Rev. CO012001

Packed Columns for
Ion Chromatography

TSKgel SuperIC-Anion HS
TSKgel SuperIC-AZ
TSKgel SuperIC-AP
TSKgel SuperIC-Anion
TSKgel SuperIC-Cation HS
TSKgel SuperIC-CR
TSKgel SuperIC-A/C

INSTRUCTION MANUAL

TOSOH CORPORATION

Safety Precautions

To help protect you and/or your property from potential damage and ensure personal safety, please read this manual thoroughly before using the product.

[Notational Conventions]

Notation	Explanation
⚠WARNING	Indicates a hazard with a medium level of risk which, if not avoided, could result in death or serious injury.
⚠ CAUTION	Indicates a hazard with a low level of risk which, if not avoided, could result in minor or moderate injury.

⚠ WARNING

■Keep away from fire
Not taking proper precautions when using flammable solvents could result in fire, explosion, or poisoning.

⚠ CAUTION

■Use only in well-ventilated areas
In case of insufficient ventilation, flammable and toxic solvents can cause fire, explosion, or poisoning.

■Do not spill solvents
Spillage and leakage can cause fire, electric shock, poisoning, injury, or corrosion.
Wear appropriate protective gear when cleaning up a spill.

■Wear protective eye gear and gloves
Organic solvents and acids should not come into direct contact with the skin.

■Handle the package with care
Inappropriate handling may cause rupturing and/or splattering of the product.

■Only use this product for its intended use
This product is intended for the separation. Do not use it for any other purpose.

■Make sure compounds are safe
Check that the target compounds and solutions after separation and purification are safe.

■Proper disposal
Dispose in accordance with local laws and regulations.

NOTE

Keep this manual with the product for future reference.

Precautions: Shipping Solvents

First Aid	Inhalation	・Move the person to an area with fresh air and rinse the mouth with plenty of water. ・Call immediately for medical attention.
	Skin exposure	・Wash the exposed area with plenty of soap and water.
	Eye exposure	・Open the eyes as wide as possible and rinse with clean water for at least 15 minutes. ・Call immediately for medical attention.
	Ingestion	・Rinse the mouth with plenty of water. ・Call immediately for medical attention.
Handling and Storage	Ventilation	・Provide adequate air ventilation to keep organic vapor concentrations below approved level.
	Container handling	・Container may break if not handled with care.
	Wear appropriate protective equipment	・Use solvent-resistant gloves and protective eye gear when using this product. Use of a gas mask, additional protective clothing or rubber boots could be appropriate when handling this product.
	Hazardous substance storage	・If any flammable solvents are used for shipping or storage of this product, keep away from fire or open heat sources.
Waste Disposal	Disposal methods	・Dispose in accordance with local laws and regulations.
	General considerations	・Please pay attention to all safety precautions with respect to the handling and storage of this product.
	Disposal precautions	・Fumes produced during incineration may contain nitrogen oxides, sulfur oxides and carbon monoxide.

☐ Shipping solvent for each column : See Section 3. Column Grades and their Specifications.

Precautions: Packing Material

First Aid	Inhalation	・Move the person to an area with fresh air and rinse the mouth with plenty of water. ・Call immediately for medical attention.
	Skin exposure	・Wash the exposed area with plenty of soap and water.
	Eye exposure	・Open the eyes as wide as possible and rinse with clean water for at least 15 minutes. ・Call immediately for medical attention.
	Ingestion	・Rinse the mouth with plenty of water. ・Call immediately for medical attention.
Handling and Storage	Ventilation	・Provide adequate air ventilation to keep organic vapor concentrations below approved level.
	Container handling	・Container may break if not handled with care.
	Wear appropriate protective equipment	・Use solvent-resistant gloves and protective eye gear when using this product. Use of a gas mask, additional protective clothing or rubber boots could be appropriate when handling this product.
	Hazardous substance storage	・If any flammable solvents are used for shipping or storage of this product, keep away from fire or open heat sources.
	Fire precautions	・Do not expose this chromatographic resin to fire or open heat sources.
Waste Disposal	Disposal methods	・Dispose in accordance with local laws and regulations. See below for additional precautions.
	General considerations	・Please pay attention to all safety precautions with respect to the handling and storage of this product.
	Disposal precautions	・This product can be safely incinerated. ・Appropriate nitrogen oxides exhaust emission precautions should be taken specifically for anion exchange packing material.

