

Care & Use Sheet for BIOshell A400 Protein C4 Nano/Capillary Columns

Description

BIOshell® A400 Protein C4 is a high-speed, high-performance liquid chromatography column based on a new Fused-Core® particle design. The Fused-Core particle provides a thin porous shell of high-purity silica surrounding a solid silica core. This particle design exhibits very high column efficiency for high MW solutes (up to 400 - 500 kDa) due to the shallow diffusion paths in the 0.2-micron thin porous shell and the small overall particle size of 3.4 micron. The densely bonded, extensively endcapped dimethylbutyl stationary phase of BIOshell A400 Protein C4 provides a stable, reversed-phase packing that can be used for separating high MW compounds such as proteins.

Column Characteristics

The Fused-Core particle has a surface area of ~15 m²/g and an average pore size of 400 Å. A printed report including the actual test chromatogram and performance results is enclosed with every column. The Fused-Core particles are heavier than commercially available totally porous particles due to the density of the solid cores. Therefore, the effective surface area per column is similar to columns packed with totally porous particles having surface areas in the 70-100 m²/g range.

Operation Guidelines

- The direction of flow is marked on the column label.
- Reversed flow may be used to attempt removal of inlet blockage or contamination.
- A new column contains 100% acetonitrile. Initial care should be taken to avoid mobile phases that are immiscible with this solvent or could cause a precipitate.
- Water and all common organic solvents are compatible with BIOshell A400 Protein C4 columns.
- BIOshell A400 Protein C4 columns are best used at temperatures below 100 °C for maximum column life.
- Mobile phase pH for BIOshell A400 Protein C4 columns is best maintained in the pH range of 1 to 9 for maximum column stability.
- BIOshell A400 Protein C4 columns are stable to operating pressures up to 400 bar (6000 psi).

Guidelines for Low-Volume Columns

High performance columns with small internal volumes (shorter lengths, internal diameters <0.5 mm) are being increasingly used for high sensitivity and high speed separations, especially with specialty detection systems such as mass spectrometers. These low-volume columns generate peaks having considerably less volume than those eluting from columns of larger dimensions (e.g., ≥2.1 mm x 150 mm). The efficiency of separations performed in low-volume columns is highly dependent on the HPLC system having components designed to minimize band spreading. All low-volume columns perform best when used with proper attention to the following factors:

- **LC/MS** – Most nano/capillary columns are utilized with the Mass Spec as the detector. Spray tips should be of low-volume design (preferably ~20 nL or less) to minimize band spreading.
- **UV Detector** – Flow cells should be of low-volume design (preferably ~20 nL or less) to minimize band spreading. To properly sense and integrate the often very fast peaks that elute from low-volume columns, the detector response time should be set to the fastest level (~0.1 second) and the integration software should sample the detector signal at least 20 points per second.
- **Injector** – The injection system should be of a low-volume design (nano). It is highly recommended that a concentration trap cartridge is used to reduce injection volume and remove unwanted salts.
- **Connecting Tubing** – The shortest possible lengths of connecting tubing with narrow internal diameters (at most 50 µm I.D.) should be used to connect the column to the injector and the detector cell. The tubing must have flat ends and should bottom out inside all fittings. Zero-dead-volume fittings should always be used where required.
- **Peak Retention** – As retention is increased, the volume of a peak increases, decreasing the effects on band spreading caused by components of the instrument.
- **Sample Solvent** – For *isocratic* separations, the sample should be dissolved in the mobile phase or in a solvent that is weaker (less polar) than the mobile phase. For *gradient* separations, the sample should be dissolved in the initial mobile phase or in a solvent substantially weaker than the final mobile phase.
- **Injection Volume** – The volume of sample injected should be kept as small as possible. It is highly recommended that a concentration trap cartridge is used to reduce injection volume and remove unwanted salts.

Column Care

To maximize column life, ensure that samples and mobile phases are particle-free. The use of an in-line filter with 0.5 micron porosity before the sample injector and the column is highly recommended. Should the operating pressure of the column suddenly increase beyond normal levels, reversing the flow direction of the column may be attempted to remove debris on the inlet frit.

To remove strongly retained materials from the column, flush the column in the reverse direction with very strong solvents such as 100% of the organic component of the mobile phase in use. A mixture (95/5 v/v) of dichloromethane and methanol is often effective at this task. Extreme cases may require the use of very strong solvents such as dimethylformamide (DMF) or dimethylsulfoxide (DMSO).

Column Storage

Long term storage of silica-based, reversed-phase columns is best in 100% acetonitrile. Columns may be safely stored for short periods (up to 3 or 4 days) in most common mobile phases. However, when using buffers, it is best to protect both the column and the HPLC equipment and remove the salts by flushing the column with the same mobile phase without the buffer (e.g., when using 60/40 ACN/buffer, flush the column with 60/40 ACN/H₂O) to eliminate any danger from corrosion from the salts while providing rapid re-equilibration of the column with the original mobile phase. Before storing the column, the end-fittings should be tightly sealed with the end-plugs that came with the column to prevent the packing from drying.

Safety

- **HPLC columns are for laboratory use only. Not for drug, household, or other use.**
- Users of HPLC columns should be aware of the toxicity or flammability of the mobile phases chosen for use with the columns. Precautions should be taken to avoid contact and leaks.
- HPLC columns should be used in well-ventilated environments to minimize concentration of solvent fumes.

Applications

The BIOshell A400 Protein C4 bonded phase is nonpolar in nature. It is best utilized with mobile phases that are mixtures of methanol and water or acetonitrile and water. Higher levels of the organic solvent component will typically reduce the retention of the sample compounds. Using elevated temperatures (e.g., 40 – 60 °C) will reduce the viscosity of the mobile phase and allow the use of faster flow rates and lower column pressure for high sample throughput. Gradient elution techniques using 5 -10% organic component as the initial mobile phase and increasing to 100% organic component as the final mobile phase often can affect separations of complex sample mixtures in minimal time.

BIOshell A400 Protein C4 columns are highly suited for the reversed-phase separation of high molecular weight compounds such as proteins with MW up to 400 to 500 kDa. The use of 20-50 mM buffers is always recommended for optimum results and long-term stability when separating ionizable compounds. Additional information on solvent selection and separation techniques can be found in Chapters Six, Seven, and Eight, *Practical HPLC Method Development*, Second Edition, L.R. Snyder, J.L. Glajch, and J.J. Kirkland, (John Wiley & Sons, 1997).

BIOshell A400 Protein C4 columns use a densely bonded, extensively endcapped dimethylbutyl bonded phase that can withstand the low pH and high temperature mobile phases that are used for protein separations. The use of low pH mobile phase modifiers, such as trifluoroacetic acid (TFA) at concentrations of 0.01-0.1% is recommended for protein separations without mass spectrometry (MS) detection. Under MS operating conditions, the use of formic acid at similar concentrations with the addition of 10-20 mM ammonium formate is suggested.

Technical Support

For technical support on this product, contact your local Sigma-Aldrich office, designated distributor in your country, or visit sigma-aldrich.com/bioshell.

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