Capto DeVirS

AFFINITY CHROMATOGRAPHY

Capto™ DeVirS (Fig 1) is a chromatography medium that is designed to be used for the capture and intermediate stages of virus purification. The combination of high capacity with high flow rates and low backpressure reduces process cycle times and increases productivity. The Capto family range consists of modern process chromatography media designed for fast, efficient, and cost-effective purification that meets the stringent demands of modern large-scale biopharmaceutical and vaccine manufacturing processes.

Capto DeVirS delivers:

- Excellent productivity from increased throughput
- Good chemical stability that makes the media more durable and allows you to use several commonly available buffers
- Affinity-like behavior for various viruses, which makes it a highly versatile medium

Fig 1. Capto DeVirS for capture and intermediate purification of virus in vaccine manufacturing processes.

Characteristics of Capto DeVirS

Capto DeVirS is based on a cross-linked high flow agarose base matrix that allows rapid processing of large sample volumes. The dextran sulfate ligand (Fig 2) is coupled to the matrix via multipoint attachment to give a medium with high chemical stability and low ligand leakage. The dextran sulfate ligand has an affinity-like behavior for several virus types and this feature allows you to use Capto DeVirS in several different applications.

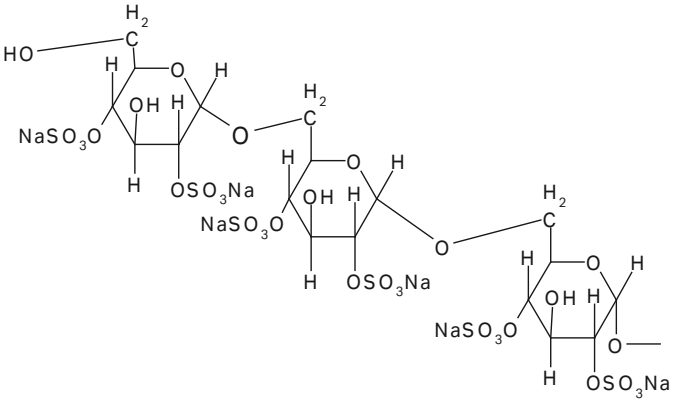

Fig 2. Capto DeVirS consists of highly cross-linked agarose base matrix coupled to dextran sulfate ligand.

High flow agarose and productivity

High throughput in downstream purification requires separation media that combine the mechanical strength of the backbone with a pore structure that allows fast mass transfer and a high capacity for target molecules. Capto media are based on a high flow agarose base matrix that is highly rigid and offers outstanding pressure/flow properties with an optimized pore structure (Table 1).

Table 1. Characteristics of Capto DeVirS

Base matrix	Highly cross-linked agarose
Average particle size[1]	75 µm (d_{50v})
Functional group	Dextran sulfate
Ligand density	70 to 130 µmol S/ml drained gel
Flow velocity	At least 600 cm/h in a 1 m diameter column with a 20 cm bed height at 20°C using process buffers with the same viscosity as water at < 3 bar (0.3 MPa)
Recommended bed height	20 to 40 cm
pH stability[2]	
Short-term stability	pH 6 to 14
Long-term stability	pH 7 to 13
Working temperature[3]	4°C to 30°C
Chemical stability	All commonly used aqueous buffers, 0.1 M NaOH[4]

[1] d_{50v} is the median particle size of the cumulative volume distribution

[2] pH stability: Short-term pH refers to the pH interval where the medium can be subjected to cleaning or sanitization-in-place (50 h/100 cycles at room temperature) resulting in a 10% decrease in dynamic capacity and less than 20% loss of sulfur content

Long-term pH refers to the pH range in which the medium can be operated without significant change in sulfur content

[3] Capto DeVirS can be used under cold-room conditions (Note: this has not been tested)

[4] No significant decrease in sulfur content after 1 wk storage in 0.1 M NaOH at 40°C

Capto media are suitable for large-scale operations because the high flow rates allow you to process large volumes, which leads to increased productivity. In addition, shorter cycle times reduce the exposure of the target protein to proteases. A typical flow rate for Capto media in a 1 m diameter column with a 40 cm bed height tends to be over 600 cm/h with a backpressure below 3 bar. A comparative pressure/flow performance of Capto DeVirS versus Capto MMC is shown in Figure 3. Capto DeVirS and Capto MMC have the same base matrix and Capto DeVirS is expected to show a similar performance after scale-up with AxiChrom™ columns.

