# THE STUDY OF ULTRASONIC VELOCITY OF MOLECULAR INTRACTIONS IN BENZENE AND 1-BUTANOL AT 303K.

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**ABSTRACT**

The experimental techniques in measuring the density, viscosity and ultrasonic velocity (CW technique) are presented in detail. Further, the theoretical formulae for the evaluation of various acoustical parameters from ultrasound velocity data are briefly given.

**Keywords:** Ultrasonic Interferometer, H-Bond, Density, Viscosity

## INTRODUCTION

This experimental techniques used to measure the ultrasonic velocity, density and viscosity in detail[1]. The basic theory involved in calculating the acoustical parameters has also been outline.

The correctness of any experimental measurements is limited not only by the accuracy of the instrument used, but also to a considerable extent, by the purity of the substances used[2]. Impurities change the behaviour of the liquids and mixtures considerably.

## METHODS AND MATERIALS

**Preparation of Solvent mixture and Measurement of Density, Viscosity and Ultrasonic Velocity**

All the chemicals which have been used for the present study, are analytical reagent (AR) and spectroscopic reagent (SR) grades of minimum assay of 99 % obtained from E-Merk, Germany and Sd fine chemicals, India[3]. Fresh conductivity water was used for preparing a fixed binary solvent mixture of (Benzene + 1-butanol) at varying molality, (say at 0.0M) at 303.15k Aqueous solutions were prepared and used on the day they were prepared. Required amount of Benzene + 1-butanol was taken to prepare binary mixtures in a dry conical flask with a ground stopper. The required quantities of amino acids for a given molality were added in the binary mixture and similar procedure was adapted for other amino acids[4]. The density ($\rho$), viscosity ($\eta$) and ultrasonic velocities (U) of amino acids namely sodium chloride. in aqueous D-glucose solution were measured following the procedures as outlined [5]. The related and relevant parameters correlated to the present study such as adiabatic compressibility ($\beta$), Free length(Lf), internal pressure ($\pi$), impedance(z) benzene and 1-butanol solution and viscosity B-Coefficient of Jones-Dole equation were calculated using the relations[6].

## RESULTS AND DISCUSSION

The observed experimental values of density ($\rho$), viscosity ($\eta$) and ultrasonic velocity (U) Benzene with 1- butanol at varying molality, say (0.00M) at a varying temperatures of 303.15K were calculated. The relevant parameters such as adiabatic compressibility ($\beta$), Free length(Lf), internal pressure ($\pi$), impedance(z) benzene and 1-butanol solution and viscosity B-Coefficient of Jones-Dole equations for the Benzene and 1-butanol at 303.15K are listed in Tables[7]. Similarly Figers represent the variation of density, viscosity and ultrasonic velocity with molality at 303.15K, and depict the variation of adiabatic compressibility ($\beta$),Free length(Lf), internal pressure ($\pi$), impedance(z) benzene and 1-butanol solution with molality at 303.15K[8].

**Table No. 1**

**Value of density (ρ), viscosity (ŋ) and velocity (U) of the Benzene and 1-Butanol solution at 303 k.**

| solution | Density (ρ) kgm⁻³ | Viscosity(ŋ) mnsm⁻² | Velocity(U) ms⁻¹ |
|----------|-------------------|----------------------|-------------------|
| Benzene | 875.33 | 0.785 | 1259.045 |
| 1-Butanol | 812.55 | 2.132 | 1225.062 |

**Table No. 2**

**Values of density (ρ), viscosity (ŋ) and ultrasonic velocity(U) of the Binary mixture of Benzene and 1-Butanol**

| Mole fraction (x) | Density(ρ) kgm⁻³ | Viscosity(ŋ) mnsm⁻² | Velocity(U) ms⁻¹ |
|-------------------|-------------------|----------------------|-------------------|
| 0 | 828.69 | 1.544 | 1236.046 |
| 0.1 | 842.15 | 1.001 | 1232.771 |
| 0.3 | 843.94 | 0.992 | 1230.326 |
| 0.5 | 846.63 | 0.878 | 1231.955 |
| 0.7 | 854.70 | 0.801 | 1234.407 |
| 0.9 | 855.60 | 0.742 | 1238.927 |

