Experimental report

08/09/2026

Proposal: 9-13-1083 **Council:** 4/2023

Title: Quantifying the effect of the lungantioxidant vitamin E on the reaction of an unsaturated lipid with anair pollutant

Research area: Chemistry

This proposal is a new proposal

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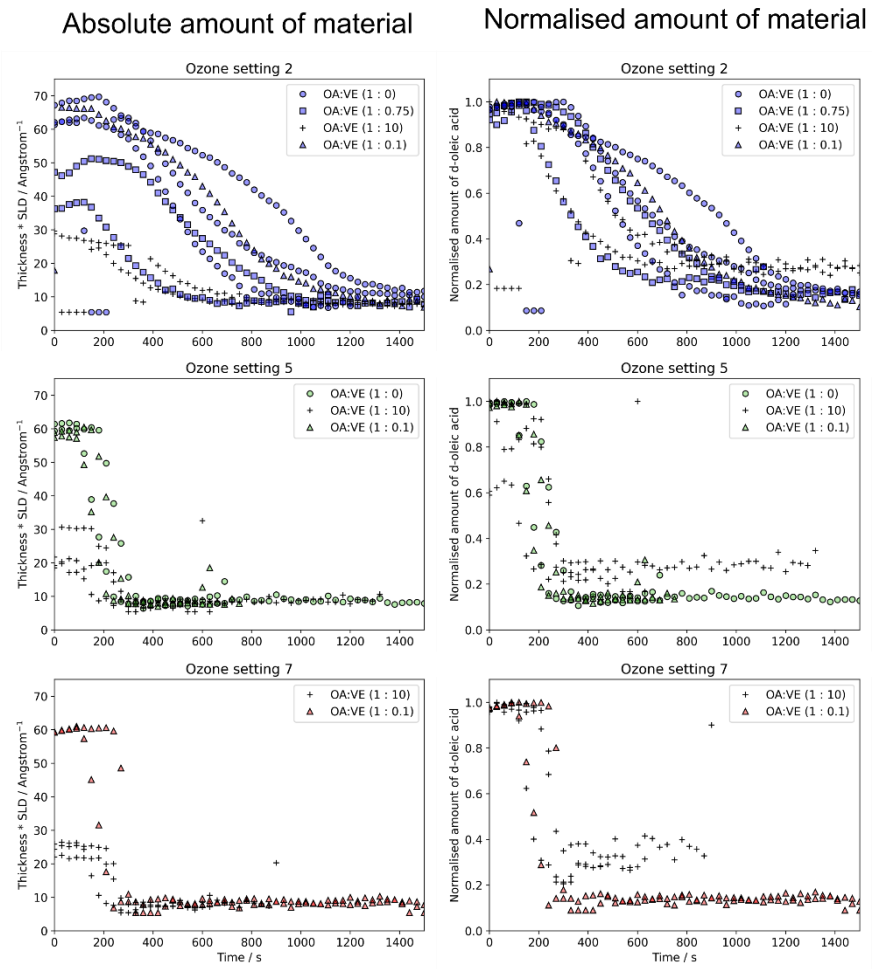
Samples: d34-oleic acid
Vitamin E

Instrument	Requested days	Allocated days	From	To
FIGARO Langmuir trough	3	3	21/11/2023	24/11/2023

Abstract:

The air we breathe has a direct impact on our health via interactions of air pollutants with the epithelial lining fluid (ELF) found in our lungs, which can lead to oxidative stress. An important part of the ELF is the surface layer of lipid surfactants and proteins. The reactivity of this layer towards the common atmospheric oxidant ozone has been studied for a number of lung surfactant proxy systems on aqueous surfaces. For cellular membranes, it is well established that vitamin E significantly slows lipid peroxidation by scavenging reactive intermediates. There is a need to determine the effect of co-existing antioxidants such as vitamin E on the oxidation of unsaturated lipids found in the ELF. We propose a neutron reflectometry experiment on mixed deuterated unsaturated lipid (oleic acid)-Vitamin E monolayers being exposed to ozone. We will be able to derive the kinetic effect of vitamin E on the reaction of oleic acid with ozone to draw health implications and to inform detailed models of the reactivity of the ELF.

Experimental report – 9-13-1083 – FIGARO



Summary of the experiment. The aim of this experiment was to quantify the anti-oxidant effect of vitamin E with regard to the reactivity of an unsaturated lipid towards ozone. This has implications for the resilience of lung surfactants towards oxidation by this common atmospheric pollutant.

We were able to successfully acquire reaction kinetic decay curves for our oleic acid-vitamin E system at various ozone concentrations and oleic acid-to-vitamin E ratios (see figure). There was a clear trend in reactivity, with reactions slowing down with an increasing proportion of vitamin E in the deposited lipid layer.

Kinetic modelling of this system (being finalised but not shown here) shows that at lower ozone concentrations, there seems to be an additional factor affecting kinetics. For some compositions the reaction appeared to be slower initially, then speed up (see figure). This has not previously been accounted for in models of lung surfactant reactivity.

A publication is in draft and close to submission, once modelling is refined. This is the first quantification of the effect of vitamin E on lipid reactivity towards ozone. The unexpected two-stage reaction kinetics observed will also be well-received by the community. Follow up proposals related to this are in the planning.