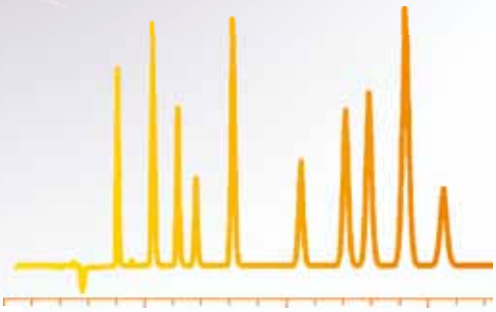
Chromatography

Environmental Analysis
Applications, Columns and Supplies



MZ ANALYSENTECHNIK

AUTHORIZED DISTRIBUTOR

MZ-Analysentechnik GmbH, Barcelona-Allee 17• D-55129 Mainz

Tel +49 6131 880 96-0, Fax +49 6131 880 96-20

e-mail: info@mz-at.de, www.mz-at.de

. . we Meet your Needs

MACHEREY-NAGEL

www.mn-net.com

MN Since 1911

How to contact us

If you have any questions concerning our chromatography program, or if you are looking for solutions to a special application, please feel free to contact us:

Technical support and customer service phone: +49 24 21 969-175

Germany and international
Phone: +49 24 21 969-0
Toll free: 0800 2616 000
Fax: +49 24 21 969-199 or 198
E-Mail: info@mn-net.com

USA
Phone: +1 484 821 0984
Toll free: 888 321 6224 (MACH)
Fax: +1 484 821 1272
E-Mail: sales-us@mn-net.com

France
Phone : +33 388 68 22 68
Fax : +33 388 51 76 88
E-Mail : sales-fr@mn-net.com

Switzerland
Phone: +41 62 388 55 00
Fax: +41 62 388 55 05
E-Mail: sales-ch@mn-net.com

Visit our Chromatography Websites!
detailed product information · free application database (with more than 3000 chromatography applications) · much more

www.mn-net.com/chroma

www.mn-net.com/apps

Contents

Pesticides from water

MN Appl. No. 304250 / 304260

Gleis, C., GIU GmbH, Teningen

Matrix: water

Columns: CHROMABOND® HR-X, 3 mL, 200 mg
REF 730931

Sample pretreatment: samples are spiked with 500 ng of each pesticide in 1000 mL water, adjusted to pH 2 with HCl or pH 7

Conditioning: 10 mL MeOH, 10 mL dist. water

Sample application: slowly pass 1000 mL spiked water sample through the column with the aid of a tubing adaptor (REF 730243).

Elution: after drying 5 mL MeOH / THF (1:1; v/v)

Subsequent analysis: HPLC

Recovery rates [%]:

compound	pH 2
metamitron	86
quinmerac	90
chloridazon	93
picloram	83
metribuzin	84
cyanazine	83
metabenzthiazuron	94
chlortoluron	91
isoproturon	89
diuron	91
dimethenamid-P	89
linuron	94
epoxyconazole	85
penconazole	90
alachlor	93
1-propiconazole	89
flufenacet	91
diflufenicam	58
triallate	42

compound	pH 7
desisopropylatrazine	90
2,4-dichlorobenzamide	95
desethylatrazine	89
hexazinone	95
bromacil	103
simazine	91
desethylterbuthylazine	89
atrazine	88
metalaxyl	97
metazachlor	93
propazine	88
terbuthylazine	86
metolachlor	97

Extraction of paraquat and diquat from water

MN Appl. No. 305370

Matrix: water

Column: CHROMABOND® HR-XCW, 3 mL, 60 mg
REF 730735

Conditioning: 1 mL MeOH, then 1 mL water (Do not let run the column dry!)

Sample application: 1 mL spiked water (0.5 µg/mL)

Washing: 1 mL MeOH

Drying: with nitrogen or air

Elution: 1 mL acetonitrile / water (1:1; v/v) + 2 % formic acid; Evaporation and reconstitution is suitable solvent.

Subsequent analysis: HPLC, e.g. NUCLEODUR® HILIC (see page 15)

Substances: paraquat; diquat

Recovery rates: paraquat: 103 %, diquat: 113 %

Pesticides from water

MN Appl. No. 302060

Matrix: water

Column: CHROMABOND® Hydra, 6 mL, 2000 mg
REF 730301

Sample pretreatment: adjust 1000 mL water to pH 7-8 with diluted NH_3 and add 100 µL of the internal standard (1 µg/L).

Conditioning: 2 x 5 mL MeOH, then 2 x 5 mL dist. water

Sample application: slowly force or aspirate the water sample through the column. Then dry for 2 h with 2 bar N_2.

Elution: aspirate 10 mL MeOH slowly through the column. Evaporate the eluted solution to dryness in a tapered flask with a rotation evaporator at 30 °C and store it in a refrigerator for about 15 min. Dissolve the residue in 200 µL cold, fresh n-hexane and transfer the solution in a conical HPLC vial. Store the solution in a refrigerator until GC analysis.

Subsequent analysis: GC columns: OPTIMA® δ-3 or OPTIMA® δ-6; HPLC column: NUCLEODUR® PolarTec

Substances: desisopropylatrazine; desethylatrazine; desethylterbuthylazine; simazine; atrazine; propazine; terbuthylazine; sebuthylazine; desmetryn; ametryn; prometryne; terbutryn; cyanazine; metazachlor; napropamide; methoprotryn; hexazinone

Recovery rates: between 95 - 100 %

Method development of an extraction of very polar pesticide metabolites - optimization of MeOH portion

MN Appl. No. 304400

Pantiru, M.E., Diss., Wissenschaftszentrum Weihenstephan für Ernährung, Landnutzung und Umwelt, TU München

Column: CHROMABOND® HR-P, 3 mL, 200 mg
REF 730108

Sample pretreatment: samples of 100 mL phosphate buffer (pH 6) with 20, 10 or 5 % MeOH are spiked with 5 µg carbamate metabolites each

Conditioning: 3 mL MeOH, then 3 x 3 mL phosphate buffer (pH 6)

Sample application: with tubing adaptor (e.g. CHROMABOND® tubing adaptor, REF 730243) the prepared sample is passed through the column (vacuum: 4 - 5 mm Hg).

Elution: after drying in a nitrogen stream (15 min) it is eluted with 2 x 3 mL acetone

Concentration: the eluate is concentrated with nitrogen in a 5 mL test tube (30 °C). The residue is reconstituted with 500 µL MeOH and passed into a HPLC vial.

Subsequent analysis: HPLC

Recovery rates [%]:

compound	20 % MeOH	10 % MeOH	5 % MeOH
butocarboxim sulfoxid	5	82	103
aldicarb sulfon	98	83	102
ethiofencarb sulfon	102	88	101
methiocarb sulfoxid	97	91	102
carbofuran 3-OH	99	99	100
methiocarb sulfon	96	100	102
carbofuran 3-keto	99	99	101

PAH analysis

PAHs from drinking water (EPA 550)

MN Appl. No. 302170

Matrix: water

Column: CHROMABOND® C_{18} ec, 6 mL, 1000 mg
REF 730015

Sample pretreatment: add 100 mg $Na_2S_2O_3$ to 1000 mL water sample and adjust the pH value to pH 2 with 6 N HCl

Conditioning: 4 x 10 mL methlyene chloride, 4 x 10 mL MeOH, then 4 x 10 mL ultra pure water

Sample application: suck or press the water sample through the column.

Washing: with 10 mL ultra pure water, then dry the column for 10 minutes with vacuum

Elution: suck 2 x 5 mL methylene chloride slowly through the column. Dry the combined fractions over Na_2SO_4. Filter the suspension and wash with 2 mL methylene chloride. Concentrate the sample to 1 mL under a nitrogen stream. For further analysis add 3 mL acetonitrile and concentrate to 0.5 mL with vacuum.

Subsequent analysis: HPLC, e.g. NUCLEODUR® C_{18} PAH (see page 16)

16 EPA-PAHs from water with CHROMABOND® Easy

MN Appl. No. 302830

Matrix: water

Column: CHROMABOND® Easy, 6 mL, 200 mg
REF 730755

Sample pretreatment: concentration of the standard: 1 µg/L

Sample: drinking water

Conditioning: 3 mL MeOH, 3 mL water

Sample application: 500 mL drinking water

Washing: 3 mL water / MeOH 5%

Drying: vacuum

Elution: 2 x 2 mL dichlormethane for GC analysis or for HPLC: concentrate dichlormethane in a nitrogen atmosphere and elute in ACN.

Subsequent analysis: HPLC, e.g. NUCLEODUR® C_{18} PAH (see page 16)

PAHs from water

MN Appl. No. 301250

Matrix: water

Column: CHROMABOND® C_{18} PAH, 6 mL, 2000 mg
REF 730166

Conditioning: 1 column volume MeOH, then 1 column volume dist. water

Sample application: aspirate 1000 mL water sample through the column (about 15 to 20 mL/min), then dry the column (stream of nitrogen or 24 h in a desiccator over P_2O_5).

Elution: elute with 4 mL acetonitrile / benzene* (3:1; v/v) and evaporate or fill up to the volume required
*: alternatively toluene can be used

Subsequent analysis: HPLC, e.g. NUCLEODUR® C_{18} PAH (see page 16)

Recovery rates [%]:

compound (each 50 ng/L)	%
naphthalene	87
acenaphthylene	89
acenaphthene	90
fluorene	82
phenanthrene	85
anthracene	90
fluoranthene	89
pyrene	89
benz[a]anthracene	87
chrysene	95
benzo[b]fluoranthene	91
benzo[k]fluoranthene	89
benzo[a]pyrene	90
dibenz[ah]anthracene	97
benzo[ghi]perylene	91
indeno[1,2,3-cd]pyrene	96

PAHs from water containing humic acids

MN Appl. No. 301260

Matrix: water

Column: CHROMABOND® NH_2 / C_{18}, 6 mL, 500/1000 mg (glass columns)
REF 730620G

Sample pretreatment: add 25 mL 2-propanol to 500 mL water sample

Conditioning: 10 mL methylene chloride, 10 mL MeOH, then 10 mL dist. water / 2-propanol (9:1; v/v)

Sample application: 250 mL sample solution

Washing: 2 mL dist. water / 2-propanol (9:1; v/v)

Drying: about 20 min, vacuum

Elution: elute with 4x1 mL methylene chloride (let percolate first 1 mL into the column packing without vacuum, then apply light vacuum) and if necessary evaporate in a stream of nitrogen and fill up with a suitable solvent.

Subsequent analysis: HPLC, e.g. NUCLEODUR® C_{18} PAH (see page 16)

Recovery rates [%]:

compound	%	compound	%
naphthalene	90	benzo[a]anthracene	88
acenaphthylene	89	chrysene	95
acenaphthene	86	benzo[b]fluoranthene	93
fluorene	87	benzo[k]fluoranthene	88
phenanthrene	87	benzo[a]pyrene	87
anthracene	89	dibenz[ah]anthracene	91
fluoranthene	90	benzo[ghi]perylene	90
pyrene	93	indeno[1,2,3-cd]pyrene	89

16 EPA-PAHs from soil with CHROMABOND® Easy

MN Appl. No. 302820

Matrix: sludge, soil

Column: CHROMABOND® Easy, 6 mL, 200 mg
REF 730755

Sample pretreatment: homogenize 5 g soil sample in 30 mL 2-propanol, filter the solution and fill up to 250 mL with water

Sample: soil or sludge

Conditioning: 3 mL MeOH, 3 mL water

Sample application: 250 mL sample solution

Washing: 2 x 3 mL water / MeOH (95:5; v/v)

Drying: vacuum

Elution: 2 x 1 mL dichlormethane for GC analysis or for HPLC analysis: concentrate dichlormethane in a nitrogen atmosphere and dissolve in acetonitrile.

Subsequent analysis: HPLC, e.g. NUCLEODUR® C_{18} PAH (see page 16)

PCBs from soil, sludge or cement

MN Appl. No. 302040

Göldner, E., Inst. für Angewandte Chemie Gockel & Weischedel & Co.

Matrix: cement, sludge, soil

Column: CHROMABOND® NAN, 3 mL, 400/1400/400 mg
REF 730109

Sample pretreatment: ca. 20 g of a dry soil, sludge, cement sample with 10 g sodium sulfate are extracted for 8 hours with 100 mL n-hexane in a soxhlet extractor. Then the extract is concentrated to a volume of 1-2 mL.

Conditioning: 2 mL n-hexane

Sample application: slowly force or aspirate the extract of the sample pretreatment through the column

Elution: aspirate 10 mL n-hexane slowly through the column. Then concentrate to 5 mL.

To gain a better peak shape in GC a subsequent acetonitrile extraction is performed: Extract 2 mL of the n-hexane-extract with 2 mL acetonitrile. After phase partition use ca. 1 mL of the acetonitrile phase for GC analysis.

Subsequent analysis: GC, e.g. OPTIMA® δ-6, as described in application number 250480 (*www.mn-net.com/apps*)

Recovery rates [%]:

PCB	extraction rates n-hexane to acetonitril
28	30.8
52	36.9
101	26.8
153	19.1
138	23.4
180	15.9

PAHs from soil

MN Appl. No. 301310

Matrix: soil

Column: CHROMABOND® CN/SiOH, 6 mL, 500/1000 mg
REF 730135

Sample pretreatment: dry 30 g soil with sodium sulphate and reflux 4 hours with 250 mL petroleum ether in a soxhlet extractor. For low PAH contents (colorless or weakly colored extracts) concentrate extract to 1/10 of its volume in a rotation evaporator.

Conditioning: 4 mL petroleum ether

Sample application: force or aspirate 20 mL of the extract through the column

Elution: 2 x 2 mL acetonitrile / benzene (3:1; v/v), then evaporate or fill up to the volume required (alternative 2 x 2 mL acetonitrile / toluene (3:1; v/v))

Subsequent analysis: HPLC, e.g. NUCLEODUR® C_{18} PAH (see page 16)

Recovery rates [%]:

compound	%	compound	%
naphthalene	85	benzo[a]anthracene	84
acenaphthylene	92	chrysene	96
acenaphthene	89	benzo[b]fluoranthene	95
fluorene	87	benzo[k]fluoranthene	90
phenanthrene	83	benzo[a]pyrene	90
anthracene	88	dibenz[ah]anthracene	96
fluoranthene	87	benzo[ghi]perylene	87
pyrene	90	indeno[1,2,3-cd]pyrene	97

Phenols in aqueous samples (EPA 528)

MN Appl. No. 302370

Ciupe, R.; Spangenberg, J.; Wild, G.; Meyer, Th., GIT Fachz. Lab 8/96

Matrix: water

Column: CHROMABOND® HR-P (e.g. 6 mL, 200 mg
REF 730119 or sorbent REF 730615)

Sample pretreatment: water samples with two different concentration ranges (0.1 and 0.003 mg/kg) were prepared without pH adjustment or desalting with MeOH as auxiliary solvent.

Conditioning: 10 mL MeOH and then 4 mL water. The column must not run dry.

Sample application: 50 mL (0.1 mg/kg) or 500 mL (0.003 mg/kg) of the prepared samples are sucked through the column. Dry the column by sucking air for 1 minute.

Elution: 4 mL MeOH

Concentration: the eluate is concentrated to 1 or 0.5 mL by heating to 70 °C.

Subsequent analysis: GC

Recovery rates [%]:

compound	0.1 mg/L	0.003 mg/L
phenol	99.0 +/-1.0	98.8 +/-0.9
o-cresol	99.1 +/-0.7	97.9 +/-0.8
m- + p-cresol	99.2 +/-0.7	97.5 +/-0.8
2,6-xylenol	97.8 +/-1.2	99.2 +/-0.7
2,4- + 2,5-xylenol	99.7 +/-0.7	98.6 +/-0.8
3,4-xylenol	98.9 +/-0.6	97.4 +/-0.7
2,3-xylenol	99.0 +/-0.4	98.9 +/-0.6
3,5-xylenol	99.4 +/-0.3	98.5 +/-0.7

Enrichment of explosive compounds from water samples with SPE

MN Appl. No. 302910

Bausinger, T., Geographisches Inst. Universität Mainz

Matrix: water

Column: CHROMABOND® HR-P, 6 mL, 200 mg
REF 730119

Sample pretreatment: test mixture contains 5 µg/L of each compound

Conditioning: 5 mL MeOH and then 3 mL acetonitrile and 10 mL water. The column must not run dry.

Sample application: suck 400 mL of the sample with 10-15 mL/min through the column, wash with water and suck the column to dryness for 40-60 min

Elution: apply 1 mL MeOH / acetonitrile (50:50; v/v) onto the column. The sorbent should become wet but do not suck the solvent through the column. Wait for 5 min and elute with 1.5 mL of the same solvent.

Subsequent analysis: fill the eluate up to 4 mL with water and then HPLC, e.g. NUCLEODUR® PolarTec
(see page 17)

Recovery rates [%]:

compound	%
octogene	114 +/- 6
2,4-diamino-6-nitrotoluene	63 +/- 25
hexogene	99 +/-14
1,3,5-trinitrobenzene	105 +/-2
2-amino-6-nitrotoluene	102 +/-1
2-amino-4-nitrotoluene	101 +/-1
1,3-dinitrobenzene	106 +/-1
2,4,6 trinitrotoluene	103 +/-1
4-amino-2,6-dinitrotoluene	107 +/-1
2-amino-4,6-dinitrotoluene	107 +/-2
2,6-dinitrotoluene	98 +/-2
2,4-dinitrotoluene	97 +/-1
2-nitrotoluene	103 +/-2
4-nitrotoluene	87 +/-1
3-nitrotoluene	92 +/-6

AOX determination in water with high content of salt or organic compounds according to DIN 38409 - H 22

MN Appl. No. 302080

Matrix: water

Column: CHROMABOND® HR-P-AOX, 6 mL, 500 mg
REF 730111.AOX

Conditioning: 5 mL MeOH, then 10 mL dist. Water, the column should not run dry.

Sample application: force or aspirate 100 mL of the original or diluted water sample (pH 1) through the column (3-5 mL/min). The column should not run dry. Discard the eluted solution. Wash with 50 mL of a nitrate washing solution (dissolve 17 g $NaNO_3$ in 100 mL dist. water, add 1.4 mL HNO_3 10 M), fill up with dist. water to 1000 mL take off 50 mL and fill up with dist. water to 1000 mL). Discard the eluted solution.

Elution: slowly force or aspirate 1 x 1 mL, then 1 x 4 mL MeOH and 10 mL dist. water through the column. Collect eluted solutions in 100 mL measuring flask and fill up with dist. water to 100 mL.

