

Solvents and Reagents for Liquid Chromatography



Kanto Reagents



Solvents for High-performance
Liquid Chromatography
HLC-SOL

Solvents for Preparative
Liquid Chromatography
Prepsol



Kanto Kagaku

Solvents and Reagents for Liquid Chromatography

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HLC-SOL(Solvents for High-Performance Liquid Chromatography)

HLC-SOL solvents, purified with a special technique, have reliable chromatographic properties, i. e. minimum UV absorbance and lowest inter-lot deviation,

leading to the enhancement of both reproducibility and detection sensitivity.

Test Parameters

UV Absorbance

The absorbance of the major peak is digitally expressed at the wavelength where each solvent absorbs.

As an example, 254nm is used when selecting a solvent for a chromatographic system with a UV detector.

Relative Intensity of Fluorescence

The amount of fluorescent impurities interfering with fluorescence analysis are checked as relative intensity of fluorescence with quinine sulfate as the standard.

Refractive Index

In measurements using a differential refractometer, the larger the difference in the refractive index between sample ingredients and the solvent, the more the detection sensitivity is enhanced.

Nonvolatile Matter

This is important Characteristics for in purification of single substance by preparative liquid or thin-layer chromatography.

Peroxides • Acidity

This is important for solvent selection in the chromatography of substances easily decomposed by acids.

Water Content

This is an important factor in preventing column deterioration and obtaining constant chromatograms when an normal phase eluent is used. The maximum value is indicated on the label.

Stabilizers

A non-interfering stabilizer is added to chemically unstable solvents to help prolong storage. All the substances added as stabilizers are shown on the product label and in the brochure of such products.

Solvents of Gradient Grade

We provide HLC-SOL acetonitrile and distilled water of gradient grades.

Figures 1, illustrates the baseline during gradient elution with a combination of HLC-SOL Acetonitrile and HLC-SOL Distilled water.

Experimental conditions

Column : LiChrospher RP-18 10 μ m(125 \times ϕ 4mm)

Temp. : Room Temp.

Flow rate : 1.0mL/min

Detection : UV 210nm

Range : 0.32 AUFS

Eluent A: Acetonitrile (HLC-SOL / GR grade)

B: Distilled water (HLC-SOL / Deionized water)

Time(min)	A%	B%
0~ 10	0	100
10~ 50	0→100	100→0
50~ 70	100	0

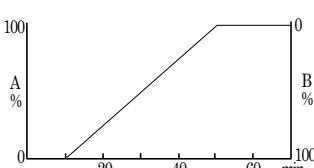


Fig.1

HLC-SOL Acetonitrile
HLC-SOL Distilled water



Fig. 2 Shows a combination of deionized water and HLC-SOL Acetonitrile, and Fig. 3 Shows GR-grade acetonitrile and HLC-SOL Distilled water.

The combination of the HLC-SOL solvents clearly provides a stable baseline in gradient elution.(Fig.1)

Fig.2

Deionized water
HLC-SOL Acetonitrile

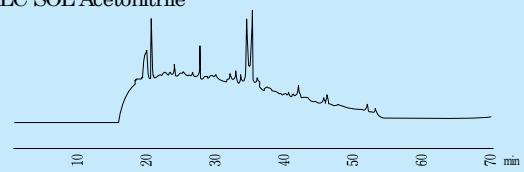
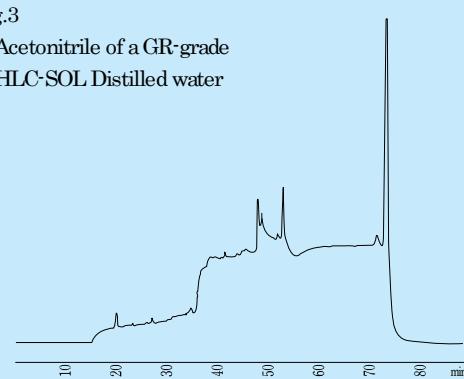


Fig.3

Acetonitrile of a GR-grade
HLC-SOL Distilled water



HLC-SOL(Solvents for High-Performance Liquid Chromatography)

Specifications

Acetonitrile for gradient elution

01031-1B 1L
01031-2B 3L

CH₃CN FW: 41.05

Certificate of Guarantee

Assay (GC)	min. 99.8%
Refractive index (n_D^{20})	1.343~1.346
Acidity (as CH ₃ COOH)	max. 0.001%
Peroxide (as H ₂ O ₂)	max. 0.0005%
Non-volatile matter	max. 0.001%
Water	max. 0.05%
Sp. Gr. (20/20°C)	0.782~0.785
Relative fluorescence intensity	to pass test

Absorbance (1cm cell, reference : water)
 λ (nm) 200 225~400
 max. 1.00 0.01

Distilled Water for gradient elution

11307-1B 1L
11307-2B 3L

H₂O FW: 18.2

Certificate of Guarantee

Refractive index (n_D^{20})	1.332~1.334
Peroxide (as H ₂ O ₂)	max. 0.0001%
pH	to pass test
Non-volatile matter	max. 0.001%
Sp. Gr. (20/20°C)	0.998~1.002
Gradient test	to pass test
Relative fluorescence intensity	to pass test

