALAYSIARED CHILI”**

It was compared with open sun drying which for open sun drying of 65 hour obtained. However saving in drying time of 49% for solar drying over open sun drying obtained. Also at average solar radiation of 420 w/m<sup>2</sup> and air flow rate 0.07 kg/s, the collector drying system and pick-up efficiencies were found about 28%, 13% and 45% respectively.

## **3. METHODOLOGY**

In this experiment onion is dried with help of solar energy. First onion is placed in the purported dry in the chamber that is made by the wooden material.at the bottom and top opening is given to the wooden chamber. The solar flat plate collector is attached at the bottom of the wooden chamber. When the solar energy incident on the flat plat it get heated and air present in that heated means density of the air is reduced. The air starts moving in upward direction in the wooden chamber where the onion is kept. The hot air takes the moisture present in the onion and moves to the environment at top of the wooden chamber. A fresh air entry takes place at the solar flat plate collector at bottom. This way due to the density defiance air circulation takes place in the chamber and moisture is removed from the onion. So that there is no direct solar radiation falls on the onion.



**Fig1: CAD model**

## **4. EXPERIMENTAL SETUP**

The setup consists of solar flat plate collector and wooden chamber with dry. The solar flat plate collector is coated with black paint inside to avoid the heat loss and it having two opening at bottom and top for air entry and leaving. The wooden chamber is attached at the top of the solar flat plate collector. It contains purported try on which onion is kept. The hot air enters at the bottom of the chamber and leaves at the top of the chamber.



**Fig2:** Actual experimental setup

Absorptivity	>0.95
Emissivity	<0.2
Transmittance	>85%
Sides insulation polyurethane	25mm
Reflective foil	Aluminum
Number of tubes	9

**Table-4:** Specification of wooden chamber

Material used	Woodem
Area of the chamber	18inchX18 inch
Height of the chamber	30inch
Dimension of drawer	17 inch X 17 inch X 6 inch

## 5. RESULT AND DISCUSSION

In this experiment small amount of onion is taken and dried in the open solar radiation and with help of solar flat plate collector.

### 5.1. DETAILS OF ONION

Harvested on 21<sup>st</sup> April

Harvested place: Sherol, Mudhol Bagalkot Distict Karnataka

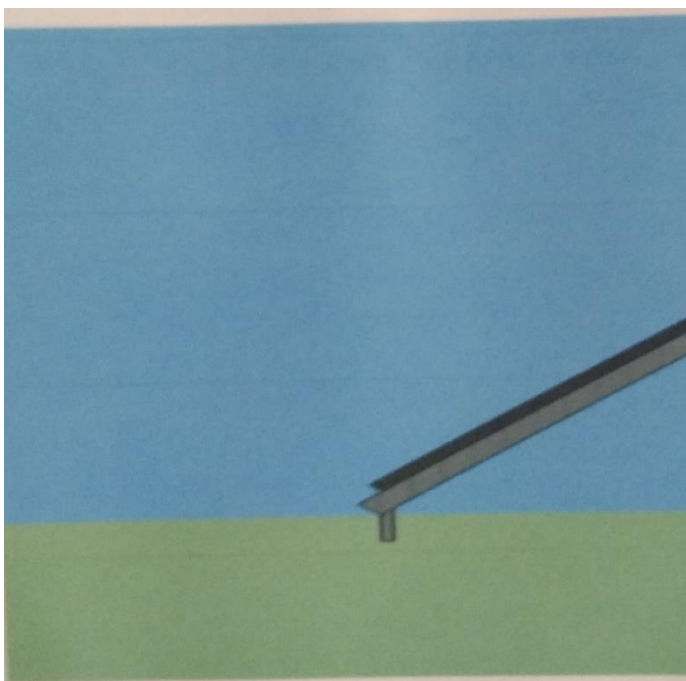
Location of dryinf : Sahyadri Csmpus, Mangalore

Moisture removing using  $= \frac{(\text{initial weight} - \text{final weight})}{\text{intimal weight}} * 100$

