

Fast Detection of PAH and PCB with the E²M



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Introduction

E²M is a compact, robust quadrupole mass spectrometer designed for mobile applications. Combined with a GC the E²M delivers a versatile GC/MS capability. Equipped with an heated (up to 240°C) air/surface probe it provides fast on-site identification of hazardous substances in solids, soil or air.

E²M combined with the air/surface probe was used for detection and identification of widespread persistent organic pollutants (POP) like polycyclic aromatic hydrocarbons (PAHs) and polychlorinated biphenyls (PCBs) in complex soil samples, without sample preparation.

Experimental

To determine the mass fragment distribution of PAHs and PCBs temperature runs using a dedicated air/surface probe were carried out. Solutions of synthetic standards in methanol were placed on an aluminum cup and the probe head

was pressed for 60 seconds onto this cup. From these "little chromatograms" (Fig. 1 and 2) measured mass fragments were used to create a **Selected Ion Monitoring (SIM)** method for the detection of the PCB and PAH. The SIM method allows monitoring for specific masses of target substances in unknown samples.

For the monitoring method the probe head was heated to 220°C and the probe line to 200°C.

To detect organic hazards like PAH or PCB in complex samples the air/surface probe connected to the E²M was just pressed onto the soil.

Results

- Partial separation of 16 PAH (EPA) (synthetic standard) by temperature run (Fig. 1).
- Separation of PCB 28, 52, 101, 153, 138 and 180¹ (synthetic standard) by temperature run (Fig. 2).
- Detection and identification of PAH and PCB in complex soil samples using the SIM mode (Fig. 3).

- Differentiation of PAH only possible by number of C atoms. Detection of FLT/PYR fluoranthene/pyrene C16 after 60seconds (Fig 3a).
- Differentiation of PCB only possible by number of Cl atoms. Detection of PCB 6 Cl after 90 seconds (Fig 3b).
- Less volatile PAHs or PCBs with 6 or more Cl-atoms were not detected in the soil samples because of their lower concentration in the sample and their lower volatility

Summary

The E²M equipped with an air/surface probe and an adequate SIM method allows fast and reliable detection of organic hazards without any time-consuming sample preparation procedure. Sampling can be realized by simple pressing the probe onto the surface of the contaminated area.

For detection of unknown complex hazardous samples the air/surface probe can serve as a little GC to separate the components, identify their specific mass fragments and generate the respective SIM method.

