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Partial Molar Volumes and Viscosity B-coefficents of Glycine in aqueous Medium At 25, 30, and 40^{o}C

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ABSTRACT

Thermodynamic properties like partial molar volume ($\Phi^o{}_v$) and B-coefficent of glycine has been determined at 25^o,30o, 35o and 40oC in an aqueous medium. The purpose of the present communication is i). To report data in aqueous medium at different temperture and concentration ii) To disscuss $\Phi^o{}_v$, B- coefficent and $B/\Phi^0{}_v$ and its dependence on temperture from the viewpoint of structrure- breaking/ making capacity of the glycine from $\delta^2\Phi^o{}_v/\delta t^2$.

Keywords: Molar voiume, B- coefficent, different temp.

INTRODUCTION

Amino acids have been used as a model compound because they represent the fundamental substances for building proteins[1-9]. However, it is recognised that amino acids in aqueous solution have two oppositly charged carboxyl and amino groups that may interfere with the adjacent amino acid side chain. thus the amino acids are necessarely the suitable model compounds for understanding the group contribution to the thermodynamic properties of protein hydration. Several biologial processes invove expansion or contraction of protein molecules resulting from temperature and pressure variation in the living system. Such prossesses include fever, hypothermia, anesthesia, etc. [10,11] and study of these processes requires fundamental imformation about volumetric properties of proteins. Amino acids are models well suited for the estimation of volumes and relataed properties of proteins .Volumetric properties of solute, such as partial molar volume and viscosity B-coefficient, are known to be sensitive to the nature of salvation. Further, salvation effects are known to be very sensitive to temperaure. However, it seems to at the present studies have been done to understand the salvation behaviors of the amino acids in aqueous medium.

MATERIALS AND METHODS

Glycine of analar R grade is used without any further purification double distilled deionised and and degassed water with a specific conductance of 2-3×10^{-6}. Mhos was used a mettle balance which can read up to 5th place of decimal, was used for weighing. All weighings were done to within ±0.01mg.

The nesessery buoyancy correction was applied . density of different solutions were determined by using 15cm^3double arm pyknometer. The pyknometer was caliberated using double distilled water . density values were reproducible with in ±0.02gm/ml.

The mesurement of relative viscosiy were made with a Schott- Gerate AVS -350 unit. The viscometer was calibrated, and two constant C and B OF The viscometer in the equation n/d =ct-Bt were obtained by measuring the flo time t with pure water , bebzene and cyclohehane at 30^0c. The temperature of the solution was maintained constant by circulating water coming from a thermostat (julabo F-25-Jarmany made).

RESULTS AND DISCUSSION

The apparent molar volume Φ_v of glycine is determined in an aqueous solution at four different temperatures. The density of glycine in aqueous medium and Φ_v values of glycine at four different temperatures have been presented in table(1). The solute- solvent interaction is guessed from the magnitude of partial molar volume Φ^o_v, which is apparent molar volume at infinite dilution.

$$\Phi_v=\Phi^o_v+\mathbf{S}_v m \qquad (1)$$

Where m is the molarity of solute and S_v depends on the solute solvent interaction because it is the variation of Φ_v with concentration of solut. The variation of Φ_v is linear. The derived Φ^0_v value along with S_v parameter of glycine are set out in table(2)

VARIATION OF Φ^0_v WITH THE TEMPERATURE:-

In the present stusy Φ^0_v increases in temperature . the increase in Φ^0_v for electrolyte are attributed to increase in solvation . our Φ^0_v values are in good aggriment with the literature value [12-17].

The apparent molar expansibilities were

$$\Phi^0_{E=}[\delta\, \Phi^0_v /\delta t] \qquad (2)$$

Calculated from equation (2). The Φ^0_E increase in magnitude per degree temperture is positive , indicating that the behavior of glycine is like the behavior of symmetrical tetraalkyl ammonium salt[17] but unlike common electrilytes , because for common behavior of electrolyte , the molar expansibilities should decreases with increasing temperature[19,20]. The variation of Φ^0_E with temperature is linear in every case through the slopes are different.