### 5.2 EXPERIMENTAL DATA

**Table-4:** Experimental readings

<b>FOR FIRST READING 1 hour</b> By conventional method Initial weight=1010kg Final weight after drying=1002kg Moisture removed= 0.79%	By using solar drier Initial weight=1010kg Final weight after drying=999.5kg Moisture removed= 1.43%
<b>FOR SECOND READING 1 hour</b> By conventional method Initial weight=1014kg Final weight after drying=993.5kg Moisture removed= 163%	By using solar drier Initial weight=1014kg Final weight after drying=999.5kg Moisture removed= 3.13%



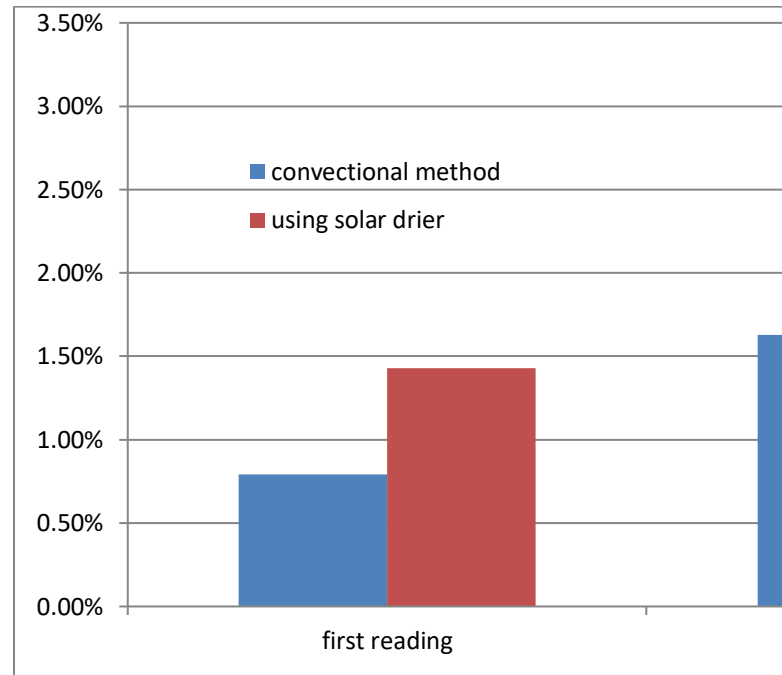
**Fig3:** side view of Actual experimental setup

**Table-3:** Solar flat plate collector specification

Operating temperature	50* to 60*
Type copper	Copper as BIS 12933
Size	2080mmX100mm
Collector frame	Aluminum
Absorber material	Copper
Absorber coating	Black chrome with nickel undercoat



**Fig4:** onion dried by conventional method



**Graph1:** moisture removing by convective solar drier

By observing the above results by using the conventional method time consuming is more and also the moisture removed from the onion is very less. Exposing the onion to sun light directly moisture removed is less and also it damages the onion conditions. With help of solar onion drier more moisture is removed and it can keep for longer time to meet market. Using this method no electricity consumed and damage of onion is less. Former will get more profit by saving the convective power and good condition of onion.

## 6. CONCLUSION

1. For the given location and for a given period of time, moisture content removed in the solar onion dryer is much higher compared to conventional method.
2. onion dried using solar onion drier is more attractive and helps the farmer to get more profit.
3. Since onion drier is closed chamber by supply of hot air its free from theft.
4. Efficiency is more in this method
5. Time required for drying is less.

## 7. REFERENCE




**Fig5:** onion dried by solar drier

[1] “SOLAR –ENERGY DRYING SYSTEM” FEYZA AKARSLAN DEPARTMENT OF TEXTILE ENGINEERING, ISPARTA TUR.

[2] H.S.ABDEL-GALIL AND R.I.A MOURAD [2] “A SOLAR DRYER PERFORMANCE OF ONION SLICE UNDER FAYOUM CLIMATIC CONDITION”

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