First International Conference on Biomedical Spectroscopy

Venue: Cardiff

Location: Cardiff, Wales, United Kingdom

Science > Biochemistry

Science > Life Sciences

Science > Chemistry

Event Date/Time: Jul 07, 2002

End Date/Time: Jul 10, 2002

Early Registration Date: May 31, 2002

Abstract Submission Date: Jun 15, 2002

First International Conference on Biomedical Spectroscopy:

From Molecules to Men

7-10 July 2002, Cardiff, Wales

Dedicated to the Memory of

Professor Dennis Chapman FRS

First International Conference on Biomedical Spectroscopy
From molecules to Man
7 – 10 July 2002, Cardiff, Wales

This certificate is to confirm that Dr. M. Cocera has attended the First International Conference on Biomedical Spectroscopy.

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Scientific Programme:
First International Conference on Biomedical Spectroscopy: From Molecules to Men

7-10 July 2002
Cardiff International Arena
Cardiff, United Kingdom

SUNDAY 7 JULY 2002

11-00AM ONWARDS: REGISTRATION: Cardiff International Arena

16:00: **Welcome** addresses by Rt Hon **Rhodri Morgan** AM, First Minister, National Assembly for Wales

16:15-16:45: PLENARY OPENING LECTURE: Erwann Loret
From NMR structures to the discovery of Tat HIV inhibitor.

16:45-17:00: TEA AND REFRESHMENTS

17:00-17:30: M.A. Thomas
Adding A New Spectral Dimension to Localized MR Spectroscopy in vivo: From Phantoms to Humans

17:30-18:00: William J. Griffiths
Electrospray Mass Spectrometry in Biomedicine

18:00-18:30: Harald E. Möller
Investigation of Energy Metabolism in Skeletal Muscle Using Dynamic ^{31}P NMR Spectroscopy

18:30-19:00: Carola Kryschi,
Second-harmonic generation of cell membranes: detection and imaging of membrane potential changes in living cells

19:00-19:30: M. Minunni
Biosensors as a new analytical tool for detection of genetically modified organisms

19:30-20:00: C. Nielsen
Methodological development of solid-state NMR for characterization of membrane proteins

20:00 ONWARDS WELCOME RECEPTION

TITLE:

SUBLYTIC INTERACTIONS OF SODIUM LAURYL ETHER SULFATE WITH PHOSPHATIDYLCHOLINE LIPOSOMES: KINETIC AND STRUCTURAL ASPECTS

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ABSTRACT:

The incorporation of the sodium lauryl ether sulfate (SLES) on phosphatidylcholine (PC) liposomes has been studied with time using the fluorescent probe 2-(*p*-toluidinyl)-naphthalene-6-sodium sulfonate (TNS). This probe reports changes on the surface potential of PC liposomes by effect of the anionic surfactant adsorption. The addition of small SLES amounts promoted an abrupt fall in the fluorescence intensity and this fall was already detected 10 secs after mixing. Only slight changes with time were observed in the fluorescence intensity of SLES-liposome-probe systems. These results indicate a fast and almost complete incorporation of SLES on the liposome surface. The surfactant/lipid molar ratios (Re) and the surfactant partition coefficients bilayerlaqueous phase (K) were determined from the linear dependence between lipid and surfactant concentrations obtained for a fixed number of surfactant molecules on the liposome surface. The Re values indicated that the highest SLES ability to adsorb on the surface occurs at the initial adsorption moments. The K values indicated that the affinity of the surfactant by the liposomes decreased after about 7500 surfactant molecules were adsorbed on the bilayer. This fact is probably caused by the increase of electrostatic repulsion between surfactant monomers in the bulk solution and the bound surfactant. The aforementioned linear dependence obtained from the data for a given number of SLES molecules on the bilayer and the range of SLES concentrations used (below and above its critical micelle concentration, CMC) suggest an adsorption mechanism regardless of the surfactant concentration: a monomeric adsorption of SLES is always assumed in both above and below surfactant CMC. In comparison with the higher adsorption reported for the analogous surfactant sodium dodecyl sulfate, the presence of ethylene oxide moles in SLES could hinder its incorporation on PC liposomes. Thus, this study of sublytic interactions allows to follow the incorporation of surfactants on the lipid bilayers and to compare the effect of different surfactants on the membranes before the lysis.

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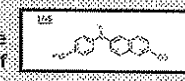
INTRODUCTION:

The anionic surfactant sodium lauryl ether sulfate (SLES) is a widely used surfactant in many household and personal care products because of its good foaming properties.

The ethylene oxide (EO) units in the SLES molecule is the unique structural difference with the sodium dodecyl sulfate (SDS). SLES has demonstrated to be less irritant than the SDS [1] on the skin and the presence of EO appears to be the cause of its milder behaviour. In this sense, the use of liposomes as a membrane model could help to understand the EO effect on the irritant activity of surfactants. Although we are aware that the phosphatidylcholine (PC) liposomes are a simple membrane model, they can provide valuable information that would be difficult to attain *in vivo*.



OBJECTIVE: the objective of this work is to investigate the sublytic interactions of SLES and PC liposomes by means of the fluorescent probe 2-(*p*-toluidinyl)-naphthalene-6-sodium sulfonate (TNS), which reports on the surface potential (Ψ_0) of membranes [2-3].

