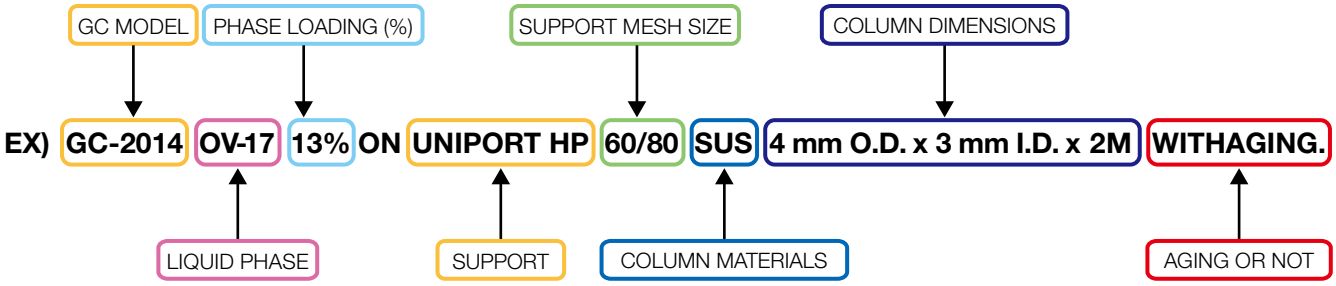
CONSUMABLES AND SUPPLIES

GC PACKED COLUMNS

When you inquire packed columns, please be sure to specify the information as following example.



Operating Precautions

Column precautions for use:

- When analysis or conditioning the column, do not set the oven temperature exceeding the maximum temperature. It may induce the column deterioration.

- Purge the packed column with enough carrier gas before start heating. Use inert- gas for carrier gas in analysis such as Nitrogen (N_2), Helium (He), Argon (Ar), which are purer than 99.99 %.

- Especially Polyester or Polyethylene glycol type packing materials are easily oxidized by air. If the column still contains air and the temperature is increased, it may cause damage and a deterioration of the column performance. (Ex. purge the column with carrier gas at least 1 hour, then raise the temperature with 1 ˚C / min. rate)

- When conditioning, do not connect the outlet of the column to the detector. It may contaminate the detector with eluted liquid phase from the column.

Code	Support	Commercially Available
S1A	Siliceous earth for gas chromatography has been flux-calcined by mixing diatomite with Na_2CO_3 flux and calcining above 900 °C. The siliceous earth is acid-washed, then water-washed until neutral, but not base-washed. The siliceous earth may be silanized by treating with an agent such as dimethyldichlorosilane to mask surface silanol groups.	Uniport HP Chromosorb W HP Chromosorb W AW DMCS
S1AB	The siliceous earth as described above is both acid- and base-washed.	Chromosorb W HP
S1C	A support prepared from crushed firebrick and calcined or burned with a clay binder above 900 °C with subsequent acid-wash. It may be silanized.	Uniport C, Uniport CS Chromosorb P AW Chromosorb P AW DMCS
S1NS	The siliceous earth is untreated.	Celite 545 etc.
S3	Copolymer of ethylvinylbenzene and divinylbenzene having a nominal surface area of 500 to 600 m^2 per g and an average pore diameter of 0.0075 µm.	Porapak Q Hayesep Q
S4	Styrene-divinylbenzene copolymer with aromatic - O and – N groups, having a nominal surface area of 400 to 600 m^2 per g and an average pore diameter of 0.0076 µm.	Porapak R Hayesep R
S5	40- to 60-mesh, high-molecular weight tetrafluoroethylene polymer.	Flusin T, Flusin T6 Chromosorb T
S6	Styrene-divinylbenzene copolymer having a nominal surface area of 250 to 350 m^2 per g and an average pore diameter of 0.0091 µm.	Chromosorb 102* Porapak P Hayesep P
S7	Graphitized carbon having a nominal surface area of 12 m^2 per g.	Unicarbon A Carbopack C
S8	Copolymer of 4 - vinyl - pyridine and styrene - divinylbenzene.	Porapak S Hayesep S
S9	A porous polymer based on 2,6-diphenyl-p-Phenylene oxide.	Tenax TA
S10	A highly polar cross-linked copolymer of acrylo-nitrile and divinylbenzene.	Hayesep C
S11	Graphitized carbon having a nominal surface area of 100 m^2 per g modified with small amounts of petrolatum and polyethylene glycol Compound.	3 % SP1500/Carbopack B
S12	Graphitized carbon having a nominal surface area of 100 m^2 per g.	Carbopack B

★: Items are not available.

Code	Phases	Commercially Available
G1	Dimethylpolysiloxane oil	OV-101
G2	Dimethylpolysiloxane gum	OV-1, SE-30
G3	50 % Phenyl-50 % methylpolysiloxane	OV-17
G4	Diethylene glycol succinate polyester	DEGS
G5	3-Cyanopropylpolysiloxane	OV-275
G6	Trifluoropropylmethylpolysiloxane	OV-210, DC-QF-1
G7	50 % 3-Cyanopropyl-50 %phenylmethylsilicone	OV-235
G8	80 % Bis (3-Cyanopropyl)-20 % 3-cyanopropylphenylpolysiloxane	OV-255
G9	Methylvinylpolysiloxane	OV-1
G11	Bis (2-ethylhexyl) sebacate polyester	DOS
G13	Sorbitol	Sorbitol
G14	Polyethylene glycol (av.mol.wt. of 950 to 1050)	PEG-1000
G15	Polyethylene glycol (av.mol.wt. of 3000 to 3700)	PEG-4000
G16	Polyethylene glycol compound (av. mol. wt. about 15,000). A high molecular weight compound of polyethylene glycol with a diepoxide linker. Available commercially as Polyethylene Glycol Compound 20M, or as Carbowax 20 M, from suppliers of chromatographic reagents.	PEG-20M
G17	75 % Phenyl – 25 % methylpolysiloxane	OV-25
G18	Polyalkylene glycol	Ucon LB-550X
G19	25 % Phenyl – 25 % Cyanopropyl – 50 % methylsilicone	OV-225
G20	Polyethylene glycol (av.mol.wt. of 380 to 420)	PEG-400
G21	Neopentyl glycol succinate	NPGS
G22	Bis (2-ethylhexyl) phthalate	DOP
G23	Polyethylene glycol adipate	PEGA
G24	Diisodecyl phthalate	DIDP
G25	Polyethylene glycol compound TPA. A high molecular weight compound of a polyethylene glycol and a diepoxide that is esterified with terephtharic acid. Available commercially as Carbowax 20M-TPA from supplier of chromatographic reagents.	PEG-20M TPA
G26	25 % 2-Cyanoethyl – 75 % methylpolysiloxane	OV-225
G27	5 % Phenyl – 95 % methylpolysiloxane	SE-52 etc.
G28	25 % Phenyl – 75 % methylpolysiloxane	DC-550
G29	3,3'-Thiodipropionitrile	TDPN
G30	Tetraethylene glycol dimethyl ether	BMEE
G31	Nonylphenoxypoly (ethyleneoxy) ethanol (av. Ethyleneoxy chain length is 30); Nonoxynol 30	Igepal CO-880
G32	20 % Phenylmethyl – 80 % dimethylpolysilicone	OV-7
G34	Diethylene glycol succinate polyester stabilized with phosphoric acid.	DEGS + H_3PO_4
G35	A high molecular weight compound of polyethylene glycol and a diepoxide that is esterified with nitroterephthalic acid.	FFAP (Unisole400)
G36	1 % Vinyl – 5 % phenylmethylpolysiloxane	SE-54 etc.
G39	Polyethylen glycol (av.mol.wt. about 1500)	PEG-1500
G40	Ethylene glycol adipate	EGA
G41	Phenylmethyldimethylpolysiloxane (10 % Phenyl substituted)	OV-3
G44	2 % low molecular weight petroleum hydrocarbon grease and 1 % solution of potassium hydroxide.	Apiezon Grease L + KOH
G45	Divinylbebzebe-ethylene glycol-dimethylacrylate	Porapak N, Hayesep N

Stationary Phases	Temp. °C Min./Max.
A	
Apiezon grease H	20/300
Apiezon grease L	50/300
Apiezon grease M	50/275
Apiezon grease N	50/250
Apiezon grease T	20/250
APS-201	/150
4, 4'-Azoxydianisole	/140
p, p'-Azoxydiphenetole (4, 4'-Azoxydiphenetole)	135/150
B	
Bentone 34 (Organic-aluminium silicate deriv.)	50/200
Bentone 34 + SP1200	50/175
Benzyl cyanide	20/50
Bis (2-methoxyethyl) adipate (BMEA)	20/80
C	
Citroflex A-4 (Acetyl tributyl citrate)	-25/180
D	
Daifl oil #10	0/100
Daifl oil #100	0/120
Di-n-butyl maleate (DBM)	20/50
Di-n-butyl phthalate (DBP)	20/100
Diisodecyl phthalate (DIDP)	20/150
Di-n-decyl phthalate (DNDP)	20/150
Diethylene glycol adipate (DEGA)	20/225
Diethyleneglycol succinate (DEGS)	20/225
Diglycerol	20/150
Dinonyl phthalate (DNP)	20/150
Dioctyl phthalate (DOP) / [Di (2-ethylhexyl) phthalate]	20/150
Dioctyl sebacate (DOS) / [Di (2-ethylhexyl) sebacate]	0/125
Dodecylbenzene sulfonic acid sodium salt (ABS)	20/150
E	
ECNSS-M (Organo silicone polymer)	50/220
EGSS-X (Organo silicone polymer)	90/225
F	
FFAP (Free Fatty Acid Phase)	50/275
H	
Halocarbon oil 14-25	20/150
n-Hexadecane	20/50
I	
Igepal CO-880 [Nonylphenoxy poly (ethyleneoxy) ethanol]	80/200
K	
Kel F oil #10	10/100
KRYTOX 143AC	/280
N	
Neopentyl glycol adipate (NPGA)	50/225
Neopentyl glycol isophthalate	50/225
Neopentyl glycol sebacate	50/225
Neopentyl glycol succinate (NPGS)	50/225

[■D/S] Deleterious substance

Stationary Phases	Temp. °C Min./Max.
O	
n-Octadecane	30/60
OV-1 (dimethyl silicone gum)	50/350
OV-3 (10 % phenyl methyl silicone)	20/350
OV-7 (20 % phenyl methyl silicone)	20/350
OV-11 (35 % phenyl methyl silicone)	30/350
OV-17 (50 % phenyl methyl silicone)	20/340
OV-22 (65 % phenyl methyl silicone)	20/300
OV-25 (75 % phenyl methyl silicone)	20/300
OV-61 (33 % phenyl methyl silicone)	20/350
OV-73 (diphenyl dimethyl silicone)	20/325
OV-101 (dimethyl silicone fluid)	20/350
OV-105 (cyanopropyl silicone)	20/270
OV-202 (trifluoropropyl methyl silicone)	0/250
OV-210 (trifluoropropyl methyl silicone)	20/275
OV-215 (trifluoropropyl methyl silicone)	20/250
OV-225 (25 % phenyl 25 % cyanopropyl silicone)	20/280
OV-275 (cyano silicone)	20/250
OV-330 (silyl wax)	30/250
OV-351 (similar to FFAP)	50/270
OV-1701 (dimethyl phenylcyano silicone)	20/340
β, β'- Oxydipropionitrile (β, β'-ODPN) [■D/S]	20/100
PEG 200 (Polyethylene glycol 200)	20/100
PEG 300 (Polyethylene glycol 300)	20/100
PEG 400 (Polyethylene glycol 400)	20/100
PEG 600 (Polyethylene glycol 600)	35/125
PEG 1000 (Polyethylene glycol 1000)	40/150
PEG 1500 (Polyethylene glycol 1500)	40/150
PEG 1540 (Polyethylene glycol 1540)	50/150
PEG 4000 (Polyethylene glycol 4000)	60/170
PEG 6000 (Polyethylene glycol 6000)	60/190
PEG 6000-P (Polyethylene glycol 6000-P)	60/210
PEG 20M (Polyethylene glycol 20M)	60/230
PEG 20M-P (Polyethylene glycol 20M-P)	60/250
PEG 20M-TPA (Polyethylene glycol 20M-TPA)	60/250
Polyphenyl ether 5ring (PPE-5ring) (OS-124)	10/200
Propylene carbonate	0/50
Propylene glycol adipate	10/225
Propylene glycol sebacate	10/225
Propylene glycol succinate	10/225
Q	
Quadrol [N, N, N', N'-tetrakis (2-hydroxy propyl) ethylene diamine]	10/150
R	
Reoplex 400	10/225

Stationary Phases	Temp. °C Min./Max.
S	
Sebaconitrile [■D/S]	-10/90
Silicone DC-11	50/300
Silicone DC-200 (dimethyl silicone)	10/250
Silicone DC-550 (25 % phenyl methyl silicone)	10/250
Silicone DC-QF-1 (FS-1265) (50 % trifluoropropyl methyl silicone)	10/250
Silicone GS-1 (dimethyl silicone)	50/350
Silicone GS-17 (50 % phenyl methyl silicone)	20/340
Silicone GS-101 (dimethyl silicone)	20/350
Silicone GS-210 (50 % trifluoropropyl methyl silicone)	20/275
Silicone GS-275 (cyano silicone)	20/250
Silicone HV grease	/300
Silicone KF-96 (dimethyl silicone)	30/300
Silicone SE-30 (dimethyl silicone gum)	50/300
Silicone SE-30 GC grade	50/350
Silicone SE-52 (5 % phenyl methyl silicone)	50/300
Silicone SE-54 (1 % vinyl 5 % phenyl silicone)	100/300
Silicone SF-96 (methyl silicone fluid)	0/250
Silicone W-96 (methyl silicone)	20/300
Silicone W-98 (methyl silicone)	20/300
Sorbitol (d-Sorbitol)	100/150
Squalane	20/150
T	
Tetraethylene glycol dimethyl ether (BMEE)	20/80
Tetraethylene pentamine (TEP) [■D/S]	20/80
Tetrahydroxyethyl ethylenediamine (THEED)	10/180
Tricresyl phosphate (TCP)	0/125
1,2,3-Tris (2-cyanoethoxy) propane (TCEP) [■D/S]	30/150
Triton X-100	20/190
Triton X-305	20/200
U	
Ucon oil 50HB 2000	20/200
Ucon oil LB 550X	20/200

[■D/S] Deleterious substance

Uniport Series

Supports	Mesh	Features
Uniport B	30/60	A diatomaceous earth prepared for GC. Surface metals have been carefully eliminated by a special process and due to no catalytic activity it offers excellent results.
	60/80	
	80/100	
	100/120	
Uniport HP	60/80	Uniport HP is subjected to special silanization. This is the most inert silanized support on the market today. As hydrogen chloride generated in the silanization process is completely eliminated, this support is ideal for ECD applications.
	80/100	
	100/120	
Uniport HPS	60/80	Uniport HPS is specially treated to make it suitable for analysis of weakly basic compounds and pesticides.
	80/100	
	100/120	
Uniport CS	30/60	Uniport C is specially silanized.
	60/80	
	80/100	
	100/120	
Uniport R	60/80	Ideal for the analysis of highly polar substances such as alcohols and amines. As this support deteriorates when kept under high temperature for long periods. It is advised not to use it above 250 °C.
	80/100	
	100/120	
Uniport S	60/80	Diatomaceous support with acidic surface for analysis of acidic or weakly acidic compounds such as cresol.
	80/100	

Gasport Series

Supports	Mesh	Type	Application	Packing Density
Gasport A	60/80	Diatomaceous earth	General purpose	0.26 g/mL
	80/100			
Gasport B	60/80	Diatomaceous earth clayware	Gases, Hydrocarbons	0.38 g/mL
	80/100			
Gasport H	60/80	Silanized diatomaceous earth	High volatile compounds (steroids, plasticizer)	0.26 g/mL
	80/100			
Gasport AS	60/80	Diatomaceous earth	Low fatty acids	0.26 g/mL
	80/100			

Flusin Series

Supports	Mesh	Cat.No.	Features	Type	Packing Density	Max.Temp.
Flusin T6	30/60	1001-32203	Despite of high operating temperature, its mechanical strength is weak.	Screened Teflon	0.58 g/mL	200 °C
Flusin GU	30/60	1001-32503	-ditto-	Glass Beads	1.5 g/mL	400 °C
	60/80	1001-32506				
	80/100	1001-32508				
Flusin GH	30/60	1001-32603	-ditto-	Silanized GU	1.5 g/mL	400 °C
	60/80	1001-32606				
	80/100	1001-32608				
Flusin P	30/60	1001-32303	An inert acid support. Suitable for analysis of free acids.	Terephthalic Acid	0.5 g/mL	185 °C
	60/80	1001-32306				

