

**PERFORMANCE EVALUATION OF A FABRICATED FLUIDIZED BED DRYER
IN COMPARISON WITH A CONVECTION SOLAR DRYER**

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Solar drying is a commonly used drying method. However, it has limitations such as dependency on weather conditions and uneven drying thus causing postharvest losses. Therefore, the objectives of this study were to design a lab-scale fluidized bed dryer and to compare the efficiency of the fluidized bed dryer with that of a natural convection solar dryer. A lab-scale Fluidized Bed Dryer (FBD) was fabricated and experimentally compared with a natural convection solar dryer. Both dryers were evaluated for their performance using 1.0, 0.5, and 0.25 kg of paddy. The performance of the dryers was evaluated in terms of drying time, drying rate and thermal efficiency. The FBD showed rapid moisture removal to achieve the safe moisture content of 14% with significantly ($p < 0.05$) less time of 528, 276 and 156 minutes respectively across 1.0, 0.5 and 0.25 kg of drying masses of paddy. Significantly ($p < 0.05$) higher drying rate of 0.595 kg/m²h was observed with the drying mass of 0.25 kg in the FBD. The highest total thermal energy requirement of 94.24 kJ and 19.65 kJ were required by the solar dryer and FBD respectively with 0.25 kg drying mass of paddy. This corresponds to the fact that the FBD demonstrated significantly ($p < 0.05$) higher thermal efficiency of 49.8% when the drying mass was 0.25 kg, while the solar dryer showed significantly ($p < 0.05$) lower thermal efficiency of 23.7% with the same drying mass. Thus, the efficiency of the fluidized bed dryer was more when drying less mass of paddy was less. Further, the findings affirm that FBD outperformed the FBD over the natural convection solar dryer in terms of drying time, drying rates and thermal efficiencies. Moreover, FBD showed better performance with a drying mass of 0.25 kg suggesting the optimum quantity of drying mass to be used in the current design.

Keywords: Convection solar dryer, Fluidization, Fluidized bed dryer, Paddy drying, Solar drying

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