

## Interactions of Some $\alpha$ -Amino Acids with Aqueous Potassium Nitrate Solution At 308.15 K.

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### Research Article

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#### ABSTRACT

The density ( $\rho$ ), viscosity ( $\eta$ ), and ultrasonic velocity ( $U$ ) have been measured for L-serine, L-valine, and L-phenylalanine in aqueous and aqueous potassium nitrate solutions (0.5 and 1.0 mol dm<sup>-3</sup>) at 308.15 K. These experimental measurements have been performed to evaluate some important acoustical, thermodynamical and transport parameters viz. adiabatic compressibility ( $\beta$ ), molar hydration number ( $n_H$ ), apparent molar compressibility ( $\phi_K$ ), apparent molar volume ( $\phi_V$ ), limiting apparent molar compressibility ( $\phi_K^0$ ), limiting apparent molar volume ( $\phi_V^0$ ), and their constants ( $S_K$ ,  $S_V$ ), transfer limiting apparent molar adiabatic compressibility ( $\Delta \phi_K^0$ ), transfer limiting apparent molar volume ( $\Delta \phi_V^0$ ) and viscosity A and B-coefficient of Jones-Dole equation. These results have been rationalized in terms of the various interactions operating in these systems.

#### INTRODUCTION

Amino acids are important biologically active and basic structural units of proteins. However, due to the complex of conformation and configuration three dimensional structures of proteins. Amino acids and peptides have been taken up as modal compounds for understanding the behavior of more complex protein molecules in solutions. Amino acids in aqueous solution are ionized and can act as acids or bases. Knowledge of acids-base property of amino acids is extremely important in understanding many properties of proteins [1]. It is well-known that electrolytes influence the stability of proteins [2]. L-serine is a non-essential amino acid synthesized by hydrolysis of many proteins. L-serine plays an important role in the catalytic function of many enzymes. L-valine is an essential amino acid that is necessary for smooth nervous system and cognitive functioning. L-phenylalanine is an essential amino acid and is classified as non-polar, because of the hydrophobic nature of the benzyl side chain. Some studies have revealed that the presence of an electrolyte drastically affects the behavior of amino acids and peptides in solutions, and this fact can be used for their separation and purification. potassium nitrate is used as a diuretic in medicine. It also includes as an ingredient in toothpaste. It makes the toothless sensitive to pain. potassium nitrate affects nucleic acid synthesis in the greening cucumber cotyledons and the stability of tropomyosin [3]. In general the electrolytes present in our body influence the properties of biological molecules like proteins [4,5] which are a vital part of our body [6].

Ultrasonic velocity measurements have been successfully employed to detect and assess weak and strong molecular interactions [7]. The density, viscosity, ultrasonic velocity and its derived parameter are sensitive to structural changes that occur in solutions and to any interactions between solvent and solute [8,9]. The adiabatic compressibility studies of amino acids in salts solutions are few [10,11]. In this study, the ultrasonic velocity, density and viscosity values for amino acids: L-serine, L-valine, L-phenylalanine in aqueous and aqueous KNO<sub>3</sub> solutions (0.5 and 1.0 mol.dm<sup>-3</sup>) at 308.15K, have been reported. Using these experimental values, the adiabatic compressibility, molar hydration number, apparent molar compressibility, apparent molar volume, limiting apparent molar compressibility, limiting apparent molar volume, and their constants ( $S_K$ ,  $S_V$ ) transfer limiting apparent molar adiabatic compressibility, transfer limiting apparent molar volume, and viscosity A and B-Coefficients of Jones-Dole

equation have been evaluated. These results have been rationalized in terms of the various interactions operating in these systems.

