Inferring the physical properties of maltodextrin/water systems in glassy state from the fitting parameters of the Free Induction Decay

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Each of the five parameters describing the conventional Free Induction Decay (FID) curve for maltodextrin/water glassy systems was explained in terms of physical characteristics of the system.
The amplitudes of the signals associated to solid and mobile protons were related to the density of the maltodextrin protons and water protons, respectively. The relaxation characteristic time of the mobile phase is proportional to the square of the molar fraction of water over the molar fraction of hydroxyl groups. Furthermore, the shorter relaxation time, associated to the relaxation of the polymer proton spins, was independent of the molecular weight and the water content. It was even constant with the experimental set-up used.
Inversion of the FID using Inverse Laplace Transform allows calculation of the continuous spectrum of relaxation times, which is the fingerprint of the material investigated. Two modes are highlighted, the shorter one which amplitude decreases as water content increases and the longer one which amplitude increases together with a shift towards longer characteristic times when the water content increases.
The work presented here allows consistent reconstruction of the FID when temperature, molecular weight and concentration are known.