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Quantitative assessment of organosulfates in size-segregated rural fine aerosol

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Abstract. Organosulfates have recently come into the focus of organic aerosol research as potentially important components of water-soluble secondary organic aerosol (SOA) which now dominate tropospheric fine aerosol. Their presence has been confirmed by the identification of sulfate esters of abundant biogenic carbonyl compounds in both smog chamber and continental aerosol. However, none of the studies have been able to determine the mass contribution of organosulfates to SOA.

In this paper, as possibly the very first attempt to quantify organosulfates in ambient aerosol, we inferred the mass concentrations of organosulfates by concurrently determining mass concentrations of total sulfur, sulfate and methanesulfonate in rural fine aerosol using two highly sensitive analytical techniques. Although uncertainties were relatively large, we found that mass concentrations of organosulfates in water-soluble fine aerosol ranged from $0.02 \mu\text{gS m}^{-3}$ to $0.09 \mu\text{gS m}^{-3}$ yielding a mass contribution of 6–12% to bulk sulfur concentrations (or 6–14% to sulfate concentrations). The inferred size distribution of organosulfates suggested that they possibly form in heterogeneous reactions from semi-volatile carbonyl compounds with subsequent or concurrent condensation of gaseous sulfuric acid producing a refractory organic film on particle surfaces.

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