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Measurement of oxidants present in secondary organic aerosol using spectrophotometric Iodometry

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Redox reactions proceeding in atmospheric particles and its aqueous solution are believed to affect not only chemical composition of aerosol but also human health; however, the amount of oxidant present in secondary organic aerosol (SOA), which is a major component of atmospheric fine-mode aerosol, remains poorly understood. In this study, we conducted a series of laboratory experiments on the alpha-pinene ozonolysis and the photooxidation of 1,3,5-trimethylbenzene (TMB) under high NOx conditions, and quantified oxidants present in SOA particles produced employing spectrophotometric iodometry (KI method). The ratios of oxidant to the total SOA mass measured for the reactions of pinene and TMB were 0.45 +/- 0.08 and 0.17 +/- 0.03, respectively. The result of pinene agreed with a literature value (0.47 +/- 0.12), and the result of TMB was close to a literature value of toluene (0.16-0.18). On the other hand, a recent study using dithiothreitol (DTT) method has reported that the oxidation potential of SOA formed from the TMB photooxidation is higher than that of SOA formed from the monoterpenes oxidation. The oxidants detected by the KI method are mainly organic peroxides (ROOH and ROOR). In the DTT method, DTT is extremely consumed by chain reactions catalyzed by quinones as well as reactions with organic peroxides. To interpret the oxidation potentials obtained by KI and DTT methods, direct comparisons with toxicity tests of SOA particles would be necessary.

References:

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