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The goals of this research have been (1) to generate knowledge concerning the nature and dynamics of adsorption of surfactants in aqueous solutions and (2) to generate innovative and fundamental paradigms that will allow an understanding of the adsorption at the molecular level. The spectroscopic probe technique has been employed to investigate aqueous solutions of micelles, polyelectrolytes, cyclodextrins and DNA. In addition, the interactions of aqueous suspension of surfactants and polymers with solid surfaces have been investigated. Keywords:

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FINAL REPORT

Photoluminescence probes of aqueous solutions of micelles & related colloidal systems.

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March 15, 1989

U.S. ARMY RESEARCH OFFICE

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Abstract

The goals of this research have been (1) to generate knowledge concerning the nature and dynamics of adsorption of surfactants in aqueous solutions and (2) to generate innovative and fundamental paradigms that will allow an understanding of the adsorption at the molecular level. The spectroscopic probe technique has been employed to investigate aqueous solutions of micelles, polyelectrolytes, cyclodextrins and DNA. In addition, the interactions of aqueous suspension of surfactants and polymers with solid surfaces have been investigated.

Statement of Problems Studied

The nature and dynamics of adsorption of surfactants and polymers in aqueous systems is of broad importance in fields as diverse as drug delivery and detergency. Often the technological aspects of these systems derives from the formation of aggregates such as micelles or hemimicelles. In

general, hydrophobic forces play an important role in determing the structures of these aggregates. This research program has deduced the structures of the aggregates by the ESR and photoluminescence probe techniques. The same ideas and methods employed to study aggregates were employed to investigate the nature and dynamics of binding of metal complexes to DNA. Knowledge of the binding is crucial for an understanding of the mechanisms of damage to DNA when the bound complexes are photoexcited.

Summary of Important Results

Eleven publications have resulted from research supported by AOR proposal 23144-CH. Among the important results obtained from this research are:

1. an investigation of the time resolved resonance Raman spectra of polypyridyl complexes of ruthenium[1]
2. an investigtion of photoinduced electron transfer through DNA[2]
3. polyelectrolyte effects on the quenching of a fluorescence probe[3]
4. fluorescence probe investigations of polymer-polyelectrolyte interactions[4]
5. fluorescence probe investigations of conformations of a polyelectrolyte adsorbed on a solid surface[5]
6. an investigation of the influence of high pressure on micellar properties[6]
7. an ESR probe investigation of chain flexibility of surfactants adsorbed on solid surfaces[7]
8. a photoprobe investigation of the nature of polymer aggregates adsorbed on a silica surface[8]
9. an investigation of the mechanism of excimer formation by pyrene in a micelles formed by a crown ether surcatant and water soluble polymers[9,10]
10. a resonance Raman investigation of the factors influencing the adsorption of metal complexes on laponite clays[11].

Participating scientific personnel

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