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# DIELECTRIC BEHAVIOR OF PROPANOLS IN A VARIETY OF SOLVENTS

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The origin of the principal relaxation times of alcohols is under dispute. This letter reports that the principal relaxation times of 1- and 2-propanols change with concentration in two slightly different manners by solvents and this difference is due to whether the solvent has the hydrogen-bonding capacity or not.

Dielectric measurements of mixtures of 1-, or 2-propanols with pyridine, chlorobenzene, dioxane and benzene were made at 25°C in the frequency range of 350-2100 MHz by a UHF slotted-line-type LMD apparatus. Fig.1 shows results of the measurements-(A) the dielectric constants and (B) the dielectric losses for 1-propanol-pyridine mixtures are plotted against the frequency. With an increase in the concentration of

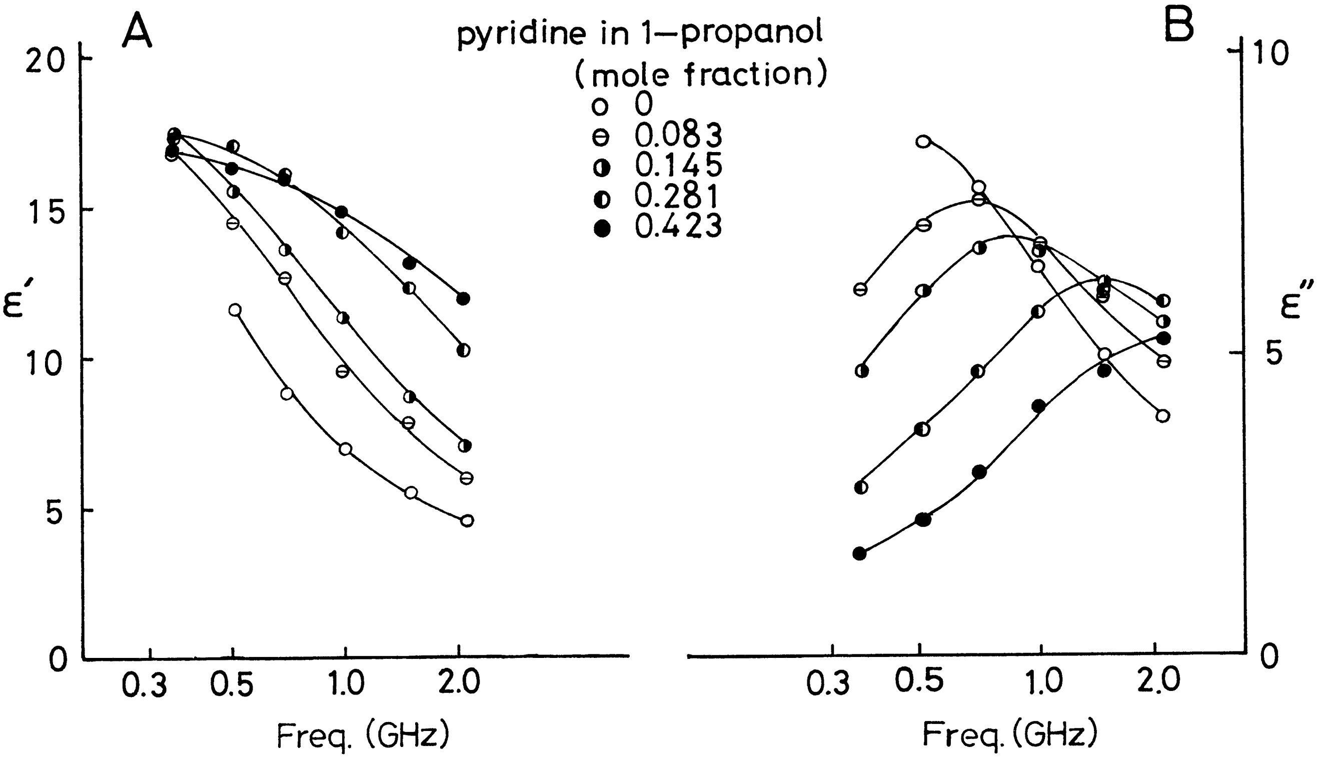

Fig.1 Dielectric constants and losses of 1-propanol–pyridine mixtures

pyridine, the position of the maximum absorption shifts to the higher frequency side and the height of the peak decreases.

The principal relaxation times of 1-, and 2-propanols are obtained from the Cole-Cole plots of ε', ε" values of the solutions. Fig.2 shows a summary of the effects of both dilution and the solvent upon the principal relaxation time thus obtained.

