



TCI Dual ~Mixed-Mode column~

TCI Chromatography Department



Mixed-Mode Column

- Target compound is **basic**
 - Choose ODS + Cation-Exchange Type
- Target compound is **acidic**
 - Choose ODS + Anion-Exchange Type
- No ion-pair reagent is required
- Hydrophobic compounds also can be retained on mix-mode columns
- The packing material has both ion-exchange and ODS phases
 - Not a mixture of packing materials of an ion-exchange and ODS



Product Line

	ODS+Cation-Exchange Type (For basic compound)			ODS+Anion-Exchange Type (For acidic compound)		
Column	TCI Dual ODS-CX10	TCI Dual ODS-CX15	TCI Dual ODS-CX20	TCI Dual ODS-AX20	TCI Dual ODS-AX10	Kaseisorb LC ODS- SAX
Ion-Exchange	Strong	Medium	Weak	Strong	Medium	Weak
Usable mobile phase pH range	2.5~7.5	2.5~7.5	2.5~7.5	2.5~7.5	2.5~7.5	2.5~7.5
Ion-Exchange pH range	2.5~7.5	2.5~7.5	4.5~7.5	2.5~7.5	2.5~7.5	2.5~7.5
Silicagel particle size and pore diameter	5 μ m, 12nm	5 μ m, 12nm	5 μ m, 12nm	5 μ m, 12nm	5 μ m, 12nm	5 μ m, 12nm

Choose Cation-Exchange Type

Basic Compound



TCI Dual ODS-CX15

Elution Power Up

Elution Power Down

TCI Dual ODS-CX10

TCI Dual ODS-CX20

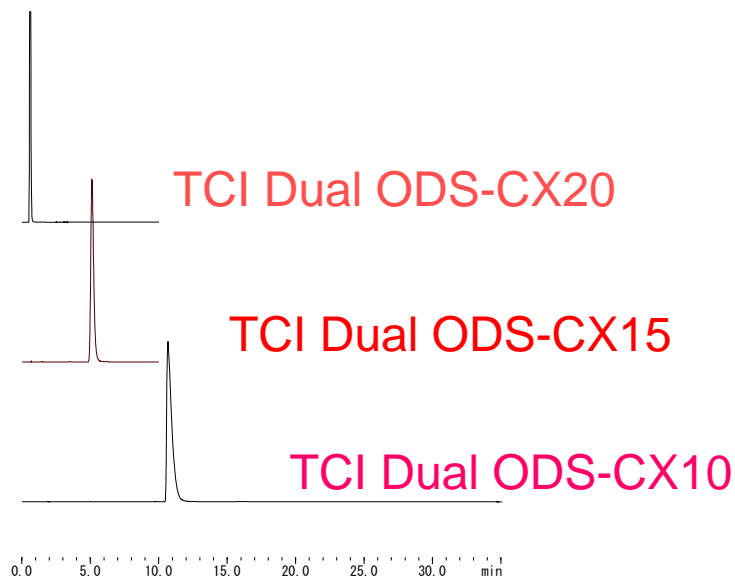
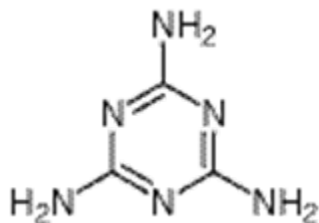
Retention Power of **Basic** Compound

TCI Dual ODS-CX10 > **TCI Dual ODS-CX15** > **TCI Dual ODS-CX20**

Retention Power : Cation-Exchange

Retention Power: **TCI Dual ODS-CX10** > **TCI Dual ODS-CX15** > **TCI Dual ODS-CX20**

Column Size : 4.6 mm I.D. × 50 mm
 Mobile Phase : CH₃CN / 20mmol/L KH₂PO₄ (pH3.0) = 40/60
 Flow Rate : 1.0 ml/min
 Detection : UV 230 nm
 Temperature : 25 °C
 Sample : Melamine



Choose Anion-Exchange Type

Acidic Compound



Kaseisorb LC ODS-SAX Super

Elution Power Up

TCI Dual ODS-AX10

Elution Power Up

TCI Dual ODS-AX20

Elution Power of **Acidic** Compound

TCI Dual ODS-AX20 > TCI Dual ODS-AX10 > Kaseisorb LC ODS-SAX

Retention Power : Anion-Exchange

Column Size :4.6mmI.D. × 150mm

Temperature:30°C

Flow Rate:1.0 mL/min

Mobile Phase:CH₃CN/50mmol/L HCOONH₄ (pH3.5)
=50/50

Sample: 1.Benzene

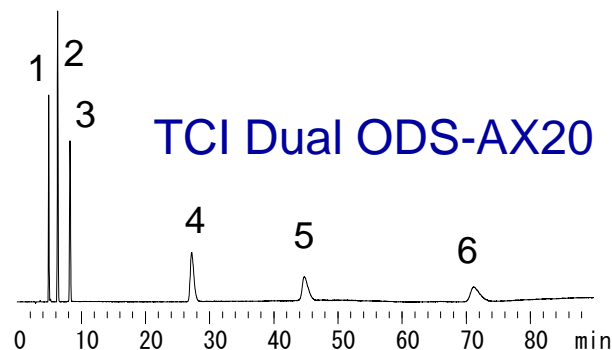
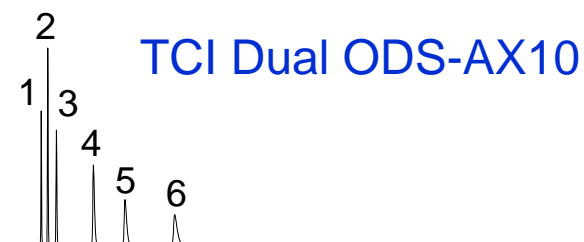
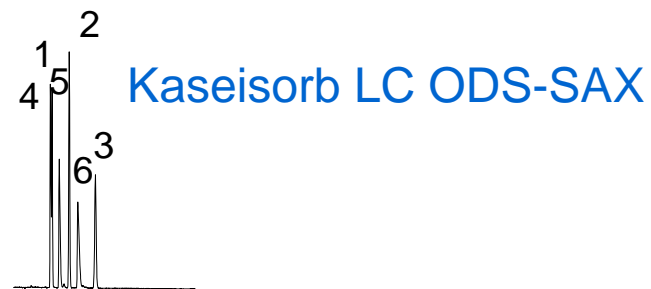
2.Toluene

