Performance evaluation of a newly developed solar drying technology: Case study of Indonesian bay leaf

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Abstract

Drying is a standard postharvest operation to guarantee the quality of medicinal and aromatic plants by reducing moisture content to microbial safe water activity for storage. Conventional open sun drying is very susceptible to contamination such as dust, pests and rodents that reduce product quality and farmer's income. Therefore, solar drying is a preferable method in tropical countries due to simplicity and affordability, especially for small farmers in rural areas. The Inflatable Solar Dryer (ISD) is a state-of-the-art technology to dry agricultural products in an easy and efficient way. The ISD is made of plastic films connected by a zipper, in which the upper part is UV-stabilized transparent polyethylene and the floor is reinforced black Polyvinyl Chloride. A tunnel shape is created by forced ventilation with a fan installed at one end of the tunnel. In this study, the ISD was used to dry Indonesian bay leaf (*Syzygium polyanthum* (Wight) Walp.) on different days in August, 2015 in Jakarta, Indonesia. Drying experiments with different air velocities were carried out using a variable DC power supply. Specific humidity and temperature of ambient-, drying- and outlet air were monitored using USB data loggers in 1 min intervals. Randomly selected samples of leaf mass from five different locations were also weighed in 30 min intervals. Drying temperature was strongly dependent on ambient conditions and found to increase up to 70 °C in the tunnel, which could be maintained for 4 h in the afternoon. An effective drying period with temperature above 60 °C could be maintained in the dryer for about 6 h. Higher water removal was observed in the leaves dried in the solar dryer as compared to those dried in the open sun. In particular, the leaves reached storable moisture content after 2 h whereas more than 5 h were required for conventional sun drying. However, the leaves tended to absorb water vapor when drying performed during the night due to cooling effect. Computational fluid dynamics was conducted to simulate air flow in the dryer. The ISD demonstrated a great potential to be implemented in rural areas with limited resources.

Keywords: drying rate, evaporation, fluid dynamic, radiation, *Syzygium polyanthum*