TDTS 1

Uptake rates for tube-type axial diffusive samplers

Introduction

The following tables provide a listing of uptake rates for tube-type axial diffusive samplers, for workplace and environmental applications.

Separate lists are given for workplace (approx. 8 hours) and environmental (1, 2 or 4 weeks) exposure periods and exposure concentrations typical of these applications.

Users of the data are strongly advised to consult the original source material to determine the level of confidence and range of applicability of the values.

Notes

This list of uptake rates is not intended to be exhaustive, and although every care has been taken in its preparation, no guarantee can be given of its accuracy. Nor does the list imply a preference for this type of sampler.

Units for uptake rates are ng ppm^{-1} min^{-1} unless otherwise stated.

Footnotes

[a] Sampler with membrane in diffusion cap.

[b] Preferred sorbent.

[c] A nickel disk, rather than the conventional stainless steel gauze, was used to support the Carbotrap sorbent material during method validation for these perfluorocarbon tracer gases. The uptake rates may not be applicable to samples using conventional steel gauzes.

[d] Rate varies predictably with exposure dose.

[e] Equivalent to Carbopack B.

[f] Sampling carried out for 1–2 weeks.

Levels

A = Validation equivalent to CEN level 1A.

B = Partial validation – see EN 482.

C = Calculated – ideal value.

D = Calculated from dynamic breakthrough volume.

E = Calculated from sorption isotherm.

F = Experimental observation.

We would be delighted to receive details of any uptake rates that have been measured and are being used in the field – please contact us.

Workplace applications

Hydrocarbons

Compound	Sorbent	Level	Uptake rate	Ref.
Buta-1,3-diene	MolSieve 13X [a]	A	1.3	1
	Carbopack X	B	1.64	15
n-Pentane	Chromosorb 106	A	1.46	1
	Carbopack B [b]	B	1.77	1
n-Hexane	Chromosorb 106	A	1.77	1
Cyclohexane	Chromosorb 106	D	1.60	28
	Tenax TA	D	1.32	28
Benzene	Tenax TA	A	1.3	1
	PoraPak Q	A	1.37	1
	Tenax GR	B	1.81	1
	Chromosorb 106	B	1.72	1
n-Heptane	Chromosorb 106	A	1.95	1
	Tenax TA	A	1.77	1
	Carbopack B	B	1.94	1
2-Methylhexane	Chromosorb 106	D	1.79	28
	Tenax TA	D	1.48	28
3-Methylhexane	Chromosorb 106	D	1.80	28
	Tenax TA	D	1.48	28
Methylcyclohexane	Chromosorb 106	D	1.88	28
	Tenax TA	D	1.55	28
Toluene	Tenax TA	B	1.67	1
	Tenax GR	B	2.12	1
	Chromosorb 106	B	1.94	1
	Carbopack B	B	2.06	1
2-Methylheptane	Chromosorb 106	D	2.33	28
	Tenax TA	D	1.95	28
n-Octane	Chromosorb 106	A	2.13	1
	Tenax TA	A	2.00	1
Xylene	Tenax TA	B	1.82	1
	Chromosorb 106	B	2.10	1
	Tenax GR	B	2.48	1
Ethylbenzene	Tenax TA	B	2.0	1
	Tenax GR	B	2.43	1
	Chromosorb 106	B	1.9	1
	PoraPak Q	D	2.38	1
Styrene	Tenax TA	A	2.40	1
	Chromosorb 106	B	2.12	1
n-Nonane	Chromosorb 106	A	2.40	1
	Tenax TA	A	2.12	1
Isopropylbenzene	Chromosorb 106	C	2.26	1
	Tenax TA	C	2.26	1
	PoraPak Q	D	2.5	1
n-Propylbenzene	Chromosorb 106	C	2.37	1
	Tenax TA	C	2.37	1
Trimethylbenzene	Chromosorb 106	C	2.37	1
	Tenax TA	C	2.37	1

Hydrocarbons (continued)

Compound	Sorbent	Level	Uptake rate	Ref.
1,3-Dimethyl-4-ethylbenzene	Tenax TA	D	2.45	28
1,4-Diethylbenzene	Tenax TA	D	2.56	28
m-Ethyltoluene	Chromosorb 106 Tenax TA	D D	2.43 2.25	28 28
o-Ethyltoluene	Chromosorb 106 Tenax TA	D D	2.57 2.44	28 28
p-Ethyltoluene	Chromosorb 106 Tenax TA	D D	2.35 2.21	28 28
n-Decane	Tenax TA Chromosorb 106	A A	2.3 2.47	1 30
Cumene	PoraPak Q	D	2.5	19
α-Pinene	Tenax TA Chromosorb 106	D A	2.35 2.56	28 30
Naphthalene	Tenax TA	A	2.55	30

