228-90637A
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SHIMADZU

Shimadzu High Performance Packed Column for HPLC

Shim-pack

IC-C4

Instruction Manual

■ Introduction

Shim-pack IC-C4 is a column for ion chromatography whose packing material is a polymer resin characterized by the ionic functional group. It is used for the analyses of alkaline metal ions such as lithium, sodium, and potassium, alkaline earth metal ions such as calcium and magnesium, and other cationic ions such as ammonium ions. It is applicable to non-suppressed ion chromatography.
Shim-pack IC-C4 is an analytical column for cation-exchange chromatography as a separation mode. Shim-pack IC-GC4 is available as a guard column for Shim-pack IC-C4.

■ Specifications

● Packing

Item	Contents
Type of support	Polymethacrylate resin
Ion exchanger	Carboxyl group
Particle size	7 µm

● Construction Materials

Material
PEEK（polyether etherketone）

● Analytical Column

P/N	Description	Dimension
228-41616-91	Shim-pack IC-C4	150 × 4.6 mm *i.d.*

● Operational Conditions

Condition	Contents
Pressure drop	Δpressure < 6.5 MPa
Temperature	50 °C (max.), 40 °C (recommended)
Flow rate	1.2 mL/min (max.), 1.0 mL/min (recommended)

■ Column Performance

Each Shim-pack IC-C4 column is shipped only after strict factory inspection. The results are summarized on the performance report with the test chromatogram, which is included in the package. The product at the time of shipment is supposed to meet the right standard and performance as indicated below, but this does not represent a guarantee of the retention time or peak shape for every applicable samples.

Description	Criteria	Chromatographic Conditions
IC-C4	*Tr*=15-20 min (Ca) *N* > 5,000 (K) Resolution (Na/NH_4)	Mobile Phase: 2.5 mmol/L Oxalic Acid aqueous solution Flow Rate: 1.0 mL/min Temperature: 40 deg.C Detection: Electroconductivity Sample: Li 0.5 µg/mL Na, NH_4 2 µg/mL K, Mg, Ca 5 µg/mL Injection Volumn: 50 µL

NOTE: Compound retention times and peak shape may vary with usage. Before developing an analysis method with the column, verify that the column satisfy the above standards.

■ Column Installation

The flow direction of the column is shown on the column (→). When installing the column, ensure that this flow direction matches the mobile phase flow direction.
Use PEEK tubing with an inner diameter of 0.25 - 0.3 mm and an outer diameter of 1.6 mm. Prevent peak broadening caused by dead volume by keeping tubing lengths as short as possible. However, the pre-heating coil kit (P/N228-45714-91) must be set between the injector and the column.
The column is connected with supplied PEEK Male nuts. Ensure that the fittings are connected properly to avoid creating dead volume between the tubing and the column interface. Extra nuts can be ordered by referring to the part number below.

Item name	P/N	Comment
Male nut, PEEK	228-18565-84	5/pkg

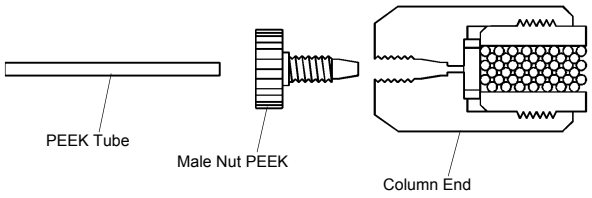

Fig.1 : Guard Column Assembly

As shown below, the guard column is installed between the injector and the column. Use supplied PEEK male nuts for the connections.

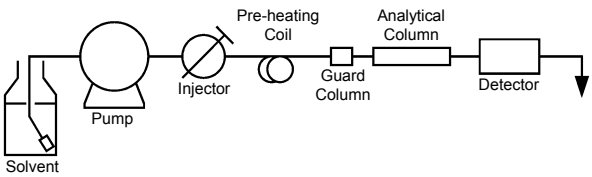

Fig.2 : Installing the Guard Column

NOTE: Entering contaminants of the flow line or air bubbles into the column may cause deterioration of the performance. Flush the flow line with the mobile phase before connecting the column.

■ Mobile Phase Solvent

The columns in this series are generally used with aqueous acid solution mobile phase. Oxalic acid, sulfuric acid, nitric acid, phosphoric acid can be used. Buffer solution can also be used. Typical mobile phase is 2.5 mmol/L oxalic acid aqueous solution.
The higher the concentration of hydroxyl ions in the mobile phase, the faster the cations elute. Therefore, it is possible to adjust retention of cations by changing acid concentration, if necessary. The pH range of the mobile phase should be 2-9. The mobile phase may contain up to 5 % methanol or acetonitrile.

- Solvents should be HPLC grade or an equivalent, and the reagents should be precision analysis grade or an equivalent. When impurities in the reagent influence the analysis, it might be ameliorable to change the reagent.
- Filter the mobile phase, rinse solvent through a membrane filter (0.2 - 0.45 μm) before use. Suspended particles can clog the column.

■ Sample

The sample which can be injected is an aqueous solution with pH 2-9. The water miscible organic solvent can be included in the sample, only if the concentration is less than 5 %. When the sample does not meet the requirement, it should be diluted with water or adjust the pH by the acid including in the mobile phase or by the base other than the desired constituent in the sample.

- When highly hydrophobic compound or the compound that the precipitation or gelation takes place in the mobile phase is included, sample pretreatment is necessary prior to analysis such as solid- or liquid-phase extraction.
- When the ionic macromolecules such as protein are included, remove them from the sample prior to analysis by extraction or ultrafiltration.
- Filter the sample through a membrane filter (0.2 - 0.45 μm) before use.

NOTE: The Filters specified to ion chromatography should be used. General purpose filters may contain ions and contaminate the samples.

■ Column Handling Precautions

- Observe the pressure, temperature, and flow rate limits given in the Specifications. The steep pressure change over the column may cause deterioration.
- Disconnect the column at room temperature without applying pressure.
- Do not shock the column by banging it or dropping it.

■ Flushing the Column

The adhesion of multivalent cations or oily compounds on the column adversely affects both the retention time and peak shape of the compounds analyzed. If the column performance deteriorates, try flushing the column with reversed direction (along with its guard column, if used) to remove contaminants. It is possible to regenerate the column using the procedure described below.

<Flushing procedure>

Deliver approx. 5 mL of water through the flow lines, approx. 50 mL mixture of 20 mmol/L aqueous solution of EDTA-2Na and acetonitrile solution (19/1, v/v), followed by approx. 5 mL water at a flow rate of 0.5 mL/min, respectively. After flushing the column, be sure to reconnect in the proper direction.

NOTE: The column can not be regenerated if it is completely heavily contaminated. Use the guard column to prevent from contamination.

■ Column Storage

Do not allow the column packing material to dry out. Always seal both ends of the column with the caps provided to prevent the evaporation of storage solvent.
When storing the column for less than a week, disconnect it and cap both ends. For a long-term storage, fill the column with mobile phase, cap it, and store in a cool and dark place. Please replace the inside of the column with flesh mobile phase every month.

NOTE: The packing material can not be regenerated if it is completely dried. Seal both ends of the column with the caps firmly for storage.

■ Technical Support

It is the customer's responsibility to develop and validate analytical conditions for a particular application. However, Shimadzu offers technical support by e-mail and phone for customers who need help.
Write specific questions to analytic@group.shimadzu.co.jp or call your local representative.

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