

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.