IR SPECTROSCOPY OF GLUCOSE AND FRUCTOSE HYDRATES IN AQUEOUS SOLUTIONS

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Although carbohydrates have been studied for a long time their compositions in aqueous media are not completely determined. In a previous study of aqueous solutions of sucrose[a] we determined by IR spectroscopy with the aid of factor analysis for obtaining the principal spectra and the species abundances that the solutions were composed of three species: pure water and sucrose solvated with 5 and 2 water molecules. The three species are present in the whole solubility range. The biggest spectral differences of the carbohydrate species lie in the C-O stretch region. To increase our body of knowledge on carbohydrates we have studied by the same technique D-glucose and D-fructose since these are the products in the first step of sucrose hydrolysis. We found also that, for each sugar, three species were present in aqueous solutions: water and two hydrates. For D-glucose these are penta- and dihydrates with an equilibrium constant of $K_G = (3.2 \pm 0.6) \times 10^{-5} L^3$ mol $^{-3}$. For D-fructose they are penta- and monohydrates with an equilibrium constant of $K_F = (7.1 \pm 1.2) \times 10^{-3}$ L^{2}mol^{-2}. For each sugar, the abundance of each hydrate is non linear as a function of the sugar concentration but their sum is. The four hydrates are present only in aqueous solutions and cannot be obtained in the solid state. We will present the spectra of each carbohydrate hydrates and give the assignment of the bands.

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