Asian Journal of Chemistry Vol. 15, Nos. 3 & 4 (2003), 1535–1538

Studies on Solute-Solvent Interaction of Different Concentrated Solutions of 1-Carboxamido Pyrazoline in 70% Dioxane-Water and Methanol-Water by Viscosity Measurement

P.B. RAGHUWANSHI*, A.Y. DESHMUKH and A.G. DOSHI

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

Viscosity measurements have been made on a system comprising 1-carboxamido-3-(2′-hydroxy-5′-chlorophenyl)-5-anisyl-Δ^2-pyrazoline in 70% dioxane-water and 70% methanol-water at 30°C. The data have been used to calculate viscosity and β-coefficient. We have also studied the effect of solvent on 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 1-carboxamido-3-(2′-hydroxy-5′-chlorophenyl)-5-anisyl-Δ^2-pyrazoline (ligand solute) in both solvent dioxane and methanol.

Key Words: Solute-solvent interaction, 1-Carboxamido pyrazoline, Viscosity measurement.

INTRODUCTION

Viscosity is one of the physical properties of the liquid and it implies resistance to flow. The significance of viscosity may be further elucidated by considering the flow of liquid through a narrow pipe. Physical properties of liquid and binary liquid mixtures have been the subject to interest in research laboratories[1–6].

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-Pole[7] equation accounts for the observed viscosity-concentration dependence of dilute electrolyte solutions; while Bresalu Miller[8], Vand[9] and Thomson[10] equation accounts for the concentration dependence of viscosity in concentrated electrolyte solutions. The present work deals with the study of interaction of 1-carboxamido-3-(2′-hydroxy-5′-chlorophenyl)-5-anisyl-Δ^2-pyrazoline (ligand) in 70% dioxane-water and methanol-water on viscosity by keeping ligand concentration constant.

EXPERIMENTAL

1-Carboxamido-3-(2′-hydroxy-5′chlorophenyl)-5-anisyl-Δ^2-pyrazoline[11] was prepared in the laboratory and its structure was confirmed by spectral data. Dioxane was purified by standard method of Vogel. Methanol was purified by the method of Nikam and Hasan[12, 13]. Dioxane-water and methanol-water (70%)

were mixed by volume and used as a solvent. The different percentages of solvent (70, 75, 80, 85%) were prepared by change in the volume of solvent and keeping the volume of ligand fixed. The solutions of different molarities (1×10^{-6}–2.5×10^{-6} M) of pyrazoline were prepared fresh by dissolving an appropriate amount in solvent mixture at 30°C. Densities of mixtures were determined by the help of pycnometer having a bulb volume of 10 cm^3 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%.

RESULTS AND DISCUSSION

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 dioxane-water and methanol-water due to increase in the concentration of ligand solute because interaction between solute-solvent increases with respect to change in the concentration.

TABLE-1
VISCOSITY OF 1-CARBOXAMIDO-3-(2'-HYDROXY-5'-CHLOROPHENYL)-5-ANISYL-Δ^2-PYRAZOLINE (LIGAND) IN DIFFERENT PERCENTAGES OF DIOXANE-WATER AND METHANOL-WATER AT 303 K

Percentage of solvent	Dioxane-water-ligand viscosity in poise	Methanol-water-ligand viscosity in poise
70	0.007343	0.01397
75	0.008523	0.01729
80	0.009497	0.01952
85	0.011470	0.02207

TABLE-2
VISCOSITY OF 1-CARBOXAMIDO-3-(2'-HYDROXY-5'-CHLOROPHENYL)-5-ANISYL-Δ^2-PYRAZOLINE (LIGAND) IN 70% DIOXANE-WATER AND METHANOL-WATER MIXTURE AT 303 K

Concentration of ligand (mol lit^{-1})	Viscosity in poise	
	70% dioxane-water	70% methanol-water
1.0×10^{-6}	0.008212	0.01586
1.5×10^{-6}	0.008838	0.01769
2.0×10^{-6}	0.009538	0.01855
2.5×10^{-6}	0.010380	0.01996

β-coefficient value

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

Mahajan *et al.*[12] have determined β-values of some sulphonic acids and showed stronger interaction between solute-solvent. Sondawale *et al.*[13] have studied interaction behaviour of some amino acids of peptides. Raghuwanshi *et al.*[14, 15] have determined β-value of substituted flavanol and showed weaker interaction between solute-solvent.

