DESIGN AND MODIFICATION OF SOLAR DRYER

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ABSTRACT

"Drying is an excellent way to preserve food and solar food dryers are an appropriate food preservation technology for a sustainable world." Actually, solar food drying is one of the oldest agricultural techniques related to food preservation, but every year, millions of dollars worth of gross national product is lost through spoilage. There is plenty of extra sunshine available to dry food and vegetables. On clean day approximately 800 Watts of solar energy are available for use per square meter area of earth surface. Typical operating conditions for solar dryer will vary depending upon weather.

Selection of dryer for particular application depends upon the countries situated in tropical and subtropical region. Solar energy has been used throughout the world to dry food products. Such is the diversity of solar dryers that commonly solar-dried products include grains, fruits, vegetables etc. Many of these fruits and vegetables contain large quantity of initial moisture content and are therefore highly susceptible to rapid quality degradation, even to the extent of spoilage, if not kept in thermally controlled storage facilities. Mechanized drying is faster than open-air drying, requires less space and usually gives a better quality product. But the equipment is expensive and requires substantial quantities of fuel or electricity to operate. Many food industries dealing with commercial products employ state-of-the-art drying equipment such as freeze dryers, spray dryers, drum dryers and steam dryers. The prices of such dryers are significantly high and only commercial companies generating substantial revenues can afford them.

Thus, in this paper, we introduced such solar dryer system which is reliable, require less space and affordable by small-scale firm and farmer to produce high quality product.

Keyword: - *Solar panel , black body, thermometers, computer fans* **.**

1. INTRODUCTION

Preservation of fruits, vegetables, and food are essential for keeping them for a long time without further deterioration in the quality of the product. Several process technologies have been employed on an industrial scale to preserve food products; the major ones are canning, freezing, and dehydration. The prime objective of drying apart from extended storage life can also be quality enhancement, ease of handling, further processing and sanitation and is probably the oldest method of food preservation practiced by humankind.

Drying process is used to remove moisture, prevents the growth and reproduction of microorganisms like bacteria, yeasts and molds causing decay and minimizes many of the moisture-mediated deteriorative reactions. It brings about substantial reduction in weight and volume, minimizing packing, storage, and transportation costs and enables storability of the product under ambient temperatures.

This procedure is especially applicable in the so-called "sunny belt" world-wide, i.e. in the regions where the intensity of solar radiation is high and sunshine duration is long. Drying by solar energy is a rather economical procedure for agricultural products, especially for medium to small amounts of products. It is still used from domestic upto small commercial size drying of crops, agricultural products and foodstuff, such as fruits, vegetables, aromatic herbs, etc. contributing thus significantly to the economy of small agricultural communities and farms.

2. PROBLEM DEFINITION

Now-a-days, energy crisis are been increasing therefore we have to look for a suitable alternative resources. Solar energy can be best alternative source. Thus we used solar energy for drying; it is traditional technique, but now days it is not possible for drying food stuff in open sunlight as atmosphere is not favorable and very unhygienic.
If we dry in such environment the nutrition value of dried product is reduced. The food cannot be preserve for the long time as well as this drying process is time consuming and needs time to time inspection. The process of banana drying has been carried out from ancient days there are many demerits of open drying products spoil due to rain, wind, moisture and dust; loss due to birds and animals; deterioration in the harvested crops due to decomposition, insect attacks and fungi, etc. In case of open sun drying, the idle time between drying sessions allow the growth of unwanted microorganisms.

2.1 CONCEPT

The solar dryer is based on vapor compression principle. It is basically a phenomenon of removal of moisture by evaporation from a solid. A solar radiation is incidence on collector which increases the temperature inside the collector chamber. The air from surrounding is enters into the chamber and then gets heated up higher temperature. This heated air is allow to flow into heating chambers. The product samples are placed on a perforated tray that allows the air to flow through it and moisture from the product is taken away by flowing air; leaving behind the dehydrated product. The air is escape from chimney and partial air is delivered to the collector chamber.

