Acoustical studies of aqueous dextran at various frequencies

Subhraraj Panda

Department of Physics, Centurion University of Technology and Management, Odisha, India

E-mail: subhraraj4u@gmail.com

ABSTRACT

In recent years, ultrasonic velocity calculation has been helpful in the understanding of solvent-solute, solvent-solvent interaction in an aqueous medium. The "ultrasonic speed (U), density (ρ) and viscosity (η)" at 323 K have been determined using ultrasonic interferometer at four different frequencies *i.e.* "1MHz, 5MHz, 9MHz and 12 MHz", pycnometer and Ostwald's viscometer of dextran in aqueous medium respectively. The derived acoustical parameters such as "Acoustic impedance (Z), Adiabatic Compressibility (β), Intermolecular free length (L_f), Relaxation time (τ), Gibb's free energy (ΔG)"have been determined from experimental data. Molecular interactions in aqueous dextran in terms of these thermo-acoustical parameters have been discussed.

Key Words: Molecular interaction, density, viscosity, frequency

Introduction

In determining the molecular structure and molecular properties of different solutions, there are many physical methods that play significant roles. The progress in ultrasonic technique has become a powerful tool in recent years in analyzing knowledge about the physical and chemical behavior of liquid molecules. The ultrasonic analysis of liquid mixtures made up of polar and non-polar components is of greater significance in understanding the intermolecular interaction between the molecules of components and they find many applications in industrial and technical processes.

In this study, "ultrasonic speed (U), density (ρ) and viscosity (η)" values of aqueous dextran over the concentration percent ranges like "0.1%, 0.25%, 0.50%, 0.75% and 1%" have been measured and reported at "1MHz, 5MHz, 9MHz and 12 MHz" at 323 K temperature. The other thermodynamic parameters like "Acoustic impedance (Z), Adiabatic Compressibility (β), Intermolecular free length (L_f), Relaxation time (τ), Gibb's free energy (ΔG)" are also evaluated and reported. The variation of these parameters with concentration and frequency of the solution are studied in terms of molecular interaction between molecules of the solution. Studies in predicting the nature and frequency of molecular interaction in the liquid medium have proved to be enormous.

Dextran is a α-D-1, 6-glucose connected glucan with side chains-3 linked to the spine units of the polymer. We have chosen a polymer dextran as a solute with distilled water as a solvent. This is the only polymer which is water soluble. It has involved a different region of examinations by analysts due to its flexible pharmaceutical, biomedical and modern application

EXPERIMENTAL SECTION

Materials

The dextran solution has been prepared by taking freshly prepared distilled water. The dextran 70,000 was used as a solute in different concentration percent ranges.