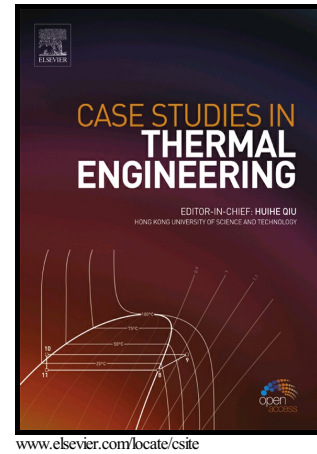


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Drying behaviour of lemon balm leaves in an indirect double-pass packed bed forced convection solar dryer system

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Abstract

The thin-layer drying behaviour of lemon balm leaves in an indirect-mode solar dryer with forced convection was investigated. The solar air heater employed a novel counter flow double-pass packed-bed wire mesh layer configuration to enhance the energy gain of the heated air. The thermal performance of the solar dryer was experimentally evaluated under Babol (36.5387° N, 52.6765° E) prevailing weather conditions. The system was comprised of a double-pass packed bed of wire mesh air heater attached to a dryer cabinet. The collector thermal efficiency was determined under realistic conditions wherein solar irradiance changed from 600 to 900 W/m², atmospheric temperature varied from 22°C to 25°C and the collector outlet temperature ranged from 38 °C to 68°C. It was found that while increasing the flow rate from 0.006125 m³/s to 0.01734 m³/s improved the collector thermal efficiency by ~ 20%; further increasing the flow rate to 0.034378 m³/s had an adverse effect on the collector efficiency. Drying experiments were performed for lemon balm leaves with initial moisture content of 80% on wet basis to the final moisture content of 10%. Mathematical models were also tested to find the best thin layer model for describing the drying behaviour of lemon balm leaves.

Keywords: Solar drying, indirect-mode dryer, lemon balm leaves, thin-layer drying models

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