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Uptake rates for radial diffusive samplers

Radial diffusive sampling is generally valid for the measurement of airborne vapours of VOCs in a concentration range of approximately 0.3–300 µg/m^3 per compound, for exposure times of 1–6 hours. However, for a range of less volatile compounds, exposure times of up to one week may be used.

Note that the high sampling rate (and related risk of back-diffusion) associated with radial diffusive samplers typically restricts the volatility range of these samplers to compounds of equal or lower volatility than benzene. It also means that stronger sorbents are generally required for these samplers when compared with either axial-type diffusive or pumped sorbent tubes.

Experimental

The data in Table 1 was supplied by Fondazione Salvatore Magugeri, Italy[1] and Ecole des Mines de Douai, France[2].

Uptake rates were measured on Radiello® radial diffusive samplers with Carbograph™ 4TD sorbent cartridges, with a sampling time of 7 days.

Additional findings

The work at Ecole des Mines[2] used an exposure chamber to validate BTEX measurements using the Radiello sampler. The group found that:

- There was no significant effect of back-diffusion at a 99% confidence level (exposure to successive thresholds of concentration from zero to twice the limit value)
- There was no significant effect of interferents at a 99% confidence level (exposure to a mixture of 34 VOCs)
- There was no significant effect of relative humidity at a 99% confidence level (exposure to 20–80% RH)
- Temperature had a small effect on the sampling rate of between ±0.6% (exposure to temperatures ranging from 10–30 °C)
- Wind velocity had an effect on the sampling rate of benzene. For wind velocities close to zero, the sampling rate of benzene decreases by 15%. At wind velocities above 0.5 m/s, the sampling rate is quasi-stable.

Compound	Uptake rate (mL/min)	Extended uncertainty (2σ) (%)	Ref.
Benzene	27.8	8.3	1
	27.9 ± 2.3	–	2
Toluene	30.0	8.3	1
	27.1 ± 1.8	–	2
Ethylbenzene	25.7	9.1	1
	24.9 ± 2.4	–	2
m-Xylene + *p*-Xylene	26.6	11.3	1
	22.0 ± 2.3	–	2
o-Xylene	24.6	9.1	1
	22.3 ± 2.2	–	2
1,2,4-Trimethylbenzene	21.9	9.6	1
n-Hexane	25.5	10.9	1
Cyclohexane	27.6	14.7	1
n-Heptane	25.3	7.6	1
n-Octane	24.1	13.4	1
n-Nonane	21.0	11.8	1
1-Methoxy-2-propanol	26.6	11.6	1
2-Ethoxyethanol	26.0	7.7	1
2-Butoxyethanol	19.4	9.7	1
Isopropyl acetate	25.8	9.6	1
n-Butyl acetate	24.5	8.2	1
2-Ethoxyethyl acetate	20.9	8.0	1
1,1,1-Trichloroethane	20.0	13.0	1
Trichloroethene	27.1	9.5	1
Tetrachloroethene	25.4	8.9	1
1,4-Dichlorobenzene	22.0	9.5	1
Dimethyl disulfide	23.7	9.1	1

Table 1: Uptake rates on Carbograph 4TD Radiello cartridges.

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Trademarks

References

1. Vincenzo Cocheo, Fondazione Salvatore Maugeri, IRCCS Environmental Research Centre, Via Svizzera, 16- I 35127 Padova, Italy.
2. Anne Pennequin-Cardinal *et al.*, Ecole des Mines de Douai, Département Chimie et Environnement, Douai, France.

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