

Experimental report

07/08/2024

Proposal: 9-12-693

Council: 4/2023

Title: Effect of polystyrene particles on the properties of model biological membranes

Research area: Biology

This proposal is a resubmission of 9-12-667

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Samples: DPPC, cholesterol

polystyrene (90 monomers, MW 9000)

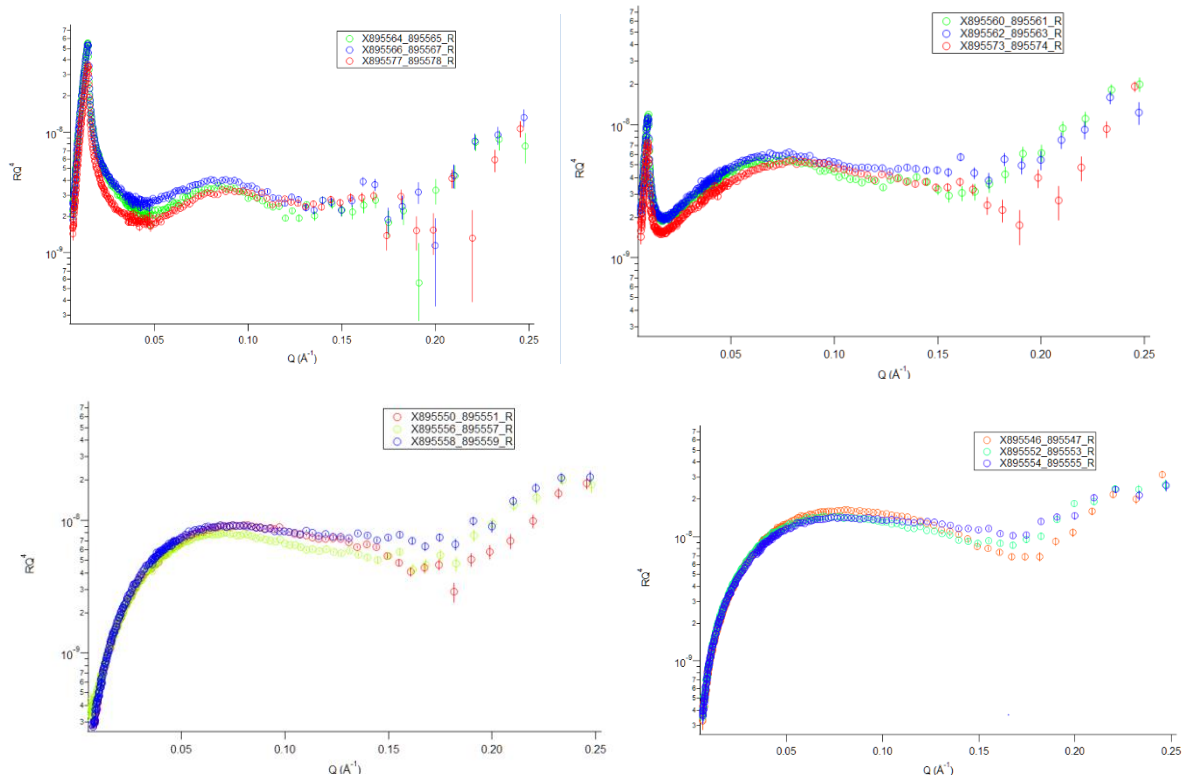
Instrument	Requested days	Allocated days	From	To
FIGARO	0	0		
D17	3	3	15/09/2023	18/09/2023

Abstract:

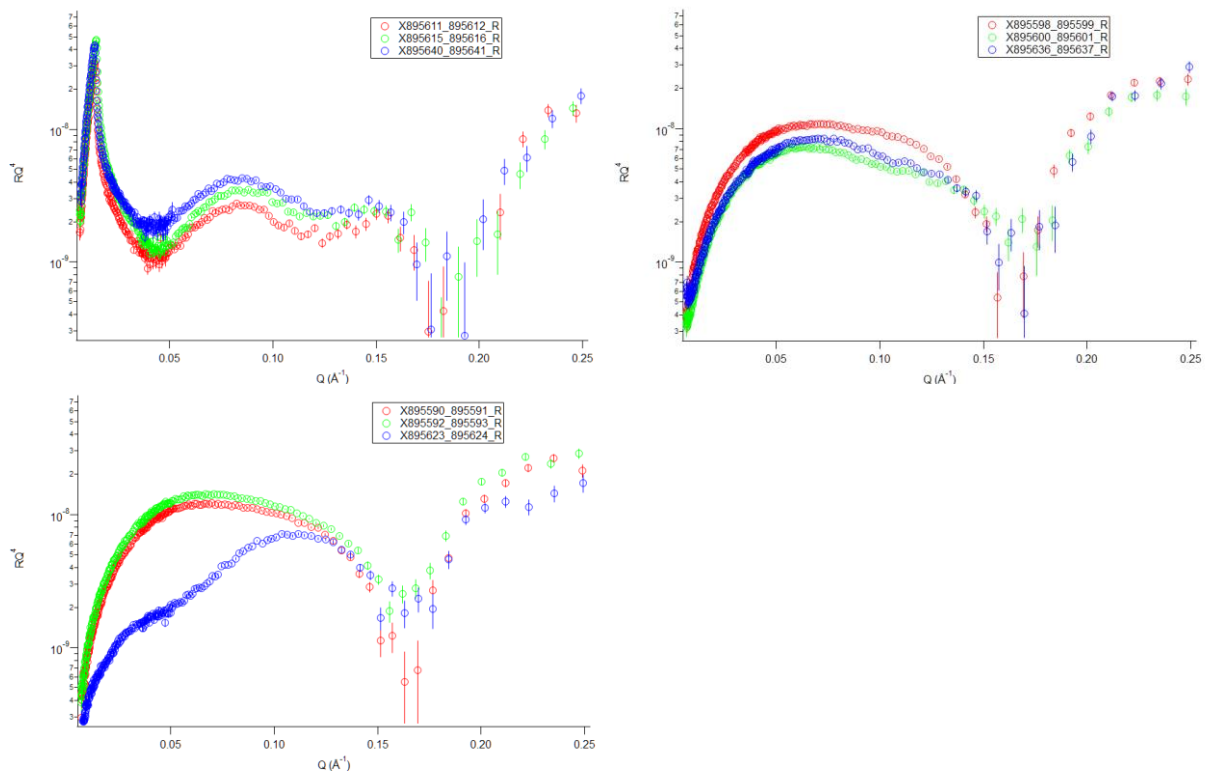
Biological membranes are the first barrier encountered by particles foreign to the cell. Characterizing the interaction of plastic nanoparticles (NPs) and polymers with cell membranes is the first step towards understanding the physical and chemical basis for their toxicity in all living organisms. Recently we found that doping doses of short chains of polystyrene (25 monomers) alter the thermal and structural properties of DPPC model membranes, in a concentration-dependent fashion. Our aim is to study the interaction of polystyrene with increasing chain-length with different biomimetic model membranes by neutron reflectometry to investigate the disposition of polymer chains in the lipid core as a function of their length and mole fraction.

We investigated the effect of PS in a biomimetic system studying the interaction of PS25 and the longer PS90 chains (90 monomers) incorporated in DPPC bilayers. The samples were prepared by vesicle fusion directly on the support.

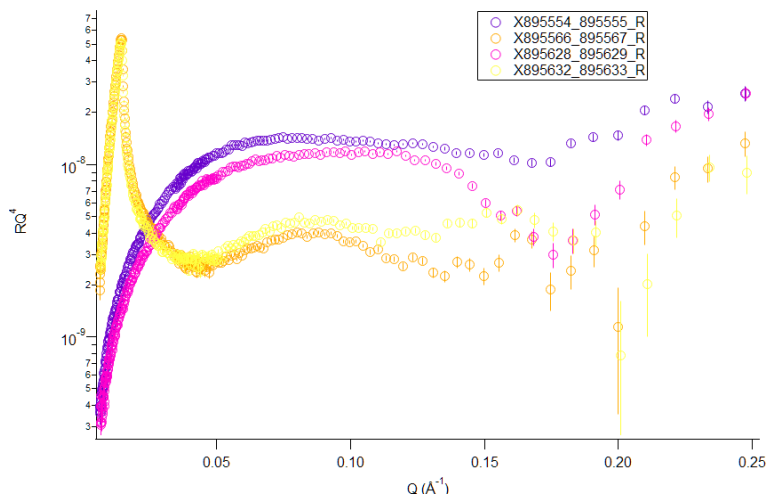
The modifications of the DPPC bilayer in addition of PS25 and PS 90 are visible in each of the four contrast (in red is reported the DPPC bilayer, in green the one with the addition of PS25 10% mol and in blue the DPPC with 10% mol PS90) showed below (D2O, 4MW, SMW and H2O).



We already observed by NR that cholesterol distributes symmetrically in the two layers of a phospholipid membrane, but it assumes an asymmetric distribution when mixed with other components, such as the ganglioside GM1. We investigated the mutual effect of PS and cholesterol on the transversal distribution of components within the core of the membrane. In presence of cholesterol (d62DPPC:chol:PS 10:1:0.15) the effect of PS90 seems to be more remarkable than PS25.



We also exploited the Langmuir Schaeffer facility at PSCM to obtain a supported bilayer with PS90 only in the external layer. The curves show some differences, as can be seen in the figure below.



We are currently fitting the different set of curves to obtain quantitative informations on the lipid and polystyrene organization.