**Table No.3**

Values of adiabatic compressibility(β), Free length(Lf), internal pressure(π) and impedance(Z) ofthe Benzene and 1- Butanol
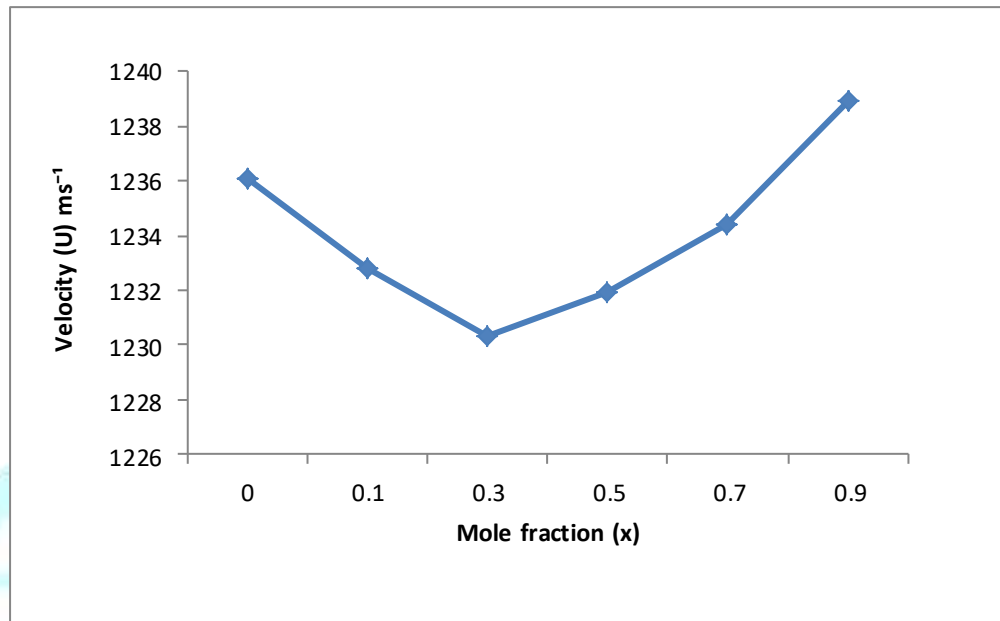
| Mole fraction | β x 10⁻¹⁰pa⁻¹ | Lf x10⁻¹⁰m⁻³ | π x 10⁶pa | Z x 10⁶ |
|---------------|----------------|---------------|------------|----------|
| 0 | 8.205 | 0.571 | 0.249 | 0.994 |
| 0.1 | 7.904 | 0.560 | 0.216 | 1.023 |
| 0.3 | 7.814 | 0.557 | 0.170 | 1.037 |
| 0.5 | 7.836 | 0.558 | 0.168 | 1.038 |
| 0.7 | 7.788 | 0.556 | 0.158 | 1.042 |