Extrapolating the strait line to meet the temperature axis shows that all the lines meet at one point. The positive increase of Φ^0_E with increase of temperature can be described to "Caging Effect"[18] .

In the recent year, it has been reported that S_v is not the sole criteria for determining the structure making or breaking phenomenon of electrolyte. Helper[20] has developed a technique of examining the sin and $(\delta^2\Phi^o_v /\delta t^2)$ for various solutes in terms of long rang range structure making and breaking capacity of solute in aqueous solutions using general thermodynamic equation.

$$[\delta C_p /\delta_p] = - [\delta^2\Phi^0_v / \delta t^2]_P \quad (3)$$

On basis of this equation (3), it has been deducted that structure making solute should have positive value and structure breaking solute should have negative value. The magnitude of $[\delta\Phi^o_v/\delta t]$ and $[\delta^2\Phi^0_v/\delta t^2]$ for glycine are 0.055and 0.053 respectively.

The relative viscocity in aqueous medium was calculated by using equation

$$\eta_r = d.t/d_o d_o \quad (4)$$

Where d and t are the density time flow of glycine solution, while d_o and t_0 are corresponding value of water the viscosity B-coefficient was derived from Jones- Dole equqtion[22] .

$$\eta_r = 1+BC \quad (5)$$

Viscosity B-coefficient of glycine at different temperature are set out in table (3). B coefficient value of glycine are positive and lesser than the carbohydrates and other organic compounds which may be due to the size effect , larger B values indicates structure making capacity of a solute. It is observed that B- coefficient values decreased with increasing temperature[23,24]. In the present study B-coefficient decrease with temperatures except at 25^0C .The salvation of any solute can be judged from the magnitude of B/Φ^0_v . These values are important indicators[25] as to whether a particular solute is solvated or unsolvated since a value between 0-2.5 points to un solvated species and any higher value to solvated ones. The B/Φ^o_v of glycine in aqueous medium are set out in table (3).

B/Φ^0_V depends on viscosity B-coefficient and Φ^o_v B/Φ^o_V of glycine is greater than 2.5, showing distinct hydration. B/Φ^o_v decreases with temperature except at 25^oC the trend is similar to the trend shown by B but dissimilar to the trend shown by Φ^o_v at high temperature B is less and Φ^o_v is more, than at lower temperature. dB/dt is negative emphasizing the greater hydration at higher temperature[23]. In the present study dB/dt is negative reveal the structure making capacity of the glycine in aqueous medium.

Table 1 Densit, apparent molar volume and relative viscosity of aqueous glycine solution at different temperature.

Con. Of Glycine	d	Φ_v	η_r	d	Φ_v	η_r
	25°C			30°C		
0	0.99704			0.99564		
0.2	1.00328	44.42	1.0317	1.00182	44.48	1.0325
0.4	1.00950	44.45	1.0599	1.00798	44.56	1.0615
0.6	1.01569	44.51	1.0873	1.01413	44.64	1.0904
0.8	1.02186	44.56	1.1132	1.02026	44.67	1.1249
1	1.02800	44.61	1.1492	1.02638	44.74	1.556
	35°C			40°C		
0	0.99403			0.99221		
0.2	1.0021	44.60	1.0267	0.99835	44.89	1.0310
0.4	1.00637	44.76	1.0568	1.00448	44.96	1.0609
0.6	1.01252	44.51	1.0879	1.01058	45.06	1.0932
0.8	1.01866	44.90	1.1199	1.01666	45.13	1.1260
1	1.02480	44.97	1.1535	1.02275	45.17	1.1605

Table 2 Partial molar volume Φ^o_v and S_v the experimental slope of aqueous Glycine solution at different temperature.

Temp.	Φ^o_v	S_v
25	43.93	0.305
30	44.32	0.200
35	44.40	0.175
40	44.67	0.220

Table 3 Viscosity B-Coefficent and B/Φ^ov of aqueous Glycine solution at different temperatures.

Temp.	B	B/ Φ^ov
25	0.124	2.822
30	0.134	3.023
35	0.132	2.973
40	0.125	2.798

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