MATHEMATICAL MODELLING AND EXPERIMENTAL STUDY OF A SOLAR DRYING SYSTEM

BY

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CERTIFICATE

It is certified that the thesis entitled "Mathematical Modelling and Experimental Study of a Solar Drying System" being submitted by Shri Sanjay Sharma is a record of the bonafide research work carried out by him under our supervision. It is original in nature and we have permitted the author to submit it for the award of the degree of Doctor of Philosophy.

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SUMMARY

In this thesis an attempt is made to investigate a solar drying system theoretically as well as experimentally. The main objective of this work was to investigate various components of solar drying system viz. a solar air heater, a drying unit and a thermal storage device for low temperature drying. The various thermophysical parameters affecting the performance of air heater, the storage unit and the drying chember have been considered. The effect of combining these units have also been considered.

The enhancement of heat transfer area of the solar air heater using rock pebbles as the porous absorber is theortically investigated by formulating a two dimensional transient model. The effect of air flow rate, depth and length of porous absorber have been studied theoretically.

The effect of air leakage on the performance of an solar air heater is theoretically studied. Both Air leak in and Air leakout systems have been examined in order to study the system performance in terms of efficiency. A new design is proposed on the basis of a theoretical analysis in which effect of air leakage does not affect the performance of the system significantly.

A solar collector cum dryer has been fabricated and tested. A mathematical model of this system has been formulated. The model is numerically simulated to evalute its performance and results are compared with the experimental observation. The vegetables like Cauliflower, Green peas and Turnip were dried and temperatures of the absorber plate, inflow and out flow fluid were recorded. The rate of reduction in the moisture content and corresponding drying rates have also been estimated.

An integreated system consisting of a solar air heater, a thermal storage unit and a drying chember has been fabricated and tested experimentally. The rock pebbles are used as a medium to store the thermal energy. The inflow and out flow air temperature are recorded and the effects of single and double glazings, night insulation covers and the variations in the air mass flow rate have been studied. It is seen that this integreated system is quite efficient and may be used during off sunshine hours also.

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