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SOLUTE-SOLVENT INTERACTIONS IN WATER SOLUTIONS OF PRIMAQUINE DRUG AT 303 AND 313 K ON ULTRASONIC AND VISCOMETRIC DATA

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ABSTRACT:
In the present study, ultrasonic velocity (υ), density (ρ), and viscosity (η) have been measured at frequency 1 MHz in the binary mixtures of Primaquinewith water in the concentration range (0.1 to 0.0125%) at 303 Kand 313 K using a multifrequency ultrasonic interferometer . The measured value of density, ultrasonic velocity, and viscosity have been used to estimate the acoustical parameters, namely adiabatic compressibility (κ), relaxation time (τ), acoustic impedance (z), free length (L_f), free volume (V_f), and internal pressure (Πi),Wada's constant(W), The obtained results support the complex formation, molecular association by intermolecular hydrogen bonding in the binary liquid mixtures.
Key Words: Primaquine, free volume, acoustical parameters, ultrasonic velocity.

INTRODUCTION:

In the field of technology, the waves are being used to measure depth of sea, directional signaling in submarine, and mechanical cleaning of surface soldering [1-3],and to detect shoals of fish.Acoustic sonograms have become an important medicinal diagnostic tool which is widely used nowadays [4-5]. Ultrasonic waves are used for both diagnosis and therapy. It includes the detection of wide variety of anomalies, such as tumor, bloodless surgery, and proper extraction of broken teeth, cardiology, and stone fragmentation [6]. Ultrasound is more sensitive than X-rays in distinguishing various kinds of tissues. It is believed to be less hazardous than X-rays, although possible hazards of ultrasound have not yet been thoroughly explored [7].. Most of the information extracted from ultrasonic study of fluids is confined to the determination of hydration number and compressibility [8-9]. The successful applications of acoustic methods to physicochemical investigations of solution become possible after the development of adequate theoretical approaches and methods for precise ultrasound velocity measurements in small volumes of liquids [10-12]. In the present paper, acoustical studies have been studied in water at differenttemperatures over a wide range ofPrimaquine concentrations. From the experimental values a number of thermodynamic parameters namely ultrasonic velocity, adiabatic compressibility, acoustic impedance, relaxation time, free length, free volume, internal pressure, Rao's constant, ultrasonic attenuation, cohesive energy, and molar volume, Wada's constant has been calculated. The variation of these parameters with concentration was found to be useful in understanding the nature of interactions between the components [13-16].

MATERIALS AND METHODS

Chemicals were purchased from local commercial suppliers and are of laboratory grade. Primaquine used in the present work was of analytical reagent (AR) grade with a minimum assay of 99.9%, Solution of different concentration ofPrimaquine were prepared by water as solvent. The ultrasonic velocity (υ) has been measured in ultrasonic interferometer Mittal Model-F-05 with an accuracy of 0.1%.The basic parameterυ, η, and ρ were measured at various concentrations (0.1 to 0.0125%) and temperatures(303K& 313 K).The various acoustical parameters were calculated from υ, η, and ρ values using standard formulas. On using ultrasonic velocity ,density and viscosity the following acoustical parameters like adiabatic compressibility(κ) [17] , intermolecular free length[18] (Lf) , relaxation time [19] (Ʈ), free volume [20] (V_f) , internal pressure [21] (Πi) , acoustic impedance [22] (Z), Wada's constant [23] (W), ultrasonic attenuation [24] (α/f^2), Rao's constant [25] (R), molar volume (Vm), and cohesive energy (CE) were calculated by applying the following expressions.

RESULT AND DISCUSSION

The measured values of ultrasonic velocity, density and related thermo-acoustical parameters like adiabatic compressibility (κ), intermolecular free length (L_f) , relaxation time (Ʈ), free volume (V_f) , internal pressure (Πi) , acoustic impedance (Z), Wada's constant (W), ultrasonic attenuation (α/f^2), Rao's constant

(R), molar volume (Vm),cohesive energy (CE) ofPrimaquine with water at 303 K, 313 K in different concentrations are shown in figure 1 to 14.

