The granular precipitate obtained was quickly filtered and dried at 45° under vacuum. Products (in sodium salt form) absorb moisture quickly except in the case where $X = -H$; $Y = -NH \cdot Ac$; $Z = -H$. The crude product was dissolved in least amount of water, acidified with hydrochloric acid. The free acid filtered, washed free of chloride ions and air-dried.

The compounds were moderately soluble in water, completely soluble in DMF and insoluble in ether, benzene, absolute alcohol, chloroform, acetone, ethyl acetate, dioxane, hot methanol, CS_2, CCl_4 and sparingly soluble in acetic acid. These were purified by dissolving in least amount of hot DMF, treating with decolourising charcoal and precipitating by dilution with acetone. The process was repeated several times to yield colourless products and the purity was tested by descending paper chromatographic technique. The physico-chemical properties of the compounds are given in Table I.

Preparation of 6 (or 7 or 8)-amino-2-(ω-sarcosino)-3 (or/and 6) sulpho (or disulpho)-1-naphthols (II)

6 (or 7 or 8) acetylamino-2-(ω-sarcosino)-3- (or/ and 6) sulpho (or disulpho)-1-naphthol (100 g) was refluxed gently with 20 ml of 50% hydrochloric acid in 100 ml flask for two hours. To the boiling solution was added 10 ml of 50% hydrochloric acid and the refluxing was continued for two hours. A little decolouring charcoal was added and the contents of the flask were again heated for 10 min. The reaction mixture was then cooled to room temperature, filtered, neutralised with required amount of sodium hydroxide

solution and precipitates of respective amines were filtered, washed well with cold water and air-dried. The compounds are soluble in DMF, moderately soluble in water and insoluble in acetone. These were purified by dissolving in DMF, treating with decolourising charcoal and precipitating by dilution with acetone. The physico-chemical properties of the compounds are given in Table I.

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EVALUATION OF SOUND VELOCITY AND INTERACTION STUDY IN TERNARY LIQUID MIXTURES

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ABSTRACT

Sound velocities have been predicted in the ternary liquid mixtures of chlorobenzene–carbon tetrachloride methanol; chloroform–toluene–acetone; benzene–carbon tetrachloride–*n*-heptane and *n*-butanol–benzene–*n*-hexane at 23° C, in the light of ideal mixing and Nomoto's relations. The relative merits of both relations have been assessed.

INTRODUCTION

NOMOTO'S[1,2] relation and ideal mixing relation[3,4] have been used to evaluate sound velocity of binary liquid mixtures. However, no attempt has been made, so far, to compare the relative merits

of both relations for the evaluation of sound velocities in ternary liquid mixtures. The aim of the present study is to compare the relative merits of Nomoto's relation and ideal mixing relation in the case of ternary solutions. Interaction in binary liquid mixtures have been extensively studied by different workers[5-12]. It

appears from the literature that no attempt has been made to study the interactions in ternary liquid mixtures. Here we have also tried to study the interactions in ternary liquid systems.

THEORY

The Nomoto's emirical relation of sound velocity (u) in binary liquid mixtures has been extended to ternary systems as,

$$R = X_1R_1 + X_2R_2 + X_3R_3 \qquad (1)$$

where R is related to the molecular weight M and density ρ as,

$$R = \frac{M}{\rho} u^{1/3} = v\, u^{1/3}. \qquad (2)$$

The additive molar volume is given by

$$v = X_1V_1 + X_2V_2 + X_3V_3. \qquad (3)$$

In the light of above equations

$$U = \left(\frac{R}{v}\right)^3 = \left(\frac{X_1R_1 + X_1R_2 + X_3R_3}{X_1V_1 + X_2V_2 + X_3V_3}\right)^3. \qquad (4)$$

The deviations from linearity are given by

$$\triangle A = A_{cal} - A_{exp} \qquad (5)$$

where A may be R, u or v.

Van Dael's relation for adiabatic compressibility in the light of Richardsen[14] and Blandamer's[15] assumption can be extended to the ternary mixtures as follows :

$$\beta_{s(1m)} = \phi_1 \frac{\gamma_1}{\gamma_{(1m)}} (\beta_s)_1 + \phi_2 \frac{\gamma_2}{\gamma_{(1m)}} (\beta_s)_2$$
$$+ \phi_3 \frac{\gamma_3}{\gamma_{(1m)}} (\beta_s)_3. \qquad (6)$$

The above equation holds true in the mixtures is an ideal one and also $\gamma_1 = \gamma_2 = \gamma_3 = \gamma_{(1m)}$. Using the additional assumption that $V_1 = V_2 = V_3$; eqn. (6) takes the form

$$\beta_{s\,(1m)} = X_1 (\beta_s)_1 + X_2 (\beta_s)_2 + X_3 (\beta_s)_3. \qquad (7)$$