Absorbance (1cm cell, reference : water)
 λ (nm) 210~400
 max. 0.01

Acetone

01026-1B 1L

(CH₃)₂CO FW: 58.08

Certificate of Guarantee

Assay (GC)	min. 99.7%
Refractive index (n_D^{20})	1.358~1.360
Acidity (as CH ₃ COOH)	max. 0.001%
Peroxide (as H ₂ O ₂)	max. 0.0005%
Non-volatile matter	max. 0.0005%
Water	max. 0.2%
Sp. Gr. (20/20°C)	0.790~0.793

Absorbance (1cm cell, reference : water)
 λ (nm) 330 340 225~400
 max. 1.00 0.10 0.01

1-Butanol

04354-1B 1L

CH₃(CH₂)CH₂OH FW: 41.05

Certificate of Guarantee

Assay (GC)	min. 99.7%
Density (20°C)	0.808~0.812
Refractive index (n_D^{20})	1.398~1.400
Water	max. 0.1%
Non-volatile matter	max. 0.0005%
Acid (as C ₃ H ₇ COOH)	max. 0.002%
Peroxide (as H ₂ O ₂)	max. 0.0005%
Relative fluorescence intensity	to pass test

Absorbance (1cm cell, reference : water)
 λ (nm) 230 240 254 270~
 max. 0.20 0.10 0.03 0.01

Benzene

04084-1B 1L

C₆H₆ FW: 78.11

Certificate of Guarantee

Assay (GC)	min. 99.7%
Refractive index (n_D^{20})	1.499~1.502
Acidity (as HCl)	max. 0.0004%
Peroxide (as H ₂ O ₂)	max. 0.0005%
Non-volatile matter	max. 0.001%
Water	max. 0.03%
Sp. Gr. (20/20°C)	0.877~0.881

Absorbance (1cm cell, reference : water)
 λ (nm) 280 290 300 330~400
 max. 0.70 0.01 0.05 0.01

tert-Butyl methyl ether

04418-1B 1L

(CH₃)COCH FW: 88.15

Certificate of Guarantee

Purity (GC)	min. 99.8%
Density (20°C)	0.738~0.744
Refractive index (n_D^{20})	1.366~1.372
Water	max. 0.1%
Non-volatile matter	max. 0.0003%
Acidity (as CH ₃ COOH)	max. 0.001%
Peroxide (as H ₂ O ₂)	max. 0.0005%
Relative fluorescence intensity	to pass test

Absorbance (1cm cell, reference : water)
 λ (nm) 210 230 254 280~
 max. 1.00 0.40 0.10 0.01

HLC-SOL(Solvents for High-Performance Liquid Chromatography)

Chloroform

07278-1B 1L
07278-2B 3L

CHCl₃ FW: 119.38

Certificate of Guarantee

Assay (GC)	min. 99.7%
Refractive index (n _D ²⁰)	1.445~1.448
Acidity (as HCl)	max. 0.001%
Free chlorine	max. 0.0001%
Non-volatile matter	max. 0.001%
Water	max. 0.03%
Sp. Gr. (20/20°C)	1.490~1.500
Relative fluorescence intensity	to pass test

Absorbance (1cm cell, reference : water)
 λ(nm) 245 254 260 270 275~400
 max. 1.00 0.20 0.10 0.03 0.01
 stabilized with Amylene

Dichloromethane

10158-1B 1L
10158-2B 3L

CH₂Cl₂ FW: 84.93

Certificate of Guarantee

Assay (GC)	min. 99.5%
Refractive index (n _D ²⁰)	1.423~1.426
Acidity (as HCl)	max. 0.001%
Free chlorine	to pass test
Non-volatile matter	max. 0.001%
Water	max. 0.05%
Sp. Gr. (20/20°C)	1.325~1.333
Relative fluorescence intensity	to pass test

Absorbance (1cm cell, reference : water)
 λ(nm) 235 240 254 260~400
 max. 0.70 0.25 0.02 0.01
 stabilized with Amylene

Cyclohexane

07547-1B 1L
07547-2B 3L

C₆H₁₂ FW: 84.16

Certificate of Guarantee

Assay (GC)	min. 99.7%
Refractive index (n _D ²⁰)	1.425~1.427
Acidity (as HCl)	max. 0.001%
Peroxide (as H ₂ O ₂)	max. 0.0005%
Non-volatile matter	max. 0.001%
Water	max. 0.01%
Sp. Gr. (20/20°C)	0.777~0.781
Relative fluorescence intensity	to pass test

Absorbance (1cm cell, reference : water)
 λ(nm) 210 220 230 240 254 225~400
 max. 1.00 0.50 0.20 0.10 0.02 0.01

1,4-Dioxane

10425-1B 1L

C₄H₈Cl₂ FW: 88.11

Certificate of Guarantee

Assay (GC)	min. 99.5%
Refractive index (n _D ²⁰)	1.421~1.423
Acidity (as CH ₃ COOH)	max. 0.001%
Peroxide (as H ₂ O ₂)	max. 0.01%
Non-volatile matter	max. 0.001%
Water	max. 0.1%
Sp. Gr. (20/20°C)	1.033~1.038

