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Unusual solvatochromic absorbance probe behaviour within mixtures of poly(ethylene glycol)-400 + ionic liquid, [bmim][Tf_2N]

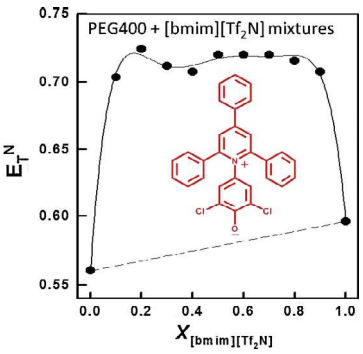
Anwar Ali *, Maroof Ali, Nisar Ahmad Malik, Sahar Uzair

Department of Chemistry, Jamia Millia Islamia (Central University), New Delhi 110025, India

HIGHLIGHTS

- Unusual behaviour of Richardt dye 33.
- Unusual behaviour of KAT parameters.
- IL + PEG-400 mixtures as favourable media.

GRAPHICAL ABSTRACT



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ABSTRACT

The potentially green solvents made up of ionic liquids (ILs) and poly(ethylene glycols) may have wide range of the applications in many chemical and biochemical fields. In the present work, solvatochromic absorbance probe behaviour is used to assess the physicochemical properties of the mixtures composed of PEG-400 + IL, 1-butyl-3-methylimidazolium bis(trifluoromethylsulfonyl)imide, [bmim][Tf_2N]. Lowest energy intramolecular charge-transfer absorbance maxima of a betaine dye, i.e., E_T^N, indicates the dipolarity/polarizability and/or hydrogen-bond donating (HBD) acidity of the [bmim][Tf_2N] + PEG-400 mixtures to be even higher than that of neat [bmim][Tf_2N], the solution component with higher dipolarity/polarizability and/or HBD acidity. Dipolarity/polarizability (π^*) obtained separately from the electronic absorbance response of probe *N*,*N*-diethyl-4-nitroaniline, and the HBD acidity (α) of PEG-400 + [bmim][Tf_2N] mixtures are also observed to be anomalously high. A comparative study of the PEG + IL mixtures has also been done with PEG-400 + molecular organic solvents (protic polar [methanol], aprotic polar [*N*,*N*-dimethylformamide], and non polar, [benzene]) mixtures, but these mixtures do not show this type of unusual behaviour. A four-parameter simplified combined nearly ideal binary solvent/Redlich–Kister (CNIBS/R–K) equation is shown to satisfactorily predict the solvatochromic parameters within PEG-400 + different solvent mixtures.

Introduction

Ionic liquids (ILs), the potentially green solvents, are the subject of the main interest of the scientific and academic community due to their unusual features, and vast range of applications in various fields [1–3]. ILs are made up of bulky organic cations and inorganic anions mainly, and show a wide range of the physicochemical properties depending upon the nature of the cations and anions, so are called tunable solvents. ILs have been used as solvents and as catalysts in many organic/inorganic/organometallic reactions [1–5]. Novel analytical applications of ionic liquids are emerging every day. Effective, and in some cases unique, utilization of ionic liquids as solvents has been demonstrated in a variety of techniques in

* Corresponding author. Tel.: +91 9540382691.
E-mail address: anwarali.chem@gmail.com (A. Ali).

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