The sound velocities with eqns. (6) and (7) are respectively,

$$\frac{X_1V_1 + X_2V_2 + X_3V_3}{X_1M_1 + X_2M_2 + X_3M_3} \cdot \frac{1}{u^2_{(im)}} = \phi_1 \frac{V_1}{M_1u_1^2}$$
$$+ \phi_2 \frac{V_1}{M_2u_2^2} + \phi_3 \frac{V_3}{M_3u_3^2} \qquad (8)$$

and

$$\frac{1}{X_1M_1 + X_2M_2 + X_3M_3} \cdot \frac{1}{u^2_{(1m)}} = \frac{X_1}{M_1u_1^2}$$
$$+ \frac{X_2}{M_1u_2^2} + \frac{X_3}{M_3u_3^2} \qquad (9)$$

where ϕ and γ are the volume fraction and principal specific heat ratio respectively and quantities with suffixes 1, 2 and 3 refer to the component liquids, 1, 2 and 3 respectively.

RESULTS AND DISCUSSION

The values of experimental sound velocities and other essential data required for the calculation have been taken from the literature[18]. The experimental sound velocity values were accurate to $\pm 0.50\%$, whereas the density values were accurate to two part to 10^5. Table I enlists the percentage deviation of sound velocity computed from Nomoto's empirical relation $\left(\frac{\triangle u}{u}\right)$ percentage deviation of R and V, along with the experimental and theoretical sound velocities predicted from Nomoto and ideal mixing relation, for all the mixtures under present investigation. An inspection of Table I shows that all the quantities vary with composition of the mixtures. Positive as well as negative deviation in R from additive rule are observed in the case of systems III and IV whereas the deviation are positive at all compositions for the systems I and II. However, $\triangle\%$ in molar volume are positive for the systems I and II while its sign is $+$ve as well as $-$ve for the systems III and IV. An inspection of Table I reveals that U_{Nomoto} values are in better agreement with the experimental values for the systems I and IV, whereas in systems II and III $U_{(1m)}$ is showing better agreement. The ratio of $u^2_{exp}/u^2_{(im)}$ of last column of Table I reveals that the magnitude of $u^2_{exp}/u^2_{(im)}$ is appreciable and more than unity at some composition in case of all systems which conclude for a possibility of molecular interaction in the systems. The molecular interaction in the systems may be due to the presence of strongly polar component, *i.e.*, chloroform, methanol, acetone and toluene in the systems. As it is evident from the variation of magnitude of $u^2_{exp}/u^2_{(im)}$ in system with the variation of composition of polar component that its magnitude is higher at higher concentration of polar component.

On the basis of above discussion it may be concluded that both relations predict sound velocity satisfactory. However, Nomoto's values are in better agreement with observed values. The variation of $u^2_{exp}/u^2_{(im)}$ with mole-fraction can be used to predict the inter-

TABLE I

Maximum percentage deviation of the molecular sound velocity (R), the molar volume (v), from linearity, the maximum percentage deviation of the sound velocity (u) from Nomoto's empirical relation and the ratio u^2_{exp}/u^2_{im}.

Chlorobenzene-Carbon tetrachloride-Methanol (23° C)

Chloro-benzene (X_1)	Carbon tetrachloride (X_2)	$(\Delta U/U)$ (%)	$(\Delta v/v)$ (%)	$(\Delta R/R)$ (%)	u_{exp} (m/s)	U_{Nomoto} (m/s)	u_{im} (m/s)	$\dfrac{u^2_{exp}}{u^2_{im}}$
0·0	0·6	3·11	0·56	1·60	940	970	1010	0·86
0·1	0·5	3·40	0·69	2·35	983	1017	1047	0·88
0·2	0·4	3·29	0·82	1·92	1030	1065	1085	0·90
0·3	0·3	3·49	0·68	1·85	1076	1114	1122	0·91
0·4	0·2	1·59	1·10	1·62	1132	1150	1160	0·95
0·5	0·1	2·01	0·54	1·21	1191	1215	1198	0·98
0·6	0·0	1·57	0·54	1·06	1247	1266	1235	1·01
0·5	0·5	0·97	0·40	0·70	1100	1110	1116	0·97
0·0	0·0	0·00	0·00	0·00	1133	1132	1133	1·00
1·0	0·0	0·00	0·00	0·00	1304	1303	1304	1·00
0·0	1·0	0·00	0·00	0·00	928	928	928	1·00

Chloroform-Toluene-Acetone (23° C)