Absorbance (1cm cell, reference : water)
 λ(nm) 220 230 240 254 280 300~400
 max. 0.70 0.50 0.40 0.20 0.10 0.01
 stabilized with 2,6-Di-tert-butyl-4-methylphenol

Carbon Tetrachloride

07140-1B 1L

CCl₄ FW: 153.82

Certificate of Guarantee

Assay (GC)	min. 99.7%
Refractive index (n _D ²⁰)	1.459~1.461
Acidity (as HCl)	max. 0.0002%
Free chlorine	max. 0.0001%
Non-volatile matter	max. 0.001%
Water	max. 0.01%
Sp. Gr. (20/20°C)	1.594~1.599
Relative fluorescence intensity	to pass test

Absorbance (1cm cell, reference : water)
 λ(nm) 265 270 280 290 295~400
 max. 0.70 0.35 0.10 0.03 0.01

1,2-Dichloroethane

10149-1B 1L

C₂H₄Cl₂ FW: 88.11

Certificate of Guarantee

Purity (GC)	min. 99.7%
Density (20°C)	1.251~1.260
Refractive index (n _D ²⁰)	1.422~1.466
Water	max. 0.03%
Non-volatile matter	max. 0.001%
Acid (as HCl)	max. 0.0002%
Free chlorine (Cl)	max. 0.0001%
Peroxide (as H ₂ O ₂)	max. 0.001%
Relative fluorescence intensity	to pass test

Absorbance (1cm cell, reference : water)
 λ(nm) 230 240 254 270~
 max. 0.30 0.10 0.02 0.01



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HLC-SOL(Solvents for High-Performance Liquid Chromatography)

N,N-Dimethylformamide

10344-1B 1L

HCON(CH₃)₂ FW: 73.09

Certificate of Guarantee

Purity (GC)	min. 99.7%
Density (20°C)	0.947~0.952
Refractive index (n _D ²⁰)	1.428~1.432
Water	max. 0.05%
Non-volatile matter	max. 0.002%
Acid (as HCOOH)	max. 0.003%
Peroxide (as H ₂ O ₂)	max. 0.001%
Relative fluorescence intensity	to pass test

Absorbance (1cm cell, reference : water)
 λ (nm) 270 275 280 300 330~
 max. 0.60 0.20 0.15 0.05 0.01

1,1,1,3,3,3-Hexafluoro-2-propanol

18529-1B 100mL

CF₃CH(OH)CF₃ FW: 168.04

Certificate of Guarantee

Purity (GC)	min. 99.7%
Density (20°C)	1.615~1.619
Water	max. 0.03%
Non-volatile matter	max. 0.001%
Acid (as HF)	max. 0.001%
Peroxide (as H ₂ O ₂)	max. 0.0005%
Relative fluorescence intensity	to pass test

Absorbance (1cm cell, reference : water)
 λ (nm) 200 220 240 270~
 max. 0.05 0.03 0.02 0.01

Ethanol

14033-1B 1L
14033-2B 3L

C₂H₅OH FW: 46.07

Certificate of Guarantee

Assay (GC)	min. 99.5%
Refractive index (n _D ²⁰)	1.360~1.363
Acidity (as CH ₃ COOH)	max. 0.001%
Peroxide (as H ₂ O ₂)	max. 0.0005%
Non-volatile matter	max. 0.0005%
Water	max. 0.3%
Sp. Gr. (20/20°C)	0.790~0.793
Relative fluorescence intensity	to pass test

Absorbance (1cm cell, reference : water)
 λ (nm) 210 220 230 240 254 260~400
 max. 0.70 0.40 0.20 0.10 0.02 0.01

n-Heptane

18005-1B 1L

CH₃(CH₂)₅CH₃ FW: 100.20

Certificate of Guarantee

Assay (GC)	min. 99.0%
Refractive index (n _D ²⁰)	1.387~1.389
Acidity (as CH ₃ COOH)	max. 0.001%
Peroxide (as H ₂ O ₂)	max. 0.0005%
Non-volatile matter	max. 0.001%
Water	max. 0.01%
Sp. Gr. (20/20°C)	0.683~0.685
Relative fluorescence intensity	to pass test

Absorbance (1cm cell, reference : water)
 λ (nm) 210 220 230 240 254~400
 max. 0.35 0.15 0.05 0.03 0.01

Ethyl Acetate

14029-1B 1L
14029-2B 3L

CH₃COOC₂H₅ FW: 88.11

Certificate of Guarantee

Assay (GC)	min. 99.7%
Refractive index (n _D ²⁰)	1.370~1.373
Acidity (as CH ₃ COOH)	max. 0.005%
Peroxide (as H ₂ O ₂)	max. 0.0005%
Non-volatile matter	max. 0.001%
Water	max. 0.1%
Sp. Gr. (20/20°C)	0.899~0.904

Absorbance (1cm cell, reference : water)
 λ (nm) 254 260 270 280 290~400
 max. 1.00 0.35 0.10 0.02 0.01

n-Hexane

18041-1B 1L
18041-2B 3L

C₆H₁₄ FW: 86.18

Certificate of Guarantee

Assay (GC)	min. 96.0%
Refractive index (n _D ²⁰)	1.374~1.376
Acidity (as CH ₃ COOH)	max. 0.001%
Peroxide (as H ₂ O ₂)	max. 0.0005%
Non-volatile matter	max. 0.001%
Water	max. 0.01%
Sp. Gr. (20/20°C)	0.659~0.663
Relative fluorescence intensity	to pass test

