

# Lipid adsorption on polyelectrolyte multilayer

## Influence of chemical pre-treatment of the multilayer and presence of cholesterol in the lipid layer

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*Lipid adsorption on top of polyelectrolyte multilayer is a promising tool for permeability control of low molecular weight compounds. In our experiments we investigated the influence of cholesterol on the formation and structure of the lipid layer adsorbed on top of PAH/PSS multilayer. The thickness of a supported DPPC/DPPA (9/1) lipid layer was found to be 28 Å. For the lipid layer obtained from DPPC/DPPA and 20% (w/w) cholesterol the measured thickness was 36 Å. A pre-treatment of the support with NaOCl can reduce the surface charge density and influence the fluidity of the supported lipid layers. This part of the project could not be completed. For the NaOCl concentrations applied in this experiment a complete destruction of the PE multilayer occurred.*

Polyelectrolyte (PE) capsules coated with lipids are expected to find applications as drug carriers. This kind of composites show properties closed to these of a supported lipid bilayer. The most important factors influencing significantly the permeability for low molecular weight compounds, thickness and thermal stability of supported lipid bilayers are the lipid composition and the interaction with the PE support. In particular, the incorporation of cholesterol and the surface charge density of the support are essential for the resulting fluidity of the supported lipid layer.

In the present work we investigated the influence of cholesterol on the thickness of lipid layers formed by vesicle adsorption on poly-sodium 4-styrenesulfonate (PSS) / poly-allylamine hydrochloride (PAH) polyelectrolyte multilayer.

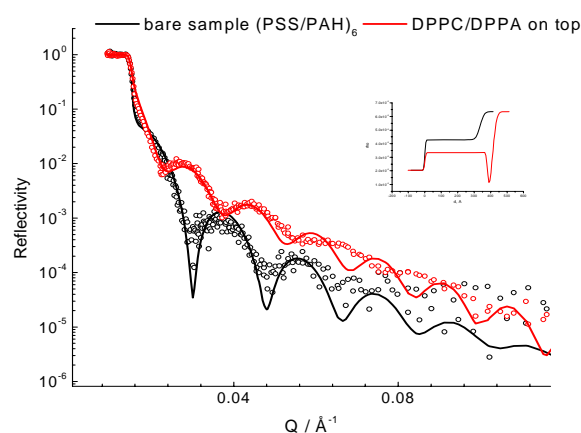
Lipid vesicles were prepared from a dipalmitoyl phosphatidyl choline (DPPC) / dipalmitoyl phosphatic acid (DPPA) mixture (9/1w/w) and DPPC/DPPA/cholesterol mixture (20% cholesterol) using the protocol of a hydrated lipid film followed by sonication and extrusion at 60°C either in H<sub>2</sub>O or D<sub>2</sub>O to a final diameter of 200 nm and concentration of 1 mg/ml.

The experiments were performed in a homemade liquid/solid experimental cell in ToF mode at the reflectometer AMOR at three angles of incidence. This way the whole necessary Q range was accessible. The first NR experiment was successfully carried out on the polyelectrolyte cushion, which was prepared in advance by layer-by-layer deposition of PSS and PAH on a Si block. The bilayer structure was obtained after in-situ lipid adsorption at 60°C for 30 min. We found a significant difference between the curves obtained for the lipid layer with and without cholesterol. The calculated thickness of the hydrophobic part was 28 Å for the DPPC/DPPA bilayer and 36 Å when 20% cholesterol was present.

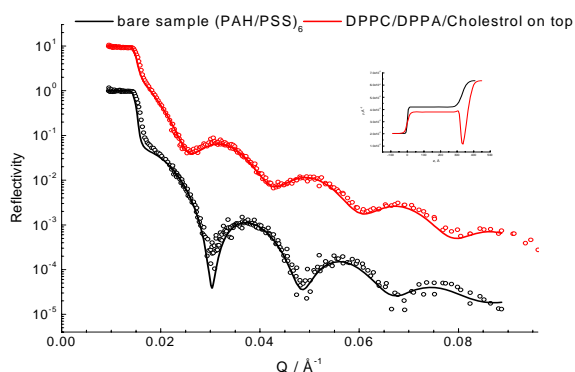
The second part of the work studied the influence of a pre-treatment of the polyelectrolyte multilayer with sodium hypochlorite NaOCl that simulates the wall of a hollow capsule prepared on fixed erythrocytes.

The treatment of the PE support with 1,2% NaOCl solution resulted in a complete destruction of the multilayer. The obtained curve was identical with that of a bare Si block. Similar situation occurred with ten times less concentrated NaOCl solution. For this reason the second part of the proposed experiment could not be performed. The conditions for the NaOCl - treatment of PE layers adsorbed

on a Si support have to be optimized before conducting the proposed experiments.



**Figure 1:** NR curves from a PE film before (black) and after formation (red) of a lipid bilayer consisting of DPPC /DPPA (9/1). Lipid vesicles prepared in D<sub>2</sub>O.



**Figure 2:** NR curves from a PE film before (black) and after formation (red) of a lipid bilayer consisting of DPPC /DPPA (9/1) and cholesterol (20%). Lipid vesicles prepared in D<sub>2</sub>O.

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