☐ TSKgel SuperIC column products contain combustible chromatographic media based on a co-polymer of vinyl compounds.

Table of Contents

1. Introduction

This instruction manual contains crucial information on how to care for and use these columns in a proper manner, so as to make the most effective use of their high performance capabilities.

Be sure to carefully read the instructions in this manual prior to use of these columns.

2. Prior to Use

Be sure to inspect the packaging and closely inspect the column for any signs of damage prior to use. If any damages are evident, contact your local TOSOH sales representative at the address listed at the end of this manual.

Please confirm the following documents are included in the package.

1) INSTRUCTION MANUAL 1 copy
2) INSPECTION DATA 1 copy

3. Column Grades and their Specifications

TSKgel SuperIC products consist of 15 different analytical columns and guard columns as shown in Tables 1 and 2.

Table 1 Analytical Column Grades and their Specifications (1)

Grade	TSKgel SuperIC-Anion	TSKgel SuperIC-AP
Part No.	0019673	0019840 (15 cm) 0019841 (7.5 cm)
Dimensions	4.6 mm I.D.× 15 cm (PEEK[1])	4.6 mm I.D.× 15 cm (PEEK[1]) 4.6 mm I.D.× 7.5 cm (PEEK[1])
Base material	Polystyrene gel	Hydrophilic polymer gel
Particle size	5 μm	6 μm
Functional group	Quaternary ammonium ion	Quaternary ammonium ion
Capacity	ca. 12 meq/L	ca. 30 meq/L
Counter ion	Borate and carbonate ion	Carbonate ion
Shipping solvent	Test eluent[2]	Test eluent[2]
Applications	Anion analysis	Anion analysis

Table 1 Analytical Column Grades and their Specifications (2)

Grade	TSKgel SuperIC-AZ	TSKgel SuperIC-Anion HS
Part No.	0021444	0022766
Dimensions	4.6 mm I.D.× 15 cm (PEEK[1])	4.6 mm I.D.× 10 cm (PEEK[1])
Base material	Hydrophilic polymer gel	Hydrophilic polymer gel
Particle size	4 μm	3.5 μm
Functional group	Quaternary ammonium ion	Quaternary ammonium ion
Capacity	ca. 30 meq/L	ca. 30 meq/L
Counter ion	Carbonate ion	Carbonate ion
Shipping solvent	Test eluent[2]	3.8 mmol/L $NaHCO_3$
Applications	Anion analysis	Anion analysis

Grade	TSKgel SuperIC-CR	TSKgel SuperIC-Cation HS
Part No.	0021475	0022768
Dimensions	4.6 mm I.D.× 15 cm (PEEK[1])	4.6 mm I.D.× 10 cm (PEEK[1])
Base material	Polystyrene gel	Polystyrene gel
Particle size	3 μm	3 μm
Functional group	Carboxylic acid	Carboxylic acid
Capacity	1.0 eq/L or more	1.0 eq/L or more
Counter ion	Hydrogen ion	Hydrogen ion
Shipping solvent	Test eluent[2]	Test eluent[2]
Applications	Cation analysis	Cation analysis

Grade	TSKgel SuperIC-A/C
Part No.	0019843
Dimensions	6.0 mm I.D.× 15 cm (SUS316)
Base material	Hydrophilic polymer gel
Particle size	4 μm
Functional group	Carboxylic acid
Capacity	ca. 0.2 eq/L
Counter ion	Hydrogen ion
Shipping solvent	H_2O
Applications	Simultaneous analysis of anion and cation

Table 2 Guard Column Grades and their Specifications (1)