It will be seen from the graph that the points for hydrogen-bonding solvents, pyridine and dioxane, lie in one curve (a), while those for non-hydrogen-bonding solvents, chlorobenzene and benzene, lie in the other curve (b). Both the polarity and the dielectric constant of the solvent play a minor role in affecting the relaxation times. This supports the view that the principal (long) relaxation times (associated with lower frequency dispersion) result from the strong hydrogen bonding between the hydroxyl groups.[1,2]

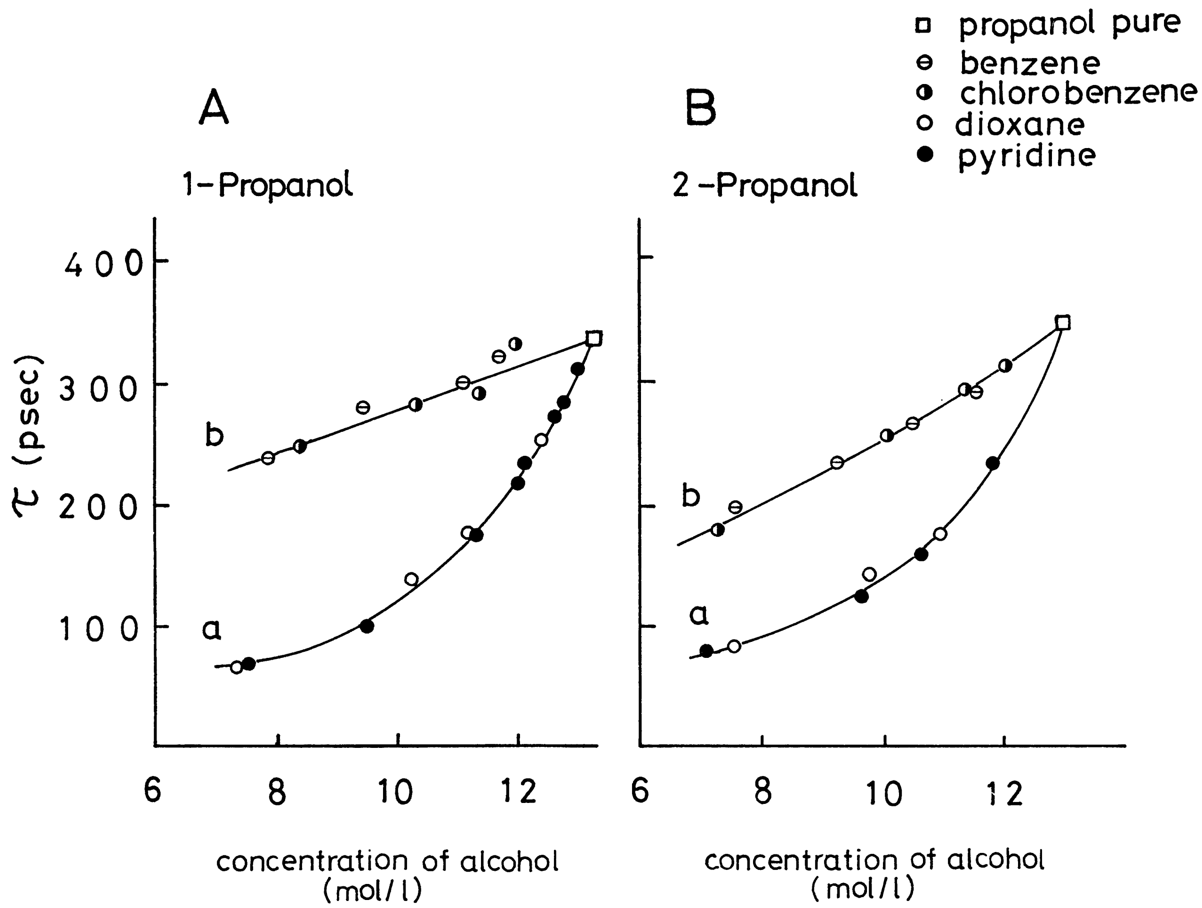

Fig.2 Dependence of the principal relaxation times on the concentration of alcohols

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### References

1) S. K. Garg and C. P. Smyth, J. Phys. Chem., 69, 1294 (1965).

2) J. B. Hasted, in "Dielectric and Related Molecular Processes," ed. M. Davies, The Chemical Society, London. 1, (1972), Chapter 5.

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