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DESIGN AND FABRICATION OF SOLAR DRYER FOR ONION

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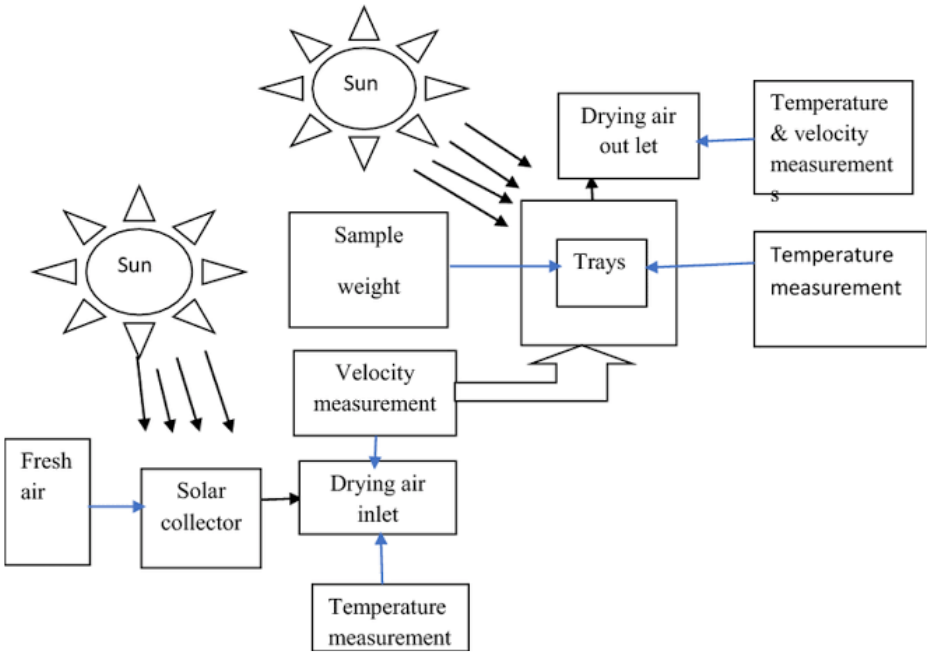
INTRODUCTION: **Solar dryers** are devices that utilize solar radiation to dry agricultural products, including fruits, vegetables, grains, and herbs. These dryers use renewable energy sources, reducing the need for fossil fuels and electricity and making them an environmentally friendly solution for drying agricultural products. Solar dryers can be designed and constructed in various sizes and shapes, depending on the type and quantity of agricultural products to be dried. Solar dryers work by absorbing solar radiation and converting it into heat, which is then used to dry agricultural products. The drying process typically involves placing the agricultural products inside a drying chamber, which is heated by the solar radiation. The drying chamber is designed to facilitate the airflow, allowing moist air to escape and be replaced by dry air, which promotes efficient and effective drying. The solar dryer's design is tailored to the specific needs of onions, taking into account factors such as airflow, temperature, and humidity levels. The fabrication process involves using locally available materials, such as wood and aluminum sheets, to construct the solar dryer. The solar dryer's performance is evaluated by measuring the drying time, onion moisture content, and quality. The solar dryer's results are compared with traditional drying methods to determine its effectiveness and efficiency.

OBJECTIVES:

a) To fabricate the solar dryer with optimum design.
b) To apply the concept of solar dryer in food storage application.
c) To testing of solar dryer with onion.

METHODOLOGY:

- Concept generation
- Design of the Model
- Finalizing the components
- Procurement of components
- Fabrication Process
- Testing the Model



MATERIALS:

1) Solar Panel [24w]: Solar panels are typically measured in terms of their physical size and the amount of electricity they can produce. A 24 watt solar panel is typically about 14-18 inches long and about 13-16 inches wide.

2) 12v DC Fans: The cooling capacity of a 12V DC fan is typically measured in cubic feet per minute (CFM) or cubic meters per minute (CMM). A higher CFM or CMM rating indicates a higher airflow capacity, which can be important in applications where heat dissipation is a concern.

3) Temperature Sensor: A temperature sensor in a solar dryer can be used to measure the temperature of the air inside the dryer. This information can be used to control the drying process and ensure that the food is being dried at a safe and appropriate temperature.

4) Blowers: A blower is a device used to move air from one place to another. They are often used to create airflow in various applications, such as HVAC systems, industrial processes, and combustion systems. Blowers are available in a variety of types, including centrifugal, axial, and regenerative blowers. Blowers can be designed for indoor or outdoor use, and can be made from a variety of materials depending on the environment they will be used in.