3.Ethylbenzene

4.Benzenesulfonic Acid

5.p-Toluenesulfonic Acid

6.4-Ethylbenzenesulfonic Acid



Mobile Phase Adjustment

1. Changing the Organic Solvent Ratio

- Organic solvent ratio UP
⇒ Elution Power UP

2. Changing the Buffer Concentration

- Buffer concentration UP
⇒ Elution Power of ionic compounds UP

3. Changing the pH

- Dissociate pH of ionic compounds
⇒ Ionic interaction UP

1.Changing the Organic Solvent Ratio

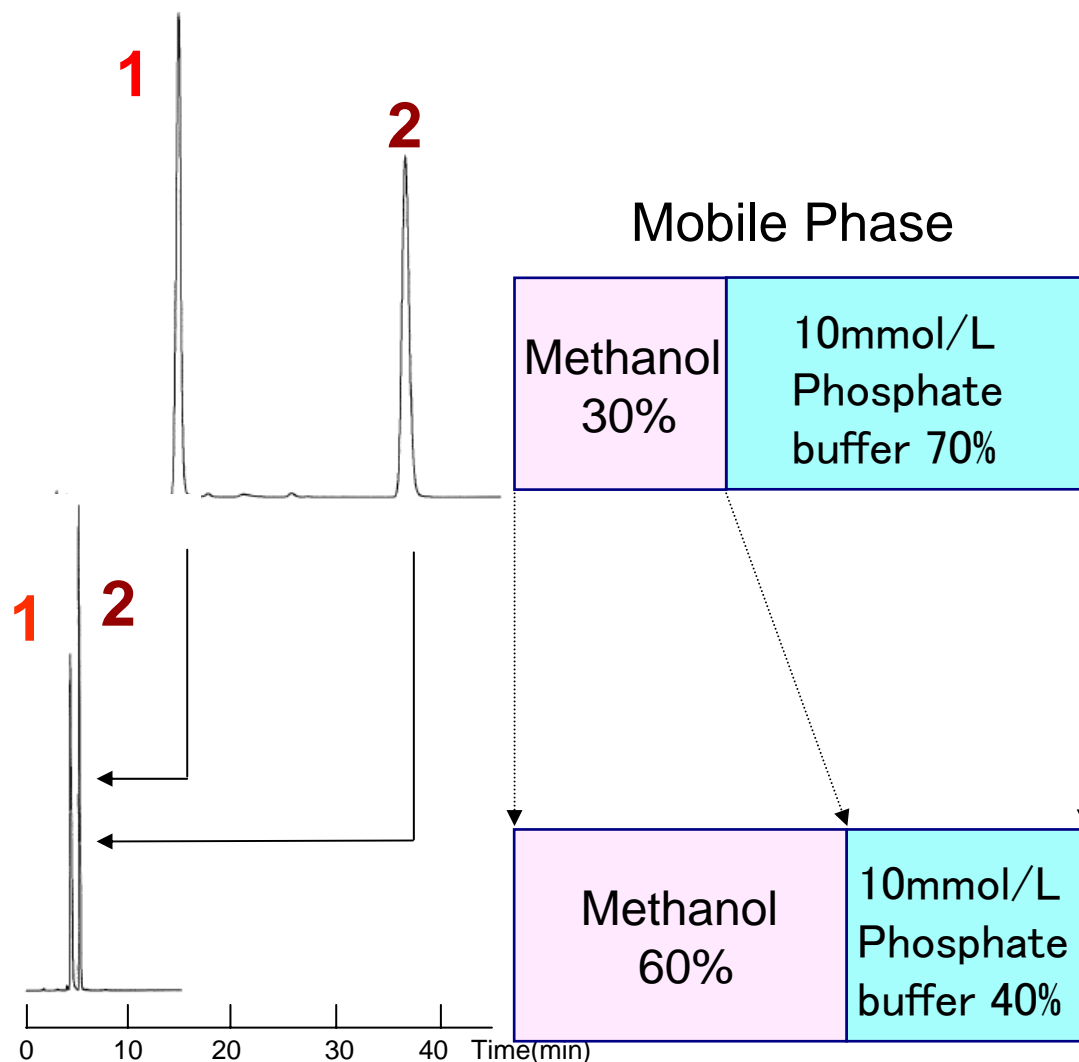
Column:TCI Dual ODS-AX20
4.6mm I.D. × 150mm

Temperature:25°C

Flow Rate:1.0 mL/min

1. 5'-Adenylic Acid
(Acidic compound)

2. Methyl Benzoate
(Hydrophobic compound)



2.Changing the Buffer Concentration

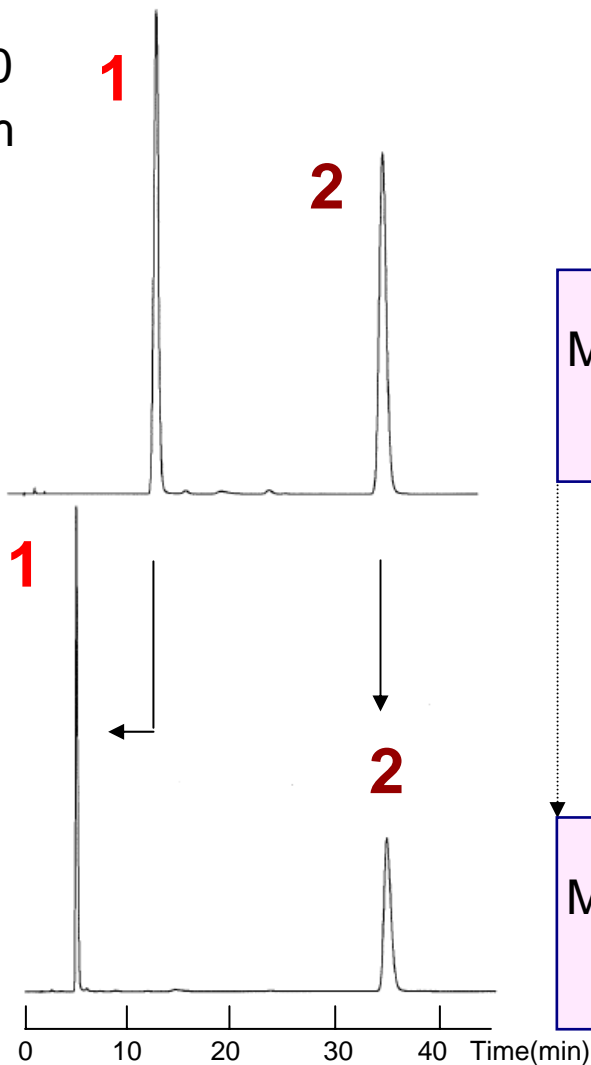
Column:TCI Dual ODS-AX20
4.6mm I.D. × 150mm

Temperature:25°C

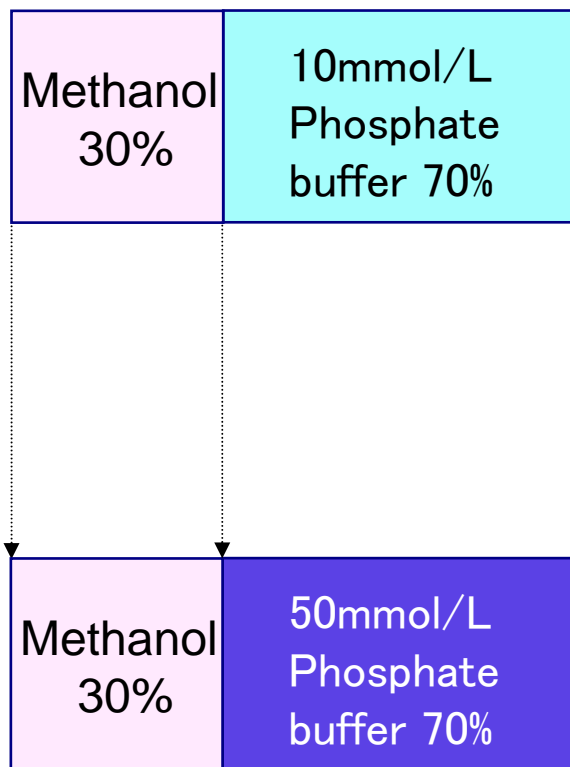
Flow Rate:1.0 mL/min

1. 5'-Adenylic Acid
(Acidic compound)

