Cell disintegration index produced by pulsed electric fields (PEF) pretreatment and its influence in the convective drying of butternut

CARCEL J. (1), LLAVATA B. (1), ROSSELLO C. (2), BON J. (1)
1 Food Technology Department. Universitat Politnica de Valcia, Valencia, Spain
2 Department of Chemistry. Universitat de les Illes Balears, Palma , Spain

Convective drying is one of the most used technique in the food industry to dehydrate food. However, there is a need for the industry to overcome the main challenges of the operation: long process times and great energy consumption. Thus, the electroporation of cell membranes generated by the application of pulsed electric fields (PEF) pretreatment could improve mass transfer and thus enhance drying of food product. The most common way to estimate the level of electroporation caused by PEF is through the cell disintegration index (Z), which varies from 0 (untreated sample) to 1 (totally destroyed sample). The aim of this work was to characterize the cell disintegration index of butternut samples caused by different PEF pretreatments and its influence in convective drying kinetics. For this purpose, butternut samples were PEF pretreated at different electric field strength (0.67, 1.34 and 2.00 kV/cm) and number of pulses (between 0 and 1000; pulse width of 20 µS and a frequency of 50 Hz). Z was determined by measuring the conductivity of samples before and after treatment. Once Z was characterized, PEF conditions equivalent to an intermediate level (Z=0.25) and a high level (Z=0.75) of electroporation were considered to apply as PEF pretreatments of drying. In this way, control samples (Z-0) and PEF pretreated samples (Z-25 and Z-75, respectively) were dried at 40 ºC and 1 m/s, recording the weight sample every 5 min.
The results showed that the greater number of pulses and the electric field strength applied, the higher the Z value; reaching values close to Z=1 in the most extreme conditions tested. Regarding the drying, it was observed that the experiments carried out with PEF pretrated samples were shorter than those performed with Z-0 samples. The greater the electroporation, the faster the drying. These results indicate that PEF pretreatment could represent an alternative to enhance the drying process of butternut.