

NOTE

Studies on Solute-Solvent Interaction of Different Concentrated Solutions of 3-Hydroxy-6-Chloro-8-Nitroflavanol in 70% Dioxane-Water and Methanol-Water by Viscosity Measurement

P.B. RAGHUWANSHI*, A.G. DOSHI and M.L. NARWADE

*Department of Chemistry
S.S.K.R. Innani Mahavidyalaya
Karanja (Lad), Dist. Akola-444 105, India*

Viscosity measurements have been made on a system comprising 3-hydroxy-6-chloro-8-nitroflavanol in 70% dioxane-water and 70% methanol-water at 32°C. The data have been used to calculate viscosity and B-coefficient. We have also studied the effect of solvent on the viscosity. It has been found that viscosity increases with increase in the percentage of dioxane and methanol. Also, viscosity increased due to increase in the concentration of 3-hydroxy-6-chloro-8-nitroflavanol (ligand solute) in case of solvent dioxane and decreased in case of solvent methanol.

Viscosity is one of the physical properties of liquids and it implies resistance to flow. The significance of viscosity may be further elucidated by considering the flow of a liquid through a narrow pipe. Physical properties of liquid and binary liquid mixture have been the subject of interest in research laboratory¹⁻⁶.

The measurements of viscosities of electrolytes in solution provide an excellent method of obtaining data on solute-solvent and solute-solute interaction. These interactions have been studied by many workers in aqueous and non-aqueous solutions but such investigations in mixed solvents are scanty.

The Jone-Pole⁷ equation accounts for the observed viscosity-concentration dependence of dilute electrolyte solution, while Bresalu Miller⁸, Vand⁹ and Thomson¹⁰ equations account for the concentration dependence of viscosity in concentrated electrolyte solution. The present work deals with the study of interaction of 3-hydroxy-6-chloro-8-nitroflavanol (ligand) in 70% dioxane-water and methanol-water mixtures and also study of effect of percentage of dioxane-water and methanol-water on viscosity by keeping ligand concentration constant.

3-Hydroxy-6-chloro-8-nitroflavanol (ligand) was prepared in the laboratory¹¹ and confirmed by spectral data. Dioxane was purified by standard method of Vogel. Methanol was purified by the reported methods^{12, 13}. Dioxane and water and methanol and water (70%) were mixed by volume and used as solvent. Different percentage of solvent (70, 75, 80 and 85%) were prepared by change in the volume of solvent and keeping the volume of ligand fixed. Solutions of different molarities (1×10^{-6} – 2.5×10^{-6} M) of ligand were prepared fresh by dissolving an appropriate amount in solvent mixture at 32°C. Densities of mixtures were determined by the help of pycnometer having a bulb volume of

10 cm³ and capillary having an internal diameter of 1 mm. Viscosities were measured by means of Ostwald viscometer. Standard error in viscosity measurement was less than 0.2%.

The data of viscosity obtained in the present investigation are presented in Tables 1 and 2. It could be seen from Table-1 that viscosity increases with increase in the percentage of dioxane and methanol solvent. Table-2 shows that viscosity increases in case of dioxane-water due to increase in the concentration of ligand solute because interaction between solute-solvent increases with respect to change in the concentration, whereas viscosity decreases in case of methanol-water due to increase in the concentration of ligand solute because interaction between solute-solvent decreases with respect to change in the concentration.

TABLE-1
VISCOSITY OF 3-HYDROXY-6-CHLORO-8-NITROFLAVANOL IN
DIFFERENT PERCENTAGES OF DIOXANE-WATER AND
METHANOL-WATER AT 305 K

Percentage of solvent	Dioxane-water-ligand viscosity in poise	Methanol-water-ligand viscosity in poise
70	1.9910	1.6542
75	2.1938	1.8117
80	2.3780	2.0007
85	2.5211	2.1673

