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# The hygroscopicity and reactivity of fatty acid atmospheric aerosol proxies are affected by nanostructure

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Atmospheric aerosol hygroscopicity and reactivity play a significant role in determining aerosol fate, and are affected by composition and other physical properties. Organic aerosol emissions contain fatty acids, along with sugars such as fructose. As surfactants, fatty acids organise into a range of nanostructures (3-D molecular arrangements), dependent on water content and mixture composition. In this study, we were able to demonstrate (and quantify) that the chemical reactivity of this proxy is dependent on its 3-D molecular arrangement. Furthermore, we have determined the effect of each observed nanostructure on hygroscopicity by measuring the swelling of these nanostructures as a function of relative humidity. We did this by coating capillaries with a fatty acid/sugar as a mixture for an urban aerosol, and following structural changes with simultaneous Small-Angle X-ray Scattering (SAXS) and Raman microscopy, at a synchrotron X-ray source. SAXS measured the nano-structural parameters required to follow both the reaction kinetics (ozonolysis) and hygroscopic swelling of each nanostructure. Raman microscopy provided complementary kinetic information and supported these findings. We found that the molecular arrangement of surfactant material has an impact on both the chemical kinetics and hygroscopicity. This has implications for the persistence of particulate matter in the urban environment and surfactant material in the atmosphere.