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Effect of anion on thermophysical properties of N,N-diethanolammonium based protic ionic liquids

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Abstract

In this work, we investigated the influence of two different anions on the various thermophysical properties of N,N-diethanolammonium based protic ionic liquids (PILs). For this purpose, two N,N-diethanolammonium based PILs have been synthesised by using trifluoroacetate and lactate as counter anions and characterized through spectral techniques. The thermophysical properties such as density and speed of sound were measured as function of temperature from (303.15 to 343.15) K at atmospheric pressure. The experimental density values used to calculate thermal expansion coefficient (α), isentropic compressibility (κ_s), molar volume (V_m) and standard entropy (S°). The thermal stabilities of the PILs were investigated by thermogravimetric analysis (TGA), and phase transition measurement was done by using differential scanning calorimetry (DSC). Further, to understand the interionic strength of PILs, lattice potential energy (U_{pot}) has been calculated. The experimental densities have been compared with the estimated densities obtained from Gardas and Coutinho model and obtained results are in good agreement. Further, the density values of studied protic ionic liquids have been compared with other protic ionic liquids. Finally, the impact of structure variants in terms of the carboxylate anions has been analyzed over the thermophysical properties of N,N-diethanolammonium based PILs.

Keywords: Ionic liquid; thermal stability; isothermal expansion; isentropic compressibility; Gardas and Coutinho model.

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