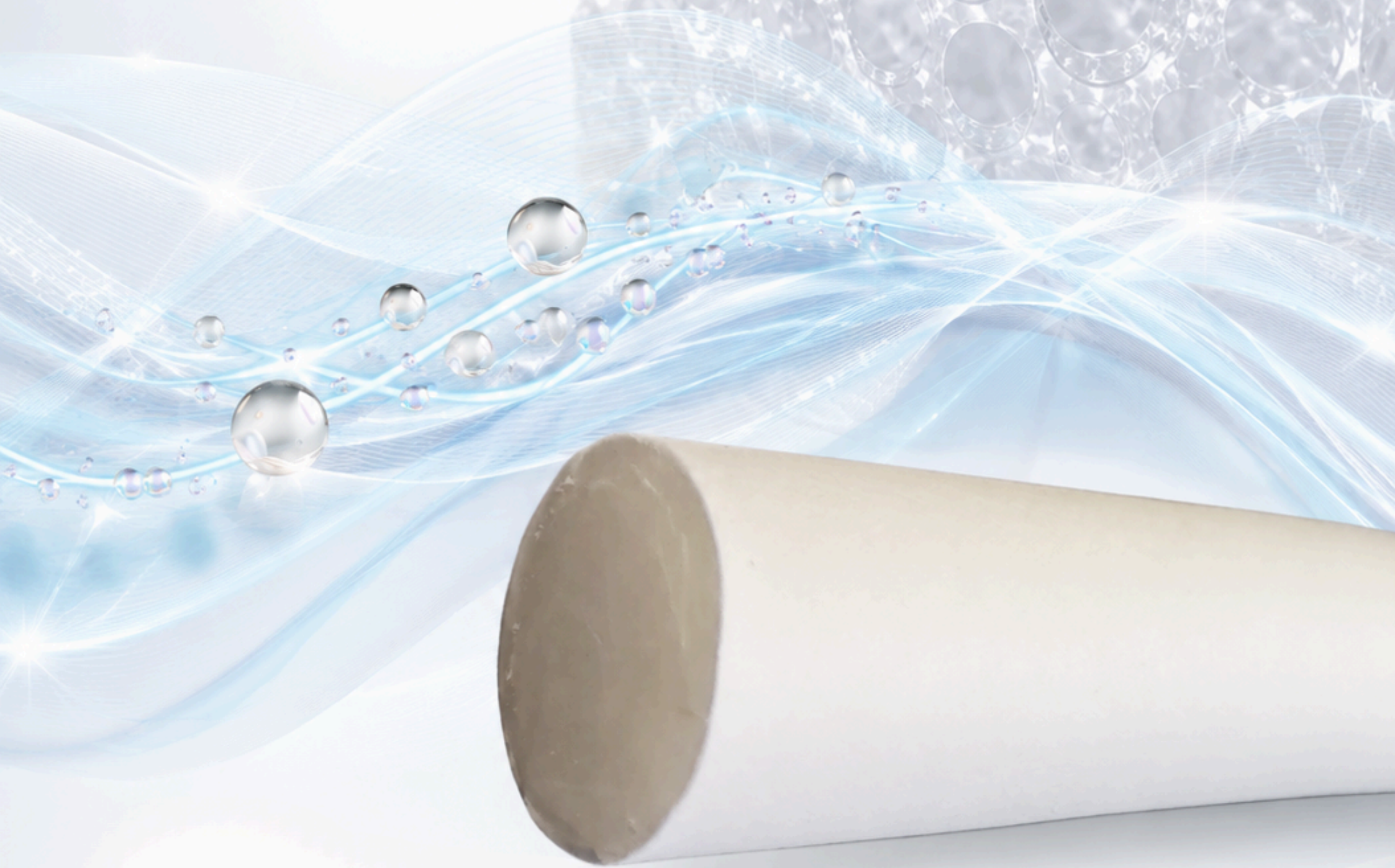




Next-Generation Separation Platform

for Biomolecules and Bioparticles



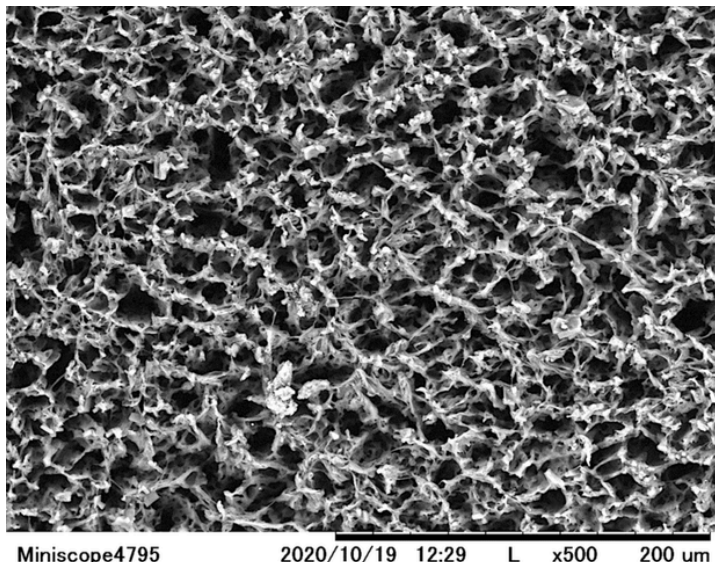
SPM TECHNOLOGY & APPLICATION GUIDE

HPLC | SPE | Filter

A New Approach to Separation

Highly Water-Permeable Medium for Affinity & Bioseparation

PEGM-Spongy Monolith



Spongy Monolith (SPM) is a **novel, highly flexible, and water-permeable porous polymer material** produced by melt-blending thermoplastic resins, such as polyethylene (PE), with hydrophilic pore-forming agents, followed by extrusion molding. Its large interconnected pores, ranging from **5 μm to several hundreds μm** , provide excellent water permeability while maintaining the flexibility and processability of the polymer matrix. SPM can be easily processed into custom shapes for HPLC, solid-phase extraction (SPE) columns, filters, and other applications.