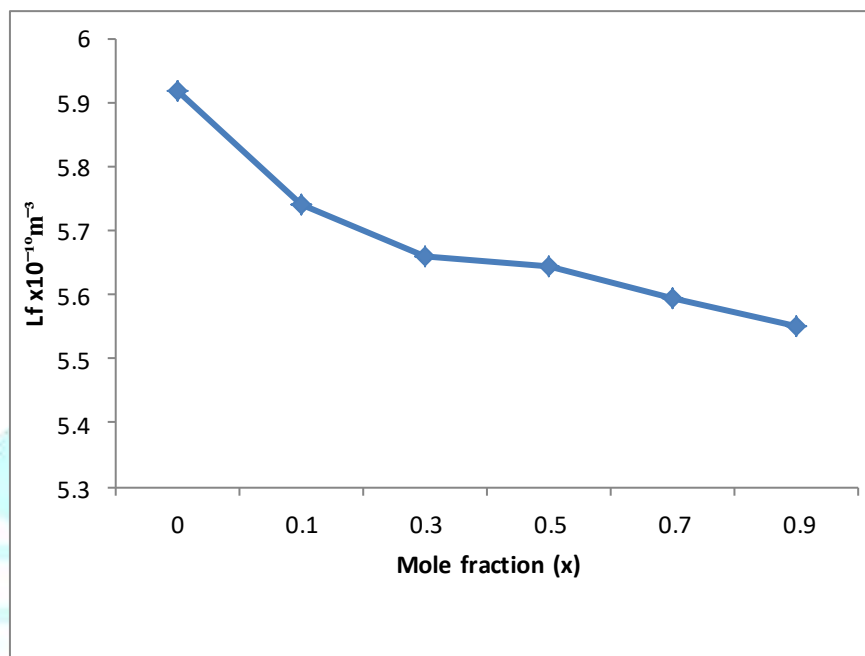| 0.9 | 7.684 | 0.553 | 0.150 | 1.054 |
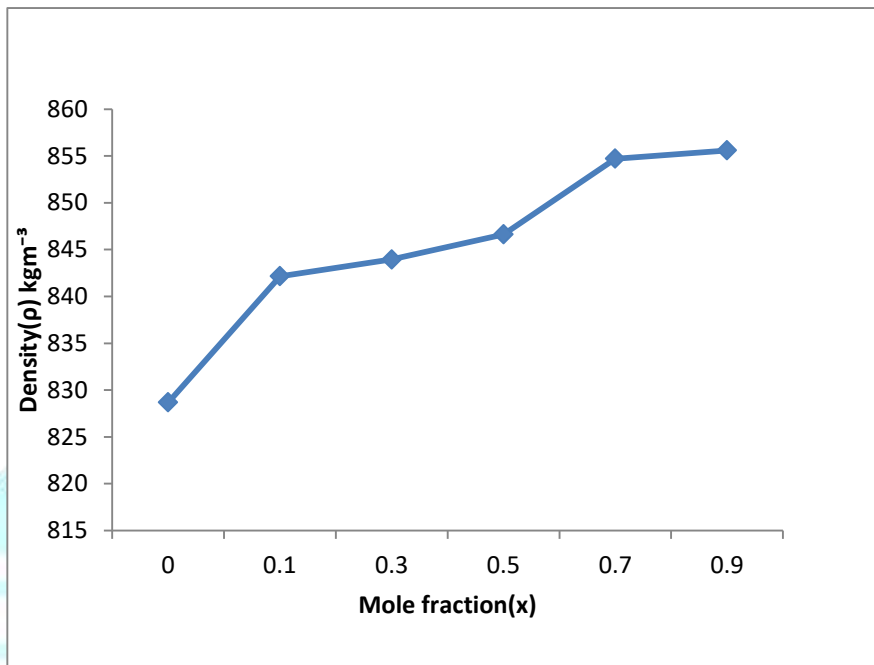


