

Shodex

Operation Manual

(temporary)

Anion separation columns for suppressor method

Shodex IC SI-52 4E

For the longest possible service life of the column,
please carefully observe the instruction in this manual.

Showa Denko K.K.

1. Introduction

The Shodex IC SI-52 4E column is developed for use in suppressor method anion chromatography.

The oxyhalides, such as chlorite (ClO_2), bromate (BrO_3) and chlorate (ClO_3), can be analyzed simultaneously with 7 common inorganic anions (fluoride, chloride, nitrite, bromide, nitrate, phosphate and sulfate) using IC SI-52 4E.

2. Specifications

Table 1

Product name	Column size L x i.d. (mm)	Theoretical plate number	Particle size	Application
IC SI-52 4E	250 x 4.0	$\geq 14,000$ (SO_4)	5 μm	For analysis
IC SI-90G	10 x 4.6	*****	9 μm	As guard column

Theoretical plate number : per one column

The packing material is an anion exchanger made from polyvinylalcohol gel chemically bonded with quaternary ammonium.

The liquid with which the columns are filled at delivery is 3.6 mM Na_2CO_3 .

Table 2

	SI-52 4E
Column material	PEEK
Recommended eluent	3.6 mM Na_2CO_3
Maximum flow rate	1.0 mL/min (recommend 0.8 mL/min)
Maximum pressure	15.0 MPa (recommend 8-11 MPa)
Usable pH range	pH 3~12
Usable temperature range	20 ~ 60 °C (recommend 45°C)
Addition of organic solvent	lower than 10% in Eluent (Acetonitrile or Methanol)

Recommend condition: for good separation of oxyhalides

Eluent : 3.6 mM Na_2CO_3

Flow rate : 0.8 mL/min

Column temperature: 45°C

3. Cautions to be taken

- 1) Attach the column to the chromatograph equipment only after the flow line of the equipment has been completely refilled with the eluent to be used.
- 2) Connect the column with the equipment so that the eluent flows in the direction marked by the arrow on the column.
- 3) Acetonitrile or methanol can be added as organic solvent up to ten percent to eluent .
- 4) Recommended temperature is 45°C, so use column oven. The retention time of each peak is highly influenced with column temperature, so there is a possibility of change the eluent performance of each peak.
- 5) Keep the flow rate when the pump is started at lower than 0.3 mL/min. and subsequently increase it gradually to the working flow rate.
- 6) To protect the column, connect the guard column Shodex IC SI-90G in series with the column upstream of it.
- 7) Pretreat samples containing organic impurities by the Sep-Pak PS-1. Accumulation of impurities in the column could cause deterioration of the column performance.

- 8) Never open the endfittings of the column.
- 9) Do not cause any strong impact to the column, such as dropping it.
- 10) When the column is not used for a long period of time (more than one month), place plugs at both ends of the column with the eluent in it, and store it in a cool, dark place.
- 11) Use only in laboratory. The column must not be used in any manufacturing process.
- 12) Not to use for clinical diagnosis.
- 13) Use or dispose of in accordance with applicable laws and regulations.

4. Preparation of Eluent

[3.6 mM Na₂CO₃]

- 1) Measure 0.381g of Na₂CO₃ into a 1 liter measuring flask.
Make it up a 1 liter solution using distilled and deionized water.
- 2) Eluent is prepared by filtering the solution passed through a 0.25 μm or 0.45 μm membrane filter.

5. Fixing column to chromatograph

- 1) Before fixing the column to the chromatograph equipment, completely replace the liquid in the flow line of the equipment with the eluent to be used.
- 2) Set the flow rate of the pump at less than 0.3 mL/min.
- 3) Fix the column to the equipment so that the eluent flows in the direction marked by the arrow on the column. Then, start the pump.
- 4) Increase the flow rate of the pump gradually and set the flow rate at the predetermined level (normally 0.8 mL/min.)

6. Sample pretreatment

- 1) Inject the sample into the column only after it has been passed through a 0.45 μm membrane filter to remove particles.
- 2) Any sample containing protein should be injected into the column only after protein has been eliminated from the sample.
- 3) Inject the sample containing organic impurities into the column only after the sample has undergone solid extraction treatment (Sep-Pak PS-1).

7. Guard column

To protect the column, connect the guard column Shodex IC SI-90G in series with the column upstream of it.

