CONTINUOUS MONITORING OF PAHs USING AUTOMATIC THERMAL DESORPTION-GAS CHROMATOGRAPHY

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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. 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 continuous identification and quantification of hydrocarbons from ethane to naphthalene. The main goal of this work was 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.

airmoVOC C6-C12

Instrument configurations

airmoVOC C6-C12
- Carrier gas: H2
- Trap: Carbotrap mixture
- Column: apolar MXT
- Oven : 37 – 350 °C
- Detector: FID
  - T°: 175 °C

airmoPAH
- Sampling line
  - Teflon (150 °C)
- Carrier gas: H2
- Trap: TENAX + Quartz wool
- Column: Apolar MXT
- Oven : 37 – 350 °C
- Detector:
  - FID
  - T°: 202 °C

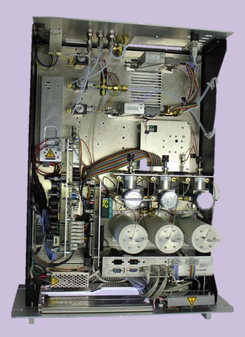
DET QMS
- Transfer line
  - MXT tube (200 °C)
- Multiplexing system
  - 175 °C
- Detector:
  - SEM
  - MID
  - 20 ms/uma

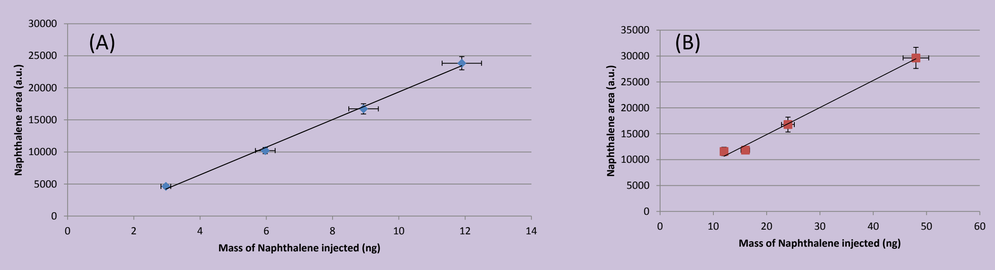
Results

Naphthalene in air

Permeation tubes
- 20 ng/min
- 60 °C

Analitycal conditions
- Sampling times
  - 300 s – 1200 s
  - At 3 ppb (naphthalene)
- Concentrations



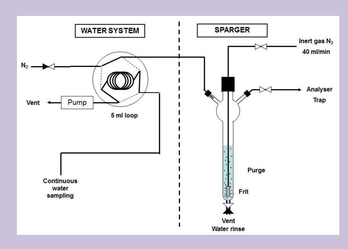


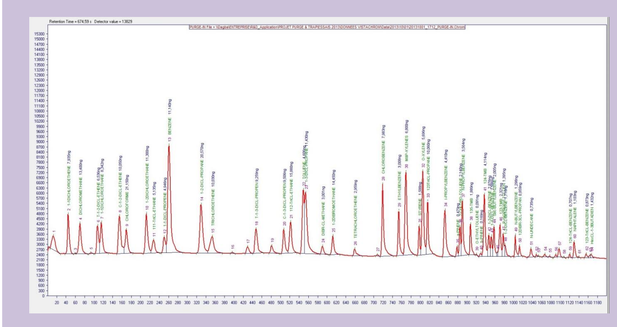
Calibration curve for Naphthalene changing the sampling time (A) and Naphthalene concentrations (B)

Naphthalene in water

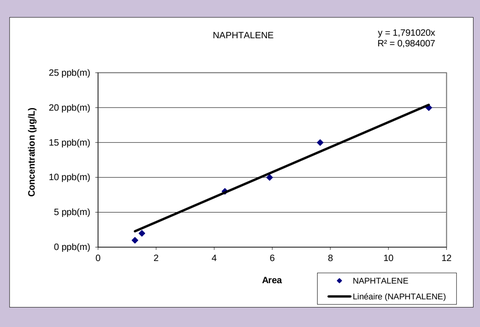
Liquid standard
- 502.2 CAL2000 MegaMix Mixture (Restek)
- 2000 µg/L