Figure: The following figures shows the variation of various acoustical parameters with concentration and temperature

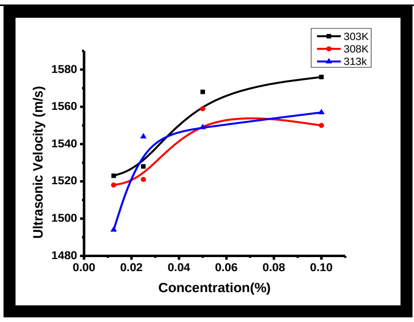

Fig.1:-Variation of Ultrasonic velocity with concentration and temperature

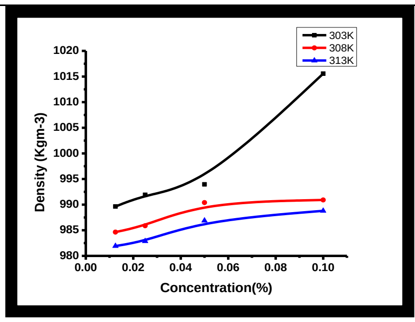

Fig.2:-Variation of Density with concentration and temperature.

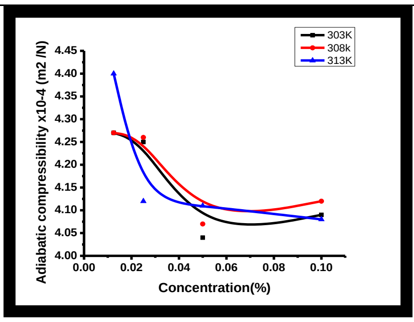

Fig.3:-Variation of Adiabatic compressibility with concentration and temperature

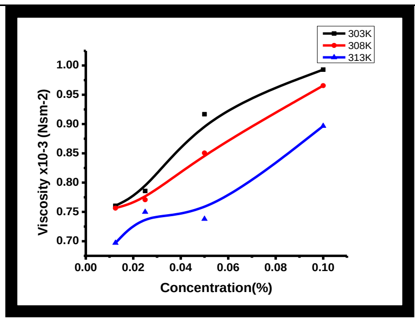

Fig.4:-Variation of Viscosity with concentration and temperature

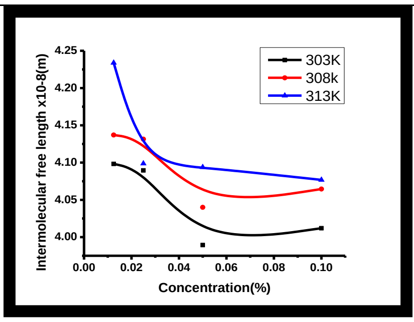

Fig.5:-Variation of Intermolecular free length with concentration and temperature