METHODS:

A mixed solar dryer is a type of solar dryer that combines both direct and indirect solar drying methods. The process of using a mixed solar dryer typically involves the following steps:

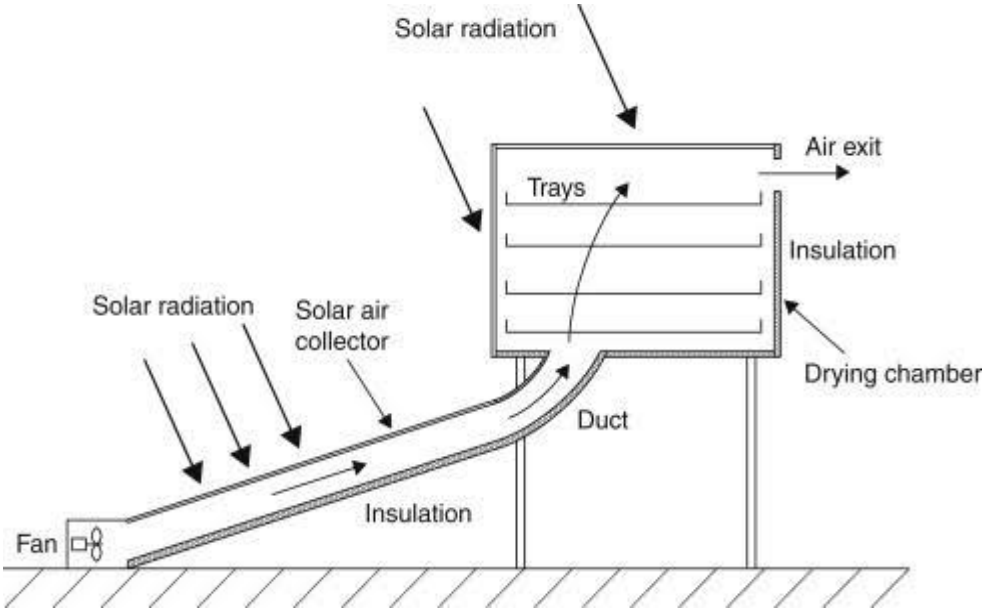
- **Preparation of the food product**: The food product is usually washed, sliced or chopped, and blanched before drying to remove surface moisture and prevent spoilage.

- **Loading the dryer**: The food product is then loaded into the drying trays in the dryer. The trays are usually made of metal or plastic and have a mesh bottom to allow air to circulate around the food.

- **Circulating air**: A fan in the dryer circulates air over the food product to ensure even drying. This helps to remove moisture from the food and prevent spoilage.

- **Monitoring the drying process**: The temperature and humidity in the drying chamber are monitored to ensure that the food product is drying at a safe rate. If necessary, the air flow and heating can be adjusted to control the drying rate.

- **Storing the Dried food**: Once the food product is completely dry, it is removed from the dryer and stored in airtight containers to prevent rehydration and spoilage. The mixed solar dryer is an effective and energy-efficient method for drying food products, especially in regions with high solar radiation and low humidity levels.



FABRICATION MODEL:

RESULT and CONCLUSION:

RESULT:

This project presents the design, construction and performance of a mixed-mode solar dryer for onion dry. In the dryer, the heated air from a separate solar pipe collector is passed through an Aluminium chamber and at the same time, the Aluminium chamber absorbs solar energy directly through the transparent glass. The results obtained during the test period revealed that the temperatures inside the dryer were much higher than the ambient temperature during most hours of the day-light. The temperature rise inside the drying cabinet was up to 68.2°C for about a half an hour. The dryer exhibited sufficient ability to dry onion items reasonably rapidly to a safe moisture level and simultaneously it ensures a superior quality of the dried product. The onions are fully dried, they should have a moisture content of around 10%, which is suitable for long term storage. Drying onions in a solar dryer can help to preserve their nutritional value, flavour, and aroma while reducing spoilage and waste.

CONCLUSION:

A mixed-mode solar dryer system can be a highly effective method for drying onions. This type of system combines the benefits of direct and indirect solar drying to achieve faster drying times and higher efficiency. Mixed-mode solar dryers use solar energy directly to heat the air, but also incorporate a backup heat source such as electric heating to maintain drying temperatures during cloudy or rainy weather. This ensures that the drying process is not interrupted, and the onions are dried efficiently. The use of mixed-mode solar dryers can result in significant energy savings, reduced operating costs, and improved product quality. The system is also environmentally friendly, as it utilizes renewable energy sources and reduces carbon emissions.

SCOPE OF FUTURE WORK:

This project is carried out in order to get outside knowledge and involve in practical applications beyond in our day-to-day academic studies under in the module of “Advanced Topics in Mechanical Engineering”. Designing of the solar dryer minimizing shortcomings associated with than low efficiency, cost not portable solar dryer.
Estimating the Size Solar Food Dryer The original design of our solar food dryer is for daytime only. In future we will try to make it that, it can be for night time by adding air heater so in future we will try to make it.