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# A Solar Timber Drying System: Experimental Performance and System Modeling

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## Abstract

*This paper presents experimental and simulated performance of a solar timber drying system. The system consists of a solar collector on the top and a drying unit at the bottom. These are connected in series through U-turn at both ends. Hot air from the collector is forced by three fans to dry timber arranged in stacks in the drying unit. The air leaving the drying unit is exhausted with a provision to recirculate partially as needed. One full scale experiment was conducted to assess the drying potentials of the solar drying system. The average temperature rise at inlet of drying unit was 8 °C and the timber was dried from 25 % to 12.2% (db) moisture content within 12 days. In order to obtain the moisture diffusivity of the timber for the simulation of drying system, timber in the form of a slab was dried under controlled conditions of temperature and relative humidity in a laboratory dryer. The diffusivity was determined by minimizing the sum of the square of the deviation between the predicted and experimental values of the moisture content of the timber. It was found that the diffusivity increased with temperature and it can be expressed as a function of the temperature using the Arrhenius type equation. For the system modeling, two sets of equations were used to describe the heat and mass transfer inside the collector and the drying unit and these were numerically solved using the finite difference method. The values of the predicted moisture content and those obtained from the experiment were in reasonable agreement. The payback period of this drying system is 3.6 years.*