Agri Articles
(e-Magazine for Agricultural Articles)
Volume: 03, Issue: 03 (MAY-JUNE, 2023)
Available online at http://www.agriarticles.com
©Agri Articles, ISSN: 2582-9882

Cabinet Solar Dryer

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The drying process of wet agricultural products (such as grains, vegetables, and fruits) is an effective way to increase shelf life, improve quality and reduce product waste.

- With dehumidification process, a big part of the moisture content of the products is eliminated, and microorganisms' activity is reduced considerably during storing period. In other words, by extracting the free water from the products, the microorganism activities are limited in the fruit, and the quality is maintained for a long period.
- In developing countries, open sun drying is a popular and effective method that is a cost-effective way to dry and store agricultural products, food, and many other products. However, the parameters that affect the drying process, such as humidity, temperature, airflow rate for drying, and heat entering the dryer chamber, can't be controlled. Consequently, it leads to a more extended drying period or undesirable drying speed. Other disadvantages of the OSD method include reducing product quality by wind, garbage, rain, insects, and animals

What is cabinet type solar dryer?

Solar Cabinet dryer mainly consists of a drying cabinet. One side of the cabinet is glazed to admit solar radiation, which is converted into lowgrade thermal heat thus raising the temperature of the air, the drying chamber, and the produce. Usually, the sunlight shines directly on the material being dried.

Cabinet Solar Air Dryer Technology

- In an effort to resolve the problem of wastage & preservation of agrihorticultural produces, SEED designed and developed the much awarded Solar Cabinet Air Dryer (patent no. 211911).
- The credit to this innovative technology goes to Prof M. Ramakrishna Rao, Founder Secretary, SEED & formerly Prof of instrumentation, IISc., Bangalore.
- Under his guidance SEED R&D team developed different models of
- Cabinet Solar Air Dryers with different drying capacities like SMD 8, SDM 25, SDM 50, SDM 100 and SDM 200. SDM 500 for higher drying capacity is in R&D.

Cabinet solar dryers: Here, the crop is located in trays or shelves inside a drying chamber. If the chamber is transparent, the dryer is termed an integral-type or direct solar dryer. If the chamber is opaque, the dryer is termed distributed-type or indirect solar dryer Fig. 13. Mixed-mode dryers combine the features of the integral (direct) type and the distributed (indirect) type solar dryers. Here the combined action of solar radiation incident directly on the product to be dried and pre-heated in a solar air heater furnishes the necessary heat required for the drying process.

Active solar cabinet dryers: Active solar dryers are also called forced convection or hybrid solar dryers. Optimum air flow can be provided in the dryer throughout the drying process to control temperature and moisture in wide ranges independent of the weather conditions. Furthermore the bulk depth is less restricted and the air flow rate can be controlled. Hence, the capacity and the reliability of the dryers are increased considerably compared to natural convection dryers.

Active ventilated cabinet solar dryers: If utility electricity is available it is cheaper to connect the fans to the grid, compared to a connection to a PV installation. Besides the fans also an electronic controller may be connected to the grid, which is able to adjust the appropriate temperature by variable speed of the fan.

Review of solar cabinet dryers that use paraffin wax as phase change material

The following results can be derived from the study of direct, indirect, and mixed-mode solar cabinet dryers

- These systems have a simple structure and can be easily constructed. Thus, such systems are very economical.
- Most agricultural products, food, and medicinal plants can be dried with solar cabinet dryers
- There is an almost uniform temperature distribution in the dryer chamber, making the products dry with acceptable quality.
- Solar cabinet dryers are the most used among the types of solar.

Drying concept

In a cabinet solar dryer, the concept revolves around utilizing solar energy to heat the air inside the cabinet, which in turn facilitates the drying process of agricultural products, herbs, fruits, vegetables, or other items. Here's a breakdown of the key concepts involved:

1. Solar Heating: The primary concept is to harness solar energy to heat the air inside the cabinet. This is achieved through the use of a transparent cover, typically made of glass or polycarbonate, which allows sunlight to enter the cabinet and trap the solar radiation.
2. Greenhouse Effect: The transparent cover creates a greenhouse effect inside the cabinet. Sunlight passes through the cover and is absorbed by the items being dried, which convert the solar energy into heat. This trapped heat raises the temperature inside the cabinet.
3. Air Circulation: Adequate air circulation is crucial for efficient drying. The cabinet is designed with ventilation openings, such as vents or small fans, which allow fresh air to enter and humid air to escape. This airflow helps carry away moisture released from the drying items, facilitating the drying process.
4. Insulation: Proper insulation of the cabinet helps retain the generated heat and prevents heat loss. Insulation materials, such as foam boards or fiberglass, are used to line the walls and ensure that the heat remains trapped within the cabinet, increasing its overall efficiency.

Advantages of the Solar Cabinet Drier

- These dryers do not use fan or blower to be operated by electrical energy.
- They are low in cost and easy to operate.
- Ease of fabrication.

- Materials are readily available in the country.
- Portable
- Products are protected against flies, rain and dust; product can be left in the dryer overnight during rain, since dryers are waterproof.
- Prevent fuel dependence and reduces the environmental impact.

Disadvantages of the Solar Cabinet Drier

- Slow drying.
- No control of temperature and humidity.
- Adequate solar radiation is required.
- Small quantity can be dried.
- Some products change colour and flavour due to direct exposure to sun.

Conclusion

A cabinet type solar dryer was designed and fabricated by angle bar, square bar, PVC sheet, polythene sheet, wheel, nut and bolt, poly coated wire net, corrugated iron sheet, paint, solar panel and exhaust fan over a collector and dryer area of 4m ^ 2 and 7.5 m ^ 2 respectively in Spices Research Centre, Shibganj, Bogra, Bangladesh.

Note: Reference taken from SEED institution