Chromosorb Series

Chromosorb W *(Note: Only Packed Columns Can be Supplied.)*

Treatment	Mesh	Surface Area	Packing Density
NAW	30/60	0.29 m^2/mL	0.24 g/mL
	60/80		
	80/100		
	100/120		
AW	30/60		
	60/80		
	80/100		
	100/120		
AW DMCS	30/60		
	60/80		
	80/100		
	100/120		
HP	60/80		
	80/100		
	100/120		

Chromosorb P *(Note: Only Packed Columns Can be Supplied.)*

Treatment	Mesh	Surface Area	Packing Density
NAW	30/60	1.88 m^2/mL	0.47 g/mL
	60/80		
	80/100		
	100/120		
AW	30/60		
	60/80		
	80/100		
	100/120		
AW DMCS	60/80		
	80/100		
	100/120		

Celite® Series

Chemical composition of Celite (%)	
SiO_2	89 ~ 90.5
Al_2O_3	4 ~ 5.5
Fe_2O_3	1.4 ~ 1.6
CaO	0.4 ~ 0.7
MgO	0.5 ~ 0.6

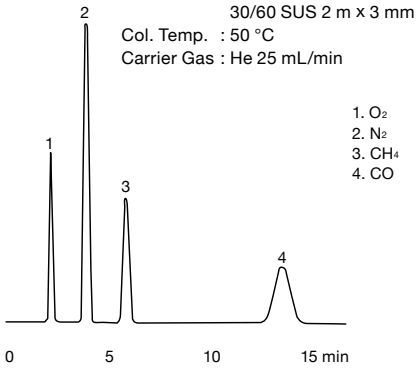
Treatment	Mesh	Surface Area	Packing Density
Celite 545 (heat treated)	30/60	0.28 m^2/mL	0.56 g/mL
	60/80		
	80/100		
	100/120		
Celite 545 SK (acid washed)	30/60		
	60/80		
	80/100		
	100/120		
Celite 545 SK DMCS (DMCS-silanized)	30/60		
	60/80		
	80/100		
	100/120		

Description	Max.Temp.	Mesh	Cat.No. 100 mL	Cat.No. 500 mL	Main Applications
Molecular Sieve 5A	350 °C	30/60	1001-11503	1001-11553	Separation of O_2, N_2, CH_4, CO_2, H_2, Xe and Kr. Separation of Ar and O_2 at low temp.
		60/80	1001-11506	1001-11556	
		80/100	1001-11508	1001-11558	
Molecular Sieve 13X	350 °C	30/60	1001-11603	1001-11653	Separation of O_2, N_2, CO, CH_4, Faster retention time than MS5A
		60/80	1001-11606	1001-11656	
		80/100	1001-11608	1001-11658	
Molecular Sieve 13X-S	350 °C	60/80	1001-11686	–	Detection of Trace CO, PID
Active Carbon	200 °C	30/60	1001-13003	1001-13053	City gas, CO, CO_2
		60/80	1001-13006	1001-13056	
		80/100	1001-13008	1001-13058	
Silica Gel	200 °C	30/60	1001-14003	1001-14053	Separation of CH_4, C_2H_6, C_2H_4, CO_2
		60/80	1001-14006	1001-14056	
		80/100	1001-14008	1001-14058	

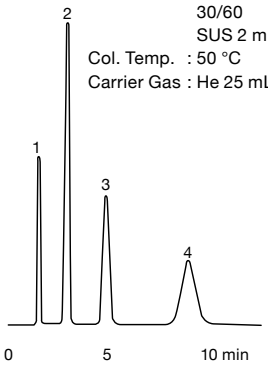
Comparision Data between Molecular Sieve A and 13X

Column : Molecular Sieve 5A 30/60 SUS 2 m x 3 mm I.D.
Col. Temp. : 50 °C
Carrier Gas : He 25 mL/min

1. O_2
2. N_2
3. CH_4
4. CO



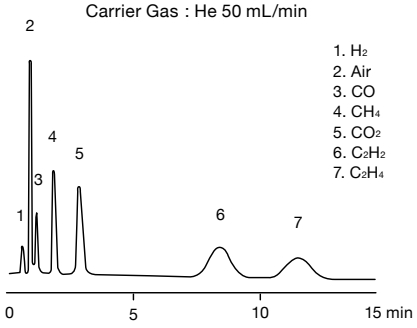
Column : Molecular Sieve 13X 30/60 SUS 2 m x 3 mm I.D.
Col. Temp. : 50 °C
Carrier Gas : He 25 mL/min



City Gas Analysis on Active Carbon

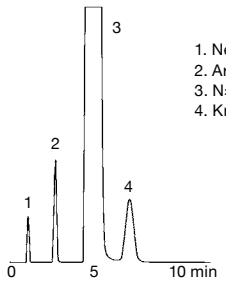
Column : Active Carbon 30/60 SUS 2 m x 3 mm I.D.
Col. Temp. : 100 °C
Carrier Gas : He 50 mL/min

1. H_2
2. Air
3. CO
4. CH_4
5. CO_2
6. C_2H_2
7. C_2H_4



Inert Gases

1. Ne 0.5 %
2. Ar 0.5 %
3. N_2 97.5 %
4. Kr 1.5 %

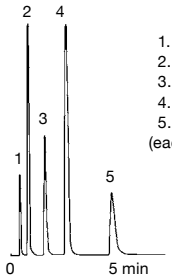


Column : Molecular Sieve 5A 60/80 SUS 3 m x 3 mm I.D.
Col.Temp. : 40 °C
Carrier Gas : He 21 mL/min
Detector : TCD 120 mA x 4
Sample Size : 1 mL

Trace Amount of CO

1. H_2
2. O_2
3. N_2
4. CH_4
5. CO

(each 10 ppm in He)

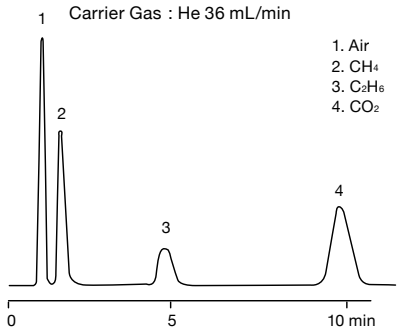


Column : Molecular Sieve 13X-S 60/80 SUS 2 m x 3 mm I.D.
Col.Temp. : 50 °C
Carrier Gas : He 50 mL/min
Detector : PID 750 V 10 x 32
Sample Size : 1 mL

Gas Analysis with Silicagel

Column : Silicagel 60/80 SUS 3 m x 3 mm I.D.
Col. Temp. : 80 °C
Carrier Gas : He 36 mL/min

1. Air
2. CH_4
3. C_2H_6
4. CO_2

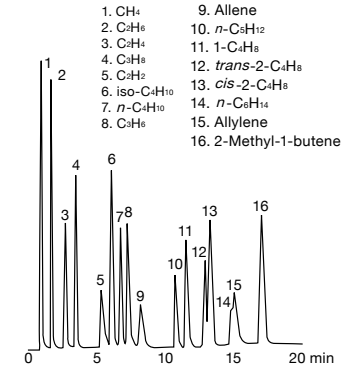


Unibeads Series

Unibeads series consists of spherical porous silica beads with different characteristics. Unibeads 1S, 2S and 3S are spherical silica beads with pores size of 25 Å, 70 Å, 100 Å. Unipak S is a spherical shape silica beads useful for analysis of Ethane, Ethylene, Acetylene, and also higher carbon number by temp. programmed analysis.

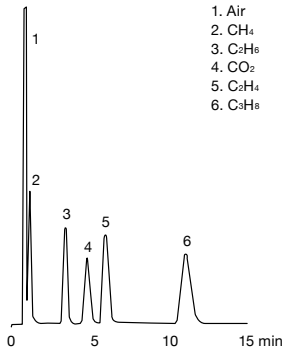
Description	Mesh	Qty.	Cat.No.	Characteristics			
				Comp.	Packing density	Pore size	Max.Temp.
Unibeads 1S	30/60	100 mL	1001-15303	SiO_2	0.71	25 Å	200 °C
	60/80		1001-15306				
	80/100		1001-15308				
Unibeads 2S	30/60	100 mL	1001-15403	SiO_2	0.53	70 Å	200 °C
	60/80		1001-15406				
	80/100		1001-15408				
Unibeads 3S	30/60	100 mL	1001-15503	SiO_2	0.37	100 Å	200 °C
	60/80		1001-15506				
	80/100		1001-15508				
Unipak S	100/150	50 mL	1001-16200	SiO_2	–	–	200 °C

Unipak S



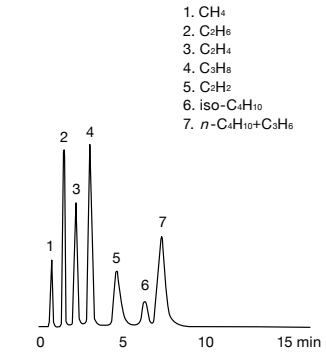
Column : Unipak S 100/150 SUS 2 m x 3 mm I.D.
Col.Temp. : 40 - 120 °C (5 °C/min)
Carrier Gas : He 40 mL/min
Detector : FID 10^2 x 4
Sample Size : 1 mL

Unibeads 1S



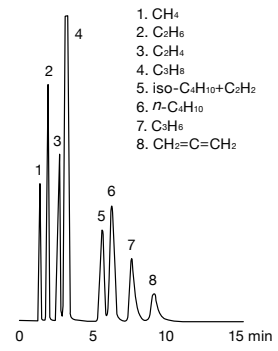
Column : Unibeads 1S 60/80 SUS 2 m x 3 mm I.D.
Col.Temp. : 70 °C
Carrier Gas : He 40 mL/min
Detector : TCD 120 mA x 8
Sample Size : 0.2 mL

Unibeads 2S



Column : Unibeads 2S 60/80 SUS 2 m x 3 mm I.D.
Col.Temp. : 70 °C
Carrier Gas : N_2 26 mL/min
Detector : FID 10 x 64
Sample Size : 0.1 mL

Unibeads 3S



Column : Unibeads 3S 60/80 SUS 2 m x 3 mm I.D.
Col.Temp. : 50 °C
Carrier Gas : N_2 16 mL/min
Detector : FID 10^2 x 64
Sample Size : 0.4 mL

Gaskuropack Series

Gaskuropack 54

Gaskuropack 54 consists of porous polymer beads made of a poly (styrene-divinylbenzene) copolymer with a high degree of bridging. This packing has been specially treated to confer high thermal stability, and has little batch variation. As it is a porous polymer, it is suitable for work environment determinations which are almost free from ghost peaks due to water or air. If coated with a liquid phase, it can in some cases permit analyses which were difficult to carry out with diatomaceous earths.

Gaskuropack 55

Gaskuropack 55 is a porous polymer type packing which makes use of the advantages of Gaskuropack 54, and was specially designed to analyze traces of glycols. It is also suitable for solvent analysis; see table of solvent retention times.

Description	Max. Temp.	Cat.No.
Gaskuropack 54 60/80	250 °C	1002-45406
Gaskuropack 54 80/100	250 °C	1002-45408
Gaskuropack 54-DA 60/80	230 °C	1002-45430
Unisole 10T 0.1 % Gaskuropack 54 60/80	250 °C	1002-45440
FFAP 20 % Gaskuropack 54 80/100	230 °C	1002-45450
Gaskuropack 55 60/80	250 °C	1002-45506
Gaskuropack 55 80/100	250 °C	1002-45508
Gaskuropack 56 60/80	220 °C	1002-45606
Gaskuropack 56 80/100	220 °C	1002-45608

Gaskuropack 56

Gaskuropack 56 has an acidic surface and is thus suited to the analysis of acidic samples. It can also be used for work environment determinations with little problem of ghost peaks due to air or water.

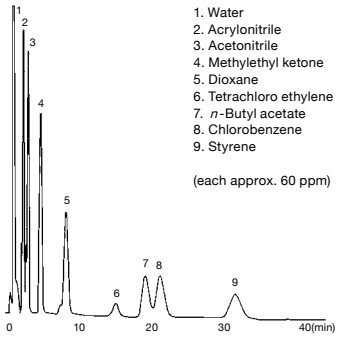
Low Hydrocarbon Retention Time Table by Gaskuropack 54

Condition	Gaskuropack 54 80/100 SUS 2 m x 3 mm I.D. He 45 mL/min Column Temp. 40 °C											
Compounds	O_2	N_2	Ar	CO	CO_2	CH_4	C_2H_6	C_2H_4	C_2H_2	C_3H_8	C_3H_6	H_2O
Retention time (min)	0.45	0.45	0.45	0.45	1.17	0.62	2.95	1.92	2.12	12.92	9.85	3.67

RT.Index 190 °C of McReynolds samples

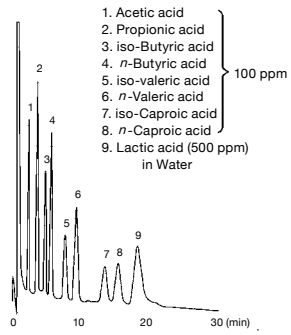
Samples	RT.Index	Samples	RT.Index	Samples	RT.Index
1-Butanol	622	Benzene	650	2-Pentanone	661
Nitropropane	700	Pyridine	715	2-Methyl-2-pentanol	732
2-Octyne	843	–	–	–	–

Solvents in Water



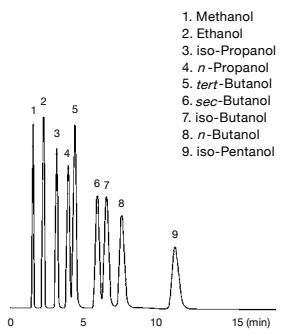
Column : Gaskuropack 54 60/80 Glass 2 m x 3 mm I.D.
Col.Temp. : 200 °C
Carrier Gas : He 25 mL/min
Detector : FID 10 x 4
Sample Size : 4 µL

Free Fatty Acids and Lactic Acid



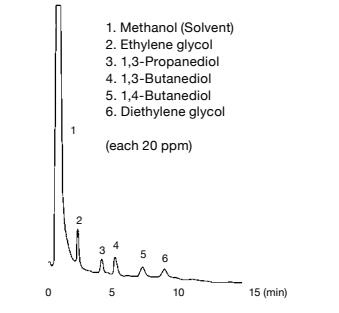
Column : FFAP 20 % Gaskuropack 54 80/100 Glass 2 m x 3 mm I.D.
Col.Temp. : 200 °C
Carrier Gas : N_2 44 mL/min
Detector : FID 10 x 8
Sample Size : 1 µL

Alcohols



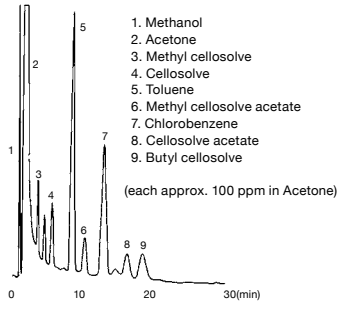
Column : Gaskuropack 54 80/100 SUS 2 m x 3 mm I.D.
Col.Temp. : 200 °C
Carrier Gas : N_2 28 mL/min
Detector : FID
Sample Size : 0.2 µL

Glycols



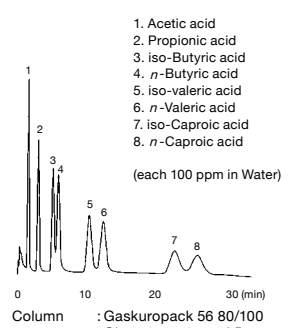
Column : Gaskuropack 55 60/80 Glass 2 m x 3 mm I.D.
Col.Temp. : 230 °C
Carrier Gas : N_2 46 mL/min
Detector : FID 1 x 64
Sample Size : 2 µL

Cellosolves



Column : Gaskuropack 55 60/80 Glass 2 m x 3 mm I.D.
Col.Temp. : 200 °C
Carrier Gas : N_2 30 mL/min
Detector : FID 10 x 16
Sample Size : 2 µL

Isolation Fatty Acid in Water



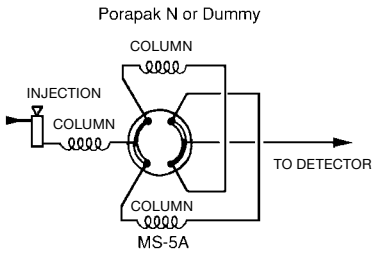
Column : Gaskuropack 56 80/100 Glass 1 m x 3 mm I.D.
Col.Temp. : 200 °C
Carrier Gas : N_2 18 mL/min
Detector : FID 10 x 16
Sample Size : 3 µL

