Concentration trends and sources of polycyclic aromatic hydrocarbons (PAHs) in Belgium

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Both aerosol- and vapour-phase samples were collected from the ambient air by high volume samplers using quartz fibre filters (QFFs) and polyurethane foams (PUFs), respectively, during different seasons at six sampling locations in the northern part of Belgium (Flanders). The levels of PAHs were determined with a fast analytical approach i.e., the application of pressurised liquid extraction (accelerated solvent extraction) resulted in a fast recovery of PAHs from QFFs and PUFs in less than 28 minutes with a minimum consumption of toxic solvents.

The annual average concentration of PAHs varied significantly at the studied sites (Table 1) and ranged from 17 ng/m^3 (at a rural site) to 114 ng/m^3 (near a petroleum harbour and industry). Although the concentrations of PAHs were found to be significantly higher (approximately 10-fold) in the vapour fraction of samples than in the particulate fraction, most of the probable human carcinogenic PAHs were found to be associated with suspended particulate matter (SPM).

Seasonal and site specific variations in PAH levels were also studied. PAHs levels in aerosol samples were relatively higher in concentration during winter compared with

other seasons, whereas no clear seasonal trend was observed for the vapour-phase PAHs. This fraction is likely to be more local in origin; hence, it can be used as a site-specific characteristic. The influence of various meteorological parameters was also studied, which shows that these parameters also play a role in the change of the PAHs levels in the ambient air. Diagnostic ratio and principal component analysis (PCA) were used to enhance the accuracy of emission source identification at the studied site, which showed relation to different anthropogenic activities, such as vehicular emission (diesel/gasoline), incinerator, petroleum/oil burning, coke production, and wood/coal combustion. In general, vehicle exhaust (diesel, gasoline) was found to be a significant contributor to the atmospheric levels of PAHs in the urban environment.

Table 1: Annual average concentration of ΣPAH at various site in Flanders (Belgium), their potentially toxic fraction and source identification.

Sampling site	Phase	ΣPAH (ng/m^3)	Toxic fraction* (%)	Source identification
Petroleumkaai	Aerosol	3.9	57.5	Petroleum industry, Vehicular
	Vapour	110	1.5	Petroleum industry, Oil burning
Borgerhout	Aerosol	8.7	54.1	Vehicular, Wood burning
	Vapour	45.7	1.8	Diesel, Gasoline
Zelzate	Aerosol	7.4	61	Coke, Vehicular, Oil burning
	Vapour	44.4	2.7	Coke, Vehicular, Stationary
Hasselt	Aerosol	4.5	54.1	Vehicular, Coal
	Vapour	38.2	1.6	Gasoline, Wood/Coal burning
Wingene	Aerosol	0.9	39.3	Vehicular, Stationary, Gasoline
	Vapour	15.6	2.1	Vehicular, Stationary, Gasoline
Mechelen	Aerosol	7.4	49.4	Vehicular, Incinerator
	Vapour	34.1	4.3	Diesel, Gasoline

* the percent of ΣPAH concentration

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