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Phase behavior and microstructure of sugar surfactant-ionic liquid microemulsions

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Abstract

Microemulsions have been explored as a unique and versatile reaction media for a variety of chemical reactions, viz. nanoparticle preparation, organic synthesis, bio-organic synthesis etc. The phase behavior and microstructure of a ternary system water/1-butyl-3-methylimidazolium hexafluorophosphate/Sugar Surfactant was studied as a function of temperature and sugar surfactant mass fraction, γ. In the present study, a hydrophobic ionic liquid 1-butyl-3-methylimidazolium hexafluorophosphate was used to replace commonly used organic solvents (n-alkanes) as an oil/non-polar phase substitute in ternary microemulsion formulations, wherein, a sugar based alkyl polyglycoside nonionic surfactant was used instead of a conventional nonionic surfactant (i.e., alkyl polyoxyethylene ether class) to solubilize hydrophobic ionic liquid and water. The effect of alkanols of variable chain length (octanol, decanol and dodecanol) as co-surfactant on the phase behavior and microstructure of ionic liquid/sugar surfactant/water ternary microemulsion systems was also investigated. The ability of nonionic sugar-based surfactant n-decyl β-D-maltoside, and n-dodecyl β-D-maltoside, to solubilize oil (hydrophobic ionic liquid) and water, i.e., X^- was evaluated. Moreover, phase behavior and microstructure of ternary systems, 1-butyl-3-methylimidazolium tetrafluoroborate:water (1:1)/sugar surfactant/n-alkanes (alkanes of varying chain length, i.e., octane, decane and dodecane) was also studied. Solubilization of a water insoluble dye, Sudan Red, in selected microemulsion systems was also investigated.

Keywords: Microemulsions; hexafluorophosphate; polyglycoside, maltoside