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Development, Design, and Performance of a PV-Ventilated Greenhouse Dryer

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Abstract

A PV-ventilated greenhouse solar dryer was developed. The basement of the dryer is a black concrete floor with an area of 5.5 ´ 8.0 m². The roof of the dryer was covered with polycarbonate plates and it was designed in the parabolic shape of facilitate the construction. Three fans powered by a solar cell module of 53 W were used to ventilate the dryer. To investigate its performance, the dryer was used to dry 4 batches of chilies during December, 2003 to March, 2004. The air temperature inside the dryer was 60-65°C at the noon of a clear day. High drying air temperature with reasonably low relative humidity inside the dryer during almost whole period of the day demonstrated the potentiality of solar drying inside the greenhouse dryer. The temperatures at three locations (top, middle and bottom) inside the dryer follow the similar pattern. Heat stored in the concrete floor helped to reduce variation of drying air temperature due to the fluctuation of solar radiation. The use of solar cell module helps to regulate indirectly the drying air temperature. The results from the experiments demonstrate that the drying time for drying of 100-150 kg of chilies in the dryer was significantly less than that required for natural sun drying but the drying efficiency increases with loading capacity. The chilies being dried in this PV-ventilated greenhouse dryer was completely protected from insects, animals and rain and good qualities of dried chilies in terms of colour and texture were obtained. The payback period of dryer was estimated to be 3.36 years. To disseminate this type of dryer, two more units of the greenhouse dryer were constructed and used for drying banana and green tea at two locations in Thailand. Users of these dryers were satisfied with the performance of the dryers.

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