Note: we recommend to test the recovery with a standard solution. Is the recovery to low, an increase of elution solvent is recommended (2 x 5 mL MeOH or 2 x 5 mL MeOH/ethyl acetate 1:1; v/v). If the sample has only a small contamination (conc. DOC < 500 mg/L) the adsorbent weight in the cartridge can be reduced for a better recovery, i.e. with CHROMABOND® HR-P-AOX, 6 mL, 200 mg,
REF 730119.AOX

Hydrocarbons in water according to ISO DIS 9377-4 / DIN H-53

MN Appl. No. 302090

Matrix: water

Column: CHROMABOND® Na_2SO_4 / Florisil®,
6 mL, 2000/2000 mg, glass column
REF 730249G

Internal standard solution: solve 20 mg n-tetracontane ($C_{40}H_{82}$) in cyclohexane, add 20 mL n-nonane (C_9H_{20}) and fill up to 1 L with cyclohexane. To prepare the extraction solution dilute the standard solution with cyclohexane 1:10.

Sample pretreatment: adjust 900 mL water (10 °C) with HCl (12 mol/L) to pH 2 and add 80 g $MgSO_4$. Add 50 mL of the extraction solution, close the bottle and stir the suspension intensely for 30 min. Add enough distilled water to separate the organic from the aqueous phase.

Conditioning: 5 mL cyclohexane

Sample application: slowly force or aspirate the organic solution through the column.

Elution: wash with 10 mL cyclohexane. Evaporate the combined organic solutions carefully to 1 mL or less. If necessary, fill up to 1 mL exactly. (Evaporation to 1 mL can be unnecessary, if the hydrocarbon content is high.)

Recovery rates: must be > 80 % for n-tetracontane.

Subsequent analysis: GC, according to application number 210600 on OPTIMA® 1 (*www.mn-net.com/apps*)

Plasticizers (phthalates and adipates) from drinking water (EPA 506)

MN Appl. No. 302160

Matrix: water

Column: CHROMABOND® C18 ec, 3 mL, 500 mg (glass column) REF 730013G

Sample pretreatment: add 5 mL MeOH to 1000 mL water sample.

Conditioning: 2 x 10 mL methylene chloride, 2 x 10 mL MeOH, then 10 mL ultra pure water.

Sample application: suck or press up to 1000 mL water sample through the column.

Washing: with 10 mL ultra pure water

Elution: suck 10 mL methylene chloride slowly through the column. Concentrate the sample under nitrogene stream to about 0.5 mL and dry over Na_2SO_4.

Subsequent analysis: GC according to EPA 606 on OPTIMA® 1 or OPTIMA® 5 column, see GC application numbers 201210 and 201220 (*www.mn-net.com/apps*)

Extraction of perfluorinated surfactants from water

MN Appl. No. 305140

Matrix: water

Column: CHROMABOND® HR-XAW, 3 mL, 60 mg REF 730747

Conditioning: 2 mL MeOH + 5% ammonia, then 2 mL MeOH and at last 2 mL water. Do not let run the column dry.

Sample application: 500 mL water sample, spiked with 1 mL standard solution (concentration: 20 µg/L of each compound)

Washing: 2 mL water, then 2 mL acetone / acetonitrile / formic acid, (50:50:1; v/v/v) and at last 2 mL MeOH

Elution: 2 mL MeOH + 5 % ammonia

Evaporation: nitrogen stream with slight heating to dryness

Reconstitution: HPLC solvent

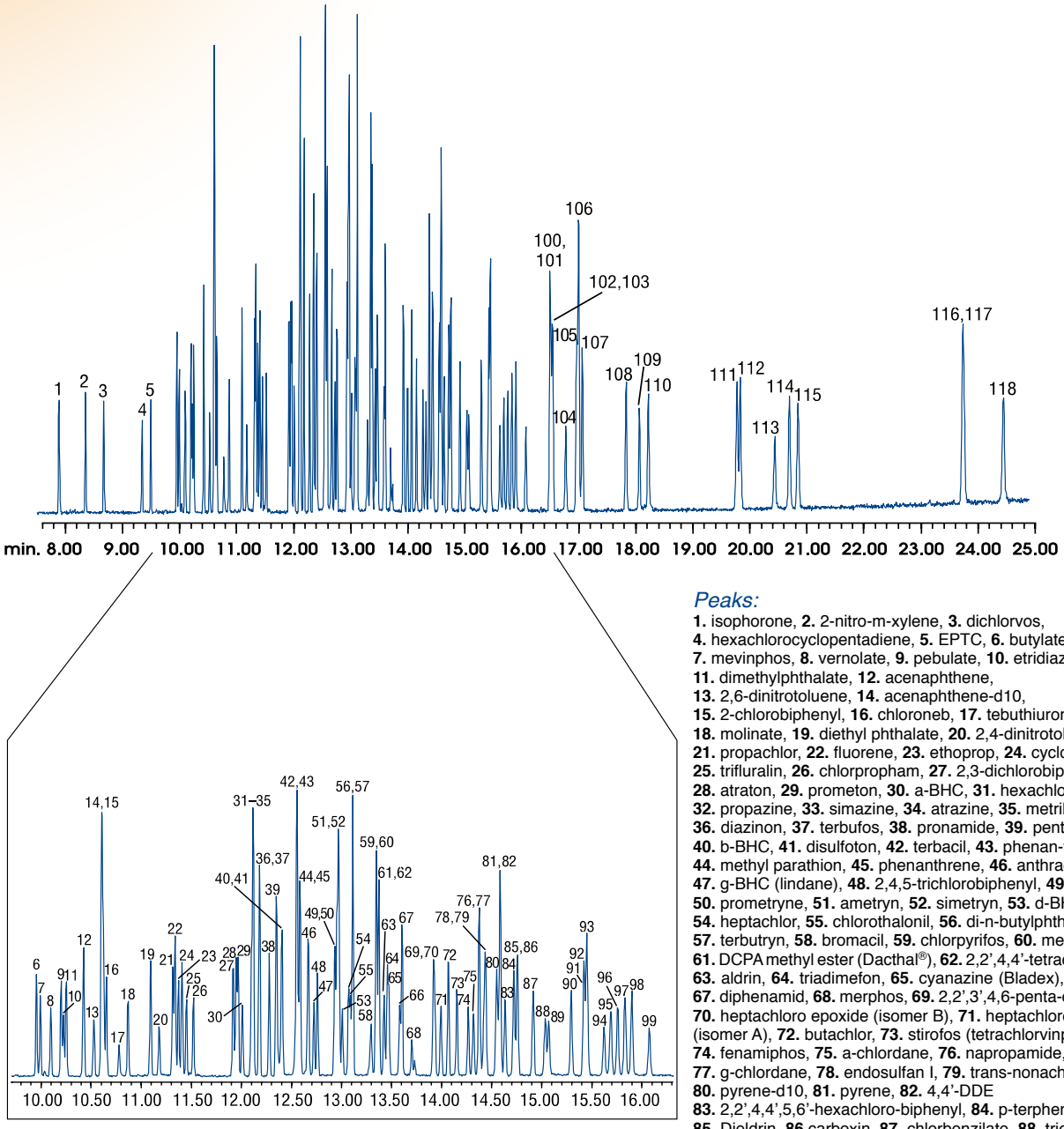
Subsequent analysis: LC-MS, e.g. NUCLEODUR® Sphinx RP (see page 18)

Recovery rates [%]:

compound	%
perfluoropropionic acid (PFPrA)	103
perfluoropentanoic acid (PFPeA)	94
perfluorohexanoic acid	94
perfluorooctanoic acid	95
perfluorooctane sulfonate potassium salt (PFOS)	81
perfluorododecanoic acid (PFDoDA)	82

Separation of PAHs, pesticides, phthalates (EPA 525)

MN Appl. No. 212810



OPTIMA® XLB, 30 m, 0.25mm ID, 0.25 µm

REF 725850.30

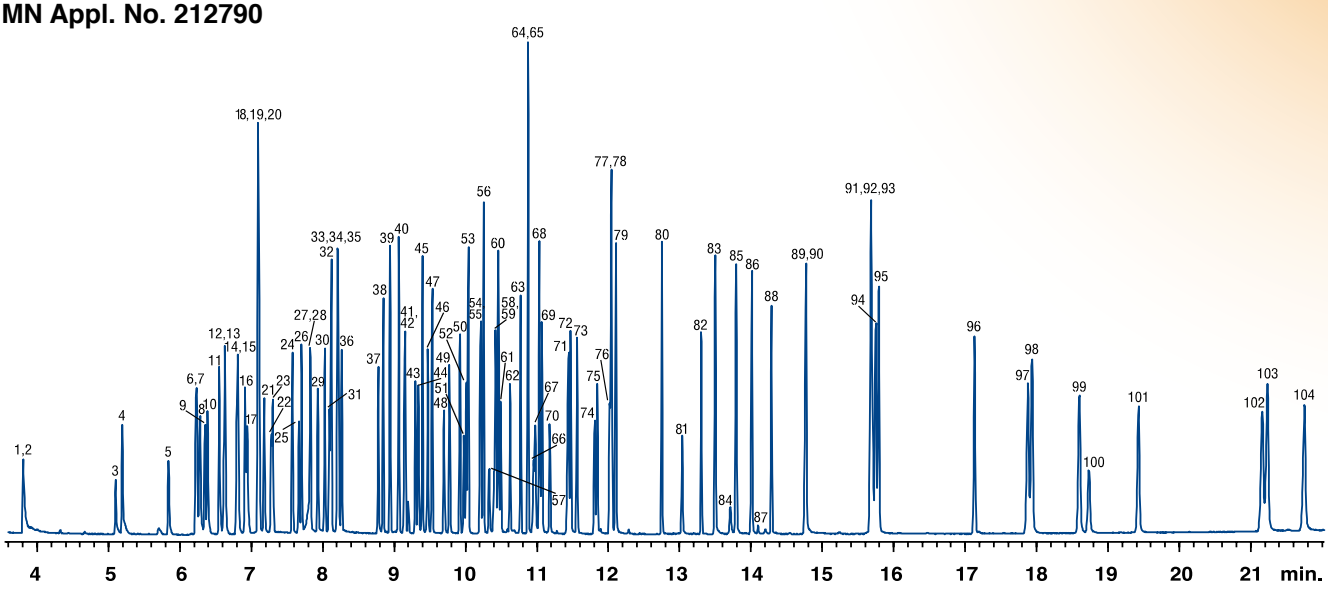
Sample:	US EPA method 525 standards, 1 µL, 5 ng / compound
Injection:	pressure pulsed (0.4 min 30 psi), splitless (for 0.4 min)
Inj. temperature:	300°C
Carrier gas:	helium, 1.0 mL/min
Temperature:	35 °C (for 2 min) → 260 °C at 20 °C/min 260 °C → 330 °C at 6 °C/min, 330 °C (for 5 min)
Detection:	GC / MS, 280 °C, scan range: 45 - 550 amu

Peaks:

1. isophorone, **2.** 2-nitro-m-xylene, **3.** dichlorvos, **4.** hexachlorocyclopentadiene, **5.** EPTC, **6.** butylate, **7.** mevinphos, **8.** vernolate, **9.** pebulate, **10.** etridiazole (terrazole), **11.** dimethylphthalate, **12.** acenaphthene, **13.** 2,6-dinitrotoluene, **14.** acenaphthene-d10, **15.** 2-chlorobiphenyl, **16.** chloroneb, **17.** tebuthiuron, **18.** molinate, **19.** diethyl phthalate, **20.** 2,4-dinitrotolu-ene, **21.** propachlor, **22.** fluorene, **23.** ethoprop, **24.** cycloate, **25.** trifluralin, **26.** chlorpropham, **27.** 2,3-dichlorobiphenyl, **28.** atraton, **29.** prometon, **30.** a-BHC, **31.** hexachlorobenzene, **32.** propazine, **33.** simazine, **34.** atrazine, **35.** metribuzin, **36.** diazinon, **37.** terbufos, **38.** pronamide, **39.** pentachlorophenol, **40.** b-BHC, **41.** disulfoton, **42.** terbacil, **43.** phenan-threne-d10, **44.** methyl parathion, **45.** phenanthrene, **46.** anthracene, **47.** g-BHC (lindane), **48.** 2,4,5-trichlorobiphenyl, **49.** alachlor, **50.** prometryne, **51.** ametryn, **52.** simetryn, **53.** d-BHC, **54.** heptachlor, **55.** chlorothalonil, **56.** di-n-butylphthalate, **57.** terbutryn, **58.** bromacil, **59.** chlorpyrifos, **60.** metolachlor, **61.** DCPA methyl ester (Dacthal®), **62.** 2,2',4,4'-tetrachlorobiphenyl, **63.** aldrin, **64.** triadimefon, **65.** cyanazine (Bladex), **66.** MGK-264, **67.** diphenamid, **68.** merphos, **69.** 2,2',3',4,6-penta-chlorobiphenyl, **70.** heptachloro epoxide (isomer B), **71.** heptachloro epoxide (isomer A), **72.** butachlor, **73.** stirofos (tetrachlorvinphos), **74.** fenamiphos, **75.** a-chlordane, **76.** napropamide, **77.** g-chlordane, **78.** endosulfan I, **79.** trans-nonachlor, **80.** pyrene-d10, **81.** pyrene, **82.** 4,4'-DDE **83.** 2,2',4,4',5,6'-hexachloro-biphenyl, **84.** p-terphenyl-d14, **85.** Dieldrin, **86.**carboxin, **87.** chlorbenzilate, **88.** tricyclazole, **89.** endrin, **90.** 4,4'-DDD, **91.** bis(2-ethylhexyl)adipate, **92.** butyl benzyl phthalate, **93.** endosulfan II, **94.** endrin aldehyde, **95.** norflurazon, **96.** 4,4'-DDT, **97.** triphenylphosphate, **98.** hexazinone, **99.** endosulfan sulfate, **100.** bis(2-ethylhexyl)phthalate, **101.** methoxychlor, **102.** 2,2',3,3',4,5',6,6'-octachloro-biphenyl, **103.** 2,2',3,3',4,4',6-heptachloro-biphenyl, **104.** endrin ketone, **105.** benzo(a)anthracene, **106.** chrysene-d12, **107.** chrysene, **108.** fenarimol, **109.** cis-permethrin, **110.** trans-permethrin, **111.** benzo(b)fluoranthene, **112.** benzo(k)fluoranthene, **113.** fluridone (Sonar®), **114.** benzo(a)pyrene, **115.** perylene-d12, **116.** dibenzo(a,h)anthracene, **117.** indeno(1,2,3-cd)pyrene, **118.** benzo(ghi)perylene

Separation of pesticides (EPA 8270)

MN Appl. No. 212790



OPTIMA® 5 MS Accent, 30 m, 0.25 mm ID, 0.25 µm

REF 725820.30

Sample: 16 µg/mL in methylene chloride

Injection: 1 µL splitless (for 0.4 min)

Inj. temperature: 300 °C

Carrier gas: helium, 1.0 mL/min

Temperature: 35 °C (for 2 min) → 260 °C at 20 °C/min → 330 °C at 6 °C/min (for 1 min)

Detection: GC/MS, 280 °C, scan range: 35-550 amu

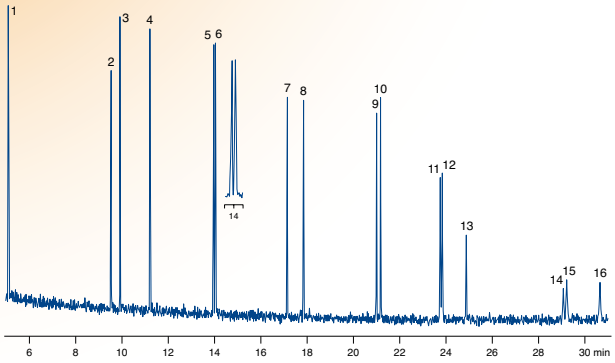
Peaks:

1. N-nitrosodimethylamine, **2.** pyridine, **3.** methyl methanesulfonate, **4.** 2-fluorophenol, **5.** ethyl methanesulfonate, **6.** phenol-d6, **7.** phenol, **8.** aniline, **9.** bis(2-chloroethyl)ether, **10.** 2-chlorophenol, **11.**1,3 dichlorobenzene, **12.** 1,4-dichlorobenzene-d4, **13.** 1,4-dichlorobenzene, **14.** 1,2-dichlorobenzene, **15.** benzyl alcohol, **16.** 2-methylphenol, **17.** bis(2-chloroisopropyl)ether, **18.** acetophenone, **19a.** 4-methylphenol, **19b.** 3-methylphenol, **20.** N-nitroso-di-n-propylamine, 21. hexachloroethane, **22.** nitrobenzene-d5, **23.**nitrobenzene, **24.** isophorone, **25.** 2-nitrophenol, **26.** 2,4-dimethylphenol, **27.** bis(2-chloro-ethoxy) methane, **28.** benzoic acid,**29.** 2,4-dichlorophenol, **30.** 1,2,4-trichlorobenzene, **31.** naphthalene-d8, **32.** naphthalene, **33.** 2,6-dichlorophenol, **34.** 4-chloroaniline, **35**. hexachloropropene, **36.** hexachlorobutadiene, **37.** 4-chloro-3-methylphenol, **38.** Isosafrole, **39.** 2-methyl-naphthalene, **40.** 1-methylnaphthalene, **41.** hexachlorocyclopentadiene, **42.** 1,2,4,5-tetrachlorobenzene, **43.** 2,4,6-trichlorophenol, **44.** 2,4,5-trichlorophenol, **45.** 2-fluorobiphenyl, **46.** safrole, **47.** 2-chlo-ronaphthalene, **48.** 2-nitroaniline, **49.** 1,4-naphthoquinone, **50.** dimethylphthalate, **51.** 1,3-dinitrobenzene, **52.** 2,6-dinitrotoluene, **53.** acenaphthylene, **54.** acenaphthene-d10, **55.** 3-nitroaniline, **56.** acenaphthene, **57.** 2,4-dinitrophenol, **58.** pentachlorobenzene, **59.** 4-nitrophenol, **60.** dibenzofurane, **61.** 2,4-dinitrotoluene, **62.** 2,3,4,6 tetrachlorophenol, **63.** diethyl phthalate, **64.** fluorene, **65.** 4-chlorophenyl phenyl ether, **66.** 4-nitro-aniline, **67.** 4,6-dinitro-2-methylphenol, **68.** di-phenylamine, **69.** azobenzene, **70.** 2,4,6-tribromophenol, **71.** phenacetin, **72.** 4-bromo-phenyl phenyl ether, **73.** hexachlorobenzene, **74.** pentachlorophenol, **75.** pentachloronitrobenzene, **76.** phenanthrene-d10, **77.** dinoseb, **78.** phenanthrene, **79.** anthracene, **80.** di-n-butylphthalate, **81.** 4-nitro-quinolin-1-oxide, **82.** isodrin, **83.** fluoranthene, **84.** benzidine, **85.** pyrene, **86.** p-terphenyl-d14, **87.** aramite, **88.** chlorbenzilate, **89.** kepone, **90.** butyl benzyl phthalate, **91.** benzo(a)anthracene, **92.** 3,3'-dichloro-benzidine, **93.** chrysene-d12, **94.** chrysene, **95.** bis(2-ethylhexyl)phthalate, **96.** di-n-octylphthalate, **97.** benzo(b)fluor-anthene, **98.** benzo(k) fluoranthene, **99.** benzo(a)pyrene, **100.** perylene-d12, **101.** 3-methylcholanthrene, **102.** indeno(1,2,3-cd)pyrene, **103.** dibenzo(a,h)anthracene, **104.** benzo(ghi)perylene