2. Methyl Benzoate
(Hydrophobic compound)



Mobile Phase



3.Changing the pH

Column:TCl Dual ODS-AX20
4.6mmI.D. × 150mm

Temperature:30°C

Flow Rate:1.0 mL/min

Mobile Phase:CH₃CN/50mmol/L Buffer=50/50

pH7.0:K₂HPO₄ (pH7.0, H₃PO₄)

pH5.0:CH₃COONH₄(pH5.0,CH₃COOH)

pH3.5:HCOONH₄(pH3.5, HCOOH)

Sample:1.Benzene

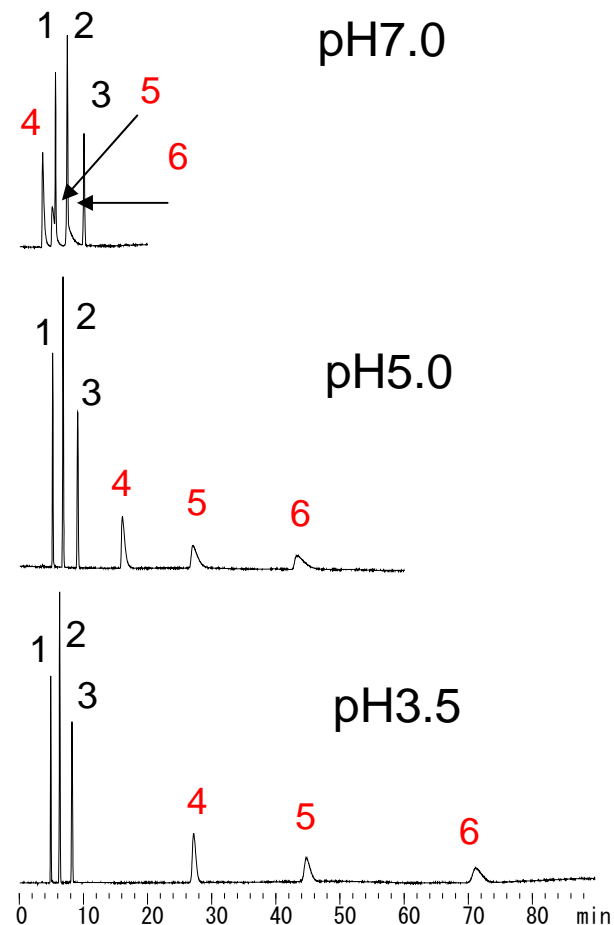
2.Toluene

3.Ethylbenzene

4.Benzenesulfonic Acid

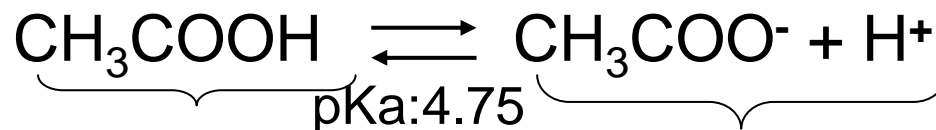
5.p-Toluenesulfonic Acid

6.4-Ethylbenzenesulfonic Acid



Sample pKa

Acetic Acid



pH2.75

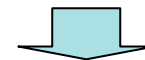
Increase hydrophobicity



Choose Reversed Phase Mode

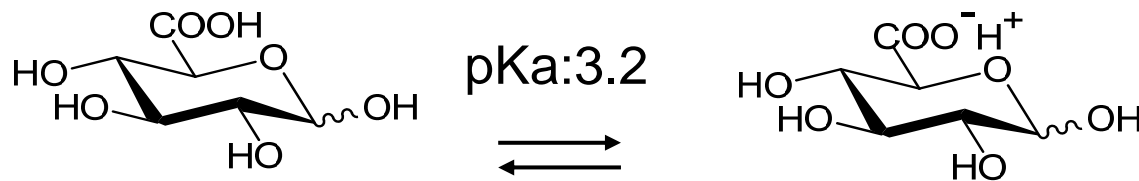
pH6.75

Increase ionicity



Choose Mixed-Mode

Glucuronic Acid



Polar compound



Inapplicable Reversed Phase Mode

Increase ionicity



Choose Mixed-Mode

Gradient Elution 1

Change organic solvent ratio

Serotonin Metabolites

Column : TCI Dual ODS-CX15 4.6 mmI.D. × 150 mm

Mobile phase : A) CH₃CN / 50mmol/L HCOONH₄ (pH3.5,HCOOH) = 10 / 90

B) CH₃CN / 50mmol/L HCOONH₄ (pH3.5,HCOOH) = 70 / 30

A to 50% B in 30min.

Flow Rate : 1.0 mL/min

Temperature : 25 °C

Detection : UV 254 nm

Sample :

1. 5-Hydroxy-L-tryptophan

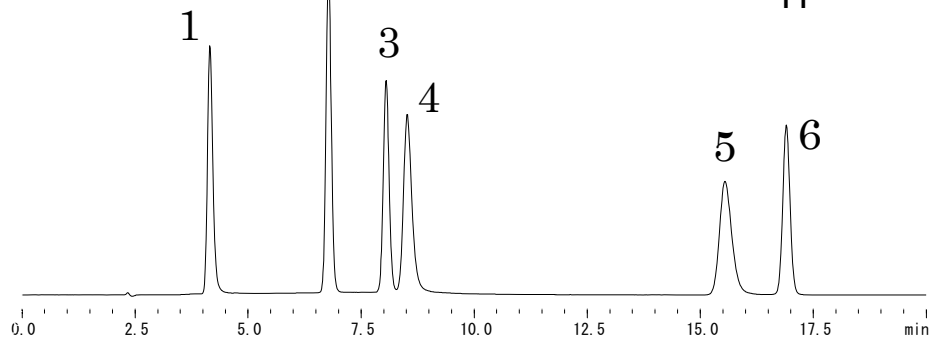
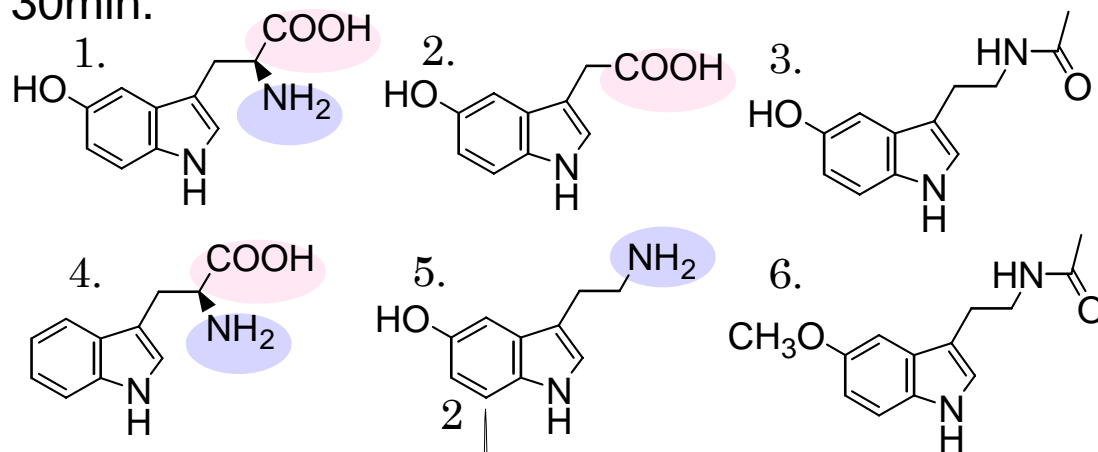
2. 5-Hydroxy-3-acetic Acid

