

Table 2: Values of Excess Parameters

(The values of excess adiabatic compressibility ($\Delta\beta_{ad}$), excess intermolecular free length (ΔLf) and excess acoustic impedance (ΔZ) along with mole fraction (X) of acetic acid.)

X	$\Delta\beta_{ad}$ (in 10^{-10})	ΔLf (in 10^{-11})	ΔZ (in 10^{+6})
0.000000	0.0000	0.0000	0.0000
0.089100	-0.0787	0.0284	+0.0004
0.171160	0.0216	-0.0094	-0.0112
0.246980	0.0234	-0.0104	-0.0140
0.317240	0.4010	-0.1471	-0.0396
0.553390	0.0665	-0.0263	-0.0240
0.736000	0.1252	-0.0464	-0.0237
0.881440	0.0278	-0.0108	-0.0144
1.000000	0.0000	0.0000	0.0000

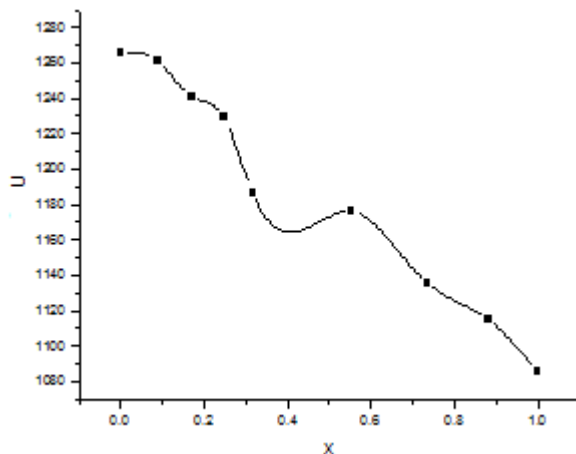


Figure 1

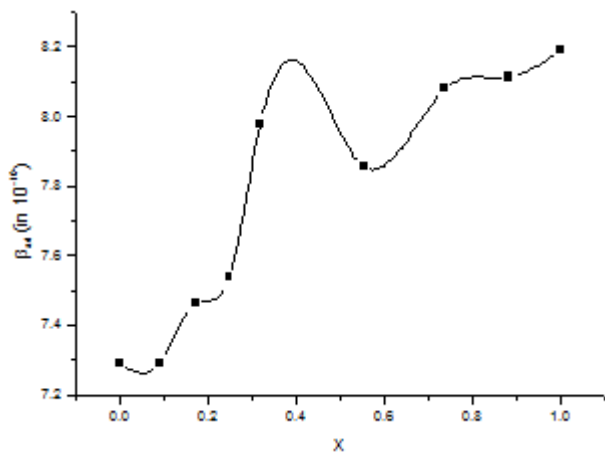


Figure 2

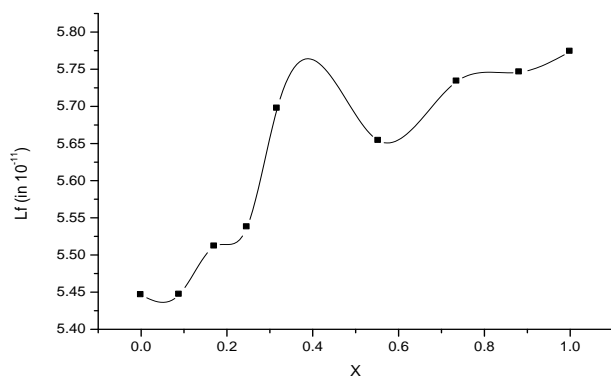


Figure 3

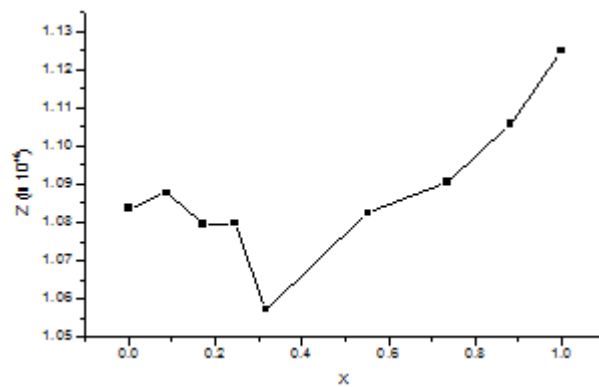


Figure 4

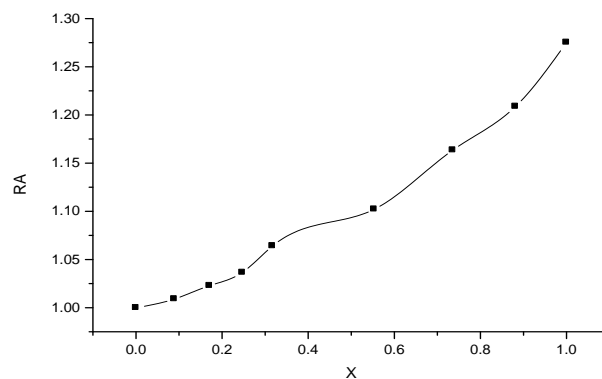


Figure 5

4. Results and Discussion

Values of density (ρ), ultrasonic velocity (U), acoustic compressibility (β_{ad}), intermolecular free length (Lf), acoustic impedance (Z), and relative association (RA) along with mole fraction of acetic acid in toluene are listed in the table (1). The excess parameter of acoustic compressibility, intermolecular free length, and acoustic impedance along with mole fraction of acetic acid in toluene listed in table (2). Also the graphical representation for above said parameter against mole fraction (X) of acetic acid is depicted in figures 1, 2, 3, 4 and 5.

Ultrasonic velocity in medium is depends upon binding forces between the molecules. [7] From the table (1) it is clear that in the system toluene + acetic acid the ultrasonic velocity decreases with increasing mole fractions of acetic acid. The decrease in velocity and increase in compressibility were attributed to the formation of hydrogen bonds between solute and solvent molecules [2].

In fig. (1), it is found that ultrasonic velocity decreases by increasing the mole fraction of acetic acid it is due to decrease in mobility of the solvent (toluene). Decrease in ultrasonic velocity may be attributed to the solute-solvent interaction.