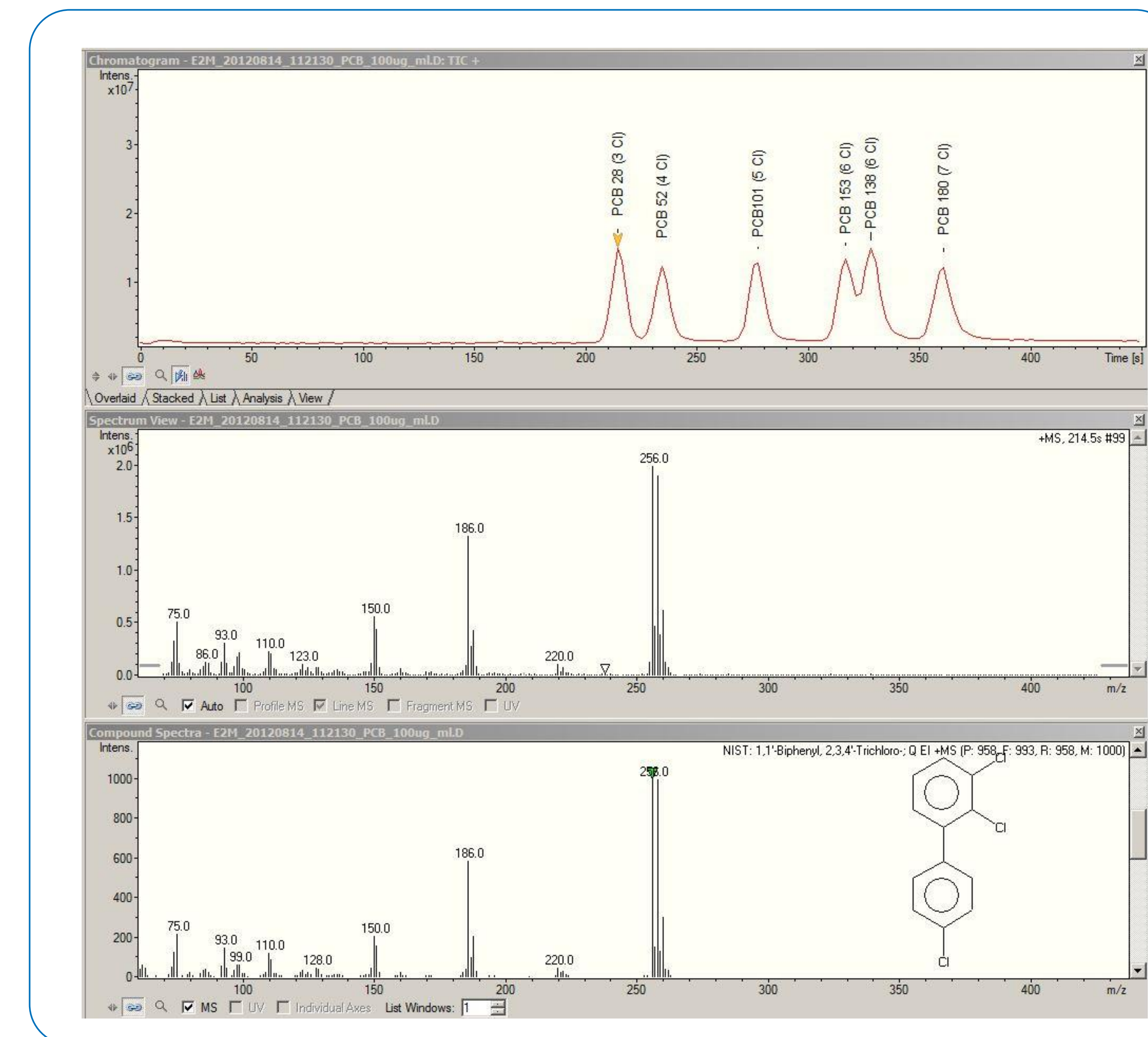


Fig. 2 Separation and identification of six different PCBs using the air/surface probe in a temperature run

References

¹Ballschmiter, K., Zell, M., Analysis of polychlorinated biphenyls (PCB) by glass capillary gas chromatography, Fresenius. Zeitschrift für analytische Chemie, Vol. **302**, 1980, S. 20-31

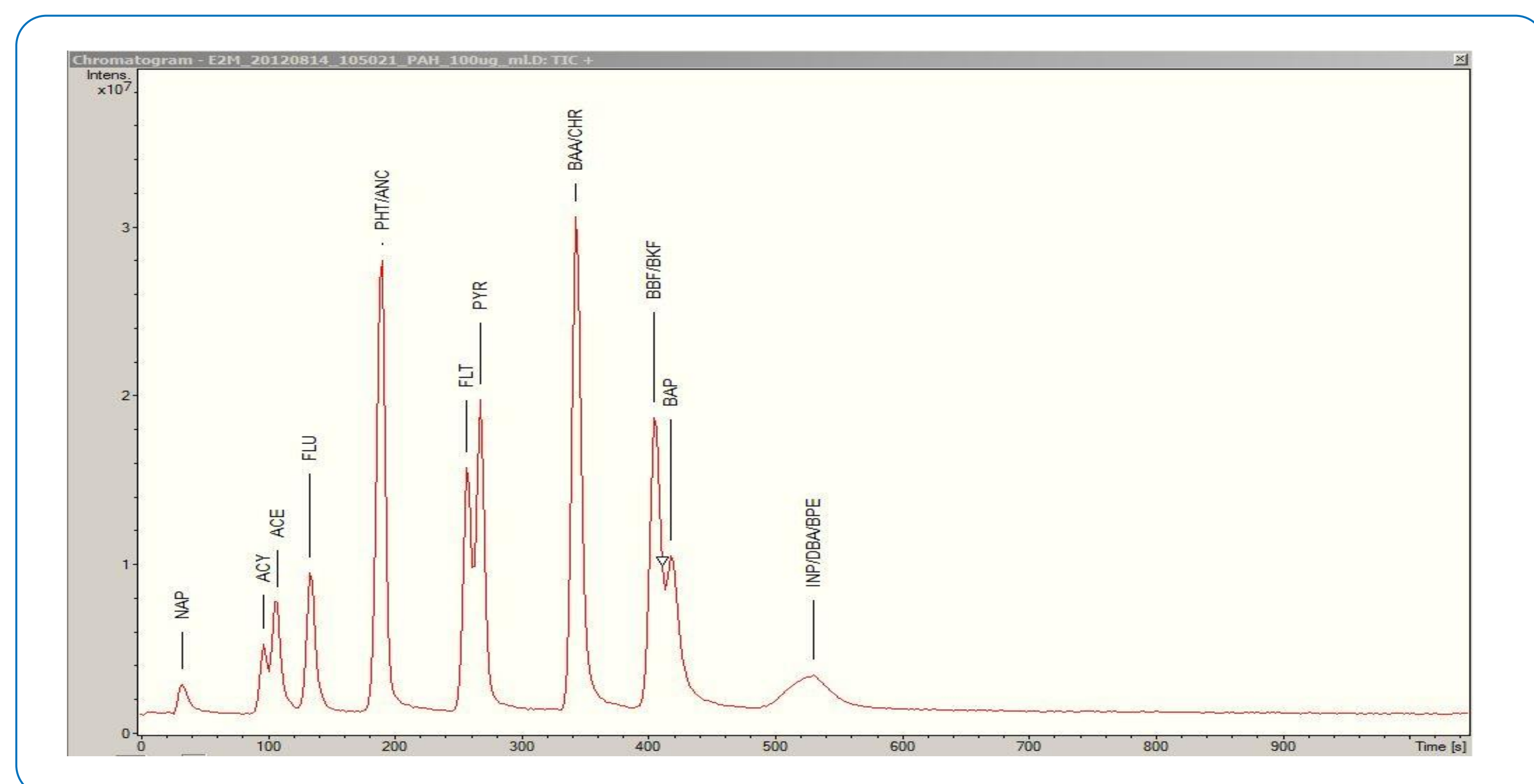


Fig. 1 Separation and identification of PAHs using the air/surface probe in a temperature run



Fig. 3 Detection and identification of different PAHs (a) and PCBs (b) in complex soil samples using the selected ion monitoring mode

Conclusions

- Mobile MS combined with a dedicated air/surface probe for fast analysis of contaminated complex environmental samples
- ID of hazardous components in less than three minutes
- Detection of PAHs and PCBs in complex soil samples in less than a minute without sample preparation

Technology