3. Acetylserotonin

4. L-Tryptophan

5. Serotonin

6. Melatonin



Gradient Elution

Change buffer concentration

Adenosine Phosphates

Column : TCI Dual ODS-AX10 (4.6 mmI.D. X 150 mm)

Mobile phase : A) CH₃OH / 10mmol/L K₂HPO₄ (pH7.0) = 20 / 80
 B) CH₃OH / 50mmol/L K₂HPO₄ (pH7.0) = 20 / 80
 0-100% B (10-30min)

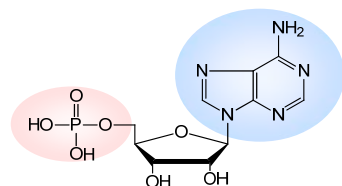
Flow rate : 1.0 mL/min

Detection : UV 254 nm

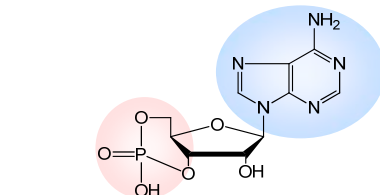
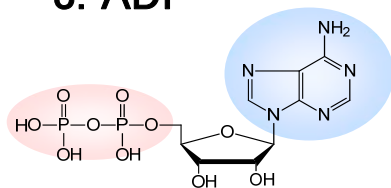
Temperature : 40 ° C

Sample : 1. AMP

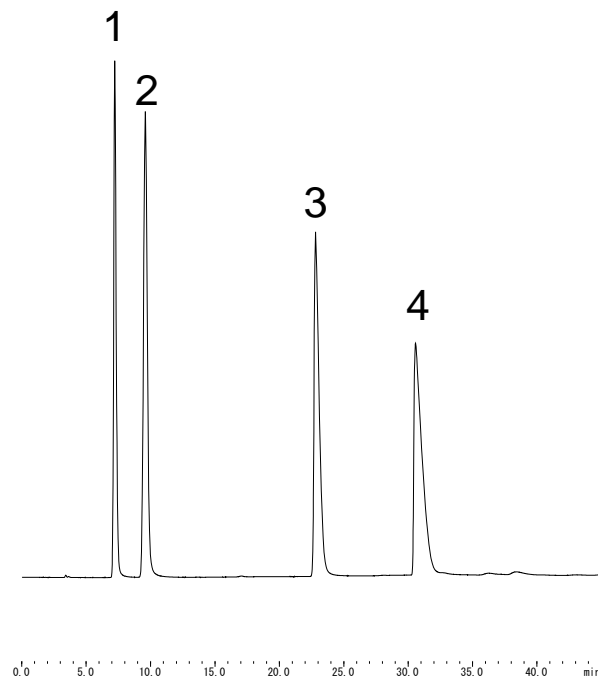
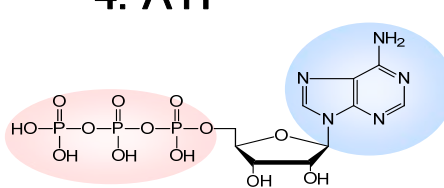
2. cAMP



3. ADP



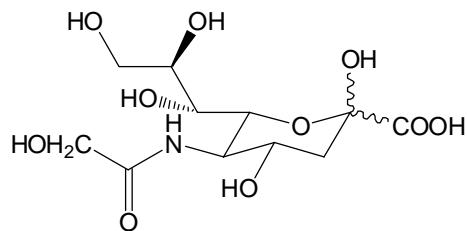
4. ATP



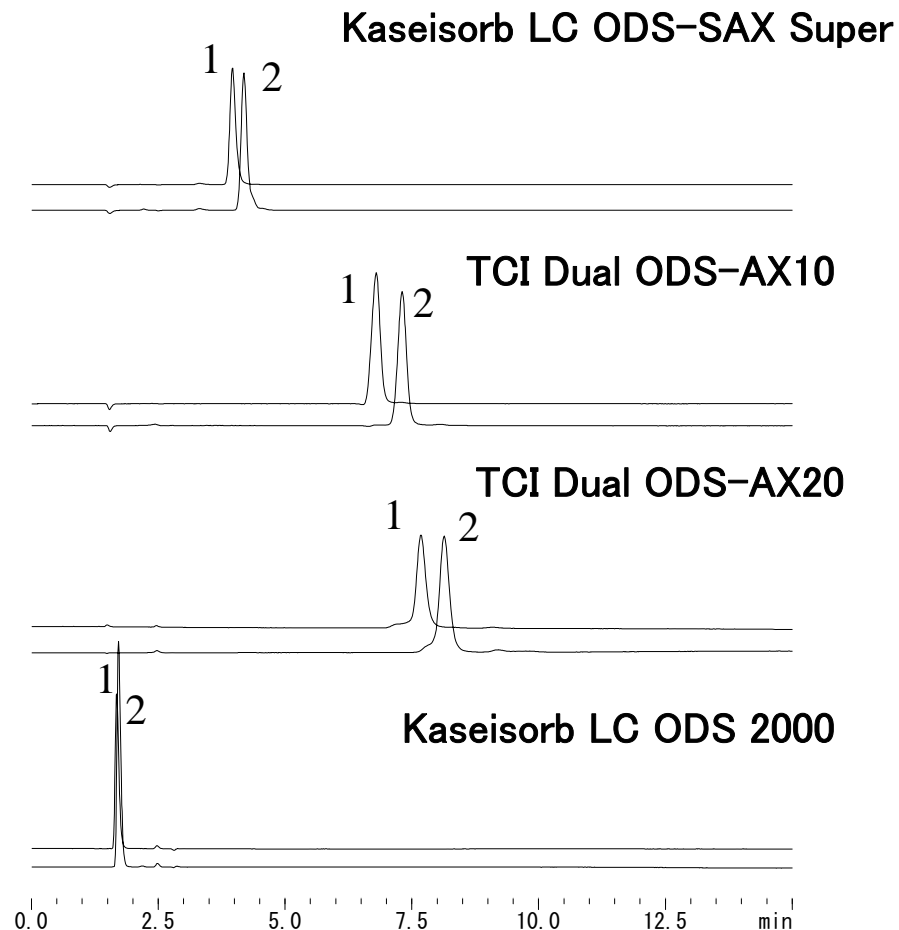
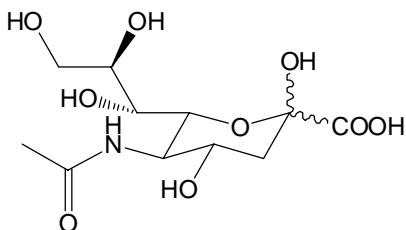
Sialic Acids

Column size : 4.6 mmI.D. × 50 mm
 Mobile phase : CH₃CN / 10mmol/L AcONH₄ (AcOH, pH5.0) = 5/95
 Flow rate : 1.0 ml/min
 Detection : UV 210 nm
 Temperature : 30 °C
 Sample :

1. N-Glycolylneuramic acid(Neu5Gc)



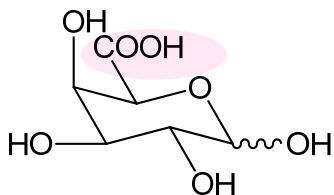
2. N-Acetylneuramic acid(Neu5Ac)



