Effect of long-term storage and blanching pre-treatments on osmotic dehydration kinetics of carrots

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We investigated the effect of both long-term storage and tissue damage occurring at various stages of blanching pre-treatments on the mass transfer rates during osmotic dehydration of carrots.

* Isothermal calorimetry at 20°C was used to measure the decrease of metabolic heat rate (P) of carrots blanched for 30 s in boiling water. Metabolic heat was used as measurement of cell vitality. As blanching time increases, the cell wall barrier to mass transfer in the subsequent osmotic treatment becomes more important than the cell membrane barrier.

Fig. 1. TAM air isothermal calorimeter

Fig. 2. Decrease of heat production rates with blanching time during long-term storage (1 to 12 weeks (W), relative values)

* The blanched carrots were osmotic dehydrated in 50% (w/w) sucrose solution at 40°C and the effective diffusion coefficients for water and solute were calculated. The dehydration experiments were repeated during 12 weeks of storage at 0°C and high relative humidity.

Fig. 3. Effect of blanching pre-treatments and long-term storage on effective diffusion coefficients during osmotic dehydration of carrot taproot parenchyma.

For each storage time, the effective diffusion coefficients of water (Dew) as well as sucrose (Des) increased after blanching treatments (10 – 30 s), which caused the death of cells in the tissue.

As the storage time progresses, the increase of the effective diffusion coefficients with blanching time is less pronounced.

Our results suggest that metabolic structural changes in the taproots during long-term storage would substantially decrease the effect of blanching on the effective diffusion coefficients. See Gómez et al., 2004. Food Research International 37, 225-232 for information on structural changes of carrots during storage.

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