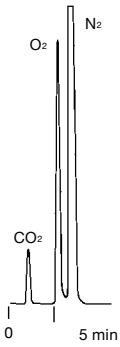
Porapak®

Type	Max.Temp.	Mesh	Weight	Cat.No.	Surface Area	Bulk Density	Applications	Polymer Type
P	250	50/80	20 g	1002-11105	100 ~ 200 m^2/g	0.27 g/cm^2	Non-Polar Glycols, Alcohols	Stylene-Divinylbenzene
		80/100		1002-11108				
		100/120		1002-11110				
P-S	250	50/80	20 g	1002-11205	100 ~ 200 m^2/g	0.27 g/cm^2	Aldehydes, Glycols	Stylene-Divinylbenzene
		80/100		1002-11208				
		100/120		1002-11210				
Q	250	50/80	26 g	1002-11305	500 ~ 600 m^2/g	0.34 g/cm^2	Most widely used Hydrocarbons, Organic compounds in water	Ethylvinylbenzene-Divinylbenzene
		80/100		1002-11308				
		100/120		1002-11310				
Q-S	250	50/80	26 g	1002-11405	500 ~ 600 m^2/g	0.34 g/cm^2	Q's silane finished Organic acids, Polar compounds	Ethylvinylbenzene-Divinylbenzene
		80/100		1002-11408				
		100/120		1002-11410				
R	250	50/80	24 g	1002-11505	450 ~ 600 m^2/g	0.3 g/cm^2	Moderate polarity Esters, Nitriles etc.	Vinylpyrollidone
		80/100		1002-11508				
		100/120		1002-11510				
S	250	50/80	26 g	1002-11605	300 ~ 450 m^2/g	0.35 g/cm^2	Alcohols, Carbonyl, Halogen compounds.	Vinylpyridine
		80/100		1002-11608				
		100/120		1002-11610				
N	190	50/80	29 g	1002-11705	225 ~ 350 m^2/g	0.38 g/cm^2	Hydrocarbons, Ammonia	DVB-EVB-Ethyleneglycol dimethacrylate
		80/100		1002-11708				
		100/120		1002-11710				
T	190	50/80	31 g	1002-11805	250 ~ 350 m^2/g	0.43 g/cm^2	Highest Polarity Amines	Ethyleneglycol dimethacrylate
		80/100		1002-11808				
		100/120		1002-11810				

Use of Column Switch

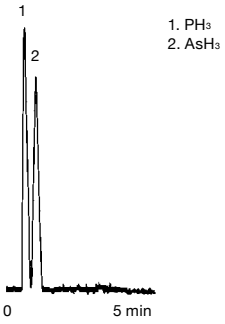
Analysis of O_2 , N_2 , CO_2





Column : Porapak N 50/80 SUS 2 m x 3 mm I.D.
+Molecular Sieve 5A 60/80 SUS 1 m x 3 mm I.D.
Col.Temp. : 40 °C

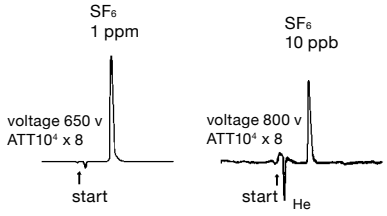
Analysis of PH_3, AsH_3



1. PH_3
2. AsH_3

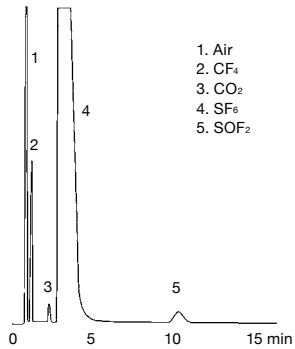
Column : Porapak QS 100/120 SUS 0.5 m x 2 mm I.D.
Col.Temp. : 30 °C
Carrier Gas : N_2 500 kPa
Detector : PID (10.2 eV) 10^2 x 2
Sample Size : 2 mL

Analysis of SF_6



Column : Porapak Q 50/80
PTFE 2 m x 3 mm I.D.
Col.Temp. : 50 °C
Carrier Gas : N_2 40 mL/min
Detector : FPD
Sample Size : 1 mL

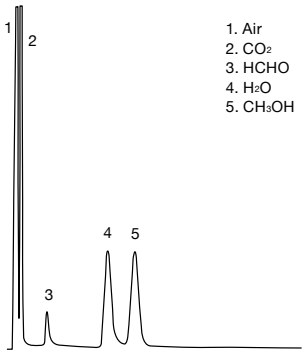
Analysis of CF_4, SF_6, SOF_2



1. Air
2. CF_4
3. CO_2
4. SF_6
5. SOF_2

Column : Porapak Q 50/80
SUS 3 m x 3 mm I.D.
Col.Temp. : 50 °C
Carrier Gas : He 32 mL/min
Detector : TCD 120 mA
Sample Size : 1 mL

Analysis of Formalin



1. Air
2. CO_2
3. HCHO
4. H_2O
5. CH_3OH

Column : Porapak T 50/80 SUS 2 m x 3 mm I.D.
Col.Temp. : 120 °C
Carrier Gas : He 24 mL/min
Detector : TCD 120 mA x 4 0.6 mL
(Head space gas)

Porapak® Retention Time Table (Unit : Min.)

Analytical conditions : Stainless steel column 80/100 mesh 1 m x 2.3 mm I.D. 30 °C He 25 mL/min. TCD

Compounds	P	Q	R	S	N	T
Oxygen	0.23	0.24	0.24	0.24	0.24	0.24
Nitrogen	0.23	0.24	0.24	0.24	0.24	0.24
Argon	0.23	0.24	0.24	0.24	0.24	0.24
Carbon monooxide	0.23	0.24	0.27	0.24	0.24	0.24
Carbon dioxide	0.36	0.65	0.60	0.66	0.90	1.26
Carbonyl sulfide	1.15	3.33	2.83	3.47	4.05	4.71
Sulfur dioxide	2.52	5.87	10.84	23.80	16.50	22.48
Nitric oxide (NO)	0.27	0.30	0.28	0.26	0.28	0.28
Nitrous oxide (N_2O)	0.42	0.76	0.66	0.81	0.94	1.22
Methane	0.26	0.35	0.32	0.38	0.35	0.39
Ethylene	0.45	1.15	0.90	1.01	1.22	1.32
Acethylene	0.53	1.15	1.16	1.20	2.00	2.96
Ethane	0.54	1.60	1.16	1.36	1.50	1.54
Propylene	1.40	6.44	4.43	5.39	7.14	7.28
Propane	1.40	7.24	5.00	5.98	7.14	7.28
Ammonia	0.65	1.52	1.88	1.77	1.89	2.72
Ethylene oxide	4.45	12.70	12.51	14.82	24.78	34.05
Difluoroethane	1.16	3.90	3.97	4.63	9.00	11.92
Chlorodifluoromethane (Freon 22)	1.22	4.32	5.61	5.60	10.99	13.88
Methyl chloride	2.10	6.16	5.74	7.00	9.76	11.92
Dichlorodifluoromethane (Freon 12)	1.43	7.43	5.73	7.13	9.78	10.28
Chlorodifluoroethane	2.04	15.44	11.71	13.73	–	–
Dichlorotetrafluoroethane	10.40	25.75	19.51	20.32	–	–

Analytical conditions : Stainless steel column 80/100 mesh 1 m x 2.3 mm I.D. 175 °C N_2 25 mL/min. FID (*: He flow TCD)

Group	Compounds	P	Q	R	S	N	T
Acids	Acetic acid	0.39	1.08	2.14	3.68	4.18	5.21
	Propionic acid	0.65	2.42	4.75	9.05	9.11	10.68
	iso-Butyric acid	0.91	4.43	8.28	16.41	16.32	18.13
	Butyric acid	1.05	5.22	9.87	19.71	19.80	22.30
	iso-Valeric acid	1.52	9.69	16.85	36.81	36.79	39.50
	Valeric acid	1.89	12.12	21.70	45.70	45.30	48.90
Alcohols	Methanol	0.24	0.35	0.39	0.48	0.61	0.69
	Ethanol	0.30	0.60	0.63	0.76	1.21	1.20
	iso-Propanol	0.37	0.91	0.89	1.03	1.79	1.90
	tert-Butanol	0.38	1.40	1.35	1.69	2.56	2.67
	n-Propanol	0.43	1.22	1.24	1.53	2.52	2.60
	sec-Butanol	0.50	1.93	1.85	2.40	3.69	3.81
	iso-Butanol	0.61	2.18	2.16	2.72	4.63	4.74
	tert-Pentanol	0.62	3.17	2.90	3.78	5.87	5.84
	n-Butanol	0.69	2.58	2.68	3.39	5.78	5.71
	iso-Pentanol	1.07	4.87	4.75	6.14	10.82	10.76
	n-Pentanol	1.10	5.63	5.67	7.04	12.88	12.40
Aldehydes	Acetaldehyde	0.24	0.44	0.39	0.49	0.65	0.71
	Propionaldehyde	0.35	0.87	0.79	0.97	1.44	1.46
	Acrorein	0.35	0.81	0.77	0.91	1.44	1.52
	iso-Butylaldehyde	0.46	1.51	1.37	1.67	2.54	2.50
	Butylaldehyde	0.54	1.77	1.62	1.96	3.07	3.04
Alkanes	Pentane	0.34	1.24	1.02	1.19	1.39	1.10
	Hexane	0.48	2.56	2.03	2.46	3.00	2.20
	Heptane	0.73	5.26	4.27	5.03	6.22	4.39
	Octane	1.14	10.99	8.54	10.36	13.28	8.94
Aromatics	Benzene	0.87	2.76	2.56	3.00	4.00	3.74
	Toluene	1.33	5.72	5.31	6.41	8.54	7.61
	Ethyl Benzene	2.09	11.60	10.69	12.98	17.58	15.05
	o-Xylene	2.52	13.48	12.53	15.32	20.79	18.05
Chloroalkyls	Methylene Chloride	0.41	0.98	0.94	1.09	1.48	1.67
	Chloroform	0.59	1.89	1.76	2.15	2.91	3.04
	Carbon Tetrachloride	0.75	2.87	2.42	2.98	3.49	3.04
	1, 2-Dichloroethane	0.78	2.28	2.16	2.56	3.84	4.09
	1, 2-Dichloropropane	0.98	3.84	3.47	4.23	6.29	6.37
Esters	Methyl formate	0.27	0.51	0.53	0.57	0.91	0.94
	Methyl acetate	0.38	1.01	0.97	1.11	1.74	1.75
	Ethyl acetate	0.52	1.99	1.83	2.15	3.30	3.16
	Methyl propionate	0.57	1.99	1.83	2.15	3.30	3.16
	Butyl acetate	1.39	8.78	7.35	9.44	14.60	13.88
Ether	Diethyl ether	0.33	1.41	0.98	1.27	1.45	1.28
Ketone	Acetone	0.33	0.89	0.81	0.96	1.59	1.66
Inorganic	Water*	0.25	0.32	0.41	0.35	0.61	0.83

Tenax

Tenax TA

Tenax TA is composed of a weak acidic porous polymer based on 2,6-diphenyl-p-phenylene oxide. A major cause of ghost peaks would be aromatic hydrocarbons including toluene, xylene, ethylbenzene, etc., contained as impurities in the Tenax GC. In trace analysis, ghost peaks affect resultant data. Tenax TA is designed to minimize ghost peaks and it can be used both as a column packing material and as a trapping adsorbent for organic volatile and semi-volatile compounds.

Tenax GR

Tenax GR is made by adding 23 % graphite carbon at the polymerization of Tenax. It has higher breakthrough volume than conventional, due to the addition.

Packing	Mesh	Weight (Capacity)	Cat.No.
Tenax TA	20/35	5 g (approx. 28 mL)	1002-31102
	35/60		1002-31103
	60/80		1002-31106
	80/100		1002-31108
	20/35	15 g (approx. 84 mL)	1002-31202
	35/60		1002-31203
	60/80		1002-31206
	80/100		1002-31208

Tenax TA property

Item	Physical property
Specific surface area (m^2/g)	: 35
Pore volume (cm^2/g)	: 2.4
Average pore size (nm)	: 200
Density (g/cm^2)	: 0.25

Packing	Mesh	Weight (Capacity)	Cat.No.
Tenax GR	20/35	10 g (33 mL approx.)	1050-25000
	35/60		1050-25010
	60/80		1050-25020
	80/100		1050-25030

Tenax GR property

Item	: Physical property
Specific surface area	: 25 m^2/g
Density	: 0.30 g/cm^2

Breakthrough Volumes at 20 °C mL/mL

Samples	Tenax TA	Tenax GR
HALOGENATED COMPOUNDS	–	–
Monochloromethane	44	121
Dichloromethane	275	890
Trichloromethane (Chloroform)	1,460	3,160
Tetrachloromethane	3,210	6,250
Monochloroethane	246	393
1, 1-Dichloroethane	664	2,350
1, 2-Dichloroethane	1,880	23,700
1, 1, 1-Trichloroethane	3,650	12,000
1, 1, 2-Trichloroethane	21,900	57,700
1, 1, 2, 2-Tetrachloroethane	185,000	932,000
Dibromomethane	4,020	15,300
Tribromomethane (Bromoform)	215	470
Tetrabromomethane	500,000	854,000
Monobromoethane	469	1,580
1, 2-Diboromoethane	27,200	113,000
1, 1, 2, 2-Tetrabromoethane	6,881,000	3,280,000
Vinyl chloride	69	278

Samples	Tenax TA	Tenax GR
HYDROCARBONS	–	–
Methane	1	1
Ethane	4	7
Propane	26	46
Butane	135	217
AROMATICS	–	–
Benzene	8,800	18,600
Toluene	34,800	127,000
INORGANIC	–	–
Water	11	26

HayeSep

HayeSep is a spherical high purity polymer. It supplies unique separation in Gas chromatograph.

Types	Polarity	Max. Temp.	Mesh	Cat.No.	Surface Area	Bulk Density	Polymer Type
D	Low	290 °C	60/80	1002-52006	803 m^2/g	0.331 g/cm^3	Divinylbenzene
			80/100	1002-52008			
			100/120	1002-52010			
Q		275 °C	60/80	1002-51206	582 m^2/g	0.351 g/cm^3	Divinylbenzene
			80/100	1002-51208			
			100/120	1002-51210			
P		250 °C	60/80	1002-51106	165 m^2/g	0.420 g/cm^3	Divinylbenzene-styrene
			80/100	1002-51108			
			100/120	1002-51110			
S		250 °C	60/80	1002-51406	583 m^2/g	0.334 g/cm^3	Divinylbenzene-4-Vinyl-pyridine
			80/100	1002-51408			
			100/120	1002-51410			
R		250 °C	60/80	1002-51306	344 m^2/g	0.324 g/cm^3	Divinylbenzene-N-Vinyl-2-Pyrollidinone
			80/100	1002-51308			
			100/120	1002-51310			
C		250 °C	60/80	1002-51906	442 m^2/g	0.322 g/cm^3	Divinylbenzene-Acrylonitrile
			80/100	1002-51908			
			100/120	1002-51910			
A		165 °C	60/80	1002-51706	526 m^2/g	0.356 g/cm^3	Divinylbenzene-Ethyleneglycol-dimethacrylate
			80/100	1002-51708			
			100/120	1002-51710			
B		190 °C	60/80	1002-51806	608 m^2/g	0.330 g/cm^3	Divinylbenzene-Polyethyleneimine
			80/100	1002-51808			
			100/120	1002-51810			
N		165 °C	60/80	1002-51506	405 m^2/g	0.355 g/cm^3	Divinylbenzene-Ethyleneglycol-dimethacrylate
			80/100	1002-51508			
			100/120	1002-51510			
T	High	165 °C	60/80	1002-51606	250 m^2/g	0.381 g/cm^3	Ethyleneglycol-dimethacrylate
			80/100	1002-51608			
			100/120	1002-51610			

Note: Please contact us about HayeSep DB. DIP.

