

Molecular Markers of Secondary Organic Aerosol in Mumbai, India

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Biogenic secondary organic aerosols (SOA) are generally considered to be more abundant in summer than in winter. Here, polar organic marker compounds from the oxidation of biogenic and anthropogenic volatile organic compounds (VOCs) in urban background aerosols from Mumbai, India were measured using gas chromatography/mass spectrometry. Surprisingly, we found that the atmospheric levels of biogenic SOA tracers in Mumbai were several times higher in winter than in summer. Similar seasonal patterns were found for a toluene SOA tracer and hydroxyacids such as glycolic, salicylic, and 4-hydroxybenzoic acids. Such seasonality may be explained by the predominance of the southwest summer monsoon, which brings clean marine air masses to Mumbai. Another explanation is that wet removal likely dominates organic aerosol loss during the monsoon season. However in winter, air masses are mainly transported from northeast Africa and west Asia and contain continental aerosols with relatively high levels of SOA. The winter/summer pattern of SOA loadings was further supported by the results from two chemical transport models (NAQPMS and GEOS-Chem). In addition, our results suggest that monoterpene- and sesquiterpene-derived secondary organic carbon (SOC) were more significant than those of isoprene- and toluene-SOC in the coastal regions of western India.