

CONSTRUCTION AND EVALUATION OF A SOLAR THERMAL-WIND HYBRID DRYER FOR FOOD PROCESSING IN CHIAPAS, MX

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Abstract: Solar dryers are a solution for solar food processing and some of these devices are designed to dry just with the heat of the sun during the day reducing the period of drying. To increase the quality of solar food, it is required to maintain the most important operation parameter - the temperature. As a solution of the sun intermittency and to maintain a constant temperature, an auxiliary system is required to backup the main system. We propose a solar thermal system as the main resource in the drying process and electrical heat back up powered by a wind system. The first subsystem is solar thermal heating; it is composed of 2 solar vacuum tube collectors consisting of 30 heat pipes, a thermal storage tank, a heat exchanger, 2 fans and a water circulation pump. The second consisting of a wind turbine, a voltage regulator, a battery bank and an inverter and 2 heat resistances, thus keeping 24-hour stable working conditions; which work as follows:

Collector capture solar radiation for heating a fluid which is stored in a thermal storage tank. This heat in the fluid is transferred to the drying chamber through the heat exchanger, while the energy generated by the wind turbine is used for the operation of the fans and pump for the circulation system of air and water. A control system also provides a portion of the thermal energy to the drying chamber with the dissipation of heat with electric resistances. The evaluation of solar dryer was conducted in no load condition without backup and with backup while controlling the temperature at (40, 50, 60 and 70) °C. The results show that without backup the chamber temperature depends of the solar radiation and they go from 50 to 70 °C during the day and in the night the temperature keep constant. When backup system is used low temperatures can be maintained during 24 hours and electrical resistance are used early in the morning and in evening time, and for low temperatures backup is not needed in high radiation days. For high temperatures, electrical resistances always are used early in the morning and in evening time and the backup system is fundamental to maintain the temperature constant and the use of it is longer compared whit low temperature. For charged chamber with apple samples, the temperature was controlled at 50,60 and 70°C during 24 hours.

Keywords: Solar thermal-wind hybrid system, Construction and evaluation of solar dryer.