Experimental report

22/07/2016

Proposal: **9-13-576** **Council:** 10/2014

Title: The interaction of environmentallyrelevant carbon nanoparticles withlung lipid

Research area: Chemistry

This proposal is a new proposal

Main proposer: **Katherine THOMPSON**

Experimental team: Alan SHERIDAN
Katherine THOMPSON

Local contacts: Richard CAMPBELL

Samples: C40H80NO8P
carbon nanoparticles particles
C40H18D62NO8P

Instrument	Requested days	Allocated days	From	To
FIGARO	2	2	22/07/2015	24/07/2015

Abstract:

Exposure to ultrafine carbon based particulate matter present in polluted air is linked to severe health effects In this initial work we will look at the interaction of carbon nanoparticles with a major lung lipid, DPPC when spread at the air-water interface. Neutron reflection will be used to determine the persistence, and possible re-absorbance of the particles at the interface as the monolayer film is subjected to repeated expansion / compression cycles.

Experimental Report for Experiment #9-13-576

The interaction of environmentally relevant carbon nanoparticles with lung lipid

Background

Gas exchange in mammals takes place in the alveolar epithelium of the lungs. The inner surfaces of the alveoli are lined with a lipoprotein fluid called lung surfactant. The presence of lung surfactant is vital to prevent collapse of the alveoli during expiration. Carbon nanoparticles are present in the atmosphere following the combustion of fossil fuels. The nanoparticles are readily inhaled and because of their small aerodynamic diameter they are capable of reaching, and being deposited in, the alveoli. We were awarded two days on Figaro to investigate the interaction of the nanoparticles with a monolayer of the major lung lipid, DPPC.

Experimental Details

All experiments were performed using a Langmuir trough housed inside an environmental chamber. The surface pressure was measured using a Wihelmy plate whilst the neutron reflectivity was recorded for monolayers of varying composition. In summary: monolayers of ^{2}H-DPPC and carbon nanoparticles on Null Reflecting Water, ^{1}H-DPPC and carbon nanoparticles on Null Reflecting Water and ^{1}H-DPPC and carbon nanoparticles on D_2O were formed and the neutron reflectivity measured over a range of surface pressures and with different ratios of DPPC to carbon nanoparticles. The reflectivity curves of the pure lipid monolayers at these pressures, and also just the carbon nanoparticles were also recorded for comparison.

Results

The experiment worked well. Whilst the presence of high levels of particles caused significant changes to the measured neutron reflectivity data, low levels of particles (more relevant to health effects from air pollution) which are sufficient to cause major changes to the structure of the monolayer in the liquid-expanded liquid-condensed region of the isotherm (from complementary BAM work) did not change the neutron reflectivity within current experimental uncertainty.