

Design and Development of Domestic Solar Dryer

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Abstract - Food preservation over a longer period is a technique that dates back centuries and applies to a wide range of foods including fruits veggies as well as other meals to safely preserve food there are several different methods moisture seems to be the key reason why food decomposes or odors after a certain amount of time which is also dangerous and unhealthy the capacity of food to keep fresh is strongly affected by water or moisture products can become spoiled as a result of excessive moisture pickup water is necessary for bacteria to dissolve the food they consume food is used for energy and growth in bacterial yeast and mold cells thanks to water nobody desires to have decayed food for every right reason so for preventing food for a longer period removing moisture which mainly affects the food on a larger scale is the best choice accepting we can have those tasty and full of nutrients various flavors types of food for a longer time with no worries the drying process removes enough moisture from food to significantly reduce the humidity levels likelihood of these adverse outcomes different types of food have a different range of moisture in them after calculating which types of food substances have which range of moisture content we can easily eliminate this unwanted moisture we analyzed the situation thoroughly to create a model that can easily complete this process in a certain time which is expected to be helpful for a longer period in less time it also uses natural resources to complete its process ie using the sun solar-operated dryers can come to the rescue in this kind of situation and there is no doubt about it.

Key Words: Portable, Food, Domestic, Humidity.

1. INTRODUCTION

The essential function of a solar dryer is using sun rays to remove the extra water content from the food substances inside the drying chamber.

Domestic and Agriculture eatable products require drying of vegetables, fruits in different seasons. Drying these eatables is an old technique in tropical countries. Drying in sunlight is a simple, quick, and low-cost method which do not reduces the food value and maintains hygiene.

Nowadays, drying is used to increase utility, improve the life span, and provide lead time between various processes. Drying is an excellent way to preserve food and solar food dryers are appropriate food preservation technology for sustainable development. Drying was probably the first ever food preserving method used by man, even before cooking. It involves the removal of moisture from agricultural produce to provide a product that can be safely stored for a longer time. "Sun drying" is the conventional technique of drying fresh produce known to man, and it generally involves plopping agricultural commodities in the tropics on sheets, roofs, or evaporation carpeting. Because the farm produce is laid out in the open air, there is a greater risk of spoilage due to adverse climatic circumstances such as rain, wind, mist, and dust, and loss of produce to birds, insects, and rodents (pests); dependent on good weather and very slow drying rate with the danger of mold growth thereby causing deterioration and decomposition of the produce. The process also requires a large area of land, takes time, and is highly labor intensive. With the advancement of culture and industry, artificial mechanical drying became a reality; however, this process is both energy intensive and costly, raising the overall cost of the product. Efforts to improve "sun drying" have recently resulted in "solar drying." Solar dryers are customized devices that regulate the drying time and safeguard agricultural goods from insect pests, dust, and rain damage. Solar dryers produce higher temperatures, lower relative humidity, lower product moisture content, and less spoilage during the drying process than natural "sun drying." In addition, it takes up less space, takes less time, and is relatively inexpensive compared to the artificial mechanical drying method.

1.1 Types of Solar Dryer

1. Direct Dryers
2. Indirect Dryers

2. OBJECTIVE OF PROJECT

Solar draying equipment and their designs are available readily in the market. In this a solar dryer design suitable for a single home is considered.

The Portability and compactness of the design were the major objectives of design, so that the machine thus designed could be stationed easily at any household place.

Also the product had to be simple in design and construction such that it could aid easy maintenance.

3. PROBLEM STATEMENT

Summers in Solapur are ridiculously hot, with highs ranging from 30 to 45 °C (86 to 113°F). Temperatures of 40 °C (104 °F) or higher are common in Solapur. In The may 1988, the maximum temperature ever recorded was 46.0 °C (114.8 °F). As a result, Solapur explicitly receives a significant amount of solar energy, Without a reason to suspect. Among all the other places in Maharashtra, Solapur is one of very few with extended amounts of time as well as plenty of sunshine. Solapur's latitude angle is 17°N and its longitude angle is 75°E, with an average solar radiation of 670 W/m².