HAYESEP RT'S RELATIVE TO C_2H_6

6 ft x 1/8 in. SUS Columns
HayeSep 80/100 mesh
60 °C 30 mL/min He

Compound	A	B	C	D	DB	DIP
CF_4	0.13	0.10	0.08	0.10	0.10	0.10
CH_4	0.09	0.12	0.11	0.11	0.11	0.12
CO_2	0.54	0.32	0.47	0.31	0.30	0.30
N_2O	0.62	0.44	0.59	0.42	0.42	0.43
F116	0.63	0.49	0.45	0.51	0.52	0.53
C_2H_2	1.29	0.65	1.03	0.64	0.62	0.64
SF_6	0.81	0.65	0.64	0.68	0.68	0.68
C_2H_4	0.81	0.71	0.75	0.70	0.70	0.70
NH_3	1.58	0.71	1.21	0.90	0.65	0.98
F13	1.10	0.90	0.84	0.87	0.88	0.90
C_2H_6	1.00	1.00	1.00	1.00	1.00	1.00
H_2O	7.06	1.14	5.31	1.08	0.95	1.10
H_2S	2.06	1.45	2.20	1.36	1.35	1.39
COS	3.02	2.59	3.10	2.56	2.58	2.59
F22	7.63	3.11	6.34	3.30	3.31	3.35
C_3H_6	4.70	3.75	4.41	4.01	4.11	4.10
C_3H_8	4.94	4.43	4.70	4.73	4.84	4.84
SO_2	10.23	3.84	5.31	3.67	3.82	3.68
PD	6.19	4.63	5.80	4.79	4.87	4.90
MA	8.09	4.70	7.03	4.92	4.96	5.00
CP	5.90	5.02	5.89	5.18	5.32	5.26
F12	7.83	5.71	6.79	6.38	6.47	6.46
IC_4	17.92	14.73	16.21	16.74	17.18	17.32
1,3BD	24.94	16.00	22.93	18.62	19.10	19.48
F114	27.35	18.35	21.46	21.48	22.11	22.88
NC_4	23.60	19.33	21.21	22.26	22.66	23.01

RELATIVE RETENTION TIMES

Ethane = 1.00
Columns 6 ft x 1/8 in. SUS 65 °C
He 30 mL/min

Compound	N	Q	R	S	T
Hydrogen	0.19	0.143	0.17	0.19	0.21
Air	0.23	0.186	0.20	0.21	0.25
Nitric oxide	0.25	0.217	0.21	0.23	0.33
Methane	0.30	0.256	0.28	0.30	0.35
Carbon dioxide	0.71	0.450	0.50	0.52	0.85
Nitrous oxide	0.80	0.570	0.59	0.59	–
Ethylene	0.83	0.74	0.78	0.78	0.90
Acetylene	1.41	0.74	1.00	0.87	2.11
Ethane	1.00	1.00	1.00	1.00	1.00
Water	10.10	1.45	6.80	4.12	19.10
Hydrogen sulphide	2.10	1.40	1.73	1.87	2.88
Hydrogen cyanide	19.30	2.31	15.60	8.26	28.80
Carbonyl sulphide	2.82	2.33	2.46	2.63	3.40
Sulphur dioxide	12.00	3.05	9.78	17.80	19.00
Propylene	4.66	3.20	3.45	3.65	4.91
Propane	4.66	3.67	3.88	4.10	4.63
Propadiene	6.50	4.12	4.39	4.70	7.55
Methylacetylene	9.50	4.12	4.84	5.14	11.30
Methyl chloride	7.43	3.93	4.67	4.92	9.20
Vinyl chloride	14.90	6.04	9.04	9.70	17.30
Ethylene oxide	17.70	6.06	8.78	9.70	23.30
Ethyl chloride	35.00	12.25	19.30	20.70	43.20
Carbon disulphide	–	32.40	–	–	40.70

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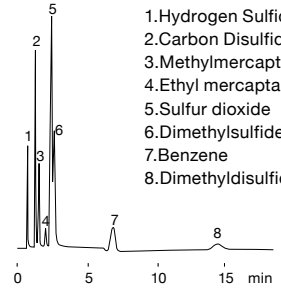
Odor Controlled Substances

Fig.1 Sulfur Compounds

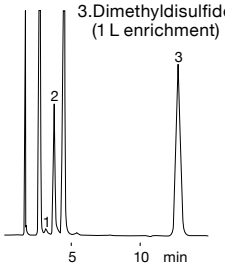


1.Hydrogen Sulfide
2.Carbon Disulfide
3.Methylmercaptane
4.Ethyl mercaptan
5.Sulfur dioxide
6.Dimethylsulfide
7.Benzene
8.Dimethyldisulfide

Column : β, β'-ODPN 25 % Uniport HP 60/80 Glass 3 m x 3 mm I.D.
Col. Temp. : 60 °C
Carrier Gas : N_2 70 mL/min
Detector : FPD High V.750 V 10^4 x 2^4
Sample Size : 1.0 µL (10 ppm)

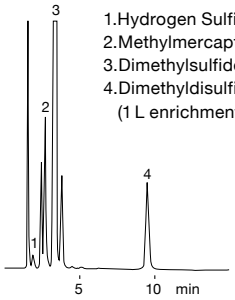
Fig.2 Odor of Refuse Dumps

1.Methylmercaptane (0.22 ppb)
2.Dimethylsulfide (1.06 ppb)
3.Dimethyldisulfide (1.85 ppb)
(1 L enrichment)



Column : β, β'-ODPN 25 % Uniport HP 60/80 Glass 3 m x 3 mm I.D.
Col. Temp. : 70 °C
Carrier Gas : He 55 mL/min
Detector : FPD Hight V.750 V 10^2 x 2^4

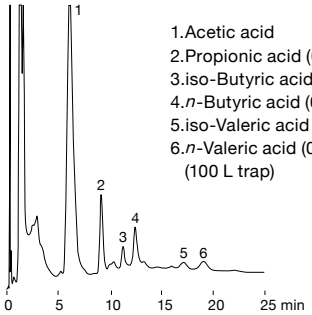
Fig.3 Odor of Septic Tank Dirt



1.Hydrogen Sulfide (0.92 ppb)
2.Methylmercaptane (1.35 ppb)
3.Dimethylsulfide (5.8 ppb)
4.Dimethyldisulfide (1.0 ppb)
(1 L enrichment)

Column : β, β'-ODPN 25 % Uniport HP 60/80 Glass 3 m x 3 mm I.D.
Col. Temp. : 70 °C
Carrier Gas : He 55 mL/min
Detector : FPD Hight V.750 V 10^2 x 2^4

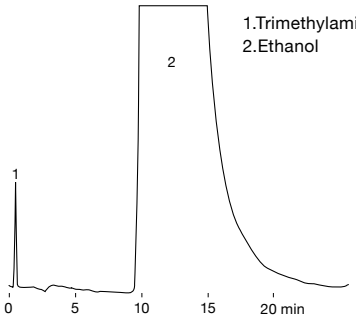
Fig.4 Low Fatty Acids of Drains



1.Acetic acid
2.Propionic acid (0.63 ppb)
3.iso-Butyric acid (0.29 ppb)
4.*n*-Butyric acid (0.06 ppb)
5.iso-Valeric acid (0.06 ppb)
6.*n*-Valeric acid (0.09 ppb)
(100 L trap)

Column : FFAP+H_3PO_4 (0.3+0.3) % Unicarbon B 60/80 Glass 1 m x 3 mm I.D.
Col. Temp. : 110 °C-210 °C (10 °C/min)
Carrier Gas : 50 mL/min
Detector : FID 10 x 2^4

Fig.5 Tri-methyl Amine (Standard sample)



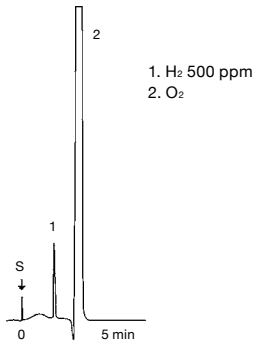
1.Trimethylamine
2.Ethanol

Column : Diglycerol+TEP+KOH (15+15+2) % Uniport HP 60/80 Glass 3 m x 3 mm I.D.
Col. Temp. : 70 °C
Carrier Gas : N_2 64 mL/min
Detector : FID 10 x 2

INORGANIC GASES

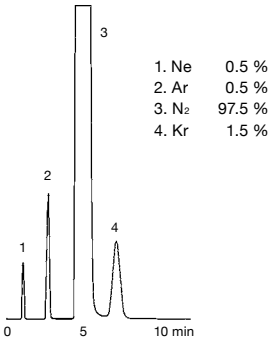
For analysis of inorganic gases, adsorbents such as molecular sieve, active alumina, active carbon and silica gel are used. For the analysis of H_2 with TCD, a quantitative determination cannot be made if He is used as the carrier gas, so it is necessary to use N_2 or Ar which has very different thermal conductivity (Fig.1). Molecular Sieve is the only packing capable of separating O_2 and N_2 at room temperature, and is suitable for the separation of permanent gases. It easily loses its resolution if it adsorbs H_2O, CO_2, H_2S, SO_2 and NH_3. Regeneration must be carried out at high temperature. For analysis of inert gases, Molecular Sieve 5A is used. For trace amount of CO analysis, consistently good results are obtained by Molecular Sieve 13X-S (Fig.3).

Fig.1 H_2 (Hydrogen)



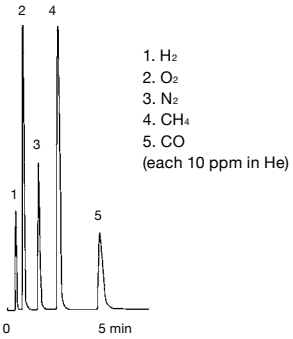
Column : Molecular Sieve 13X 30/60
SUS 4 m x 3 mm I.D.
Col.Temp. : 42 °C
Carrier Gas : N_2 30 mL/min
Detector : TCD 80 mA x 2
Sample Size : 2 mL

Fig.2 Inert Gases



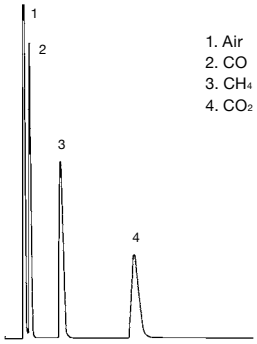
Column : Molecular Sieve 5A 60/80
SUS 3 m x 3 mm I.D.
Col.Temp. : 40 °C
Carrier Gas : He 21 mL/min
Detector : TCD 120 mA x 4
Sample Size : 1 mL

Fig.3 Trace CO



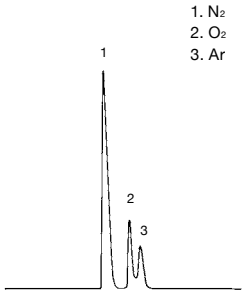
Column : Molecular Sieve 13X-S 60/80
SUS 2 m x 3 mm I.D.
Col.Temp. : 50 °C
Carrier Gas : He 50 mL/min
Detector : PID 750 V 10 x 32
Sample Size : 1 mL

Fig.4 CO, CH_4



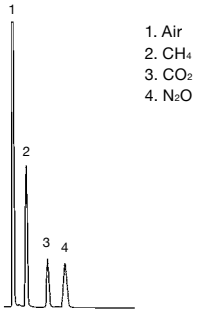
Column : Active Carbon 60/80
SUS 2 m x 3 mm I.D.
Col.Temp. : 50 °C
Carrier Gas : He 38 mL/min
Detector : TCD 120 mA x 16
Sample Size : 0.5 mL

Fig.5 Inert Gases



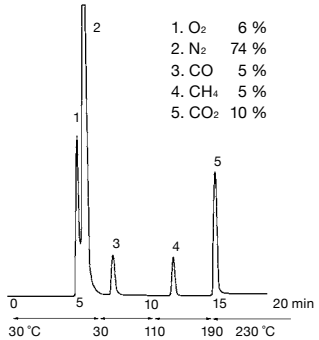
Column : Gaskuropack 54 60/80
SUS 6 m x 3 mm I.D.
Col.Temp. : -70 °C
Carrier Gas : He 31 mL/min
Detector : TCD 120 mA x 64
Sample Size : 1 mL

Fig.6 Inert Gases



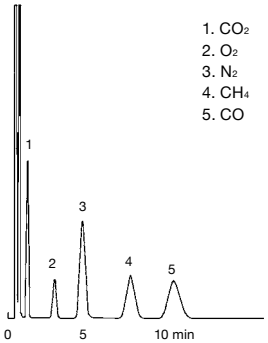
Column : Unibeads C 60/80
SUS 2 m x 3 mm I.D.
Col.Temp. : 130 °C
Carrier Gas : He 68 mL/min
Detector : TCD 120 mA x 32
Sample Size : 0.4 mL

Fig.7 Inorganic Gases by Temperature Programming



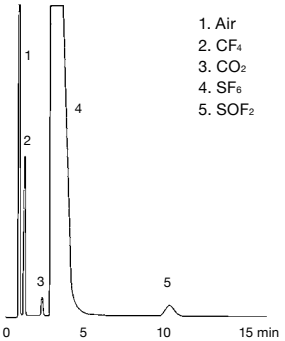
Column : Unibeads C 80/100
SUS 3 m x 3 mm I.D.
Col.Temp. : 30 °C (6 min) - 230 °C (20 °C/min)
Carrier Gas : He 30 mL/min
Detector : TCD 120 mA x 32
Sample Size : 0.3 mL

Fig.8 Inorganic Gases



Column : WG-100
SUS 1.8 m x 1/4 in. O.D.
Col.Temp. : 50 °C
Carrier Gas : He 33 mL/min
Detector : TCD 120 mA x 16
Sample Size : 0.3 mL

Fig.9 CF_4, SF_6, SOF_2

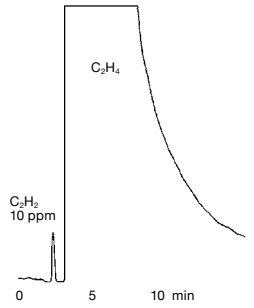


Column : Porapak Q 50/80
SUS 3 m x 3 mm I.D.
Col.Temp. : 50 °C
Carrier Gas : He 32 mL/min
Detector : TCD 120 mA
Sample Size : 1 mL

LOWER HYDROCARBONS

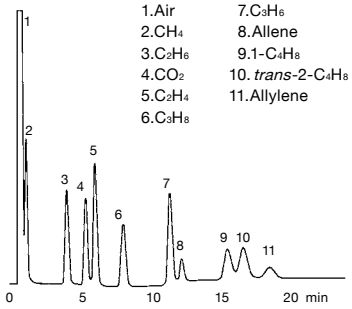
For analysis of lower hydrocarbons up to C3, adsorption, partition chromatography and packing material with the both interactions made from adsorbent coated with stationary phase are used. With these packings, peaks of lower hydrocarbons are liable to change depending on the conditioning temperature and time, hence care must be taken to conditioning temp. and time. In spherical silica gels the Unibeads series, which has a high column efficiency, gives characteristic separation patterns depending on the pore size, and is suitable for analysis of lower hydrocarbons up to C3. It is particularly suitable for CO_2 analysis (Fig.2). If the sample contains water, adsorptive packings are not suitable as the water produces considerable tailing. Gaskuropack 54, which is porous polymer, can however be used for the analysis of hydrocarbons up to C3 even when water is present (Fig.3).