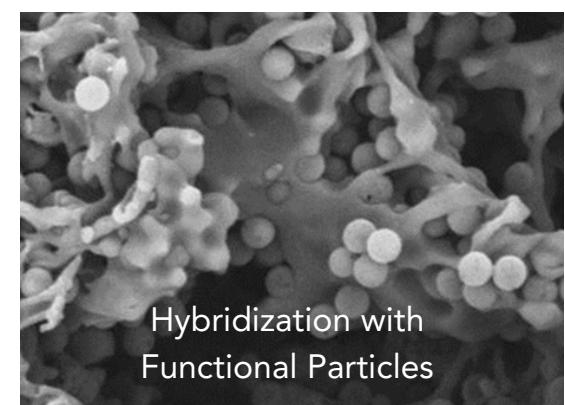


HPLC Column

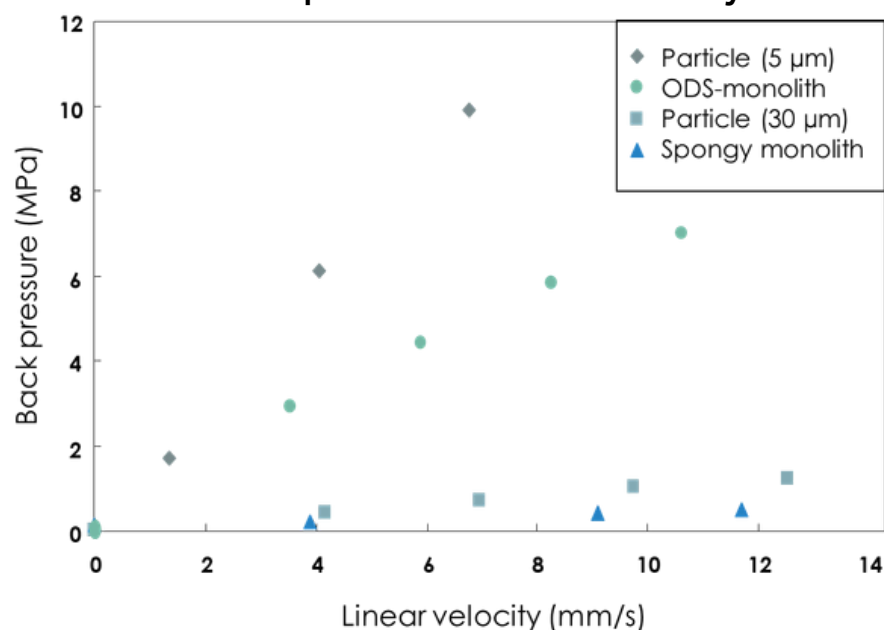


Solid Phase Extraction Cartridges

A key advantage of SPM is its versatility in surface modification and functionalization. For instance, PEGM (poly(ethylene-co-glycidyl methacrylate))-based SPM contains a high density of epoxy groups on the polymer surface, **enabling efficient immobilization of target proteins**. These reactive groups can also be further modified to introduce a wide range of functional groups. Furthermore, SPM can be combined with materials such as carbon, polymer particles, and fibers to incorporate additional functions tailored to specific applications. This versatility makes SPM a powerful platform for affinity purification and high-performance bioseparations.



Backpressure vs. Linear Velocity



The large pores enable **high flow rates at extremely low column backpressures**. Compared with conventional particle-packed column (30 μm particle size), SPM achieves approximately 40% of the backpressure, corresponding to 2.4-fold higher permeability. This allows for the straightforward construction of high-throughput separation platforms that are difficult to achieve with conventional media, while maintaining approximately 75% of the theoretical plate number achieved with conventional packed columns.

LC conditions:

Column size, 100 mm $\times$ 4.6 mm I.D.; mobile phase, MeCN/H₂O=7/3; temperature, 40 $^{\circ}\text{C}$

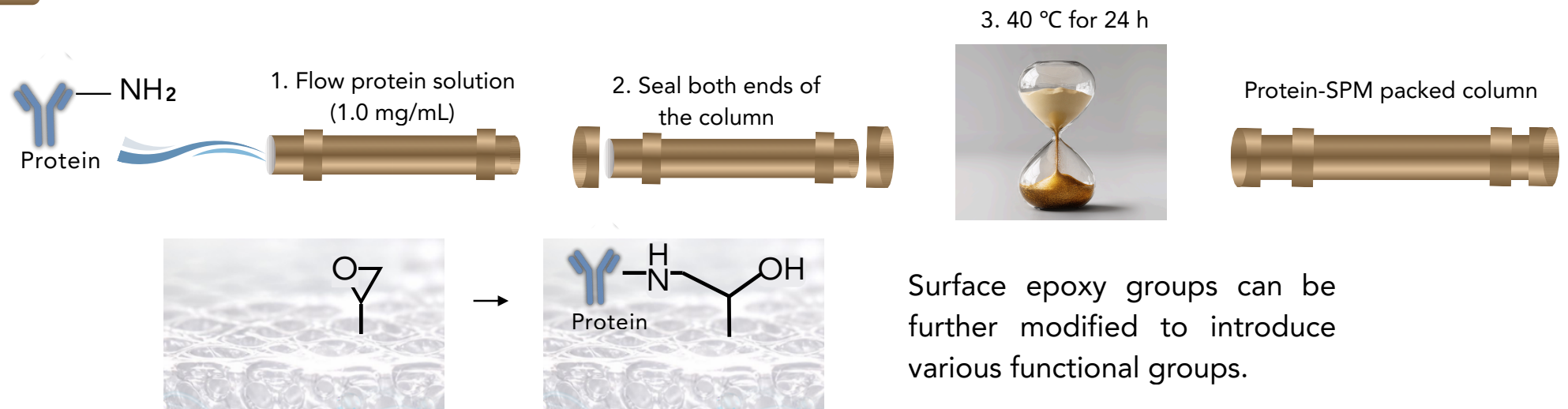
Representative Physical Properties of SPM