There is requirement of portable dryer at domestic level. The portable domestic solar dryer can be made at small level. This solar dryer will absorb Solar energy available at which will be utilized to remove moisture from our domestic product ie- Onion, Potato, Chilly, Coriander, Currey tree, Spinach, etc. The circulation of the hot air can be done with the help small Solar Fan. The solar energy can be abstracted with the help of toughened glass.

4. MODEL OF SOLAR DEHYDRATION SYSTEM

Figure 1 shows the system modelling done in Solid works platform, this is a front view of model in this figure some parts like collector, solar panels, transparent glass, roller wheel, exhaust hole is indicated

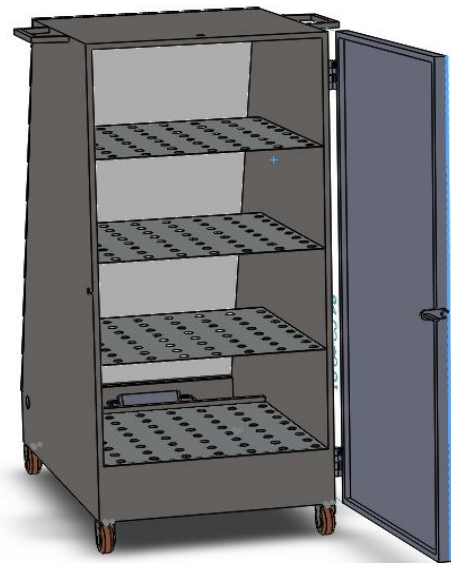
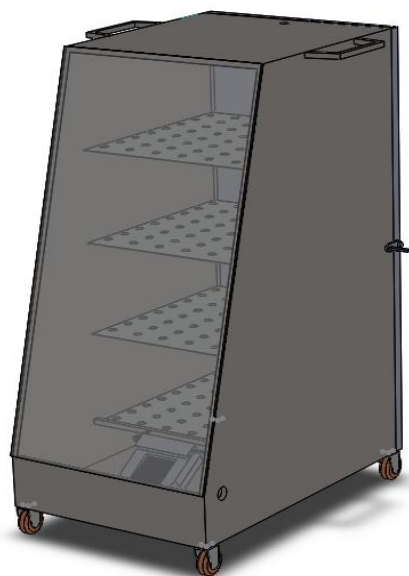


Chart -1: Solid Works of Design And Development of Domestic Solar Dryer

4.1 System Parts Models

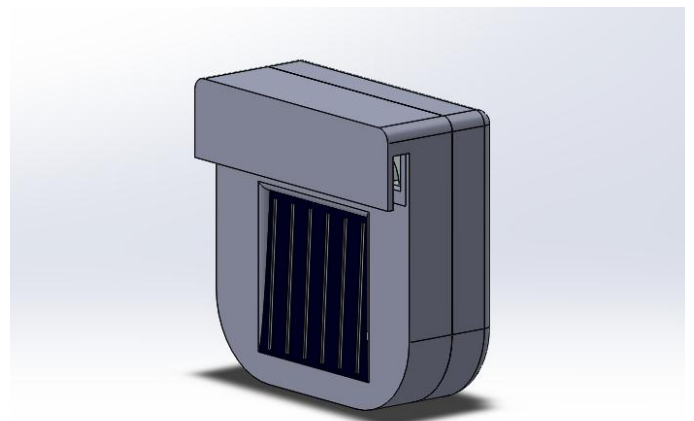
This Design and Development of Domestic Solar Dryer consists following parts:

Solar Fan, Storage Chamber, Trays, Toughened Glass, Roller Wheels, Door.

All above parts are modelled in Solid Works platform according to its specification obtained from calculation.

4.1.1 Solar Fan

The solar fan are used to circulate the hot air in the product. It is of 16*9*12.5 cm and it is of 300 grams in weight and it is black in color. The material is ABS plastic.



