



Case Study

Ambient Air Monitoring Applications

Ambient air and emissions monitoring of Polycyclic Aromatic Hydrocarbons – airmoC10-C20+

Context & Challenges

Polycyclic Aromatic Hydrocarbons (PAHs) are a group of over 100 different chemicals that are known to be formed typically during incomplete combustion of organic matter at high temperature. Their major sources in the atmosphere include industrial processes, vehicle exhausts, waste incinerations, and domestic heating emissions. Due to their carcinogenic/mutagenic effects, 16 PAHs are currently listed as priority air pollutants.

Chromatotec® Solutions

Actual analytical methods dedicated to monitor PAHs require multistep sampling preparations and are not suited for continuous monitoring. Automatic Thermal Desorption-Gas chromatography equipped with flame ionization detector (AUTO-TD-GC-FID) is the standard method for the monitoring of volatile and semi-volatile hydrocarbons. This technique allows for identifying and quantifying continuously hydrocarbons from ethane to naphthalene. The main goal of this work is to implement a new and simple method for sampling and determination of PAHs in gas and solid phase in air by using thermal desorption technique followed by gas chromatography equipped with two detectors: a flame ionization detector and a Mass spectrometer.

A detailed study was carried out to optimize the experimental method in each of its phases, including sampling, thermal desorption, analytical separation, and detection. First, the limits of use of the analytical system were determined during the laboratory phase using liquid standards of the 16 PAHs.



Technical information and results

Analytical conditions: airmoC10-C20+

Sampling: ≈ 1000 ml

Carrier gas: hydrogen (≈ 460 hPa)

Column: MXT 30CE, film thickness: 1 μm, id: 0.28 mm, length: 30 m

Amplification: high (level 3)

Cycle duration: 30 to 60 min

Detection range: from few ng/m³ to μg/m³

A typical chromatogram of PAH sample is shown in Figure 3. The results are displayed using Vistachrom software. All results can be re-treated using peak viewer software. On the chromatogram, one can see that PAH from Naphthalene to pyrene.

With the mass spectrometer, the different PAH can be confirmed by mass spectrometer using the specific ion of the different products (Figure 2). The retention times are displayed in the substance table in the Figure 1.

Situation in October 2015:

airmoC10-C20+ provides in standard the quantification of Naphthalene, Acenaphtylene, Acenaphtene, Fluorene, Phenanthrene, Anthracene, Fluoranthene and Pyrene continuously with the airmo C10-20. In addition, the system can also analyze 2-methylnaphthalene and 1-methylnaphthalene. The next step is to validate this instrument for the measurement of benzo (a) pyrene.

More developments are planned to identify and quantify the heavier PAHs.

Another version 2 to 5 times more sensitive is available depending on application

#	Name	RT Min	RT Max	Select Peak	GC Result formula	With X=
10	MSP-XYLENES	851	861	Middle	11 * X	Area/BS
11	STYRENE	879	887	Middle	X	Area/BS
12	O-XYLENE	887	896	Middle	11 * X	Area/BS
13	N-NONANE	913	923	Middle	11.4 * X	Area/BS
14	α-PINENE	964	974	Middle	X	Area/BS
15	N-DECANE	1021	1031	Middle	1.1 * X	Area/BS
16	β-PINENE	1062	1072	Middle	X	Area/BS
17	N-UNDECANE	1142	1152	Middle	12.5 * X	Area/BS
18	N-DODECANE	1227	1237	Middle	13 * X	Area/BS
19	NAPHTHALENE	1245	1260	Max	12 * X	Area/BS
20	ACENAPHTHYLENE	1549	1559	Middle	12 * X	Area/BS
21	ACENAPHTHENE	1600	1610	Middle	12 * X	Area/BS
22	FLUORENE	1755	1765	Middle	12 * X	Area/BS
23	PHENANTHRENE	2135	2145	Middle	12 * X	Area/BS
24	ANTHRACENE	2155	2170	Middle	12 * X	(Area+12)/BS
25	FLUORANTHENE	2760	2772	Middle	1.1 * X	Area/BS
26	PYRENE	2885	2900	Middle	X	Area/BS

Figure 1 – Substance table

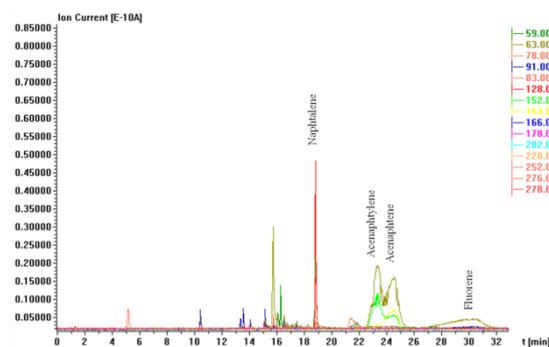


Figure 2 – Chromatogram obtained with mass spectrometer with PAH sample

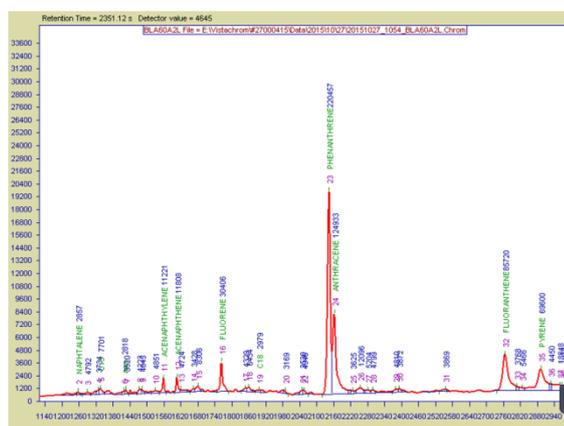


Figure 3 - chromatogram of PAH sample analyzed by airmoC10-C20