TABLE-2
VISCOSITY OF 3-HYDROXY-6-CHLORO-8-NITROFLAVANOL IN 70% DIOXANE-
WATER AND METHANOL-WATER MIXTURE AT 305 K

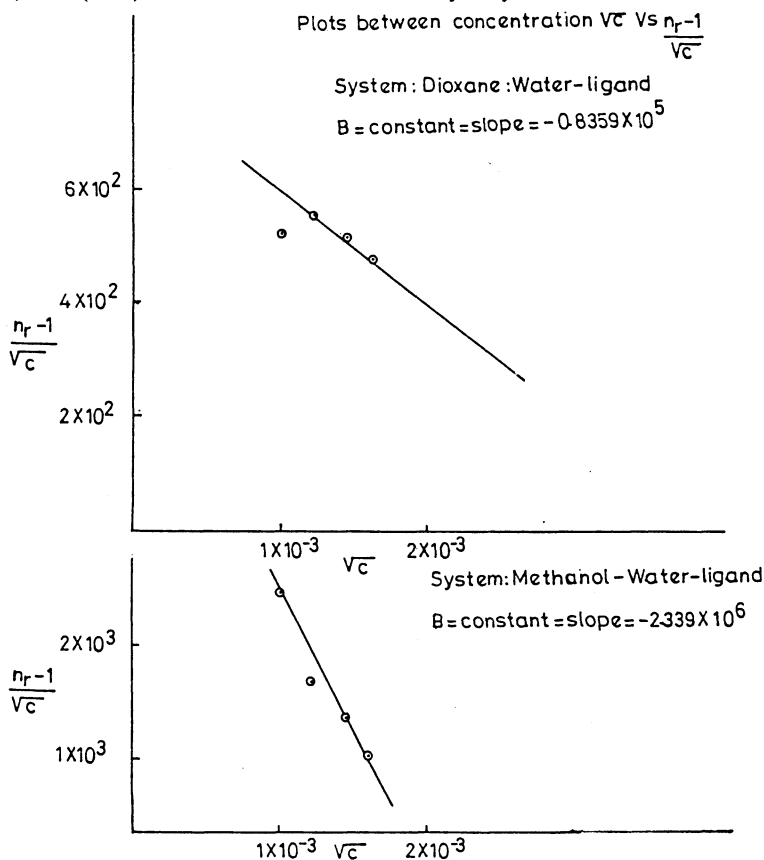
Concentration moles lit ⁻¹	Viscosity in poise	
	70% Dioxane-water	70% Methanol-water
1×10^{-6}	1.6274	1.7216
1.5×10^{-6}	1.7571	1.5815
2×10^{-6}	1.8463	1.5208
2.5×10^{-6}	1.8881	1.4135

B-coefficient value

The relative viscosity (n_r) and specific viscosity ($n_r - 1$) were calculated. Jones-Doles have applied the equation $(n_r - 1)/\sqrt{C} = A + B\sqrt{C}$ and investigated the role of solute-solvent interaction.

In the present investigation negative straight line (*i.e.*, negative slope) is observed in the graph. It shows weaker interaction between solute-solvent which favours the decrease in viscosity because solute particles feebly occupy the pores of solvent.

Mahajan *et al.*¹² have determined B-values of some sulphonic acids and showed stronger interaction between solute-solvent. Sondawale *et al.*¹³ have studied the interaction behaviour of some amino acids of peptides. Recently, Raghuwanshi *et al.*¹⁴ have determined B-value of bromoflavanol and showed weaker interaction between solute-solvent.

Fig. 1 Plots of concentration \sqrt{c} vs. $(n_r - 1)/\sqrt{c}$

REFERENCES

1. S.S. Joshi, T.M. Aminabhai, R.H. Balundgi and S.S. Shukla, *J. Chem. Eng. Data*, **35**, 185 (1990).
2. S.S. Joshi, T.M. Aminabhai and S.S. Shukla, *Canad. J. Chem.*, **68**, 319 (1990).
3. S.S. Joshi and T.M. Aminabhai, *Fluid Phase Equil.*, **60**, 251 (1990).
4. V.A. Aminabhai, T.M. Aminabhai and R.H. Balundgi, *Ind. Eng. Chem. Res.*, **29**, 2106 (1990).
5. M.I. Aralaguppi, T.M. Aminabhai, R.H. Balundgi and S.S. Joshi, *J. Phys. Chem.*, **95**, 5299 (1991).
6. _____, *Fluid Phase Equil.*, **71**, 99 (1991).
7. G. Jones and M. Pole, *J. Am. Chem. Soc.*, **51**, 2950 (1992).
8. B.R. Breslau and J.F. Miller, *J. Phys. Chem.*, **74**, 1056 (1970).
9. V. Vand, *J. Phys. Colloid Sci.*, **20**, 267 (1965).
10. D.J. Thomson, *J. Colloid Sci.*, **20**, 267 (1965).
11. P.B. Raghuvanshi, P.S. Utale and A.G. Doshi, *Oriental J. Chem.* (in press).
12. D.T. Mahajan, Ph.D. Thesis, Amravati University (1997).
13. P.J. Sondawale and M.L. Narwade, *Oriental J. Chem.*, **13**, 169 (1997).
14. P.B. Raghuvanshi, A.G. Doshi and M.L. Narwade, *Oriental J. Chem.*, (in press).

(Received: 1 August 1998; Accepted: 1 June 1999)

AJC-1735