PAH and PCB analysis

PAHs acc. to EPA 610

MN Appl. No. 213190



OPTIMA® 35 MS, 30 m, 0.25mm ID, 0.25 µm

REF 726154.30

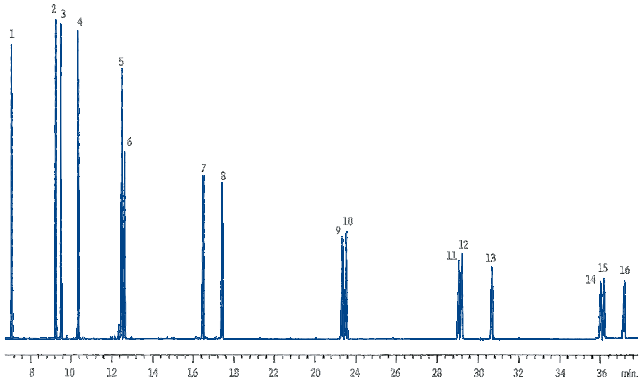
Injection:	1.0 µL H_2, split 1:10
Carrier gas:	helium, 0.6 bar
Temperature:	100 °C (for 3 min) → 300 °C at 6 °C/min, 300 °C (for 10 min)
Detector:	MSD

Peaks:

1. naphthalene, **2.** acenaphthylene, **3.** acenaphthene, **4.** fluorene, **5.** phenanthrene, **6.** anthracene, **7.** fluoranthene, **8.** pyrene, **9.** benz[a]anthracene,**10.** chrysene, **11.** benzo[b]fluoranthene, **12.** benzo[k]fluoranthene, **13.** benzo[a]pyrene, **14.** indeno[1,2,3-cd]pyrene, **15.** dibenz[ah]anthracene, **16.** benzo[ghi]perylene

Separation of PAHs

MN Appl. No. 212800



OPTIMA® 5 MS Accent, 30 m, 0.25 mm ID, 0.25 µm

REF 725820.30

Sample:	1 µL of 20 ng/µL, PAH Mix
Injection:	splitless (for 1 min)
Inj. temperature:	300 °C
Carrier gas:	hydrogen, 40 cm/sec.
Temperature:	40 °C (for 1 min) → 200 °C at 20 °C/min, 200 °C → 310 °C at 4 °C/min, 310 °C (for 5 min)
Detection:	FID, 310 °C

Peaks:

1. naphthalene, **2.** acenaphthylene, **3.** acenapthene, **4.** fluorene, **5.** phenanthrene, **6.** anthracene, **7.** fluoranthene, **8.** pyrene, **9.** benzo(a)anthracene, **10.** chrysene, **11.** benzo(b)fluoranthene, **12.** benzo(k)fluoranthene, **13.** benzo(a)pyrene, **14.** indeno(1,2,3-cd)pyrene, **15.** dibenzo(a,h)anthracene, **16.** benzo(ghi)perylene

Determination of PCBs and PAHs with PCB 28 / PCB 31 separation in less than 10 min

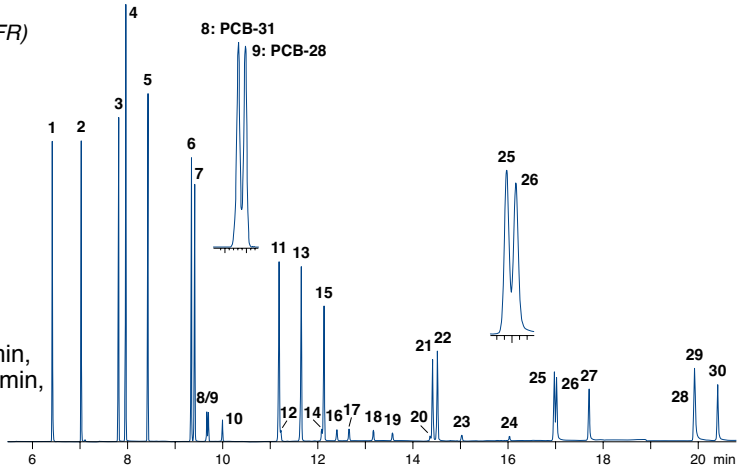
MN Appl. No. 212920

Centre d'Analyses de Recherche, Lab. D'Hydrologie, Illkirch (FR)

OPTIMA® XLB, 30 m, 0.25mm ID, 0.25 µm

REF 725850.30

Inj. volume:	1µL, standard 0.005 ng/µL
Inj. temperature:	250 °C
Injection:	pulsed, splitless
Inj. pulse:	1.38 bar in 1 min
Purge flow:	60 mL/min
Carrier gas:	helium
Temperature:	40 °C (for 2 min) → 240 °C at 30 °C/min, 240 °C (for 2 min) → 340 °C at 10 °C/min, 340 °C (for 5 min)
Detection:	MS source: 230 °C Interface: 280 °C Quadrupol: 150 °C



Peaks:

1. naphthalene, **2.** 2-methylnaphthalene, **3.** acenaphthylene, **4.** acenaphthene, **5.** fluorene, **6.** phenanthrene, **7.** anthracene, **8.** PCB 31, **9.** PCB 28, **10.** PCB 52, **11.** Fluoranthene, **12.** PCB 101, **13.** Pyrene, **14.** PCB 77, **15.** 2-methylfluoranthene, **16.** PCB 118, **17.** PCB 153, **18.** PCB 138, **19.** PCB 126, **20.** PCB 180, **21.** Benzo(a)anthracene, **22.** Chrysene, **23.** PCB 169, **24.** PCB 194, **25.** Benzo(b)fluoranthene, **26.** Benzo(k)fluoranthene, **27.** Benzo(a)pyrene, **28.** Dibenzo(ah)anthracene, **29.** Indeno(123cd)pyrene, **30.** Benzo(ghi)perylene

Efficient sample preparation (SPE) and superior GC analysis · Expertise from one source

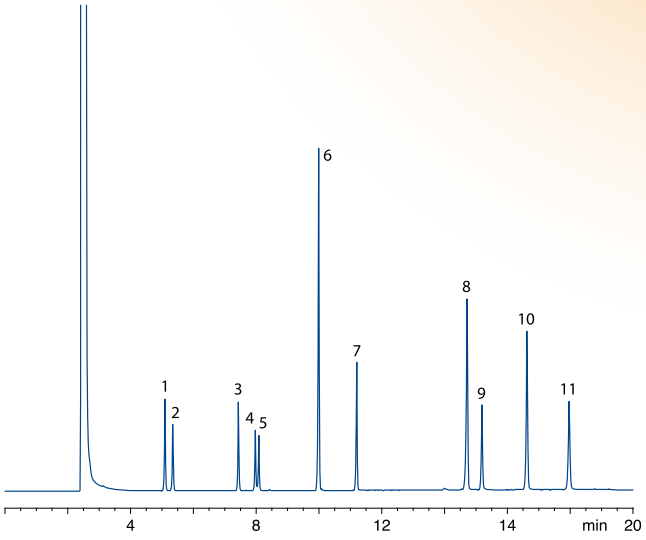
Analysis of phenols in accordance with EPA 604 on medium-polar ultra low bleed column

MN Appl. No. 213600

OPTIMA® 17 MS, 30 m, 0.25mm ID, 0.25 µm

REF 726162.30

Sample: phenol-mix 604
Inj. volume: 1 µL
Inj. temperature: 230 °C
Carrier gas: helium, 0.8 bar, split 1:30
Temperature: 100 °C → 250 °C at 10 °C/min
Detection: FID, 280 °C



Peaks:
1. phenol, **2.** 2-chlorophenol, **3.** 2,4-dimethylphenol,
4. 2-nitrophenol, **5.** 2,4-dichlorophenol, **6.** 4-chloro-3-methylphenol,
7. 2,4,6-trichlorophenol, **8.** 4-nitrophenol, **9.** 2,4-dinitrophenol,
10. 2-methyl-4,6-dinitrophenol, **11.** pentachlorophenol

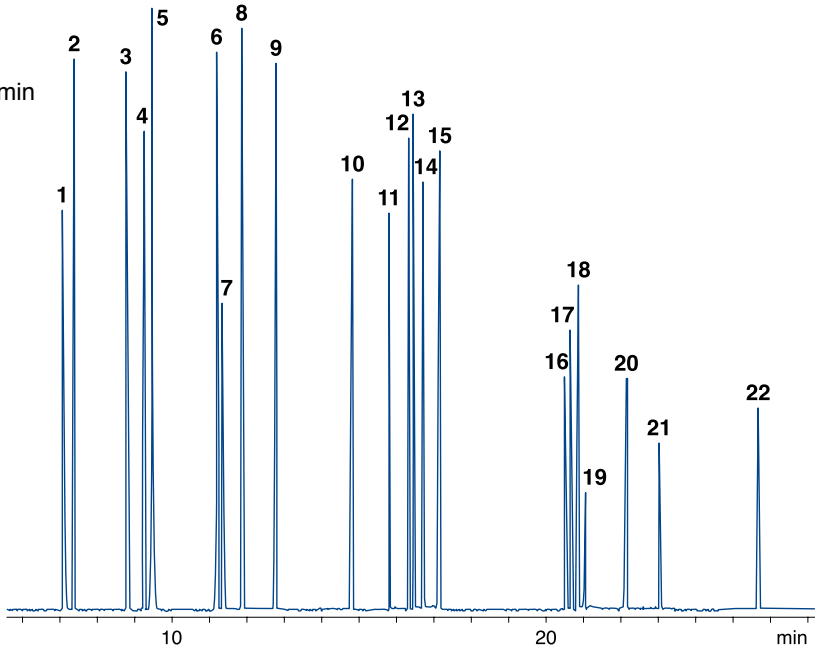
Analysis of isomeric phenols

MN Appl. No. 250060

OPTIMA® δ-3, 60 m, 0.25 mm ID, 0.25 µm

REF 726420.60

Injection: 1.0 µL, split 1:80
Carrier gas: helium, 1.3 bar
Temperature: 60 °C (3 min) → 320 °C, 6 °C/min
Detector: MSD HP 5971



Peaks:
1. phenol, **2.** 2-chlorophenol, **3**. 2-methylphenol,
4. 4-methylphenol, **5.** 3-methylphenol,
6. 2,4-dimethylphenol, **7.** 2-nitrophenol,
8. 2,4-dichlorophenol, **9.** 2,6-dichlorophenol,
10. 4-chloro-3-methylphenol, **11.** 2,3,5-trichlorophenol,
12. 2,4,6-trichlorophenol, **13.** 2,4,5-trichlorophenol,
14. 2,3,4-trichlorophenol, **15.** 2,3,6-trichlorophenol,
16. 2,3,5,6-tetrachlorophenol,
17. 2,3,4,5-tetrachlorophenol,
18. 2,3,4,6-tetrachlorophenol,
19. 2,4-dinitrophenol, **20.** 3,4,5-trichlorophenol,
21. 2-methyl-4,6-dinitrophenol,
22. 2-isopropyl-4,6-dinitrophenol

EPA 502 / EPA 524 volatile organics calibration mix (VOCs)

MN Appl. No. 211280

OPTIMA® 624, 50 m, 0.25 mm, 1.40 µm

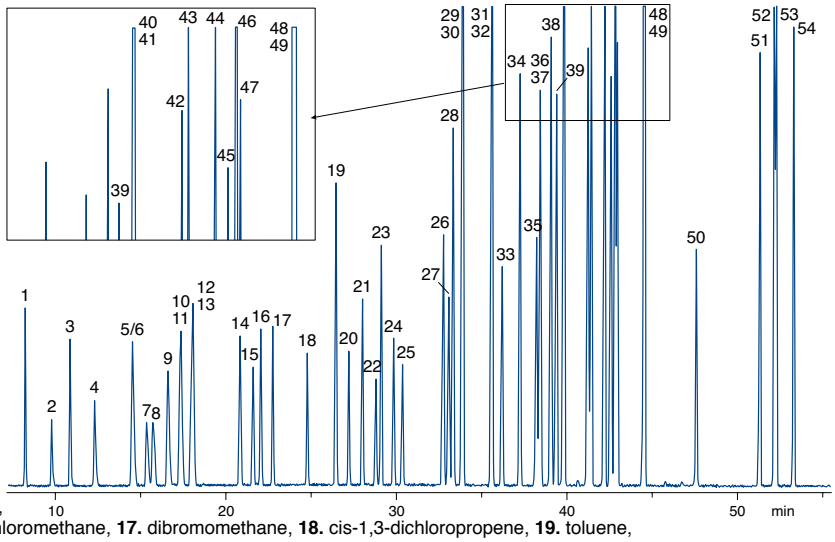
REF 726785.50

Injection: 1 µL, 280 °C, split 1: 50

Carrier gas: helium, 1.5 bar

Temperature: 40 °C (for 5 min) → 70 °C at 2.5 °C/min,
70 °C → 100 °C at 3.0 °C/min,
100 °C → 220 °C at 4.0 °C/min,
220 °C (for 5 min)

Detector: MSD 5971 [HP]
Scanmode, thres: 300,
EMV: 2400



Peaks:

1. 1,1-dichloroethene, **2.** dichloromethane (methylene chloride), **3.** trans-1,2-dichloroethene, **4.** 1,1-dichloroethane, **5.** 2,2-dichloropropane, **6.** is-1,2-dichloroethene, **7.** bromochloromethane, **8.** trichloromethane (chloroform), **9.** 1,1,1-trichloroethane, **10.** 1,1-dichloropropene, **11.** tetrachloromethane (carbon tetrachloride), **12.** 1,2-dichloroethane, **13.** benzene, **14.** trichloroethene, **15.** 1,2-dichloropropane, **16.** bromodichloromethane, **17.** dibromomethane, **18.** cis-1,3-dichloropropene, **19.** toluene, **20.** trans-1,3-dichloropropene, **21.** 1,1,2-trichloroethane, **22.** tetrachlorethene, **23.** 1,3-dichloropropane, **24.** dibromochloromethane, **25.** 1,2-dibromoethane, **26.** chlorobenzene, **27.** ethylbenzene, **28.** 1,1,1,2-tetrachloroethane,**29.** m-xylene, **30.** p-xylene, **31.** o-xylene, **32.** styrene, **33.** tribromomethane (bromoform), **34.** isopropylbenzene, **35.** 1,1,2,2-tetrachloroethane, **36.** 1,2,3-trichloropropane, **37.** bromobenzene, **38.** n-propylbenzene, **39.** 2-chlorotoluene, **40.** 1,3,5-trimethylbenzene, **41.** 4-chlorotoluene, **42.** tert-butylbenzene, **43.** 1,2,4-trimethylbenzene, **44.** sec-butylbenzene, **45.** p-isopropyltoluene, **46.** 1,3-dichlorobenzene, **47.** 1,4-dichlorobenzene, **48.** n-butylbenzene, **49.** 1,2-dichlorobenzene **50.** 1,2-dibromo-3-chloropropane, **51.** 1,2,4-trichlorobenzene, **52.** hexachlorobutadiene, **53.** naphthalene, **54.** 1,2,3-trichlorobenzene

EPA 502 / EPA 524 volatile organics calibration mix (VOCs)

MN Appl. No. 211300

OPTIMA® δ-3, 50 m, 0.20 mm, 0.20 µm

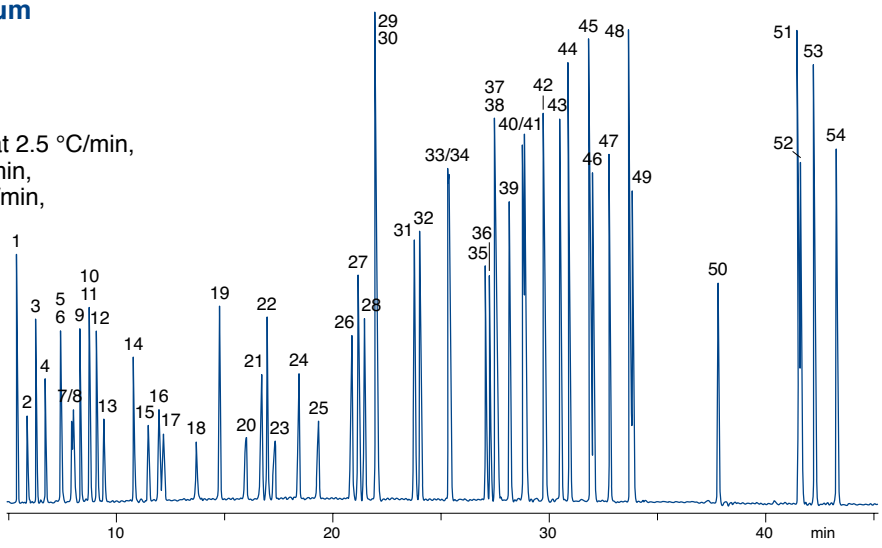
REF 726400.50

Injection: 1 µL, 280 °C, split 1: 40

Carrier gas: helium, 1.8 bar

Temperature: 40 °C (for 5 min) → 70 °C at 2.5 °C/min,
70 °C → 100 °C at 3.0 °C/min,
100 °C → 160 °C at 4.0 °C/min,
160 °C (for 5 min)

Detector: MSD 5971 [HP]
Scanmode, thres: 400,
EMV: 1976



Peaks:

1. 1,1-dichloroethene, **2.** dichloromethane (methylene chloride), **3.** trans-1,2-dichloroethene, **4.** 1,1-dichloroethane, **5.** 2,2-dichloropropane, **6.** is-1,2-dichloroethene, **7.** bromochloromethane, **8.** trichloromethane (chloroform), **9.** 1,1,1-trichloroethane, **10.** 1,1-dichloropropene, **11.** tetrachloromethane (carbon tetrachloride), **12.** 1,2-dichloroethane, **13.** benzene, **14.** trichloroethene, **15.** 1,2-dichloropropane, **16.** bromodichloromethane, **17.** dibromomethane, **18.** cis-1,3-dichloropropene, **19.** toluene, **20.** trans-1,3-dichloropropene, **21.** 1,1,2-trichloroethane, **22.** tetrachlorethene, **23.** 1,3-dichloropropane, **24.** dibromochloromethane, **25.** 1,2-dibromoethane, **26.** chlorobenzene, **27.** ethylbenzene, **28.** 1,1,1,2-tetrachloroethane, **29.** m-xylene, **30.** p-xylene, **31.** o-xylene, **32.** styrene, **33.** tribromomethane (bromoform), **34.** isopropylbenzene, **35.** 1,1,2,2-tetrachloroethane, **36.** 1,2,3-trichloropropane, **37.** bromobenzene, **38.** n-propylbenzene, **39.** 2-chlorotoluene, **40.** 1,3,5-trimethylbenzene **41.** 4-chlorotoluene, **42.** tert-butylbenzene, **43.** 1,2,4-trimethylbenzene, **44.** sec-butylbenzene, **45.** p-isopropyltoluene, **46.** 1,3-dichlorobenzene, **47.** 1,4-dichlorobenzene, **48.** n-butylbenzene, **49.** 1,2-dichlorobenzene **50.** 1,2-dibromo-3-chloropropane, **51.** 1,2,4-trichlorobenzene, **52.** hexachlorobutadiene, **53.** naphthalene, **54.** 1,2,3-trichlorobenzene

