Partial Molar Volume of Phenylboronic Acid in Protic Solvents at Selected Temperatures

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Phenylboronic acid is used for treating fungal and bacterial infection. The literature has a lack of thermo-physical data on aqueous solutions of phenylboronic acid and water soluble derivatives. In this work, the apparent molar volume of phenylboronic acid in water, 0.154 M NaCl, 0.1 M HCl, 100% methanol, and 100% ethanol as solvents at (293.15, 298.15, 303.15, 308.15, 313.15, and 318.15) K temperatures and at a pressure of 101.325 kPa were determined from the density data obtained using a vibrating tube Anton PAAR DMA-4500 M density meter. The partial molar volume, \( V_m \), of phenylboronic acid in different solvents at selected temperatures was evaluated by extrapolating the apparent molar volume versus molality plots to \( m = 0 \). In addition, the partial molar expansivity, \( E^0 \), the isobaric coefficient of thermal expansion, \( a_T \), the interaction coefficient, \( S_v \), and the Heppler’s constant have also been computed. It is observed that \( V_m \) values are increasing with temperature, and on the other hand, \( S_v \) values are decreasing with temperature for all the solutions. The positive values that are smaller than \( V_m \) for water and 0.154 M NaCl solutions suggest the dominance of solute-solvent interactions over solute-solute interactions. These interactions are hydrophilic interactions among the molecules in water and coulombic electrostatic and hydrophilic interactions for 0.154 M NaCl solutions while the negative values among the molecules in 0.1 M HCl, methanol, and ethanol indicate hydrophobic interactions. The positive Hepler’s constant values and positive partial molar expansivity, \( E^0 \), values for the solutions confirm structure promoting tendency behavior of phenylboronic acid in protonic solvents.