Fig.1 Trace Acetylene in Ethylene



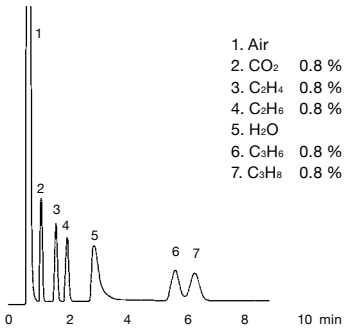
Column : Unibeads C 60/80
SUS 2 m x 3 mm I.D.
Col.Temp. : 140 °C
Carrier Gas : N_2 76 mL/min
Detector : FID 1 x 32
Sample Size : 1 mL

Fig.2 CO_2 in Hydrocarbons



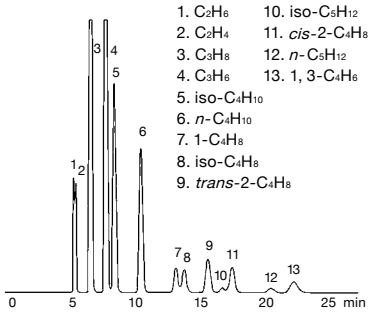
Column : Unibeads 1S 80/100
SUS 1 m x 3 mm I.D.
Col.Temp. : 40 -160 °C (10 °C/min)
Carrier Gas : He 20 mL/min
Detector : TCD 100 mA x 8
Sample Size : 1 mL

Fig.3 Hydrocarbons and Water



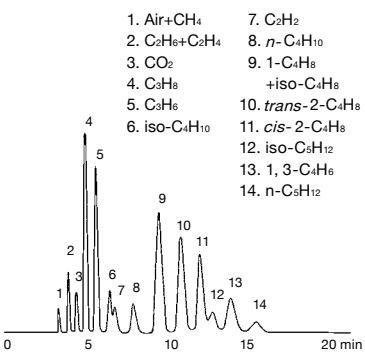
Column : Gaskuropack 54 60/80
SUS 2 m x 3 mm I.D.
Col.Temp. : 70 °C
Carrier Gas : He 24 mL/min
Detector : TCD 120 mA x 8
Sample Size : 0.5 mL

Fig.4 Hydrocarbons



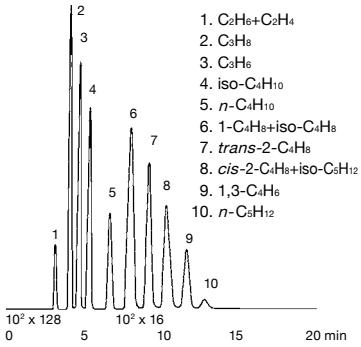
Column : Sebaconitrile 25 %
Uniport C 60/80
SUS 10 m x 3 mm I.D.
Col.Temp. : 30 °C
Carrier Gas : N_2 35.5 mL/min
Detector : FID 10^2 x 64
Sample Size : 0.1 mL

Fig.5 C-C5 Hydrocarbons



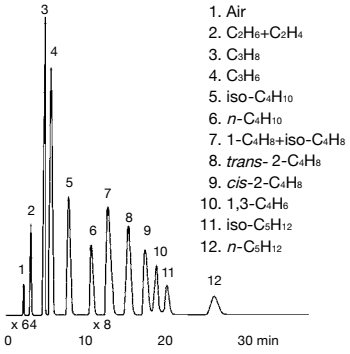
Column : VZ-7 60/80 SUS 6 m x 3 mm I.D.
Col.Temp. : 40 °C
Carrier Gas : He 15 mL/min
Detector : TCD 120 mA x 64
Sample Size : 0.5 mL

Fig.6 C1-C5 Hydrocarbons



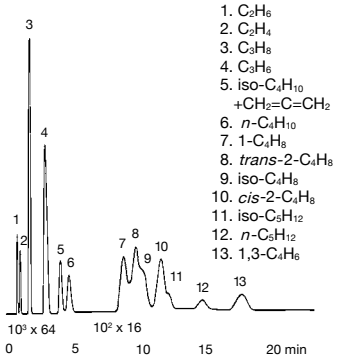
Column : VZ-8 60/80 SUS 6 m x 3 mm I.D.
Col.Temp. : 40 °C
Carrier Gas : He 20 mL/min
Detector : FID 10^2 x 128 x 16
Sample Size : 0.2 mL

Fig.7 C1-C5 Hydrocarbons



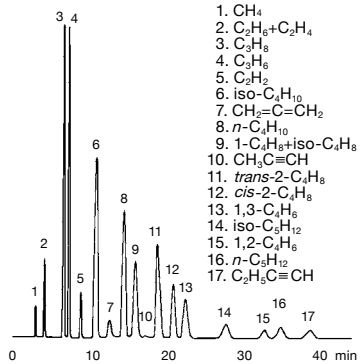
Column : VZ-9 60/80 Cu 6 m x 3 mm I.D.
Col.Temp. : 38 °C
Carrier Gas : He 25 mL/min
Detector : TCD 150 mA
Sample Size : 1 mL

Fig.8 C1-C5 Hydrocarbons



Column : VZ-10 60/80 SUS 2 m x 3 mm I.D.
Col.Temp. : 50 °C
Carrier Gas : He 35 mL/min
Detector : FID 10^3 x 64, 10^2 x 16
Sample Size : 0.2 mL

Fig.9 C-C5 Hydrocarbons Isomers

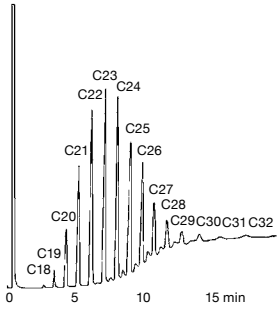


Column : VZN-1 60/80 SUS 7 m x 3 mm I.D.
Col.Temp. : 40 °C
Carrier Gas : N_2 20 mL/min
Detector : FID 10^3 x 16
Sample Size : 0.5 mL

HYDROCARBONS

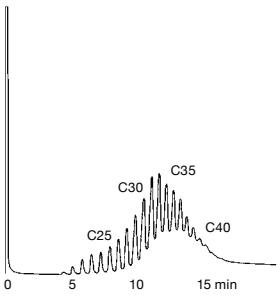
For simple hydrocarbon composites like paraffin wax, packed columns can be used for the analysis. 1 % OV-1 or Dexsil is generally used for the analysis. To elute it faster, a shorter length and narrow I.D. column is used with a temperature programming. Fig 1, 2 are applications in such cases.

Fig.1 Paraffin (m.p. 50~52 ˚C)



Column : Unisole 10T 5 %
Uniport HP 80/100
Glass 2 m x 3 mm I.D.
Col.Temp. : 160-260 °C (10 °C/min)
Carrier Gas : N_2 80 mL/min
Detector : FID 10^3 x 8
Sample Size : 1.0 µL

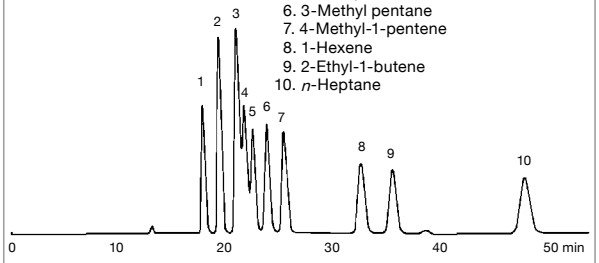
Fig.2 Paraffin (m.p. 68~70 ˚C)



Column : Silicone OV-1 1 %
Uniport HP 100/120
SUS 0.5 m x 2 mm I.D.
Col.Temp. : 150-300 °C
(10 °C/min)
Carrier Gas : N_2 20 mL/min
Detector : FID 10 x 128
Sample Size : 0.4 µL
(15 ppm in Chloroform)

Fig.3 C5 Hydrocarbons

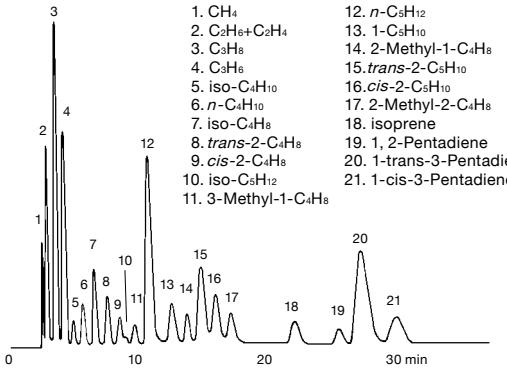
1. 1-Pentane
2. *trans*-2-Pentene+2-Methyl-1-butene
3. *cis*-2-Pentene+2-Methylpentane
4. 2,3-Dimethyl butane
5. 2-Methyl-2-butene
6. 3-Methyl pentane
7. 4-Methyl-1-pentene
8. 1-Hexene
9. 2-Ethyl-1-butene
10. *n*-Heptane



Column : Sebaconitrile 25 % Uniport C 60/80 SUS 10 m x 3 mm I.D.
Col.Temp. : 70 °C Carrier Gas : N_2 20 mL/min
Detector : FID 10^2 x 512 Sample Size : 0.4 µL

Fig.4 C5 Hydrocarbons

1. CH_4
2. C_2H_6+C_2H_4
3. C_3H_8
4. C_3H_6
5. iso-C_4H_{10}
6. *n*-C_4H_{10}
7. iso-C_4H_8
8. *trans*-2-C_4H_8
9. *cis*-2-C_4H_8
10. iso-C_5H_{12}
11. 3-Methyl-1-C_4H_8
12. *n*-C_5H_{12}
13. 1-C_5H_{10}
14. 2-Methyl-1-C_4H_8
15. *trans*-2-C_5H_{10}
16. *cis*-2-C_5H_{10}
17. 2-Methyl-2-C_4H_8
18. isoprene
19. 1, 2-Pentadiene
20. 1-trans-3-Pentadiene
21. 1-cis-3-Pentadiene

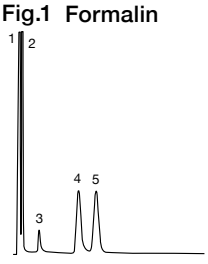


Column : VZ-7 60/80 SUS 6 m x 3 mm I.D.
Col.Temp. : 45 °C Carrier Gas : He 20 mL/min Detector : TCD

ALDEHYDE·KETONE

Porapak T shows a good peak of CO_2 and APS-201 shows a good peak of water (refer to Fig.1 & 2). The sensitivity will be low when analyzing formaldehyde with a FID. However, by methanizing or derivatizing the sample with 2,4-Dinitrophenylhydrazine, it can be analyzed at a low concentration level using FID or FTD.

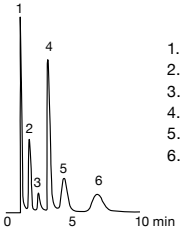
Fig.1 Formalin



1. Air
2. CO_2
3. HCHO
4. H_2O
5. CH_3OH

Column : Porapak T 50/80
SUS 2 m x 3 mm I.D.
Col.Temp. : 120 °C
Carrier Gas : He 24 mL/min
Detector : TCD 120 mA x 4 0.6 mL
(Headspace gas)

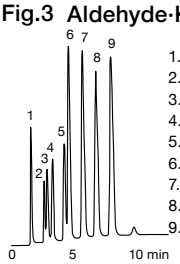
Fig.2 Aldehyde·Ketone



1. Formaldehyde
2. Acetaldehyde
3. Methanol
4. Water
5. Methyl ethyl ketone
6. Methyl iso-butyl ketone

Column : APS-201 20 % Flusin T 60/80
SUS 2 m x 3 mm I.D.
Col.Temp. : 90-130 °C (5 °C/min)
Carrier Gas : He 32 mL/min
Detector : TCD 110 mA x 128
Sample Size : 0.4 µL

Fig.3 Aldehyde·Ketone



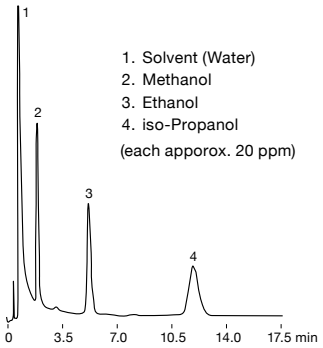
1. Acetaldehyde
2. Propion aldehyde
3. Acetone
4. iso-Butyraldehyde
5. *n*-Butyraldehyde
6. Methylethyl ketone
7. Methyl iso-propyl ketone
8. Methyl n-propyl ketone
9. Methyl iso-butyl ketone

Column : TCP 20 % Uniport R 60/80
SUS 3 m x 3 mm I.D.
Col.Temp. : 80-115 °C (5 °C/min)
Carrier Gas : He 35 mL/min
Detector : FID 10^2 x 256
Sample Size : 0.4 µL

ALCOHOLS・GLYCOLS

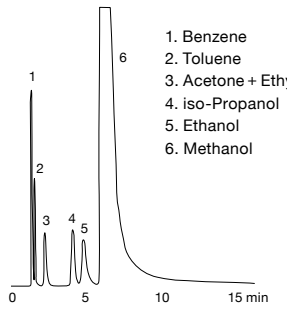
By using PEG or high polar liquid phases, sharp peak shapes can be obtained for analyzing alcohols. For trace analysis of multiple alcohols, derivatizing of such alcohols is necessary by using a silylation reagent.
For trace analysis of methanol, PEG1000 is suitable. Gaskuropack 54, which is made of porous polymer beads, is often used for analysis of lower alcohols. It also can be used for an analysis of residual solvents in pharmaceuticals, which is extracted with water (refer to Fig.1). Gaskuropack 55 can be used for analyzing glycols. Symmetrical peaks can be obtained by combining Unisole 30T and Flusin P for higher alcohols. For trace analysis of multiple alcohols, derivatizing of such alcohols is necessary by using a silylation reagent. Gaskuropack 54, which is made of porous polymer beads, is often used for analysis for lower alcohols. Gaskuropack 55 can be used for analyzing glycols. Symmetrical peaks can be obtained by combining Unisole 30T and Flusin P. For higher alcohol analysis, PEG-HT can be used. When the boiling point range of the sample is wide or isomers are included, we recommend using a capillary column. For analysis of impurities in methanol, sorbitol can be used as a liquid phase, which delays the elution of methanol.

Fig.1 Alcohol in Water



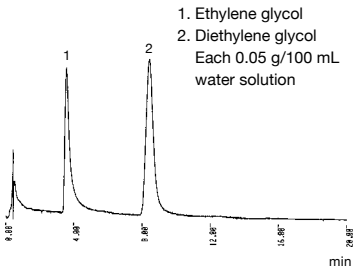
Column : Gaskuropack 54 60/80
Glass 2 m x 3 mm I.D.
Col.Temp. : 110 °C
Inj.Temp. : 250 °C
Carrier Gas : N_2 60 mL/min
Detector : FID 1 x 32
Sample Size : 2 µL

Fig.2 Impurities in Methanol



Column : Sorbitol 25 % Gasport B 60/80
SUS 6 m x 3 mm I.D.
Col.Temp. : 100 °C
Carrier Gas : He 33 mL/min
Detector : FID 10 x 128
Sample Size : 0.4 µL

Fig.3 Ethylene Glycol・Diethylene Glycol

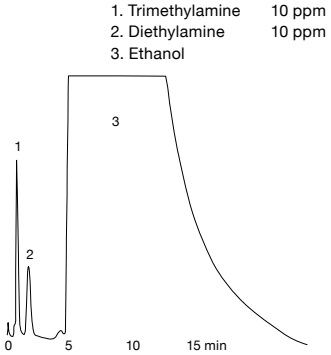


Column : Sorbitol 12 %
Chromosorb W AW DMCS 80/100
Glass 1.5 m x 3 mm I.D.
Col.Temp. : 170 °C
Carrier Gas : N_2 64 mL/min
Detector : FID 10 x 32
Sample Size : 2 µL

AMINES

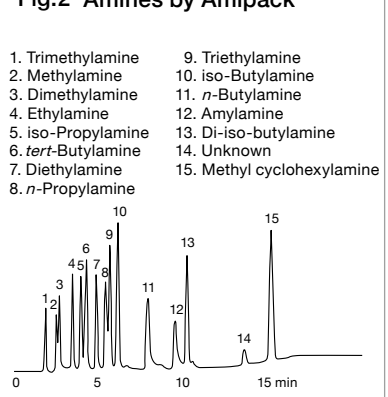
The Amipack 131 is our unique packing material for amine analysis. Generally the packing material, Diglycerol+TEP+KOH is used for the analysis of trace trimethyl amines. However, the Amipack 131 without addition of KOH is more stable (Fig.1). The Amipack 141 or Unicarbon B is useful for the analysis of mixture of lower amines (Fig.2).
By adding KOH to Unisole 10T or PEG-HT, which has relatively high stability avariety of amines are able to be analyzed on them (Fig.3).

Fig.1 Trimethylamine



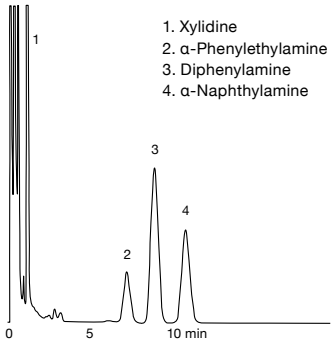
Column : Amipack 131 80/100
Glass 3 m x 3 mm I.D.
Col.Temp. : 70 °C
Carrier Gas : N_2 40 mL/min
Detector : FID 10 x 8
Sample Size : 1 µL

Fig.2 Amines by Amipack



Column : Amipack 141 80/100
Glass 3 m x 3 mm I.D.
Col.Temp. : 70-180 °C (7.5 °C/min)
Detector : FID 10^3 x 16
Sample Size : 0.4 µL

Fig.3 Aromatic Amine

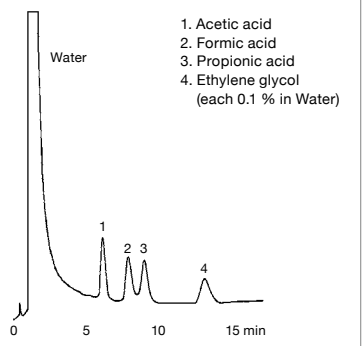


Column : PEG-HT+KOH (5+1) %
Uniport HP 60/80
Glass 2 m x 3 mm I.D.
Col.Temp. : 180 °C
Carrier Gas : N_2 85 mL/min
Detector : FID 10 x 64
Sample Size : 1 µL

FATTY ACIDS

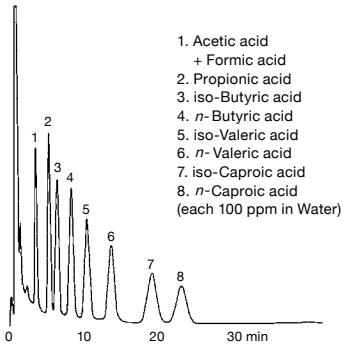
Unisole F-200 is the most suitable packing material for analysis of traces of lower fatty acids in water. Though there are few ghost peaks due to water, quantitative analyses can be performed at concentrations in the order of 10 ppm (Fig.2). If a short column is used, lower fatty acids of up to about C14 can be analyzed. Sharp peaks can be obtained with the injection volume of 1 μL, at 200 °C of Inj.Temp. Formic acid and acetic acid are however eluted together. In order to separate them, the analysis must be carried out on a combination of PEG-6000 and Flusin P. (Fig.1). Unisole 400 or FFAP is used for analysis of higher free fatty acids. (Fig.3). To separate saturated from unstaturated fatty acids they must be esterified before analysis.

