2.080 The infrared signature of secondary organic aerosol from OH and O3 channel oxidation of isoprene and α-pinene.

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Abstract:

The IR spectroscopy has great advantages in studying different functional groups in aerosols. It can provide a whole image of functional groups and bond information for secondary organic aerosol (SOA) without further treatment. In this study, the absorption ratio of O−H to C=O (O−H/C=O) was used to examine the difference between the O3 and OH oxidation channels in the photochemical oxidation of isoprene and α-pinene. Our experiments show similar characteristics of IR spectra of SOA from both isoprene and α-pinene. The IR spectra of SOA from the OH channel are characterized by strong absorptions of hydrogen bonded O−H and weak absorptions of C=O (large ratio of O−H/C=O); while the absorptions of C=O are more abundant than O−H in the O3 channel. The peak height ratio of O−H/C=O is 0.36 (0.24) in the SOA from the isoprene-O3 (α-pinene-O3) system, while it is as high as 1.63 (2.19) in the SOA from the isoprene-OH (α-pinene-OH) system. This demonstrates that the major organic products from the O3 channels are aldehydes, ketones and organic acid. In contrast to the O3 channel, alcohols or polyalcohols are more abundant from the OH channel. Thus, the ratio of O−H/C=O can be used to characterize SOA formation channels. In isoprene-NO2 irradiations, the ratios of O−H/C=O are 0.35, which are almost the same as the corresponding values in isoprene-O3 but totally different from the values in isoprene-H2O2. It strongly supports that the O3 channel plays a key role in the formation of SOA from isoprene-NO2 irradiations.