Geophysical Research Abstracts, Vol. 7, 07421, 2005
SRef-ID: 1607-7962/gra/EGU05-A-07421

Oxidative processing and mass transfer properties of fatty acids associated with aerosol particles

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Heterogeneous reactions between condensed phase alkenes and oxidants lead to gas phase reactive intermediates and the formation of hydrophilic molecules, which may affect the ability of aerosol particles to act as cloud condensation nuclei or their effect on human health. C18 fatty acids with one or two conjugated double bonds were used as low volatility model of condensed phase alkenes in general. Saturated or unsaturated fatty acids are ubiquitously associated with aerosol particles. As surfactants, they have been suggested to form a barrier to mass accommodation of trace gases to liquid aerosol particles. In this work, the reaction of ozone with oleic acid is studied in an aerosol flow tube. Samples of gas and particulate phases samples taken downstream of the flow tube are analysed off-line using GC-MS for determining the contents of the four major products nonanal, azelaic, nonanoic and 9-oxononanoic acids. The changes in hygroscopicity due to oxidation by ozone have been measured using a hygroscopicity tandem DMA system. Finally, deliquescent sea-salt particles are coated with a film of fatty acids and fed into an aerosol flow tube to measure the effect of the coating on the bulk accommodation coefficient of HNO3. The influence of the fatty acid chain length on this effect is investigated.