

Chemical characterisation of PM_{2.5} aerosols collected during a 2007 summer campaign at a forested site in Brasschaat, Belgium

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Within the framework of the project "Formation mechanisms, marker compounds, and source apportionment for biogenic atmospheric aerosols" (BIOSOL) aerosol samples are collected at three forested sites in Europe. One of the sites is the state forest "De Inslag" in Brasschaat, Belgium. This forest is located at 51°18'33"N, 4°35'14"E, 15 m above sea level. It is at about 12 km NE of the center of the city of Antwerp and at about 9 km to the east of the Antwerp harbour area, so that the aerosol composition is expected to be strongly impacted by anthropogenic emissions in addition to the biogenic emissions from the forest. During a 2007 summer campaign, aerosol samples were collected from 5 June until 13 July. A high-volume dichotomous sampler (HVDS) was deployed for separate day and night aerosol collections in two size fractions (fine: <2.5 µm; coarse: >2.5 µm). The HVDS was located on a tower at about 9 m above ground level. Double (i.e., front and back) pre-fired Gelman Pall quartz fibre filters were used as collection surfaces for each of the two size fractions. The purpose of the back filters was to assess sampling artifacts, in particular for the carbonaceous aerosol constituents. A total of 71 HVDS samples and 10 field blanks were taken. All filters were analysed for organic carbon and elemental carbon (OC and EC) with a thermal-optical transmission technique (Birch & Cary, 1996) and those from the PM_{2.5} size fraction were analysed for water-soluble OC (WSOC) as described by Viana *et al.* (2006) and for water-soluble inorganic cationic and organic and inorganic anionic species by suppressed ion chromatography with conductometric detection (thereby using an hydroxide gradient eluent for the anionic species and an isocratic methanesulphonic acid eluent for the cationic species). The campaign median concentrations and interquartile ranges for the various components, as obtained from the front filters of the PM_{2.5} size fraction, and the median back/front filter concentration ratios for PM_{2.5} are given in Table 1. The back/front filter ratios are small for most species measured, suggesting that sampling artifacts are negligible for these species. It is known that some of the species measured (i.e., OC, WSOC, NO₃⁻) are subject to both positive and negative artifacts (e.g., Turpin *et al.*, 2000) and substantial back/front ratios are obtained for them. Sulphate, which is essentially from anthropogenic sources at our site, is by far the major component, followed by OC and NH₄⁺. The relative concentrations of the 3 species are quite similar to those

found at urban sites in Belgium (Maenhaut, 2007), thus indicating that the site is indeed strongly impacted by anthropogenic emissions. Consequently, substantial concentrations of particulate-phase organic compounds from mixed biogenic/anthropogenic origin, such as organosulphates and nitrooxy-organosulphates, are expected (Surratt *et al.*, 2008). The measured organic compounds accounted, on average, for 8% of the WSOC and the latter represented 51% of the OC. This latter percentage is intermediate between the percentages of around 40% found for Ghent and of 60% found for the other two (and much less anthropogenically disturbed) forested sites studied within BIOSOL.

Table 1. Front filter median concentrations and interquartile ranges and median back/front filter concentration ratios (all for PM_{2.5}).

Species	Front filter conc. (ng/m ³)		Median back/front ratio
	median	(interq. range)	
OC	1730	(1270 – 2200)	0.17
EC	400	(280 – 620)	0.00
WSOC	810	(570 – 1170)	0.21
NH ₄ ⁺	1080	(650 – 2100)	0.04
SO ₄ ²⁻	2700	(1840 – 3900)	0.00
NO ₃ ⁻	650	(400 – 2200)	0.24
Na ⁺	108	(65 – 210)	0.01
Mg ²⁺	2.7	(1.42 – 6.7)	0.00
K ⁺	38	(18.7 – 93)	0.12
Ca ²⁺	27	(14.7 – 36)	0.00
MSA	79	(46 – 119)	0.03
Oxalic	75	(50 – 140)	0.01
Malonic	49	(28 – 82)	0.02
Succinic	11.0	(5.7 – 54)	0.02
Glutaric	4.7	(3.3 – 9.7)	0.26

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