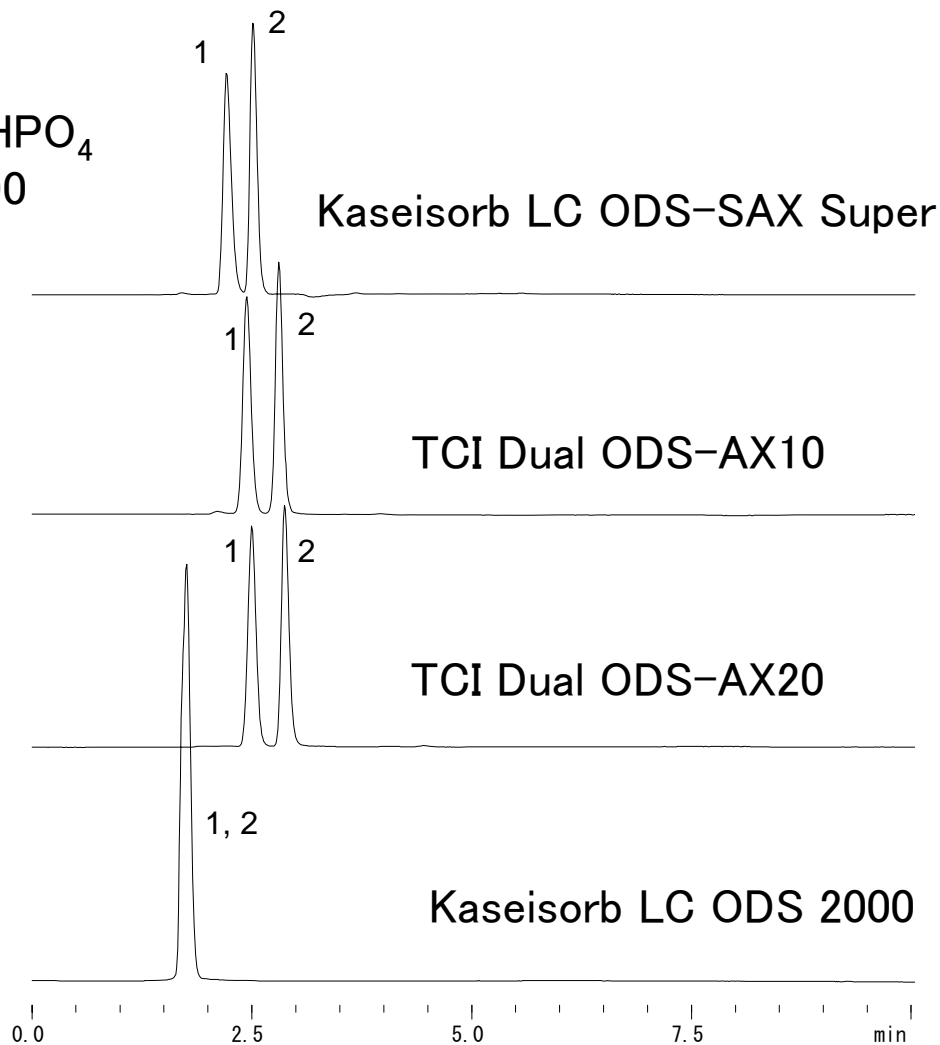
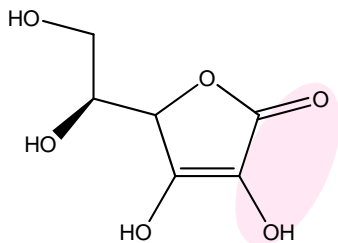
Galacturonic Acid, L-Ascorbic Acid

Column : 4.6 mm I.D. × 150 mm
 Mobile Phase : CH₃OH / 10mmol/L K₂HPO₄
 (pH7.0, H₃PO₄) = 10/90
 Flow Rate : 1.0 mL/min
 Detection : UV 210 nm
 Temperature : 40 °C
 Sample :

1. Galacturonic Acid



2. L-Ascorbic Acid



Column Size : 4.6 mm I.D. X 150 mm
 Mobile phase : CH₃CN / H₂O / H₃PO₄
 = 5 / 95 / 0.1

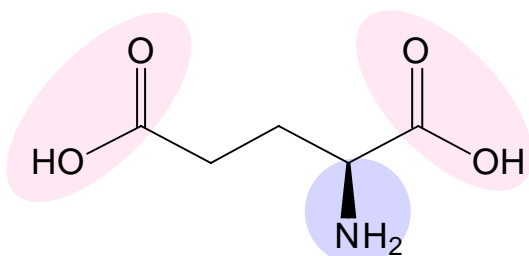
Detection : UV 210 nm

Flow rate : 1.0 mL/min

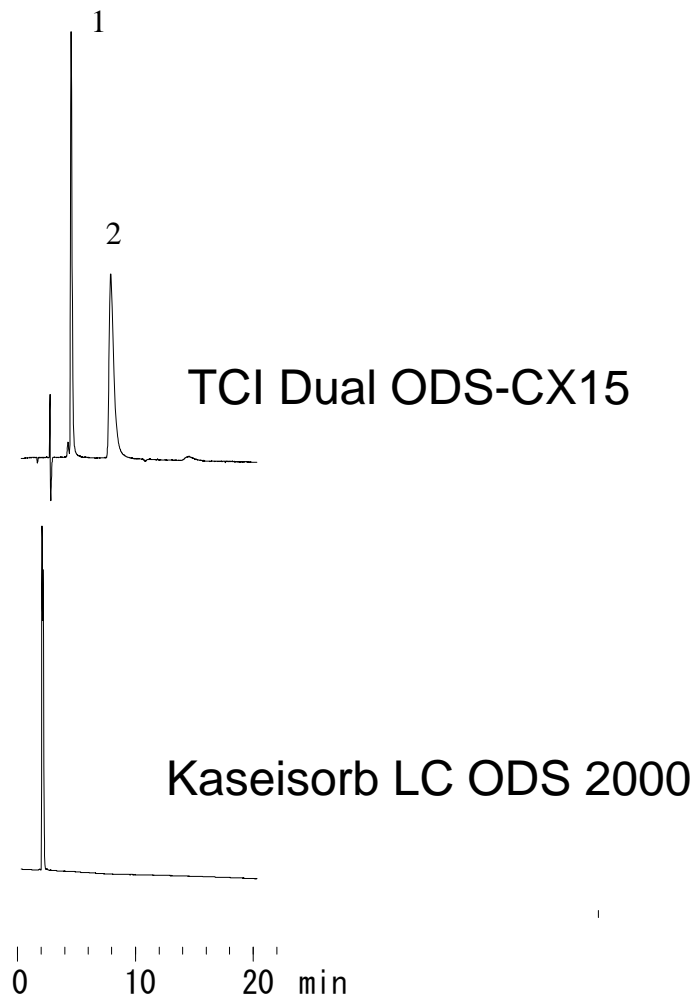
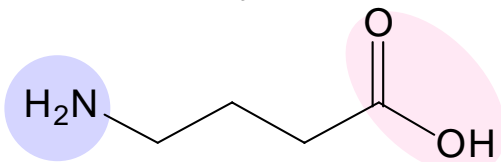
Temperature : 25 °C

Sample :