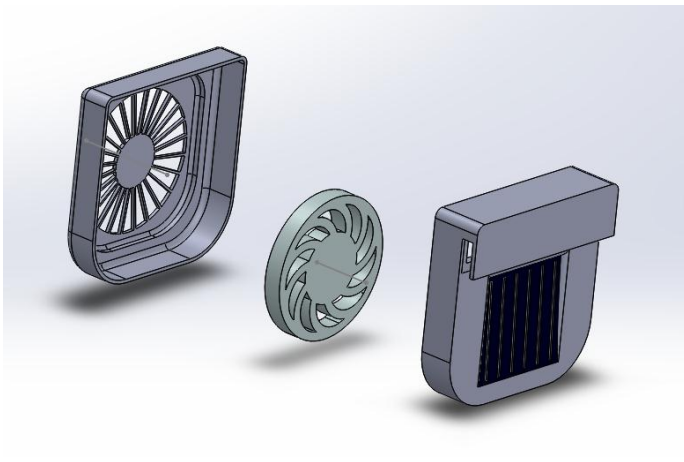


Fig: 4.2 Solar Fan

4.2.2 Trays

The trays are used for keeping the food products on this and this tray loaded into dehydration system. There are total Four trays are used which are of size 40cm by 40cm in width and length. The trays are manufactured by using stainless steel and small holes are provided because to flow the air and the holes is of 7mm diameter. Figure shows image of one tray which is used for keeping food sample on this, likewise Four trays are used.

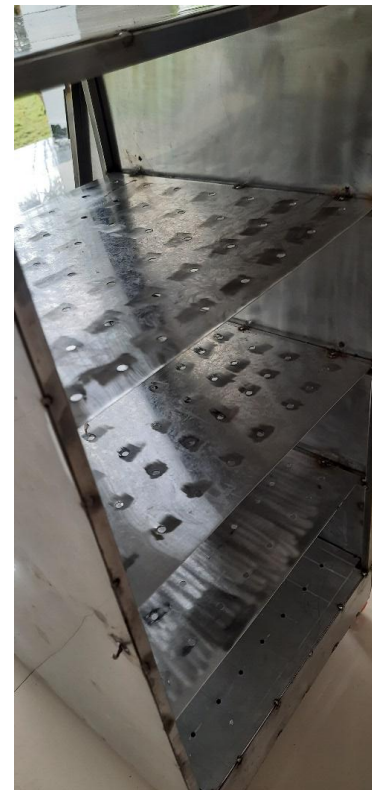


Fig:- 4.3 Trays

4.3.3 Toughened Glass

It is toughened glass used on the top of solar Fan. This is good wear resistant than ordinary glass. The dimensions of this toughened glass is 80cm x 40cm (L x W) thickness of 3mm.

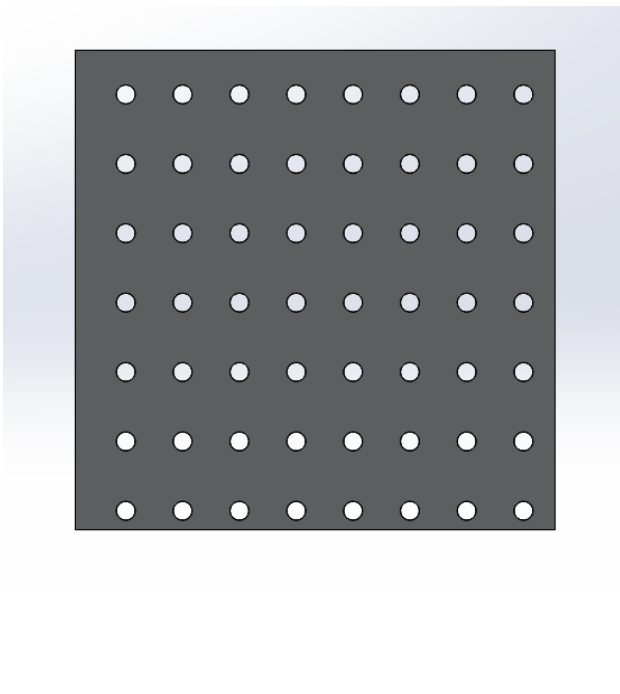




Fig:- 4.4 Toughened Glass

4.4.4 Roller Wheels

Roller Wheels are used to carry system to any place. This is a caster roller wheels this can carry up to 100 kg of weight. This wheel is made from high quality polyurethane plastic is very hard and can corrosion resistant and quite in operation.