Analysis of hydrocarbons

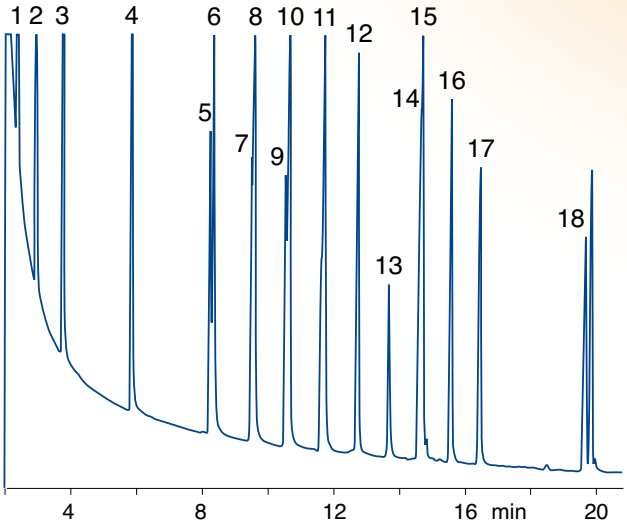
MN Appl. No. 210780

Inst. für Meereskunde, Kiel

OPTIMA® δ-6, 30 m, 0.25 mm ID, 0.25 µm

REF 726470.30

Sample: 10 ng/µL
Flow: 36 cm/sec
Carrier gas: hydrogen
Temperature: 80 °C (for 1 min) → 320 °C at 6 °C/min, 320 °C (for 10 min)



Peaks:
1. C-10, **2.** C-11, **3.** C-12, **4.** C-14, **5.** C-16:1, **6.** C-16, **7.** C-17:1, **8.** C-17, **9.** C-18:1, **10.** C-18, **11.** C-19, **12.** C-20, **13.** C-21, **14.** C-22:1, **15.** C-22, **16.** C-23, **17.** C-24, **18.** C-28

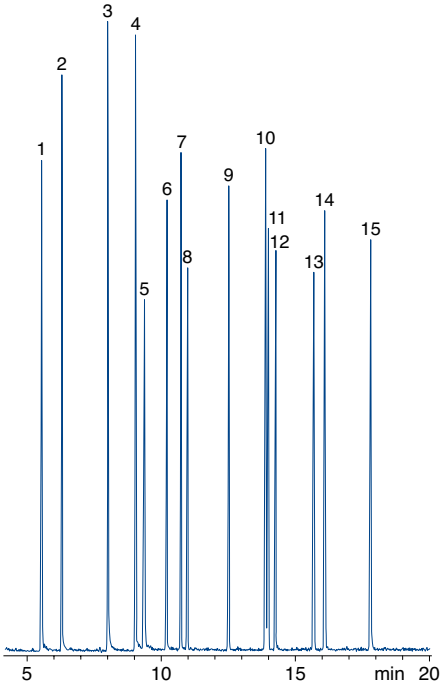
Analysis of phthalates in accordance with EPA 8060 on medium-polar ultra low bleed column

MN Appl. No. 213610

OPTIMA® 17 MS, 30 m, 0.25 mm ID, 0.25 µm

REF 726162.30

Injection: 1.0 mL, 280 °C, 0.5 min splitless, 25 mL/min
Carrier gas: helium, 0.6 bar
Temperature: 120 °C → 220 °C at 25 °C/min, 220 °C → 330 °C at 8 °C/min, 330 °C (for 10 min)
Detector: MSD



Peaks:
1. Dimethyl phthalate, **2.** Diethyl phthalate,
3. Di-isobutyl phthalate, **4.** Di-n-butyl phthalate,
5. Bis (4-methyl-2-pentyl) phthalate, **6.** Bis (2-methoxyethyl) phthalate
7. Di-n-pentyl phthalate, **8.** Bis (2-ethoxyethyl) phthalate, **9.** Di-n-hexyl phthalate,
10. Bis (2-ethylhexyl) phthalate, **11.** Benzyl-butyl phthalate,
12. Bis-(2-butoxyethyl) phthalate, **13.** Di-cyclohexyl phthalate,
14. Di-n-octyl phthalate, **15.** Di-n-nonyl phthalate

Phthalates analysis

Separation of phthalates (EPA 606)

MN Appl. No. 213160

OPTIMA® δ-3, 30 m, 0.25 mm ID, 0.25 µm

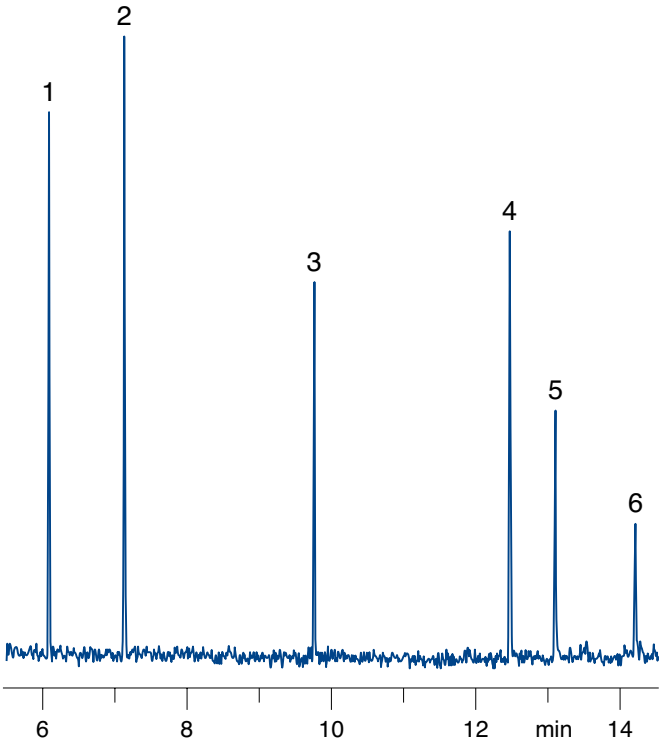
REF 726420.30

Inj. volume: 1 µL, split 1:10

Carrier gas: hydrogen, 1.4 mL/min

Temperature: 100 °C → 320 °C at 15 °C/min

Detection: MSD



Peaks:

1. dimethyl phthalate, **2.** diethyl phthalate, **3.** dibutyl phthalate, **4.** benzyl butyl phthalate, **5.** bis(2-ethylhexyl) phthalate, **6.** di-n-octyl phthalate

Pesticides

MN Appl. No. 124480

Column: EC 250/3 NUCLEODUR® PolarTec, 3 µm
REF 760479.30

Conditions

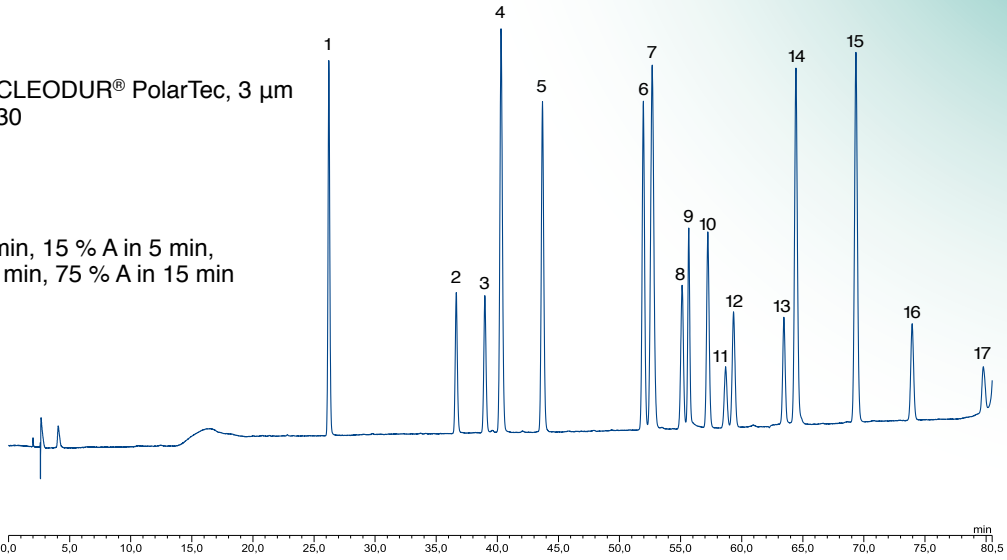
Eluent: A) MeOH
B) water

Gradient: 2 % A for 10 min, 15 % A in 5 min,
43 % A for 60 min, 75 % A in 15 min

Flow rate: 0.56 mL/min

Temperature: 35 °C

Detection: 230 nm



Peaks:
1. desethylatrazine, **2.** metoxuran, **3.** hexazinone, **4.** simazine, **5.** cyanazine, **6.** methabenzthiazuron, **7.** atrazine, **8.** chlorotoluron, **9.** monolinuron, **10.** isoproturon, **11.** metazachlor, **12.** diuron, **13.** metobromuron, **14.** sebuthylazine, **15.** terbuthylazine, **16.** linuron, **17.** metolachlor

Separation of paraquat and diquat on NUCLEODUR® HILIC with LC-MS detection

MN Appl. No. 123060

Column: EC 125/2 NUCLEODUR® HILIC, 3 µm
REF 760531.20

Substances: paraquat; diquat

Concentration: 500 µg/mL

Conditions

Eluent: acetonitrile / 50 mM ammonium formate,
pH 3.2 (80:20; v/v)

Flow rate: 0.3 mL/min

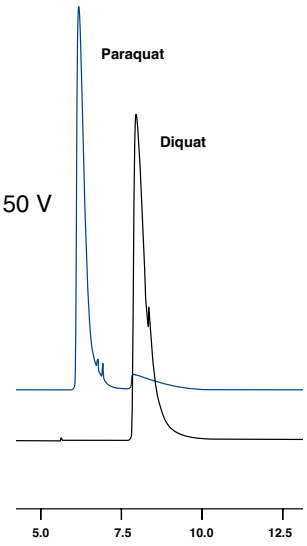
Inj. volume: 1.0 µL

Detection: LC-MS

Mode: ESI+

Sample temp.: 450 °C

Needle: 3.0 kV
Cone voltage: 50 V



A separation with UV detection is shown by Appl. No.: 123050 (*www.mn-net.com/apps*)

Separation of carbamate pesticides (EPA 531.1)

MN Appl. No. 124220

Column: EC 150/4.6 NUCLEODUR® C_{18} HTec, 3 µm
REF 760325.46

Conditions

Eluent: A) water
B) acetonitrile

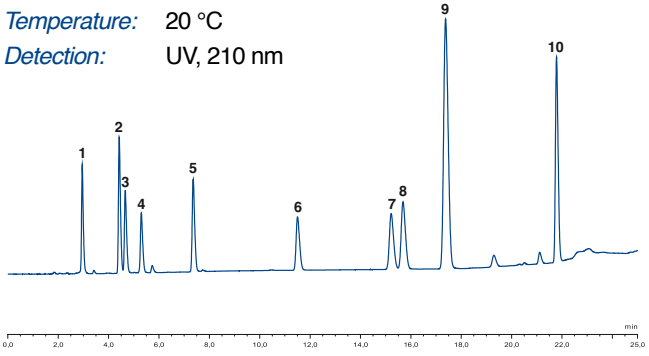
Gradient: 17.5 - 32.5 % B in 6 min, 32.5 - 45.0 % B
in 10 min, 45.0 - 90.0 % B in 9 min

Flow rate: 0.8 mL/min

Inj. volume: 2.5 µL

Temperature: 20 °C

Detection: UV, 210 nm



Peaks:
1. aldicarb sulfoxide, **2.** aldicarb sulfone, **3.** oxamyl, **4.** methomyl, **5.** 3-hydroxycarbofuran, **6.** aldicarb, **7.** propoxur, **8.** carbofuran, **9.** carbaryl, **10.** methiocarb

Fast separation of 16 EPA PAHs on NUCLEODUR® C_{18} PAH

MN Appl. No. 123820

Column: EC 100/4 NUCLEODUR® C_{18} PAH, 3 µm
REF 760783.40

Conditions

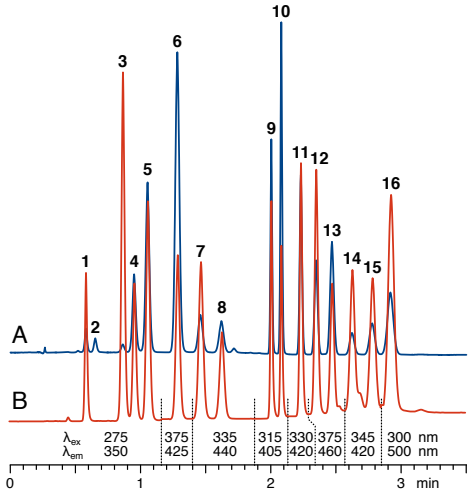
Eluent: A) MeOH/water (80:20; v/v)
B) acetonitrile

Gradient: 2 - 20 % B in 1.2 min, 20 - 100 % B in 0.5 min, 100 % B for 2.5 min, 100 - 2 % B in 0.4 min, 2 % B for 5 min (equilibration)

Flow rate: 2.5 mL/min

Temperature: 35 °C

Detection: A: UV, 254 nm
B: Fluorescence, see chromatogram



Peaks:
see below

Separation of 16 EPA PAHs with MeOH/water gradient on NUCLEODUR® C_{18} PAH

MN Appl. No. 123830

Column: EC 125/4 NUCLEODUR® C_{18} PAH, 3 µm
REF 760784.40

Conditions

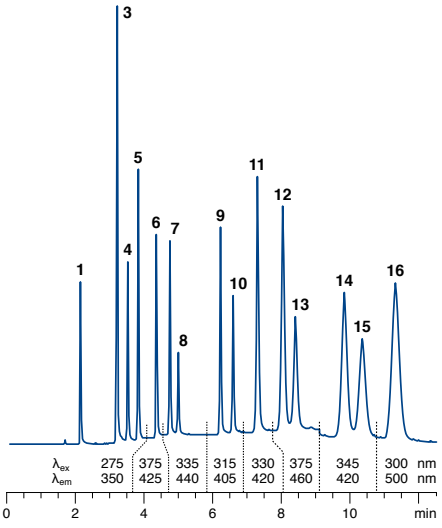
Eluent: A) water
B) MeOH

Gradient: 65 - 97 % B in 6 min, 97 % B for 5 min, 97 - 65 % B in 0.5 min

Flow rate: 2.0 mL/min

Temperature: 35 °C

Detection: Fluorescence



Peaks:
see below

Separation of 18 PAHs on NUCLEODUR® C_{18} PAH

MN Appl. No. 123840

Column: EC 125/4 NUCLEODUR® C_{18} PAH, 3 µm
REF 760784.40

Conditions

Eluent: A) MeOH/water (70:30; v/v)
B) acetonitrile

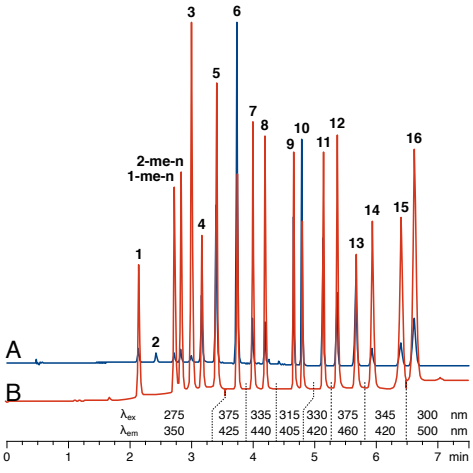
Gradient: 0 - 20 % B in 1.5 min, 20 - 50 % B in 1.5 min, 50 - 100 % B in 1.0 min, 100 % B for 3.0 min, 100 - 0 % B in 0.5 min

Flow rate: 1.5 mL/min

Temperature: 35 °C

Inj. volumes: UV, 1 µL (10 ng per compound)
Fluorescence, 0.5 µL (5 ng per compound)

Detection: A: UV, 254 nm,
B: Fluorescence, see chromatogram



Peaks:

1. naphthalene, **2.** acenaphthylene (not detectable with fluorescence), **3.** acenaphthene, **4.** fluorene, **5.** phenanthrene, **6.** anthracene, **7.** fluoranthene, **8.** pyrene, **9.** benz[a]anthracene, **10.** chrysene, **11.** benzo[b]fluoranthene, **12.** benzo[k]fluoranthene, **13.** benzo[a]pyrene, **14.** dibenz[ah]anthracene, **15.** benzo[ghi]perylene, **16.** indeno[1,2,3-cd]pyrene, **1-me-n**: 1-methylnaphthalene, **2-me-n**: 2-methylnaphthalene

Separation of nitroaromatics (EPA 8330 Mix A/B)

MN Appl. No. 124490 and 124500

Column: EC 150/3 NUCLEODUR® PolarTec, 5 µm
REF 760488.30

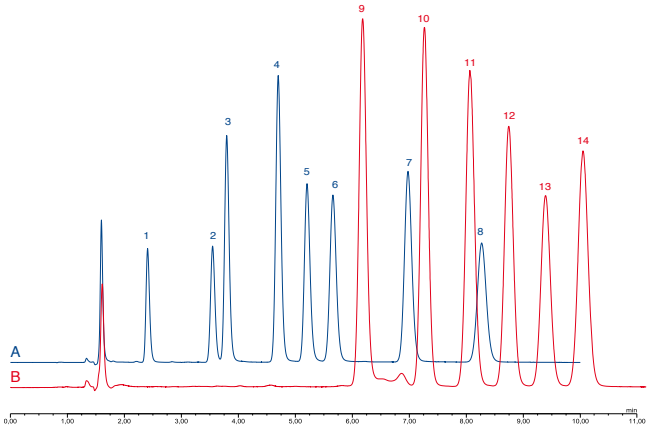
Conditions

Eluent: Mix A: MeOH/water (50:50; v/v)
Mix B: water + 0.1 % CHOOH/ MeOH (55:45; v/v)

Flow rate: 0.46 mL/min

Inj. temperature: Mix A: 50 °C; Mix B: 60 °C

Note:
Please also view application number 124510 showing Mix A and Mix B in a single run (*www.mn-net.com/apps*)



Peaks:

Mix A: **1.** octogen (HMX), **2.** hexogen (RDX), **3.** 1,3,5-trinitrobenzene, **4.** 1,3-dinitrobenzene, **5.** nitrobenzene, **6.** 2,4,6-trinitrotoluene, **7.** 2-amino-4,6-dinitrotoluene, **8.** 2,4-dinitrotoluene,

Mix B: **9.** n-methyl-n-2,4,6,-tetranitroaniline (tetryl), **10.** 4-amino-2,6-dinitrotoluene, **11.** 2,6-dinitrotoluene **12.** 2-nitrotoluene, **13.** 4-nitrotoluene, **14.** 3-nitrotoluene

