ABSTRACT

This study observed the effects of different drying methods on quality parameters of dried tomato. Fresh plum tomatoes were purchased, washed in potable water, and sliced to approximately 3mm thickness using stainless steel knives. The tomato slices were then spread on galvanized iron trays and dried simultaneously using direct sunlight, a stainless steel solar cabinet dryer, a wooden solar cabinet dryer, and an electric oven set at 60 °C dry bulb temperature and 1.0 m/s air speed. During drying, ambient dry bulb temperature varied from 22.0 – 32.5 °C and relative humidity from 70.8 – 97.0 %. Solar radiation varied from 231.14 – 912.41 W/m². The initial moisture content was determined by gravimetry to be 95.4 % (wet basis), and weights of the samples being dried were determined at hourly intervals. L*, a* and b* colour
parameters were determined before and after drying using a chromameter, as were the protein, lycopene, vitamin A and vitamin C contents. After drying, the moisture contents at intervals were determined by calculations, and the drying rate and moisture ratio were computed. The effective moisture diffusivity, \( D_{eff} \), and activation energy, \( E_a \), were determined by the Arrhenius equation. Rehydration ratios were also computed as a measure of rehydration ability. Sun dried samples were dried to 10.2 % (wet basis), 8.5 % (wet basis) for samples dried in the stainless steel solar dryer, 8.7 % (wet basis) for samples dried in the wooden solar dryer, and 21.7 % (wet basis) for hot air dried samples. The results showed that moisture content, drying rate and moisture ratio decreased with increase in drying time, and the majority of the drying occurred in the falling rate period. The effective moisture diffusivity was \( 5.07 \times 10^{-7} \text{ m}^2/\text{s} \) for sun dried samples, \( 2.32 \times 10^{-7} \text{ m}^2/\text{s} \) for samples dried in the stainless steel solar cabinet dryer, \( 2.51 \times 10^{-7} \text{ m}^2/\text{s} \) for samples dried in the wooden solar cabinet dryer, and \( 6.06 \times 10^{-7} \text{ m}^2/\text{s} \) for samples dried in the hot air oven. Activation energies varied from 39.14 to 42.12 kJ/mol for sun dried samples, 39.14 to 42.12 kJ/mol for samples dried in the stainless steel solar cabinet dryer, 39.01 to 41.32 kJ/mol for samples dried in the wooden solar cabinet dryer, and 31.84 kJ/mol for hot air dried samples. Effective moisture diffusivity was found to decrease with increase in temperature and drying time, while activation energy was found to be directly proportional to time of drying. The Page model best predicted the drying for sun drying and samples dried using the stainless steel solar cabinet dryer, while the Logarithmic and Two-term models best predicted the drying for samples dried using the wooden solar dryer and hot air oven, respectively. All colour parameters were found to decrease with temperature and drying time. Samples dried under direct sunlight retained the best brightness, redness and yellowness, although the differences were not significant at the 95 % significance level (\( P < 0.05 \)). Protein content increased significantly (\( P > 0.05 \)) with drying,
with solar dried samples having the highest values. For lycopene, solar dried samples also recorded the highest values, although not significantly different from other dried samples (P<0.05). Being sensitive to heat, vitamins A and C were lost during drying, with solar dried samples again retaining the most vitamins.