## MATERIALS AND METHODS

Analytical reagent (AR) and spectroscopic reagent (SR) grades with minimum assay of 99.9% of L-serine, L-valine, L-phenylalanine and potassium nitrate are obtained from E-Merck, Germany and SdFine Chemicals, India, which are used as such without further purification. Water used in the experiment was deionised, distilled and degassed prior to making solutions. Solutions of aqueous potassium nitrate (0.5 - 1.0 mol.dm<sup>-3</sup>) were prepared by volume and used on the day they were prepared. Solution of amino acids in the concentration range of 0.02-0.1 mol.dm<sup>-3</sup> was made by mass on the molarity concentration scale with precision of  $\pm 1 \times 10^{-4}$ g on an electronic digital balance (Model: SHIMADZU AX-200). The density was determined using a specific gravity bottle by relative measurement method with an accuracy of  $\pm 0.01$  kgm<sup>-3</sup>. An ultrasonic interferometer having the frequency of 2 MHz (MITTAL ENTERPRISES, New Delhi, Model: F-81) with an overall accuracy of  $\pm 0.1\%$  has been used for velocity measurement. An electronic digital operated constant temperature bath (Raaga Industries, Model: ULTRA COLD CHAMBER-437) has been used to circulate water through the double walled measuring cell made up of steel containing the experimental solution at the desired temperature. The accuracy in the temperature measurement is  $\pm 0.1$  K.

## THEORY AND CALCULATIONS

Using the measured data, the following volumetric, compressibility and transport parameter have been calculated using the standard relations.

$$\text{Adiabatic compressibility } \beta = \frac{1}{U^2 \rho} \quad (1)$$

Molar hydration number has been computed using the relation

$$n_H = \left( \frac{n_1}{n_2} \right) \left( 1 - \frac{\beta}{\beta_0} \right) \quad (2)$$

where,  $\beta$  and  $\beta_0$  are adiabatic compressibilities of solution and solvent respectively,  $n_1$  and  $n_2$  are number of moles of solvent and solute respectively.

The apparent molar compressibility has been calculated from relation.

$$\phi_K = \frac{1000}{m\rho_0} (\rho_0 \beta - \rho \beta_0) + \left( \frac{\beta_0 M}{\rho_0} \right) \quad (3)$$

where,  $\beta$ ,  $\rho$  and  $\beta_0$ ,  $\rho_0$  are the adiabatic compressibility and density of solution and solvent, respectively,  $m$  is the molar concentration of the solute and  $M$  the molecular weight of the solute.  $\phi_K$  is the function of  $m$  as obtained [12,13] and is given by

$$\phi_K = \phi_K^0 + S_K m^{1/2} \quad (4)$$

where,  $\phi_K^0$  is the limiting apparent molar compressibility at infinite dilution and  $S_K$  is a constant.  $\phi_K^0$  and  $S_K$  of equation 4 have been evaluated by least square method.

The apparent molar volume  $\phi_V$  has been calculated using the relation.

$$\phi_V = \left( \frac{M}{\rho} \right) - \left( \frac{1000(\rho - \rho_0)}{m\rho\rho_0} \right) \quad (5)$$

The apparent molar volume  $\phi_V$  has been found to differ with concentration according to [14] empirical relation as:

$$\phi_V = \phi_V^0 + S_V m^{1/2} \quad (6)$$

where,  $\varphi_V^0$  is the limiting apparent molar volume at infinite dilution and  $S_v$  is a constant and these values were determined by least square method.

Transfer volumes, and transfer adiabatic compressibilities of each amino acid,  $\Delta\varphi_V^0$  and  $\Delta\varphi_K^0$  from water to aqueous potassium nitrate solutions were calculated using the equation.

$$\Delta\varphi_y^0 = \varphi_y^0 \text{ (in aqueous potassium nitrate solution)} - \varphi_y^0 \text{ (in water)} \quad (7)$$

where,  $\varphi_y^0$  denotes limiting apparent molar volume  $\varphi_V^0$ , and limiting apparent molar adiabatic compressibility  $\varphi_K^0$ .

The importance of viscometric study of electrolyte solution in mixed solvent systems is well established [15,16]. The entire viscosity data have been analyzed in the light of Jones-Dole semi empirical equation [17].

$$\left(\frac{\eta}{\eta_0}\right) = 1 + Am^{1/2} + Bm \quad (8)$$

where,  $\eta$  and  $\eta_0$  are the viscosities of the solution and solvent respectively and  $m$  are the molar concentration of the solute.  $A$  and  $B$  are constants which are definite for a solute-solvent system.  $A$  is known as the Falkenhagen coefficient which characterizes the ionic interaction and  $B$  is the Jones-Dole or Viscosity  $B$ -coefficient which depends on the size of the solute and the nature of solute-solvent interactions.