Separation of carbonyl DNPH compounds (EPA TO-11 A, EPA 8315)

MN Appl. No. 123620

Column: EC 250/4 NUCLEODUR® C_{18} HTec, 5 µm
REF 760316.40

Sample: commercial standard test mixture

Conditions

Eluent: A) acetonitrile
B) water

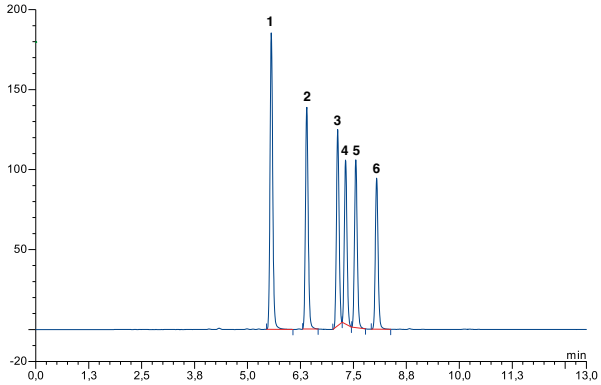
Gradient: 44 - 12 % B in 7.5 min,
12 % B for 7.5 min,
12 - 44 % B in 5 min

Flow rate: 0.65 mL/min

Temperature: 60 °C

Inj. volume: 5 µL

Detection: UV, 360 nm



Peaks:

1. formaldehyde-2,4-DNPH, **2.** acetaldehyde-2,4-DNPH, **3.** acrolein-2,4-DNPH, **4.** acetone-2,4-DNPH, **5.** propionaldehyde-2,4-DNPH, **6.** crotonaldehyde-2,4-DNPH

Determination of perfluorinated surfactants by LC-MS

MN Appl. No. 123340

Matrix: water

Column: EC 125/2 NUCLEODUR® Sphinx RP, 3 µm
REF 760807.20

Conditions

Eluent: A) 10 mM amonium acetate in water/MeOH (75:25; v:v)
B) 10 mM amonium acetate in acetonitrile/MeOH (75:25; v:v)

Gradient: 10 % - 30 % B in 3 min, 30 % - 55 % B in 8 min, 55 % - 10 % B in 4 min

Flow rate: 0.30 mL/min

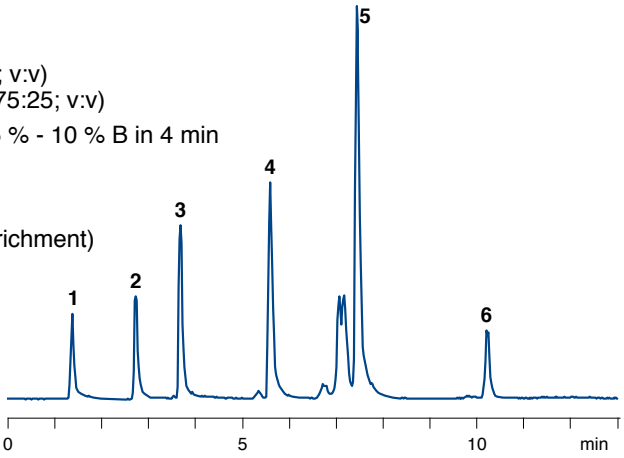
Temperature: 50 °C

Inj.volume: 2.5 µL (each concentration = 5 mg/L, after SPE enrichment)

Detection: MS, ESI negative

Needle voltage: -3.00 kV

Sample temperature: 450 °C



Peaks:

1. perfluoropropionic acid (PFPrA, pentafluoropropionic acid), **2.** perfluoropentanoic acid (PFPeA), **3.** perfluorohexanoic acid (PFHxA, undecafluorohexanoic acid), **4.** perfluorooctanoic acid (PFOA), **5.** perfluorooctane sulfonate potassium salts (PFOS, heptadecafluorooctanesulfonic acid), **6.** perfluorododecanoic acid (PFDoDA)

Separation of Phthalates on NUCLEODUR® C_{18} HTec, 3 µm

MN Appl. No. 124300

Column: EC 125/2 NUCLEODUR® C_{18} HTec, 3 µm
REF 760324.20

Sample concentration: 0.5 mg/mL of each compound

Conditions

Eluent: A) acetonitrile
B) water

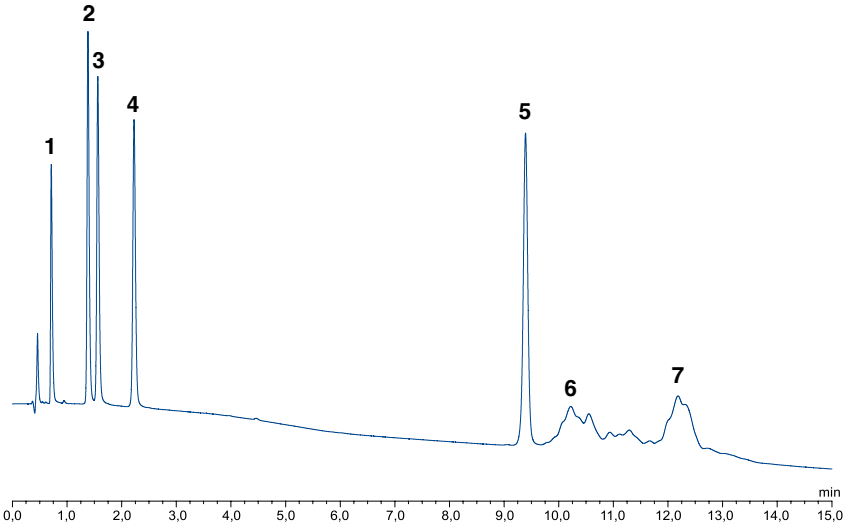
Gradient: 27.5 - 22.5 % B in 2.5 min,
22.5 - 15 % B in 2.0 min,
15 - 0 % B in 10.5 min

Flow rate: 0.5 mL/min

Inj. volume: 1 µL

Temperature: 45 °C

Detection: UV, 225 nm



Peaks:

1. dimethyl phthalate, **2.** dipropyl phthalate,
3. diphenyl phthalate, **4.** dibutyl phthalate,
5. diisooctyl phthalate, **6.** diisononyl phthalate,
7. diisodecyl phthalate

CHROMABOND® HR-X*pert*…

the innovative concept of five polymer-based RP- and mixed-mode ion exchange phases for SPE:

- ⇨ **CHROMABOND® HR-X** hydrophobic PS / DVB copolymer
- ⇨ **CHROMABOND® HR-XC** strong mixed-mode cation exchanger
- ⇨ **CHROMABOND® HR-XA** strong mixed-mode anion exchanger
- ⇨ **CHROMABOND® HR-XCW** weak mixed-mode cation exchanger
- ⇨ **CHROMABOND® HR-XAW** weak mixed-mode anion exchanger

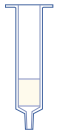
All **CHROMABOND® HR-X*pert*** phases are based on pure and spherical polymeric resin and provide:

- ⇨ Excellent recovery rates and highest reproducibility
- ⇨ Reliable and cost-efficient analyses
- ⇨ Robust retention mechanism even for aggressive washing procedures
- ⇨ Low limits of detection also for critical matrices

HR-X — spherical, hydrophobic polystyrene-divinylbenzene adsorbent resin

- hydrophobic polystyrene-divinylbenzene copolymer
  pH stability 1 – 14
  high-purity material with highest reproducibility and lowest blank values due to a novel manufacturing process
  spherical particles, size 85 µm; pore size 55 – 60 Å
  very high surface 1000 m^2/g
  capacity 390 mg/g (caffeine in water)
  excellent recovery rates especially for the enrichment of pharmaceuticals / active ingredients due to the spherical structure of the particles, very homogeneous surface, and optimized pore structure

- recommended application:
  pharmaceuticals / active ingredients from tablets, creams and water / waste water
  drugs and pharmaceuticals from urine, blood, serum and plasma
  trace analysis of pesticides, herbicides, phenols, PAHs and PCBs from water



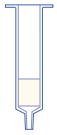
CHROMABOND® HR-X polypropylene columns

Volume	Adsorbent weight						Pack of
	30 mg	60 mg	100 mg	200 mg	500 mg	1 g	
1 mL	**730934**		**730935**				30
3 mL		**730936**		**730931**	**730937**		30
6 mL				**730938**	**730939**		30
15 mL					**730940**	**730941**	20

HR-XC — strong cation exchanger

- strong acidic benzenesulphonic acid cation exchanger
  exchange capacity 1.0 meq/g, pKa < 1
  base material PS/DVB copolymer (HR-X)
  pH stability 1 – 14
  high purity material, highest reproducibility and lowest blank values due to an optimized production process
  spherical particles, size 85 µm; pore size 65 – 75 Å
  very large specific surface 800 m^2/g; pore volume 1.4 cm^3/g
  RP capacity 300 mg/g (caffeine in water)
  outstanding recovery rates especially for the enrichment of basic analytes

- recommended application:
  basic active ingredients from heavily matrix-contaminated samples like e.g. urine, plasma, serum
  fungicides from food, melamine from milk
  basic analytes like e. g. amines
  bases with **pKa 2 – 10**



CHROMABOND® HR-XC polypropylene columns

Volume	Adsorbent weight						Pack of
	30 mg	60 mg	100 mg	150 mg	200 mg	500 mg	
1 mL	**730969**		**730049**				30
3 mL		**730956**			**730952**	**730953**	30
6 mL				**730957**		**730955**	30

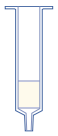
Glass columns, LV columns, CHROMAFIX® cartridges, MULTI 96 and adsorbent on request!

HR-XA

strong anion exchanger

- strong basic quaternary ammonium anion exchanger
  exchange capacity 0.25 meq/g, pKa ~ 18
  base material PS/DVB copolymer (HR-X)
  pH stability 1 – 14
  high purity material with highest reproducibility and
  lowest blank values due to an optimized production process
  spherical particles, size 85 µm; pore size 55 – 65 Å
  very large specific surface 850 m^2/g; pore volume 1.4 cm^3/g
  RP capacity 350 mg/g (caffeine in water)
  outstanding recovery rates especially for the enrichment of acidic analytes

- recommended application:
  acidic active ingredients from heavily matrix-contaminated samples like e. g. urine, plasma, serum
  phenolic acids
  acidic herbicides
  weak/medium-strength acids with **pKa 2 – 8**



CHROMABOND® HR-XA polypropylene columns

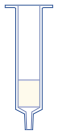
Volume	Adsorbent weight						Pack of
	30 mg	60 mg	100 mg	150 mg	200 mg	500 mg	
1 mL	**730968**		**730727**				30
3 mL		**730950**			**730951**	**730954**	30
6 mL				**730958**		**730966**	30

HR-XCW

weak cation exchanger

- weak acidic carboxylic acid cation exchanger
  exchange capacity > 0.7 meq/g, pKa ~ 5
  base material spherical PS/DVB copolymer (HR-X)
  pH stability 1 – 14
  high purity material, highest reproducibility and
  lowest blank values due to an optimized production process
  spherical particles, size 85 µm; pore size 50 – 60 Å
  very large specific surface 850 m^2/g; pore volume 1.2 – 1.4 cm^3/g
  RP capacity 350 mg/g (caffeine in water)
  outstanding recovery rates especially for enrichment of strongly basic analytes

- recommended application:
  basic compounds like quaternary amines
  active ingredients from heavily matrix-contaminated samples like e.g. urine, plasma, serum
  strong bases with **pKa > 10**



CHROMABOND® HR-XCW polypropylene columns

Volume	Adsorbent weight						Pack of
	30 mg	60 mg	100 mg	150 mg	200 mg	500 mg	
1 mL	**730731**		**730733**				30
3 mL		**730735**			**730739**	**730741**	30
6 mL				**730737**		**730743**	30

Glass columns, LV columns, CHROMAFIX® cartridges, MULTI 96 and adsorbent on request!

HR-XAW

weak anion exchanger

- weak basic secondary and tertiary ammonium anion exchanger, exchange capacity > 0.5 meq/g, pKa ~ 6

  base material spherical PS/DVB copolymer (HR-X)
  pH stability 1 – 14

  high purity material with highest reproducibility and lowest blank values due to an optimized production process

  spherical particles, size 85 µm; pore size 55 – 65 Å
  very large specific surface 850 m^2/g; pore volume 1.2 – 1.4 cm^3/g
  RP capacity 350 mg/g (caffeine in water)

  outstanding recovery rates especially for enrichment of acidic analytes

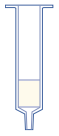
- recommended application:

  perfluorinated surfactants

  acidic compounds like sulfonates

  active ingredients from heavily matrix-contaminated samples like e.g. urine, plasma, serum

  strong acids with **pKa < 1**



CHROMABOND® HR-XAW polypropylene columns

Volume	30 mg	60 mg	100 mg	150 mg	200 mg	500 mg	Pack of
1 mL	**730728**		**730729**				30
3 mL		**730747**			**730748**	**730744**	30
6 mL				**730749**		**730745**	30

Easy

polar, bifunctionally modified polystyrene-divinylbenzene copolymer

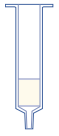
- polar modified polystyrene-divinylbenzene copolymer with a weak anion exchanger

  pH stability 1 – 14, particle size 80 µm, pore size 50 Å,
  specific surface 650 – 700 m^2/g,

  The Easy effect:
  - without preconditioning
  - due to bifunctional modification much more hydrophilic than conventional polystyrene-divinylbenzene polymers
  - easily wettable with water

- recommended application:

  polar herbicides / pesticides from water (acidic, neutral, basic)
  polar phenols from water
  polyaromatic compounds
  polychlorinated biphenyls
  drug analysis from urine, blood, serum, plasma,
  pharmaceuticals / active ingredients from tablets, creams



CHROMABOND® Easy polypropylene columns

Volume	30 mg	60 mg	100 mg	200 mg	500 mg	1 g	Pack of
1 mL	**730751**		**730752**				30
3 mL		**730753**		**730754**	**730759**		30
6 mL				**730755**	**730756**		30

HR-P

polystyrene-divinylbenzene adsorbent resin

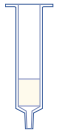
- highly porous polystyrene-divinylbenzene copolymer

  specific surface 1200 m^2/g
  particle size 50 – 100 µm

  very high binding capacity, up to 30 % of adsorbent weight
  (for comparison: silica adsorbents about 3 %)

- recommended application:

  aromatic compounds
  phenols from water
  nitroaromatics from water
  pesticides from water
  PAHs from oil



CHROMABOND® HR-P polypropylene columns

Volume	100 mg	200 mg	500 mg	1 g	Pack of
1 mL	**730280**				30
3 mL		**730108**	**730117**		30
6 mL		**730119**	**730111**	**730118**	30

Glass columns, LV columns, CHROMAFIX® cartridges, MULTI 96 and adsorbent on request!

HR-P-AOX

AOX from waters with high salt loads (DIN 38409 – H22)

- special PS/DVB phase
- recommended application:
  extraction of AOX (adsorbable organically bonded halogens) from waters containing high salt loads / organic pollutants in accordance with DIN 38409 – H22

Volume	Adsorbent weight		Pack of
CHROMABOND® HR-P-AOX polypropylene columns			
	200 mg	500 mg	
6 mL	**730119.AOX**	**730111.AOX**	30

C_{18} ec

octadecyl silica, endcapped

- base material silica, pore size 60 Å, particle size 45 µm, specific surface 500 m^2/g, pH stability 2 – 8
  octadecyl phases, endcapped, carbon content 14 %
  very nonpolar, hydrophobic interactions with a wide variety of organic compounds
  advantageous for clean-up of samples with large structural variations (polarity differences)
- recommended application:
  nonpolar compounds
  aflatoxins, amphetamines, antibiotics, antiepileptics, barbiturates, caffeine, drugs, preservatives, fatty acids, nicotine, PAHs, pesticides, PCBs, heavy metals, vitamins
  very well suited for desalting of samples

Volume	Adsorbent weight					Pack of
CHROMABOND® C_{18} ec polypropylene columns						
	100 mg	200 mg	500 mg	1 g	2 g	
1 mL	**730011**					100
3 mL		**730012**	**730013**			50
6 mL			**730014**	**730015**	**730141**	30
CHROMABOND® C_{18} ec glass column						
3 mL			**730013G**			50

C_{18} Hydra

octadecyl silica for polar analytes

- base material silica, pore size 60 Å, particle size 45 µm, specific surface 500 m^2/g, pH stability 2 – 8
  special octadecyl phase for polar analytes, not endcapped, carbon content 15 %
- recommended application:
  more polar compounds like pesticides and their polar degradation products,
  phenols, phenoxycarboxylic acids, nitroaromatics, pharmaceuticals

Volume	Adsorbent weight						Pack of
CHROMABOND® C_{18} Hydra polypropylene columns							
	50 mg	100 mg	200 mg	500 mg	1 g	2 g	
1 mL	**730294**	**730295**					100
3 mL			**730296**	**730297**	**730298**		50
6 mL				**730299**	**730300**	**730301**	30

Glass columns, LV columns, CHROMAFIX® cartridges, MULTI 96 and adsorbent on request!

C_{18} PAH

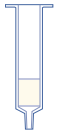
octadecyl silica for PAH analysis

- base material silica, pore size 60 Å, particle size 45 µm, specific surface 500 m^2/g, pH stability 2 – 8

  special octadecyl modification for enrichment of PAH, not endcapped, carbon content 14 %

- recommended application:

  PAHs from water



CHROMABOND® C_{18} PAH polypropylene columns

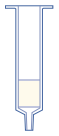
Volume	Adsorbent weight	Pack of
	2 g	
6 mL	**730166**	30

NH_2/C_{18}

combination phase for PAH analysis

- special combination phase:
  aminopropyl phase for removal of interfering humic acids
  octadecyl phase for enrichment of PAH

- recommended application:
  PAHs from water containing humic acids



CHROMABOND® NH_2/C_{18} polypropylene columns · glass column

Volume	Adsorbent weight		Pack of
	500/500 mg	500 mg/1 g	
6 mL PP	**730618**	**730620**	30
6 mL glass		**730620G**	30

NH_2

aminopropyl silica

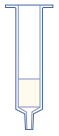
- base material silica, pore size 60 Å, particle size 45 µm, specific surface 500 m^2/g, pH stability 2 – 8

  aminopropyl phase, carbon content 3.5 %

  polar, weak anion exchanger

- recommended application:

  trace elements
  lipids



CHROMABOND® NH_2 polypropylene columns

Volume	Adsorbent weight				Pack of
	100 mg	200 mg	500 mg	1 g	
1 mL	**730031**				100
3 mL		**730413**	**730033**		50
6 mL			**730180**	**730626**	30

SiOH

unmodified silica

- unmodified, weakly acidic silica, pore size 60 Å, particle size 45 µm, specific surface 500 m^2/g, pH stability 2 – 8

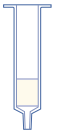
  very polar

  adsorbs humidity from air, for this reason it should be kept well closed and if necessary dried before use

  due to its high affinity for polar compounds it should not be conditioned with polar (e.g. MeOH) or water-containing solvents

- recommended application:

  aflatoxins
  chloramphenicol
  pesticides
  steroids
  vitamins



CHROMABOND® SiOH polypropylene columns

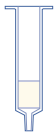
Volume	Adsorbent weight					Pack of
	100 mg	200 mg	500 mg	1 g	2 g	
1 mL	**730071**					100
3 mL		**730214**	**730073**			50
6 mL			**730070**	**730075**	**730107**	30
15 mL					**730217**	20

Glass columns, LV columns, CHROMAFIX® cartridges, MULTI 96 and adsorbent on request!

