Profiles and seasonal-distribution of PAH and *n*-alkanes in the urban atmosphere of Elche, Spain

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Particle-bound PAHs and *n*-alkanes have been widely studied since the organic fraction of atmospheric particulate matter (PM) was considered as a complex mixture of hundreds of different compounds. These two families of pollutants have received special attention due to PAH mutagenic and/or carcinogenic properties and because of the relatively high concentrations of aliphatic hydrocarbon found in most of the studied areas.

Organic compounds can be found in both the coarse (>2.5 μm) and the fine (<2.5 μm) fractions of atmospheric PM, although the higher concentrations are usually associated to the fine fraction (Sicre *et al* 1987), which is also the most dangerous one because it can reach the human lung alveoli (Gerde *et al,* 1991).

PM1, PM2.5 and PM10 samples were collected, from November 2008 until July 2009, for simultaneous 24-hourperiods on the roof of a 15 m height building at the Miguel Hernández University by means of low volume samplers (2.3 m^3/h) on teflon-impregnated glass-fibre filters. Seventeen PAHs and twenty seven *n*-alkanes from C16 to C40, plus the branched alkanes pristine and phytane were analysed by thermal desorption coupled with gas chromatography-mass spectrometry (TD-GC-MS) (Gil-Moltó *et al,* 2009).

Mean concentrations of the sum of all PAHs and hydrocarbons studied (TPAH and THC, respectively) for the spring-summer (SS) and autumn-winter (AW) seasons, along with the concentrations of hydrocarbons with odd and even carbon number, are shown in Table 1.

Table 1. Mean concentrations during the study period.

Compound	Season	PM1 (ng/m^3)	PM2.5 (ng/m^3)	PM10 (ng/m^3)
TPAH	SS	0.42	0.56	0.57
	AW	1.03	1.42	1.44
THC	SS	9.71	11.96	17.14
	AW	13.02	19.31	19.42
HCeven	SS	4.05	5.10	5.88
	AW	5.45	8.07	8.04
HCodd	SS	5.62	6.84	11.22
	AW	7.50	11.07	11.35

Around 70 % of PAHs were associated to the PM1 fraction, and almost the rest were found in the PM2.5-1 one. As expected, PAHs were predominantly associated to the submicron fraction, making this fraction more toxic for human health. In fact, all PAHs were found linked to particles below 2.5 μm.

Benzo(b)fluoranthene and its homologue benzo(k)fluoranthene, two PAH strongly associated to vehicular emissions, were the most abundant PAH in all the fractions, followed by chrysene, usually related to incomplete combustion or pyrolysis of coal and crude oil, as well as home heating.

No statistical differences were found in PAH profiles in PM1 and PM2.5, pointing to common sources for all PAHs in these two fractions.

Hydrocarbon particle content presented different profiles depending not only on the size fraction, but also on season of the year. In general, the higher *n*-alkane concentrations were observed during the cold season, although their size distributions were different from those obtained for the warm period. During the spring-summer period, around 30% of the total *n*-alkanes were associated to the PM10-2.5 fraction, and practically the rest (56%) was in the PM1 one. Meanwhile, when temperatures decreased, 69% of the THC were found in PM1 and 30% in PM2.5-1. Therefore, a clear shift of *n*-alkane towards the submicron fraction is observed.

The values of the carbon preference index (CPI) (between 1.3 and 1.9) and percentages of total wax *n*-alkanes (%WNA) were calculated. WNA values for PM1, PM2.5 and PM10 are shown in Figure 1, along with the concentrations of *n*-alkanes in PM1 for the two seasons.

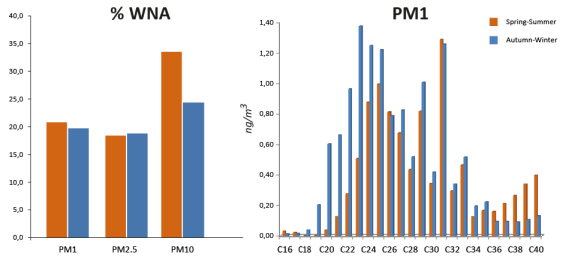

Figure 1. Percentage of Plant Wax and PM1 *n*-alkane concentrations during the study period.

C_{max}, CPI and % WNA suggest a mixture of anthropogenic and biogenic origins for *n*-alkanes, with an increase of biogenic emissions during the spring-summer period. Wax *n*-alkanes from plants significantly contributed to the total content of *n*-alkanes PM10, especially during the war season.

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