Halogenated hydrocarbons

Compound	Sorbent	Level	Uptake rate	Ref.
Methyl chloride (chloromethane)	SpheroCarb/ UniCarb	B	1.3	1
Vinyl chloride	SpheroCarb/ UniCarb	B	2.0	1
1,1-Dichloroethene	SpheroCarb/ UniCarb	B	2.5	1
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon® 113)	Chromosorb 102	B	3.5	1
Chlorotrifluoromethane	Chromosorb 102	B	1.8	1
Dichloromethane	Chromosorb 106 Chromosorb 102	B B	1.56 1.56	1 1
1,2-Dichloroethane	Chromosorb 102 Chromosorb 106 Tenax GR	B B B	1.9 2.03 1.72	1 26 26
Halothane	Tenax TA Chromosorb 102 Chromosorb 106	B B B	2.59 3.6 4.28	1 1 36
Enflurane	Tenax TA Chromosorb 106 Chromosorb 106	B D B	2.29 2.8 3.24	1 28 36
Sevoflurane	Chromosorb 106	B	3.09	36
Isoflurane	Tenax TA Chromosorb 106 Chromosorb 106	B D B	2.20 2.51 3.43	1 28 36
Bromoethane	Chromosorb 106	E	2.45	1
Bromobenzene	Chromosorb 106 Tenax TA	D D	3.59 3.31	28 28
Trichloromethane (chloroform)	Tenax GR Chromosorb 102 Chromosorb 106	B B B	2.18 2.35 2.47	1 1 26
Tetrachloromethane	Tenax GR Chromosorb 102	B B	3.72 2.87	1 1
Trichloroethene	Chromosorb 106 Chromosorb 102	B B	2.66 2.3	1 1
1,1,1-Trichloroethane	Chromosorb 106 Chromosorb 102 Tenax GR	B B B	2.3 2.3 2.92	1 1 1

Halogenated hydrocarbons (continued)

Compound	Sorbent	Level	Uptake rate	Ref.
Tetrachloroethene	Chromosorb 106 Tenax TA Chromosorb 102 Tenax GR	B B B B	3.1 2.8 2.6 2.9	1 1 1 26
Epichlorohydrin	Chromosorb 106	E	2.45	1
Allyl chloride	Chromosorb 106	D	1.75	28
Benzyl chloride	Tenax TA	D	2.72	28
Perfluoro-dimethylcyclobutane	Carbotrap [c]	B	15 mL h^{-1}	1
Perfluoro-methylcyclopentane	Carbotrap [c]	B	15 mL h^{-1}	1
Perfluoro-methylcyclohexane	Carbotrap [c]	B	15 mL h^{-1}	1
p-Dichlorobenzene	Tenax	C	3.23	34

Esters and glycol ethers

Compound	Sorbent	Level	Uptake rate	Ref.
Methyl acetate	Chromosorb 106	A	1.74	30
Ethyl acetate	Chromosorb 106 Tenax TA	B B	2.0 1.6	1 1
n-Butyl acetate	Tenax TA Chromosorb 106 Tenax GR	B A B	2.26 2.6 1.93	1 30 26
Isobutyl acetate	Chromosorb 106 Tenax TA	D D	2.17 1.91	28 28
sec-Butyl acetate	Chromosorb 106 Tenax TA	D D	2.29 1.90	28 28
tert-Butyl acetate	Chromosorb 106 Tenax TA	D D	2.26 1.79	28 28
Vinyl acetate	Chromosorb 106	D	1.93	28
Methyl methacrylate	PoraPak Q Chromosorb 106 Tenax TA	B D D	2.0 2.14 1.77	1 28 28
Methyl acrylate	Chromosorb 106 Tenax TA	D D	1.96 1.50	28 28
Butyl acrylate	Tenax TA Chromosorb 106	B D	2.6 2.11	1 32
Ethylhexyl acrylate	Tenax TA	D	2.99	28
2-Methoxyethanol	PoraPak Q Chromosorb 106	A B	1.5 2.1	1 1
2-Methoxyethyl acetate	PoraPak Q Chromosorb 106 Tenax GR Tenax TA	A B B B	2.8 2.08 1.81 1.64	1 26 26 26
2-Ethoxyethyl acetate	Chromosorb 106 Tenax TA Tenax GR	B B B	2.3 2.1 2.08	1 1 26
2-Butoxyethanol	Chromosorb 106 Tenax TA	B B	2.1 1.97	1 1
1-Methoxy-2-propanol	Chromosorb 106 Tenax TA Tenax GR	B B B	1.88 1.56 1.55	5 5 26
Methoxypropyl acetate	Chromosorb 106 Tenax TA Tenax GR	B B B	2.5 2.21 2.23	26 26 26
2-Methoxypropanol	Chromosorb 106 Tenax TA	B B	1.85 1.52	1 1

Aldehydes and ketones

Compound	Sorbent	Level	Uptake rate	Ref.
Butan-2-one	Chromosorb 106 Tenax GR Tenax TA	B B B	1.72 1.37 1.34	26 26 26
2-Methylpentan-4-one (methyl isobutyl ketone, MIBK)	Tenax TA Tenax GR Chromosorb 106	B B B	1.71 1.69 2.01	1 26 1
Cyclohexanone	Tenax TA Chromosorb 106 Tenax GR	D B B	2.3 1.96 1.78	1 26, 31 26
2-Methylcyclohexanone	Tenax TA	D	2.31	28
3-Methylcyclohexanone	Tenax TA	D	2.22	28
4-Methylcyclohexanone	Tenax TA	D	2.14	28
Furfural	Tenax TA	A	2.5	11
Hexanal	Tenax TA Chromosorb 106	D A	1.64 2.06	28 30
Decanal	Tenax TA	D	2.32	28