Florisil®

magnesium silicate

- matrix magnesium silicate (MgO - SiOH 15:85), high purity, particle size 150 – 250 µm
- recommended application:
  organic tin compounds, aliphatic carboxylic acids, PCBs, PAHs

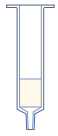


Volume	Adsorbent weight				Pack of
CHROMABOND® Florisil® polypropylene columns					
	200 mg	500 mg	1 g	2 g	
3 mL	**730457**	**730081**			50
6 mL		**730238**	**730082**	**730239**	30
CHROMABOND® Florisil® glass columns					
			1 g	2 g	
6 mL			**730082G**	**730239G**	30

Na_2SO_4/Florisil®

hydrocarbons from water acc. to DIN H-53/ISO DIS 9377-4

- special combination phase of sodium sulphate and Florisil®
- recommended application:
  hydrocarbons from drinking, surface and waste waters

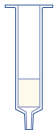


Volume	Adsorbent weight	Pack of
CHROMABOND® Na_2SO_4 / Florisil® glass columns		
	2 g/2 g	
6 mL	**730249G**	30

CN/SiOH

combination phase for PAH analysis

- special combination phase
  cyanopropyl phase for selective adsorption of polycyclic aromatics via π-π interactions
  unmodified silica phase for removal of polar compounds
- recommended application:
  extraction of the 16 PAHs according to EPA from soil samples

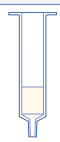


Volume	Adsorbent weight	Pack of
CHROMABOND® CN/SiOH polypropylene columns		
	500 mg/1 g	
3 mL	**730112**	50
6 mL	**730135**	30

NAN

special phase for PCB analysis

- special combination phase:
  N: sodium sulphate for removal of trace water;
  A: SiOH/$AgNO_3$ phase for removal of sulphur, sulphur-containing and polar compounds
- recommended application
  extraction of PCB from sludge



Volume	Adsorbent weight		Pack of
CHROMABOND® NAN polypropylene columns			
	400/1400/400 mg	700/2000/700 mg	
3 mL	**730109**		50
6 mL		**730149**	30

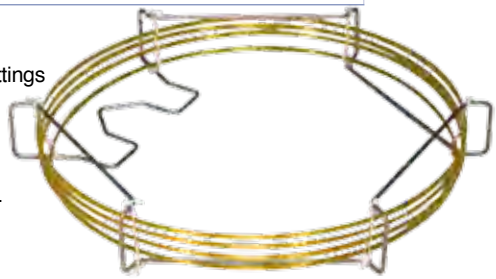
Glass columns, LV columns, CHROMAFIX® cartridges, MULTI 96 and adsorbent on request!

Summary of MN phases for GC

Phase	Composition	max. Temp. [1]	USP	Similar phases [2]
OPTIMA® 1	100 % dimethylpolysiloxane	340/360 °C	G1 G2 G38	PERMABOND® SE-30, OV-1, DB-1, SE-30, HP-1, SPB™-1, CP-Sil 5 CB, Rtx®-1, 007-1, BP1, MDN-1, AT™-1, ZB-1, OV-101
OPTIMA® 1 MS	100 % dimethylpolysiloxane	340/360 °C	G1 G2 G38	Ultra-1, DB-1MS, HP-1MS, Rxi®-1MS, Rtx®-1MS, Equity™-1, AT™-1MS, VF-1MS, CP-Sil 5 CB MS
OPTIMA® 1 MS Accent				
OPTIMA® 5	5 % phenyl – 95 % methylpolysiloxane	340/360 °C	G27 G36	PERMABOND® SE-52, SE-54, SE-52, HP-5, SPB™-5, CP-Sil 8, Rtx®-5, 007-5, BP5, MDN-5, AT™-5, ZB-5
OPTIMA® 5 MS	5 % diphenyl – 95 % dimethylpolysiloxane	340/360 °C	G27 G36	DB-5, DB-5MS, HP-5MS, Ultra-2, Equity™-5, CP-Sil 8CB low bleed/MS, Rxi®-5MS, Rtx®-5SIL-MS, Rtx®-5MS, 007-5MS, BPX™5, MDN-5S, AT™-5MS, VF-5MS
OPTIMA® 5 MS Accent	silarylene phase with selectivity similar to 5 % diphenyl – 95 % dimethylpolysiloxane	340/360 °C	G27 G36	
OPTIMA® XLB	silarylene phase as above, optimized silarylene content	340/360 °C	–	DB-XLB, Rxi®-XLB, Rtx®-XLB, MDN-12, VF-XMS
OPTIMA® δ-3	phase with autoselectivity	340/360 °C	G49	no similar phases
OPTIMA® δ-6	phase with autoselectivity	340/360 °C	–	no similar phases
OPTIMA® 1301	6 % cyanopropylphenyl – 94 % dimethylpolysiloxane	300/320 °C	G43	HP-1301, DB-1301, SPB™-1301, Rtx®-1301, CP-1301, 007-1301
OPTIMA® 624	6 % cyanopropylphenyl – 94 % dimethylpolysiloxane	280/300 °C	G43	HP-624, HP-VOC, DB-624, DB-VRX, SPB™-624, CP-624, Rtx®-624, Rtx®-Volatiles, 007-624, BP624, VOCOL
OPTIMA® 624 *LB*	as above, low bleed phase	280/300 °C	G43	
OPTIMA® 1701	14 % cyanopropylphenyl – 86 % dimethylpolysiloxane	300/320 °C	G46	OV-1701, DB-1701, CP-Sil 19 CB, HP-1701, Rtx®-1701, SPB™-1701, 007-1701, BP10, ZB-1701
OPTIMA® 35 MS	silarylene phase with selectivity similar to a 35 % diphenyl – 65 % dimethylpolysiloxane phase	360/370 °C	G42	DB-35 MS, HP-35, SPB™-35, Rxi®-35SIL MS, Rtx-35, 007-35, BPX™-35, MDN-35, AT™-35 MS, ZB-35, OV-11, VF-35 MS
OPTIMA® 17	phenylmethylpolysiloxane, 50 % phenyl	320/340 °C	G3	OV-17, DB-17, HP-50+, HP-17, SPB™-50, SP-2250, Rxi®-17, Rtx®-50, CP-Sil 24 CB, 007-17, ZB-50
OPTIMA® 17 MS	silarylene phase with selectivity simar to 50 % phenyl, 50 % methylpolysiloxane	340/360 °C	G3	OV-17, AT™-50, BPX™-50, DB-17, DB-18ms, HP-50+, HP-17, SPB™-50, SPB™-17, SP-2250, Rtx®-50, CP-Sil 24 CB, 007-17, VF-17ms, ZB-50
OPTIMA® 210	trifluoropropylmethylpolysiloxane (50 % trifluoropropyl)	260/280 °C	G6	OV-210, DB-210, Rtx®-200, 007-210
OPTIMA® 225	50 % cyanopropylmethyl – 50 % phenylmethylpolysiloxane	260/280 °C	G7 G19	DB-225, HP-225, OV-225, Rtx®-225, CP-Sil 43, 007-225, BP225
OPTIMA® 240	33 % cyanopropylmethyl – 67 % dimethylpolysiloxane	260/280 °C	–	no similar phases
OPTIMA® WAX	polyethylene glycol 20000 daltons	250/260 °C	G16	PERMABOND® CW 20 M, DB-Wax, Supelcowax™, HP-Wax, HP-INNOWax, Rtx®-Wax, CP-Wax 52 CB, Stabilwax, 007-CW, BP20, AT™-Wax, ZB-Wax
OPTIMA® FFAP	polyethylene glycol 2-nitroterephthalate	250/260 °C	G25 G35	PERMABOND® FFAP, DB-FFAP, HP-FFAP, CP-SIL 58 CB, 007-FFAP, CP-FFAP CB, Nukol

[1] **first temperature for isothermal operation, second value for short isotherms in a temperature program**
Please note, that for columns with 0.53 mm ID and for columns with thicker films temperature limits are generally lower. For details refer to the description of individual phases.

[2] **phases which provide a similar selectivity based on chemical and physical properties**



Each Column is individually tested and supplied with test certificate and test chromatogram, but without fittings or ferrules. Column ends are melted or closed with septa, and thus protected from atmospheric oxygen. Additionally, we supply the corresponding test mixture with each column. On request, all columns can be supplied on a **5 inch (13 mm) cage** for the Agilent GC 6850: For ordering, please add an E at the end of the REF number (e.g. 726470.30E). For a considerably longer lifetime, even for contaminated or matrix-containing samples; MN offers the option of **integrated precolumns**. Please contact us for details.

The following selection of GC column dimensions is only an excerpt of our product range. For the full range of GC columns ask for our chromatography catalog or visit:

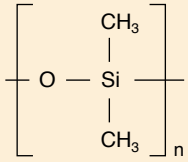
www.mn-net.com

Custom made dimensions can be obtained on request.

OPTIMA® 1 MS Accent

100 % dimethylpolysiloxane

- selectivity identical to OPTIMA® 1



increased sensitivity due to an unmatched low background level

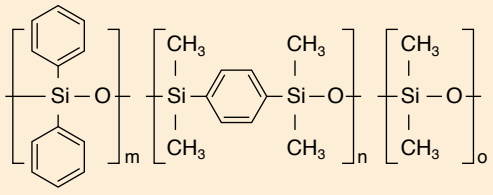
- max. temperature for isothermal operation 340 °C,
  max. temperature for short isotherms in a temperature program 360 °C
- **lowest column bleed,** nonpolar phase, ideal for ion trap and quadrupol MS detectors
- perfect inertness for basic compounds
- solvent rinsing for removal of impurities applicable
- application areas: all-round phase for environmental analyses, trace analyses, EPA methods, pesticides, PCB, food and drug analyses
- similar phases: Ultra-1, DB-1 MS, HP-1 MS, Rxi-1 MS, Rtx-1 MS, Equity-1, AT-1 MS, VF-1 MS, CP-Sil 5 CB MS
- USP G1 / G2 / G38

Length →	15 m	25 m	30 m	50 m	60 m
0.2 mm ID (0.4 mm OD)					
0.20 µm film		**725801.25**		**725801.50**	
0.25 mm ID (0.4 mm OD)					
0.25 µm film	**725805.15**		**725805.30**		**725805.60**
0.50 µm film			**725806.30**		**725806.60**
0.32 mm ID (0.5 mm OD)					
0.25 µm film			**725802.30**		**725802.60**

OPTIMA® 5 MS Accent

silarylene phase

chemically bonded, cross-linked silarylene phase with polarity similar to a 5 % diphenyl - 95 % dimethylpolysiloxane phase



increased sensitivity due to an unmatched low background level

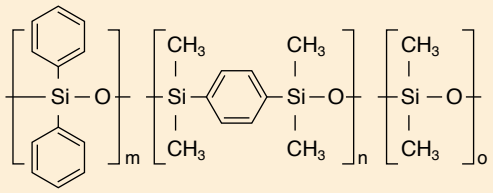
- max. temperature for isothermal operation 340 °C, max. temperature for short isotherms in a temperature program 360 °C,
  for columns with films > 0.5 µm max. temperatures are 320 and 340 °C, respectively
- **lowest column bleed,** nonpolar phase, ideal for ion trap and quadrupol MS detectors
  solvent rinsing for removal of impurities applicable
  application areas: all-round phase for environmental analyses, trace analyses, EPA methods, pesticides, PCB, food and drug analyses
  similar phases: DB-5 MS, HP-5 MS, Ultra-2, Equity-5, CP-Sil 8 CB low bleed/MS, Rxi-5 MS, Rtx-5SIL-MS, Rtx-5 MS, 007-5 MS, BPX5, MDN-5S, AT-5 MS, VF-5 MS
- USP G27 / G36

Length →	12 m	15 m	25 m	30 m	50 m	60 m
0.2 mm ID (0.4 mm OD)						
0.20 µm film			**725810.25**		**725810.50**	
0.35 µm film	**725815.12**				**725815.50**	
0.25 mm ID (0.4 mm OD)						
0.25 µm film		**725820.15**		**725820.30**		**725820.60**
0.50 µm film				**725825.30**		**725825.60**
1.00 µm film				**725826.30**		**725826.60**
0.32 mm ID (0.5 mm OD)						
0.25 µm film				**725811.30**		**725811.60**
0.50 µm film				**725813.30**		
1.00 µm film			**725812.25**			**725812.60**

OPTIMA® XLB

silarylene phase

chemically bonded, cross-linked silarylene phase, optimized silarylene content for lowest column bleed



similar phases: DB-XLB, Rxi-XLB, Rtx-XLB, MDN-12, VF-XMS

- max. temperature for isothermal operation 340 °C,
- max. temperature for short isotherms in a temperature program 360 °C,
- lowest column bleed, nonpolar phase, ideal for ion trap and quadrupol MS detectors
- perfect inertness for basic compounds
- solvent rinsing for removal of impurities applicable
- application areas: ultra low bleed phase, highly selective for environmental and trace analyses, pesticides
- recommended phase for PCB separations

Length →	30 m	60 m
0.25 mm ID (0.4 mm OD)		
0.25 µm film	**725850.30**	**725850.60**

OPTIMA® δ-3

polysiloxane phase with autoselectivity

- medium polar without CN groups
  analytes determine the polarity of the phase
  unique from MN, no similar phase
  ideal for MSD and PND detectors
- USP G49

- max. temperature for isothermal operation 340 °C,
  max. temperature for short isotherms in a temperature program 360 °C
  for 0.53 mm ID columns the max. temperatures are 320 and 340 °C, resp.
- autoselectivity resulting in a wide range of polarities from approximately the non-polar OPTIMA® 5 to the midpolar OPTIMA® 1701

Length →	25 m	30 m	50 m	60 m
0.2 mm ID (0.4 mm OD)				
0.20 µm film	**726400.25**		**726400.50**	
0.25 mm ID (0.4 mm OD)				
0.25 µm film		**726420.30**		**726420.60**
0.50 µm film		**726421.30**		
0.32 mm ID (0.5 mm OD)				
0.25 µm film		**726440.30**		**726440.60**
0.35 µm film		**726441.30**		**726441.60**
1.00 µm film		**726442.30**		**726442.60**

OPTIMA® δ-6

polysiloxane phase with autoselectivity

- medium polar without CN groups
  analytes determine the polarity of the phase
  unique from MN, no similar phase
  ideal for MSD and PND detectors

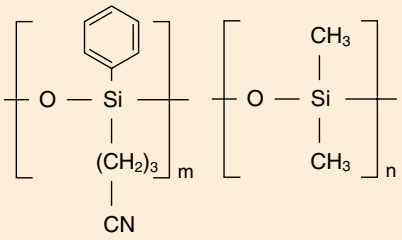
- max. temperature for isothermal operation 340 °C,
  max. temperature for short isotherms in a temperature program 360 °C
  for 0.53 mm ID columns the max. temperatures are 320 and 340 °C, resp.
- autoselectivity resulting in a wide range of polarities from approximately the mid-polar OPTIMA® 17 to the polar OPTIMA® 210

Length →	25 m	30 m	50 m	60 m
0.2 mm ID (0.4 mm OD)				
0.20 µm film	**726465.25**		**726465.50**	
0.25 mm ID (0.4 mm OD)				
0.25 µm film		**726470.30**		**726470.60**
0.32 mm ID (0.5 mm OD)				
0.25 µm film		**726480.30**		**726480.60**
0.35 µm film		**726481.30**		**726481.60**
1.00 µm film		**726482.30**		**726482.60**

OPTIMA® 624

6 % cyanopropyl-phenyl – 94 % dimethylpolysiloxane

- medium polar phase



- max. temperature for isothermal operation 280 °C, max. temperature for short isotherms in a temperature program 300 °C
- recommended for environmental analyses
- for corresponding columns with lower film thickness see OPTIMA® 1301
- USP G43

similar phases: HP-624, HP-VOC, DB-624, DB-VRX, SPB-624, CP-624, Rtx-624, Rtx-Volatiles, 007-624, BP624, VOCOL

OPTIMA® 624 *LB*

6 % cyanopropyl-phenyl – 94 % dimethylpolysiloxane

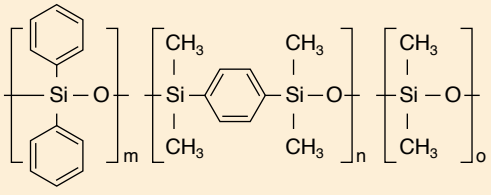
- excellent Low Bleed columns for halogenated hydrocarbons, volatiles, aromatic compounds, solvents etc.

