ABSTRACT

Microwave-vacuum drying characteristic of sliced as well as whole button mushrooms (*Agaricus bisporus*) was investigated to determine the drying conditions under which high quality dehydrated button mushrooms could be obtained in a short time. A laboratory microwave-vacuum drying system was developed for drying studies, which had the provision of varying microwave power levels and pressures. Button mushrooms with an initial moisture content of 92.5% (wet basis) were dried up to a final moisture content of approximately 6 % (w.b.). The effect of process variables, namely microwave power (115 to 285 W), pressure (6.5 to 23.5 kPa) and slice thickness (6 to 14 mm) were studied on the drying characteristics of fresh mushrooms and quality attributes of dehydrated products. Hot air-drying experiments at different temperatures (50, 60 and 70°C) were also performed on button mushroom for comparison. Microwave-vacuum drying resulted in 70 to 90 % reduction in the drying time and the mean effective moisture diffusivity in microwave-vacuum drying process was found 8 to 10 folds higher as compared to air-drying process. The effects of microwave power, pressure and slice thickness on drying efficiency and some quality attributes of dehydrated mushroom slices were analyzed by Response Surface Methodology (RSM) technique. Microwave power and slice thickness had significant effect ($p \leq 0.05$) on drying efficiency whereas the system pressure strongly affected the quality of the dehydrated products such as colour, hardness, rehydration ratio and sensory scores. An optimum drying conditions of 202 W microwave power; 6.5 kPa system pressure; and 7.7 mm thickness were found for better quality dehydrated products in microwave-vacuum drying of sliced mushrooms.

Shrinkage ratio and apparent density of button mushrooms were determined during microwave-vacuum and air-drying at various moisture contents ranging from 85 to 5 % (w.b.). In both the methods, the shrinkage ratio of mushroom reduced linearly with the moisture content but the microwave-vacuum drying had lower shrinkage than the air drying. Simple mathematical models were used to correlate the shrinkage ratio and apparent density with moisture content of mushrooms. Semi-empirical models were also developed based on the solution of the one-dimensional heat and mass transfer equations to simulate the temperature and moisture content changes in mushroom slices during microwave-vacuum drying. Experimental results indicated that the predictions were more accurate for temperature than moisture content changes during drying. The mushroom dried at the optimized conditions in microwave-vacuum drying were compared with hot air-dried and freeze-dried products for quality attributes such as colour, hardness, rehydration ratio, ascorbic acid content, sensory scores and bulk density. Microwave-vacuum dehydrated mushroom products were found superior than the hot air dried products and were comparable to freeze dried mushroom products.

Keywords: Microwave-vacuum drying, Button mushroom, Drying rate, Scanning electron microscopy, Rehydration ratio, Response surface methodology, hardness, optimization, Shrinkage, Apparent density, Modeling