Inferences and Future Perspectives

This thesis was conceived with the central idea to explore the possibilities of formation of polyion complexes from random copolymers. The work presented here is a stepwise investigation on the polyion complexes formed from the novel random copolymers (RCPs) of methoxy poly(ethylene glycol) monomethacrylate (MePEGMA) and (3-(methacryloylamino)propyl)trimethylammonium chloride (MAPTAC).

To begin with, RCP-SDS system was studied in detail as a model system to get a preliminary insight into the various aspects of the random copolymer-surfactant complexes. The results suggest that the properties of the random copolymer complexes could be finely tuned by varying the poly(ethylene glycol) content in the polymer.

The study on the complexes of the RCPs with biosurfactants like bile salts as well as natural surfactants like sodium oleate and sodium laurate showed the viability of these RCPs as a potential constituent of the drug delivery systems.

In a further effort, this idea was carried forward towards a comprehensive understanding of the biophysical interactions of RCP with DNA. RCPs form stable polyplexes having micelle-like structure with a nanometric core of cationic units neutralized by phosphate anions of DNA surrounded by a shell of hydrophilic segments of PEG.

The ease of preparation and broad choice of polymer architecture available with random copolymers make RCP-surfactant/DNA complexes
promising in addressing various basic and practical problems in vehicle based
drug/gene therapy research.

However the correlations reported in this thesis are a minimum first step towards establishing a database needed to provide insight into the various characteristics of PEG based random copolymer-surfactant/DNA complexes used as delivery systems. The projected feasibility and efficacy could be evaluated only by a detailed study on the \textit{in vitro} and \textit{in vivo} performances. We would be pursuing work in this direction through possible collaborations.

While we have been able to reach a conclusion regarding the formation and basic properties of the RCP-surfactant/DNA complexes, the detailed structure and morphology of these systems are still elusive, even though several attempts were made in this direction. From a fundamental point of view, it would be interesting to probe the structural characteristics in detail. This could also help to rationalize the properties and in designing new copolymer self-assemblies. These would be some of the directions that could be pursued in future.
List of Publications

1. Water-Soluble Complexes from Random Copolymer and Oppositely Charged Surfactant. 1. Complexes of Poly (ethylene glycol) Based Cationic Random Copolymer and Sodium Dodecyl Sulfate

   Nisha C. K., Manorama S. V., Munia Ganguly, Souvik Maiti, Jayachandran K. N. Langmuir (under revision)

3. Small Angle Neutron Scattering Studies on Water-Soluble Complexes of Poly (ethylene glycol) Based Cationic Random Copolymer and Sodium Dodecyl Sulfate (in process)
   Nisha C. K., Manorama S. V., P. S. Goyal, V. K. Aswal, Souvik Maiti, Jayachandran K. N.

4. Water-Soluble Complexes from Random Copolymer and Oppositely Charged Natural Surfactants. (in process)
   Nisha C. K., Manorama S. V., Souvik Maiti, Jayachandran K. N.

Other Publications

1. Probing the Association Behavior of Poly(ethylene glycol) based Amphiphilic Comb-like Polymer in NaCl Solution
2. Aggregation and Polymerization of PEG based Macromonomers with Methacryloyl Group as only Hydrophobic Segment.

3. Interpenetrating Polymer Networks of Poly(N-isopropyl acrylamide) with Anionic and Cationic Polymers
Dhara D. Chatterji P. R., Nisha C. K.

4. Super Absorbancy and Volume Phase Transition in Crosslinked Poly((3-(methacryloylamino)propyl trimethyl ammonium chloride) Hydrogels
Dhara D. Nisha C. K., Chatterji P. R.

5. Super Absorbent Hydrogels: Interpenetrating Networks of Poly(acrylamide-co-acrylic acid) and Poly(vinyl alcohol): Swelling Behavior and Structural Parameters
Dhara D., Nisha C. K., Chatterji P. R.