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Motion evaluation of particles in a multi-pass vibro-fluidized bed tea dryer

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Multi-pass vibro-fluidized bed dryer is a novel energy saving design concept. This single unit drying chamber has three sloping decks fixed vertically one over the other in a zigzag path. The docks slope in opposite directions to facilitate uniform particle motion. Each deck measures 3.6 m x 0.78 m and consists of perforated sheets having 13 holes per square centimeter of 1.5 m .The three deck units is made to vibrate horizontally at a 3 mm amplitude using an eccentric shaft driven by a 5 kW electric motor. A centrifugal fan (5 kW) with the capacity of 2.83 m^3/s is used to supply air for fluidization.

The scope of this study was limited to optimize the vibration frequency and slope of the deck to obtain the expected particle moving speed of 6 mm/s at different moisture contents (MC). Orthodox rolled tea dhools of three levels of moisture (10%, 30% and 55%) were used for testing at different vibration frequencies and slope of the deck at the fixed amplitude and air flow rate. The three moisture contents represented the expected mean moisture contents in the three decks.

All calculations were done by using a plot of speed, frequency and slope on Excel sheets. Results revealed that the moisture content influenced the particle motion speed on the bed. Decrease in moisture increased the particle speed at a given bed slope and frequency. The frequency of 38 Hz (504 rpm) was the best for the expected particle speed for all three moisture levels. The optimum bed slopes were determined as 3%, 4% and 5% for 10%, 30% and 55% MC (wet basis), respectively, at 38Hz (504 rpm).

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