Absorbance (1cm cell, reference : water)
 λ (nm) 210 220 230 240 270~400
 max. 0.30 0.15 0.05 0.03 0.01



HLC-SOL(Solvents for High-Performance Liquid Chromatography)

Methanol

25183-1B 1L
25183-2B 3L

CH₃OH FW: 32.04

Certificate of Guarantee

Assay (GC)	min. 99.7%
Refractive index (n_D^{20})	1.327~1.330
Acidity (as HCOOH)	max. 0.001%
Peroxide (as H ₂ O ₂)	max. 0.0005%
Non-volatile matter	max. 0.0005%
Water	max. 0.05%
Sp. Gr. (20/20°C)	0.791~0.794
Relative fluorescence intensity	to pass test

Absorbance (1cm cell, reference : water)
 λ (nm) 210 220 230 240 254 260~400
 max. 0.70 0.30 0.15 0.07 0.02 0.01

Toluene

40180-1B 1L

C₆H₅CH₃ FW: 92.14

Certificate of Guarantee

Assay (GC)	min. 99.7%
Refractive index (n_D^{20})	1.496~1.498
Acidity (as HCl)	max. 0.001%
Peroxide (as H ₂ O ₂)	max. 0.0005%
Non-volatile matter	max. 0.001%
Water	max. 0.03%
Sp. Gr. (20/20°C)	0.866~0.869

Absorbance (1cm cell, reference : water)
 λ (nm) 285 290 300 330 350~400
 max. 1.00 0.50 0.15 0.03 0.01

2-Propanol

32435-1B 1L
32435-2B 3L

(CH₃)₂CHOH FW: 60.10

Certificate of Guarantee

Assay (GC)	min. 99.7%
Refractive index (n_D^{20})	1.376~1.378
Acidity (as C ₂ H ₅ COOH)	max. 0.001%
Peroxide (as H ₂ O ₂)	max. 0.0005%
Non-volatile matter	max. 0.001%
Water	max. 0.2%
Sp. Gr. (20/20°C)	0.785~0.788
Relative fluorescence intensity	to pass test

Absorbance (1cm cell, reference : water)
 λ (nm) 210 230 254 260~400
 max. 0.70 0.15 0.02 0.01

2,2,4-Trimethylpentane

31005-1B 1L

(CH₃)₃CCH₂CH(CH₃)₂ FW: 114.23

Certificate of Guarantee

Assay (GC)	min. 99.0%
Refractive index (n_D^{20})	1.390~1.392
Acidity (as CH ₃ COOH)	max. 0.001%
Peroxide (as H ₂ O ₂)	max. 0.0005%
Non-volatile matter	max. 0.001%
Water	max. 0.01%
Sp. Gr. (20/20°C)	0.691~0.694
Relative fluorescence intensity	to pass test

Absorbance (1cm cell, reference : water)
 λ (nm) 210 220 230 254~400
 max. 0.50 0.20 0.08 0.01

Tetrahydrofuran

40060-1B 1L
40060-2B 3L

C₄H₈O FW: 72.11

Certificate of Guarantee

Assay (GC)	min. 99.7%
Refractive index (n_D^{20})	1.406~1.408
Acidity (as CH ₃ COOH)	max. 0.001%
Peroxide (as H ₂ O ₂)	max. 0.01%
Non-volatile matter	max. 0.001%
Water	max. 0.1%
Sp. Gr. (20/20°C)	0.886~0.890

Absorbance (1cm cell, reference : water)
 λ (nm) 235 240 254 270 310~400
 max. 1.00 0.70 0.30 0.10 0.01

Trifluoroacetic acid

40578-1B 5×1mL

CF₃COOH FW: 114.02

Certificate of Guarantee

Purity (HPLC)	min. 99.8%
Relative fluorescence intensity	to pass test

Absorbance (1cm cell, reference : water)
 λ (nm) 200 280 300~
 max. 0.03 0.003 0.001



Kanto Kagaku

Prepsol (Solvents for Preparative Liquid Chromatography)

Preparative work with high-performance liquid chromatography is an effective method of separating and purifying medical or bioactive substances. It also has a potential for industrial application. Solvents used for this procedure must be of high quality as well as inexpensive. To meet

such requirements, Kanto provides solvents for mass-preparative liquid chromatography. Prepsol has the advantageous features of low UV absorption and limited non-volatile substances. We provide Prepsol in 18-liter packaging, taking a large-scale application into account.

Test Parameters

Nonvolatile Matter

Special care is taken to minimize nonvolatile matter in solvents.

UV Absorbance

Prepsol yields low blank values in UV absorption spectra.

Acidity • Peroxides

For separation of unstable substance against acids or peroxides solvent with Low content of acidity or peroxide is important.

Refractive Index

In measurements with a RI detector refractometer, the larger the refractive index difference between sample ingredients and the solvent, the more the detection sensitivity is enhanced.

