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Dual mode diffusion and sorption of sodium chloride in pre-cooked egg white

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ABSTRACT

The concentration profiles of NaCl by the one-dimensional diffusion in pre-cooked EW (egg white) were obtained at 5-80°C.

D_s (Fick's diffusion coefficients) estimated at respective concentrations of NaCl in EW showed peaks at a certain NaCl concentration in the substrate. The peak became prominently high with the increase in temperature. These variations were interpreted in terms of the dual mode sorption and diffusion theory, which was successfully applied to the diffusion behavior of NaCl in Japanese radish. In EW, the water swollen protein phase coexists with the dispersed liquid water phase. It is in the former phase where the diffusion rate in EW is determined via the dual mode mechanism. By applying the theory, thermodynamic diffusion coefficients, $D_T(p)$, of the partitioned species at respective temperatures were found to be smaller than those, $D_T(L)$, of the Langmuir sorption species. The variations of D with peaks were interpreted with these two D_T 's and equilibrium parameters of the two species. The sorption isotherms of NaCl by EW were found to be slightly convex upward at low NaCl concentrations, which were successfully interpreted by considering the two phases mentioned above and the equilibrium parameters for the partitioned and Langmuir species.