1. L-Glutamic Acid

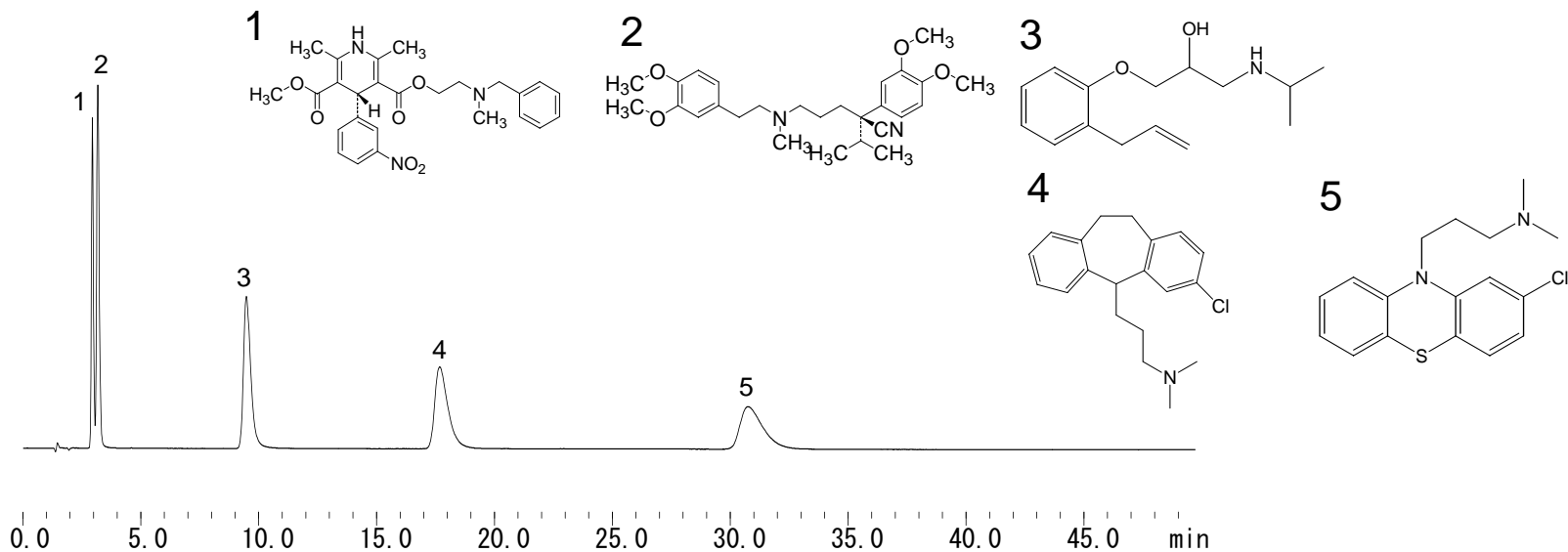


2. γ -Aminobutyric acid (GABA)



Basic Drugs

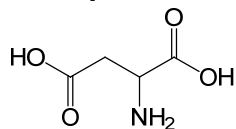
Column : TCI Dual ODS-CX20 4.6 mm I.D. × 150 mm
 Mobile phase : CH₃CN / 50mmol/L CH₃COONH₄ (pH5.0, CH₃COOH) = 80 / 20
 Flow Rate : 1.0 mL/min
 Detection : UV 210 nm
 Temperature : 40 °C
 Sample : 1. Nicardipine 2. Verapamil 3. Alprenolol
 4. Clomipramine 5. Chlorpromazine



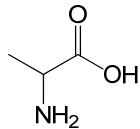
Amino Acids

Column : TCI Dual ODS-CX15(4.6 mmI.D. × 150 mm)
 Mobile Phase : A) CH₃CN / 5 mmol/L KH₂PO₄ (pH3.0, H₃PO₄) = 5/95
 B) CH₃CN / 50 mmol/L KH₂PO₄(pH3.0, H₃PO₄) = 40/60
 0-100%B(5-20min.)

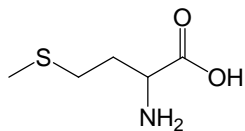
Flow Rate : 1.0 mL/min
 Detection : UV 210 nm
 Temperature : 40 °C



