

A review of the significance effect of external factors of the solar dryer design to dried foods product quality

ABSTRACT

Purpose – The purpose of this paper is to present and discuss the external factors of the solar dryer design that influenced the thermal efficiency of the solar dryer that contribute to the better quality of dried food products. Design/methodology/approach – From the reviewed works of literature, the external factors including the drying temperature, airflow rate and relative humidity have significant effects to increase the rate of moisture diffusivity of the freshly harvested products during the drying process. The proper controls of airflow rate (Q), velocity (V), relative humidity (RH%) and drying temperature (°C) can influence the dried product quality. The dehydration ratio is the procedure to measure the quality of the dried food product. Findings – The indirect solar dryer including the mixed-mode, hybrid and integrated was found shorter in drying time and energy-intensive compared to sun drying and direct drying. The recommended drying temperature is from 35.5°C to 70°C with 1–2 m/s velocity and 20%–60% relative humidity. The optimum thermal efficiency can be reached by additional devices, including solar collectors and solar accumulators. It gives a simultaneous effect and elongated the drying temperature 8%–10% higher than ambient temperature with 34%–40% energy saving. The recommended airflow rate for drying is 0.1204 to 0.0894 kg/s. Meanwhile, an airflow rate at 0.035–0.04 kg/m² is recommended for an optimum drying kinetic performance. Research limitations/implications – This paper discusses the influence of the external factors of the solar dryer design on the thermal performance of the solar dryer and final dried food products quality. Therefore, the findings cannot serve as a statistical generalization but should instead be viewed as the quantitative validation subjected to fundamentals of the solar dryer design process and qualitative observation of the dried food product quality. Practical implications – A well-designed of solar dryer with low operating and initial fabrication cost, which is simple to operate is useful for the farmers to preserve surplus harvested crops to an acceptable and marketable foods product. The optimization of the external and internal factors can contribute to solar dryer thermal performance that later provides an organoleptic drying condition that results in good quality of dried product and better drying process. The recommended drying temperature for a drying method is between 35°C up to 70°C. Drying at 65.56°C was effective to kill microorganisms. Meanwhile, drying at 50°C consider as average drying temperature. The recommended airflow rate for drying is 0.1204 to 0.0894 kg/s. Meanwhile, air flowrate at

0.035–0.04 kg/m² is recommended for optimum drying kinetic performance. The recommended value of aspect ratio and mass flow rate is 200 to 300 for an optimum evaporation rate. The good quality of dried products and good performance of solar dryers can be developed by proper control of airflow rate (Q), velocity (V), relative humidity (RH%) and drying temperature (°C). Social implications – The proper control of the drying temperature, relative humidity and airflow rate during the drying process will influence the final dried food products in terms of shape, color, aroma, texture, rupture and nutritious value. It is crucial to control the drying parameters because over-drying caused an increment of energy cost and reduces the dry matter. The quick-drying will disturb the chemical process during fermentation to be completed. Originality/value – This study identifies the potential of the solar drying method for dehydrating agricultural produces for later use with the organoleptic drying process. The organoleptic drying process can reduce mold growth by promising an effective diffusion of moisture from freshly harvested products. The research paper gives useful understandings that well-designed solar drying technology gives a significant effect on dried product quality.