Grade	TSKguardcolumn SuperIC-A	TSKguardcolumn SuperIC-AP
Part No.	0019674	0019842
Dimensions	4.6 mm I.D.× 1 cm (PEEK[1])	4.6 mm I.D.× 1 cm (PEEK[1])
Base material	Polystyrene gel	Hydrophilic polymer gel
Particle size	5 μm	6 μm
Functional group	Quaternary ammonium ion	Quaternary ammonium ion
Capacity	ca. 12 meq/L	ca. 30 meq/L
Counter ion	Borate and carbonate ion	Carbonate ion
Shipping solvent	Test eluent[2]	Test eluent[2]
Analytical column	TSKgel SuperIC-Anion	TSKgel SuperIC-AP

Grade	TSKguardcolumn SuperIC-AZ	TSKguardcolumn SuperIC-A HS
Part No.	0021445	0022767
Dimensions	4.6 mm I.D.× 1 cm (PEEK[1])	4.6 mm I.D.× 1 cm (PEEK[1])
Base material	Hydrophilic polymer gel	Hydrophilic polymer gel
Particle size	4 μm	3.5 μm
Functional group	Quaternary ammonium ion	Quaternary ammonium ion
Capacity	ca. 30 meq/L	ca. 30 meq/L
Counter ion	Carbonate ion	Carbonate ion
Shipping solvent	Test eluent[2]	3.8 mmol/L $NaHCO_3$
Analytical column	TSKgel SuperIC-AZ	TSKgel SuperIC-Anion HS

Grade	TSKguardcolumn SuperIC-CR	TSKguardcolumn SuperIC-C HS
Part No.	0021476	0022769
Dimensions	4.6 mm I.D.× 1 cm (PEEK[1])	4.6 mm I.D.× 1 cm (PEEK[1])
Base material	Polystyrene gel	Polystyrene gel
Particle size	3 μm	3 μm
Functional group	Carboxylic acid	Carboxylic acid
Capacity	1.0 eq/L or more	1.0 eq/L or more
Counter ion	Hydrogen ion	Hydrogen ion
Shipping solvent	Test eluent[2]	Test eluent[2]
Analytical column	TSKgel SuperIC-CR	TSKgel SuperIC-Cation HS

Table 2 Guard Column Grades and their Specifications (2)

Grade	TSKguardcolumn SuperIC-A/C
Part No.	0019844
Dimensions	4.6 mm I.D.× 2 cm (SUS316)
Base material	Hydrophilic polymer gel
Particle size	4 μm
Functional group	Carboxylic acid
Capacity	ca. 0.2 eq/L
Counter ion	Hydrogen ion
Shipping solvent	H_2O
Analytical column	TSKgel SuperIC-A/C

[1] PEEK : Poly ether ether ketone

[2] Test eluent

- TSKgel SuperIC-Anion, TSKguardcolumn SuperIC-A
  6.0 mmol/L sodium tetraborate+15 mmol/L boric acid
  +0.2 mmol/L sodium hydrogen carbonate
- TSKgel SuperIC-AP, TSKguardcolumn SuperIC-AP
  1.7 mmol/L sodium hydrogen carbonate+1.8 mmol/L sodium carbonate
- TSKgel SuperIC-AZ, TSKguardcolumn SuperIC-AZ
  6.3 mmol/L sodium hydrogen carbonate+1.7 mmol/L sodium carbonate
- TSKgel SuperIC-CR, TSKguardcolumn SuperIC-CR
  2.2 mmol/L methanesulfonic acid+1.0 mmol/L 18-crown 6-ether
- TSKgel SuperIC-Cation HS
  3.0 mmol/L methanesulfonic acid+0.4 mmol/L 18-crown 6-ether
  + 0.2 mmol/L L-histidine
- TSKguardcolumn SuperIC-C HS
  1.2 mmol/L methanesulfonic acid+0.4 mmol/L 18-crown 6-ether
  +0.2 mmol/L L-histidine

When the TOSOH Ion Chromatograph IC-2001 or IC-2010 is used with suppression mode, one of the following suppressor gels should be installed.

