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Semivolatile behaviour of dicarboxylic acids during summer campaigns at K-puszta

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It is well-known that the collection of carbonaceous aerosols on quartz fibre filters is prone to both positive and negative artifacts (e.g., Turpin *et al.*, 2000). In studies on these artifacts, one normally concentrates on organic carbon (OC) as a whole or occasionally on water-soluble OC (WSOC). It is rare that studies are carried on individual organic species. One example of the latter type of study is that by Limbeck *et al.* (2001), who used a tandem filter setup at a rural background site in South Africa and measured dicarboxylic acids (DCAs) and other polar organic species on the front and back filters. Substantial amounts were found on the back filter. The authors' interpretation was that the DCA concentrations on the back filters were caused by the adsorption of gaseous organic species and that DCAs have a semivolatile behaviour. Low-volume TSP samplers were used in that study, the face velocity across the filter was about 22 cm/s, and the collection time per sample was around one week.

We conducted a similar study as that of Limbeck *et al.* (2001), but there were also substantial differences. The samplings for our study took place during summer campaigns in 2003 and 2006 at K-puszta, Hungary; we used a high-volume dichotomous sampler (HVDS), which provides separate fine (PM2.5) and coarse size fractions, the face velocity through the PM2.5 filters was 80 cm/s, and the collection time per sample was around 12 hours. Pre-fired Gelman Pall quartz fibre filters were used for both size fractions. During the 2003 campaign it was consistently warm and dry, but the 2006 campaign was divided in separate cold and warm periods (Maenhaut *et al.*, 2008). The front and back filters for the PM2.5 size fraction of all samples were analyzed for OC, elemental carbon (EC), and total carbon (TC) with a thermal-optical transmission technique (Birch & Cary, 1996), for WSOC as described by Viana *et al.* (2006), and for water-soluble organic and inorganic anionic species by suppressed ion chromatography with conductometric detection. The median front filter concentrations for a number of components and the interquartile ranges of the back/front filter concentration ratios (both for PM2.5) are given in Table 1. The front/back filter ratios, as derived from the data of Limbeck *et al.* (2001), are included for comparison. Our back/front ratios for oxalic and succinic are low and clearly lower than those obtained by Limbeck *et al.* (2001); malonic was not present on the back filter in the earlier study, whereas we found larger back/front ratios than for oxalic and succinic; of the 4 DCAs studied by us, glutaric has the largest back/front ratio, but Limbeck *et al.* (2001) found an even greater back/front ratio for this species. It is clear that results from one site and sampler cannot be generalised to all sites and sampler types. Therefore, similar studies as the present one are being carried out for other sites in Europe.

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Table 1. Front filter median concentrations and interquartile ranges for the back/front filter concentration ratio (both for PM2.5 of the HVDS) at K-puszta. Comparison with data of Limbeck *et al.* (2001).

Species	Cold period 2006		Warm period 2006		2003		Limbeck *et al.* (2001)
	Median front conc. (ng/m^3)	Interq. range for back/front ratio	Median front conc. (ng/m^3)	Interq. range for back/front ratio	Median front conc. (ng/m^3)	Interq. range for back/front ratio	Mean back/ front ratio
TC	2100	0.09 – 0.17	4600	0.12 – 0.16	4400	0.10 – 0.13	0.12
WSOC	970	0.17 – 0.26	2900	0.13 – 0.19	2600	0.15 – 0.19	
SO_4^{2-}	1790	0.00 – 0.00	3600	0.00 – 0.00	3500	0.00 – 0.01	
MSA	29	0.01 – 0.13	29	0.01 – 0.08			
Oxalic	73	0.01 – 0.02	210	0.01 – 0.03	196	0.01 – 0.03	0.14
Malonic	33	0.03 – 0.13	65	0.01 – 0.13			0.00
Succinic	32	0.02 – 0.08	142	0.01 – 0.05	41	0.01 – 0.03	0.26
Glutaric	7.1	0.17 – 0.35			7.8	0.15 – 0.22	0.38