Analytical conditions
- 2,5 – 500 µl in 5 l of water



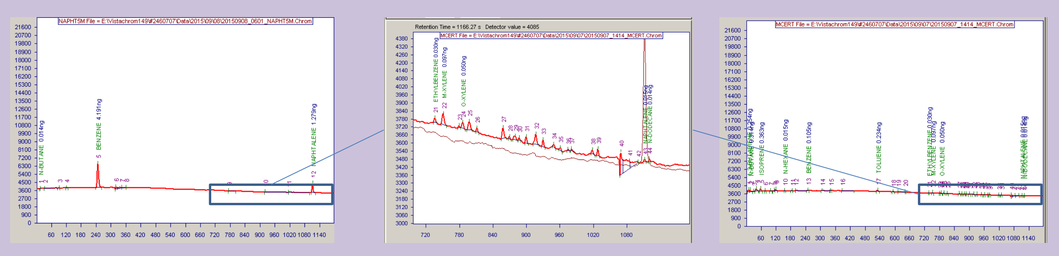


Chromatogram obtain with FID detector

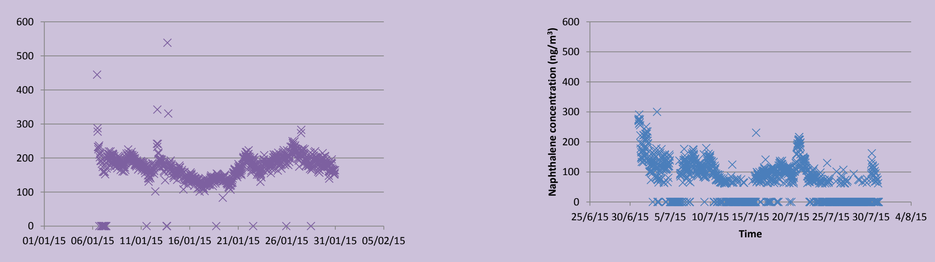


Calibration curve for Naphthalene

Naphthalene trend near Bordeaux



0.015 ng of Naphthalene

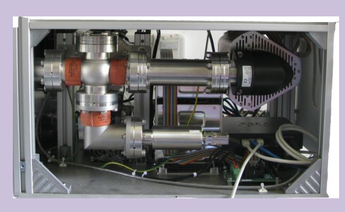


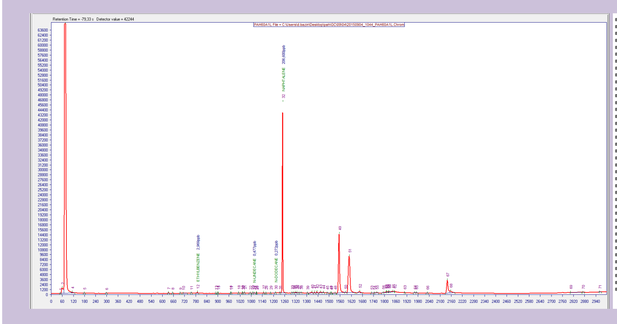
171 ng/m^3 in January 2015

70 ng/m^3 in July 2015

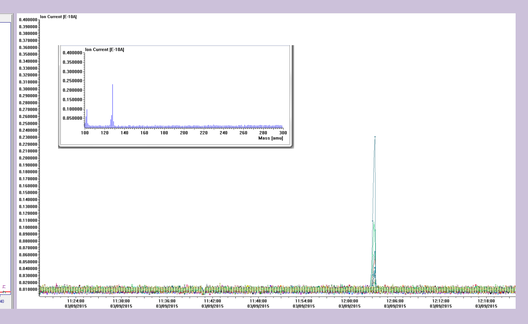
airmoPAH

Sample
- SV Calibration Mix #5/610 PAH Mix (Restek)
  - 16 components
  - 2 mg/ml in methylene chloride





Chromatogram obtain with FID detector



Chromatogram obtain with MS

The results show that the airmoVOC C6-C12 is suited for the measurement of Naphthalene in air and in water. The measured concentrations of Naphthalene in ambient air were 171 and 70 ng/m^3 in January and July respectively. The airmoPAH is capable of measuring the first 4 PAHs. Further studies will characterize the capability of the system for the measurement of PAHs in the gas and particle phase.