DENSITIES AND VISCOSITIES OF MONOCHLOROACETIC ACID IN ETHANOL–WATER MIXTURES

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THE Jones–Dole equation[1]

$$\eta/\eta_0 = 1 + AC^{1/2} + BC \quad (1)$$

accounts for the observed viscosity–concentration dependence of dilute electrolyte solutions. For application to higher concentrations, a quadratic term DC^2 has been included in the Jones–Dole equation[2,3]. The A coefficient is a measure of long range coulombic forces between ions. The B coefficient is an empirical constant qualitatively correlating ion-solvent interactions characteristic for each electrolyte and solvent.

The apparent molar volumes of electrolytes have been calculated for several concentrations of electrolytic solutions from the corresponding density data using the equation[4]

$$\phi_v = \frac{1000(d_0 - d)}{m d d_0} + \frac{M_2}{d} \quad (2)$$

where d is the density of the solution, d_0 the density of the solvent, m the molality of the solution and M_2 the molecular weight of the electrolyte. The density of the solutions obey Root's equation[5]

$$\frac{d - d_0}{C} = A - B\sqrt{C}, \quad (3)$$

where A and B are the constants of Root's equation. The plot of $(d - d_0)/C$ versus $\sqrt{C}$ as expected is linear. Values of A and B evaluated from intercept and slope of the plots are given in table 1.

The Masson equation[6]

$$\phi_v = \phi_v^0 + S_v\sqrt{C} \quad (4)$$

in which ϕ_v^0 is the apparent molar volume at infinite dilution, C is the molar concentration and S_v is the experimental slope, is also applicable to concentrated solutions. These empirical parameters have been employed to indicate the type of ion-ion interaction. The effect of temperature on the limiting apparent molar volume (ϕ_v^0) has been interpreted in terms of the solute-solvent interaction while that on the limiting slope (S_v) in terms of the ion-ion and ion-solvent interactions.

Ethanol–water mixtures were prepared as reported earlier[7]. Densities and viscosities of solutions were measured using calibrated pycknometer ($\pm 0.1\%$) and Ostwald viscometer ($\pm 0.3\%$) respectively in a thermostated paraffin bath of ± 0.1°C thermal stability. The concentration range was from 0.1 to 0.01 M.

The applicability of Jones–Dole equation is shown by the linear plot of $[(\eta/\eta_0) - 1]/\sqrt{C}$ versus $\sqrt{C}$ at all temperatures. The values of constants A and B given by the intercept and slope of the plots respectively are given in table 2. The values of A coefficients are positive in case of monochloroacetic acid solutions in 0, 8 and 16.4 wt.% solvent mixtures. This indicated strong ion-ion interactions, which may be due to unusual cation-cation and cation-anion interactions as suggested by other workers[8,9]. The electrostatic ion-ion interaction and hence A value decreases with decrease in dielectric constant of the medium *i.e.* with an increase in ethanol in the solvent mixtures. This could be due to increased solvation of ions in lower dielectric constant of the medium. As expected A value decreased with the rise in temperature due to more violent thermal agitation at higher temperatures and therefore the force of ion-ion interaction diminishes.

Table 1 *Parameters of Root's equation*

Temp. (°C)	A	B	A	B	A	B
	0% Ethylalcohol		8% Ethylalcohol		16.4% Ethylalcohol	
30	0.070	−0.0647	0.0552	−0.0818	0.0485	−0.03226
32	0.072	−0.06956	0.0558	−0.08271	0.0522	−0.036
34	0.074	−0.06896	0.0556	−0.08421	0.0566	−0.036
36	0.078	−0.07619	0.0594	−0.09412	0.060	−0.05555
	25.3% Ethylalcohol		34.4% Ethylalcohol		54.1% Ethylalcohol	
30	0.0341	−0.01535	0.0506	−0.0444	0.1170	−0.02571
32	0.0317	−0.01107	0.0524	−0.04933	0.1145	−0.250
34	0.0316	−0.01035	0.0490	−0.043	0.131	−0.3157
36	0.034	−0.02182	0.0496	−0.04533	0.133	−0.32

Table 2 *Parameters of Jones–Dole equation*

Temp. (°C)	A	B	A	B	A	B
	0% Ethylalcohol		8% Ethylalcohol		16.4% Ethylalcohol	
30	0.0792	0.02666	0.0208	0.1143	0.0202	0.0423
32	0.0504	0.06	0.0328	0.1230	0.0198	0.05166
34	0.0488	0.07	0.015	0.1314	0.018	0.060
36	0.0486	0.07454	0.012	0.15	0.0232	0.06316
	25.3% Ethylalcohol		34.4% Ethylalcohol		54.1% Ethylalcohol	
30	−0.0199	−0.02953	−0.0247	−0.00976	−0.0085	−0.02143
32	−0.0272	−0.0310	−0.0244	−0.0230	−0.0082	−0.022
34	−0.0214	−0.03383	−0.020	−0.02335	−0.0085	−0.0233
36	−0.0173	−0.03733	−0.027	−0.02764	−0.0053	−0.02764

However A values are negative in electrolyte solutions in 25.3, 34.4 and 54.1 wt % solvent mixtures. Negative A values cannot be explained on Falkenhagen theory.