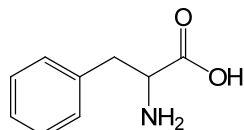
Aspartic Acid



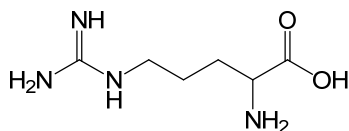
Alanine



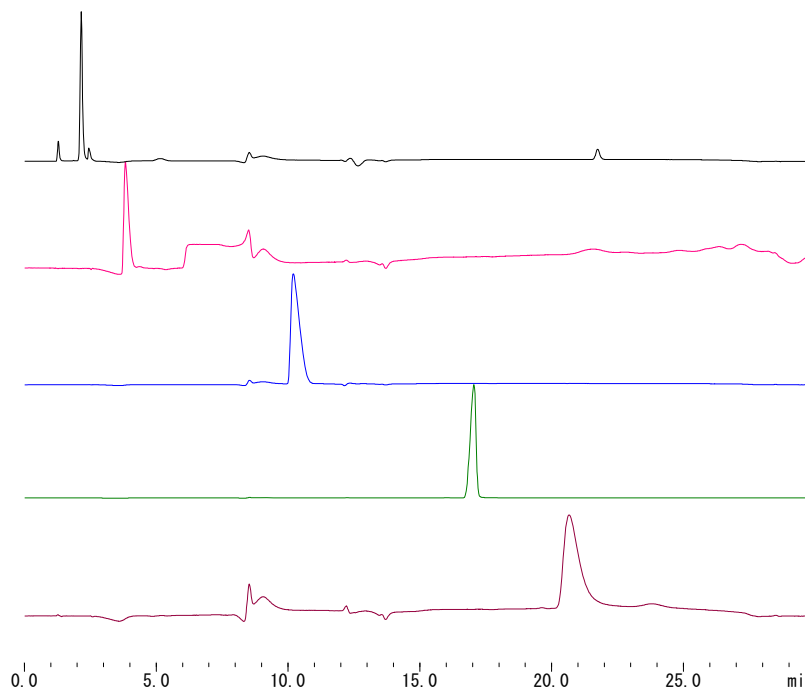
Methionine



Phenylalanine



Arginine



Aspartic Acid

Alanine

Methionine

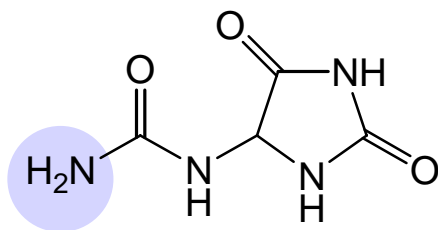
Phenylalanine

Arginine

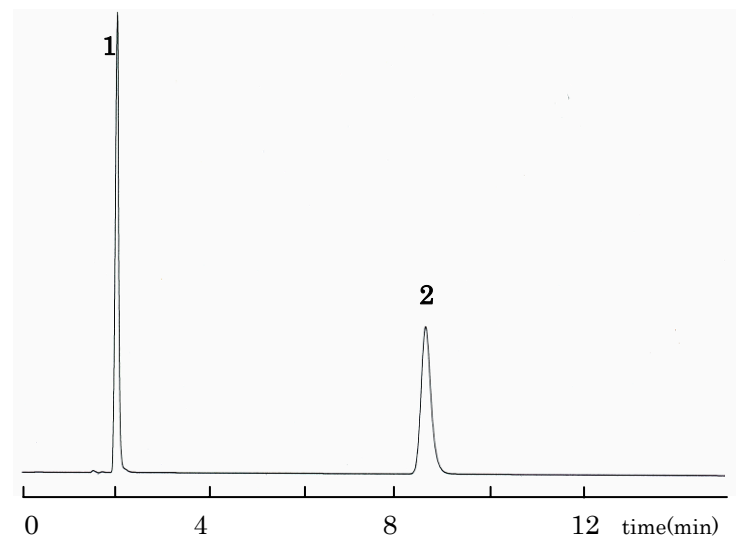
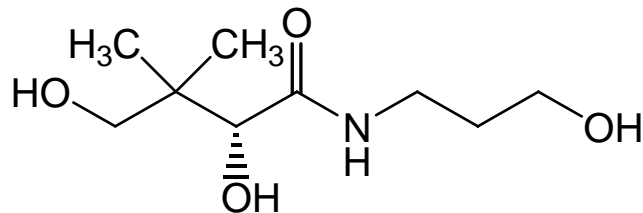
Allantoin, D-Panthenol

Column : TCI Dual ODS-CX10 4.6 mm I.D. × 150 mm
 Mobile Phase : CH₃OH / 20mmol/L K₂HPO₄ (pH6.0, H₃PO₄) = 10/90
 Flow Rate : 1.0 mL/min
 Detection : UV 210 nm
 Temperature : 30 °C
 Sample :

1. Allantoin



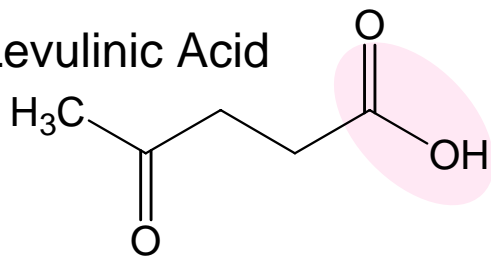
2. D-Panthenol



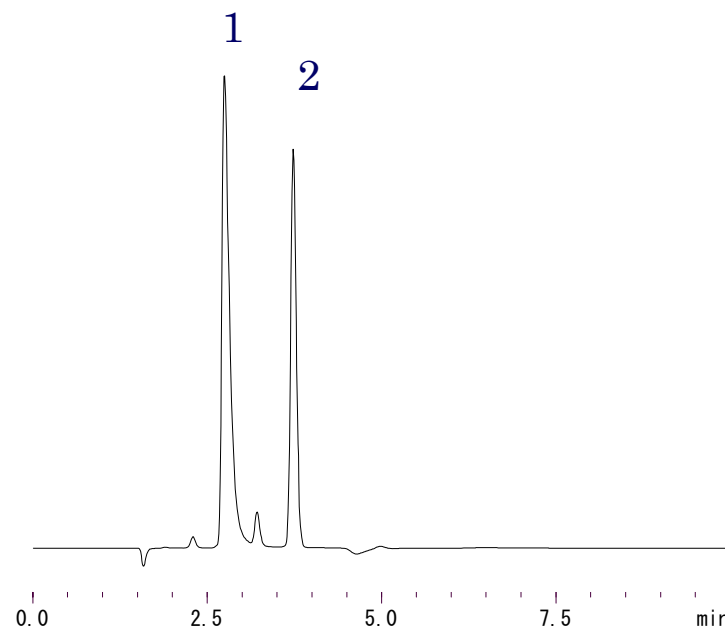
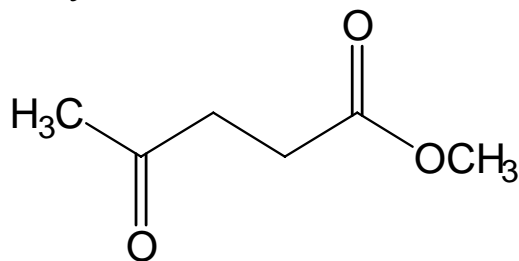
Levulinic Acid, Methyl Levulinate

Column : TCI Dual ODS-AX20 4.6mm I.D. × 150mm
 Mobile Phase : CH₃CN / 20 mmol/L K₂HPO₄(pH7.0, H₃PO₄) = 20 / 80
 Flow Rate : 1.0 mL/min
 Detection : UV 210 nm
 Temperature : 25 °C
 Sample :

1. Levulinic Acid



2. Methyl Levulinate



Nucleotides

Column Size : 4.6 mmI.D. × 150 mm

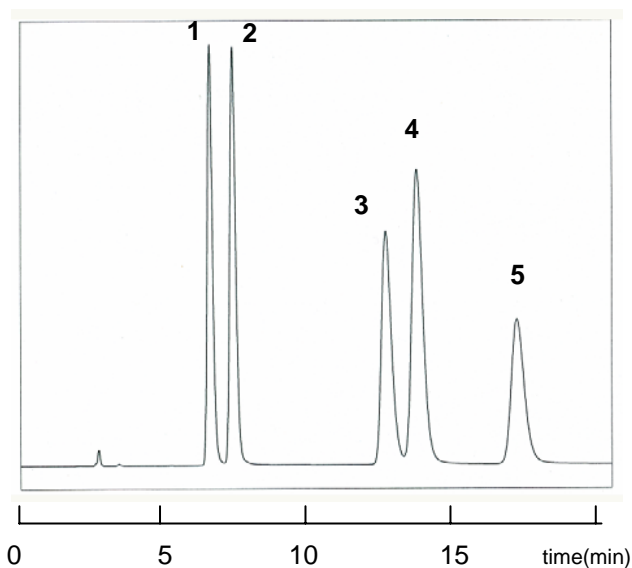
Mobile Phase : CH₃OH / 10mmol/L K₂HPO₄ (pH 7.0, H₃PO₄) = 20 / 80

