DESIGN, DEVELOPMENT AND EVALUATION OF AN IMPROVED SOLAR AND BIOMASS HYBRID DRYER FOR AGRICULTURAL PRODUCTS

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Drying, one of the acceptable preservation methods for many of foods, by the means of solar heat is very popular among Sri Lankan farmers. Unavailability of cost effective dryer is a major problem facing small scale farmers to increase their income at the harvesting season. This study mainly aimed to address the problem associated with the efficiency of solar dryers. Solar and biomass hybrid dryer was designed to increase the efficiency of solar collector by tracking the sun's daily rotation and hybrid mode was included so that drying can be made continuously during the night time and in rainy seasons. The dryer mainly consists of a solar heat collector, drying chamber, biomass burner and forced ventilation system.The total production cost of the dryer was 15,000 LKR. The performance of the dryer was evaluated with only biomass (T1), solar energy without tracking (T2), Solar energy with tracking (T3) and in hybrid mode (T4) compared to direct sun drying (T5). Banana, Jackfruit and mushroom were used separately in the evaluation process. No load test; indicated that, temperature could rise up to 49.95^{0}C and 45.04^{0}C in drying chamber when it is operated in hybrid mode with tracking and only solar energy with tracking, respectively. It was 39.43^{0}C for solar energy without tracking. The efficiencies of collector and sawdust biomass burner were 34.07% and 26.56%, respectively. Moisture removing rates for 1 kg of each product were 0.125 kg/h for mushroom 0.08 kg/h for banana and 0.11 kg/h for jackfruit, when the hybrid mode was used with the solar tracking. Dryer was evaluated using drying time, moisture removing rate, and drying efficiency. The statistical analysis reveals that T4 has significantly performed in total consumed time and efficiency ($p<0.05$) than other treatments. Hence, it can be concluded that hybrid solar dryer with solar tracking is efficient for small scale fruits and vegetable drying.

Keywords: Biomåss burner, Collector efficiency, Hybrid dryer, Solar energy, Solar tracking