Table 2 reveals that B values are positive in solutions in 0, 8 and 16.4 wt % solvent mixtures suggesting structure-promoting tendency of added electrolyte. B values coefficients increase continuously with temperature indicating strong ion-solvent interaction at higher temperatures. On the other hand B values are negative in solutions in 25.3, 34.4 and 54.1 wt % solvent mixtures. This clearly indicates that monochloroacetic acid acts as liquid structure breaker. Negative B values increase with temperature (*i.e.* dB/dT is negative) indicate structure-making tendency of added electrolyte at elevated temperatures. The positive B value may also be explained on the basis of the large size of acetate ions.

ϕ_v^0 is a measure of solute-solvent interaction and S_v is a measure of ion-ion interaction. The limiting apparent molar volume (ϕ_v^0) and limiting slope (S_v) for different systems are given in table 3.

Limiting apparent molar volume (ϕ_v^0) values slightly decrease with increase of temperature in solutions in 0, 8 and 16.4 wt % solvent mixtures. This can be attributed to the negligible weakening in already strong solute-solvent interaction with rise in temperature. In monochloroacetic acid solutions in 25.3, 34.4 and 54.1 wt % solvent mixtures the values of ϕ_v^0 are almost constant throughout the temperature range. It may therefore be concluded that ϕ_v^0 values correspond to a maximum suggesting that the solute-solvent interactions are stronger than those of ion-ion interactions in the temperature range 30° to 36°C.

The positive S_v values show that the salt will be appreciably associated and this would result in the weakening of the solute-solvent interaction. In salts containing ions of small radii and compact nature there is no interionic penetration[10]. However in ac-

Table 3 *Parameters of Masson's equation.*

Temp. °C	ϕ_v^0 ($cm^3 mol^{-1}$)	S_v	ϕ_v^0 ($cm^3 mol^{-1}$)	S_v	ϕ_v^0 ($cm^3 mol^{-1}$)	S_v
	0% Ethylalcohol		8% Ethylalcohol		16.4% Ethylalcohol	
30	28.4	54.4	40.0	84.21	40.2	57.14
32	25.6	60.0	39.2	88.0	39.6	57.35
34	23.6	69.56	39.2	88.42	38.2	59.25
36	19.2	76.08	36.8	96.0	35.8	60.0
	25.3% Ethylalcohol		34.4% Ethylalcohol		54.1% Ethylalcohol	
30	64.0	26.0	46.89	48.48	22.6	92.90
32	65.7	12.41	48.0	41.18	24.4	91.85
34	65.5	16.36	48.6	45.55	28.0	89.6
36	65.9	11.82	48.9	45.55	26.8	88.42

etate ion which is quite large, there is a possibility of strong electrostatic ion-ion interaction and therefore positive values of S_v are expected.

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EFFECT OF TRIMETHOPRIM IN TRICHINIASIS OF ALBINO RATS

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TRICHINIASIS has been recognised as one of the important meat borne helminthic zoonoses. A tentatively calculated 27 million cases of trichiniasis in the world, presents a serious challenge to meat hygienists[1]. Depending upon the severity of infection it may serve enough to cause haemorrhage, muscular pain, hypereosinophillia, thrombosis and restlessness. At present there is no proper therapeutic agent for the treatment of trichiniasis. Cortico-steriods and thiabendazole have been found helpful to some extent[2]. Trimethoprim (TMP), a well-established therapeutic agent was reported to serve well in the treatment of some parasitic infections[3,4]. The present communication reports the effect of this drug against trichiniasis induced in albino rats.

Healthy adult male albino rats (laboratory inbred) were inoculated with *Trichinella spiralis* larvae with the help of hypodermic syringe. Larvae were collected from the diaphragmatic-muscle of the post-infected rats (maintained in our laboratory) following digestion method by hydrochloric acid and pepsin solution. After 21 days of post-infection the rats were completely infected, which were used throughout the study. The infected rats were divided into 7 groups of 12 animals in each. Each rat of T_1, T_2, T_3 and T_4 groups received TMP orally at a dose of 10, 20, 30 and 40 mg/kg body weight/day respectively. A group of 12 infected animals (maintained without drug) served as the corresponding control (*C*). Animals of each treated and control groups were sacrificed at weekly intervals and 4 at a time *i.e* four animals of each group were sacrificed at the end of 1st, 2nd and 3rd week. Another group (*T*) of 12 infected rats administered with TMP at a dose of 50 mg/kg body weight/day and sacrificed at monthly intervals and four at a time. The corresponding 12 infected control (C_T) animals were also maintained and sacrificed side by side following the same pattern. Muscle from the leg, intercostal region neck, tongue and diaphragm were collected from each rat and examined for trichinae larvae following digestion method.

Digestion method: The collected muscles were weighed, cut into small pieces and suspended in 1 litre of distilled water containing 10 g pepsin and 5 ml of concentrated hydrochloric acid. The solution was incubated at 37°C and stirred with a mechanical stirrer for 3 hr. At that time muscles were digested, larvae separated from the muscle and deposited. The sediment was caught on a fine muslin screen and the thoroughly washed larvae were taken into saline (0.85%) and counted.

The results showed that TMP at all dose levels progressively reduced the total counts at the early days of the drug treatment but later the intensity of reduction was very slow (figure 1). Although TMP was effective to some extent against the parasitic infection it was found that the counts never became nil, even after 3 months of drug treatment in high doses (figure 2).

It is well established that TMP inhibits folate reductase, a specific enzyme for the conversion of folic acid to tetrahydrofolic acid, a causative agent of one carbon metabolism. Thus TMP indirectly inhibits the protein synthesis to some extent. Though the in-