## RESULT AND DISCUSSION

The experimental values of density ( $\rho$ ), viscosity ( $\eta$ ), and ultrasonic velocity ( $U$ ), for different molar composition of each of the three amino acids viz., L-serine, L-valine and L-phenylalanine in aqueous potassium nitrate solutions are shown in Table-1. The values of adiabatic compressibility ( $\beta$ ), molar hydration number ( $n_H$ ), apparent molar compressibility ( $\varphi_K$ ), apparent molar volume ( $\varphi_V$ ), limiting apparent molar compressibility ( $\varphi_K^0$ ), limiting apparent molar volume ( $\varphi_V^0$ ), and their constants ( $S_K$ ,  $S_v$ ), transfer adiabatic compressibility ( $\Delta\varphi_K^0$ ), transfer volume ( $\Delta\varphi_V^0$ ), and viscosity  $A$  and  $B$  coefficient of Jones-Dole equation are calculated and the results are given Tables 2-3. Further, the Figs.1-2 show the variation of transfer adiabatic compressibility and transfer volume of L-serine, L-valine, and L-phenylalanine in aqueous potassium nitrate solutions at 308.15 K and the curves are drawn using least square fitting.

In all the three amino acids systems (Table-1), the values of density and ultrasonic velocity increase with increase in molar concentration of amino acids as well as potassium nitrate ( $KNO_3$ ) content. This increasing trend suggests a moderate strong electrolytic nature in which the solutes (amino acids) tend to attract the solvent (aqueous potassium nitrate) molecules. Molecular interaction is thus responsible for the observed increase in density and ultrasonic velocity in these mixtures. The factors apparently responsible for such behavior may be due to the presence of interactions caused by the proton transfer reactions of amino acids in aqueous potassium nitrate mixtures. The increase in the ultrasonic velocity in these solutions may be attributed to the cohesion brought about by the ionic hydration [18]. In all the three systems, the value of adiabatic compressibility (Table-2) decreases with increase in concentration of solute (amino acids) as well as increase in concentration of aqueous  $KNO_3$ . The decrease in adiabatic compressibility is attributed to the influence of the electrostatic field of ions ( $NH_3^+$  and  $COO^-$ ) on the surrounding solvent molecules ( $K^+$ ,  $NO_3^-$ ) called electrostriction. The magnitudes of  $\beta$  values are larger in L-serine than in other two amino acids. The larger  $\beta$  value which shows molecular associations / interactions is greater in L-serine than in two amino acids. Amino acids molecules in the neutral solution exist in the dipolar form and thus have stronger interaction with the surrounding water molecules. The increasing electrostrictive compression of water around the molecules results in a large decrease in the compressibility of the solutions. This result in the present study generally confirms the conclusions drawn earlier from the velocity data. The interaction between the solute and the water molecules present in the solvent can be termed as hydration. From (Table-2) it is observed that the positive values of  $n_H$  indicate an appreciable solvation of solutes [19]. This is an added support not only for the structure promoting tendency of the solutes but also for the presence of appreciable dipole-dipole interactions between solute and water molecules. This also leads to further suggestion that the compressibility of the solution will be less than that of the solvent. As a result, solutes will gain mobility and hence there will be more probability of conducting solvent molecules. This may further enhance the interaction between solute and solvent molecules. The values of  $n_H$  decrease with increase in concentration of amino acids in all systems. But these values are found to increase with increasing the concentration of potassium nitrate solutions. The decreasing behavior of  $n_H$  shows

that the strength of interaction gets weakened between the ion-solvent molecules, but however it increases the ion-ion interaction in the mixtures [20].

The following observation has been made on  $\phi_K$  and  $\phi_V$  (Table-2) of the three amino acids in aqueous potassium nitrate solutions at 308.15 K.

- (i) The values of  $\phi_K$  and  $\phi_V$  are all negative over the entire range of the molarity.
- (ii) The negative values of  $\phi_K$  and  $\phi_V$  increase with the increase in concentration of amino acids, but it is found to decrease with increasing the contents of  $KNO_3$ .
- (iii) The magnitude of  $\phi_K$  is in the order:  
L-serine > L-valine > L-phenylalanine.

