

Monitoring of PAHs in vapour and particle phase at representative locations in Saxony



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Foreword

The research project aims at establishing the gas-particle ratio of PAHs at typical measurement locations in Saxony and at various outside temperatures over the course of the year. For this purpose, sampling of particle-bound PAHs as per VDI 2463, Part 11, currently applied in Saxony, is to be compared with parallel sampling of gaseous and particulate PAHs as per DIN ISO 12884 which the EU suggested as reference procedure in its 4th Daughter Directive.

Measurement locations

| | |
|--------------------|---------------------|
| Radebeul-Wahnsdorf | City outskirts |
| North Dresden | Inner city location |
| Görlitz | Inner city location |

Sampling

Sampling of particulate PAHs

The air sample is drawn over 24 hours at a volume flow of 30m³/h via a PM10 sampling head through a quartz fibre filter. The sampling system is located in a measuring container air conditioned to 20°C (Fig. 1).

Sampling of gaseous and particulate PAHs

The air sample is drawn over 24 hours at a volume flow of 30m³/h via a sampling head (Fig. 2) through a glass-fibre filter and a downstream PU foam cartridge.

Laboratory analyses and quality assurance

PAH establishment by means of GC-MS

Using toluol, the filter and PU foam are jointly subjected to hot extraction in a Soxhlet extractor over at least 16 hrs under fast reflux. Water is extracted with the help of Na₂SO₄ and the extract further concentrated. The GC-MS is calibrated against internal (deuterated) standards. Both the GC-MS and the columns used are made by Hewlett-Packard.

PAH establishment by means of HPLC

Using toluol, a quarter filter is subjected to ultrasonic extraction. The extract is filtered through silica gel. PAHs are then analysed using HPLC with fluorescence detector. Calibration is effected by means of an internal standard (methylfluoranthene). Both the HPLC and the columns used are made by Merck-Hitachi.

Quality assurance measures

- Process blank values
- Recovery rates (including by deuterated standards)
- Detection limits
- Sampling efficiency
- Certified reference material
- Real sample comparison,
- Gravimetric analysis of PM 10 (Fig. 3)
- Comparison of calibration standards

Results

Both procedures are comparable for the purpose of the method specified in DIN ISO 12844. The currently used HPLC procedure for benzo(a)pyrene complies with the requirements of the 4th Daughter Directive (Fig. 4).

The analysis of coronene with HPLC reveals a noticeable systematic error as a result of coelution.

In the gaseous phase, a significant fraction of the volatile compounds fluoranthene and benzo(a)anthracene is found, in particular in the summertime (Fig. 5). Therefore only the method outlined in ISO 12844 should be used during that time.

Acknowledgement

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Fig. 1 Sampling system



Fig. 1 Sampling head

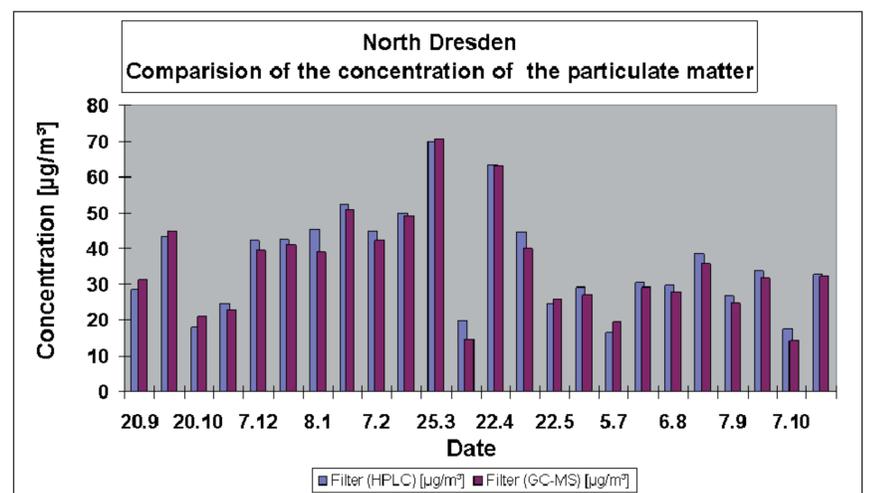


Fig. 3 Comparison of particulate matter concentrations

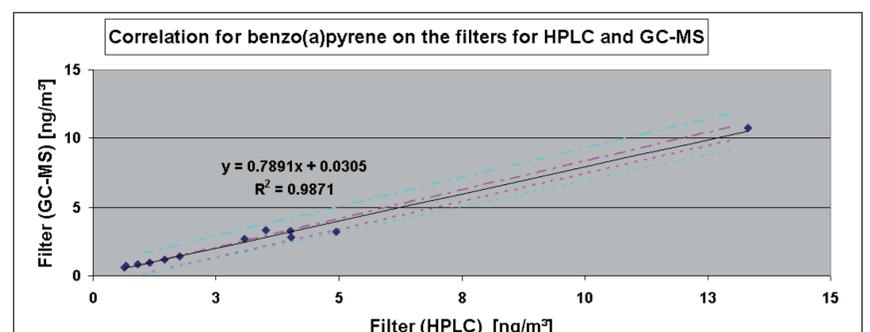


Fig. 4 Benzo(a)pyrene correlation

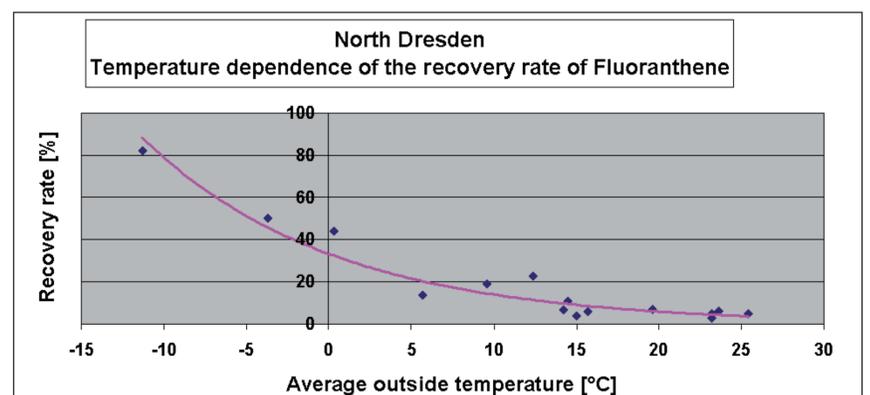


Fig. 5 Temperature dependence of fluoranthene

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