Control of thermal runaway during microwave convective air drying of tomatoes

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Abstract

Microwave drying of foodstuffs is widely studied as it mainly provides a short drying time. However, overheating problems often appear with black spots formation as a result of the high level of energy density provided at the end of drying. In fact, most studies are carried out at constant power throughout the drying, which means that the specific power (Ps) increases during drying.

This study addresses the problem of thermal runaway which occurs during the microwave drying of tomatoes. A microwave/hot air (MWHA) drying system along with a LabView computer program to automatically control the power density has been developed. MWHA drying with or without control of the microwave specific power has been implemented. The microwave Ps ranged from 3 to 7 W/g and the air temperature from 30 to 50 °C. The product weight as well as its temperature was recorded online to easily control the Ps.

The results showed that the Ps control during MWHA drying helped to lower the product temperature at the end of drying and hence control the dried product quality. In fact, tomatoes dried by MWHA with no Ps control presented a local overheating unlike those dried with specific power control which did not develop black spots. This study also showed that the MWHA drying strategy with Ps control had preserved 64.8% of tomato lycopene in contrast to 42.5% when tomatoes were dried without Ps control.