Water content

This is an important factor in preventing column deterioration and obtaining constant chromatograms when an absorptive type of chromatographic carrier is used. The maximum value is indicated on the label.

Specifications

Acetonitrile

CH₃CN FW: 41.05

Certificate of Guarantee

Assay (GC)	min. 99.8%
Refractive index (n_D^{20})	1.343~1.346
Acidity (as CH ₃ COOH)	max. 0.001%
Peroxide (as H ₂ O ₂)	max. 0.0005%
Non-volatile matter	max. 0.0003%
Water	max. 0.05%

Absorbance (1cm cell, reference : water)
 λ (nm) 230 280~400
max. 0.30 0.01

Distilled Water

H₂O FW: 18.02

Certificate of Guarantee	
Refractive index (n_D^{20})	1.332~1.334
Peroxide (as H ₂ O ₂)	max. 0.0005%
Non-volatile matter	max. 0.0003%
pH	5.5~7.5

Absorbance (1cm cell, reference : water)
 λ (nm) 210~400
max. 0.01

Chloroform

CHCl₃ FW: 119.38

Certificate of Guarantee

Assay (GC)	min. 99.5%
Refractive index (n_D^{20})	1.445~1.448
Acidity (as HCl)	max. 0.001%
Non-volatile matter	max. 0.0005%

Water max. 0.03%

Absorbance (1cm cell, reference : water)
 λ (nm) 254 280
max. 0.30 0.02
Stabilized with Amylene

Ethanol

C₂H₅OH FW: 47.07

Certificate of Guarantee	
Assay (GC)	min. 99.5%
Refractive index (n_D^{20})	1.360~1.363
Acidity (as CH ₃ COOH)	max. 0.001%
Non-volatile matter	max. 0.0005%
Water	max. 0.001%
	max. 0.3%

Absorbance (1cm cell, reference : water)
 λ (nm) 220 260
max. 0.40 0.02



Prepsol(Solvents for Preparative Liquid Chromatography)

Ethyl Acetate

14029-96 18L

CH₃COOC₂H₅ FW: 88.11

Certificate of Guarantee

Assay (GC)	min. 99.7%
Refractive index (n _D ²⁰)	1.370～1.374
Acidity (as CH ₃ COOH)	max. 0.001%
Peroxide (as H ₂ O ₂)	max. 0.0005%
Non-volatile matter	max. 0.0003%
Water	max. 0.05%

Absorbance (1cm cell, reference : water)

λ (nm) 260 290～400
max. 0.40 0.01

Methanol

25183-96 18L
25183-84 2×3L

CH₃OH FW: 32

Certificate of Guarantee

Assay (GC)	min. 99.8%
Refractive index (n _D ²⁰)	1.327～1.330
Acidity (as HCOOH)	max. 0.001%
Peroxide (as H ₂ O ₂)	max. 0.0005%
Non-volatile matter	max. 0.0005%
Water	max. 0.02%

Absorbance (1cm cell, reference : water)

λ (nm) 220 260 280～400
max. 0.30 0.02 0.01

n-Hexanen

18635-96 18L

C₆H₁₄ FW: 86.18

Certificate of Guarantee

Assay (GC)	min. 97.0%
Refractive index (n _D ²⁰)	1.374～1.377
Acidity (as CH ₃ COOH)	max. 0.001%
Peroxide (as H ₂ O ₂)	max. 0.0005%
Non-volatile matter	max. 0.0003%
Water	max. 0.01%

Absorbance (1cm cell, reference : water)

λ (nm) 220 240 300～400
max. 0.50 0.20 0.01



APPENDIX

Elution Profile of Solvents

The table on the next page arranges representative eluents used for thin-layer chromatography (TLC) and liquid chromatography (LC) in the order of decreasing eluting strength on standardized silica gel plates.

Ranking and Eluting Strength in Normal-phase Chromatography

Solvents of lower rank in the table tend to have larger polarity and eluting strength, and elute adsorbates rapidly. In general, they give high R_f values in TLC and low κ' values (relative retention value) in LC. In reversed-phase chromatography, polar, water-soluble solvents (refer to acetonitrile through methanol in the ranking table) are usually used. Mixing of these organic solvents with water reduces eluting strength.

Evaporation Number

The evaporation rate of each solvent is given as a relative value to diethyl ether (= 1). The use of a highly volatile solvent in preparative chromatography makes it easier to evaporate the solvent.

Use the table as a quick reference for experiments because complex interactions may occur among samples, eluents, and carriers in chromatographic separation and alter this order.

Viscosity

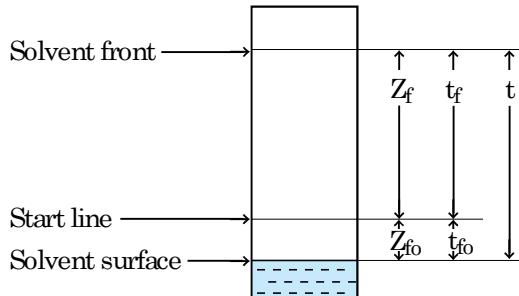
An increase in viscosity reduces the dispersion coefficient, decreases substance mobility, and deteriorates separation efficiency, thus extending analytical time in TLC and LC. Viscosity greatly affects pressure in LC; solvents with low viscosity are generally recommended.