Length →		25 m	30 m	50 m	60 m
OPTIMA® 624	**0.2 mm ID (0.4 mm OD)**				
	1.10 µm film	**726784.25**			
	0.25 mm ID (0.4 mm OD)				
	1.40 µm film	**726785.25**	**726785.30**	**726785.50**	**726785.60**
	0.32 mm ID (0.5 mm OD)				
	1.80 µm film	**726787.25**	**726787.30**	**726787.50**	**726787.60**
	0.53 mm ID (0.8 mm OD)				
	3.00 µm film	**726789.25**	**726789.30**		
OPTIMA® 624 *LB*	**0.25 mm ID (0.5 mm OD)**				
	1.40 µm film		**726791.30**		**726791.60**
	0.32 mm ID (0.5 mm OD)				
	1.80 µm film		**726786.30**	**726786.50**	

OPTIMA® 35 MS

silarylene phase

chemically bonded cross-linked silarylene phase with selectivity similar to 35 % phenyl / 65 % methyl polysiloxane



- max. temperature for isothermal operation 360 °C, max. temperature for short isotherms in a temperature program 370 °C
- very low column bleeding, midpolar phase, recommended for ion-trap detectors
- optimum column for confirmation of analytical results in combination with a 1 MS or 5 MS
- polymer without CN groups
- recommended application: allround phase for environmental analyses, ultra trace analyses, EPA methods, pesticides, PCBs, food and drug analyses
- USP G42

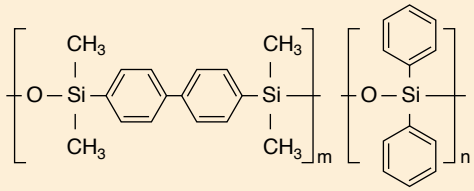
similar phases: DB-35 MS, HP-35, SPB-35, Rxi-35SIL MS, Rtx-35, 007-35, BPX-35, MDN-35, AT-35 MS, ZB-35, OV-11, VF-35 MS

Length →	30 m	60 m
0.25 mm ID (0.4 mm OD)		
0.25 µm film	**726154.30**	**726154.60**
0.32 mm ID (0.5 mm OD)		
0.25 µm film	**726157.30**	**726157.60**

OPTIMA® 17 MS

silarylene phase

- medium polar silarylene phase with selectivity analogue to 50 % phenyl – 50 % methylpolysiloxane



similar phases: OV-17, AT-50, BPX-50, DB-17, DB-17ms, HP-50+, HP-17, SPB-50, SPB-17, SP-2250, Rtx-50, CP-Sil 24 CB, 007-17, VF-17ms, ZB-50

- max. temperature for isothermal operation 340 °C, max. temperature for short isotherms in a temperature program 360 °C
- ideal for ion trap detectors
- optimum reference column in combination with a 1 MS or 5 MS
- no CN groups in the polymer
- recommended applications: all-round phase for environmental analyses, ultra-trace analyses, EPA methods, pesticides, PCBs, food and drug analyses
- USP G3

Length →	30 m	60 m
0.25 mm ID (0.4 mm OD)		
0.25 µm film	**726162.30**	**726162.60**
0.32 mm ID (0.5 mm OD)		
0.25 µm film	**726165.30**	**726165.60**

GC Application Guide

- explaining basics and principles of GC:
  phase selection by column properties,
  important GC parameters,
  helpful hints for troubleshooting
- **280 selected applications** from the fields
  - ✓ environmental pollutants
  - ✓ solvents · chemicals
  - ✓ fragrances · food and cosmetic components
  - ✓ drugs · pharmaceutical ingredients
  - ✓ petrochemical products
  - ✓ chiral separations
- latest and more applications at ***www.mn-net.com/apps***

NUCLEODUR® C_{18} HTec

base-deactivated octadecyl phase

- **key features:**
  - reliable and durable standard RP phase, suited for LC/MS
  - outstanding base deactivation
  - excellent stability and high loadability
- **technical characteristics:**

high density octadecyl modification (C_{18})
pore size 110 Å; particle sizes 1.8 µm, 3 µm and 5 µm for analytical separations
carbon content 18 %, pH stability 1 – 11, USP L1

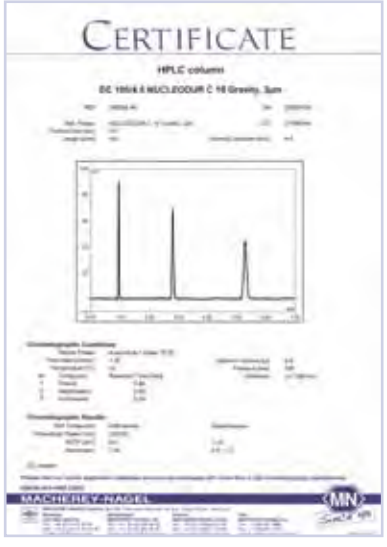
eluent in column acetonitrile / water

Length →	30 mm	50 mm	75 mm	100 mm	125 mm	150 mm	250 mm	Guard columns
NUCLEODUR® C_{18} HTec, 1.8 µm							particle size 1.8 µm	
EC columns								
2 mm ID	**760301.20**	**760305.20**	**760304.20**	**760306.20**		**760308.20**		
3 mm ID	**760301.30**	**760305.30**						
4 mm ID	**760301.40**	**760305.40**						
4.6 mm ID	**760301.46**	**760305.46**						
NUCLEODUR® C_{18} HTec, 3 µm							particle size 3 µm	
2 mm ID		**760321.20**			**760324.20**	**760325.20**	**760326.20**	**761120.30**
3 mm ID		**760321.30**			**760324.30**	**760325.30**	**760326.30**	**761120.30**
4 mm ID		**760321.40**			**760324.40**	**760325.40**	**760326.40**	**761120.40**
4.6 mm ID		**760321.46**	**760322.46**	**760323.46**	**760324.46**	**760325.46**	**760326.46**	**761120.40**
NUCLEODUR® C_{18} HTec, 5 µm							particle size 5 µm	
2 mm ID		**760311.20**			**760314.20**	**760315.20**	**760316.20**	**761110.30**
3 mm ID		**760311.30**			**760314.30**	**760315.30**	**760316.30**	**761110.30**
4 mm ID		**760311.40**			**760314.40**	**760315.40**	**760316.40**	**761110.40**
4.6 mm ID		**760311.46**	**760312.46**	**760313.46**	**760314.46**	**760315.46**	**760316.46**	**761110.40**

Our HPLC QC policy

- **highest production standard**
  our facilities are EN ISO 9001:2008 certified
- **strict quality specifications** for outstanding reliability
- **perfect reproducibility** within each batch and from lot to lot

- Each column is individually tested and supplied with test chromatogram and test conditions



Test mixture for reversed phase columns

Designation	Pack of	REF
Test mixture for reversed phase columns in acetonitrile	1 mL	**722394**

NUCLEODUR® Sphinx RP

bifunctional RP phase

- **key features:**
  - distinct selectivity based on well-balanced bifunctional surface coverage
  - widens the scope for method development based on additional π-π interactions
  - suitable for LC/MS due to low bleeding characteristics
- **technical characteristics:**

  octadecyl and propylphenyl modified silica; pore size 110 Å; particle sizes 1.8 µm, 3 µm and 5 µm; carbon content 15 %;
  pH stability 1 – 10; high reproducibility and consistent quality, USP L1/L11

eluent in column acetonitrile / water

Length →	30 mm	50 mm	75 mm	100 mm	125 mm	150 mm	250 mm	Guard columns
NUCLEODUR® Sphinx RP, 1.8 µm								particle size 1.8 µm
EC columns								
2 mm ID	**760821.20**	**760822.20**	**760825.20**	**760823.20**		**760824.20**		
3 mm ID	**760821.30**	**760822.30**						
4 mm ID	**760821.40**	**760822.40**						
4.6 mm ID	**760821.46**	**760822.46**						
NUCLEODUR® Sphinx RP, 3 µm								particle size 3 µm
2 mm ID		**760806.20**			**760807.20**	**760805.20**	**760808.20**	**761557.30**
3 mm ID		**760806.30**			**760807.30**	**760805.30**	**760808.30**	**761557.30**
4 mm ID		**760806.40**			**760807.40**	**760805.40**	**760808.40**	**761557.40**
4.6 mm ID		**760806.46**	**760813.46**	**760812.46**	**760807.46**	**760805.46**	**760808.46**	**761557.40**
NUCLEODUR® Sphinx RP, 5 µm								particle size 5 µm
2 mm ID		**760800.20**			**760801.20**	**760802.20**	**760803.20**	**761550.30**
3 mm ID		**760800.30**			**760801.30**	**760802.30**	**760803.30**	**761550.30**
4 mm ID		**760800.40**			**760801.40**	**760802.40**	**760803.40**	**761550.40**
4.6 mm ID		**760800.46**	**760815.46**	**760809.46**	**760801.46**	**760802.46**	**760803.46**	**761550.40**

NUCLEODUR® C_{18} PAH

special octadecyl phase for PAH analyses

- base material NUCLEODUR® silica, particle size 3 µm, pore size 110 Å; polymeric coating · USP L1
- eluent in column acetonitrile / water 70:30
- allows efficient gradient separation of the 16 PAH according to EPA
- detection of the separated PAH by UV (250 to 280 nm), with diode array or with fluorescence detection at different wavelengths for excitation and emission (acenaphthylene cannot be analysed with fluorescence detection)

Length →	50 mm	100 mm	125 mm	150 mm	250 mm	Guard columns
NUCLEODUR® C_{18} PAH, 1,8 µm						particle size 1.8 µm
EC columns						
2 mm ID	**760771.20**	**760773.20**				
3 mm ID	**760771.30**	**760773.30**				
4 mm ID	**760771.40**	**760773.40**				
NUCLEODUR® C_{18} PAH, 3 µm						particle size 3 µm
3 mm ID		**760783.30**	**760784.30**	**760785.30**	**760786.30**	**761780.30**
4 mm ID		**760783.40**	**760784.30**	**760785.30**	**760786.30**	**761780.40**

PAH standard according to EPA for HPLC

PAH standard for HPLC	16 PAH according to EPA method 610 in acetonitrile (1 ml)	**722393**

As guard columns for EC columns use ChromCart® guard column cartridges with guard column adaptor EC (REF 721359).
8 mm ChromCart® guard column cartridges in packs of 3, analytical main columns in packs of 1.
Microbore and VarioPrep columns on request.

NUCLEODUR® PolarTec

RP phase with embedded polar group

key features:

- hydrophobic phase with pronounced hydrophilic properties
- separation mechanism based on hydrophobic (van der Waals) and polar interactions
- suitable for LC/MS due to low bleeding characteristics

technical characteristics:

embedded polar group, endcapped · 15.5 % C · USP L1/L60

suited for 100 % aqueous eluents

pore size 110 Å, available particle sizes 3 µm and 5 µm

pH stability 1 – 10

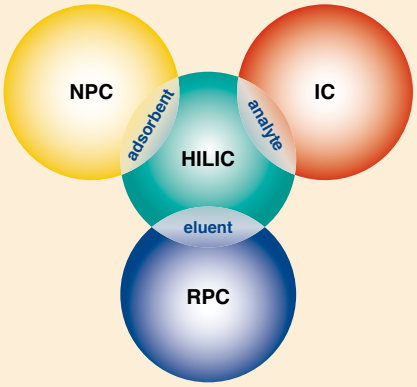
eluent in column acetonitrile / water

Length →	50 mm	75 mm	100 mm	125 mm	150 mm	250 mm	Guard columns
NUCLEODUR® PolarTec, 3 µm							particle size 3 µm
EC columns							
2 mm ID	**760473.20**			**760477.20**	**760478.20**	**760479.20**	**761160.30**
3 mm ID	**760473.30**			**760477.30**	**760478.30**	**760479.30**	**761160.30**
4 mm ID	**760473.40**			**760477.40**	**760478.40**	**760479.40**	**761160.40**
4.6 mm ID	**760473.46**	**760475.46**	**760476.46**	**760477.46**	**760478.46**	**760479.46**	**761160.40**
NUCLEODUR® PolarTec, 5 µm							particle size 5 µm
2 mm ID	**760483.20**			**760487.20**	**760488.20**	**760489.20**	**761161.30**
3 mm ID	**760483.30**			**760487.30**	**760488.30**	**760489.30**	**761161.30**
4 mm ID	**760483.40**			**760487.40**	**760488.40**	**760489.40**	**761161.40**
4.6 mm ID	**760483.46**	**760485.46**	**760486.46**	**760487.46**	**760488.46**	**760489.46**	**761161.40**

As guard columns for EC columns use ChromCart® guard column cartridges with guard column adaptor EC (REF 721359).
8 mm ChromCart® guard column cartridges in packs of 3, analytical main columns in packs of 1.
Microbore and VarioPrep columns on request.

NUCLEODUR® HILIC

zwitterionic phase



key features:

- ideal for reproducible and stable chromatography of highly polar analytes
- suitable for analytical and preparative applications as well as LC-MS
- very short column conditioning period

technical characteristics:

ammonium - sulfonic acid modified silica; pore size 110 Å; particle sizes 1.8 µm, 3 µm and 5 µm; carbon content 7 %; pH stability 2 – 8.5

eluent in column acetonitrile – water (80:20; v/v)

Length →	30 mm	50 mm	75 mm	100 mm	125 mm	150 mm	250 mm	Guard columns
NUCLEODUR® HILIC, 1.8 µm								particle size 1.8 µm
EC columns								
2 mm ID	**760521.20**	**760523.20**	**760525.20**	**760526.20**		**760528.20**		
3 mm ID	**760521.30**	**760523.30**						
4 mm ID	**760521.40**	**760523.40**						
4.6 mm ID	**760521.46**	**760523.46**						
NUCLEODUR® HILIC, 3 µm								particle size 3 µm
2 mm ID		**760532.20**			**760531.20**	**760533.20**	**760530.20**	**761580.30**
3 mm ID		**760532.30**			**760531.30**	**760533.30**	**760530.30**	**761580.30**
4 mm ID		**760532.40**			**760531.40**	**760533.40**	**760530.40**	**761580.40**
4.6 mm ID		**760532.46**		**760534.46**	**760531.46**	**760533.46**	**760530.46**	**761580.40**
NUCLEODUR® HILIC, 5 µm								particle size 5 µm
2 mm ID		**760552.20**			**760551.20**	**760553.20**	**760550.20**	**761590.30**
3 mm ID		**760552.30**			**760551.30**	**760553.30**	**760550.30**	**761590.30**
4 mm ID		**760552.40**			**760551.40**	**760553.40**	**760550.40**	**761590.40**
4.6 mm ID		**760552.46**		**760554.46**	**760551.46**	**760553.46**	**760550.46**	**761590.40**

As guard columns for EC columns use ChromCart® guard column cartridges with guard column adaptor EC (REF 721359).
8 mm ChromCart® guard column cartridges in packs of 3, analytical main columns in packs of 1.
Microbore and VarioPrep columns on request.

Derivatization reagents

- for improved volatility, better thermal stability or a lower limit of detection in gas chromatography
  prerequisite: quantitative, rapid and reproducible formation of only one derivative
  halogen atoms introduced by derivatization (e. g. trifluoroacetates) allow specific detection (ECD) with the advantage of high sensitivity
  elution orders and fragmentation patterns in MS can be influenced by a specific derivatization
- reagents for **silylation**, **acylation** and **alkylation** (methylation) available

For the full range of derivatization reagents and method development kits please ask for our chromatography catalog **"Columns and Supply"** or visit ***www.mn-net.com***

Silylation reagents · BSTFA · SILYL-991

- **N,O-bis-trimethylsilyl-trifluoroacetamide**
  m.w. 257.4, Bp 40 °C (12 mm Hg), density d20°/4° = 0.961

BSTFA: $CF_3 - C(=N - Si(CH_3)_3) - O - Si(CH_3)_3$

BSTFA is nonpolar (less polar than MSTFA), and can be mixed with acetonitrile for improved solubility.
For compounds, which are difficult to silylate (like secondary alcohols and amines), we recommend BSTFA + 1 % trimethylchlorosilane (TMCS), available under the designation SILYL-991.

Silylation with BSA, BSTFA or SILYL-991 (BSTFA + 1 % TMCS)

Procedure:
add 0.5 mL of the silylation reagent to 1 – 10 mg sample; if necessary, add some solvent (normally pyridine or DMF [dimethylformamide] are used). Heat to 60 – 80 °C for 20 min to increase the reaction rate. 1 – 2 drops of TMCS (trimethylchlorosilane) or TSIM will also speed up the reaction.

BSA MN Appl. No. 213091 · BSTFA MN Appl. No. 213092
SILYL-991 MN Appl. No. 213093

	Packing unit				
	20 x 1 mL	1 x 10 mL	5 x 10 mL	1 x 50 mL	1 x 100 mL
BSTFA	**701220.201**	**701220.110**	**701220.510**		
SILYL-991 (BSTFA – TMCS (99:1)	**701490.201**			**701490.150**	**701490.1100**

Due to their purpose, derivatization reagents are very reactive substances. For this reason they should be stored cool and protected from moisture. Our derivatization reagents are supplied in vials with crimp caps for easy access with a syringe. Vials with pierced sealing disks have limited stability and should be used soon.

MSTFA · MSHFBA · MBDSTFA

- **N-methyl-N-trimethylsilyl-trifluoroacetamide**
  m.w. 199.1, Bp 70 °C (75 mm Hg), density d20°/4° = 1.11
- **N-methyl-N-trimethylsilyl-heptafluorobutyramide**
  m.w. 299.1, Bp 148 °C (760 mm Hg)
- **N-methyl-N-*tert*-butyldimethylsilyl-trifluoroacetamide**
  m.w. 241.3, Bp 168 – 170 °C (760 mm Hg), density d20°/4° = 1.121

MSTFA: $R'CO-N(CH_3)-Si(CH_3)_2-R''$
$R' = CF_3$, $R'' = CH_3$
MSHFBA: $R' = C_3F_7$, $R'' = CH_3$

MBDSTFA (MTB-TFA):
$R' = CF_3$, $R'' = C_4H_9$

Silylation with MSTFA, MSHFBA or MBDSTFA

Procedure:
Dissolve 10 – 15 mg sample in 0.8 mL solvent, then add 0.2 mL of the silylation reagent. The reaction mixture can be heated to 60 – 70 °C for up to 1 hour and can be analysed directly. If TFA is used as a solvent, proceed as follows [M. Donike, J. Chromatogr. 85 (1973) 1 – 7]: dissolve 1 – 2 mg sample in 100 µL TFA. Dropwise add 0.9 mL of the silylating reagent. After cooling the sample can be chromatographed directly.

MSTFA MN Appl. No. 213111 · MSHFBA MN Appl. No. 213112 · MBDSTFA MN Appl. No. 213113

	Packing unit							
	10 x 1 mL	20 x 1 mL	1 x 10 mL	5 x 10 mL	1 x 100 mL	6 x 50 mL	6 x 100 mL	12 x 100 mL
MSHFBA		**701260.201**	**701260.110**	**701260.510**	**701260.1100**		**701260.6100**	
MSTFA		**701270.201**	**701270.110**	**701270.510**	**701270.1100**	**701270.650**	**701270.6100**	**701270.12100**
MBDSTFA	**701440.101**	**701440.201**						

Acylation reagents

- Anhydrides
  Heptafluorobutyric acid anhydride
  HFBA: $C_3F_7 - CO - O - CO - C_3F_7$
  m.w. 410.06, Bp 106 – 107 °C (760 mm Hg), density d20°/4° = 1.665
- Bisacylamides
  N-methyl-bis(trifluoroacetamide)
  MBTFA: $CF_3 - CO - N(CH_3) - CO - CF_3$
  m.w. 223.08, Bp 123 – 124 °C (760 mm Hg), density d20°/4° = 1.55

Methods for acylation

Acylation with fluorinated acid anhydrides:

Acylation with HFBA can be used for alcohols, phenols, carboxylic acids, amines, amino acids and steroids forming volatile, stable derivatives suited for FID as well as for ECD detection.

Procedure:
Dissolve 0.1 to 1 mg of the sample in 0.1 mL solvent, add 0.1 mL of the respective anhydride and heat to 60 – 70 °C for 1 – 2 hours. If the sample need not be concentrated prior to the analysis and if there is no danger of catalytically induced side reactions, pyridine is used as solvent. The reaction solution can be injected directly into the gas chromatograph. Otherwise use a volatile solvent and evaporate solvent, excess reagent and acid in a stream of nitrogen. Dissolve the residue in 50 µL hexane, chloroform etc. and inject aliquot portions.

TFAA MN Appl. No. 213041 · HFBA MN Appl. No. 213042

Acylation with fluorinated acid amides:

This method is recommended for alcohols, primary and secondary amines as well as for thiols under mild, neutral conditions.