8. Regeneration

Cause	Washing procedure
Pollution by low valiancy hydrophilic ions	Washed by the following steps. (flow rate 0.3 mL/min) 1. 25 minutes : deionized water 2. 100 minutes: 10 times concentrated eluent 3. 25 minute: deionized water 4. 100 minutes: eluent
Pollution by high valiancy hydrophobic ions	Washed by the following steps. (flow rate 0.3 mL/min) 1. 25 minutes : deionized water 2. 20 minutes: 5% acetonitrile 3. 100 minute: 100% acetonitrile 4. 50 minutes: deionized water 5. 100 minutes: eluent

9. Removal and storage of column

- 1) Reduce the flow rate of the pump to less than 0.3 mL/min. and stop heating the column. Allow the eluent to continue flowing until the column temperature cools down to room temperature.

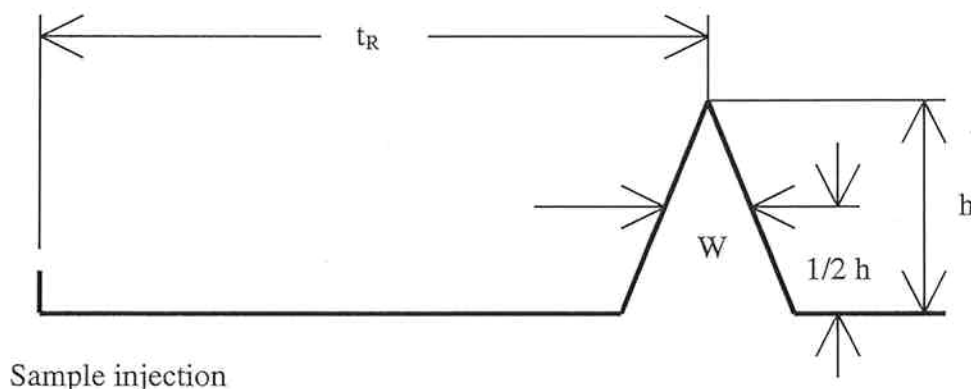
Note: If the column is removed before the column temperature cools down to room temperature, air enters the column, resulting in deterioration of the column performance.

- 2) Stop the pump and disconnect the column from the equipment.
- 3) Put the exclusively-designed plugs on both ends of the column and store it in a cool, dark place.

10. Column performance test

Measure the theoretical plate number under the following conditions:

- 1) Sample: SO_4^{2-} (40 mg/L)
- 2) Volume of sample to inject: 50 μL
- 3) Eluent: 3.6 mM sodium carbonate (Na_2CO_3)
- 4) Flow rate: 0.8 mL/min.
- 5) Column temperature: 45°C
- 6) Detector: Conductivity detector (+ suppressor)
- 7) Calculation formula for theoretical plate number: $N=5.54 (t_R/W)^2$



-- Warranty -----

1. Showa Denko K. K. warrants that the Shodex Column, at the time of delivery to the user, will conform to the specification of the attached Certificate of Analysis, if the Shodex Column is used in accordance with the operating manual. The foregoing warranty is exclusive and is in lieu of all other warranties with respect to the Shodex Column, whether written, oral, implied, statutory or otherwise. No warranties by Showa Denko K. K. are implied or otherwise created, including, but not limited to, the warranty of merchantability and fitness for particular purposes.

2. Any claim of inconformity to the specification must be notified to Showa Denko K.K. within ten (10) days after delivery to the user. User's exclusive remedy and Showa Denko K.K.'s exclusive liability for such claim are limited to the replacement of the Shodex Column in question. In no event is Showa Denko K.K. liable for any

indirect, incidental or consequential damage arising out of in connection with the Shodex Instrument, whether or not such damage is allegedly based on breach of warranty, negligence or otherwise.

3.No warranty is made in any of the following cases:

- 1) If the Shodex Column is not used in accordance with the operating manual
- 2) If the Shodex Column is remodelled by anyone other than person or firm designated by Showa Denko K.K.
- 3) If the Shodex Column is disposed of
- 4) If the Shodex Column is resold by the user without giving prior written notice to Showa Denko K.K.
- 5) If the performance of the Shodex Column is not conform to the specification of the attached Certificate of Analysis due to any of the reasons below:
 - a) Computer virus
 - b) Impurities contained in the sample, reagent, gas air or cooling water provided by the user
 - c) Breakdown or malfunction of equipment, apparatus or component used in combination with the Shodex Column
 - d) Force majeure such as fire, earthquake, flood, other natural disaster, crime, riot, act of terrorism, war or radioactive contamination

4.In no event is Showa Denko K.K. liable for (i) the results of analyses or preparations using the ShodexColumn or any portion of the same, including, but not limited to, the reliability, accuracy, efficacy and safety of said results, and (ii) the occupational hazard in the use of the Shodex Column, whether or not such use is made in accordance with the attached Conditions for use.

5.The Shodex Instrument is for laboratory use only. It must not be used for clinical diagnosis. Showa Denko K.K. is not liable for any use of the Shodex Instrument except laboratory use.

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