Title Design, testing and optimization of vibro-fluidized bed paddy dryer

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Abstract

The objectives of this research were to design, construct and test a prototype of vibro-fluidized bed paddy dryer with a capacity of 2.5–5.0 t/h and develop a mathematical model that determines optimum operating parameters. Experimental drying conditions were: air flow rate, 1.7 m^3/s; bed velocity, 1.4 m/s; average drying air temperature, 125–140°C; residence time of paddy approximately 1 minute; bed height, 11.5 cm; fraction of air recycled, 0.85 and vibration of intensity, 1 (frequency, 7.3 Hz and amplitude, 5 mm). Moisture content of paddy with a feed rate of 4821 kg/h was reduced from 28 to 23% d.b. Specific primary energy consumption (SPEC) was 6.15 MJ/kg-water evaporated. Electrical power of blower motor and vibration motor was 55% as compared to electrical power of blower motor used in fluidized bed drying without vibration. Comparison between the experimental and simulated results showed that the mathematical model could predict fairly well. To find out optimum operating parameters, the grid search method was employed with criteria based on acceptable moisture reduction and quality and minimum energy consumption.