Drying Kinetics, Energy Requirement, Bioactive Composition, and Mathematical Modeling of Allium Cepa Slices

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Abstract : The drying kinetics, specific energy consumed (SEC), effective moisture diffusivity (EMD), flavonoid, phenolic, and vitamin C contents of onion slices dried under convective oven drying (COD) were compared with microwave drying (MD). Drying was performed with onion slice thicknesses of 2, 4, 6, and 8 mm; air drying temperatures of 60, 80, and 100°C for COD, and microwave power of 450 W for MD. A decrease in slice thickness and an increase in drying air temperature led to a drop in the drying time. As thickness increased from 2 – 8 mm, EMD rose from 1.1-4.35 x 10⁻⁸ at 60°C, 1.1-5.6 x 10⁻⁸ at 80°C, and 1.25-6.12 x 10⁻⁸ at 100°C with MD treatments yielding the highest mean value (6.65 x 10⁻⁸ m² s⁻¹) at 8 mm. Maximum SEC for onion slices in COD was 238.27 kWh/kg H₂O (2 mm thickness), and the minimum was 39.4 kWh/kg H₂O (8 mm thickness) whereas maximum during MD was 25.33 kWh/kg H₂O (8 mm thickness) and minimum, 18.7 kWh/kg H₂O (2 mm thickness). MD treatment gave a significant (p 0.05) increase in the flavonoid (39.42 – 64.4%), phenolic (38.0 – 46.84%), and vitamin C (3.7 – 4.23 mg 100 g⁻¹) contents, while COD treatment at 60°C and 100°C had positive effects on only vitamin C and phenolic contents, respectively. In comparison, the Weibull model gave the overall best fit (highest R²=0.999; lowest SSE=0.0002, RSME=0.0123, and χ^2 = 0.0004) when drying 2 mm onion slices at 100°C.

Keywords : allium cepa, drying kinetics, specific energy consumption, flavonoid, vitamin C, microwave oven drying **Conference Title :** ICFAE 2022 : International Conference on Food and Agricultural Engineering

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