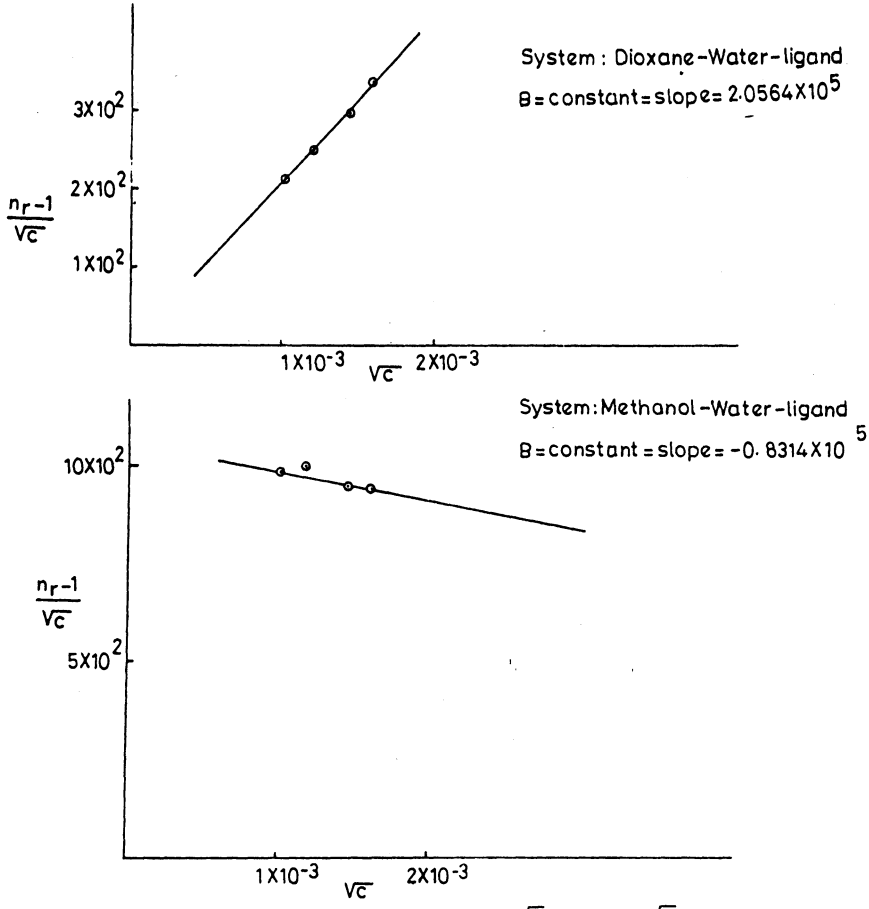

Fig. 1. Plots between concentration $\sqrt{c}$ *vs.* $(n_r - 1)/\sqrt{c}$

In the present investigation positive straight line (*i.e.*, positive slope) is observed in the graph for dioxane-water solvent (Fig. 1). It shows stronger interaction between solute and solvent, which favours an increase in viscosity because solute particles strongly occupy the pores of solvent, whereas in case of methanol-water solvent negative straight line (*i.e.* negative slope) is observed in the graph. It showed weaker interaction between solute and solvent as solute particle feebly occupy the pores of solvent.

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, *Can. 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. Aralguppi, T.M. Aminabhai, R.H. Balundgi and S.S. Joshi, *J. Phys. Chem.*, **95**, 5299 (1991).
6. M.I. Aralaguppi, T.M. Aminabhai and R.H. Balundgi, *Fluid Phase Equil.*, **71**, 99 (1991).
7. G. Jones and M. Pole, *J. Am. Chem.*, **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.*, **25**, 789 (1979).
11. P.B. Raghuwanshi, P.S. Utale and A.G. Doshi, *Asian J. Chem.*, **10**, 597 (1998).
12. D.T. Mahajan, Ph.D. Thesis, Amravati University (1997).
13. P.J. Sondawale and M.L. Narwade, *Orient. J. Chem.*, **13**, 169 (1997).
14. P.B. Raghuwanshi, A.G. Doshi and M.L. Narwade, *Orient. J. Chem.*, **14**, 341 (1998).
15. ———, *Asian J. Chem.*, **11**, 1023 (1999).

(*Received*: 13 January 2003; *Accepted*: 28 April 2003) AJC-3059