< IC-2001 >

Part No. 0019675 Suppressor gel TSKsuppress IC-A (20 mL gel, for anion)

Part No. 0020310 Suppressor gel TSKsuppress IC-C (20 mL gel, for cation)

< IC-2010 >

Part No. 0022770 Suppressor gel TSKsuppress IC-A (30 mL gel, for anion)
Part No. 0022771 Suppressor gel TSKsuppress IC-A (60 mL gel, for anion)
Part No. 0022772 Suppressor gel TSKsuppress IC-C (30 mL gel, for cation)
Part No. 0022773 Suppressor gel TSKsuppress IC-C (60 mL gel, for cation)

An analytical column and a guard column should be connected using the following parts.

Part No. 0016566 Connector (For 1/16" PEEK tubing, package of 2)
Part No. 0017172 PEEK tubing (1/16" O.D., 0.25 mmI.D.× 2 m, 9 cm-cut tubing should be used.)

4. Column Configuration

The typical configuration of columns are shown in Figures 1-1 and 1-2.

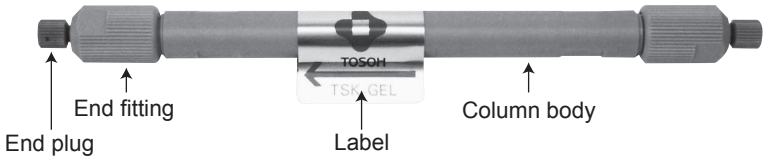

Figure 1-1 Analytical Column

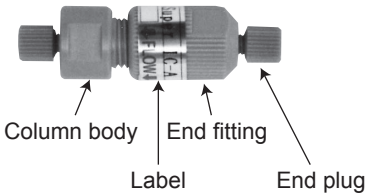

Figure 1-2 Guard Column

5. Operation

The general operating conditions for each column are shown in Table 3.

Table 3 General Operating Conditions (1)

Grade	TSKgel SuperIC-Anion TSKguardcolumn SuperIC-A	TSKgel SuperIC-AP TSKguardcolumn SuperIC-AP
Flow rate	Up to 0.8 mL/min	Up to 0.8 mL/min
Pressure	Analytical : Up to 7.0 MPa Guard : Up to 1.0 MPa	Analytical (15 cm) : Up to 7.0 MPa Analytical (7.5 cm) : Up to 3.5 MPa Guard : Up to 1.0 MPa
Temperature	25 ～ 40 ℃	25 ～ 40 ℃
pH range	pH 2.0 ～12.0	pH 2.0 ～12.0
Organic solvent	Not recommended	Up to 20 vol%

Grade	TSKgel SuperIC-AZ TSKguardcolumn SuperIC-AZ	TSKgel SuperIC-Anion HS TSKguardcolumn SuperIC-A HS
Flow rate	Up to 0.8 mL/min	Up to 1.5 mL/min
Pressure	Analytical : Up to 15.0 MPa* Guard : Up to 3.0 MPa	Analytical : Up to 25.0 MPa Guard : Up to 5.0 MPa
Temperature	25 ～ 40 ℃	25 ～ 40 ℃
pH range	pH 2.0 ～12.0	pH 2.0 ～12.0
Organic solvent	Acetonitrile, Methanol : 100 % available	Acetonitrile, Methanol : 100 % available

*Up to 10.0 MPa when using eluent contains organic solvent.

Grade	TSKgel SuperIC-CR TSKguardcolumn SuperIC-CR	TSKgel SuperIC-Cation HS TSKguardcolumn SuperIC-C HS
Flow rate	Up to 0.8 mL/min	Up to 1.2 mL/min
Pressure	Analytical : Up to 15.0 MPa Guard : Up to 3.0 MPa	Analytical : Up to 25.0 MPa Guard : Up to 5.0 MPa
Temperature	25 ～ 40 ℃	25 ～ 40 ℃
pH range	pH 1.0 ～5.0	pH 1.0 ～5.0
Organic solvent	Not recommended	Not recommended

Table 3 General Operating Conditions (2)

Grade	TSKgel SuperIC-A/C TSKguardcolumn SuperIC-A/C
Flow rate	Up to 0.6 mL/min
Pressure	Analytical : Up to 7.0 MPa Guard : Up to 2.0 MPa
Temperature	25 ～ 40 ℃
pH range	pH 2.0 ～12.0
Organic solvent	Acetonitrile : Up to 20 % (Alcohols are not recommended)

⚠CAUTION : Leaks at the connection

Make sure that there are no leaks at each of the connections in ion chromatograph.

