Abstract

Surfactants or surface-active agents are materials of distinct chemical functionalities with hydrophobic and hydrophilic moieties in a same molecule. This amphipathic nature of surfactant provides various noble properties in aqueous solution (surface accumulation, aggregation, a range of polarity in the aggregate (e.g.; micelle) interior). Surfactant or surfactant mixtures with inherent microstructures are used to modify the solubilization efficacies of otherwise water-insoluble compounds (e.g., PAHs or drugs). The strategy of mixing/blending gives entirely new aqueous solution properties with distinctly improved performances. Gemini surfactants, having two alkyl chains and head groups together with connecting spacer show better solution properties which are exploited in the present work.

Various gemini surfactants (both anionic and cationic) have been synthesized and characterized. Micellization properties (CMC, microenvironment, aggregate morphology, etc.) have been acquired using various physico-chemical methos such as conductometry, fluorometry, dynamic light scattering, transmission electron microscopy, zeta-potential measurements among others. Blending of gemini mixtures have been carried out and interaction parameters have been computed using various regular solution theories. Fluorescence data have also been used to derive information related to microenvironment of the mixed aggregates. Various compositions are chosen for blending geminis and the effect on solubilization of water insoluble materials has been seen.

Both synthetic (raloxifene hydrochloride, RLX) and naturally extracted (curcumin, CUR) anti-cancer drugs were used for solubilization/bio-availability studies. It has been observed bioavailability enhances distinctly and can be exploited in drug release studies. The release pattern of drugs follows Higuchi model which is known a better approach for the sustain drug release. Breast cancer cells (MCF-7) were used to study the performances of blended gemini based formulations. Lower IC_{50} values are obtained with systems containing vesicular

aggregate. Further, blend shows better antioxidant activity of CUR which can be utilized for sustain release in the treatment of various cancerous cells in general.

Blended mixtures were also used to see the effect on another class of water insoluble material (polycyclic aromatic hydrocarbons, PAHs). To our surprise, the blended mixture exhibits enhanced solubility of PAHs as observed in case of drugs. This observation allows to conclude that blending of amphiphiles can be used as a general approach to enhance entrapment of water insoluble material and further utilized for other applications as inspected in the present thesis.