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Molecular characterization of organic aerosols in the Kathmandu Valley, Nepal: insights into primary and secondary sources

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Organic atmospheric aerosols in the Hindu Kush-Himalayan-Tibetan Plateau region are still poorly characterized. To better understand the sources and formation processes of the primary organic aerosols (POA) and secondary organic aerosol (SOA) in the foothills region of the central Himalaya, we studied atmospheric aerosol samples collected over a one-year period from April 2013 to April 2014 at the suburban site of Bode in the Kathmandu Valley. We measured concentrations of major ions, organic carbon (OC), elemental carbon (EC), and various organic tracers emitted by specific sources. Tracer-based estimation methods were employed to characterize aerosol species, identify their likely sources, and apportion contributions from each source. The concentrations of OC and EC increased during winter with a maximum monthly average in January. Levoglucosan (an organic tracer for biomass burning), OC, and EC showed similar seasonal variations throughout the year. With an annual average concentration of 788±685 ng m-3 (ranging from 58.8 to 3079 ng m-3), levoglucosan was observed as the dominant species among all the analyzed organic tracers. Biomass burning contributed a significant fraction to OC, averaging 24.9±10.4% during the whole year, and up to 36.3±10.4% in the post-monsoon season. On an annual average basis, anthropogenic toluene-derived secondary OC accounted for 8.8% and biogenic secondary OC contributed 6.2% to total OC. The annual contribution of fugal-spores to OC was 3.2% with the maximum during the monsoon (5.9%). For plant debris, it accounted for 1.4% of OC during the monsoon. Therefore, OC is mainly associated with biomass burning and other anthropogenic activity in the Kathmandu Valley. Our findings are conducive to designing control measures to mitigate the heavy air pollution and its impacts in the Kathmandu Valley and surrounding area.