The above observation clearly suggests that the negative values of  $\phi_K$  and  $\phi_V$  in all systems indicate the presence of ion-solvent interactions. Since more number of water molecules is available at lower concentration of potassium nitrate, the chances for the penetration of solute molecules into the solvent molecules are highly favored. The decrease in  $\phi_V$  is due to strong ion-ion interaction and vice-versa. The observed behavior of  $\phi_K$  reveals the strengthening of the ion-solvent interaction in all systems studied. The negative values of  $\phi_V$  indicate electrostrictive solvation of ions [21]. From the magnitude of  $\phi_K$ , it can be concluded that stronger molecular association is found in L-serine than in other two amino acids and hence L-serine is a more effective structure maker.

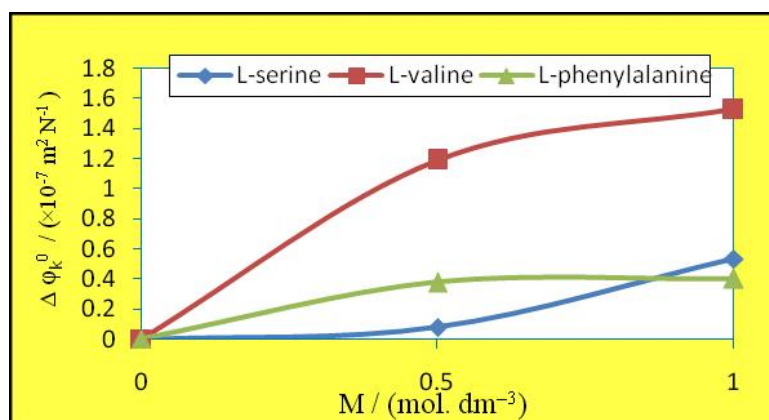


Figure 1: Variation of transfer adiabatic compressibility ( $\Delta\phi_K^0$ ) of some  $\alpha$ -amino acids with molarity of aqueous potassium nitrate solutions at 308.15 K

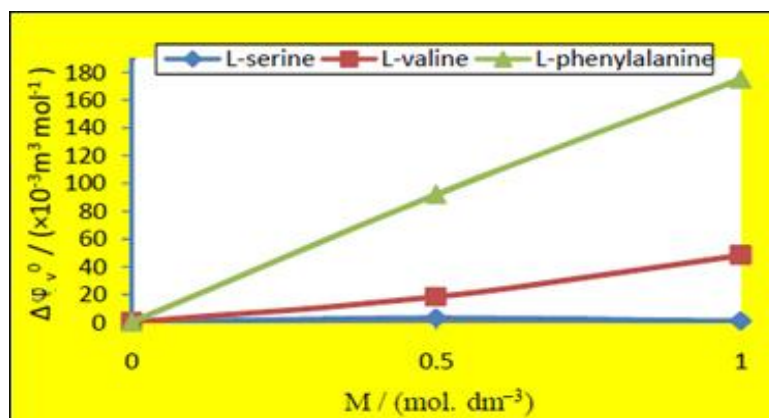


Figure 2: Variation of transfer volume ( $\Delta\phi_V^0$ ) of some  $\alpha$ -amino acids with molarity of aqueous potassium nitrate solutions at 308.15 K

