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STUDY OF ADIABATIC COMPRESSIBILITY IN A BINARY LIQUID MIXTURE CONTAINING QUINOLINE AND MESITYLENE AT DIFFERENT TEMPERATURES

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Short Profile

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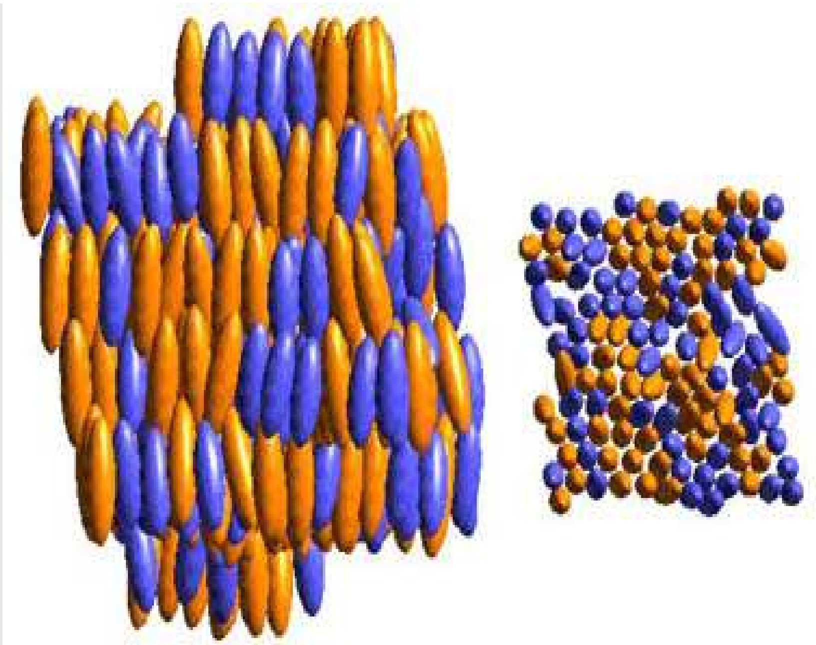

ABSTRACT:
The ultrasonic velocity, density and viscosityvalues have been measured in a binary liquid mixture containing quinoline and mesityleneat different temperatures from 303.15 to 318.15 K over the whole composition range. These measured data have been utilized to determine the adiabatic compressibility (β)and the results obtained here are explained in the light of the molecular interactions between the components of the liquid mixture.

KEYWORDS
Binary liquid mixture, quinoline,mesitylene, adiabatic compressibility.

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INTRODUCTION :

The study of molecular interactions and the variations in these interactions due to structural changes have been carried out by various experimental techniques such as Infrared Spectroscopy technique[1], Nuclear Magnetic Resonance[2-3], Raman[4] spectra and dielectric property measurements[5].But, the complete understanding of the nature of intermolecular and intramolecular interaction may not be possible by any single method. Ultrasonic methods have the added advantage of being less cost with efficiency comparable to other methods. As a part of ongoing research [6-9], we report here the results of ultrasonic study of determination of adiabatic compressibilityin a binary liquid mixture containing heterocyclic aromatic compound such as quinoline with mesitylene over the entire range of composition at different temperatures from T=303.15K to 318.15K.

EXPERIMENTAL PROCEDURE

The chemicals were redistilled and purified by the standard methods described[10.] Liquidmixtures of different known compositions were prepared by mixing measured amounts ofthe pure liquids in cleaned and dried flasks. Ultrasonic velocity was measured by a singlecrystal variable path interferometer (Mittal enterprises) at a frequency of 3 MHz. Theaccuracy of the velocity measurements is ±5 ms-1. The densities of pure liquids and liquidmixtures were measured by employing a specific gravity bottle at all the temperatures andweights were taken to an accuracy of ±0.1 mg.The Viscosities were measured with Ostwald viscometer. The viscometer wascalibrated at each temperature using redistilled water. The measurements were made at allthe temperatures with the help of thermostat with an accuracy of ±0.1K.

THEORY

The adiabatic compressibility (β) has been determined by using the following relation

$$\beta = 1 / \rho \, U^2$$

Where ρ and U are experimentally measured values of density and ultrasonic velocity.

RESULTS & DISCUSSION

Experimentally measured ultrasonic velocities and densities of pure liquidsare compared with the literature values and they are good agreement with each other as given in Table-1 and the determined values of adiabatic compressibility at different temperatures over entire molefraction range are given in Table-2and their corresponding variations are represented in Figure-1.

