

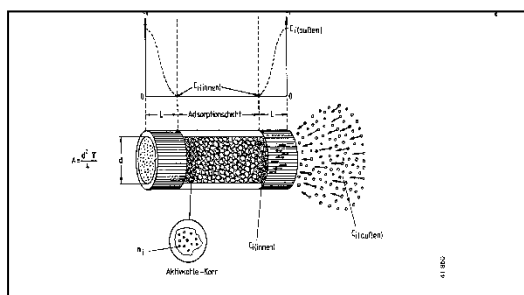
## Diffusion tube for Benzene Toluene Xylenes

Hydrocarbons play a significant role in photochemical processes in the atmosphere and contribute as precursor substances to the formation of ozone. Benzene is of principal interest, as even very small quantities may have a carcinogenic potential. Toluene originates from its wide use as solvent in industry as well as from evaporation of unburned fuels. M-Xylene is considered as highly reactive in photochemical processes. In Clean Air Implementation Plans a great attention is given to the reduction of volatile hydrocarbons.

In the framework of implementation of the EU Council Directive 96/62/EC on ambient air quality assessment and management there is a need for relatively simple and cost-effective measurement methods, especially for indicative monitoring. Diffusive samplers play an important role in this field.

The use of passive measurement methods simplified was suggested by Technical Committee CEN / TC 264 "Air quality" [1]. European Standard EN 14662-5: 2003 shall apply to all samplers by diffusion regardless of the physical nature of the process flow control and the nature of adsorption process as well as the determination analysis.

The diffusive sampler consists of an open-ended glass tube containing granular coconut shell charcoal. Two porous plugs of cellulose acetate at both ends of the tube fix the charcoal in the tube and act as diffusion barriers during sampling. To protect the sampler from contamination during storage and transport the tube is placed in a glass vial which is sealed by a PTFE coated screw cap.



Scheme of the diffusive sampler for aromatic hydrocarbons

Ambient air diffuses into the sampling tube in a controlled manner. BTX are absorbed on the activated charcoal and desorbed by carbon disulphide in the laboratory and analysed by gas chromatography.

In the Swiss Ordinance for the Protection of air, there is no limit values for benzene and other hydrocarbons.

There are limit values in different countries:

European Union	5 $\mu\text{g}/\text{m}^3$ as yearly mean
France	2 $\mu\text{g}/\text{m}^3$ as yearly mean
Peru	2 $\mu\text{g}/\text{m}^3$ as yearly mean

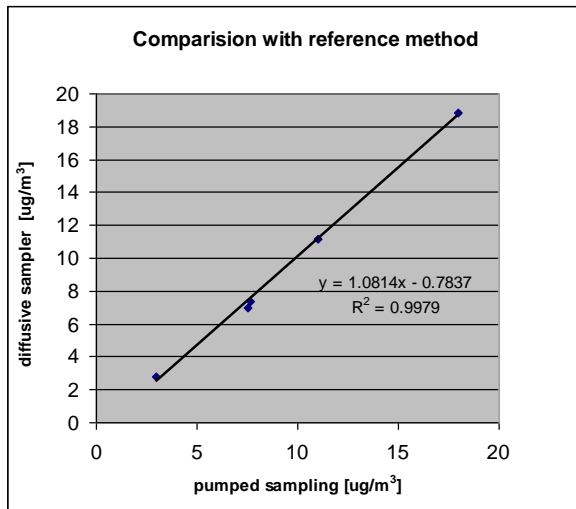
The BTX diffusive sampler is a cost effective method to evaluate critical zones. If the concentration, which is determined with a passive sampler, reaches 80% of the limit value, the result has to be verified by an active standard method



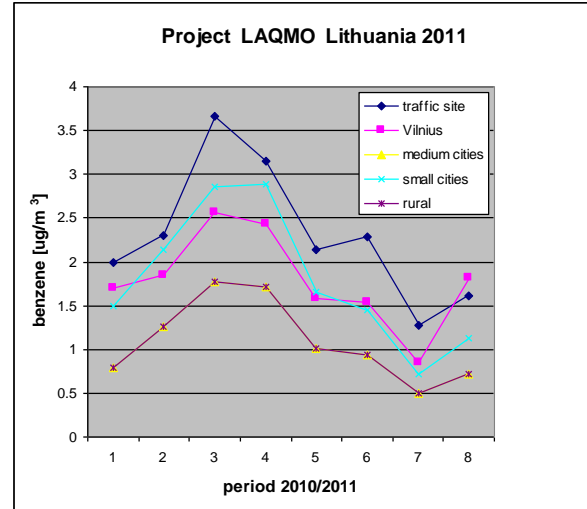
Protective shelter for ORSA5 Sampler in combination with  $\text{NO}_2$  diffusion tube

The diffusive sampler is suitable for area wide surveillance of Hydrocarbons, e.g. for the characterization of trends resulting from the implementation of state plans.

## Specifications



Comparison of diffusive sampler in controlled test-atmospheres with active pumped method



Time course of benzene in different areas of Lithuania [2]

Sampling rate [2]	Benzene: 6.44 ml/min Toluene: 5.72 ml/min m-Xylene: 5.03 ml/min
Working range	0.5 – 50 $\mu\text{g}/\text{m}^3$
Sampling time	2 – 4 weeks
Detection limit	0.2 $\mu\text{g}/\text{m}^3$ for a sampling time of 4 weeks
External influences: wind speed	influence of wind speed < 10% up to 4.5 m/sec using protection shelters
temperature	no influence between 10 to 30°C
humidity	no influence between 20 to 80%
Storage	before use: 24 months after exposure: 6 months
Cross sensitivity	selective method
Expanded uncertainty*	28.4 % at concentration levels of 5 $\mu\text{g}/\text{m}^3$
* According to GUM; subject to change without notice; revised 20.02.2023	

## References

[1] EN-14662-5:2005: Ambient air quality - Standard method for measurement of benzene concentrations - Part 5: Diffusive sampling followed by solvent desorption and gas chromatography

[2] Lithuanian Air Monitoring System Modernization Using Diffusive Samplers  
Final Report [www.gamta.lt](http://www.gamta.lt)  
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