# Overall Conclusion

The inherent versatility of surfactants originates from their amphiphilic character, and the molecules possess both polar, water-soluble sections and nonpolar, water- insoluble moieties. Numerous structural modifications to the surfactant structural designs have been carried out to enhance their efficiencies at various fronts. Among them, gemini surfactants with two hydrophilic heads and two hydrophobic groups per molecule separated by a covalently bound spacer chain at the head groups have generated tremendous interest both from technological as well as academic point of view.

Nowadays, some established surfactant classes have been replaced by surfactants that are less toxic to the marine environment and/or undergo faster biodegradation. The trend towards more environmentally benign surfactants continues. With the aim to develop greener surfactants with multifunctional properties, various cationic gemini surfactants (having different spacers) are synthesized and characterized (Chapter 1). Various physico-chemical properties are used to determine different aggregation and surface properties. Synthesized surfactants are having better properties (cmc or Krafft temperature) over to their conventional counterparts. Based on NMR and DLS studies, lower micelle sizes have been found for hydrophilic spacer based geminis over polymethylene spacer based ones. From this study, 16-Isb-16 has been selected for the detailed study on vesicle to micelle (VMT) / micelle to vesicle transitions (MVT). VMT / MVT has been influence by various external stimuli such as concentration, pH, temperature or salt. However, pH has been found to play a decisive role in vesicle formation. pH can be varied either by dilution or by buffer / NaOH. 16-Isb-16 forms vesicular aggregates near pH 7.0 or ~ 42-45°C. NaSal has been found most effective in converting vesicles to micelles. Polycyclic aromatic hydrocarbon (PAH) solubilization studies show that

synthesized greener gemini surfactants are better solubilizer in aqueous solution then single chain conventional cationic surfactants. However, they were found inferior then polymethylene spacer based geminis. But drawback of poor biodegradability of polymethylene spacer based geminis, the present synthesized geminis are potential candidates for medicinal, aquatic or soil remediation applications.

Model transfection studies, *in vitro*, use to perform with lipoplexes in presence of helping lipids. The preliminary transfection studies, with the synthesized gemini surfactants, on human lung cancer (A549) and normal (L132) cells show that the present geminis has a potential to replace helping lipid. Further, at equal concentration, most of the synthesized surfactants are fatal for A549 and have no adverse effect on L132. 16-Eg-16 shows good pDNA transfection ability towards A549.