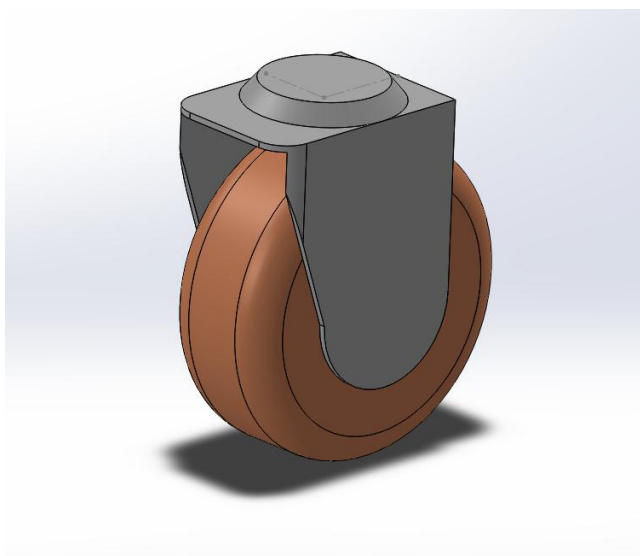


Fig:- 4.5 Roller Wheels

5. CONSTRUCTION AND WORKING

The proposed experimental set-up consists of different components such as,

- i. Solar Fan
- ii. Trays
- iii. Toughened Glass
- iv. Roller Wheel
- v. Handle

Photograph 5.1 shows the experimental set-up. It consists of the Solar Fan the dimension of solar fan is 16*9*12.5cm, it is of 300gr and it made up of ABS Plastic the function of that is to circulate the air in the product and the Toughened glass is used to Pass the sun radiation and also Protected from the dust its thickness is 6mm and it is of 40*80cm. The product is made of Stainless Steel. The Roller Wheels are Used to move here and there where we want because we are using in the house. Treys are made up of Stainless steel it is used to keep foods on that and it thickness of 2mm and it is of 40*40cm.



Photograph 5.1 Experimental Set-up

Photograph 5.2 dehydration system the food products are kept for dehydration, the food products are kept on trays. The dehydration system is made by using Stainless steel of 2mm thickness and 40*40cm.



5.2 Dehydration System

The design of solar dryer consists of a cupboard and drawer type construction suitable with small trays for handling. The trays are perforated to circulate heated air uniformly in the

space available. The sun rays are taken inside through a clear glass which transfer heat to the eatables for drying. The trays are designed to accumulate heat. A small solar powered fan is mounted to circulate hot air inside the dryer. The time required to dry the vegetables vary according to initial conditions. A glass shield is inclined at 35-40° to ground with hinged panel. Three sliding drawers are vertically mounted to keep the vegetables. A small chimney is provided on the side top to remove hot air. The inlet air passage is at the bottom with a screen to avoid insects entering in. The space is calculated as per the heat generated in between 9:30 AM to 4:30 PM time.

6. FUTURE SCOPE

The performance of existing solar food dehydration system can still be improved upon especially in the aspect of reducing the dehydration time, and probably storage of heat energy within the system by increasing the size of the dehydration system. They are some future scopes on this project those are as follows,

This project has achieved the objective of using conventional/ Natural resources for the completion of the required procedure without electricity or harming nature in any indirect form.

The product is highly user friendly.

Surely there is scope for future development as required.

7. CONCLUSIONS

The Design and Development of Domestic Solar Dryer is a unique, compact and portable.

Solar drying has proven to be both technically and economically beneficial for a variety of crops. However it is, necessary to develop large-scale dryers that may be used throughout the year for different products to make them attractive to the farmers.

To enhance product quality, UV radiation, dust, insects, fungi, and other sources of contamination must be protected, as well as temperature and relative humidity control. Analogously, if a long shelf-life is permitted, the storage conditions of solar-dried products should be tailored to the crop and the packaging fine tuned.

Hence we have come to end of the project on this topic we would like to share the experience our team while doing this project a very thanks to Our earnest Guide & Our dear HOD. So for setting such target for us we enjoyed every bit of work we put into this project we do hope that our provides will be interesting and knowledgeable thank you

Our project can surely help to build new society with less amount of Food Waste around. This can surely help our nature to grow and breathe without Wastage of food.

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BIOGRAPHIES



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