Migration Coefficient of Solvents on TLC Plates

This value represents how fast a solvent moves on a plate coated with silica gel 60. The larger the κ value, the shorter the developing time. The developing time will be predicted by calculating from the formula, $t = \frac{(Z_f - Z_{f0})^2}{\kappa}$. For example, in developing by 50mm with benzene at $Z_{f0} = 5$ mm, substitute 8.6 for κ with reference to the table. The developing time is estimated to be about 6 min [$t = \frac{(50 - 5)^2}{8.6} \times \frac{1}{60} \approx 6$]. In developing by 75mm with benzene, the estimated time is about 11 minutes [$\approx \frac{(75 - 5)^2}{9.8} \times \frac{1}{60}$].

[Notes for the ranking table]

- *1. A wavelength showing 20% transmission against water is defined as the limiting wavelength (1cm cell).
- *2. Relative value to diethyl ether (= 1). The larger the value is, the less the solvent evaporates.
- *3. (reference)
- *4. Calculated from the Debye's equation in benzene.
- *5. Separation factor (taking polarity and selectivity into account)
- *6. Solvent strength with alumina as adsorbent
- *7. Rate of migration that the solvent front moves to the height of 50, 75, and 100mm on a silica gel-60 TLC plate. The larger the κ value, the shorter the developing time.



$$\kappa' = \frac{(Z_f - Z_{f0})^2}{t_f + t_f0}$$

Z_f [mm.] Distance between the solvent front and the start line.

Z_{f0} [mm.] Distance between the solvent surface and the start line.

t_f [sec] Time reaching from the start line to the solvent front.

t_{f0} [sec] Time reaching from the solvent surface to the start line..

t [sec] Developing time of the chromatogram

Table of Elution Profile of Solvents (Adsorbent: Silica Gel)

Order O	Parameter	Evaporation no.		Viscosity		Surface tension γ dyn/cm	Pole moment DMD)	Separation factor k'	Solvent strength ε^*	TLC mobile rate coefficient [†] (Silica gel 60 plate, 22°C, saturated N-developing chamber)	
		Refractive index n_D^{20}	Boiling point °C	(22°C)	(40°C)					A κ 50mm 22°	B κ 75mm 22°
1	n-Heptane*	195	1.338	98.4	0.40	0.33	20.4	0.01	9.2	10.6	11.4
2	n-Hexane*	195	1.372	68.8	120	1.4	0.31	0.26	1.9	0	0.01
3	n-Pentane	200	1.358	36.1		0.22		16.0			10.6
4	Cyclohexane*	210	1.426	80.8	77	3.5	0.94	0.71	2.0	0	0.04
5	Trimethylpentane*	210	1.397	125.7						0.04	5.4
6	Carbon disulfide	380	46.3	298	1.8	0.36	0.32	2.6	0	1.0	0.15
7	Carbon tetrachloride*	265	1.460	76.8	91	4	0.94	0.74	27.0	2.2	0
8	Trichlorethylene		1.481	86.9	58	3	0.57	0.48	3.4		
9	Xylene	290	1.495-1.505	137/140	5/7	13.5	0.68	0.54			
10	Toluene*	285	1.499	110.6	21	6.1	0.57	0.47	28.1	2.4	0.4
11	Benzene*	285	1.501	80.1	75	3	0.63	0.49	28.9	2.3	0.4
12	Chloroform*	245	1.447	61.3	160	2.5	0.56	0.47	27.1	4.7	1.1
13	Dichlormethane*	230	1.424	39.7	356	1.8	0.43	0.36	26.5	8.9	1.5
14	di-iso-Propylether		1.368	68	135	1.6	0.35		32	3.9	1.3
15	tert-Butanol		82.6	31	11	2.82	1.79		12.2	1.7	3.9
16	Diethyl ether	210	1.354	34.6	449	1	0.24	0.20	17.0	4.2	1.3
17	iso-Butanol		1.398	107.7	9	24	3.71	2.12		18.2	
18	Acetonitrile*	190		82		0.39		29.3	37.5	3.5	6.2
19	iso-Butylmethylketone		1.396	115.9	15	10	0.59		22.7		
20	Propanol-(2)*	205	1.378	82.4	32	10	2.27	1.35	21.7	18.3	1.7
21	Ethyl acetate*	205	1.372	77.2	77	2.9	0.44	0.36	23.9	6.0	4.3
22	Propanol-(1)*		1.386	97.2	14	16	2.09	1.40	23.8	20.1	1.7
23	Ethylmethylketone		1.379	79.6	72	2.8	0.43		24.6	18.5	2.7
24	Acetone*	335	1.359	56.2	180	2.1	0.32	0.27	23.7	20.7	5.4
25	Ethanol*	205	1.383	78.3	44	8.3	1.14	0.82	22.8	24.3	1.7
26	Dioxane*	215	1.422	101.3	30	7.3	1.21	0.92	33.7	2.2	0.4
27	Tetrahydrofuran*	230		66	131	2.3	0.47	0.38		7.4	1.7
28	Methanol	205	1.331	64.7	96	6.3	0.52	0.45	22.6	32.6	6.6
29	Pyridine	305	1.509	115.3	15	12.7	0.92	0.73	12.3	2.2	0.71
30	Water*		1.333	100.0	17		0.95	0.65	72.7	80.2	