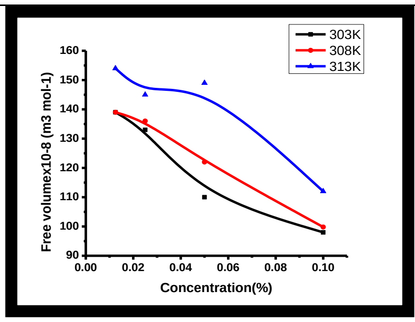

Fig.6:-Variation of free volume with concentration and temperature

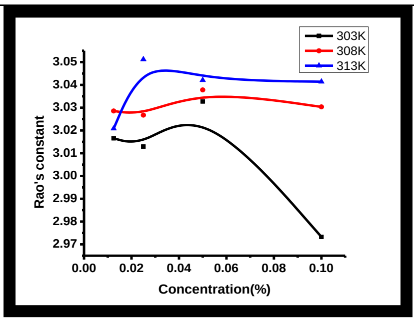

Fig.7:-Variation of Rao's constant with concentration and temperature

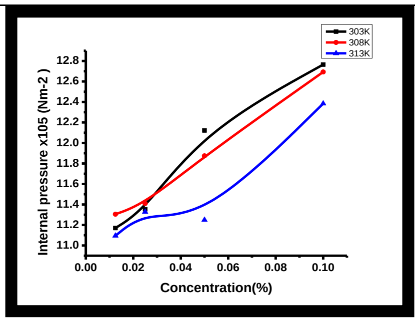

Fig.8:-Variation of Internal Pressure with concentration and temperature

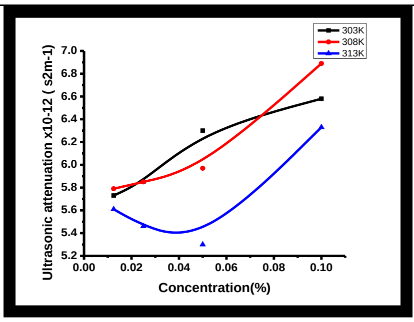

Fig.9:-Variation of Ultrasonic attenuation with concentration and temperature

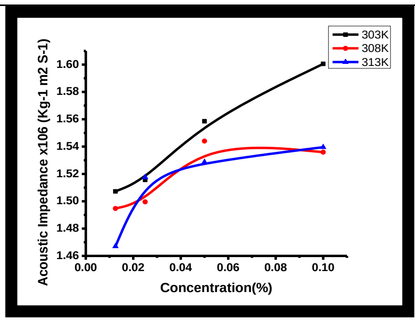

Fig.10:-Variation of Acoustic Impedance with concentration and temperature

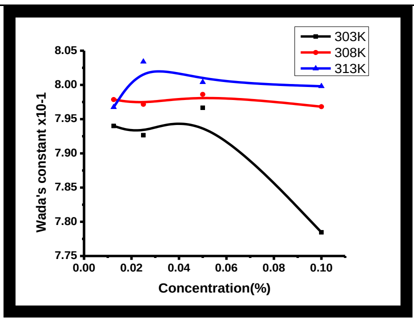

Fig.11:-Variation of Wada's constant with concentration and temperature

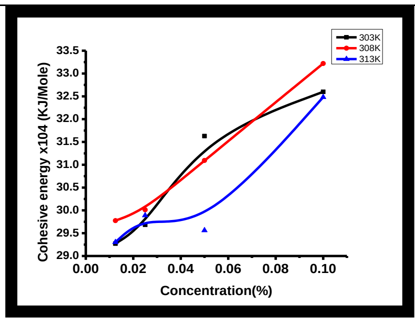

Fig.12:-Variation of Cohesive energy with concentration and temperature

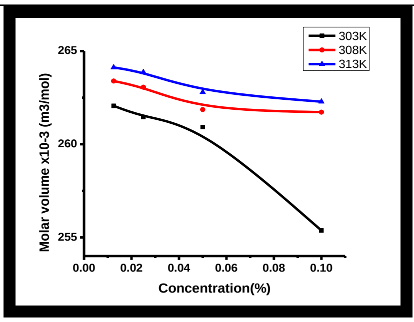

Fig.13:-Variation of Molar volume with concentration and temperature

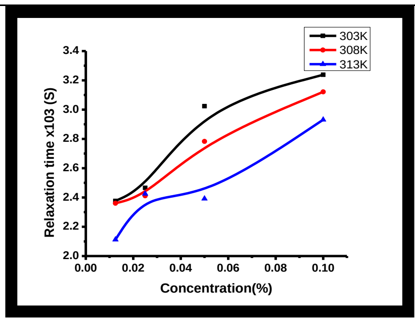

Fig.14:-Variation of Relaxation time with concentration and temperature

CONCLUSION

In the present paper the ultrasonic velocity(υ), density, viscosity and acoustical parameters, viz. adiabatic compressibility ,intermolecular free length, relaxation time, acoustic impedance , attenuation, Rao's constant, molar volume, cohesive energy, Wada's constant have been measured at different concentrations. The parameters indicate that there is a strong molecularinteraction between unlike molecules as the concentration of drug solution increases. The molecular interaction decreases with an increase in temperature.

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