MATERIALS AND METHODS:

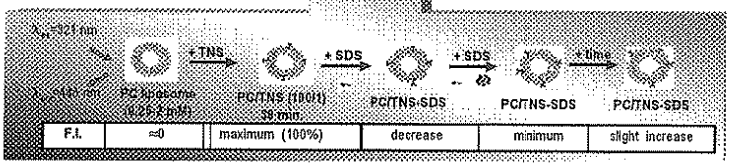
PC from soybean lecithin (Lipoid GmbH).
SLES with 2 EO moles (27% actve matter) (Albright and Wilson Iberica).
SDS (Merck)
TRIS Buffer (5.0 mM TRIS (Merck) and 100 mM NaCl), adjusted at pH 7.4 with HCl.
TNS (Sigma Chemical Co.) as 100 μM TNS in TRIS buffer and stored at 4ºC.
Polycarbonate membranes (Nucleopore).

Determination of critical micelle concentration (CMC) by the Wilhelmy plate method (Kruss K-12 Processor Tensiometer).

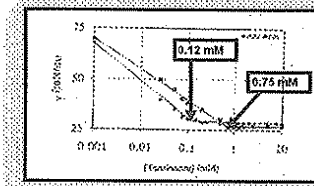
PC liposomes with TNS and interaction with SLES: PC-chloroform was evaporated to dryness and the lipid film was dispersed with TRIS buffer. Extrusions through polycarbonate membranes of 800-400-200 nm pore size were performed to form unilamellar liposomes.

Determinations of the fluorescence (F.I.) variations were performed on a spectrofluorometer (Shimadzu RF-540, Kyoto Japan). The Ψ_0 of vesicles was calculated from the F.I. ratio of pure liposomes and those containing surfactant molecules at the same [PC]. From these values, we can obtain the number of surfactant molecules adsorbed on the outer monolayer per vesicle (***n***) by applying (a), (b), and (c) [3].

$$\frac{f(-)}{f(0)} = \exp\left\{\frac{F\psi_0}{RT}\right\} \quad \text{(a)} \qquad \sigma_0 = 11.74 \times \sqrt{C} \times \sinh\left(\frac{ze\psi_0}{2kT}\right) \quad \text{(b)} \qquad n = \frac{\sigma_0}{1.6021892 \cdot 10^{-19}} \times Sext \times 10^{-22} \quad \text{(c)}$$



RESULTS AND DISCUSSION:



EO moles
- decrease of the CMC
- increase of the γ_{CMC}

Hence, we may assume that the EO units in SLES decrease its surface activity.

Figure 1: Variation in the surface tension of SLES and SDS solutions in TRIS buffer vs [surfactant].

Addition of SLES in liposomes even < [CMC]
- abrupt decrease of F.I.
- slight changes of F.I. with time

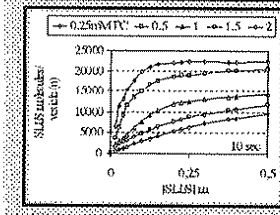
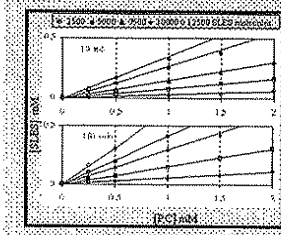


Figure 2: Variation in *n* vs. the [SLES] in the system after 10 secs of incubation (PC/TNS molar ratio 100).

The adsorption is fast and almost complete, in line with the previously reported adsorption of SDS [3]. The EO moles in the molecular structure of the SLES seem to hinder the adsorption on the bilayer, despite of the similar behaviour of these surfactants in the solubilization process[4].



For a fixed ***n***, a linear relationship between [SLES] and [PC] concentrations can be established.

⇓

adsorption mechanism below/above the surfactant CMC as **monomers**:

- from solution → liposome surface (below CMC)
- from micelles → solution → liposome surface (above CMC)

Slight changes on the liposome surface with time

⇓

surfactant migration to the inner monolayer

Figure 3: [SLES] resulting in different number of molecules incorporated on the outer surface of liposomes vs [PC] after 10 seconds and 180 min of incubation.

CONCLUSIONS:

- the EO units in SLES decrease its surface activity.
- the adsorption on the liposome surface is fast and almost complete and a slower migration to the inner monolayer occurs with time.
- the EO moles in the SLES molecule seem to hinder the adsorption on the bilayer.
- a monomeric mechanism of the surfactant adsorption below and above its CMC is assumed.
- a hindered adsorption on the skin of the SLES could explain its minor damaging effect beside the SDS.

REFERENCES:

1. Charbonnier, V., Morrison, B.M. Jr., Paye, M., and Maibach H.I. *Food Chem. Toxicol.* 2001, *39*, 279-286.
2. Eisenberg, M., Gresalfi, T., Riccio, T, and McLaughlin, S. *Biochemistry* 1979, *18(23)*, 5213-5223.
3. Cócera, M., López, O., Estelrich, J., Parra, J.L., and de la Maza, A. *Langmuir* 2000, *16(9)*,4068-4071.
4. de la Maza, A., Coderch, L., López, O., Baucells, J, and Parra, J.L. *J. Am. Oil Chem. Soc.* 1997, *74(7)*, 1-8.