Fig.1 Formic acid·Acetic Acid



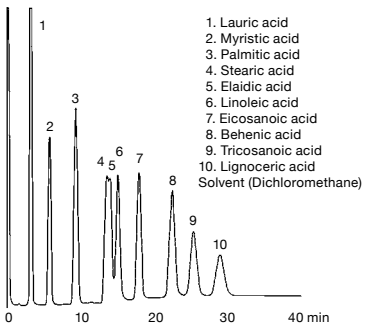
Column : PEG 6000 10 % Flusin P 30/60
Glass 2 m x 3 mm I.D.
Col.Temp. : 130 °C
Carrier Gas : He 40 mL/min
Detector : TCD 150 mA
Sample Size : 2 µL

Fig.2 Free Fatty Acids in Water



Column : Unisole F-200 30/60
Galss 2 m x 3 mm I.D.
Col.Temp. : 140 °C
Carrier Gas : N_2 32 mL/min
Detector : FID 10 x 8
Sample Size : 1 µL

Fig.3 Higher Free Fatty Acids

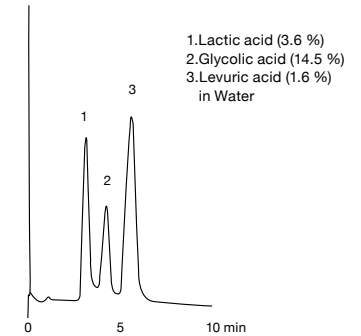


Column : Unisole 400 5 %
Uniport S 60/80
Glass 1 m x 3 mm I.D.
Col.Temp. : 180-240 °C (3 °C/min)
Carrier Gas : N_2 68 mL/min
Detector : FID 10^3 x 4
Sample Size : 0.4 µL

ORGANIC ACIDS

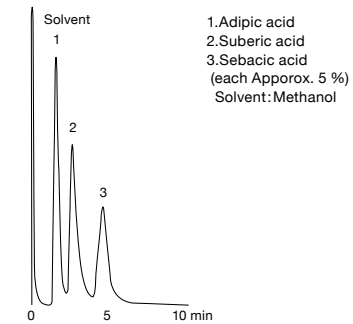
Some organic acids have stronger adsorptive property than fatty acid which makes trace analysis of such compounds difficult. Therefore, special care must be taken for such analysis. To prevent adsorption, these acids are first derivatized and highly polar stationary phases such as polyesters, are fairly used. Hydroxylic acids or dicarboxylic acids can be analyzed by using Unisole 30T as the stationary phase (Fig.1). However, at low concentrations, quantitative results cannot be inferred due to the unsymmetrical peaks. By adding phosphoric acid to Unisole 10T, symmetrical peaks can be obtained for organic acids (Fig.3).

Fig.1 Hydroxy Acids



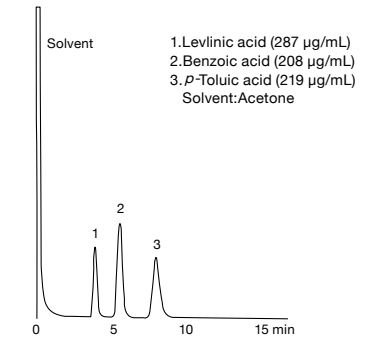
Column : Unisole 30T 3 % Flusin P 60/80
Glass 1 m x 3 mm I.D.
Col.Temp. : 165 °C
Carrier Gas : N_2 45 mL/min
Detector : FID 10^3 x 4
Sample Size : 0.4 µL

Fig.2 Dicarboxylic Acids



Column : Unisole 30T 10 %
Uniport HP 80/100
Glass 0.5 m x 3 mm I.D.
Col.Temp. : 235 °C
Carrier Gas : N_2 27 mL/min
Detector : FID 10^3 x 4
Sample Size : 0.4 µL

Fig.3 Benzoic Acids

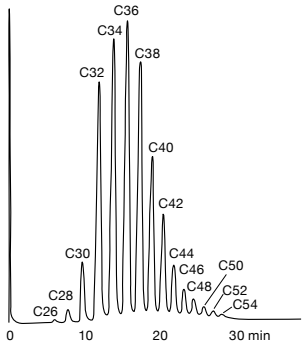


Column : Unisole 10T+H_3PO_4 (5+0.5) %
Uniport HP 80/100
Glass 1 m x 3 mm I.D.
Col.Temp. : 160 °C
Carrier Gas : N_2 63 mL/min
Detector : FID 10 x 64
Sample Size : 1 µL

ESTERS

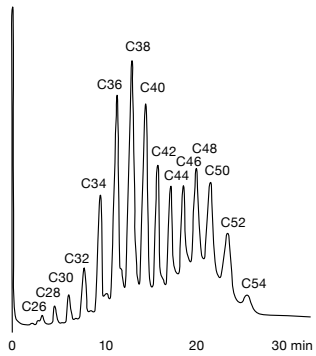
Various kinds of ester determinations are associated with food analysis. Oils can be analyzed directly as triglycerides, or as methylesters of fatty acids by transesterification. For direct analysis as triglycerides, the sample is dissolved in a solvent such as hexane, and injected directly onto the gas chromatograph. In the case of samples containing a wide spread of carbon chain lengths, such as fats in dairy products, the triglycerides are first classified into short, medium and long carbon chains by separation using TLC, then each class is extracted and analyzed separately for such analysis.
A short column packed with non-polar stationary phase with low loading, and high maximum operating temperature is chosen. Adsorption is unlikely and for analysis at high temperature, use of stailess steel column is highly recommened. Also in order to gain theoretical plates, a fine mesh of support and columns of 2 mmID are commonly used.
Fig.1, 2 are analysis of triglycerides in coconut oil and butter on GS-1, which is equivalent to OV-1, and on OV-1, respectively. Alternatively, the oils can be esterified and analyzed as methyl esters of fatty acids. Three methods are generally used, i.e. boron trifluoride/methanol, sulfuric acid/methanol and sodium meth oxide. Here the boron trifluoride/methanol method is most common. In this method, the oil is first saponified by heating in a solution of sodium hydroxide/methanol, and the non-saponified residue is removed. To the saponified product, 14 % boron trifluoride/methanol solution is added, then conduct reaction mixture heated under refluxing in the water bath. When the reaction is completed, an ester layer is formed on methanol layer. After cooling, the ester is extracted by shaking vigorously with a mixture of petroleum ether and water, and the either layer is injected onto the gas chromatograph. In order to concentrate the methyl esters in the ether layer, unreacted compounds are completely removed by repeating the extraction several times until the aqueous layer shows no more acidity. Repeating the extraction also appears to be necessary to prolong the lifetime of the column. A fairly good separation of methyl esters of fatty acids of up to C22 can be obtained with Unisole-3000 (Fig.4).

Fig.1 Triglycerides in Coconut Oil



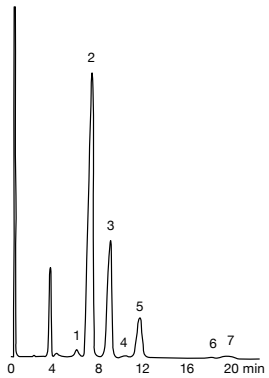
Column : Silicone GS-1 1 % Uniport HP 100/120
SUS 0.5 m x 2 mm I.D.
Col.Temp. : 180-320 °C (5 °C/min)
Carrier Gas : N_2 60 mL/min
Detector : FID 10^2 x 32
Sample Size : 1.0 µL

Fig.2 Triglycerides in Butter



Column : Silicone OV-1 1 % Uniport HP 100/120
SUS 0.5 m x 3 mm I.D.
Col.Temp. : 220-320 °C (5 °C/min)
Carrier Gas : N_2 16 mL/min
Detector : FID
Sample Size : 0.2 µL

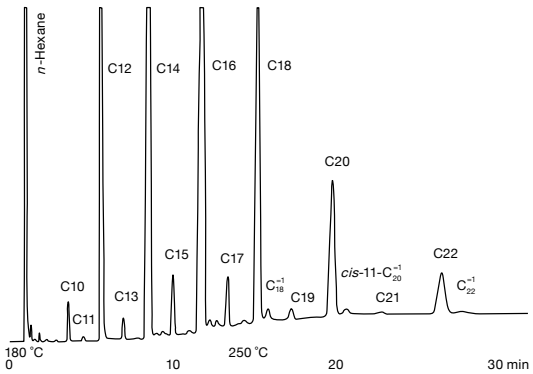
Fig.3 Rape Seed Oil Methyl Ester



1. Methyl stearate C18
2. Methyl oleate C18:1
3. Methyl linoleate C18:2
4. Methyl arachidate C20
5. Methyl linolenate C18:3
+Methyl eicosenoate C20:1
6. Methyl docosanoate C22
7. Methyl erucate C22:1

Column : DEGS 15 % Uniport B 60/80
Glass 2 m x 3 mm I.D.
Col.Temp. : 190 °C
Carrier Gas : He 78 mL/min
Detector : FID 10^3 x 16
Sample Size : 0.3 µL

Fig.4 Methyl Esters of Whale Oil

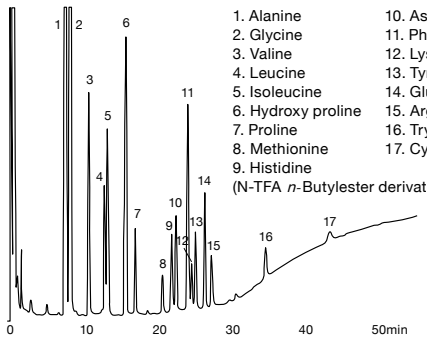


Column : Unisole 3000 Uniport C 80/100
Glass 3 m x 3 mm I.D.
Col.Temp. : 180-250 °C (5 °C/min)
Carrier Gas : N_2 29 mL/min
Detector : FID 10^2 x 32
Sample Size : 0.4 µL

BIO CHEMICALS

In the biochemical field, it is necessary to analyze a variety of samples, but direct sample analysis with gas chromatograph is difficult since most are non-volatile substances. These substances are converted to various derivatives before GC analysis.
Amino acids are the structural units of proteins. Amino acids have both amino and carboxyl groups, and as they are not volatile, they cannot be analyzed directly by gas chromatograph. To convert them to volatile substances, the carboxyl groups are usually first esterified with a hydrochloric acid/butanol mixture or other reagents. The remaining amino groups are then converted to the TFA derivatives with TFAA, etc. Resultants, an N-acyl-alkyl esters, are then analyzed. Alternatively, amino acids may be converted to derivatives in one step with a silylating reagent such a s BSTFA which silylates both functional groups. After that the derivatives can then be analyzed. Silylated derivatives, not give a single peak depending on the reaction temperature, time and catalyst for reaction. Furthermore, as amino acids have an asymmetric carbon atom, optical isormers exist. Optical isomers can then be separated on capillary columns with the optically active stationary phases, such as Chriasil-DEX or Chriasil-L-Val, which is suitable for the analysis of ordinary derivatives of amino acids. They may also be combined with an optically active reagent such as TPC, which will convert to diastereoisomers, and then analyzed on an ordinary capillary column.

Fig.1 Amino Acid · N-TFA · n-Butylester

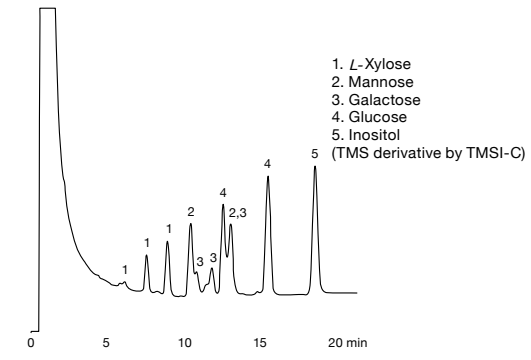


Column : Apiezon grease M 10 % Uniport HP 100/120
Glass 3 m x 2 mm I.D.
Col.Temp. : 100-260 °C (5 °C/min)
Carrier Gas : N_2 50 mL/min
Detector : FID 10^3 x 4
Sample Size : 3 µL

SUGARS

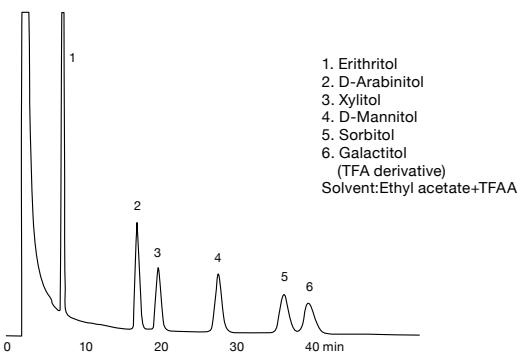
Sugars are found in almost every food. Gas Chromatography is widely used for its trace analysis due to its high resolution efficiency and ability to effectively quantitate. Sugars, however, cannot be analyzed directly. Polysaccharides and large oligosaccharides must be decomposed into their component monosaccharides, and converted to derivatives before analysis.
Hydrolysis or methanolysis are used for the common decomposition. In methanolysis, the sugar is heated in a mixture of HCl/methanol so as to give the methyl glycosides of the component monomers. HCl concentration must be varied depending on the sample, and it is convenient to use a prepared HCl/methanol reagent which is adjusted to the desired concentration with anhydrous methanol. After neutralization, the sugar obtained is silylized and analyzed by GC. In the case of aminosaccharides, it is first necessary to acetylate the amino group.
As the silylating agent, TMSI-H or TMSI-C can be used. TMSI-C, in particular, has the advantage that the reaction proceeds even when a small amount of water exists, and it is therefore suitable for analysis of monosaccharides in aqueous. After methanolysis, sugars exist as a mixture of α and β anomers in pyranose and furanose forms which give several peaks, resulting difficult identification. In order to obtain a single peak from each sugar, the sugar are first reduced with sodium borohydride and subject to subsequent acetylation then analyzed. Care should be taken as some sugars replaced to give the same sugar alcohol. The packing material have to be changed with the components to be separated; however, it is better to choose a stationary phase that can withstand high temperature, and a silanized support such as Uniport HP.

