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Organic composition of aerosols from controlled forest fires

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Controlled field fires were carried-out in May 2008 in the Gestosa area, in the upper zone of the Serra da Lousã mountain range in central Portugal. Particulate matter (PM2.5-10/PM2.5) in the smoke plume of these burnings has been sampled. A portion of the filters was analysed by a thermal-optical method to determine the elemental and organic carbon (EC and OC). The PM2.5 in the smoke plumes reached average levels up to 13,000 [U+F06D]g.m-3. The total carbon in the coarse fraction concentration (PM2.5-10) was find to range between 49 and 331 μg.m-3. The elemental carbon represented less than 3% of the carbonaceous content in PM2.5-10 varying from 0.02 to 0.58 μg.m-3. The total carbon in the fine fraction (PM2.5) ranged between 295 and 6,126 μg.m-3. More than 95% of total carbon in PM2.5 is organic presenting concentrations between 0.42 and 0.94 μg.m-3.
The particulate organic matter was then solvent extracted and fractionated by vacuum flash chromatography into 5 different classes of compounds whose structure were characterised by Gas Chromatography - Mass Spectrometry (GC-MS). The chromatographic results were dominated by odd –numbered alkanes and acids with and even number of carbon atoms. The organic speciation also enabled the quantification of specific molecular tracers (e.g. steradienes and amyryl-alkanoates) The carbon preference index (CPI) for higher plant waxes was 2.32 and is 12.19 for PM2.5 and PM2.5-10, respectively, indicating a major incorporation of recent biological components into aerosol samples. Sugar alcohols and anhydrosugars, which also represented a significant aerosol component, were analysed by HPLC with electrochemical (amperometric) detection. The Levoglucosan-to-mannosan ratio to this burnings carried out at shrub-dominated Mediterranean forest was 11.65, 6.09 for PM2.5-10 and PM10 respectively. This information could be conducive to source apportionment studies.