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Dual mode diffusion and sorption of sodium chloride
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ABSTRACT

This study aims to obtain insight into mechanisms of NaCl diffusion in pork meats under cooking conditions: the loins at 5 (raw), 63 (precooked) and 98 °C (precooked), the mince at 98 °C (precooked), and the filet at 98 °C (precooked). It has been generally presumed that NaCl in any of pork meats diffuses with a constant Fick's diffusion coefficient, D , through liquid water channel imbibed in them. However in the present study, we experimentally obtained skewed bell shape variations of D in all of the above meats with respective maxima at certain low NaCl concentrations. These variations were interpreted in terms of a dual mode sorption and diffusion theory, which had been successfully applied to NaCl diffusion behaviors in Japanese radish and solidified egg white. This interpretation gives a thermodynamic diffusion coefficient, $D_T(p)$ for the partition species of NaCl and another one, $D_T(L)$ for the Langmuir type sorption species, both in the water swollen substrates in the meats. It was found that $D_T(p)$ values are sizably smaller than corresponding $D_T(L)$ values. This difference was ascribed to the lower water content in the p region than that in the L region. With the two D_T 's and additional equilibrium parameters, the theory explained the remarkable decrease of D value with C at 21 °C found by Guiheneuf et al. and nearly constant D values in the higher C range at 5 °C reported by other researchers. Experimentally obtained sorption isotherms of NaCl, which were slightly convex upward in the low C range, were satisfactory reproduced with the parameters and the fractions of water swollen substrates in the whole meats.