3. WORKING

The solar dryer is forced convective type. In this dryer we use the two heating chambers to dry the different product at same time. There are two DC brushless computer fans of 12V and 2WATT each, and this are provided to increase the mass flow rate of air. To run, this two fans we required 12V, 5WATT solar panel. To increase efficiency of dryer we used the copper plate in between two heating chamber and to reduce heat losses in collector chamber aluminum foil is used. The product to be dried is placed on the a perforated tray.
A part of incidence solar radiation on the glass cover is reflected back to atmosphere and remaining is transmitted inside dryer collector. Further, a part of transmitted radiation is reflected back from the surface of the product. The remaining part is absorbed by the surface of the black body. Due to the absorption of solar radiation, black body temperature increase and its starts emitting long wavelength radiation which is not allowed to escape to atmosphere due to presence of glass cover. Thus the temperature inside collector chamber becomes higher. The glass cover server one more purpose of reducing direct convective losses to the ambient which further become beneficial for rise in product and chamber temperature respectively.
After getting certain temperature, the foodstuff is placed into the tray and the solar panel is kept in the sunlight; gets charged within few seconds. There are two computer fans which directly connected to solar panel. Due to charged solar panel the fans starts rotating and surrounding air (Ti) is force into the collector chamber. This air then heated up to T1 temperature in the collector chamber and delivers to first heating chamber .In first heating chamber evaporation process takes place and the moisture from the product is been drive away with heated air. After this process the temperature of the heated air is slightly reduce to T2. Then this air is supplied as the input to the second chamber, in this chamber again the moisture is taken away by the air and its temperature is reduced to T3. The air from the second chamber is exhausted from chimney, where partial air is supplied to collector chamber. By the "ENERGY CONSERVATION PRINCIPLE" the temperature of exhaust air may help to heat up the surrounding air in collector chamber.
After sometime check whether the product is dehydrate if it is not keep it for some time period and if it is totally dried then remove the foodstuff .

3.1 FIGURE

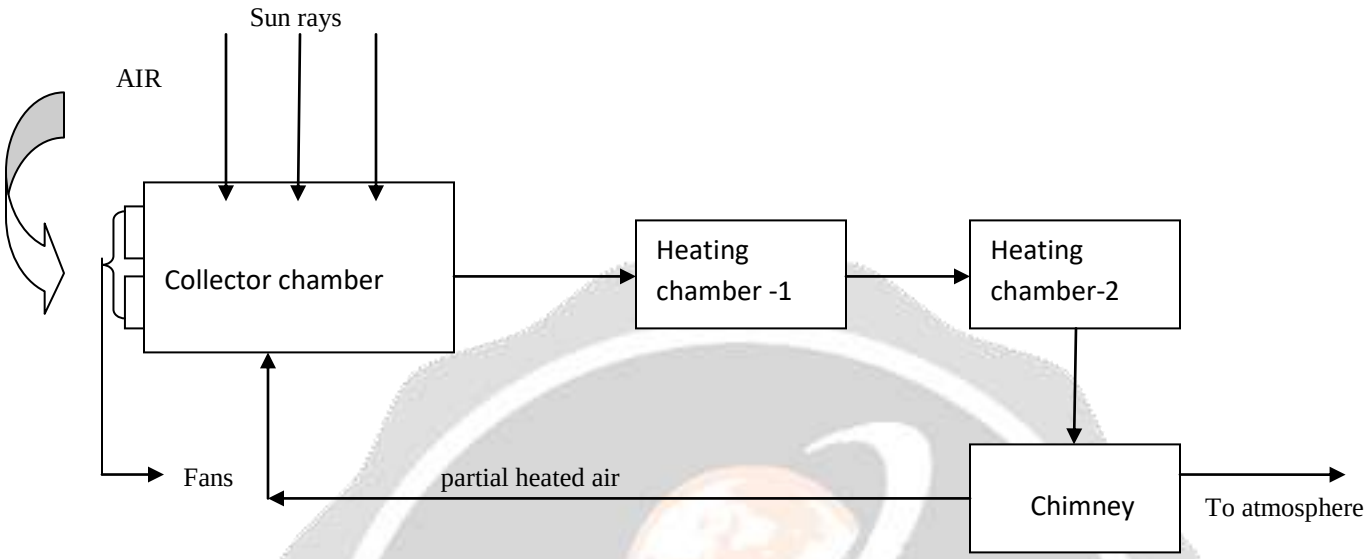

Fig: Block Diagram of Solar dryer

3.2 ILLUSTRATIONS OR PICTURES:

4. CONCLUSIONS

The project is beneficial and best suited for that local community. A portable and inexpensive solar dryer will be designed and constructed using locally available materials. The collection efficiency of solar drying system will calculated using the climatic condition which includes ambient temperature, solar radiation, relative humidity, air velocity and atmospheric pressure. The hourly variation of the temperature inside the solar dryer is higher than surrounding temperature during the observation period and it depends on the intensity of radiation received on earth surface maximum. The dryer will be able to remove 80% of moisture on dry basis in one day observation.

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