Fig.1 TMS Derivatives of Sugar in Water



Column : Silicone OV-101 3 % Chromosorb W AW DMCS 80/100
Glass 2 m x 3 mm I.D.
Col.Temp. : 150-220 °C (3 °C/min)
Carrier Gas : N_2 42 mL/min
Detector : FID 10^2 x 8
Sample Size : 1 µL

Fig.2 TFA Derivatives of Sugar Alcohols

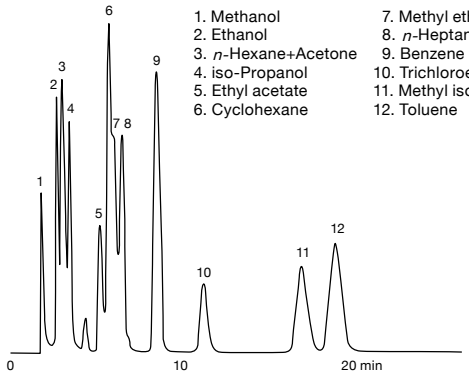


Column : Silicone OV-105 2 % Uniport HP 80/100
Glass 3 m x 3 mm I.D.
Col.Temp. : 130 °C
Carrier Gas : N_2 20 mL/min
Detector : FID 10^2 x 8
Sample Size : 1 µL

Solvents

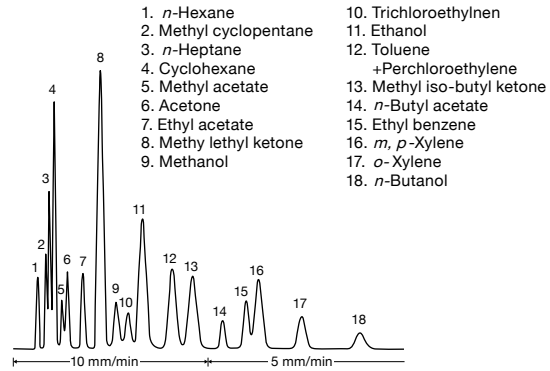
Separation analysis of solvents is needed in environmental studies; however, choosing a packing material to be able to separate all organic components is difficult. It is recommended that selection may be made by consulting literature on the subject, e.g. “Gas Chromatographic Retention Data”, from which the figurers in Table 1 have been taken.
GL Sciences supplies 2 types of packing for solvent analysis, BX-10 and BX-100.
BX-10 gives the best separation for solvent analysis, and good peaks even for quantification of trace amounts of alcohols. However, it is not suitable for samples containing water or air (Fig.2). BX-100 is suitable for trace analysis of solvents in air, and the analysis can be carried out without any risk of air causing Oxidative decomposition. Its mechanical strength and maximum operating temperature are lower (Fig.4). Porous polymers are often used in solvent analysis. Gaskuropack 54, for example, is suitable for analysis of organic solvents in water or air (Fig.5). Gaskuropack 55 is suitable for trace analysis of polar substances, but not for injection of large quantities of water or air (Fig.6). In addition, Unisole 30T with its wide field of applications can be used for solvents analysis (Fig.7). Unisole F-200 is used for separation of low free fatty acids. It may also be suitable for analyzing solvent traces in water giving ghost peaks (Fig.8).

Fig.1 Solvents



Column : DOP 30 % Uniport R 60/80 SUS 3 m x 3 mm I.D.
Col.Temp. : 100 °C
Carrier Gas : He 45 mL/min
Detector : FID 10^2 x 64
Sample Size : 0.2 µL

Fig.2 Solvents



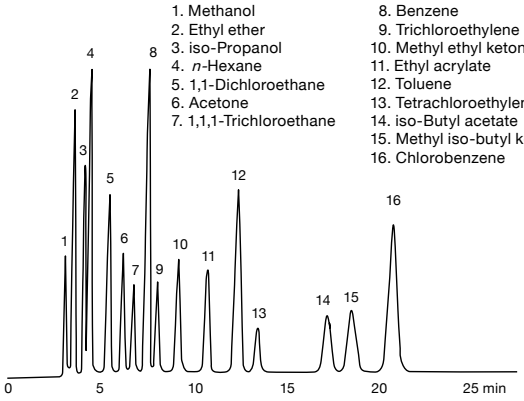
Column : BX-10 60/80 SUS 3 m x 3 mm I.D.
Col.Temp. : 85 °C
Carrier Gas : N_2 30 mL/min
Detector : FID 10^2 x 256
Sample Size : 0.3 µL

Retention Index (120 °C)

	Apiezon L	DOP	Silicone DC-550	PPE 5ring	PEG 600	PEG 1000	PEG 20M	TCP
Methanol	336	486	425	503	936	905	862	629
Ethanol	403	563	498	578	974	944	893	689
n-Propanol	513	672	610	703	1084	1048	1000	795
iso-Propanol	450	602	539	615	965	933	883	713
n-Butanol	620	782	720	816	1199	1160	1111	908
iso-Butanol	584	742	680	766	1136	1101	1055	861
Acetone	441	589	554	648	871	849	815	690
MEK	552	691	663	758	950	935	904	787
MIBK	703	829	802	889	1057	1040	1012	917
Methyl acetate	470	592	575	664	852	847	824	680
Ethyl acetate	551	668	663	741	910	903	879	754
n-Butylacetate	756	869	864	945	1108	1094	1066	954
iso-Butylacetate	712	823	818	890	1043	1033	1005	902
Methylcellosolve	591	763	715	843	1268	1222	1159	917
Ethylcellosolve	666	828	786	907	1308	1264	1203	–
n-Butylcellosolve	863	1031	981	1102	1489	1447	1392	1171
Methylcellosolveacetate	756	919	911	1038	1306	1275	1235	1057
Ethylcellosolveacetate	824	983	975	1100	1345	1314	1280	1181
n-Pentane	500	500	500	500	500	500	500	500
n-Hexane	600	600	600	600	600	600	600	600
Cyclohexane	691	693	699	729	746	753	756	718
Benzene	683	750	733	821	976	975	961	824
Toluene	796	860	839	928	1075	1075	1061	933
o-Xylene	926	991	970	1075	1227	1219	1213	1072
m-Xylene	901	963	940	1044	1176	1173	1173	1034
p-Xylene	899	964	938	1037	1172	1167	1166	1029
Ethylbenzene	884	947	933	1026	1165	1159	1152	1023
Methylchloride	526	636	603	671	924	932	914	715
Water	341	471	513	498	1120	1062	990	620

SOLVENTS

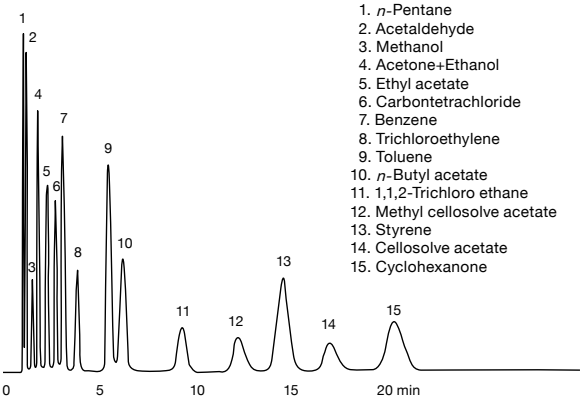
Fig.3 Solvents



1. Methanol
2. Ethyl ether
3. iso-Propanol
4. *n*-Hexane
5. 1,1-Dichloroethane
6. Acetone
7. 1,1,1-Trichloroethane
8. Benzene
9. Trichloroethylene
10. Methyl ethyl ketone
11. Ethyl acrylate
12. Toluene
13. Tetrachloroethylene
14. iso-Butyl acetate
15. Methyl iso-butyl ketone
16. Chlorobenzene

Column : BX-20 100/120
SUS 6 m x 2 mm I.D.
Col.Temp. : 90 °C
Carrier Gas : He 20 mL/min
Detector : FID 10^3 x 16
Sample Size : 0.4 µL

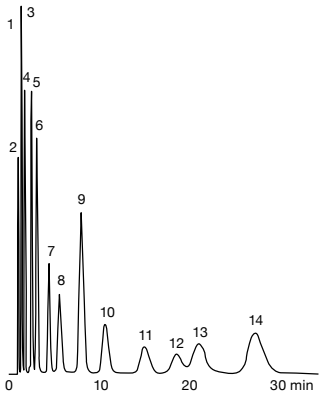
Fig.4 Solvents



1. *n*-Pentane
2. Acetaldehyde
3. Methanol
4. Acetone+Ethanol
5. Ethyl acetate
6. Carbontetrachloride
7. Benzene
8. Trichloroethylene
9. Toluene
10. *n*-Butyl acetate
11. 1,1,2-Trichloro ethane
12. Methyl cellosolve acetate
13. Styrene
14. Cellosolve acetate
15. Cyclohexanone

Column : BX-100 60/80
Glass Col. 3 m x 3 mm I.D.
Col.Temp. : 110 °C
Carrier Gas : N_2 35 mL/min
Detector : FID 10^3 x 16
Sample Size : 0.4 µL

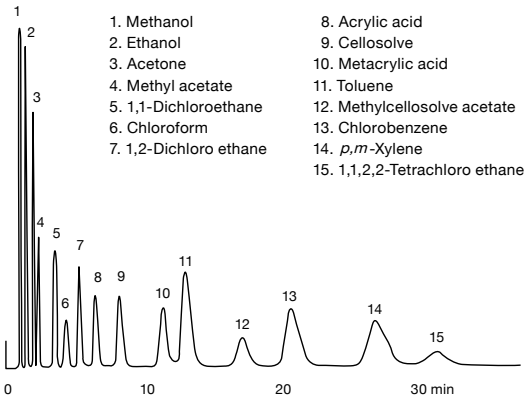
Fig.5 Solvents



1. Methanol
2. Acetaldehyde
3. Ethanol
4. Acrylonitrile
5. Acetonitrile
6. *n*-Propanol
7. *cis*-1,2-Dichloro ethylene
8. Methyl cellosolve
9. Benzene
10. Cellosolve
11. 1,1,2-Trichloro ethane
12. Tetrachloro ethylene
13. iso-Butyl acetate
14. Chlorobenzene

Column : Gaskuropack 54 60/80
Glass 2 m x 3 mm I.D.
Col.Temp. : 180 °C
Carrier Gas : N_2 35 mL/min
Detector : FID 10^3 x 32
Sample Size : 0.4 µL

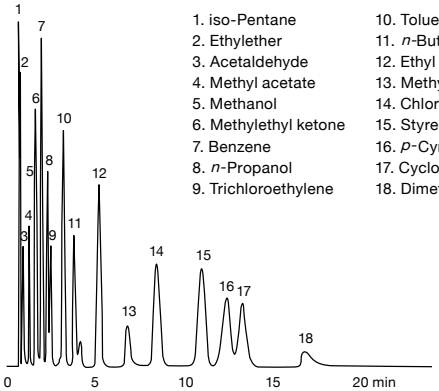
Fig.6 Solvents



1. Methanol
2. Ethanol
3. Acetone
4. Methyl acetate
5. 1,1-Dichloroethane
6. Chloroform
7. 1,2-Dichloro ethane
8. Acrylic acid
9. Cellosolve
10. Metacrylic acid
11. Toluene
12. Methylcellosolve acetate
13. Chlorobenzene
14. *p,m*-Xylene
15. 1,1,2,2-Tetrachloro ethane

Column : Gaskuropack 55 60/80
Glass 2 m x 3 mm I.D.
Col.Temp. : 180 °C
Carrier Gas : N_2 35 mL/min
Detector : FID 10^3 x 32
Sample Size : 0.4 µL

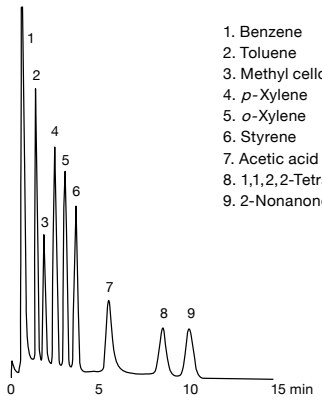
Fig.7 Solvents



1. iso-Pentane
2. Ethylether
3. Acetaldehyde
4. Methyl acetate
5. Methanol
6. Methylethyl ketone
7. Benzene
8. *n*-Propanol
9. Trichloroethylene
10. Toluene
11. *n*-Butyl acetate
12. Ethyl benzene
13. Methyl cellosolve
14. Chlorobenzene
15. Styrene
16. *p*-Cymene
17. Cyclohexanone
18. Dimethyl formamide

Column : Unisole 30T 5 % Uniport HP 80/100
Glass 2 m x 3 mm I.D.
Col.Temp. : 70 °C
Carrier Gas : N_2 30 mL/min
Detector : FID 10^3 x 64
Sample Size : 0.4 µL

Fig.8 Solvents in Water



1. Benzene	7 ppm
2. Toluene	7 ppm
3. Methyl cellosolve	14 ppm
4. *p*-Xylene	7 ppm
5. *o*-Xylene	7 ppm
6. Styrene	7 ppm
7. Acetic acid	28 ppm
8. 1,1,2,2-Tetrachloroethane	14 ppm
9. 2-Nonanone	7 ppm

Column : Unisole F-200 30/60
Glass 2 m x 3 mm I.D.
Col.Temp. : 110 °C
Carrier Gas : He 25 mL/min
Detector : FID 10 x 1
Sample Size : 1 µL

Retentions Time of Solvents

		Packing Material						
		①	②	③	④	⑤	⑥	⑦
Hydrocarbons	n-Pentane	0.97	0.88	1.01	4.16	2.36	0.67	0.80
	n-Hexane	1.21	1.20	1.33	8.48	4.38	0.72	0.92
	n-Heptane	1.66	1.79	1.97	18.10	8.40	0.84	1.15
	n-Octane	2.55	2.89	3.20	39.30	16.47	1.06	1.55
	n-Nonane	4.24	5.19	5.59	81.40	31.52	1.51	2.29
	n-Decane	7.47	9.15	10.20	–	65.50	2.41	3.63
	iso-Pentane	0.93	0.85	0.95	3.72	2.19	0.66	0.77
	iso-Octane	1.57	1.85	1.88	22.19	10.56	0.79	1.13
	Methyl cyclopentane	1.52	1.44	1.66	8.65	5.05	0.81	1.05
	Methyl cyclohexane	2.33	2.27	2.68	18.93	10.36	1.00	1.41
	Cyclohexane	1.85	1.69	1.98	9.69	5.71	0.90	1.19
Alcohols	Methanol	4.18	0.80*	1.44*	1.17	0.95	1.32*	1.15
	Ethanol	5.07	0.99*	1.83	1.89	1.41	1.54	1.25
	n-Propanol	9.28	1.48*	3.08	3.76	2.59	2.55	1.80
	n-Butanol	18.34	2.43*	5.67	8.07	5.17	4.66	2.87
	iso-Propanol	4.97	1.14*	1.99	2.85	2.04	1.49	1.28
	iso-Butanol	12.84	1.99*	4.39	6.64	4.45	3.38	2.29
	sec-Butanol	8.83	1.76*	3.40	6.05	3.85	2.40	1.84
	tert-Butanol	4.58	1.28*	2.06	4.37	2.73	1.36	1.28
	iso-Amylalcohol	33.15	9.23*	9.49	14.87	9.50	6.67	3.67
	Cyclohexanol	110.11	9.51*	27.58	37.29	24.19	23.17	9.03
Aromatic hydrocarbons	Benzene	3.59	2.09	3.23	9.57	6.01	1.77	1.69
	Toluene	6.31	3.52	5.89	20.76	12.19	2.85	2.59
	Ethylbenzene	10.49	5.97	10.31	39.99	21.29	4.61	3.96
	p-Xylene	11.42	6.22	11.04	42.53	23.52	4.80	4.20
	m-Xylene	11.42	6.28	11.04	42.53	23.52	5.00	4.20
	o-Xylene	14.55	7.65	13.58	48.83	27.75	6.32	5.05
	Styrene	19.16	7.77	16.37	46.52	27.05	9.65	6.07
	p-Cymene	–	13.94	27.39	–	62.29	11.38	8.79
	Chlorobenzene	15.26	6.37	12.71	31.19	19.45	7.70	4.84
	o-Dichlorobenzene	87.54	20.65	57.91	95.74	62.97	33.09	14.79
Esters	Methyl acetate	2.18	1.51	1.69	3.33	2.27	1.13	1.16
	Ethyl acetate	2.98	2.19	2.32	6.20	3.95	1.36	1.40
	n-Propyl acetate	4.93	3.66	3.78	13.09	7.64	2.01	1.95
	n-Butyl acetate	8.77	6.35	6.83	28.63	15.23	3.40	3.01
	iso-Propyl acetate	3.32	2.71	2.65	10.15	5.59	1.44	1.51
	iso-Butyl acetate	6.45	5.22	5.05	23.72	11.87	2.47	2.39
	iso-Amyl acetate	12.31	9.17	9.85	53.52	24.07	4.57	3.99
	Methyl methacrylate	5.29	3.27	4.10	11.76	7.09	2.37	2.05
	Methyl acrylate	3.53	2.16	2.64	5.99	3.93	1.70	1.52
	Ethyl acrylate	5.60	3.16	4.53	11.07	6.37	2.23	1.95
Chlorinated hydrocarbons	Dichloromethane	2.64	1.91	1.80	3.44	2.28	1.50	1.34
	Trichloroethylene	4.58	2.30	3.98	9.81	6.36	2.24	1.91
	1, 1, 1-Trichloroethane	2.78	1.88	2.67	8.24	5.05	1.39	1.41
	Tetrachloroethylene	6.33	4.02	6.58	20.52	11.64	2.85	2.65
	1, 2-Dichloroethane	5.68	2.30	4.03	6.89	4.77	3.08	2.05
	1, 1, 2-Trichloroethane	16.54	4.24	10.21	16.53	10.51	9.70	4.47
	1, 1, 2, 2-Tetrachloroethane	13.69	9.53	36.56	43.08	27.03	44.69	13.16
	Carbon tetrachloride	4.68	1.78	2.73	8.89	5.37	1.36	1.43
	Chloroform	4.80	1.53	3.20	5.73	3.92	2.45	1.68
	cis-1, 2-Dichloroethylene	3.97	1.65	2.93	5.12	3.31	2.05	1.66
	1, 1-Dichloroethane	2.60	1.47	2.15	4.92	3.28	1.34	1.28
	Freon 11	0.94	1.22	0.78	3.58	2.26	0.70	0.65
	Freon 12	0.92	0.91	0.75	1.44	1.29	0.78	0.52
	Freon 114	0.92	0.96	0.76	2.50	1.04	0.71	0.54
Cellosolves	Methyl cellosolve	25.59	2.85*	6.91	6.93	4.62	5.79*	3.12
	Cellosolve	26.66	3.88*	9.31	13.00	7.74	7.65*	4.01
	Butyl cellosolve	–	10.91*	29.17	58.67	29.00	23.26*	10.60
	Methyl cellosolve acetate	25.13	9.47	12.99	26.68	15.11	9.57	5.16
	Cellosolve acetate	27.53	12.46	19.04	50.31	25.40	12.55	6.80
Ether	Ethyl ether	1.17	0.95	1.16	3.45	2.05	0.71	0.85
Aldehydes	Acetaldehyde	1.43	0.99	1.09	1.32	1.03	0.78	0.83
	Acrolein	2.37	1.52	1.78	2.41	1.75	1.15	1.09
Oxides	Dioxane	7.68	3.57	5.19	9.79	6.64	3.21	2.41
	Tetrahydrofuran	3.36	2.03	2.67	5.63	3.99	1.31	1.40
Amides	Dimethylformamide	59.00*	17.23*	23.77*	12.76	9.33	13.89*	8.00*
	Acrylamide	–	–	–	24.49	23.83	–	–
Ketones	Acetone	2.31	1.74	1.76	2.73	1.89	1.07	1.09
	MEK	3.63	2.63	2.72	5.55	3.43	1.48	1.43
	MIBK	7.22	5.64	5.61	19.57	10.04	2.50	2.32
	Cyclohexanone	36.36	18.09	22.60	36.17	21.96	12.27	7.84
	2-Hexanone	12.06	7.41	8.85	24.35	13.99	3.14	2.85
	2-Methylcyclohexanone	47.54	20.65	30.89	64.70	38.38	11.45	7.91
Nitriles	Acrylonitrile	4.18	2.14	2.40	2.19	1.81	2.01	1.48
	Acetonitrile	4.44	2.24	2.58	3.04	2.29	2.16	1.47
Acids	Acrylic acid	–	2.14*	–	6.32	6.08	–	20.29
	Methacrylic acid	–	2.24*	–	12.72	10.64	–	32.33
	Acetic acid	–	3.31*	17.17*	3.48	3.78	22.83*	8.06
	n-Propionic acid	–	5.45*	32.36*	7.32	6.92	40.15*	14.46
	iso-Butyric acid	–	7.16*	42.18*	12.72	10.65	49.22*	18.51
	n-Butyric acid	–	9.02*	59.98*	14.84	12.66	72.74*	26.08
Inorganic	Water	10.41*	0.93*	1.23*	0.83	–	4.31*	1.51*

