RELATÓRIO DE ATIVIDADES

COPIN - Professor Visitante

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Recife, dezembro de 2002
RELATÓRIO DE ATIVIDADES

1. CONFERÊNCIAS

1.1 “MONOLAYERS OF AMPHIPHILIC CYCLODEXTRINS AND THEIR MIXING WITH PHOSPHOLIPIDS”

Conferência Geral apresentada no Departamento de Química Fundamental - UFPE
Recife, PE em 31 de outubro de 2002

Abstract

Monolayers of Amphiphilic Cyclodextrins and their Mixing with Phospholipids

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Cyclodextrins (CD) are cyclic oligosaccharides built of 6,7 or 8 glucopvranose units. Due to their hydrophobic cavity they are capable of including a wide range of organic molecules. They find, therefore, wide applications in alimentary, pharmaceutical and separation technologies. When modified by grafting hydrophobic fatty acids to either their primary or secondary face they become surface active and self-assembling systems. The monolayer properties of the modified â cyclodextrins with the chain length varying from 2 to 14 carbons have been characterized by surface tension and surface pressure measurements. It has been found that the symmetry of the structure of cyclodextrin molecules has an important effect on the dielectric properties of these amphiphiles. Thus for a â CD molecule, due to its asymmetry, packing in monolayers was unfavorable and its effective dipole moment per glucopyranose unit as compared to â or ã CDs was the highest. This was attributed to the existence of voids between molecules constituting a monolayer filled up with interstitial water. The effect of the chain length on the surface properties of âCDs had also been studied. A particular behavior of âCD_8 was observed. This molecule packs in an open arrangement, 2.8 times effective diameter of the molecule (190 Å²). Due the almost the same length of its hydrophilic and hydrophobic moieties the âCD_8 has the highest effective dipole moment per molecule and a very high dipole moment per chain. In another study performed in the laboratory we compared the mixing behavior in monolayers of a positively charged on the primary face and with grafted on the secondary face hexyls âCD (NH_3âCDOC_6) with either zwitterionic dipalmitoylphosphatidyl choline (DPPC) or phosphatidic acid (DPPA). The occurrence of an interaction at the level of oppositely charged polar groups NH_3âCDOC_6 and DPPA was demonstrated by the non-ideal composition dependence of the water additivity coefficient characterizing interfacial water. Also positive mixing energies and interaction parameters at collapse pressures...
evidenced that the cyclodextrin formed less stable monolayers with DPPA than with DPPC for which ideal mixing occurred. Surface potential data for these systems corroborated those from surface pressure-molecular area relationships. Whereas the effective dipole moment of DPPA increases with the increase in molecular area that of CD decreases. It is believed that the effective dipole moment of DPPA largely depends on structure of the bound water entailed by the reorientation of its polar group. The unfavorable matching in dielectric properties between the two molecules (NH3âCDOC6 and DPPA) modifies the structure of bound water to the CD and gives rise to the nonideality of mixing of these two molecules in monolayers.


1.2 “MOLECULAR RECOGNITION IN MONOLAYERS. INTERACTION BETWEEN HUMAN SEROTONIN TRANSPORTER PROTEIN (SERT) AND ITS SPECIFIC LIGANDS”

Conferência apresentada na VI Reunião Regional da Sociedade Brasileira de Bioquímica e Biologia Molecular – SBBQ
Fortaleza, CE em 07 de novembro de 2002

2. ENSINO

Prof. Dr. Adam Baszkin

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Physical Surface Chemistry class

In the framework of the Postgraduate Program of Material Sciences (Chemistry and Physics Departments of the UFPE) the Physical Surface Chemistry class will be taught during three months twice a week (Tuesdays and Thursdays) from December 2002 through February 2003. This course is aimed to provide basic knowledge of physical surface chemistry necessary for better understanding of **biomaterials functioning and of the prerequisites necessary for the new materials tailored for medicinal purposes.** The course will include teaching of the following matters:

- Interfacial thermodynamics principles (functions of state, reversibility of processes, the excess interfacial quantities and the relationship between their integral and differential functions)
- Surface and interfacial tensions of liquids and methods of their measurement
- Molecular basis of surface activity, classification of surfactants and of adsorption isotherms, Gibbs monolayers, insoluble monomolecular films and their physical state
- Gibbs adsorption equation, Langmuir adsorption equation and their application.
- Association of surfactants (colloids): micelles, vesicles, and membranes.
- Thermodynamics of micelles formation, molecular geometry and formation of association colloids, aggregation numbers, critical micelle concentration (cmc)
- Wetting and spreading (thermodynamics of wetting, classification of wetting processes, contact angles and their hysteresis, kinetics of wetting, solid surface free energy, critical surface tension of wetting, intermolecular forces involved in solid-liquid adhesion)
- Interfacial forces (covalent bonds, columbic forces, dispersion and van der Waals forces, Hamaker constants, dipoles and polarization, electric double layer force, hydrophobic interaction, repulsion entropic forces, packing and depletion forces). Direct measurement of surface forces.
- Characterization of solid surfaces: spectroscopes (ESCA, SIMPS, ATR-FTIR), microscopes: (SEM, STM, AFM)

2. PESQUISA

2.1 Desenvolvimento de Projeto de Pesquisa: “Estudo de Filmes Interfaciais Mistos de Fosfolipídeos, lectinas, polissacarídeos e fármacos utilizando técnica de Langmuir-Blodgget”

As atividades de pesquisa do Prof. Adam Baszkin foram desenvolvidas no Laboratório de Polímeros Condutores do Departamento de Física da UFPE, sob a responsabilidade do Prof. Celso de Melo Pinto, sobre “Estudo de Filmes Interfaciais Mistos de Fosfolipídeos, lectinas, polissacarídeos e fármacos utilizando técnica de Langmuir-Blodgget”.

O presente projeto está inserido, como continuidade, no contexto de um projeto maior, financiado no acordo CAPES-COFECUB 269/99, que vem sendo desenvolvido pelo grupo de pesquisa da UFPE em colaboração com grupo de pesquisa da Universidade de Paris, desde 1999, sobre “**Caracterização físico-química de lectinas vegetais nativas do Nordeste Brasileiro: Aplicação à formulação de Sistemas micro e nanoparticulados de Liberação Controlada de Medicamentos**”. Este projeto está sendo atualmente desenvolvido pelo Doutorado em Ciências Biológicas, sob a responsabilidade da Profa.
Nereide Stela Santos Magalhães e da Profa. Luana Cassandra Breitenbach Barroso Coelho, em colaboração com a pós-graduação em Física, sob a responsabilidade Prof. Celso de Melo Pinto, e a pós-graduação em Química com a colaboração da Profa. Rosa Souto Maior.

Estudo das Propriedades de superfície de Lectinas em filmes mistos com fosfolipídeos
1. Estudo das propriedades interfaciais de biomateriais em filmes mistos utilizando a técnica de Wilhelmy
2. Estudo das propriedades interfaciais de biomateriais em filmes mistos utilizando a técnica de Langmuir-Blodgett
3. Caracterização espectroscópica de filmes LB em infravermelho
4. Caracterização espectroscópica de filmes LB com Raios-X

2.2 REDAÇÃO DE ARTIGO CIENTÍFICO

• Interaction of the Bauhinia monandra Lectin (BmoLL) with Lipid Monolayers
Véronique Rosilio, Cesar A. S. Andrade, Luana C. B. B. Coelho, Nereide S. Santos-Magalhães, Adam Baszkin
Colloids and Surfaces B: Biointeractions (submetido, 2003)

3. CO-ORIENTAÇÃO DE TESES

• Curso de Mestrado em Bioquímica -UFPE
Aluno: Nerivan Barbosa
Projeto: “Estudo da interação interfacial entre o ácido úsnico e monocamadas de fosfolipídeos”
Orientador: Prof. Dr. Adam Baszkin
Co-Orientador: Profa. Dra. Nereide Stela Santos Magalhães
Colaborador: Prof. Dr. Carlos Baltar
Situação: Elaboração do Projeto

• Programa de Pós-Graduação em Ciências de Materiais - UFPE
Aluno: César Augusto Souza Andrade
Projeto: “Estudo de filmes mistos interfaciais Langmuir-Blodgett de monocamadas de fosfolipídeos com lectina de Bauhinia monandra”
Orientador: Prof. Dr. Celso Pinto de Melo
Co-Orientador: Prof. Dr. Adam Baszkin
Colaborador: Profa. Dra. Nereide Stela Santos Magalhães
Situação: Projeto em desenvolvimento