Pore size	10 μm ; through-pores of 5~50 μm (max. approx. 500 μm)
Specific surface area	~several m^2/g
Density	0.2 g/cm^3
Porosity	71.6%
Hardness	30° (soft to hard)
Melting point	85 $^{\circ}\text{C}$
Elongation at break	274%
Water absorption	1.03%
Disposability	No toxic gasses generated during combustion

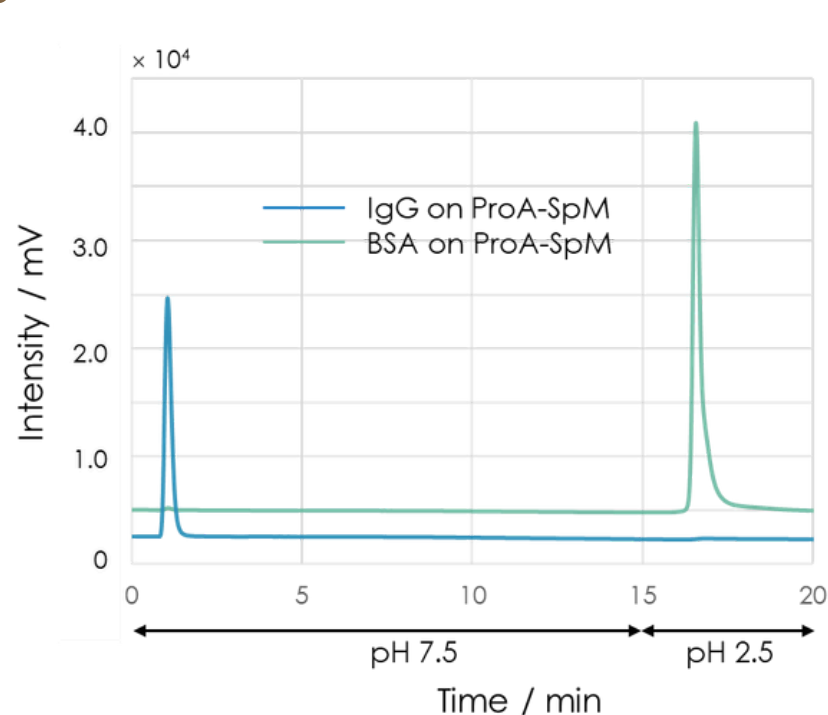


SPM: A Platform for Bioseparation

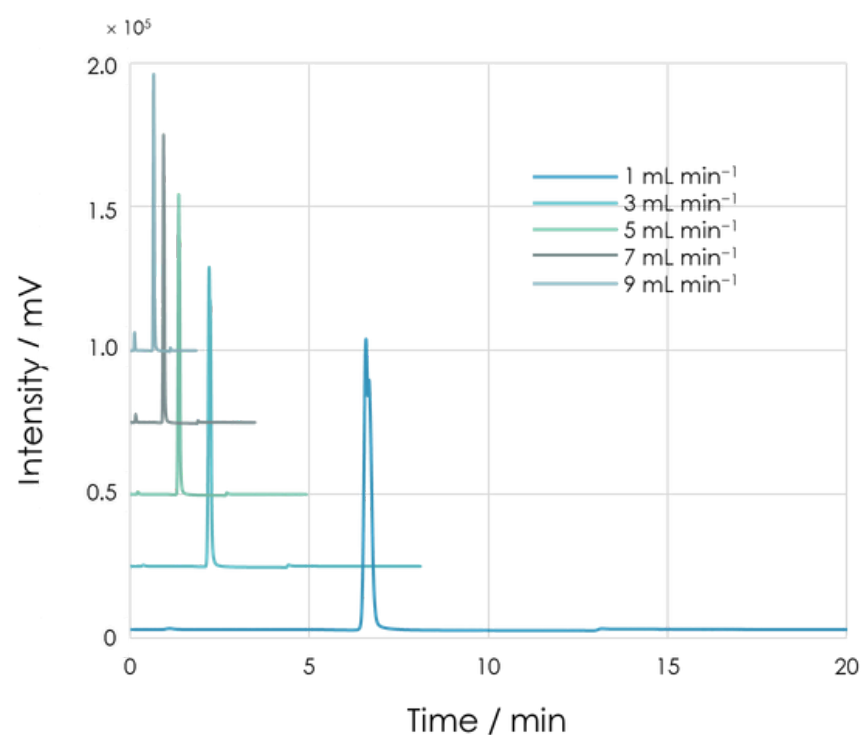
