23. Free volume/percolation model for the glass transition temperature of polyols aqueous solution

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The glass transition behavior of aqueous solutions containing carbohydrates or natural biopolymers is fundamental to determine their stability during storage of biomolecules, cells or organisms at low temperatures and the damage of the materials being cryopreservated. We use the free volume/percolation model (FVPM) that relates T_g to the percolation threshold of a 3-dimensional system, to estimate the glass transition temperature of simple polyol-water systems and compare the results with the experimental values and those obtained with other theoretical and semiempirical models. The model requires no adjustable parameters, but only information on the volumetric data of the aqueous system. Once the molar volume of water in the supercooled region was calculated by using the trehalose-water mixtures as a model system, a validation of the model was attempted by comparing its prediction with experimental data for other polyol-water systems. We have chosen aqueous solutions of polyols for which volumetric data are available, such as sucrose, fructose, glucose and glycerol.