⚠CAUTION : Pressure limitations of IC-2001

The IC-2001 has maximum pressure limit of 15 MPa.
All columns should be used up to 15 MPa on the IC-2001.

⚠CAUTION : Column installation onto the ion chromatograph

Columns : TSKgel SuperIC-AZ, TSKgel SuperIC-Anion HS, TSKgel SuperIC-CR and TSKgel SuperIC-Cation HS

Since these columns have higher pressure ratings, make sure that there are no leaks at each connection, especially between the pump and the column.
In the IC-2001, when column temperature is less than 40 ℃, the eluent should be run at a flow rate at up to 0.3 mL/min to prenent activation of the pressure limiter sensor of the system.

⚠CAUTION : Preparation of eluent

1) Make sure the properties of chemicals for the eluent by referring to the Material Safety Data Sheet (MSDS).
2) Chemicals, solvents and deionized water used to prepare the eluent should be of the highest purity available.
3) To maintain reproducibility it is recommended to first prepare the eluent in a 10-fold concentrate and then dilute appropriately before to use.

⚠CAUTION : Crown ether containing eluent

Crown ether containing eluents are used for the TSKgel SuperIC-CR and TSKgel SuperIC-Cation HS columns. If there is a change in the composition of the eluent containing crown ethers, it may take several minutes to equilibrate the column.

[Example]

If you replace the eluent comprised of 2.2 mmol/L methanesulfonic acid +1.0 mmol/L 18-crown 6-ether with that of 2.2 mmol/L methanesulfonic acid +0.5 mmol/L 18-crown 6-ether (or vise-versa) or the elution of 2.2 mmol/L methanesulfonic acid+1.0 mmol/L 18-crown 6-ether with that of 2.2 mmol/L methanesulfonic acid+2.0 mmol/L 18-crown 6-ether (or vise-versa), do not start the analysis until at least 60 min at 0.7 mL/min equilibrium time has been run.

6. Installation

6-1 Parts for Connection

Part No. 0016566　Connector (For 1/16" PEEK tubing, package of 2)

6-2 Flow Direction

The flow direction of the eluent is determination by the direction of the arrow show on the label attached to the column.

6-3 Installation

1) Take the column from the package and remove the end plugs from the column.
2) Start the pump until the eluent leaks flows of the outlet tubing that is connected to the column. (Leakage eluent should be removed from the inlet tubing.)
3) Connect the guard column and the analytical column sequentially to the tubing, making sure the flow direction is the same as that indicated on the label and then pump the eluent at a half of the intended analysis flow rate.
4) After making sure there are no leaks at any of the connections, shut the door of column oven.
5) After making sure the column temperature reaches the set point, adjust the pump to run at the analysis flow rate.
6) Equilibrate the column with the eluent before starting analysis.

⚠CAUTION : Switching to another analysis mode

Before switching to another analysis mode (anion or cation), rinse the flow lines

in the system with 80 % acetonitrile.
(Flow rate : 0.5 mL/min, Time for rinse : 30 min or more)

6-4 Flow Diagram

Flow diagrams of the suppression and non-suppression modes are shown in Figures 2 and 3.