Table-1 Values of density ( $\rho$ ), viscosity ( $\eta$ ) and ultrasonic velocity (U) of amino acids in aqueous potassium nitrate solutions at 308.15K for									
M / (mol.dm <sup>-3</sup> )	$\rho$ / ( kgm <sup>-3</sup> )			$\eta$ / (x 10 <sup>-3</sup> Nsm <sup>-2</sup> )			U / (m.s <sup>-1</sup> )		
	water + potassium nitrate (KNO <sub>3</sub> )								
	0.0 M	0.5M	1.0 M	0.0M	0.5M	1.0M	0.0M	0.5M	1.0M
System - I : water + potassium nitrate +L-serine									
0.00	994.0	1010.9	1021.5	0.7190	0.7323	0.7636	1517.1	1522.2	1526.1
0.02	995.7	1013.3	1023.9	0.7242	0.7389	0.7766	1518.4	1523.8	1527.5
0.04	996.5	1015.0	1025.6	0.7302	0.7519	0.7818	1519.5	1525.8	1530.9
0.06	997.9	1016.3	1027.0	0.7358	0.7596	0.7998	1523.0	1527.1	1532.6
0.08	998.4	1017.9	1028.0	0.7382	0.7700	0.8043	1526.1	1528.3	1535.8
0.10	999.0	1019.7	1030.0	0.7410	0.7818	0.8088	1529.0	1529.8	1536.8
System - II : water + potassium nitrate +L-valine									
0.00	994.0	1010.9	1021.5	0.7190	0.7323	0.7636	1517.1	1522.2	1526.1
0.02	996.9	1014.5	1024.1	0.7267	0.7440	0.7814	1519.1	1524.7	1532.6
0.04	997.5	1016.7	1026.9	0.7390	0.7601	0.7899	1520.2	1526.2	1535.6
0.06	999.0	1019.1	1028.4	0.7495	0.7666	0.8016	1525.0	1528.1	1536.2
0.08	1000.2	1021.9	1030.4	0.7498	0.7851	0.8109	1527.4	1530.6	1538.3
0.10	1001.2	1024.0	1032.1	0.7509	0.7984	0.8199	1531.0	1534.4	1541.0
System - III :water + potassium nitrate +L-phenylalanine									
0.00	994.0	1010.9	1021.5	0.7190	0.7323	0.7636	1517.1	1522.2	1526.1
0.02	998.5	1016.8	1025.5	0.7476	0.7510	0.7896	1523.4	1527.7	1534.9
0.04	999.0	1019.4	1027.3	0.7575	0.7661	0.7917	1525.0	1529.1	1538.3
0.06	1000.0	1021.1	1029.1	0.7653	0.7768	0.8064	1527.7	1533.1	1543.2
0.08	1001.7	1022.9	1032.4	0.7881	0.7901	0.8169	1530.8	1534.7	1546.6
0.10	1003.0	1024.7	1035.3	0.7911	0.8088	0.8216	1532.8	1536.8	1550.5

The limiting apparent molar compressibility  $\phi_K^0$  provides information regarding ion-solvent interaction and  $S_K$ , that of ion-ion interactions in the solution. From (Table-3) it is observed that  $\phi_K^0$  values are negative and they increase with increasing the concentration of potassium nitrate in all systems studied. Appreciable negative values of  $\phi_K^0$  and its behavior for all systems reinforce our earlier view regarding the existence of ion-solvent interaction in the mixtures. The negative values of  $\phi_K^0$  (loss of compressibility of the medium) indicate that the water molecules surrounding the amino acids molecules present a greater resistance to compression than the bulk [22]. The magnitude of  $\phi_K^0$  is in the order L-serine > L-valine > L-phenylalanine. The values of  $S_K$  exhibit positive value and they decrease with increasing the concentration of potassium nitrate in all the three amino acids. This behavior indicates the existence of ion-ion interaction with increase in potassium nitrate content and suggests structure making / breaking effect of the amino acids. It is well known that solutes causing electrostriction lead to decrease in the compressibility of the solution. This is reflected by the negative values of  $\phi_K$  of the amino acids. The volume behavior of a solute at infinite dilution is satisfactorily represented by  $\phi_V^0$  which is independent of the ion-ion interactions and provides information concerning ion-solvent interactions. (Table-3) reveals that the values of  $\phi_V^0$  are negative in all the three studied amino acids. The values of  $\phi_V^0$  increase with the addition of potassium nitrate contents in all the systems studied. The increase in  $\phi_V^0$  may be attributed to the increased hydrophilicity / polar character of the side chain of the amino acids. It is evident from the Table -3 that  $S_V$  is positive in all the three systems suggesting the presence of strong ion-ion interactions.

