AIMS AND SCOPES OF THE PRESENT STUDY

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Microemulsions are thermodynamically stable, macroscopically homogeneous but microscopically heterogeneous, mixtures of water and oil stabilized by surfactant monolayer. In spite of large number of studies, comprehensive knowledge on microemulsion are still considered to be fragmentary in nature. Ionic liquids are considered to have potentials as a substituent of the conventional polar component in μE. A combined individual potentials of ionic liquid and microemulsion have motivated to undertake different physico-chemical studies on ionic liquid microemulsion. Sometimes ionic liquids as single polar components suffer from some limitations which may be overcome through the usage of ionic liquid in combination with another polar solvent, e.g., water. With this purview, it was thought to be worthy to carry out the works as outlined below:

1. Formation, phase behaviour and physicochemistry of system comprising water/(Tween-20+n-alkanol)/n-heptane w/o μE were studied. The effect on the variation of cosurfactant chain length, [water] / [surfactant] mole ratio (ω), (indicative of the water pool size), and temperature were investigated in detail. Energetic and structural parameters were evaluated. The aim was to understand the effect of n-alkanol chain length on the formation stability and respective property of the derived w/o μE systems. Except a few cases studies on microemulsion using a series of n-alkanol are not available in the literature. Such an initiative was made as point of reference so that the data set could be compared with the similar systems comprising ionic liquid in lieu of water.

2. Although most of the studies on ILs are associated with the imidazolium ion, however, there has been a current trend to search for alternate, easily available but low cost ILs other than the imidazolium ion. Pyridinium based ILs have specific properties, viz., broad liquidous temperature range, inertness to air, moisture and superior solubilization capacity. In spite of high possible potentials, there have been a little research on 1-butyl-4-methylpyridinium tetrafluoroborate ([$b_4$mpy][BF_4]) comprising μE although it is one of the most reported pyridinium based IL. Another advantage of using this IL is that the system itself can be investigated without

any molecular probe (because of the presence of the pyridinium ring) in the UV-visible region.

Curcumin is a natural polyphenolic compound isolated from the rhizome of turmeric (Curcuma longa). Researches over the last few decades have shown that curcumin possesses a great variety of beneficial biological and pharmacological activities. Despite its highly promising features as a health-promoting agent, poor aqueous solubility in neutral aqueous medium of curcumin one of the major draw backs in its bioavailability, clinical efficiency and metabolism. A number of attempts have been made to increase the solubility in polar medium and hence the bioavailability of curcumin through encapsulation in different organized assemblies. Once used in the IL-in-oil microemulsion, curcumin may have a possibility to reside in the inner polar core of the μE because curcumin is not soluble in n-heptane. Thus the spectroscopic investigation involving curcumin in the microemulsion will be able to probe the microenvironment of the polar domain

3. Usually IL-in-oil μEs are more rigid and less temperature sensitive; such limitations can be overcome provided the pure IL is replaced with a binary mixture of IL and water. The aim of this study was to replace the water pool with ionic liquid of the aforementioned μE. However use of pure ionic liquid as polar domain in IL/O μE may have limitations such as rigidity, viscosity, salvation, etc. To overcome these problems, it is thought to be worthy to use a binary mixture of ionic liquid and water in place of pure ionic liquid. The investigation aims to derive the density, excess molar density and viscosity in understanding the synergistic and antagonistic behavior of all the combinations. Surface tension studies on aqueous solution of [bmim][MS] in the water rich region could evaluate the surface activity, surface excess and molecular area of the IL. Conductance measurements for all the combinations and cyclic voltammetry measurements in the IL rich region helped in understanding the states of aggregates in solution. Absorption and emission spectroscopic studies of an anionic xanthene dye eosin Y have been performed in the water rich region. Fluorescence lifetime and anisotropy measurements could shed light on the viscosity of the media. Efforts have also been made to correlate the life time and fluorescence anisotropy with the experimentally determined viscosity. Also we intended to correlate the data of the binary

mixture in the water rich region with the aggregation behavior of IL as there are several reports with conclude that [bmim] based ionic liquids can form micelle like aggregates in water after attainment of certain concentration. The choice of this anion is intentional as the anion is an alkyl group containing simple inorganic ion. Our main aim is to use the binary mixture of [bmim][MS] and water in microemulsion of oil continuum. However due to relatively higher melting point, this ionic liquid, in its pure form, was thought to be not useful for practical purpose. Moreover, imidazolium based ionic liquid containing [MS] anion would be less toxic compared to the fluorine based ILs. It is reported there that this particular ionic liquid could deactivate water above a certain concentration even if water is present in high amount (upto50 mole%). We also intended to check the validity of the generalization which subsequently have motivated us to undertake the physicochemical investigations on the binary mixture of [bmim][MS] and water. Such study is believed to help in understanding the interaction between [bmim][MS] and water at the molecular level as well as the orientation of the IL at the air solution interface which, in turn, will put new physical insight into the area of IL comprising binary mixtures.

4. Water is the "greenest" among all solvents. In our previous report, we showed that [bmim][MS] in combination with water exhibited some unusual behavior. The binary mixtures were studied using a number of techniques in the bulk condition. Different properties of the binary mixture could be tuned/altered by judicious mixing of the components. Previously, we have carried out systematic physicochemical investigations on water / (Tween 20 + n-pentanol) / n-heptane water-in-oil μE. It is, therefore, important to undertake the challenge in investigating the polar domain in oil microemulsion comprising the binary mixture of ionic liquid, [bmim][MS], in combination with water. Such studies are important in terms of their application as well as fundamental understanding point of view. However to the best our knowledge, no systematic studies have yet been carried out using a binary mixture of IL and water, which would be the novelty of the present work.