In fig. (2), adiabatic compressibility increases by increase in mole fraction it means there is formation of hydrogen bonds between solute and solvent molecules. [8] Minima in β_{ad} due to there are definite contraction on maxima and variation observed is due to complex formation. [9]

In fig. (3), as mole fraction increases the intermolecular free length also increases. This is due to loose packing of the molecules inside the shield which may be brought by weakening of molecule interaction. Free length depends upon intermolecular attractive and repulsive forces. Its graphical nature same as adiabatic compressibility. [10]

In fig. (4), as mole fraction increases the acoustic impedance decreases. The decrease in specific acoustic impedance indicates significant interaction between the mixing components. The acoustic impedance increases from 0.317240 mole fraction, due to the possibility of molecular interaction between unlike molecules [1]. The acoustic impedance value of pure acetic acid and toluene is greater than acoustic impedance values of its mixtures. At 0.317240 mole fraction the value of acoustic impedance is minimum. [11]

In fig (5), the relative association increases due to increase in mole fraction of acetic acid, proves stronger dipole - induced dipole interaction between unlike molecules which results in contraction of volume. This indicates significance solute-solvent interaction. [12]- [14]

As mole fraction increases the viscosity increases, it means acetic acid is more viscous from table (1). From table (2), the negative values of excess acoustic impedance, shows there is weak molecular interaction existing between unlike molecules. [4] Most of values of excess intermolecular free lengths are negative. It shows sound waves cover long distance due to decrease in intermolecular free length. It means dominant nature of hydrogen bond interaction between unlike molecules. [15] Values of excess adiabatic compressibility shows that weak molecular interaction between unlike molecules of components liquid. [1]

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