

Mathematical Modelling of Ultrasound Pre-Treatment in Microwave Dried Strawberry (Fragaria L.) Slices

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Abstract : In this study, the strawberry (Fragaria L.) fruits, which were pretreated with ultrasound (US), were worked on in the microwave by using 90W power. Then mathematical modelling was applied to dried fruits by using different experimental thin layer models. The sliced fruits were subjected to ultrasound treatment at a frequency of 40 kHz for 10, 20, and 30 minutes, in an ultrasonic water bath, with a ratio of 1:4 to fruit/water. They are then dried in the microwave (90W). The drying process continued until the product moisture was below 10%. By analyzing the moisture change of the products at a certain time, eight different thin-layer drying models, (Newton, page, modified page, Midilli, Henderson and Pabis, logarithmic, two-term, Wang and Singh) were tested for verification of experimental data. MATLAB R2015a statistical program was used for the modelling, and the best suitable model was determined with R^2_{adj} (coefficient of determination of compatibility), and root mean square error (RMSE) values. According to analysis, the drying model that best describes the drying behavior for both drying conditions was determined as the Midilli model by high R^2_{adj} and low RMSE values. Control, 10, 20, and 30 min US for groups R^2_{adj} and RMSE values was established as respectively; 0,9997- 0,005298; 0,9998- 0,004735; 0,9995- 0,007031; 0,9917-0,02773. In addition, effective diffusion coefficients were calculated for each group and were determined as $3,80 \times 10^{-8}$, $3,71 \times 10^{-8}$, $3,26 \times 10^{-8}$ ve $3,5 \times 10^{-8}$ m/s, respectively.

Keywords : mathematical modelling, microwave drying, strawberry, ultrasound

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