

Design and Evaluation of a Fully-Automated Fluidized Bed Dryer for Complete Drying of Paddy

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Abstract : Drying of high moisture paddy remains a major problem in the Philippines, especially during inclement weather condition. To alleviate the problem, mechanical dryers were used like a flat bed and recirculating batch-type dryers. However, drying to 14% (wet basis) final moisture content is long which takes 10-12 hours and tedious which is not the ideal for handling high moisture paddy. Fully-automated pilot-scale fluidized bed drying system with 500 kilograms per hour capacity was evaluated using a high moisture paddy. The developed fluidized bed dryer was evaluated using four drying temperatures and two variations in fluidization time at a constant airflow, static pressure and tempering period. Complete drying of paddy with $\geq 28\%$ (w.b.) initial MC was attained after 2 passes of fluidized-bed drying at 2 minutes exposure to 70 °C drying temperature and 4.9 m/s superficial air velocity, followed by 60 min ambient air tempering period (30 min without ventilation and 30 min with air ventilation) for a total drying time of 2.07 h. Around 82% from normal mechanical drying time was saved at 70 °C drying temperature. The drying cost was calculated to be P0.63 per kilogram of wet paddy. Specific heat energy consumption was only 2.84 MJ/kg of water removed. The Head Rice Yield recovery of the dried paddy passed the Philippine Agricultural Engineering Standards. Sensory evaluation showed that the color and taste of the samples dried in the fluidized bed dryer were comparable to air dried paddy. The optimum drying parameters of using fluidized bed dryer is 70 oC drying temperature at 2 min fluidization time, 4.9 m/s superficial air velocity, 10.16 cm grain depth and 60 min ambient air tempering period.

Keywords : drying, fluidized bed dryer, head rice yield, paddy

Conference Title : ICAFE 2015 : International Conference on Agricultural and Food Engineering

Conference Location : Sydney, Australia

Conference Dates : December 10-11, 2015