ABSTRACT

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TITLE: "Interaction of Surfactant-Surfactant, Surfactant-Salt and Surfactant -Polyelectrolytes in Aqueous Media"

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The interaction and self-aggregation of surfactants, 1-hexadecyl-3-methylimidazolium chloride (HDMimCl or written as, C_{16}MImCl), a Surface Active Ionic Liquid (SAIL) and dodecyltrimethylammonium bromide (DTAB) was investigated at three different temperatures (T = 303.15 K, 313.15 K and 323.15 K) with different stoichiometric mole fractions using conductometry, tensiometry, spectrofluorimetry, steady state fluorescence anisotropy and dynamic light scattering techniques. With the help of well-established theoretical models such as Clint, Rubingh and Motomura, ideal cmc (critical micelle concentration) in mixtures, interaction parameters, micellar mole fraction of components and activity coefficients of components have been calculated using conductometric cmcs of individual and mixed surfactant systems.

Self-aggregation, interfacial, and thermodynamic properties of C_{16}MImCl have been explored in aqueous solutions with the influence of four sodium salts (NaCl, NaBr, Na_2SO_4, and Na_3PO_4) by conductometry, tensiometry, spectrofluorimetry, isothermal titration calorimetry and dynamic light scattering methods. Melting of iceberg, in general, governs the process of micellization in aqueous solution in presence of the investigated salts within the investigated temperature range (298.15 - 318.15 K), while the dehydration of imidazolium head groups takes the leading role below 303.15 K for the C_{16}MImCl-Na_3PO_4 system.

Investigation has been made on the interaction of a biodegradable polyelectrolyte, sodium alginate (NaAlg) with two oppositely charged cationic surfactants, C_{16}MImCl and (1-Hexadecyl) triphenylphosphonium bromide (C_{16}TPB), while later a conventional surfactant over a wide concentration regime of polyelectrolyte (0.001, 0.005 and 0.01% w/v) at 298.15 K. Dual influence of electrostatic and hydrophobic interactions operates in this investigation when mixing surfactants to oppositely charged polyelectrolyte. A number of different experimental techniques, e.g., conductometry, tensiometry, steady state and time resolved spectrofluorimetry, turbidimetry, isothermal titration calorimetry, dynamic light scattering, attenuated total reflection, high resolution transmission electron microscope and fluorescence microscopy have been implemented to get comprehensive information originated from the interaction of oppositely charged polyelectrolyte and surfactants.

Interaction of a novel azabenzocrown ether (H_2DTC) with different kinds of surfactants such as, conventional anionic (SDS, sodium dodecyl sulphate), cationic (DTAB, dodecyltrimetyl ammonium bromide), gemini cationic [16-4-16, 1,3-butan-bis-(dimethyl hexadecyl ammonium bromide], ionic liquid (C_{16}MImCl) and non-ionic (Tween-60) has been investigated at the wide range of surfactant concentrations (premicellar, micellar and post micellar regime) in 15% (v/v) EtOH-water medium at 298.15 K.

An attempt has been made to elucidate the structural stability of stem bromelain (BM) with the possible interaction with two different kinds of anionic surfactants at 298.15 K. The interaction of different surfactants with stem bromelain at all concentrations of surfactants: below, at and above of the cmc in phosphate buffer medium (pH 7) was investigated by several physicochemical methods, like, tensiometry and isothermal titration calorimetry and steady state fluorescence measurements. Circular Dichroism study shows the stability of secondary structure of BM in presence of NaC and NaDC below C_3, while BM lost its structural stability even at very low surfactant concentration of SDDS and SDBS. Molecular docking studies have been employed to visualize the probable location of the compounds (bile salt surfactants and conventional surfactants) in the surrounding microenvironment of the Trp. residue(s) of BM. The binding energy of NaDC with BM does not vary much as compared to NaC, but the binding energy values are more negative than SDDS and SDBS.

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