THERMODYNAMIC AND ULTRASONIC STUDY OF L-VALINE IN AQUEOUS POTASSIUM CHLORIDE SALT

V.A. Giratkar[1*], R.B.Lanjewar[2], S.M.Gadegone[3], M.R. Lanjewar[4]
giratkar.vandana@gmail.com
[1]Department of Chemistry, Sardar Patel College, Chandrapur, 442403, Maharashtra, India
[2]Department of Chemistry, M.P. Deo Memorial Science College, Nagpur, Maharashtra, India
[3]Department of Chemistry, Kamla Nehru College, Nagpur, Maharashtra, India
[4].Department of Chemistry, R.T.M. Nagpur University, Nagpur 440033 , India

Abstract

The experimentally measured parameters like density (ρ), viscosity (η) and ultrasonic velocity (u) of L-Valine of different concentrations in 2% of KCl solutions have been measured at different temperatures. These parameters were used to calculate thermodynamic parameters like adiabatic compressibility (β_a), intermolecular free length (L_f), acoustic impedance (Z), internal pressure (π_i), relaxation time (τ), Gibb's free energy (ΔG), Rao's constant (R), Wada's constant (W) and molecular radius (ro).The study of these parameters shows the existence of intermolecular interaction in the present system.

Keywords: L-Valine, Ultrasonic velocity, thermodynamic parameters, inter molecular interactions

INTRODUCTION

The study of interactions such as hydrogen bonding, electrostatic interactions,and hydrophobic interaction of proteins with salt is important since it explains the conformational stability and unfolding behavior of globular proteins. But proteins are complex molecules of large molecular weights. Hence their direct study is difficult and tedious. Hence study of such the interactions in the systems of amino acids and peptides can be done to reducecomplexity and also it requires less complex measurements techniques [1]. Physicochemical properties of amino acids in aqueous and aqueous electrolytes media finds variety of application in various fields of sciences [2].

L-Valine is an essential non- proteinogenic amino acidwhich helps to remove extra nitrogen from liver and also stimulate muscle growth and the central nervous system. It helps in repairing damaged tissues, promotes normal growth and provides energy to cells. It regulates blood sugar level. It is non-polar in nature and found inside a protein structure to protect it from water. Deficiency of L-valine causes degenerative nerve diseases. Some of the studies on interaction of Valine in aqueous electrolytic solutions have been carried by few researchers [3-5].

MATERIALS AND METHODS

The compound L-Valine(purity 99%) CAS No. 72-18-4, molecular weight 117.146 was obtained from HIMEDIA India Ltd and was used as supplied. The digital balance having an accuracy of ±0.1mg was used for the measurement of weights. The fresh L-Valine solutions under the study of different concentration in 2% aqueous KCl solution were prepared. The densities of the solutions were measured by specific gravity bottle by relative measurement method with an accuracy of ±0.1 $kg.m^{-3}$at constant temperature using digital constant temperature water bath having an accuracy of ±0.1K. The viscosity measurements were done by using Ostwald's viscometer. The ultrasonic velocity of solvent and solution of different concentration at different temperature range (288.15 K to 303.15 K) were measured by using digital ultrasonic interferometer at frequency 2MHz (VI Microsystems Pvt. Ltd. Perungudi, Chennai) with an accuracy of ±0.1%.