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The study of physico chemical properties of furfuryl propionate in binary liquid mixtures AT 303K

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ABSTRACT

The physico – chemical studies made by ultrasonic velocity in binary liquid mixtures of furfuryl propionate in Butanol & pentanol have been carried out at 303K. The measurement of ultrasound velocity density & other acoustic parameter and other excess values are evaluated. From the excess values of parameters. The nature and extent of the interactions in these binary systems are discussed.

Key words: Physico-chemical properties, binary liquid mixtures.

INTRODUCTION

In current years, ultrasonic technique has become a powerful tool for studying the molecular behavior of liquid mixtures[1-2]. This is because of its ability of characterizing physico chemical properties of liquid medium [3-4].the measurement of ultrasonic velocity have been adequately employed in understanding the molecular interactions in liquid mixtures. Molecular interaction studies can be carried out by both specific [5-6]and non – specific [7-9]techniques. However, ultrasonic velocity[10] and density measurement have been widely used in the field of interaction and structural aspect evaluation studies.

EXPERIMENTAL

The density was measured at 303K using specific gravity bottle by the standard procedure. The ultrasonic velocity was measured at 303K using a single crystal interferometer with a high degree of accuracy operating at a frequency of 2Mhz.

RESULTS AND DISCUSSION

The thermodynamic parameters such as Isentropic Compressibility (β_s), Intermolecular free length (L_f), Molar volume (V_m) and Available volume (V_a) calculated by using the following relatons :

$$\beta_s \frac{1}{v^2 \rho} \quad ...(1)$$

$$L_f = K\sqrt{\beta_s} \quad ...(2)$$

$$V_m \frac{\overline{M}}{\rho} \quad ...(3)$$

$$V_a = V_T \left\{1 - V/V_\infty\right\} \quad ...(4)$$

The excess values were calculated using the formula :

$$A_E = A_{exp} - A_{add}$$

Table I and II shows the value of ultrasonic velocity (V), density (P) and excess isentropic compressibility (β^E_s), excess intermolecular free length (L^E_f), excess molar volume (V^E_s), and excess available volume (V^E_a), for furfuryl propionate + butanol, furfuryl propionate +pentanol at 303K. it is

observed that on increasing mole fraction of furfuryl propionate it decreases the ultrasound velocity for both the studied systems shown in table I & II, β^E_s values are negative which suggest the presence specific interaction between the molecules due more negative for the propionate and higher alcoholic mixtures[11]. β^E_s values are more negative for the butanol system than that of pentanol system. This indicate that the less interaction in former system.

The intermolecular free lenth (L_f) has been calculated by using semi empirical relation give by Jacobson12. Since (L_f) is a derived parameters form δ. The trends in the variation of L^E_f exhibit more or less similar pattern as that of β^{eE} values. The system exhiniting specific interactions. The excess intermolecular free length has negative sign. Which also support the specific interaction between unlike molecules. It is observed that V^E_m is negative which support the work of Marsh & Burfitt[13] and V^E_a values are negative and positive at all mole fractions which indicate the existence of intermolecular interactions between the components[14].

Table 1 : Experimental values of ultrasonic velocity (V), density (ρ) and excess values of isentropic compressibility (β^E_s) intermolecular free length(L^E_F), molar volume (V^E_s), for furfuryl propionate + butanol, pentanol at 303K

Mole Fraction Furfuryl propionate	V (ms^{-1})	ρ (gm/ml.)	ρ^E (gm/ml.)	β^e_s (cm2/dyne 10^{12}.	L^E_F (A°)	V^E_s (ml/mole)	V^E_a (ml/mole)
Furfuryl propionate + butanol							
0.0000	1290.00	0.8624	0.0000	0.00	0.00	0.00	0.00
0.0618	1287.31	0.8740	-0.0008	-1.08	-341.30	-77.23	-4.01
0.1291	1281.56	0.8868	-0.0014	-1.96	-617.00	-149.01	-6.69
0.2026	1274.05	0.9011	-0.0018	-2.78	-877.32	-213.09	-8.93
0.2832	1264.33	0.9169	-0.0022	-3.51	-1106.11	-265.02	-10.62
0.3721	1257.13	0.9346	-0.0023	-4.68	-1472.97	-301.54	-14.61
0.4706	1250.83	0.9545	-0.0021	-6.14	-1933.20	-317.79	-20.05
0.5804	1210.91	0.9769	-0.0016	-4.08	-1286.08	-306.00	-8.59
0.7033	1174.30	1.0019	-0.0012	-2.41	-758.99	-256.08	-1.88
0.8421	1139.41	1.0303	-0.0007	-1.03	-324.87	160.00	0.97
1.0000	1106.00	1.0625	-0.0000	0.00	0.00	0.00	0.00
Furfuryl propionate + Pentanol							
0.0000	1255.00	0.8067	0.0000	0.00	0.00	0.00	0.00
0.0747	1244.04	0.8242	-0.0016	-0.17	-56.19	-130.90	0.86
0.1538	1233.15	0.8438	-0.0022	-0.50	-157.86	-247.79	1.23
0.2375	1221.12	0.8649	-0.0026	-0.74	-234.33	-341.37	1.71
0.3264	1210.91	0.8872	-0.0030	-1.26	-398.03	-407.17	0.73
0.4210	1199.10	0.9113	-0.0031	-1.64	-517.60	-442.54	0.01
0.5216	1183.97	0.9373	-0.0029	-1.67	-526.95	-443.86	0.28
0.6291	1164.93	0.9652	-0.0024	-1.25	-393.64	-405.65	1.57
0.7441	1146.40	1.9950	-0.0020	-0.92	-290.53	-322.61	1.66
0.8674	1127.28	1.0271	-0.0015	-0.56	-177.00	189.49	0.97
1.0000	1106.00	1.0625	-0.0000	0.00	0.00	0.00	0.00

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