PREFACE

The present dissertation describes the experimental and theoretical studies on interfacial, solution/dispersion and gelation behavior of oppositely charged surfactants formed between hexadecyltrimethylammonium bromide (HTAB, cationic) and dicarboxylic amino acid based surfactants (C_{12}AAS)Na_2, anionic). Also the interfacial and dispersion behavior of metallosurfactants formed by bivalent metals (Ca^{+2}, Mn^{+2} and Cd^{+2}) and (C_{12}AAS)Na_2 were studied in combination with natural phospholipid, soy phosphatidylcholine and cholesterol.

The dissertation begins with an introduction and relevant literature survey. A general understanding on the aformantioned systems were reviewed in general way, followed by a description of aim and scope of the present work. Afterwards, the thesis entails four different chapters.

Chapter 1 describes the interfacial and micellization behavior of *N*-dodecyl derivatives of amino-malonate, -aspartate and -glutamate in combination with HTAB, investigated by surface tension, conductance, UV-vis absorption/emission spectroscopy, dynamic light scattering and viscosity studies. Surface excess, limiting molecular area, surface pressure at the critical micelle concentration (*CMC*) and Gibbs free energy of micellization were evaluated by analyzing the experimental data. *CMC* values were also determined from the sigmoidal variation in the micellar polarity (by analyzing the pyrene UV-vis absorbance/emission spectra) with surfactant concentration. Micellar aggregation number (n) was determined by static fluorescence quenching method. Dependence of 'n' on the mole fraction of (C_{12}AAS)Na_2, $\alpha_{(C_{12}AAS)_2M_2}$ were discussed. Dependence of micellar size (measured by dynamic light scattering, DLS) and viscosity of the aggregates on the composition of mixed surfactant systems were also interpreted. Application potential of such mixed surfactant systems as gel-based drug delivery and nanoparticle synthesis were then discussed.

In Chapter 2 theoretical studies on micellar structure and composition of $(C_{12}AAS)Na_2$+HTAB mixtures have been presented and discussed. Oppositely charged surfactants exhibit synergistic interaction, governed by the structural parameters as well as the composition of the mixture. Different parameters, *viz.*, theoretical values of critical micelle concentration and its comparison with the earlier reported values (experimental), mole fraction of surfactants at micellar phase and interface, interaction parameters at bulk/interface, ideality/non-ideality of the mixing processes and activity coefficients were evaluated, using Rubingh, Rosen, Motomora and Sarmoria-Puvvada-Blankschtein models.

Chapter 3 describes the physicochemical investigation on gels formed by $C_{12}MalNa_2$, $C_{12}AspNa_2$ and $C_{12}GluNa_2$ in combination with HTAB at different ratio. $(C_{12}AAS)Na_2$-HTAB mixed systems exhibited different phases, *viz*., gel, viscous, precipitate and clear fluid as established through ternary phase diagram. Internal structure and liquid crystalline behavior of gels were investigated by combined polarisation optical microscopy and fluorescence microscopic studies. Porous and flower like surface morphologies were identified by field emission scanning electron microscopy. Phase transitions along with the associated weight loss of surfactant aggregates were established by thermogravimetric analysis (TGA) as well as the thermotropic behavior of aggregates were investigated by differential scanning calorimetric (DSC) studies. Gels were investigated in terms of its biocompatibility studies. Insignificant irritation on mouse skin and antibacterial effects on *Staphylococcus aureus*, a potent causative agent of skin and soft tissue infections, were also examined.

In Chapter 4, reports on the metallosurfactants (Ca^{+2}-/Mn^{+2}-/Cd^{+2}-AAS), synthesized by stoichiometric mixing of aqueous mixture of $(C_{12}AAS)Na_2$ with $CaCl_2$, $MnCl_2$ and $CdCl_2$, respectively have been described. Water insoluble metallosurfactants were characterized by NMR, FTIR, XRD and TGA studies. Interfacial properties of the metallosurfactant monolayers, in combination with soy phosphatidylcholine (SPC) and cholesterol were investigated by surface pressure-area measurements, surface rheology and Brewster angle microscopic studies. Hybrid vesicles, formed by metallosurfactant,

SPC and cholesterol were characterized by DLS, TEM, DSC studies. Biocompatibility of the hybrid vesicles were evaluated by MTT assay and cell viability studies.

Finally attempts have been made to make an overall summary and conclusion based on the different experimental and theoretical observations.

The thesis then follows the basic data, off-prints/reprints of the published papers and abstracts of the conferences attended.