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Performance analysis of an improved solar dryer integrated with multiple metallic solar concentrators for drying fruits

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Abstract

Reducing postharvest losses (PHL) of fresh perishable agro-produce is a key strategic pathway to increasing incomes, food and nutrition security in East Africa. In response, an improved Hybrid Indirect Passive (HIP) solar dryer with a modified solar collector plate and drying cabinet, has been developed and presented as a better food drying alternative against the traditional open sun drying (OSD) method. A conventional active-mode Solar Photovoltaic and Electric (SPE) dryer with an auxiliary thermal-backup system was also fabricated. The fruit drying performance of the HIP and SPE dryers was evaluated using pineapples and mangoes, and compared against the traditional open sun drying (OSD) method. The food drying duration for the SPE, HIP and OSD methods were 10 h, 18 and 30 h; respectively. Drying efficiency of the improved HIP dryer was comparable to the SPE dryer and was 18% higher than the OSD method. Therefore, modifying the solar collector plate with multiple metallic solar concentrators coupled with an improved greenhouse cabinet significantly improves the drying performance of the HIP dryer. The HIP dryer is, therefore recommended for mass adoption against the OSD method.

Keywords

Solar drying; Value-addition; Drying; Post-harvest losses; Fruits; Food