Procedure:
Add 0.5 mL MBTFA to about 2 mg sample. If there is no reaction at ambient temperature, heat the reaction mixture to 120 °C. Compounds which are difficult to dissolve, can be trifluoroacetylated in suitable solvent mixtures. It is recommended to use a ratio of solvent to MBTFA of 4 : 1. The reaction mixture can be chromatographed directly.

MBTFA MN Appl. No. 213051 · MBHFBFA MN Appl. No. 213052

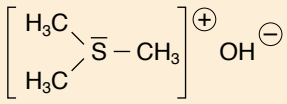
	Packing unit		
	20 x 1 mL	1 x 10 mL	5 x 10 mL
HFBA	**701110.201**	**701110.110**	**701110.510**
MBTFA	**701410.201**	**701410.110**	**701410.510**

Due to their purpose, derivatization reagents are very reactive substances. For this reason they should be stored cool and protected from moisture. Our derivatization reagents are supplied in vials with crimp caps for easy access with a syringe. Vials with pierced sealing disks have limited stability and should be used soon.

Alkylation reagents

In GC generally methylation is the main type of alkylation used.

- **Trimethylsulphonium hydroxide**
  TMSH (0.2 M in MeOH) · m.w. 94.06



Methods for methylation

Methylation with TMSH

Methylation with TMSH is recommended for free acids, chlorophenoxycarboxylic acids, their salts and derivatives as well as for phenols and chlorophenols.

Procedure:
Dissolve 100 mg sample (e. g. butter) in 5 mL of a suitable solvent (e. g. *tert.*-butyl methyl ether). Add 50 µl reagent to 100 µl of this solution. The mixture is injected directly. The temperature of the injector must be at least 250 °C.

MN Appl. No. 213060

	Packing unit			
	10 x 1 mL	20 x 1 mL	1 x 10 mL	5 x 10 mL
TMSH	**701520.101**	**701520.201**	**701520.110**	**701520.510**

Useful consumables for your GC

Ferrules for GC

- Graphite ferrules provide the highest temperature stability (up to 450 °C). They are reusable when handled with care. We also offer 1/16" graphite ferrules specially designed for Carlo Erba / Fisons or for Agilent gas chromatographs.
- Vespel ferrules come in three types: pure Vespel, Vespel with 15 % graphite and Vespel with 40 % graphite. All versions are stable up to 400 °C and reusable.
- PTFE ferrules can only be used up to 250 °C. They are not reusable and not recommended for temperature programming. However, they show the best chemical inertness of all ferrules.

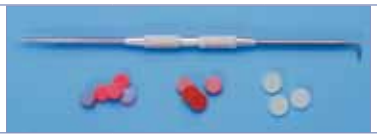
(packing unit 10 ferrules)

Bore (= column OD)	Graphite	Vespel			PTFE
		plain	+ 15 % graphite	+ 40 % graphite	
max. temp. →	450 °C	400 °C	400 °C	400 °C	250 °C
1/16" ferrules					
no bore	**708336**	**706187**	**706167**		**706177**
0.4 mm	**708309**			**706246**	
0.5 mm	**708308**			**706247**	
0.8 mm	**708301**			**706248**	
1.0 mm	**708302**				
1.2 mm	**708303**				
1/16"	**706155**	**706180**	**706160**	**706190**	**706170**

Septa for GC

Designation	Material	Thickness	Hardness	max. Temp.
Standard septa (ST)	beige silicone rubber	4 mm	60 shore	
High temperature septa (HT)	red, specially pretreated, non-bleeding silicone rubber	3 mm	60 shore	320 °C *
Silicone septa, soft	transparent silicone rubber	3 mm	45 shore	250 °C
Silicone septa PTFE	white silicone rubber, one side coated with grey PTFE	3 mm		200 °C

* When used at considerably higher temperatures – and working without septum purge – interfering peaks can occur due to thermal decomposition of the material.

Septum grade (packs of 50 septa)	Outer diameter 9 mm N 9	10 mm N 10	11 mm N 11	12 mm N 12	13 mm N 13	17 mm N 17
Standard septa (ST)	702609	702610	702611	702612	702613	
High temperature septa (HT)	702619	702620	702621	702622	702623	702632
Silicone septa, soft	702602		702604	702605	702606	
Silicone septa PTFE		702625	702626	702627	702628	
Septum remover (tool for removing septa which have become baked into the injection port of the gas chromatograph)						706141

Tools and general accessories for GC

- **Diamond file:**
  a useful tool for cutting capillaries and smoothing ends of capillaries. Square capillary ends without protruding particles are especially important for butt connections (e.g. in Valco unions).
- **Magnifying lens:**
  a very versatile tool for any laboratory. In capillary GC it is often important to inspect column integrity or check cut ends of capillaries. When closing a column by melting the magnifying lens can be used to check whether the column is really closed or whether an open channel has been formed in the sealed end. Our lens provides 8fold magnification and is supplied with a scale as pictured in the figure below. The space between lines corresponds to 1/10 mm.

Lens with scale

Diamond file

Description	Specification	Pack of	REF
Tools for capillary GC			
Diamond file	for cutting capillaries and straightening capillary ends	1	**708300**
Magnifying lens with scale	magnification 8x	1	**706296**

Description	Pack of	REF	Specification
Universal capillary glass connectors			
linear	5 connectors	**707971**	
linear	10 connectors	**707972**	
Y splitter	1 connector	**707973**	
PTFE shrinking tube, thin-walled	1 m	**708305**	for connecting capillaries, min ID expanded 1.17 mm, max. ID shrunk 0.40 mm

Polyamide (PA) = Nylon

- hydrophilic membrane
- for aqueous and organic/aqueous medium polar liquids

	Type	Pore size [µm]	Membrane diameter [mm]	Color code top	Color code bottom	Standard pack filters/pack	Standard pack REF	BIG-BOX filters/pack	BIG-BOX **REF**
	Xtra PA-20/25	0.20	25	labelled	–	100	**729212**	400	**729212.400**
	Xtra PA-45/25	0.45	25	labelled	–	100	**729213**	400	**729213.400**
	AO-20/15 MS*	0.20	15	yellow	green	100	**729048**	800	**729048.800**
	AO-45/15 MS*	0.45	25	colorless	green	100	**729049**	800	**729049.800**
	AO-20/3	0.20	3	colorless	colorless	100	**729010**		
	AO-45/3	0.45	3	colorless	colorless	100	**729011**		

* MS = minispike on filter exit

Polytetrafluoroethylene (PTFE)

- hydrophobic membrane
- for nonpolar liquids and gases
- very resistant towards all kinds of solvents as well as acids and bases flushing with alcohol, followed by water, makes the originally hydrophobic membrane more hydrophilic

	Type	Pore size [µm]	Membrane diameter [mm]	Color code top	Color code bottom	Standard pack filters/pack	Standard pack REF	BIG-BOX filters/pack	BIG-BOX **REF**
	Xtra PTFE-20/25	0.20	25	labelled		100	**729207**	400	**729207.400**
	Xtra PTFE-45/25	0.45	25	labelled		100	**729205**	400	**729205.400**
	Xtra PTFE-100/25	0.1	25	labelled	colorless	100	**729247**	400	**729247.400**
	O-20/15 MS*	0.20	15	yellow	colorless	100	**729008**	800	**729008.800**
	O-45/15 MS*	0.45	15	colorless	colorless	100	**729009**	800	**729009.800**
	O-20/3	0.20	3	colorless	colorless	100	**729014**		
	O-45/3	0.45	3	colorless	colorless	100	**729015**		

* MS = minispike on filter exit

Regenerated Cellulose (RC)

- hydrophilic membrane with very low adsorption
- for aqueous and organic/aqueous liquids, i. e. polar and medium polar sample solutions
- binding capacity for proteins 84 µg/filter of 25 mm diameter
- RC filter with integrated glass fibre prefilter (**GF/RC**): recommended for solutions with a high load of particulate matter or for highly viscous solutions

	Type	Pore size [µm]	Membrane diameter [mm]	Color code top	Color code bottom	Standard pack filters/pack	Standard pack REF	BIG-BOX filters/pack	BIG-BOX **REF**
	Xtra RC-20/25	0.20	25	labelled		100	**729230**	400	**729230.400**
	Xtra RC-45/25	0.45	25	labelled		100	**729231**	400	**729231.400**
	RC-20/15 MS*	0.20	15	yellow	blue	100	**729036**	800	**729036.800**
	RC-45/15 MS*	0.45	15	colorless	blue	100	**729037**	800	**729037.800**
	Combi Filters								
	GF/RC-20/25	1.0/0.20	25	blue	blue	100	**729050**	400	**729050.400**
	GF/RC-45/25	1.0/0.45	25	black	blue	100	**729051**	400	**729051.400**

* MS = minispike on filter exit

Polyester (PET)

- hydrophilic multipurpose membrane
- for polar as well as nonpolar solvents
  the HPLC filter, especially suited for mixtures of water and organic solvents
  for TOC/DOC determination, not cytotoxic, does not inhibit the growth of microorganisms and higher cells
- polyester filter with integrated glass fibre prefilter (**GF/PET**): recommended for solutions with a high load of particulate matter or for highly viscous solutions

	Type	Pore size [µm]	Membrane diameter [mm]	Color code top	Color code bottom	Standard pack filters/pack	Standard pack REF	BIG-BOX filters/pack	BIG-BOX **REF**
	Xtra PET-20/25	0.20	25	labelled		100	**729221**	400	**729221.400**
	Xtra PET-45/25	0.45	25	labelled		100	**729220**	400	**729220.400**
	Xtra PET-120/25	1.2	25	labelled		100	**729229**	400	**729229.400**
	PET-20/15 MS*	0.20	15	yellow	orange	100	**729022**	800	**729022.800**
	PET-45/15 MS*	0.45	15	colorless	orange	100	**729023**	800	**729023.800**
	Combi Filters								
	GF/PET-20/25	1.0/0.20	25	blue	orange	100	**729032**	400	**729032.400**
	GF/PET-45/25	1.0/0.45	25	black	orange	100	**729033**	400	**729033.400**

* MS = minispike on filter exit

Vials and Caps

Screw neck vials and inserts N 9

702283	702284	702813	702818
			
1.5 mL	1.5 mL	0.2 mL	0.1 mL
11.6 x 32 mm	11.6 x 32 mm	6 x 31 mm	5.7 x 29 mm
clear, label + scale	amber, label + scale	clear	clear
flat bottom	flat bottom	conical, 15 mm tip	with plastic spring
100 / PP box	100 / PP box	100 / PE bag	100 / PE bag

Ready assembled screw closures N 9 and single septa N 9

REF	(Scale 1:1.6)	Cap description	Septum description	Hardness	Thickness	Pack of
702732		N 9 PP screw cap, color as indicated, center hole	Red Rubber / FEP colorless	40° shore A	1.0 mm	100 / PE bag
702033		as above, but with closed top				
702287.1		N 9 PP screw cap, color as indicated, center hole	Silicone white / PTFE red	40° shore A	1.0 mm	100 / PE bag
702288.1		N 9 PP screw cap, color as indicated, center hole	Silicone white / PTFE blue, slit	40° shore A	1.0 mm	100 / PE bag
702035		N 9 PP screw cap, color as indicated, center hole	PTFE red / Silicone white / PTFE red	40° shore A	1.0 mm	100 / PE bag

Bonded screw closures N 9 (septa firmly connected with the cap; cannot be separated)

REF		Cap description	Septum description	Hardness	Thickness	Pack of
702026		N 9 PP bonded screw cap, blue, center hole	Silicone beige / PTFE white	45° shore A	1.3 mm	100 / PE bag
702027		N 9 PP bonded screw cap, blue, center hole	Silicone beige / PTFE white, slit	45° shore A	1.3 mm	100 / PE bag

Crimp neck vials and inserts N 11

702885	702892	702813	702818
			
1.5 mL	1.5 mL	0.2 mL	0.1 mL
11.6 x 32 mm	11.6 x 32 mm	6 x 31 mm	5.7 x 29 mm
clear, label + scale	amber, label + scale	clear	clear
flat bottom	flat bottom	conical, 15 mm tip	with plastic spring
100 / PP box	100 / PP box	100 / PE bag	100 / PE bag

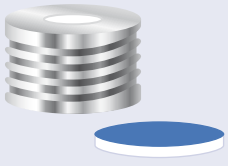
Ready assembled crimp closures N 11, plain crimp caps N 11 and single septa N 11

REF		Cap description	Septum description	Hardness	Thickness	Pack of
70256		N 11 aluminium crimp cap, silver, center hole	Natural rubber / Butyl red-orange / TEF colorless	45° shore A	1.0 mm	100 / PE bag
70288		N 11 aluminium crimp cap, silver, center hole	Silicone white / PTFE red	40° shore A	1.3 mm	100 / PE bag
702823		N 11 aluminium crimp cap, silver, center hole	Silicone white / PTFE blue, cross-slit	40° shore A	1.5 mm	100 / PE bag
702995		N 11 aluminium crimp cap, silver, center hole	PTFE red / Silicone white / PTFE red	40° shore A	1.0 mm	100 / PE bag
702879		N 11 magnetic crimp cap, gold, center hole	Silicone white / PTFE red	55° shore A	1.0 mm	100 / PE bag

Crimping tools N 11

REF	Type of crimping tool	Pack of
735111	Manual crimper, height adjustable, for 11 mm aluminium crimp caps	1 / box
735911	Manual decapper for 11 mm aluminium crimp caps	1 / box

Ready assembled magnetic screw closures N 18

REF		Cap description	Septum description	Hardness	Thickness	Pack of
702055		N 18 magnetic screw cap, silver, center hole	Silicone white / PTFE blue	55° shore A	1.5 mm	100 / PE bag

Vials and Caps

Screw neck Headspace vials N 18

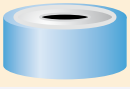
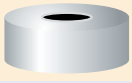
702826

20 mL
22.5 x 75.5 mm
clear
rounded bottom
100 / PP box

Crimp neck vials N 20: 20 and 50 mL

REF 70254	REF 702261	REF 702263
		
PerkinElmer	DANI, Agilent	CTC, Varian
20 mL	20 mL	20 mL
23 x 75.5 mm	22.5 x 75.5 mm	22.5 x 75.5 mm
clear	clear	clear
rounded bottom	flat bottom	rounded bottom
bevelled HS crimp neck	flat DIN crimp neck	flat DIN crimp neck
100 / PP box	100 / PP box	100 / PP box

Ready assembled crimp closures, plain crimp caps and single septa N 20

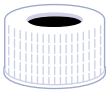
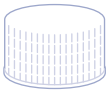
REF		Cap description	Septum description	Hardness	Thickness	Pack of
		**Center hole caps**				
702775		N 20 aluminium crimp cap, silver, center hole	Butyl light grey / PTFE dark grey	50° shore A	3 mm	100 / PE bag
70234		N 20 aluminium crimp cap, silver, center hole	Butyl dark grey / PTFE grey (only centrically laminated, typically called Pharma-Fix)	50° shore A	3 mm	100 / PE bag
702817		N 20 aluminium crimp cap, silver, center hole	Silicone blue / PTFE colorless	40° shore A	3 mm	100 / PE bag
		**Bi-metal crimp caps**				
702838		N 20 bi-metal crimp cap, blue/silver, center hole	Butyl light grey / PTFE dark grey	50° shore A	3 mm	100 / PE bag
702834		N 20 bi-metal crimp cap, blue/silver, center hole	Silicone blue / PTFE colorless	40° shore A	3 mm	100 / PE bag
		**Magnetic crimp caps**				
702929		N 20 magnetic crimp cap, silver, center hole 8 mm	Silicone blue / PTFE colorless	40° shore A	3 mm	100 / PE bag

Screw neck vials N 24 (EPA)

702021	702022	702023	702024
			
20 mL	20 mL	40 mL	40 mL
27.5 x 57 mm	27.5 x 57 mm	27.5 x 95 mm	27.5 x 95 mm
clear, flat bottom	amber, flat bottom	clear, flat bottom	amber, flat bottom
100 / PP box	100 / PP box	100 / PP box	100 / PP box

Bonded screw closures N 24, plain screw caps N 24 and single septa N 22

(images scale 1:2)

702058	702059	702060	702061	702062
Bonded screw closures N 24 (septa firmly connected with the cap; cannot be separated)		**Plain screw caps N 24**		**Septum N 22**
				
N 24 PP bonded screw cap, white, center hole	N 24 PP bonded screw cap, white, closed top	N 24 PP screw cap, white, center hole	N 24 PP screw cap, white, closed top	
Silicone white / PTFE beige, 45° shore A, 3.2 mm	Silicone white / PTFE beige, 45° shore A, 3.2 mm	no liner	no liner	Silicone natural / PTFE beige, 45° shore A, 3.2 mm
100 / PE bag	100 / PE bag	100 / PE bag	100 / PE bag	100 / PE bag

Crimping tools N 20

REF	Type of crimping tool		Pack of
735120	Manual crimper, height adjustable, for 20 mm aluminium crimp caps		1 / box
735920	Manual decapper for 20 mm aluminium crimp caps		1 / box

HPLC

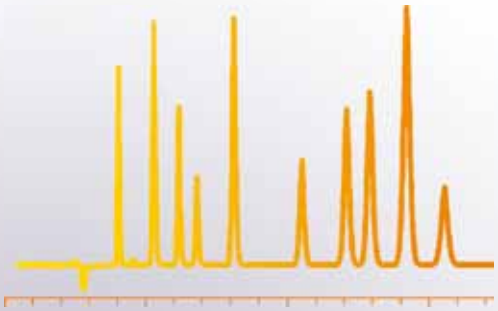
GC

TLC

SPE & Flash

Syringe Filters

Vials



MACHEREY-NAGEL

. . . we Meet your Needs

Made by German Quality MACHEREY-NAGEL

local distributor

MZ ANALYSENTECHNIK

AUTHORIZED DISTRIBUTOR

MZ-Analysentechnik GmbH, Barcelona-Allee 17• D-55129 Mainz
Tel +49 6131 880 96-0, Fax +49 6131 880 96-20
e-mail: info@mz-at.de, www.mz-at.de

Environmental e2/2/0/10.2011 BV
Printed in Germany
KATEN200087

www.mn-net.com

MACHEREY-NAGEL

MACHEREY-NAGEL GmbH & Co. KG · Neumann-Neander-Str. 6–8 · 52355 Düren · Germany

Germany and international:
Tel.: +49 24 21 969-0
Fax: +49 24 21 969-199
E-mail: info@mn-net.com

Switzerland:
MACHEREY-NAGEL AG
Tel.: +41 62 388 55 00
Fax: +41 62 388 55 05
E-mail: sales-ch@mn-net.com

France:
MACHEREY-NAGEL EURL
Tel.: +33 388 68 22 68
Fax: +33 388 51 76 88
E-mail: sales-fr@mn-net.com

USA:
MACHEREY-NAGEL Inc.
Tel.: +1 484 821 0984
Fax: +1 484 821 1272
E-mail: sales-us@mn-net.com

MN Since 1911