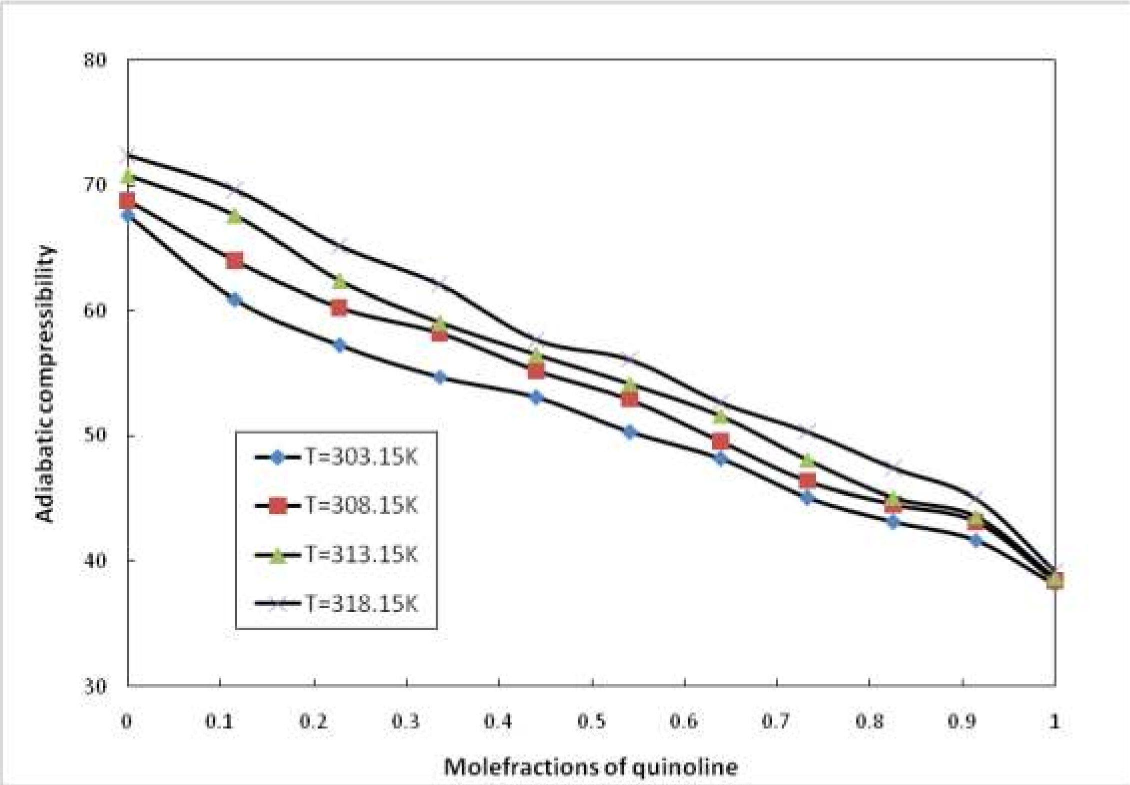
Table-1: Comparison of experimental densities ρ and ultrasonic velocities U of pure liquids with literature values.

Liquids	Density 'ρ' (kg . m^{-3})		Ultrasonic Velocity 'U' (m . s^{-1})	
	Expt	Lit	Expt	Lit
Quinoline	1.0854	1.0857[11]	1553.68	1547[11]
Mesitylene	0. 8563	0.8569[12]	1314.15	1316.82 [12]

Table-2: The values of adiabatic compressibility at different temperatures

Adiabatic compressibility (β) x $10^{-11} m^2 N^{-1}$				
Molefraction of quinoline	T=303.15K	T=308.15K	T=313.15K	T=318.15K
0.0000	67.6214	68.7893	70.8304	72.3907
0.1160	60.9245	63.9851	67.5823	69.6648
0.2280	57.2237	60.2561	62.4044	65.1809
0.3361	54.7408	58.1981	59.0583	62.0451
0.4405	53.0716	55.2021	56.4850	57.6921
0.5415	50.3199	52.9299	54.2111	56.1321
0.6392	48.1777	49.5370	51.6377	52.6597
0.7337	45.0840	46.4075	48.1161	50.3529
0.8253	43.1734	44.5675	45.1301	47.4164
0.9140	41.7062	43.1683	43.6262	45.0254
1.0000	38.1669	38.4316	38.7214	39.1741

Figure-1: Variation of adiabatic compressibility with respect to molefraction at different temperatures



From the table-2 and Figure-1 it is observed that,the value of compressibility decreases withincrease in molefractionof quinoline. Also from the table, it is observed that as the temperature increases the adiabatic compressibility increases in the mixture. Similar observations are made by Ali and Nain13 in their experiment andthey reported that the interactions are stronger at considered lower temperature and become weaker with increase of temperature.

CONCLUSION

The variations of adiabatic compressibility with the mole fraction of quinoline at different temperatures are suggested that the interactions are stronger at considered lower temperature and become weaker with increase of temperature.

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