**Graph No.1**
**Variations of density(ρ) of benzene and 1-butanol at 303k.**
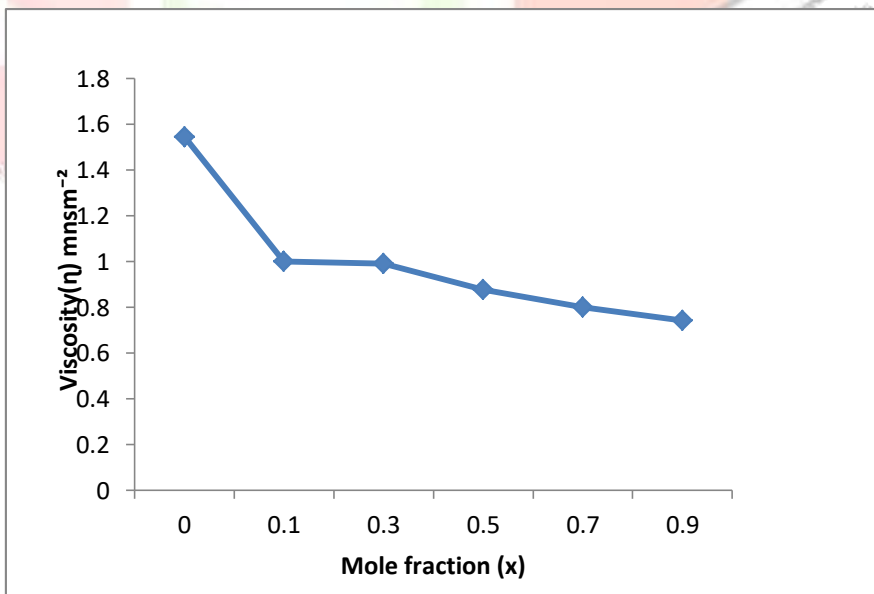
**Graph No.2**

**Variations of viscosity(η) of benzene and 1-butanol at 303k.**



**Graph No.3**

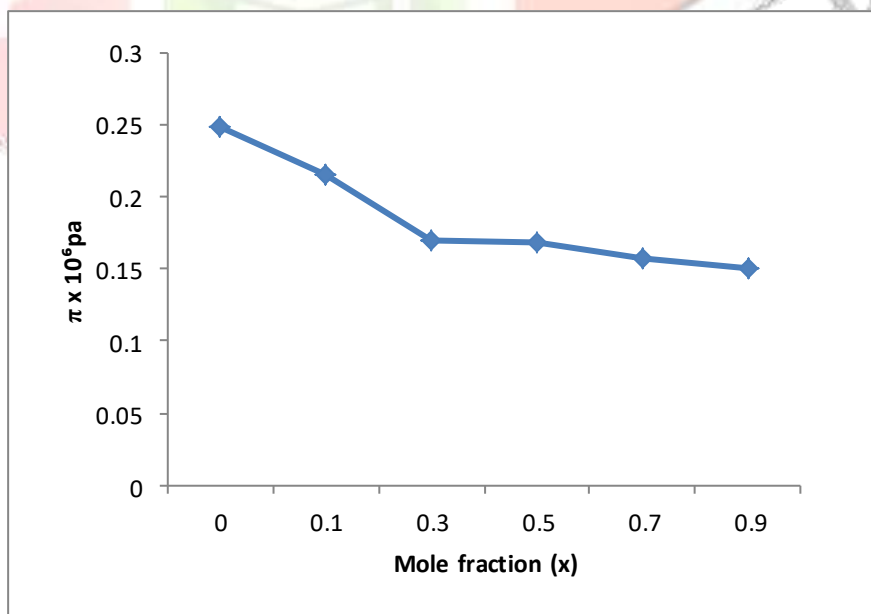**Variations of velocity (U) of benzene and 1-butanol at 303k**
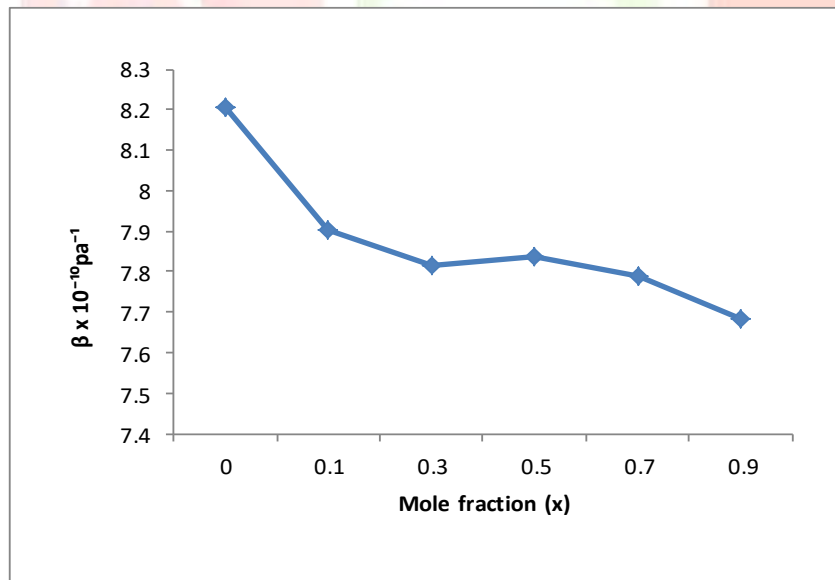
**Graph No.4**