Alcohols

Compound	Sorbent	Level	Uptake rate	Ref.
Ethanol	Chromosorb 106	A	1.3	30
Propan-1-ol	Chromosorb 106	D	1.47	28
Propan-2-ol (isopropanol)	SpheroCarb/ UniCarb Chromosorb 106	C A	2.0 1.52	1 30
n-Butanol	Chromosorb 106 Tenax	A D	1.74 1.33	30 28
Furfuryl alcohol	Tenax TA	D	2.50	28
Tetrahydrofurfuryl alcohol	Chromosorb 106 Tenax TA	D D	2.39 1.90	28 28

Miscellaneous

Compound	Sorbent	Level	Uptake rate	Ref.
Acrylonitrile	PoraPak N Chromosorb 106	A D	1.35 1.48	1 28
Acetonitrile	PoraPak N PoraPak N Chromosorb 106	A A A	1–2 h 0.8–8 h 1.48	1 1 30
Propionitrile	PoraPak N PoraPak N	A A	1.4–2 h 1.3–8 h	1 1
Carbon disulfide	SpheroCarb/ UniCarb	A	2.6	1
Nitrous oxide [d]	Mol. Sieve 5 Å	B	1.25	13
Ethylene oxide	SpheroCarb/ Unicarb	B	1.6	1
Propylene oxide	Chromosorb 106	A	1.24	30
1,4-Dioxane	Spherocarb/ UniCarb	C	3.0	1
Allyl glycidyl ether	Chromosorb 106 Tenax TA	D D	2.40 1.83	28 28
Butyl glycidyl ether	Chromosorb 106 Tenax TA	D D	2.61 2.36	28 28
Tetrahydrofuran	Chromosorb 106	D	1.64	28
N-Methylpyrrolidone	Tenax TA Chromosorb 106	C A	1.83 2.41	28 30
N-Vinylpyrrolidone	Tenax TA	A	2.51	30

Environmental applications

One week

Compound	Sorbent	Level	Uptake rate	Ref.
Buta-1,3-diene	Carbopack X	B	1.19	15
Benzene	Tenax TA Carbograph 1 [e] Chromosorb 106 Ambersorb XAD-4	B A A B	1.45 2.14 1.52 1.21	1 1 1 1
Toluene	Carbograph 1 Chromosorb 106 Ambersorb XAD-4	A A B	2.16 2.05 1.62	1 1 1
Xylene	Carbograph 1 Chromosorb 106	A A	2.37 2.42	1 1
n-Nonane	Tenax TA	C	2.00 [f]	–

Two weeks

Compound	Sorbent	Level	Uptake rate	Ref.
Buta-1,3-diene	Carbopack X	B	1.02	–
Benzene	Tenax TA Chromosorb 106 Carbograph 1 Carbopack X	A A B B	1.03 1.47 ± 0.22 2.02 ± 0.22 1.99 ± 0.18	1 29 1 35
Xylene	Tenax TA Chromosorb 106 Carbograph 1	A A A	1.49 2.09 ± 0.29 2.07 ± 0.21	1 1 1
Ethylbenzene	Chromosorb 106	B	2.31 ± 0.07	1
Trimethylbenzene	Carbopack B	B	2.30	1

Four weeks

Compound	Sorbent	Level	Uptake rate	Ref.
n-Dodecane	Tenax TA	C	3.75	–
Benzene	Tenax TA [a] Chromosorb 106 Tenax GR Carbograph 1	B B B B	0.70 ± 0.09 1.28 ± 0.25 0.8 1.85 ± 0.15	1 1 3 1
Toluene	Tenax TA Chromosorb 106 Chromosorb 106 Chromosorb 106 Carbograph 1	A B B A A	1.03 ± 0.26 2.10 ± 0.03 1.93 ± 0.12 1.82 ± 0.18 2.07 ± 0.26	1 29 31 1 1
Xylene	Tenax TA Carbograph 1 Chromosorb 106	A A A	1.46 ± 0.67 1.94 ± 0.29 1.91 ± 0.35	1 1 1
Ethylbenzene	Chromosorb 106 Carbopack B	B B	2.24 2.30	1 1
Trimethylbenzene	Tenax TA Carbopack B	B B	2.67 2.30	1 1
Decane	Tenax TA	B	2.93	1
Undecane	Tenax TA	B	3.34	1
Tetrachlorobutadiene	Tenax TA	B	3.0	33
Pentachlorobutadiene	Tenax TA	B	3.4	33
Hexachlorobutadiene	Tenax TA	B	3.5	33

References

'MDHS' refers to the UK Health and Safety Executive (HSE) series of Methods for the Determination of Hazardous Substances. See http://www.hsl.gov.uk/publications/mdhs.aspx.

Note also that HSE/HSL Internal Reports can be obtained from the HSE.

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