1 Protein Immobilization on PEGM-SPM



2 High-Flow Affinity Separation Using a Protein A-immobilized SPM Column

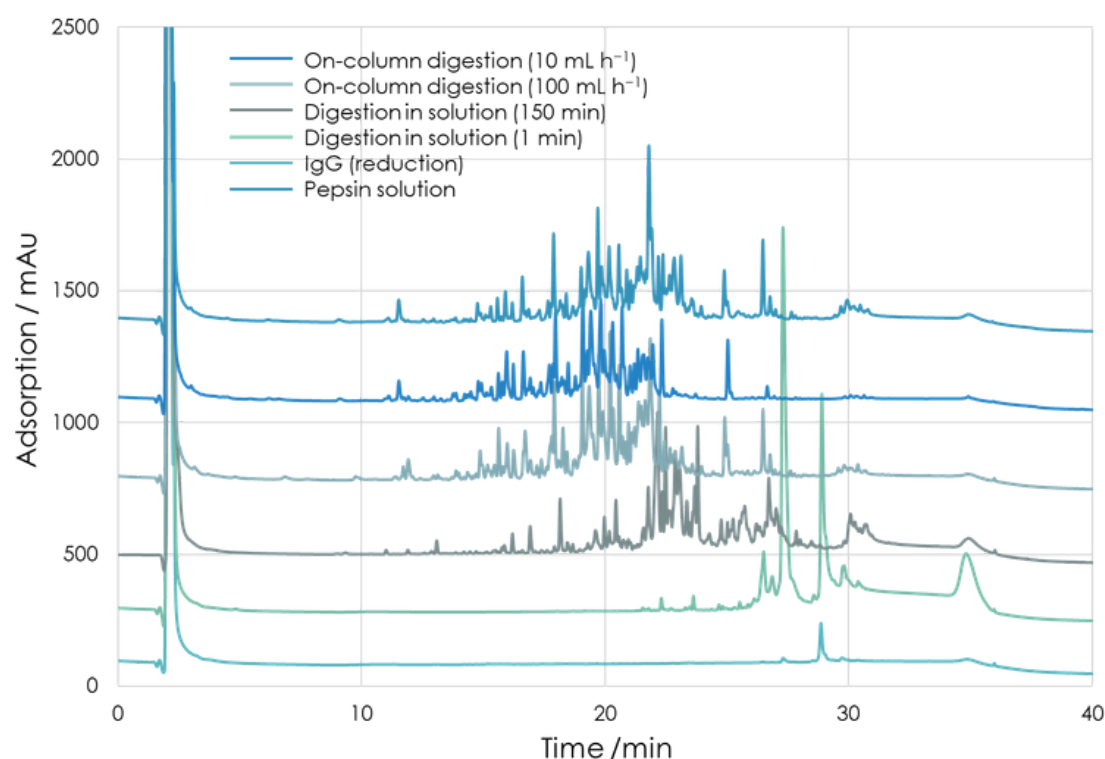


IgG: Immunoglobulin G BSA: Bovine Serum Albumin
Mobile Phase A: 50 mM phosphate buffer +150 mM NaCl (pH7.5)
Mobile Phase B: 50 mM phosphate buffer -150 mM NaCl (pH2.5)



The ProA-SPM column can be operated at flow rate more than three times higher than those of conventional particle-packed columns.