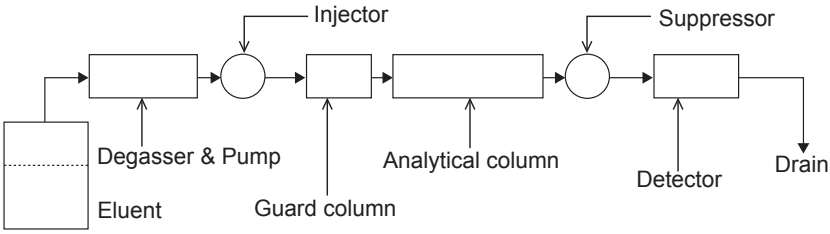

Figure 2 Suppression Mode

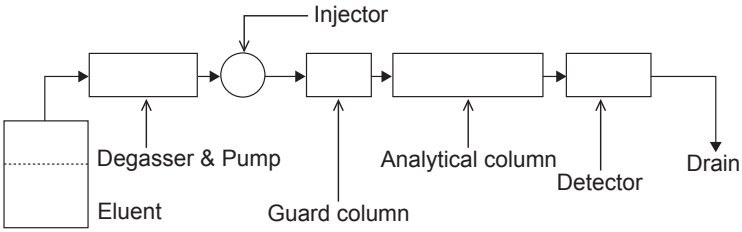

Figure 3 Non-suppression Mode

6-5 Sample Preparation

6-5-1 Elimination of Insoluble Matters

It is highly recommended that all precipitate is removed from the sample. Although some precipitate is not visible to the naked eye, by centrifuge or use a filter to avoid contamination of the column.

6-5-2 Elimination of Hydrophobic Compounds

To prevent accumulation of hydrophobic compounds on the packing material, use a commercially available disposable ODS column, prior to the analytical column.

6-5-3 Dilution of Sample Solution

If the ionic strength of the sample solution is too high (over 100 ppm per ion),

overloading of the column may occur which will reduce the accuracy of the quantitative analysis.
In this case, the sample solution must be diluted to an appropriate ionic strength with sample buffer or deionized water.

7. Storage and Disposal

Always keeps the column hydrated with storage solvent by attaching the end fittings to the column. Store the column at room temperature.

7-1 Column Storage

7-1-1 Storage Solvent

For the preparation of storage solvent, see “CAUTION : Preparation of eluent (Page 7)“.

- TSKgel SuperIC-Anion, TSKguardcolumn SuperIC-A,
  TSKgel SuperIC-AP, TSKguardcolumn SuperIC-AP,
  TSKgel SuperIC-AZ, TSKguardcolumn SuperIC-AZ,
  TSKgel SuperIC-CR, TSKguardcolumn SuperIC-CR,
  TSKgel SuperIC-Cation HS, TSKguardcolumn SuperIC-C HS
  Always keep the column hydrated with eluent.
- TSKgel SuperIC-Anion HS, TSKguardcolumn SuperIC-A HS
  Keep the column in eluent buffer if it will be used again within a week.
  If the column will not be used for more than a week, it should be store in filled with 3.8 mmol/L $NaHCO_3$.
- TSKgel SuperIC-A/C
  Keep the column in eluent buffer if it will be used again within a week.
  If the column will not be used for more than a week, it should be store in deionized water.
  Solvent replacement conditions
  Solvent : H_2O (Deionized water)
  Flow rate : 0.3 mL/min
  Temp. : Less than 40 ℃
  Flow time : 30 min or more

7-1-2 Storage Temperature

Store the column at 15 ~ 30 ℃. If the column is stored less than 0 ℃, it may freeze and result in degradation of performance.

7-2 Disposal

The column body should be discarded as plastics or stainless steel.
Packing materials in the column should be disposed as plastics.

8. Column Cleanup

8-1 Removal of Polyvalent Electrolytes

Prolonged operation with a complex mixture of ions in the sample may lead to gradual accumulation of polyvalent electrolyte compounds in the column.
This is evidenced by changes in chromatographic behavior and apparent loss of ion exchange capacity.
Adsorbed materials can be stripped from the column by flushing with the following cleaning solvents. (The effectiveness of this procedure will depand on the properties of the individual contaminants.)
The column should be cleaned for more than an hour at a half of the operating flow rate shown on the INSPECTION DATA sheet.