Table-2 Values of adiabatic compressibility ( $\beta$ ), molar hydration number ( $n_H$ ), apparent molar compressibility ( $\phi_K$ ), and apparent molar volume ( $\phi_V$ ) of amino acids in aqueous potassium nitrate solutions at 308.15K for												
M / (mol .dm <sup>-3</sup> )	$\beta / (\times 10^{-10} \text{ m}^2 \text{ N}^{-1})$			$n_H$			$-\phi_K / (\times 10^{-7} \text{ m}^2 \text{ N}^{-1})$			$-\phi_V / (\times 10^{-3} \text{ m}^3 \text{ mol}^{-1})$		
water + potassium nitrate (KNO <sub>3</sub> )												
	0.0 M	0.5M	1.0 M	0.0M	0.5M	1.0M	0.0M	0.5M	1.0M	0.0M	0.5M	1.0M
System - I : water + potassium nitrate +L-serine												
0.00	4.3710	4.2692	4.2034	-	-	-	-	-	-	-	-	-
0.02	4.3561	4.2502	4.1858	9.48	11.86	10.67	1.1538	1.4568	1.4838	85.78	117.04	114.63
0.04	4.3463	4.2319	4.1603	7.85	11.63	13.06	1.1423	1.3654	1.3993	73.42	99.79	97.74
0.06	4.3203	4.2193	4.1455	10.74	10.37	11.69	1.1308	1.2118	1.3422	63.00	87.50	87.28
0.08	4.3006	4.2061	4.1242	11.19	9.34	12.00	1.1219	1.1596	1.3244	55.32	85.27	80.69
0.10	4.2817	4.1904	4.1108	11.35	9.83	11.22	1.1128	1.1583	1.2758	50.25	84.93	77.27
System - II : water + potassium nitrate +L-valine												
0.00	4.3710	4.2692	4.2034	-	-	-	-	-	-	-	-	-
0.02	4.3469	4.2401	4.1572	15.32	18.15	28.00	1.8426	2.2152	2.8449	146.21	175.40	128.58
0.04	4.3380	4.2226	4.1297	10.49	14.53	22.33	1.6098	1.7774	2.3980	88.13	140.97	124.15
0.06	4.3042	4.2022	4.1204	14.15	13.93	16.77	1.4798	1.7572	1.8566	83.80	132.54	114.09
0.08	4.2856	4.1770	4.1012	13.57	14.38	15.48	1.4146	1.7332	1.7552	77.84	130.99	105.58
0.10	4.2612	4.1478	4.0801	13.96	15.14	14.94	1.4083	1.6692	1.6938	72.23	126.44	100.43
System - III : water + potassium nitrate +L-phenylalanine												
0.00	4.3710	4.2692	4.2034	-	-	-	-	-	-	-	-	-
0.02	4.3154	4.2139	4.1390	35.34	34.50	39.03	3.7694	4.0108	4.0430	226.53	286.84	190.76
0.04	4.3042	4.1955	4.1136	21.23	22.99	27.21	2.2197	2.7399	2.8417	125.72	206.05	138.02
0.06	4.2847	4.1667	4.0804	18.29	21.31	24.85	1.8780	2.4263	2.5712	100.44	164.53	120.33
0.08	4.2602	4.1507	4.0498	17.60	18.48	23.27	1.8081	2.1147	2.4807	96.50	144.90	129.04
0.10	4.2435	4.1320	4.0178	16.13	17.11	22.50	1.6708	1.9548	2.4239	90.11	133.06	130.33

The values of transfer adiabatic compressibility  $\Delta \phi_K^0$  and transfer volume  $\Delta \phi_V^0$  (Table-3) are positive and they increase with increase in the concentration of potassium nitrate in all the three amino acid systems which suggest the existence of strong ion-solvent interactions in the mixtures. Generally, the interaction between amino acids and potassium nitrate can be classified as: (i) ion-ion interaction among the K<sup>+</sup>, and NO<sub>3</sub><sup>-</sup> ions and (COO<sup>-</sup>,NH<sub>3</sub><sup>+</sup>) zwitterionic end groups, (ii) ion-hydrophilic interactions between ions and hydrophilic groups (-CONH<sub>2</sub>, -CONH) of amino acids, (iii) ion-nonpolar group interaction occurring between ions and the nonpolar groups (-CH<sub>2</sub>/-CH<sub>3</sub>) of amino acids. The  $\Delta \phi_K^0$  and  $\Delta \phi_V^0$  values can also be explained on the basis of co-sphere overlap model [23] in terms of solute-co-solute interactions. According to this model, ion-ion and ion-hydrophilic group interactions contribute positively, whereas ion-non-polar group interactions contribute negatively to the  $\Delta \phi_K^0$  and  $\Delta \phi_V^0$  values. Therefore, from Figs. 1-2, the positive  $\Delta \phi_K^0$  and  $\Delta \phi_V^0$  values observed in all the three amino acids suggest that the interaction contribution of type (i) and (ii) is much stronger than that of type (iii). The magnitude of  $\Delta \phi_V^0$  is in order: L-serine < L-valine < L-phenylalanine.