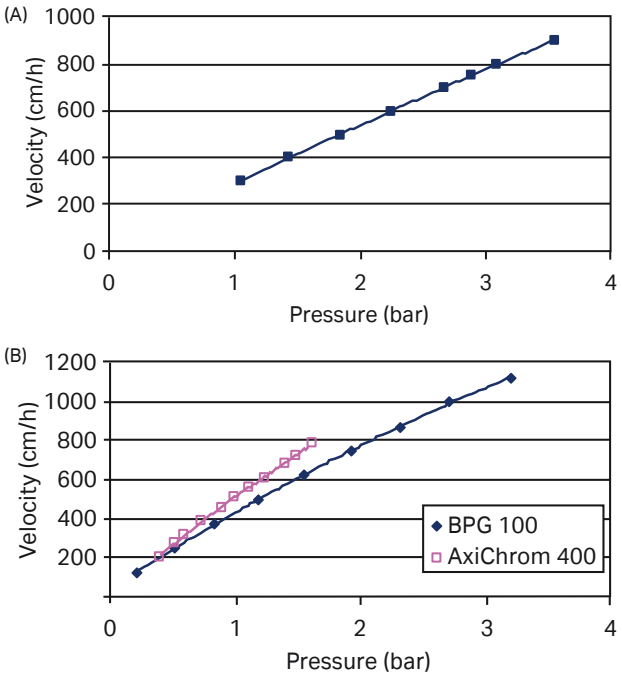

Fig 3. (A) Pressure/flow characteristics of Capto DeVirS packed in a BPG™ 100 column packed to a 20 cm bed height. Pressure/flow data was generated in water at 20°C; **(B)** Pressure/flow characteristics of Capto MMC packed in BPG 100 to a 20 cm bed height

Affinity chromatography

Affinity chromatography uses an immobilized ligand that adsorbs to a specific molecule or group of molecules under suitable binding conditions and desorbs under appropriate elution conditions. These conditions depend on the target molecule, feed composition, and chromatography medium, and they must be studied together with other chromatographic parameters (i.e., sample load, flow velocity, bed height, regeneration, and cleaning-in-place [CIP] conditions) to establish optimal conditions for efficient product recovery.

Packing and scalability

Capto DeVirS medium is supplied preswollen in different pack sizes, including bioprocess pack sizes. The medium can be packed and used in laboratory columns such as Tricorn™ and XK columns. We recommend AxiChrom columns for scale-up of Capto DeVirS to large-scale vaccine manufacturing.

Use of Capto DeVirs to capture influenza virus

Capto DeVirS was used for the capture step in the purification of influenza virus. A Design of Experiments (DoE) approach was used to conduct impurity clearance, optimize pH, and conductivity. We observed from these studies that:

- The optimum conductivity for the binding of influenza virus to Capto DeVirS was below 5 mS/cm
- The optimum pH for the binding and elution of influenza virus from Capto DeVirS was 6.8 to 7.8. In general, we suggest a low pH for binding and a high pH for elution

We purified different strains of influenza virus and found that Capto DeVirS produced good DNA removal, virus binding capacity, and yield (Table 2).

Table 2. Purification of different influenza strains on Capto DeVirS in an XK50 column (5 x 17 cm) with 330 ml of medium and a linear flow rate of 150 cm/h

Influenza strain	A/South Dakota	A/Uruguay	B/Florida
Loading titer (log_{10}FFU[1]/ml)	9.3	6.6	7.9
Step yield (%)	76	77	84
HCD[2] level (ng/dose)	0.20	N/A	0.93

[1] FFU = Fluorescence Focal Unit

[2] HCD = Host cell DNA

CIP and sanitization

CIP is a procedure for removing contaminants such as lipids, endotoxins, and precipitated or denatured proteins that remain in the packed column after regeneration. These types of contamination occur frequently during the purification of viruses from crude feedstock. Regular CIP prevents the build-up of contaminants in the medium bed and it also helps to maintain the capacity, flow properties, and general performance of Capto DeVirS.

A specific CIP protocol should be designed for each process according to the type of contaminants present. The frequency of CIP depends on the nature and the condition of the feedstock —for the capture steps, we recommend CIP after each cycle with 1 M NaOH for at least 30 min in reversed flow.

In order to reduce microbial contamination in the packed column, sanitization using 0.5 to 1.0 M NaOH with a contact time of 1 h is recommended.

Storage

Store medium in the container at a temperature of 2°C to 8°C. Make sure that the screw top is fully tightened. Packed columns should be equilibrated in 20% ethanol to prevent microbial growth. After storage, equilibrate with at least 5 bed volumes of starting buffer before use.

Ordering information

Product	Quantity	Code no.
Capto DeVirS[1]	25 ml	17-5466-01
Capto DeVIrS[1]	100 ml	17-5466-02
Capto DeVirS[1]	1 l	17-5466-03
Capto DeVirS[1]	5 l	17-5466-04

[1] This product is part of our Custom Designed Media program

Related literature

	Code no.
Affinity Chromatography: Principles and methods, Handbook	18-1022-29

cytiva.com/bioprocess

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