Typical cleaning solvents

- TSKgel SuperIC-Anion, TSKguardcolumn SuperIC-A,
  TSKgel SuperIC-AP, TSKguardcolumn SuperIC-AP,
  TSKgel SuperIC-AZ, TSKguardcolumn SuperIC-AZ,
  TSKgel SuperIC-Anion HS, TSKguardcolumn SuperIC-A HS
  20 mmol/L sodium carbonate+20 mmol/L sodium hydrogen carbonate
- TSKgel SuperIC-CR, TSKguardcolumn SuperIC-CR,
  TSKgel SuperIC-Cation HS, TSKguardcolumn SuperIC-C HS
  10 mmol/L methanesulfonic acid+1.0 mmol/L 18-crown 6-ether
- TSKgel SuperIC-A/C, TSKguardcolumn SuperIC-A/C
  5 mmol/L sulfuric acid or 0.1 % phosphoric acid

8-2 Removal of Hydrophobic Compounds

Flush the packing material in the column with a cleaning solvent containing organic solvents. (Cleanup effect will depend on properties of contaminants.)
The column should be cleaned for more than an hour at a half of the operating flow rate shown in the INSPECTION DATA sheet.

⚠CAUTION : Applicable solvent
Applicable organic solvent (i.e., acetonitrile or methanol) depends on the type of the column. Make sure to use the organic solvents recommended for each

column by referring to Table 3.

Please note, no organic solvents can be run on the TSKgel SuperIC-Anion, TSKgel SuperIC-CR and TSKgel SuperIC-Cation HS columns. The use of a disposable pretreatment column or guardcolumn is highly recommended to prevent damages to the column.

9. Calculation of Theoretical Plate Number and Asymmetry Factor

The theoretical plate number (N) and the asymmetry factor (As) as well as their chromatographic conditions for each columns are as shown on the INSPECTION DATA sheet.

9-1 Method of Calculating Theoretical Plate Number

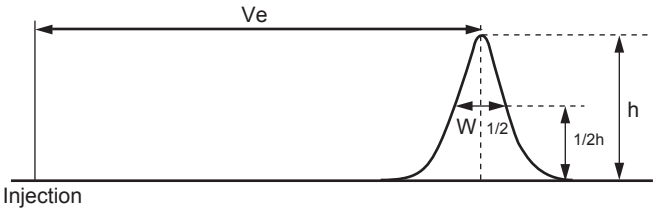

Figure 4 Method of Calculating Theoretical Plate Number

The theoretical plate number (N) of a column is calculated by the half width method shown in Figure 4 and the following equation.

$N = 5.54 (Ve/W_{1/2})^2$

Ve : Elution time (min)

$W_{1/2}$: Peak width (min) at one-half the peak height

h : Peak height

9-2 Method of Calculating Asymmetry Factor

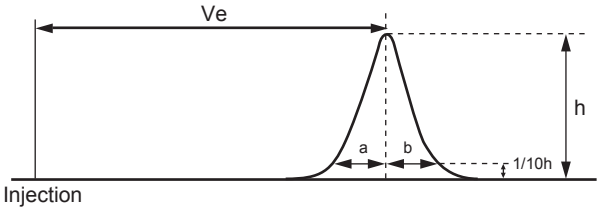

Figure 5 Method of Calculating Asymmetry Factor

The asymmetry factor (As) of a column is calculated by the 1/10h method.

As = b/a

10. Quality Specifications and Warranty

10-1 Conditions for Inspection Data

1) TSKgel Super IC-Anion

Eluent : 6.0 mmol/L sodium tetraborate+15 mmol/L boric acid
+0.2 mmol/L sodium hydrogen carbonate
Flow rate : 0.8 mL/min
Temp. : 40 ℃
Sample : SO_4^{2-} ion (5 mg/L)
Injection vol. : 30 μL
Suppressor gel : TSKsuppress IC-A
Instrument : TOSOH Ion Chromatograph IC-2001

2) TSKgel SuperIC-AP

Eluent : 1.7 mmol/L sodium hydrogen carbonate
+1.8 mmol/L sodium carbonate
Flow rate : 0.8 mL/min
Temp. : 40 ℃
Sample : SO_4^{2-} ion (5 mg/L)
Injection vol. : 30 μL
Suppressor gel : TSKsuppress IC-A
Instrument : TOSOH Ion Chromatograph IC-2001

3) TSKgel SuperIC-AZ

Eluent : 6.3 mmol/L sodium hydrogen carbonate
+1.7 mmol/L sodium carbonate

Flow rate : 0.8 mL/min
Temp. : 40 ℃
Sample : SO_4^{2-} ion (5 mg/L)
Injection vol. : 30 μL
Suppressor gel : TSKsuppress IC-A
Instrument : TOSOH Ion Chromatograph IC-2001