Flow Rate : 1.0 mL/min

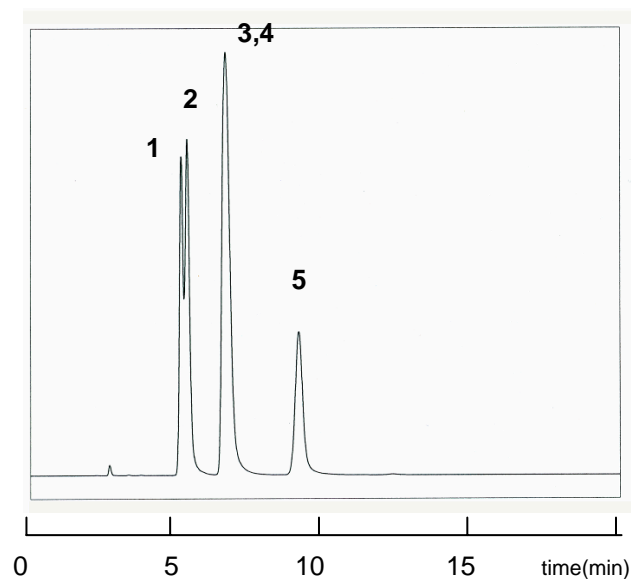
Detection : UV 254 nm

Temperature : 40 °C

Sample : 1. CMP 2. UMP 3. IMP 4. GMP 5. AMP



TCI Dual ODS-AX20



TCI Dual ODS-AX10

Halide Ions

Column : Kaseisorb LC ODS-SAX Super

4.6mm I.D. × 150 mm

Mobile Phase: CH₃CN/ 50mmol/L CH₃COONH₄

(pH 5.00, CH₃COOH) = 50/50

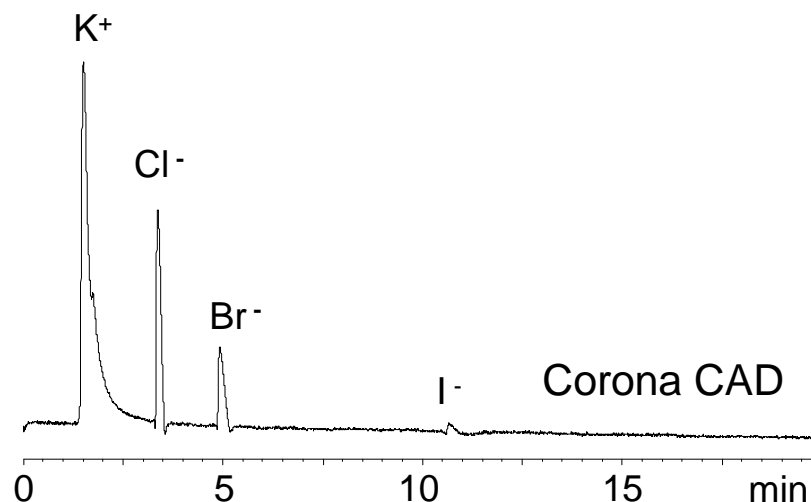
Detection : UV 210 nm, Corona CAD

Flow Rate : 1.0 mL/min

Temperature : 40 °C

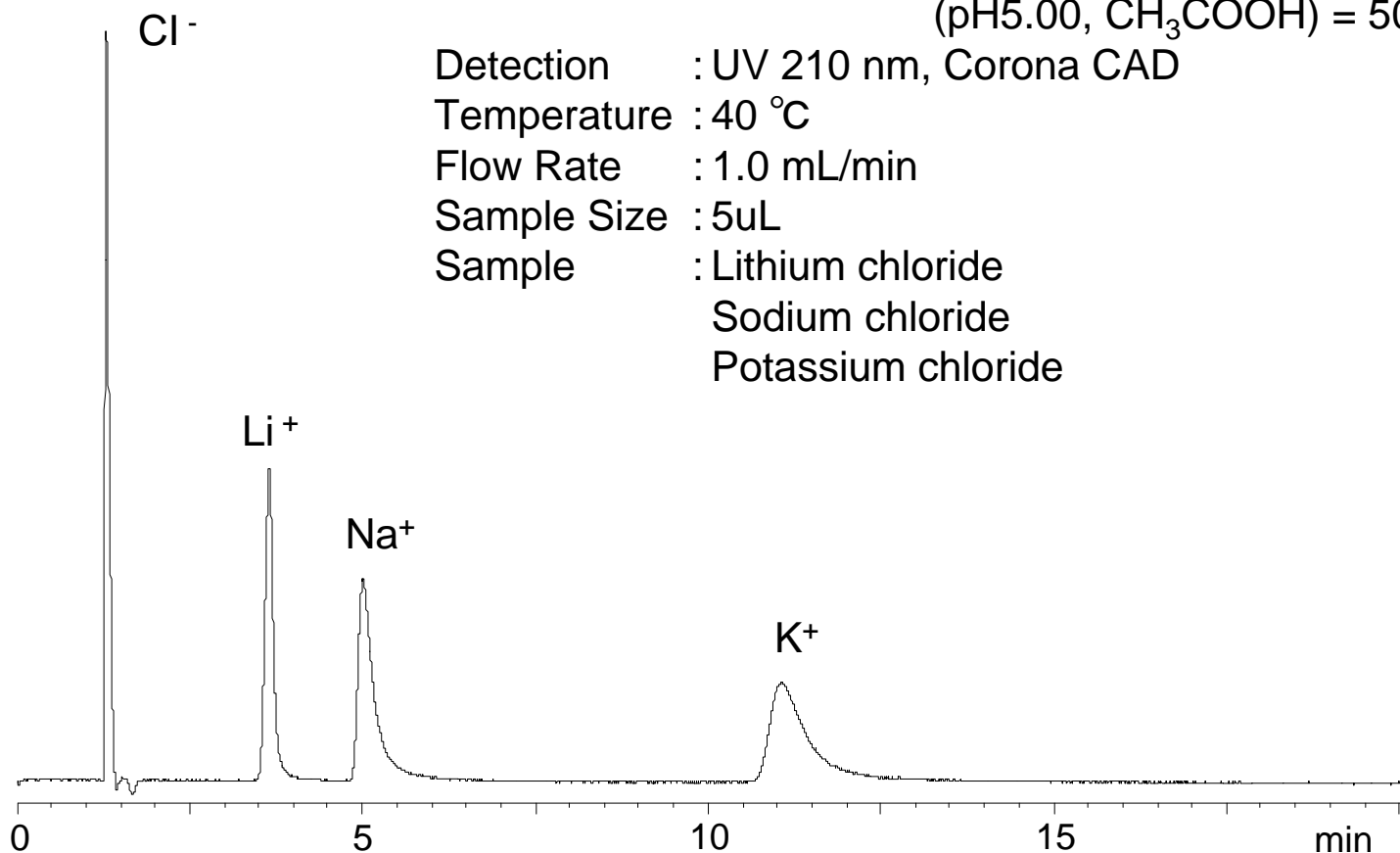
Sample Size : 5 μL

Sample: Potassium chloride
Potassium bromide
Potassium iodide



Alkali Halides

Column : TCI Dual ODS-CX15
 4.6 mm I.D. × 150 mm
 Mobile Phase : CH₃CN/ 50mmol/L CH₃COONH₄
 (pH5.00, CH₃COOH) = 50/50
 Detection : UV 210 nm, Corona CAD
 Temperature : 40 °C
 Flow Rate : 1.0 mL/min
 Sample Size : 5uL
 Sample : Lithium chloride
 Sodium chloride
 Potassium chloride





Product

Type	ODS+Cation-Exchange For Basic compounds analysis			ODS+Anion-Exchange For Acidic compounds analysis		
Column	TCI Dual ODS-CX10	TCI Dual ODS-CX15	TCI Dual ODS-CX20	TCI Dual ODS-AX20	TCI Dual ODS-AX10	Kaeisorb LC ODS-SAX Super
Retention Power	Strong	Medium	Weak	Strong	Medium	Weak
2.0 × 50mm	S3705	S3765	S3715	S3735	S3725	S1821
2.0 × 100mm	S3707	S3767	S3717	S3737	S3727	S1832
2.0 × 150mm	S3702	S3762	S3712	S3732	S3722	S1298
2.0 × 250mm	S3703	S3763	S3713	S3733	S3723	S1299
4.6 × 50mm	S3704	S3764	S3714	S3734	S3724	S1833
4.6 × 100mm	S3709	S3769	S3719	S3739	S3729	S1834
4.6 × 150mm	S3700	S3760	S3710	S3730	S3720	S1292
4.6 × 250mm	S3701	S3761	S3711	S3731	S3721	S1293
10.0 × 150mm	S3706	S3766	S3716	S3736	S3726	S1835
10.0 × 250mm	S3708	S3768	S3718	S3738	S3728	S1836
Cartridge type guard column [Holder: S1450]						
3.0 × 15mm	S3770	S3771	S3772	S3775	S3774	S3773