

STUDY OF LANGMUIR MONOLAYERS AND LB FILMS CONTAINING DRUG MOLECULES FOR BIOSENSOR APPLICATIONS

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INTRODUCTION

The long term goal of this project is the realization of a specific biosensor for a family of macrocyclic antibiotics used in veterinary medicine (bovine mastitis): Rifamycins (Rfs).



Current legislation imposes a very low limit, i.e. 10^{-7} M, for these molecules in milk.

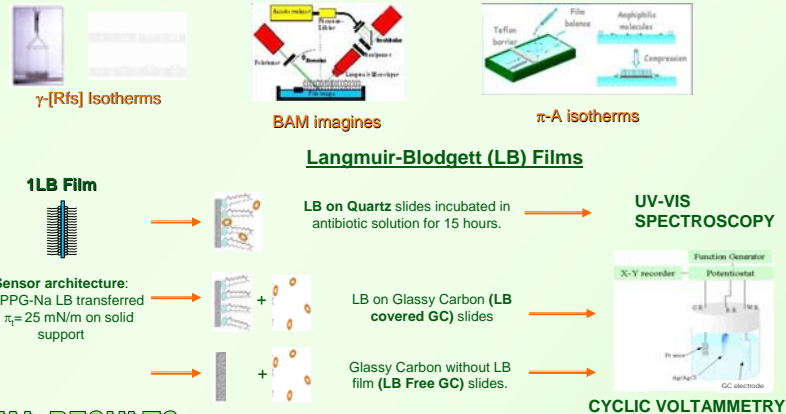
The sensor will be built transferring on solid support dipalmitoylphosphatidylglycerol Sodium Salt (DPPG-Na) layers by means of the Langmuir-Blodgett (LB) technique. The characterization of Rfs in water and their interaction with DPPG-Na LB monolayer have been performed by Surface Tension-Rifamycins Concentration (γ -[Rfs]) isotherms, Surface Pressure-Area (π -A) isotherms and Brewster Angle Microscopy (BAM).

We used two different analytic methods, i.e. UV-Visible absorption and Cyclic Voltammetry (CV) to test the performance of our nano-sensor.

MATERIALS

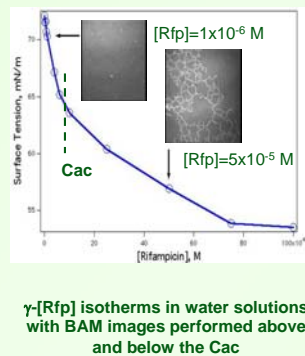
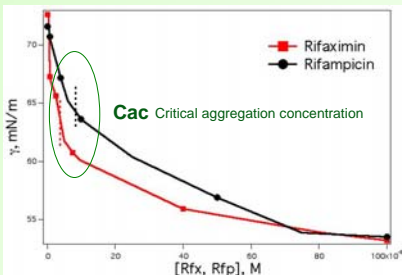


METHODS

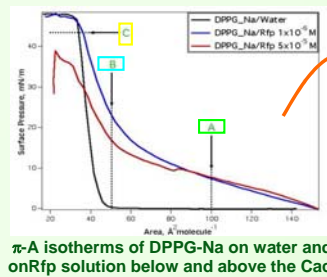


EXPERIMENTAL RESULTS

SURFACE TENSION - [Rfs] ISOTHERMS



SURFACE PRESSURE-AREA ISOTHERMS and BAM

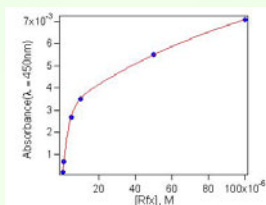
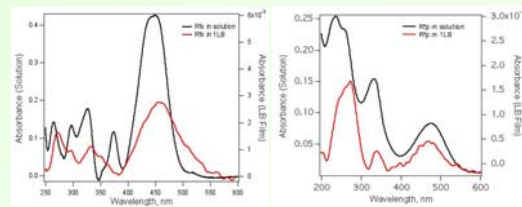


BAM images of DPPG-Na Langmuir monolayer at three different molecular areas

	A 100 Å ² /molecule	B 50 Å ² /molecule	C 35 Å ² /molecule
Dppg Na/ Water			
Dppg Na/ Rfp 1x10 ⁻⁶ M			
Dppg Na/ Rfp 5x10 ⁻⁵ M			

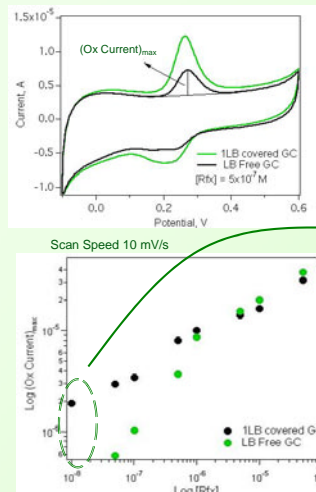
Domains with different brightness correspond to phases with different molecular density and thickness.

UV-VIS SPECTROSCOPY



Absorbance at 450 nm as a function of Rfx concentration in the incubation solution.

CYCLIC VOLTAMMETRY



Rfx concentration as low as 1×10^{-8} M are detected only using 1LB covered GC electrodes

CONCLUSIONS

- π -A isotherms and BAM images indicate that Rfs interact with DPPG Na monolayer changing its phase behavior. The antibiotics affect the monolayer both in monomer and aggregated form.
- UV-Vis spectroscopy and CV showed the presence of Rfs in the LB film of DPPG-Na.
- UV-Vis spectroscopy cannot be used as detection method for Rfs concentration lower than 5×10^{-7} M.
- The presence of 1LB layer on the GC electrode enhances the migration of the antibiotics at the electrode surface allowing to decrease the Rfs detection limit.

