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Ultrasonic Velocity and Jones-Dole Equation B Coefficients for Aqueous Solution of Piperacillin and Tazobactam at Different Temperatures

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ABSTRACT

The acoustic and viscometric study of aqueous solution of Piperacillin and Tazobactam is carried out. This study was carried out at 298.15 K. The accurately measured viscosity values were used to calculate Jhon-Dole coefficient A and B. The viscometric and acoustic parameters are useful for understanding the different types of interactions of drugs in solution. The effect of solute on solvent is predicted from coefficient constant A and B.

Keywords : Acoustic, Jhon-Dole, Piperacillin ,Tazobactam

I. INTRODUCTION

To study the physical, chemical and thermodynamic properties of thepolymeric solutions, liquids, liquid mixtures and electrolytic solutions Ultrasonic and viscometry study is useful[1-2]. Jones-Dole viscosity coefficients 'A' and 'B' are very useful in predicting the type and extent of molecular interactions present in the solution. The Jones–Dole B coefficient [3] is often used to classify ions as either structure-makers (kosmotropes) or structure-breakers (chaotropes) according to their supposed strengthening or weakening of the hydrogen-bond network of water [4-5].

$$\eta / \eta_o = 1 + Ac^{1/2} + BC$$

The constant A is related to the long-range interionic [6-8] and the term Ac1I2 is predominant in very dilute solutions. The coefficient B is related to the interaction between the ions and the solvent and is interpreted as a measure of the structure forming and structure-breaking capacity of an electrolyte in solution [9].

In the present study ultrasonic velocity and viscosity of aqueous solution of Piperacillin and Tazobactamin is measured at different temperatures . From the viscosity coefficient A and B molecular interaction is predicted.

II. Experimental

The ultrasonic velocity (U) of Piperacillin and Tazobactam in aqueous solution which prepared by taking purified AR grade samples, have been measured using an ultrasonic interferometer (Mittal type, Model F-81) working at 2MHz frequency and at different . The accuracy of sound velocity was ±0.1 ms-1. An electronically

digital operated constant temperature water bath has been used to circulate water through the double walled measuring cell made up of steel containing the experimental solution at the desire temperature. The density of pure liquids and liquid mixtures was determined using density bottle by relative measurement method with an accuracy of ±0.1Kgm-3. The viscosities of the solution is determined by using Ostwald's viscometer.

III. Result and Discussion

With increase in concentration ultrasonic velocity increases shows that strong interaction exist in the solution in aqueous solution ultrasonic velocity is more at 303.15K compared to 298.15K , indicates strong molecular interaction in aqueous solution. Positive values of 'A' show the presence of strong solute-solute interactions while negative values of 'B' show weak solute-solvent interactions at low temperature. A negative B-ionic coefficient indicates that the ion is a 'structure breaker' and a positive B-ionic viscosity coefficient indicates that the ion is a 'structure former'[10].in the present study it is seen that from the value the B- coefficient is positive for both temperature suggesting structure making property of ions with strong solute solvent interaction present in the solution. Also the value of A- coefficient indicates strong interaction exist in the solution. at 303.15K strong solute –solvent interaction is observed.

Table 1 : Ultrasonic Velocity, Viscosity, jones -Dole Coefficient of Aqueous Solution of Piperacillin and Tazobactam at Different Temperatures

Concentration	Ultrasonic Velocity (m/s)	Density (Kg)	Viscosity $*10^{-3}$	Relative Viscosity	Coefficient A	Coefficient B
At 298.15K						
0.001	1632.33	1512.66	0.346	-0.61124	-0.0165	0.0513
0.01	1581.66	1508.30	0.389	-0.56292		
0.1	1521.30	1505.40	0.409	-0.54045		
At 303.15K						
0.001	1645.36	1514.21	0.334	-0.62472	-0.0168	0.0524
0.01	1598.63	1510.98	0.392	-0.55955		
0.1	1543.58	1507.32	0.412	-0.53708		

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