

Volatile organic components (VOCs)

Introduction

The World Health Organisation (WHO) definition of VOCs includes all organic compounds (substances made up of predominantly carbon and hydrogen) with boiling temperatures in the range of 50-260 degrees C, VOCs are released in vehicle exhaust gases either as unburned fuels or as combustion products, and are also emitted by the evaporation of solvents and motor fuels.

VOC's contribute, to varying degrees, to the formation of ground level ozone. In addition, certain VOCs are known to cause cancer.

Studies show that VOC concentrations are usually higher indoors than outdoors. Most of the VOCs found in a large office building following construction resulted from the materials used to construct and furnish the building. Contributors included hard surface and carpet flooring materials, paints, adhesives and sealants, office furniture, computers, insulations, vinyl wallcoverings, ceiling tile, cabinetry, fireproofing, and textile furnishings.

Sources

Aromatics	Traffic, industry, consumer products
Aliphatics	Traffic
Chlorinated	Industry, dry cleaning
terpenes	Natural

Some Limit values or guideline values

Substance	Annual concentration [µg/m³]	Source
Benzene	5	EU ¹
Toluene	30	LAI ²
Xylenes	30	LAI
Ethylbenzene	22000	
Carbontetrachloride	2	WHO ³
a-Pinene	50	AGÖF ⁴

Only for benzene exists a limit value. WHO gives some recommendation for the environment, whereas AGÖF gives guiding values for a variety of substances for indoor environment.

Sampling



Tube with glass char



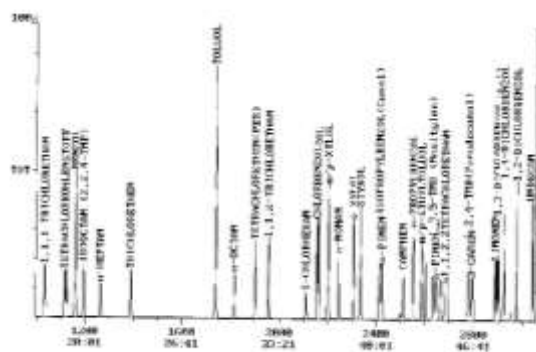
Tube fixed for exposure

The exposure time in ambient air should be 2 to 4 weeks. In the indoor environment 1 week is sufficient.

Analytics

The exposed diffusive samplers are extracted by adequate solvents. Two standard programs are available

- apolar fraction: aromatics, alkanes and terpenes
- polar fraction: alcohols, ethers, and esters.



The analysis is performed with CG/MS technique. The detection limit for a two-week exposure is around 0.3 µg/m³.

polar Hydrocarbons

methyl acetate
t-butylmethyl ether
t-butanol
isopropanol
diisopropyl ether
vinyl acetate
methyl ethyl ketone (2-Butanon)
methylvinyl ketone (3-Buten-2-one),
ethyl acetate
tetrahydrofuran
1-propanol
2-butanol
isopropyl acetate
isopropyl-methyl-ketone
isobutanol
methyl propyl ketone (2-Pentanone)
diethylketone
pinakoline (t-BMK)
propyl acetate,
1-methoxy-2-propanol
1-butanol
1,4-dioxane
isobutylmethyl ketone
isobutyl acetate
butylmethylketone (2-hexanone)
butyl acetate
N,N-dimethylformamide
1-methoxy-2-propylacetat
1-hexanol
cyclohexanone
2-butyloxy ethanol
2-ethyl-1-hexanol
1-acetoxy-2-butoxyethane
1-methyl-2-pyrrolidone
2-pyrrolidone
Dichlormethane
Cyclohexane
Methylcyclohexane

non polar Hydrocarbons

benzene
2,2,4 trimethylpentane (iso octane)
n-heptane
toluene
n-octane
ethylbenzene
m/p-xylol
n-nonane
Dodecane
Tridecane
Cyclohexane
o-xylene
styrene
isopropylbenzene cumole)
n-propylbenzene
m/p-ethyltoluene
1,3,5-trimethylbenzene (mesitylen)
n-decane
o-ethyltoluene
1,2,4 trimethylbenzene(pseudocumol
1,2,3trimethylbenzene (hemellitol)
a-pinene
camphene
b-pinene
3-carene
limonene
1,1,1-trichlorethane
1,2Dichloroethane
chloroformium
tetrachloromethane
1,1,1-trichloroethene
tetrachloroethen (PER)
1,1,2,-tricholoethane
chlorobenzene
1,1,2,2-tetrachloroethane
1,3-dichlorobenzene
1,2-dichlorobenzene
1,4-dichlorobenzene
undecan

References

- 1 Council Directive 2000/69/EC on limit values for benzene and carbon monoxide in ambient air
- 2 Länderausschuss für Immissionsschutz (Deutschland) <http://www.lai-immissionsschutz.de>
- 3 Air Quality Guidelines for Europe (1999)
- 4 Arbeitsgemeinschaft ökologischer Forschungsinstitute e.V. AGÖF-Orientierungswerte für Inhaltsstoffe von Raumluft www.agoef.de

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