



INDIAN INSTITUTE OF TECHNOLOGY GUWAHATI
SHORT ABSTRACT OF THESIS

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Thesis Title: **EXPERIMENTAL INVESTIGATION OF CEREAL CROP DRYING IN AN INCLINED BUBBLING FLUIDIZED BED**

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SHORT ABSTRACT

Rice is the primary source of staple food for more than half of the world's population. Drying of cereal crop is important in terms of maintenance of nutritional value of food, loss due to pest and fungi attack as well as to maintain long storage life. Paddy drying process consumes high energy due to the removal of internal moisture. The main objective for a sustainable dryer is to reduce required energy input by means of designing an efficient drying system which can provide the dried products with acceptable quality level. Paddy drying was carried out in four different inclined positions, viz., vertical bed (0° inclined), 15° , 30° and 45° in a bubbling fluidized bed. Experiments were conducted for 0.5 to 2.5 kg batch size with superficial velocities of 1.1ms^{-1} to 2.6ms^{-1} and drying air temperatures of 55°C to 65°C to evaluate the hydrodynamic behaviour, drying characteristics and energy consumption during the drying process. Better results in terms of energy consumption and moisture removal rate were observed with bed inclination of 15° due to the secondary motion created because of the pressure difference between the vertical faces of the dryer. Considering the particle mixing behaviour observed during the experiments with the inclined bed dryer, the distributor plate was modified for better drying efficiency and reduction in drying energy consumption and experiments were conducted with the modified distributor plate. The heat transfer rate and drying efficiency increased due to the proper motion of air flow while using the modified distributor plate in the bubbling fluidized bed dryer. Spirals were inserted inside the drying chamber and all the experiments were repeated with and without the use of spirals inserts. Use of spirals inside the drying chamber enhanced better mixing of paddy, reduces drying time as well as reduces energy consumption significantly. Best performance with a combination of minimum energy consumption and faster moisture removal rate was obtained with a bed inclination of 15° , an inventory of 2.5 kg, air velocity of 2.1ms^{-1} , air temperature of 65°C using modified distributor plate with the use of spirals inserts. Energy consumptions decreased by 12.2% when modified distributor plate is used. Energy consumptions decreased by 48.8% when spiral inserts are used. Energy consumptions decreased by 67.7% when the inventory is increased from 0.5 kg to 2.5kg, 48.8% when the temperature is increased from 55°C to 65°C , 43.2% when the inclination is increased from 0° to 15° and 32.3% when the velocity is increased from 1.1 m/s to 2.1 m/s at the optimum condition. In addition, energy consumption reduced 10% by the effect of scale up.