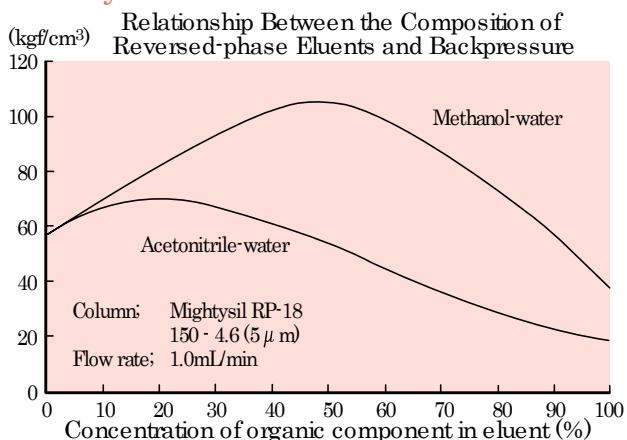
* available as HLC-SOL



APPENDIX

Relationship Between Solvent Viscosity and Pressure

Solvents commonly used for reversed-phase chromatography, such as acetonitrile / water and methanol/water, have a rather higher viscosity than those for normal-phase column and generates backpressure high. In view of a column's life, operating pressure should be as low as possible.



Quick Reference for Solvent Selection

The figure on the following page briefly illustrates the relationship between the analytes, classified by functional groups, and the solvents to be used. This demonstrates the effective use of the table in elution ranking. It is a common practice in routine experiments to treat complex materials with eluents composed of two or three solvents. Nevertheless, make good use of the ranking table for TLC and LC on the basis of properties shown in the figure.

In the central part of the figure, sample substances with chemical structures of analytes are arranged in the order of polarity attributable to composing functional groups. The polarity increases from the top left to the bottom right. Note that the polarity of compounds generally rises with an increase in the strength and number of functional groups, while it drops with an increase in molecular weight or carbon numbers.

Normal-phase Chromatography

(a) Separation of nonpolar or weakly polar substances

Use nonpolar or weakly polar solvents from heptane to benzene or chloroform in the ranking table.

(b) Separation of substances containing heteroatoms (especially oxygen and nitrogen)

Use centrally placed solvents from ether to ketone in the table. When preparing a binary mixture eluent, add a solvent containing the same polar group as the sample or a polar solvent as another proton acceptor / receptor to a nonpolar solvent. In this case, it must be kept in mind that the effect of the more polar solvent is dominant.

(c) Separation of substances containing hydrophilic, basic, or acidic groups (e. g., amino group, carboxyl group)

Use more polar solvents. (A too-strong polarity may mask small differences between solutes and make separation impossible.)

For very polar substances (e. g., carbohydrates, amino acids, nucleotides), partition chromatography is recommended. For substances ionizing in aqueous solutions, use ion-exchange or ion-pair chromatography.

Reversed-phase Chromatography

The conditions are generally opposite to that for normal phase. Choose eluent on the basis of the solubility of sample substances to the solvents used.

Substances easily dissolved in lower alcohols: RP-2

Substances easily dissolved in chloroform or ethyl methyl ketone: RP-8

Highly fatty substances easily dissolved in hexane: RP-18

APPENDIX

Quick Reference for Solvent Selection

Relationship between solvent and sample substance		Normal-phase chromatography			
		Separation mode	Adsorption		Partition
		Normal-phase eluent	Silica gel, alumina	Cellulose	
1	n-Heptane	larger	(χ) σ_{eluent} , γ	R-H	
2	n-Hexane	larger		R-X	
3	n-Pentane	larger		R-NO ₂	
4	Cyclohexane	larger		C ₆ H ₅ -	
5	Trimethylpentane	larger		R-C(=O)-R'	
6	Carbon disulfide	larger		R-C(=O)-OR'	
7	Carbon tetrachloride	larger		R-C(=O)-OH	
8	Trichlorethylene	larger		R-NH ₂	
9	Xylene	larger		R ₂ NH	
10	Toluene	larger		R ₃ N	
11	Benzene	larger		Ar-OH	
12	Chloroform	larger		R-COOH	
13	Dichloromethane	larger		Ar-COOH	
14	di-iso-Propylether	larger		Nucleotide	
15	tert Butanol	larger		$\text{H}_3\text{N}^+ - \text{C}(\text{COO}^-)_2$	
16	Diethylether	larger			
17	iso-Butanol	larger			
18	Acetonitrile	larger			
19	iso-Butylmethylketone	larger			
20	Propanol-(2)	larger			
21	Ethyl acetate	larger			
22	Propanol-(1)	larger			
23	Ethylmethylketone	larger			
24	Acetone	larger			
25	Ethanol	larger			
26	Dioxane	larger			
27	Tetrahydrofuran	larger			
28	Methanol	larger			
29	Pyridine	larger			
30	Water	larger			
		Reversed-phase chromatography			
		Reversed-phase eluent (normal/reversed-phase eluent)	RP-18/RP-8 RP-2 -Diol-CN-NH ₂		