4) TSKgel SuperIC-Anion HS
Eluent : 3.8 mmol/L sodium hydrogen carbonate
+3.0 mmol/L sodium carbonate
Flow rate : 1.5 mL/min
Temp. : 40 ℃
Sample : SO_4^{2-} ion (5 mg/L)
Injection vol. : 30 μL
Suppressor gel : TSKsuppress IC-A
Instrument : TOSOH Ion Chromatograph IC-2010

5) TSKgel Super IC-CR
Eluent : 2.2 mmol/L methanesulfonic acid
+1.0 mmol/L 18-crown 6-ether
Flow rate : 0.7 mL/min
Temp. : 40 ℃
Sample : Na^+ and NH_4^+ ion (2 mg/L each)
Injection vol. : 30 μL
Suppressor gel : TSKsuppress IC-C
Instrument : TOSOH Ion Chromatograph IC-2001

6) TSKgel Super IC-Cation HS
Eluent : 3.0 mmol/L methanesulfonic acid
+0.4 mmol/L 18-crown 6-ether+0.2 mmol/L L-histidine
Flow rate : 1.2 mL/min
Temp. : 40 ℃
Sample : Na^+ ion (2 mg/L) and K^+ ion (5 mg/L)
Injection vol. : 30 μL
Suppressor gel : TSKsuppress IC-C
Instrument : TOSOH Ion Chromatograph IC-2010

7) TSKgel Super IC-A/C
Eluent : 6.0 mmol/L 18-crown 6-ether+0.45 mmol/L 5-sulfosalicylic acid
+5.0 mmol/L L-tartaric acid+5 % acetonitrile
Flow rate : 0.6 mL/min

Temp. : 40 ℃
Sample : Cl^- ion (2.95 mg/L) and Na^+ ion (0.38 mg/L)
Injection vol. : 30 μL
Instrument : TOSOH Ion Chromatograph IC-2001

10-2 Quality Specifications

Table 4 Quality Specifications

Grade	TSKgel SuperIC-Anion	TSKgel SuperIC-AZ
Part No.	0019673	0021444
Plates	9,000 or more (SO_4^{2-})	10,000 or more (SO_4^{2-})
Asymmetry	1.1～2.0 (SO_4^{2-})	0.8～1.5 (SO_4^{2-})

Grade	TSKgel SuperIC-AP	TSKgel SuperIC-AP
Part No.	0019840	0019841
Plates	8,000 or more (SO_4^{2-})	4,000 or more (SO_4^{2-})
Asymmetry	0.8～1.5 (SO_4^{2-})	0.8～1.5 (SO_4^{2-})

Grade	TSKgel SuperIC-Anion-HS
Part No.	0022766
Plates	8,000～11,000 (SO_4^{2-})
Asymmetry	0.9～1.4 (SO_4^{2-})

Grade	TSKgel SuperIC-CR	TSKgel SuperIC-Cation HS
Part No.	0021475	0022768
Plates	8,000～16,000 (Na^+)	4,500～7,000 (Na^+)
Asymmetry	0.9～1.6 (Na^+)	0.9～1.4 (Na^+) 2.4～3.6 (K^+)
Rs	5.6 or more (Na^+-NH_4^+)	—

Grade	TSKgel SuperIC-A/C
Part No.	0019843
Plates	5,000 or more (Cl^-), 14,000 or more (Na^+)
Asymmetry	0.8～2.0 (Cl^-), 0.8～2.0 (Na^+)

10-3 Warranty

Check the appearance of the column and test its performance according to Section 9 within two weeks of the receipt of the column.

If the quality specifications in Table 4 can not be obtained or the column has been damaged during transportation, contact a TOSOH representative within two weeks. TOSOH will replace the column free of charge.

Note that column lifetime is not guaranteed.

No column should be returned to TOSOH without TOSOH's prior consent.

The specifications of these columns may be improved without notice.

TOSOH CORPORATION

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