A NEW DESIGN FOR A SOLAR DRYER: PART II

DESIGN AND CONSTRUCTION

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Drying and disinfection are essential for improving shelf life after harvest. You can disinfect it without using pest control. Heat it to 55 to 60 degrees Celsius. Keep it at this temperature for at least 30 minutes. This can disinfect it. The promising option is to remove the moisture and reduce it up to 10 to 11%. During drying, the temperature can be increased up to the disinfection range with controlled air change. Using solar energy to dry agricultural products helps meet demand without waste. It does this in a sustainable way. With solar drying, its long-term preservation is a vital part.

In my last article (part I), we discovered how easily agricultural products like mangos, onions, bananas, grapes, tomatoes, and vegetables spoil. To keep food from spoiling, solar drying systems are necessary. Traditional outdoor drying is costly and requires a lot of work. It also exposes food to damaging UV rays, causing loss. Solar dryers, like the modular hemispherical ones, can dry, heat, and control pests. They do this without harming the food's nutrients, smell, taste, or look. The hemispherical shape of the dryer allows for maximum internal drying chamber volume and low insulation requirements. The dryer can be used in two modes: Dry produce like pulses, dry fruits, and cereals undergo drying and physical disinfection post-harvest. This is due to their low moisture content. Similarly, agricultural products with high water content, such as fresh fruits and vegetables, are also dried. The hemispherical shape has an innovative design. It provides good air circulation, temperature control, and humidity regulation. This makes it suitable for both indoor and outdoor use. In India, the solar drying system is very useful. This is because solar radiation varies between 4 and 7 kWh/m2/day on sunny days.

Temperature and duration of exposure can be controlled remotely by the IoT, as shown in Figure 1. Nomenclature: 104 Solar dryer, 114 User devise, 112 Controller, 116 Communication Media.

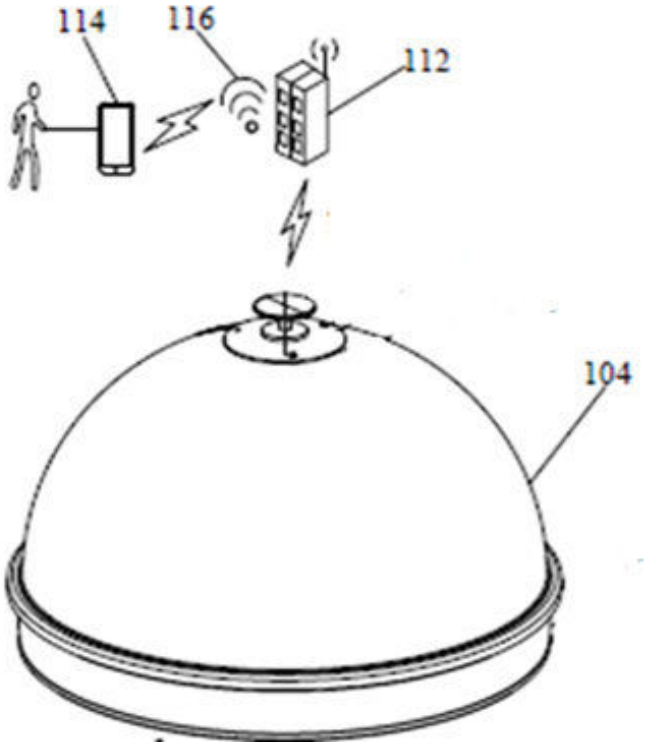

Fig.1 Modular solar dryer cum disinfector

Figure 2 shows a photo of a modular solar dryer for domestic applications designed for a 1 kg load.

Fig.2 Modular solar dryer cum disinfector (Domestic Version) Patent No. 377915 (India)

Fig.3 Modular solar Industrial Version 3 m Dia.

Working of dryer is in two modes first is during day which utilizes direct solar energy when available as shown in Fig.3. In second mode when solar radiations are not available either in night or off sunshine hours solar heat energy stored in hot water is used by using heat exchanger, blower, main duct and supply duct. All system components are well insulated as shown in Fig 4.

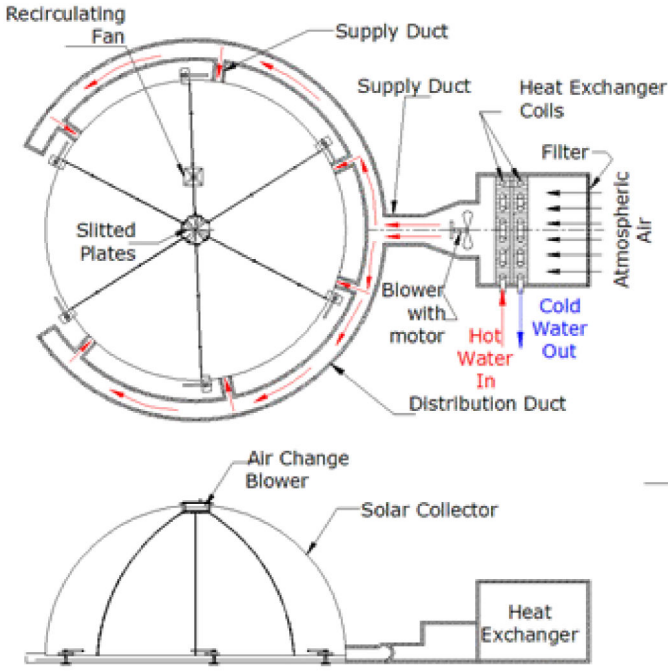

Fig.4 Modular solar dryer cum disinfector

Working

The controller works with the humidity sensor and temperature sensor. Together, they manage how the blower motor works. This motor is part of the air change mechanism. The controller monitors time, temperature, and humidity inside the dryer and maps such parameters to the user device. The user device is set up to get real-time updates from the controller. These updates are about the drying process. They cover temperature, humidity, and how long the drying takes. In drying processes, changing the air is crucial. This innovative hemispherical design makes it possible. Hot and humid air ascends and accumulates at the top end of the dryer. The blower operates intermittently in this area. It turns on and off based on the dryer's internal temperature and humidity. This makes it easy to remove moisture or particles.

EDUCATIONAL OPPORTUNITIES

From the numerous applications of solar energy, drying is a promising one for research. Technological advancements have improved this field. Now, engineers must create versatile models. These models should have a user-friendly interface and be easy to use. Students must focus on their fundamental understanding of solar thermal energy applications as a carrier option.

CAREER PATH

Solar drying finds its place for agricultural, processing, and packaging researchers. All these domains of applications need clever marketing. The significant sector for this new design is domestic users.

CONCLUSION

Solar drying, using enclosed structures and natural or forced airflow, is a good method. It helps reduce losses after harvest. It also improves the quality of dried products, unlike traditional sun drying methods. Proposed design can be beneficial for passive and active solar dryers. This design does two things. First, it dries the agricultural produce. Second, it protects the produce from direct sunlight. This helps keep the produce's nutritional value, smell, taste, and color appealing. Because it has the shape of a hemisphere, the drying space has air moving around and changing evenly. This results in uniform drying.. The point for removing air is at the highest point. This makes it possible to remove air for drying. It also allows for minimal air change when disinfecting.

References

Raul Raudales. Aug2,2005 Vegetable Product Drying, U.S.Patent US6922908B1 https://patents.google.com/patent/US6922908B1/en

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