L. R. Snyder: J. Chromatogr. 92, 223-230 (1974)

APPENDIX

Solvent Miscibility

Examine the miscibility of the solvents when preparing eluents or altering a solvent in an HPLC column. Use the following table as your reference:

n-Heptane	
n-Hexane	
n-Pentane	
Cyclohexane	
Carbon tetrachloride	
Xylene	
Toluene	
Benzene	
Chloroform	
Dichloromethane	
di-iso-Propylether	
Diethylether	
Acetonitrile	🚫🚫🚫🚫
Propanol-(2)	
Ethyl acetate	
Propanol-(1)	
Ethylmethylketone	
Acetone	
Ethanol	
Dioxane	🚫
Tetrahydrofuran	
Methanol	🚫🚫🚫🚫
Pyridine	
Water	🚫🚫🚫🚫🚫🚫🚫🚫🚫🚫
n-Heptane	
n-Hexane	
n-Pentane	
Cyclohexane	
Carbon tetrachloride	
Xylene	
Toluene	
Benzene	
Chloroform	
Dichloromethane	
di-iso-Propylether	
Diethylether	
Acetonitrile	
Propanol-(2)	
Ethyl acetate	
Propanol-(1)	
Ethylmethylketone	
Acetone	
Ethanol	
Dioxane	
Tetrahydrofuran	
Methanol	
Pyridine	
Water	

* \otimes indicates combination not producing homogenous solution.

Source: N. B. Godfrey, Chem. Technol. 2 (1972) 359
J. H. Hildebrand and R. L. Scott, The Solubility of Nonelectrolytes, Reinhold Publ. Corp. York, N. Y. (1950)

Ordering information

HLC-SOL Solvents for High-performance Liquid Chromatography

Cat. No.	Product name	Package size	Cat. No.	Product name	Package size
01026-1B	Acetone	1L	14029-1B	Ethyl acetate	1L
01031-1B	Acetonitrile	1L	14029-2B	Ethyl acetate	3L
01031-2B	Acetonitrile	3L	18005-1B	n-Heptane	1L
04084-1B	Benzene	1L	18529-1B	1,1,1,3,3,3-Hexafluoro-2-propanol	100mL
04354-1B	1-Butanol	1L	18041-1B	n-Hexane	1L
04418-1B	tert-Butyl methyl ether	1L	18041-2B	n-Hexane	3L
07140-1B	Carbon tetrachloride	1L	25183-1B	Methanol	1L
07278-1B	Chloroform	1L	25183-2B	Methanol	3L
07278-2B	Chloroform	3L	32435-1B	2-Propanol (isopropyl alcohol)	1L
07547-1B	Cyclohexane	1L	32435-2B	2-Propanol (isopropyl alcohol)	3L
07547-2B	Cyclohexane	3L	40060-1B	Tetrahydrofuran	1L
10149-1B	1,2-Dichloroethane	1L	40020-2B	Tetrahydrofuran	3L
10158-1B	Dichloromethane	1L	40180-1B	Toluene	1L
10158-2B	Dichloromethane	3L	40578-1B	Trifluoroacetic acid	5×1mL
10344-1B	N,N-Dimethylformamide	1L	31005-1B	2,2,4-Trimethylpentane (isoctane)	1L
10425-1B	1,4-Dioxane	1L			
11307-1B	Distilled water	1L			
11307-2B	Distilled water	3L			
14033-1B	Ethanol	1L			
14033-2B	Ethanol	3L			

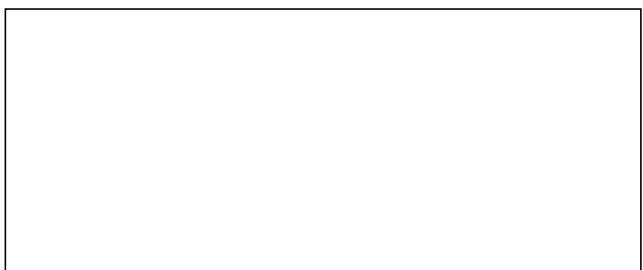
Prepsol Solvents for Mass-preparative Liquid Chromatography

Cat. No.	Product name	Package size	Cat. No.	Product name	Package size
01031-96	Acetonitrile	18L	14029-96	Ethyl acetate	18L
01031-84	Acetonitrile	2×3L	18635-96	n-Hexane	18L
07278-84	Chloroform	25kg	25183-96	Methanol	18L
11334-96	Distilled water	18L	25183-84	Methanol	2×3L
14033-84	Ethanol	18L			

* For the price, refer to the nearest Kanto Chemical sales office.

* Contact us for availability of other package sizes than those listed above.





KANTO CHEMICAL CO., INC.

REAGENT DIVISION

East Muromachi Mitsui BLDG, 2-1, Nihonbashi Muromachi 2-chome,
Chuo-ku, Tokyo, 103-0022 JAPAN

Telephone +813-6214-1092
Telefax +813-3241-1053

<http://www.kanto.co.jp> E-mail:kanto-61@gms.kanto.co.jp