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Fabrication of Solar Dryer using Polythene

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Abstract
Based on how dryers operate, the current project's main goal is to create a dryer that satisfies the fundamental needs of dryers, which may be enhanced by altering the indirect forced solar dryer's design. Energy conservation and food preservation through the solar dryer's moisture removal procedure are the ideas behind its construction. In this experiment, the dryer is called a "Solar Dryer" since it is designed to use both electrical and solar energy. In this solar dryer, a recirculating duct is added from the exhaust fan assembly to the drying chamber. The hot air that passes through the air flow first passes through the rectangular duct, then through a divergent duct, and finally reaches the drying chamber. However, some hot air is wasted in between, but the recirculating duct returns this air to the drying chamber to heat the food product. When compared to indirect sun dryers without air recirculation, this dryer's drying time decreases, drying rate increases, and moisture content removal rate increases after use.

Keyword: **solar dryer, solar plate, design and component.**

INTRODUCTION

The process of drying is complex and involves the simultaneous movement of mass and heat. The initial and final moisture contents, drying air temperature, relative humidity, and velocity are only a few of the variables that affect how much energy is needed to dry a given product.

DESIGN, USED IN COMPONENTS

DRYING CHAMBER TRAYS

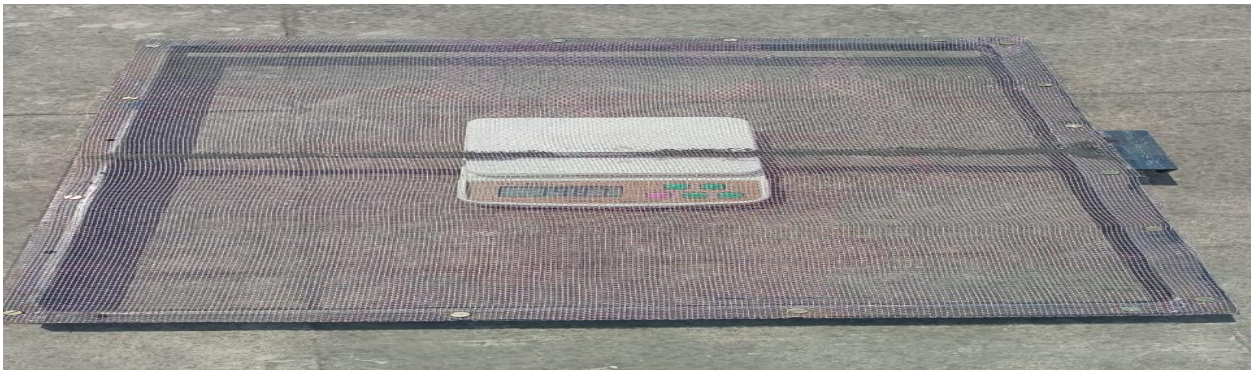

Fig.1 (DRYING CHAMBER TRAYS)

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THERMOCOUPLE

The thermocouple is usually placed in a particular area of the dryer, like the airflow path or close to the heating elements, to guarantee precise temperature readings.

Fig.2 (Thermocouple)

IRON FRAME

We have created a frame that is 75 cm long, 55 cm wide, 64 cm high in front, and 64 cm high in rear to complete the entire process. Steel frames are sturdy, durable, and moldable after all the parts are put together. In addition to its extraordinary strength, steel will last for a long time since it is resistant to corrosion and zinc coatings, which improve its effectiveness against rust. Fire, pest, and weather resistance, strength, longevity, and durability are just a few of the many benefits. For corrosion protection, a black oil coating is applied to the iron frame.

Fig. 3 (Iron Frame)

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SOLAR PANEL

Through the use of photovoltaic (PV) boards or mirrors that focus solar radiation, solar-powered devices transform sunlight into electrical energy. Batteries or thermal storage can be used to store this energy, or it can be used to create electricity. Renewable energy is used by solar panels to generate power. Moreover, there is no pollution here. In order to power the 10 watt exhaust fan that is installed in our project, we put a 40 watt solar panel to produce 18 volt electricity and run the exhaust fan for air ventilation.

Fig. 4 (Solar Panel)

EXHAUST FAN

The purpose of exhaust fans is to keep a chamber well ventilated. They assist in keeping the space full of fresh air by eliminating the damp and harmful air from the chamber. We are using a DC 24V exhaust fan in our project. The maximum temperature of the chamber is 72 degrees Celsius, which is the ideal range for drying. We have preserved certain fruits, leaves, and vegetables within the chamber for this reason. When the temperature of the chamber is high, we employ an exhaust fan to ventilate the air and eliminate any water droplets that may have gotten inside the polythene.

Fig. 5 (Exhaust Fan)

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DRYING TRAYS

There are two trays set up inside the chamber, and a net is fastened to one. Hot air circulates continuously through the net tray. A forced convectional heating process in the dryer eliminates moisture from the particles that are put on the tray. The removal of moisture from the air is done partially yet simultaneously. Because air may easily flow through the net tray, the moisture from the solid items in the upper tray is reduced.

