Design and Development of Solar Dryer Cabinet with Thermal Energy Storage

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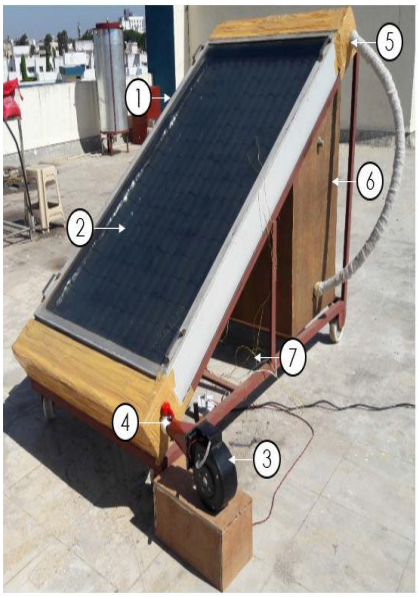
Drying is an essential process in the preservation of agricultural products, marine products. Food products, especially fruits and vegetables require hot air in the temperature range of 45-65˚C for safe drying. Open sun drying is a traditional method practiced widely in tropical climates for drying agricultural products. However, this method of drying is extremely weather dependent and has the problems of dirt, dust, rain, contamination, infestation, microbial attacks, etc., thus affecting the product quality. Since traditional sun drying is a relatively slow process, considerable losses can occur. Solar dryers used in agriculture for food and crop drying are used for industrial drying processes. They can be proved to be a very useful device from the energy conservation point of view. It not only saves energy but also saves a lot of time, occupies less area, improves quality of the product, makes the process more efficient.



1. Flat plate collector
2. Absorber plate of collector
3. Air blower
4. Inlet air to collector
5. Outlet air from collector
6. Dryer chamber
7. Thermocouples location

Fig. Photograph of experimental set up

In this study, we have developed the compact and portable forced convection solar dryer with thermal energy storage.

The performance of the solar dryer has been tested experimentally. Solar dryer is having capacity of 15 kg of perishable food items and it consist of the flat plate collector based air heating system with thermal energy storage, which used Paraffin wax as phase change material (PCM). The effect of mass flow rates of air on the outlet temperature of the collector, dryer chamber, drying rate and drying time with and without implementation of thermal energy system has also been tested. The efficiency of solar dryer is 23% with phase change material and testing was performed for drying of chilies, beetroot, and potato chips. The payback period for the system found to be 2.84 years.