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Analysis of the Proton Spin-Lattice Relaxation in Wine and Hydroalcoholic Solutions

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Abstract:

NMR relaxometry is a powerful analytical method that can easily be applied to wine. Proton spin–lattice nuclear magnetic relaxation dispersion profiles of wines have revealed a signature dominated by paramagnetic manganese relaxation. However, manganese is a relatively scarce element in wine. With this study focusing on model wines, we analyse the impact of four factors: alcohol by volume (ABV), dissolved dioxygen, tartaric acid, and pH on the relaxation time, but important issues concerning high ABV systems are also discussed. Dissolved dioxygen concentration increases strongly with ABV, and paramagnetic O₂ can contribute significantly to the relaxation process. Moreover, ABV modifies the viscosity and also impacts the relaxation mechanisms. In contrast, the organic acid and the pH do not show a significant effect. Analysis of the profiles recorded for distinct ABVs confirms the influence of the viscosity.

Keywords: wine, relaxation, NMR, viscosity, oxygen