Fig. 6 (Drying Trays)

POLYTHENE

The primary goal of the polythene cover installation is isolation. It is positioned above the solar dryer. For the drying chamber to get the most solar radiation possible, transparent polythene is utilized. The polythene lowers the irradiation value and reduces UV radiation by absorbing sun radiation inside the chamber. Installing a polythene cover over the solar dryer serves to keep the heat steady.

Fig. 7 (Polythene)

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WEIGHT MACHNE

Solar dryers employ a weighing scale—more precisely, a high-frequency Wi-fi scale—to track the product's weight decrease while drying. This makes sure that ideal conditions are maintainedand aids in monitoring the drying process. For precise measurements, the scale can be integrated right inside the drying chamber, as shown in a study on drying mango leftovers.

Fig. 8 (WEIGHT MACHNE)

WORKING AND APPLICATIONS

GENERAL WORKING:
AIR FLOW: The exhaust fan configuration maintains the dryer's internal air flow. The air enters by the axial intake and is then flung radially into the tapered duct, where the uniform decrease in the duct's height increases the air's velocity.

HEATING: The sunlight hitting the collecting plate (polthene) inside the heating chamber helps to heat the air inside. The drying room is then filled with this heated air.

DRYING: The food item to be dried is struck by hot air at the appropriate temperature when it enters the drying chamber. The food's drying phenomena comes next.

MOISTURE REMOVAL: Through an outflow port at the top of the drying chamber, the food item's moisture is extracted.

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Advantages of Solar Drying

1. A transparent cover reduces the chance of product contamination.
2. Defense against precipitation, dew, and debris.
3. Superior product quality compared to open sun drying.
4. Easy and economical construction.

Disadvantages of Solar Drying

1. Damage to crops caused by animals, birds, and rodents.
2. Damage from dew, rain, storms, and direct sunlight.
3. Pollution from dust, dirt, trash, and other sources.
4. Losses due to excessive drying.
5. Microorganism development and insect infestation.
6. Extra losses during storage as a result of uneven or insufficient drying

Limitations of Solar Drying

1. Unless solar drying is paired with a conventional energy-based system, it can only occur on sunny days.
2. Because solar energy collection is restricted, solar dryers operate more slowly than those that use conventional fuels.
3. Usually, they are employed for drying at temperatures ranging from 40 to 50 degrees Celsius.

FUTURE IMPROVMENTS

Even with its high level of efficiency, there is always room for advancements and enhancements by fostering better collaboration between food scientists and solar researchers. While solar technicians are ignorant of the technical specifications of the many processes used in food processing, food technologists are not aware of the capabilities of the latest generation of sun dryers.

Any technical project might take many different forms and undergo many revisions. But some ideas for upcoming technological advancements are as follows:

1. The installation of solar panels and the construction of a separate electricity supply unit to power the entire dryer.
2. A solenoid valve can be installed at either end of the recirculation duct and is controlled
3. by a humidity sensor and a programmable humidity control. A display panel behind the sun dryer shows the humidity levels inside the duct. It will assist in halting air circulation when the air's moisture content beyond a specific threshold.
4. To further remove moisture inside the drying chamber, silica gel sheets bonded between honey comb panels are introduced.

CONCLUSION

For a number of crops, solar drying systems have proven to be both technically and financially beneficial. However, in order to entice farmers, small-scale dryers that may be utilized for various goods all year round must be developed. The product's quality must be maximized by providing protection from dust, insects, mold, and other contaminants.

REFERENCES

1. Jitendra kumar gautam, pankaj verma, IOSR Journal of Mechanical and Civil Engineering (IOSR-JMCE) e-ISSN: 2278-1684,p-ISSN: 2320-334X, Volume 21, Issue 5 Ser. 1 (Sept. – Oct. 2024), PP 31-37www.iosrjournals.org
2. Jyoti Singh, Pankaj Verma (2018); Fabrication of Hybrid Solar Dryer; International Journal of Scientific and Research Publications, Volume 5, Issue (6), (ISSN: 2250-3153).
3. Chanpet, M., Rakmak, N., Matan, N., & Siripatana, C. (2020). Effect Of Air Velocity, Temperature, And Relative Humidity On Drying Kinetics Of Rubberwood. Heliyon, 6(10).
4. Sharma, S., Sharma, V. K., Jha, R., & Ray, R. A. (1990). Evaluation Of The Performance Of A Cabinet Type Solar Dryer. Energy Conversion And Management, 30(2), 75-80.

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5. Rebhi, R., Menni, Y., Lorenzini, G., & Ahmad, H. (2022). Forced-Convection Heat Transfer In Solar Collectors And Heat Exchangers: A Review. Journal Of Advanced Research In Applied Sciences And Engineering Technology, 26(3), 1-15.
6. Asnaz, M. S. K., & Dolcek, A. O. (2021). Comparative Performance Study Of Different Types Of Solar Dryers Towards Sustainable Agriculture. Energy Reports, 7, 6107-6118.