**Variations of adiabatic compressibility (β)
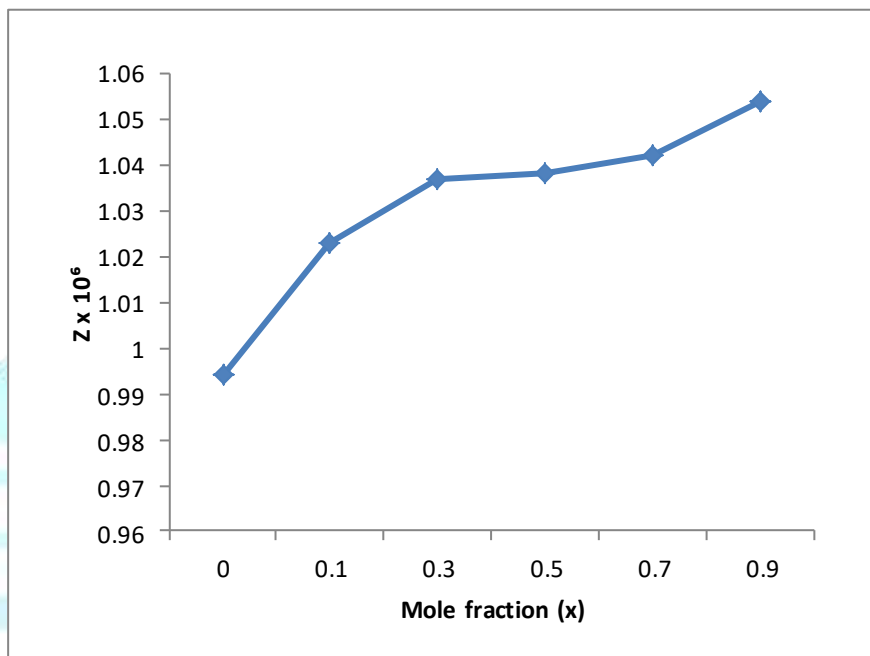of the benzene and 1-butanol at 303k.**



**Graph No.5**

**Variations of free length(Lf) of the benzene
and 1-butonal**

**Graph No.6**

**Variations of Internal pressure (π) of the benzene
and 1-butanol at 303k.**



**Graph No.7**

**variations of Impedance(Z) of the benzene and
1-butanol at 303k**

## CONCLUSION

By exhaustively analysing the behaviour of adiabatic compressibility (β), Free length (Lf), internal pressure (π), impedance (z) benzene and 1-butanol solution of varying temperatures at 303.15K the present investigation has been summarized as

- In the present system of mixtures has been identified as a strong structure-maker in a solution over the other two amino acids[9].
- The partial transfer volume studies predict that ion–ion interactions are prevailing in the present system of mixtures thereby establishing that strong ion-ion interactions are existing in the present study[10].
- The present investigation also observes that a strong
  solute-solvent interactions in the present systems of liquid mixtures[11].

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