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Thermal modeling of a natural convection greenhouse drying system for jaggery: An experimental validation

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Abstract

The aim of this work is to develop a thermal model so as to predict the jaggery temperature, the greenhouse air temperature and the moisture evaporated (jaggery mass during drying), during the drying of jaggery under natural convection conditions. The experiment was conducted separately for 0.75 kg and 2.0 kg of jaggery pieces having dimensions of $0.03 \times 0.03 \times 0.01 \text{ m}^3$ for complete drying. The jaggery was dried in a roof-type even span greenhouse with floor area of $1.20 \times 0.78 \text{ m}^2$. Experiment was carried out during February 5–8, 2004 at IIT Delhi ($28^\circ 35' \text{N } 72^\circ 12' \text{E}$) from 10 am to 5 pm. A computer program was developed in MATLAB software so as to calculate the jaggery temperature, the greenhouse air temperature and the moisture evaporated and was also used to predict the thermal performance of the greenhouse on the basis of solar intensity and ambient temperature. The software developed was experimentally validated. It was shown that the analytical and experimental results for jaggery drying are in good agreement.

Keywords

Thermal modeling; Drying of jaggery; Greenhouse

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