$T_2$ dispersion through time domain $^1$H NMR measurements on the D, L - glucose concentrated solutions

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ABSTRACT

We studied the diffusion-chemical exchange process by time-domain nuclear magnetic resonance (TD-NMR) in order to characterize the dispersion of observed $T_2$ of D, L-glucose solutions (in phosphate and borate buffers at pH 5.0, 7.2 and 8.0) at different interpulse spacing from CPMG sequences. We found that $T_2^{-1} = R_2$ shows characteristic dispersion as a function of interpulse spacing. We develop a relaxation model that differentiates the common influence to chiral influence in relaxation function based on the different motion properties for ions, [OH]$^-$ and [H$_3$O]$^+$ in magnetic fields. Assuming that the most important propriety of reactivity is molecular motion of glucose, combined by hydration effect of solvent we use thermal decomposition for test of relaxation model (85$^\circ$C, 65 h, pH 8.0). We found that this process applied to D and L-glucose with borate anions (pH 8.0) shows an unchangeable behavior for $R_2$, which sustains our earlier hypothesis about the protective role of borate on sugars. In case of phosphate buffer systems (pH 8.0), the thermal decomposition processes for D and L-glucose are very different one from the other, a fact which shows the different pathways for decomposition, with connection to the instability of L-glucose, especially at low pH.