Chloroform (X_1)	Toluene (X_2)	$(\Delta U/U)$ (%)	$(\Delta v/v)$ (%)	$(\Delta R/R)$ (%)	u_{exp} (m/s)	U_{Nomoto} (m/s)	u_{im} (m/s)	$\dfrac{u^2_{exp}}{u^2_{im}}$
0·0	0·6	−14·64	4·45	0·00	1296	1130	1272	1·03
0·1	0·5	−16·80	0·42	0·04	1242	433	1240	1·00
0·2	0·4	0·08	0·47	1·12	1194	1217	1208	0·97
0·3	0·3	3·28	1·10	2·19	1145	1183	1176	0·94
0·4	0·2	3·70	1·17	2·41	1108	1150	1144	0·93
0·5	0·1	3·42	0·87	2·02	1074	1112	1113	0·93
0·6	0·0	3·71	0·56	1·80	1034	1073	1081	0·91
0·5	0·5	2·93	0·26	1·25	1141	1175	1161	0·96
1·0	0·0	0·00	0·00	0·00	1200	1199	1200	1·00
0·0	1·0	0·00	0·00	0·00	1320	1320	1320	1·00
1·0	0·0	0·00	0·00	0·00	1002	1001	1002	1·00

Benzene-Carbon tetrachloride-Heptane (23° C)

Benzene (X_1)	Carbon tetrachloride (X_2)	$(\Delta U/U)$ (%)	$(\Delta v/v)$ (%)	$(\Delta R/R)$ (%)	u_{exp} (m/s)	U_{Nomoto} (m/s)	U_{im} (m/s)	$\dfrac{u^2_{exp}}{u^2_{im}}$
0·1	0·6	0·73	0·00	—0·29	988	995	982	1·01
0·1	0·5	21·91	—0·52	7·43	1016	1301	1021	0·99
0·2	0·4	—53·86	—12·87	—0·58	1052	684	1059	0·98
0·3	0·3	0·64	−6·04	—0·86	1089	1082	1097	0·98
0·4	0·2	1·63	—0·63	—1·17	1131	1112	1136	0·99
0·5	0·1	3·00	—0·60	—1·60	1179	1145	1090	1·16
0·6	0·0	4·46	—0·49	—1·96	1230	1177	1212	1·02
0·5	0·5	3·29	0·05	1·05	1064	1100	1119	0·90
0·0	0·0	0·00	0·00	0·00	1065	1065	1065	1·00
1·0	0·0	0·30	0·00	0·00	1310	1306	1310	1·00
0·0	1·0	0·00	0·00	0·00	928	928	928	1·00

TABLE I (Contd.)

n-Butanol–Benzene-n-Hexane (23° C)

n-Butanol (X_1)	Benzene (X_2)	($\Delta U/U$) (%)	($\Delta v/v$) (%)	($\Delta R/R$) (%)	u_{exp} (m/s)	U_{Nomoto} (m/s)	u_{im} (m/s)	$\dfrac{u^2_{exp}}{u^2_{im}}$
0·2	0·5	0·08	−0·57	−0·42	1227	1232	1252	0·96
0·3	0·4	−0·07	−0·15	−0·37	1227	1226	1252	0·96
0·4	0·3	0·05	−0·32	−0·29	1226	1226	1252	0·95
0·5	0·2	0·35	−0·19	−0·07	1223	1227	1253	0·95
0·7	0·0	0·12	0·15	0·11	1230	1228	1254	0·96
0·6	0·2	1·23	−0·22	0·19	1243	1258	1274	0·95
0·5	0·5	1·78	−0·27	0·32	1289	1312	1312	0·96
0·0	0·0	0·00	0·00	0·00	1113	1113	1113	1·00
1·0	0·0	0·01	−0·87	0·00	1315	1314	1315	1·00
0·0	1·0	0·84	0·27	0·00	1310	1299	1310	1·00

actions in the ternary solution, especially in these cases where properties other than sound velocity and density are not known.

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EMBRYO IN VALLISNERIA, A QUANTITATIVE STUDY

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ABSTRACT

Histochemical and statistical analyses for nucleic acids, basic as well as sulfhydryl proteins and polysaccharides, reveal that the developing latency of all the cells of either a quadrant or an octant (l and l' tiers) is nearly the same. The facsimile of all the cell derivatives of ca remain exactly alike till the globular stage and metabolites disperse to reappear at the new loci of growth.

THE major organs of the embryo, shoot apical meristem, radicle and cotyledon (one or two), can be traced back to specific sectors formed at the very beginning of embryonic development in angio-sperms. However in the major groups of vascular plants, huge variations exist with respect to the alignment of these quadrants and octants and their role in organogenesis (Maheshwari[1]). According to the