



UNDERSTANDING STRUCTURE OF WATER BY ULTRASONIC MEASUREMENTS IN AQUEOUS AND 10% ETHANOL-WATER SOLUTIONS OF FRUCTOSE AT THREE DIFFERENT TEMPERATURES

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ABSTRACT

Ultrasonic velocity (U) and density have been measured experimentally for aqueous solution of fructose and 10% ethanol-water solutions at concentration range (0.1M-0.9M) and at temperatures (298, 303 and 308K). The acoustic parameter such as adiabatic compressibility (β) has been worked out. The results are correlated in terms of structure of water described to the cage like structures of water and secondary molecular interaction between the solute and solvent molecules of the medium

Keywords: Ultrasonic velocity, Adiabatic compressibility, fructose, Ethanol-water

1. Introduction

Ultrasonic velocity of pure liquids and liquid mixtures are basically correlated to the secondary forces (hydrogen bonding, Vander Waal's forces and dispersion forces) between molecules and atoms¹. Ultrasound analysis provides extensive applications in characterizing thermodynamic and physiochemical behavior of liquid mixture². The study of the carbohydrates or saccharides has become a subject of growing curiosity because of multidimensional, physical, biochemical and scientifically used molecule³⁻⁶. The ultrasonic velocity in a liquid is basically related to the binding forces between the atoms or molecules and has been effectively employed in understanding the nature of molecular

interactions in pure liquids and binary and ternary mixtures⁷⁻⁹. Carbohydrates displayed on the surface of cells play critical roles in cell-cell recognition, adhesion, signaling between cells, and as markers for disease progression. Neural cells use carbohydrates to facilitate development and regeneration¹⁰. Viruses identify carbohydrates to get entry into host cells¹¹; and bacteria attach to carbohydrates for host cell adhesion¹². Recognition of the specific saccharides involved in these processes is important to better understand cell-cell recognition at the molecular level and to assist the design of therapeutic and diagnostic tools.

2. Experimental

The solutions of fructose were prepared by dilution method. All the chemicals are of AR grades of 99.99 % purity. Composition range of Fructose is from 0.1 M to 0.9M in aqueous and in 10% ethanol-water solvent systems. The ultrasonic velocity in the liquid mixtures have been measured by means of ultrasonic interferometer (Mittal type: Model: M-83) functioning at frequency 3MHz with an overall accuracy of ± 0.1 m/s, an electronically digital operate constant temperature water bath has been used to flow water through the double walled measuring cell, made up of a steel containing the experimental solution at the preferred temperature. For weighing, an electronic digital balance with an accuracy of ± 0.1 mg was used. Densities were measured