

Experimental report

06/09/2022

Proposal: 9-13-742

Council: 4/2017

Title: A new method for high precision measurements of absorption kinetics in phospholipid bilayers

Research area: Soft condensed matter

This proposal is a new proposal

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Samples: Cholesterol

1-Palmitoyl-2-Oleoyl-sn-Glycero-3-Phosphocholine

1,2-Dipalmitoyl-D62-sn-Glycero-3-Phosphocholine-1,1,2,2-D4-N,N,N-trimethyl-D9

1-palmitoyl-d31-2-oleoyl-sn-glycero-3-phosphocholine

Instrument	Requested days	Allocated days	From	To
D17	2	2	23/03/2018	25/03/2018

Abstract:

More and more often neutron reflectometry is used to study the modifications induced by insertion of small guest molecules (peptides or drugs for examples) into supported model membrane systems. In most of the cases it is impossible to quantify correctly the amount of inserted material simply because the volume fraction and the contrast of these molecules in the bilayer are too small. On the contrary even if the amount of material is small the structural modifications induced to the bilayer are clearly detectable.

With this proposal we propose to optimize a biologically relevant bilayer system that could be used for quantification of the amount of inserted material with a sensitivity on the order of 1% volume fraction.

Report for 9-13-742

The experiment 9-13-742 was designed to evaluate the possibility of producing a null-reflecting bilayer to enhance the sensitivity of a typical NR experiment towards the detection of guest molecules present in the bilayer. This approach was designed following the work of Campbell at the air-water interface.

Null reflecting conditions were achieved by using quartz as solid substrate and a 69% D₂O and 31% H₂O mixture as water phase.

The proposed plan was to prepare an SLB composed of 2% d75DPPC, 42% d31POPC and 16% POPC (by volume). Theoretical calculations did show that with such a composition headgroups and tails would have the same SLD matched to the quartz and water ones. Experiments, however, resulted in a more complex picture, in which full contrast conditions could not be achieved. Different batches of lipids were prepared and compared, and results were similar. After a careful analysis, it was clear that the precision necessary in preparing the lipid mixtures could not be achieved. Indeed it is sufficient that the % of one of the components is slightly off from its nominal value that a NR signal arises.

The result of the experiment was therefore negative, and it demonstrated that this approach is not feasible because of the uncertainty intrinsically present during sample preparation. For this reason the approach was abandoned and further measurements not performed.