3 On-Column Digestion Using a Pepsin-Immobilized SPM Column



When Pepsin, a digestive enzyme, is immobilized on PEGM-SPM, antibody proteins injected via the HPLC injector can be digested into peptide fragments within the column. The large flow-through pores of the monolith, enables the detection of peptide fragments comparable to those obtained by in-solution digestion.

SPM HPLC Column

(Density: 0.2 g /cm³, Pore size: 10 μm)

Material	PEGM incl. Epoxy	PEGM-OH2 incl. Diol	EVA Hydrophobic Ester	EVA-OH incl. Hydroxyl
I.D. × Length (mm)	SUS Column			
4.6 × 30	EP-4630-10S	EPH-4630-10S	EV-4630-10S	EVH-4630-10S
4.6 × 50	EP-4650-10S	EPH-4650-10S	EV-4650-10S	EVH-4650-10S
4.6 × 100	EP-46100-10S	EPH-46100-10S	EV-46100-10S	EVH-46100-10S
I.D. × Length (mm)	PEEK Column			
4.6 × 30	EP-4630-10P	EPH-4630-10P	EV-4630-10P	EVH-4630-10P
4.6 × 50	EP-4650-10P	EPH-4650-10P	EV-4650-10P	EVH-4650-10P
4.6 × 100	EP-46100-10P	EPH-46100-10P	EV-46100-10P	EVH-46100-10P

(Example)

EPH-4630-10T

Polymer
Material

Column
Size

Pore Size
Column Material

SPM Solid Phase Extraction Cartridge

(Density: 0.2 g/cm³, Pore size: 10 μm)

Material	PEGM incl. Epoxy	EVA Hydrophobic Ester
pcs	Syringe type / 3 mL	
10	SP3M-EP-10T	SP3M-EV-10T
50	SP3M-EP-10	SP3M-EV-10

【Product specifications & Custom orders】

- **HPLC Column:** Density 0.2 / 0.3 g/cm³, Pore size of 10 / 30 / 60 μm are available
- **SPE Cartridge:** Volume 1 mL/3 mL, Pore size of 10 / 60 μm are available

*Custom specifications and sizes not listed above are available.
Please contact us for details.

(Example)

SP3M-EP-10T

Column
Volume

Polymer
Material

Pore Size
(T: test)

Example of protein immobilization

Protein A (46.7 kDa) is a cell wall protein of Staphylococcus aureus that specifically binds to immunoglobulin G (IgG). Protein A has up to four affinity IgG-binding sites. Protein A can also retain its activity even after exposure to 4 M urea and 6 M guanidine hydrochloride.

ref. Kubota, K.; Kubo, T.; Tanigawa, T.; Naito, T.; Otsuka, K. Sci. Rep. 2017: 178

Protocol

Protein A Immobilized Affinity Column

Reagents: water, acetonitrile, phosphate buffer, protein A

- ① Prepare 1 mL of Protein A solution (1 mg/mL) in 10 mM phosphate buffer (pH7).
- ② Wash the SPM-packed column sequentially with 5 mL of acetonitrile and 5 mL of water.
- ③ Inject half of the prepared protein A solution (1 mg/mL), followed by the remaining half in the reverse flow direction.
- ④ Seal both ends of column and incubate at 37 °C for 24 h.
- ⑤ Wash the column with water at 1 mL/min for 60 min using an HPLC pump.

*For storage, replace the solvent with water and store the column in a cool place.
The columns remained usable for up to one year when stored sealed and refrigerated.