Viscosity is another important relation in understanding the structure as well as molecular interaction occurring in the mixtures. From Table-1 it is observed that the values of viscosity increase with increase in molar concentration of amino acids as well as potassium nitrate content. This increasing trend indicates the existence of ion-solvent interaction occurring in these systems. In order to shed more light on this, the role of viscosity coefficients has been obtained. From the Table-3 it is observed that the values of A coefficient are positive for all the systems indicating the presence of ion-ion interactions [24]. Further, the values of the B-coefficient are positive in all systems studied. B-coefficient is also known as measure of order and disorder introduced by the solute into the solvent. It is also a measure of ion-solvent interaction and relative size of the ion and solvent molecules. The behavior of B-coefficient in all the three systems suggests the existence of strong ion-solvent interaction [25]. The magnitude of B values is in the order L-serine > L-valine > L-phenylalanine. This conclusion is in excellent agreement with that drawn from  $\phi_K$  and  $\Delta \phi_V^0$ .

**Table-3 Values of limiting apparent molar compressibility ( $\phi_K^0$ ), limiting apparent molar volume ( $\phi_V^0$ ), and their constants  $S_K$  and  $S_V$ , transfer adiabatic compressibility ( $\Delta\phi_K^0$ ), transfer volume ( $\Delta\phi_V^0$ ), and A and B co-efficient of Jones-Dole equation of the amino acids in aqueous potassium nitrate solutions at 308.15 K for**

Amino acids	$KNO_3$ M / (mol. dm <sup>-3</sup> )	$-\phi_K^0 / (\times 10^{-7}$ m <sup>2</sup> N <sup>-1</sup> )	$-\phi_V^0 / (\times 10^{-3}$ m <sup>3</sup> mol <sup>-1</sup> )	$S_K / (\times 10^{-7}$ N <sup>-1</sup> m <sup>-1</sup> mol <sup>-1</sup> )	$S_V / (\times 10^{-3}$ m <sup>3</sup> L <sup>1/2</sup> mol <sup>-3/2</sup> )	$\Delta\phi_K^0 / (\times 10^{-7}$ m <sup>2</sup> N <sup>-1</sup> )	$\Delta\phi_V^0 / (\times 10^{-3}$ m <sup>3</sup> mol <sup>-1</sup> )	A / (dm <sup>3/2</sup> .mol <sup>-1/2</sup> )	B / (dm <sup>3/2</sup> .mol <sup>-1</sup> )
L-serine	0.0	1.7148	142.61	1.8739	215.52	-	-	0.8310	3.6283
	0.5	1.6363	139.63	1.1441	188.68	0.0785	2.98	0.0413	1.8032
	1.0	1.1829	141.50	0.2148	206.50	0.5319	1.11	0.0503	0.4703
L-valine	0.0	3.6779	203.19	6.6155	261.20	-	-	0.0423	0.3908
	0.5	2.4879	184.78	2.7729	384.43	1.190	18.41	0.0146	0.9342
	1.0	2.1523	154.84	2.5364	169.87	1.5256	48.35	0.1016	0.4076
L-phenylalanine	0.0	5.3277	394.39	11.2985	874.51	-	-	0.2214	0.3054
	0.5	4.9506	302.38	11.2186	736.17	0.3771	92.01	0.0656	0.7939
	1.0	4.9285	219.04	8.7678	326.27	0.3992	175.35	0.2009	0.1150

### CONCLUSION

In the present work volumetric, compressibility and transport parameters of L-serine, L-valine and L-phenylalanine in aqueous potassium nitrate solutions at 308.15 K were obtained using density, viscosity and ultrasonic velocity data and the results have been used to study the existence of ion-solvent interactions. From the magnitude of  $\phi_K^0$ ,  $\Delta\phi_V^0$  and the values of B-coefficient, it can be concluded that L-serine possesses strong ion-solvent interaction than the other two amino acids. The transfer adiabatic compressibility  $\Delta\phi_K^0$  and transfer volume  $\Delta\phi_V^0$  data suggest that ion-ion and ion-hydrophilic group interactions are dominating over the ion-non polar group interactions.

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