*: Tailing peak

Note: ① BX-10 60/80 Glass 3 m x 3 mm I.D. 85 °C N_2 35 mL/min ② BX-20 100/120 SUS 3 m x 2 mm I.D. 90 °C N_2 35 mL/min
③ BX-100 60/80 Glass 3 m x 3 mm I.D. 110 °C N_2 35 mL/min ④ Gaskuropack 54 60/80 Glass 2 m x 3 mm I.D. 180 °C N_2 35 mL/min
⑤ Gaskuropack 55 60/80 Glass 2 m x 3 mm I.D. 180 °C N_2 35 mL/min ⑥ Unisole 30T 5 % Uniport HP 80/100 Glass 2 m x 3 mm I.D. 70 °C N_2 29 mL/min
⑦ Unisole F-200 30/60 Glass 3 m x 3 mm I.D. 110 °C N_2 30 mL/min

Shimadzu GC Glass Columns

GC-7A/9A/12A/14A/14B/15A/16A/2014

Length	5 mm O.D. x 3.2 mm I.D.	5 mm O.D. x 2.6 mm I.D.
	Cat.No.	Cat.No.
0.6 m	3003-34506	3003-34406
1.1 m	3003-34511	3003-34411
1.6 m	3003-34516	3003-34416
2.1 m	3003-34521	3003-34421
3.1 m	3003-34531	3003-34431
4.1 m	3003-34541	3003-34441
5.1 m	3003-34551	3003-34451

When 3 m or longer column is installed in the injection port at the same time, use the following column for 14G.

GC-14G

Length	5 mm O.D. x 3.2 mm I.D.
	Cat.No.
3.1 m	3003-38531
4.1 m	3003-38541
5.1 m	3003-38551

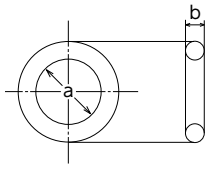
GC-17A/18A

Length	5 mm O.D. x 2.6 mm I.D.
	Cat.No.
1.0 m	3003-39510
2.0 m	3003-39520
3.0 m	3003-39530

GC-8A (2 pcs/set)

Length	5 mm O.D. x 3.2 mm I.D.	5 mm O.D. x 2.6 mm I.D.
	Cat.No.	Cat.No.
1.0 m	3003-37510	3003-37410
2.0 m	3003-37520	3003-37420
3.0 m	3003-37530	3003-37430

O-rings for Glass columns



P type O-ring

- Heat-resistant silicone :
  Flexible until 280 ˚C
  (Curing Temperature : 300 ˚C)
  No bonding to columns
- Red silicone
  Wide range heat-resistance from -60 ˚C to +230 ˚C.
  Not strong mechanically. Decomposed with high temperature steam.

Type	Material	High silicone	Red silicone
	a x b	Cat.No.	Cat.No.
P-4	3.8 x 1.9	3007-11604	3007-11404
P-5	4.8 x 1.9	3007-11605	3007-11405

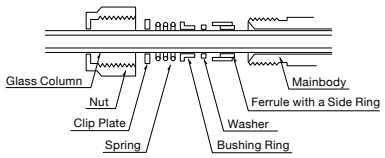
Note: P-4 is for 5 mm I.D. glass columns, P-5 is for 6 mm I.D. glass columns
Qty.: 20/pk

Liners

Liner for packed columns

Applications	Shimadzu No.(Ref.)	Inertness	Qty.	Cat.No.
7A, 9A-16A 3 mm I.D.	221-14093	No ne	2 pcs	3001-16115
7A, 9A-16A 2.6 mm I.D.	221-14094	No ne	2 pcs	3001-16117
17A Packed columns	221-41484	No ne	1 pc	3001-16119

Ferrules with Side Ring



Ferrules with a Side Ring

Model	Description	Contents of	Cat.No.
GI-5SB	Shimadzu attachment lug	Nut, Holding ring, Spring, 2 pcs Washer (GI-5S, 10 pcs)	3001-21002
GI-5S	Graphite with a side ring	Graphite ferruel with a side ring and washer (10 pcs)	3007-14152

SUS Column Adaptors & Packing

Description	Cat.No.
SUS Column Adaptor (INJ.)	3001-67002
SUS Column Adaptor (DET.)	3001-67001
Column Packing Aluminum (100 pcs)	3007-16201

Shimadzu GC SUS columns

Common Type

4 mm O.D. x 3 mm I.D. (exception 5A, 3B)

Length	Cat.No.	Length	Cat.No.
0.5 m	3003-81305	3.0 m	3003-81330
1.0 m	3003-81310	4.0 m	3003-81340
1.5 m	3003-81315	5.0 m	3003-81350
2.0 m	3003-81320	6.0 m	3003-81360

Glass Columns for GL Sciences GCs

GC-4000/390B

For FID without insert.

6.2 mm O.D., box nut and ferrule are not included.

Length	6.2 mm O.D. x 3 mm I.D.	6.2 mm O.D. x 4 mm I.D.
	Cat.No.	Cat.No.
1.0 m	3003-56310	3003-56410
1.5 m	3003-56315	3003-56415
2.0 m	3003-56320	3003-56420
2.5 m	3003-56325	3003-56425
3.0 m	3003-56330	3003-56430

Note: 2 pcs x 3 m length glass column cannot be installed in the same oven.
Please contact us for inquired.

For FID with insert.

6.2 mm O.D., box nut and ferrule are not included.

Length	6.2 mm O.D. x 3 mm I.D.	6.2 mm O.D. x 4 mm I.D.
	Cat.No.	Cat.No.
1.0 m	3003-57410	3003-57510
1.5 m	3003-57415	3003-57515
2.0 m	3003-57420	3003-57520
2.5 m	3003-57425	3003-57525
3.0 m	3003-57430	3003-57530

Accessories

Nut and ferrule set.

Description	Qty.	Cat.No.
Glass Column Installation Set	1 set	2701-23530

GC-4000/390B TCD

Description	Cat.No.
Glass Column for TCD 6.2 x 3 x 1.0 m	3003-57310
Glass Column for TCD 6.2 x 3 x 2.0 m	3003-57320
Glass Column for TCD 6.2 x 3 x 3.0 m	3003-57330

Accessories

Description	Cat.No.
Lead Tube for Glass Column of GC-4000/390B TCD	3003-57000

GC-3200

6.2 mm O.D., box nut and ferrule are not included.

Column I.D.	6.2 mm O.D. x 3 mm
Length	Cat.No.
1.0 m	3003-57610
1.5 m	3003-57615
2.0 m	3003-57620
2.5 m	3003-57625
3.0 m	3003-57630

GL Sciences GC Glass Column Accessories

Glass Liner

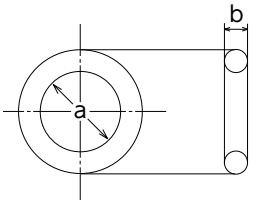
Description	Qty.	Cat.No.
Glass Liner	2 pcs	2701-22753

Liner Spacer/Liner Ring

Description	Qty.	Cat.No.
SUS Column Adaptor 1/8 in. for Liner Injection Port	1 pc	2701-22751

O-rings for Glass Columns

- Heat-resistant silicone:
  Flexible until 280 °C
  (Curing Temperature: 300 °C)
  No bonding to columns
- Red silicone
  Wide range heat-resistant from -60 °C to +230 °C.
  Not strong mechanically. Decomposed with high temperature steam.



P type O-ring

Description	Material	High Silicone	Red Silicone
	a x b	Cat.No.	Cat.No.
P-4	3.8 x 1.9	3007-11604	3007-11404
P-5	4.8 x 1.9	3007-11605	3007-11405

Note: P-4 is for 5 mm I.D. glass columns, P-5 is for 6 mm I.D. glass columns
Qty.: 20 pcs

SUS Columns for GL Sciences GCs

GC-4000/390B/380

GC390B uses only 1/8 in. column with winding diameter approx. 15 cm with nut & ferrule.

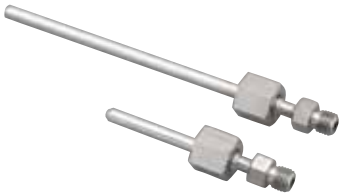
Column ID	1/8 in. x 2.2 mm	1/4 in. x 4.35 mm
Length	Cat.No.	Cat.No.
0.5 m	3003-61905	3003-61505
1.0 m	3003-61910	3003-61510
1.5 m	3003-61915	3003-61515
2.0 m	3003-61920	3003-61520
2.5 m	3003-61925	3003-61525
3.0 m	3003-61930	3003-61530
4.0 m	3003-61940	3003-61540

GC-3200/323

Winding diameter 10 cm. 1/8 in. O.D. x 2.2 mm I.D., with nut and ferrule.

Length	Cat.No.
0.5 m	3003-61405
1.0 m	3003-61410
1.5 m	3003-61415
2.0 m	3003-61420
2.5 m	3003-61425
3.0 m	3003-61430
4.0 m	3003-61440
5.0 m	3003-61450

GL Sciences GC SUS Column Adaptors



GL Sciences GC SUS Column Adaptors

GC-4000/390B/380

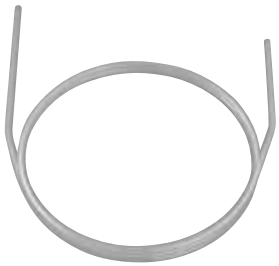
Description	Qty.	Cat.No.
SUS column adaptor 1/8 in. for injection port	1 pc	2701-26240
SUS column adaptor 1/4 in. for injection port	1 pc	2701-26241
SUS column adaptor 1/8 in. for FID	1 pc	2701-26250
SUS column adaptor 1/4 in. for FID	1 pc	2701-26251
SUS column adaptor set 1/8 in.	1 pc	2701-26260
SUS column adaptor set 1/4 in.	1 pc	2701-26261

GC-3200

Description	Qty.	Cat.No.
SUS column adaptor 1/8 in. for injection port	1 pc	2701-22751
SUS column adaptor 4 mm for injection port	1 pc	3001-57000
SUS column adaptor 4 mm for TCD	1 pc	3001-57001
GC-3200 SUS column adaptor set 4 mm	1 pc	3001-57003
SUS column adaptor for injection port 1/4 in.	1 pc	3001-57004
GC-3200 SUS column adaptor set 1/4 in.	1 pc	3001-57006
Graphite ferrule GI-1/4	10 pcs	3007-14164

Glass Columns/Accessories for Agilent GCs

6890 : FID/NPD/ECD/old type FPD
7890 : FID/NPD/ECD



I.D.	2 mm	I.D.	4 mm
Length	Cat.No.	Length	Cat.No.
3.0 feet	–	3.0 feet	3003-59403
4.0 feet	3003-59204	4.0 feet	3003-59404
6.0 feet	3003-59206	6.0 feet	3003-59406

Note: If an injection port and a detector are not at a parallel position, please contact us.

Length	Cat.No.
1.0 m	3003-59310
2.0 m	3003-59320
3.0 m	3003-59330

Note: If an injection port and a detector are not at a parallel position, please contact us.

Ferrules

Description	Qty.	Cat.No.
Graphite Ferrule GI-1/4	10 pcs	3007-14164
15 % Graphite/85 % Vespel Ferrule GV-1/4	10 pcs	3007-31135

SUS Columns for Agilent GCs

I.D.	1/8 in. x 2.2 mm
Length	Cat.No.
2.0 feet	3003-83202
4.0 feet	3003-83204
6.0 feet	3003-83206
8.0 feet	3003-83208

Wool (Quartz・Glass・PTFE)

The quartz wool is used for fixing GC packings.

Description	Treatment	Weight	Cat.No.
Quartz Wool Fine (1-6 µm)	–	5 g	3001-12401
	–	10 g	3001-12402
	–	100 g	3001-12403
	Silane treated	5 g	3001-12404
	H_3PO_4 treated	5 g	3001-12405
Glass Wool (1 µm)		50 g	3001-12504
		500 g	3001-12505
PTFE Wool		10 g	3001-12601

Note: Max. temp.: Quartz wool 800 °C. Silane treated 350 °C, H_3PO_4 Treated 250 °C
Glass wool 500 °C, PTFE wool 200 °C

Column Name Plates

The column name plates are used to indicate the contents of prepared column. Information such as column material, mesh range etc. can be written on the plates with a ball-point pen or iron pen.

Writing area : 50 x 18 mm
Max. temperature : 450 ˚C

Description	Qty.	Cat.No.
Column Name Plate	50 pcs	3001-13001

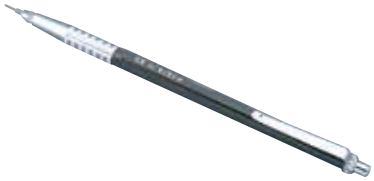
Column Tags

These tags are used to indicate the contents of GC columns. There are embossed and plain type.

Writing area : 53 x 27 mm

Description	Qty.	Cat.No.
Column Tag (Embossed)	30 pcs	3001-13103
Column Tag (Plain)	50 pcs	3001-13104

Iron Pen For Name Plates



This is used to write information on name plates or tags, and also can be used for marking on hard surface like metal.

Description	Cat.No.
Iron Pen for Name Plates/Tags	3001-13401