

Operating Instructions

Weak cation exchange Chromatography Media **Cellufine™ MAX CM**

Description

Cellufine MAX is the new name of 2nd generation Cellufine chromatography media. Cellufine MAX CM weak cation exchanger is highly cross-linked, surface modified media with high dynamic binding capacities and stable at high flow velocities. These high performances of the optimized media offer significant opportunity for increasing downstream purification throughput.

Characteristics of Cellufine MAX

Type	CM (carboxymethyl)
Ion exchange type	Weak cation / -CH ₃ COOH
Matrix	Highly cross-linked cellulose with dextran scaffold
Particle size	ca. 40 – 130 μm (Average 90 μm)
Ion exchange capacity	0.09~0.22 meq /ml
Flow velocity	600 cm/h(0.3M pa) I.D.30 cm-L 20 cm, pure water at 24 °C
Dynamic binding capacity	>120 mg Lysozyme / ml gel
pH stability (20°C, 1week)	2 – 13
Chemical stability	Stable all commonly used aqueous buffers, 0.5 M NaOH
Storage	20 % ethanol

Packing to the column

- Calculate volume required for the desired bed dimension.
 - Packed bed volume = column cross sectional area (cm²) x bed height (cm)
 - Required sedimented gel volume $\div$ Packed bed volume x 1.2
 - The slurry concentration in the bottle of Cellufine MAX CM is approximately 50 % in 20% ethanol.
- Wash the gel with water or the appropriate buffer.
- Prepare a 40 – 60 % (v/v) slurry with water, 0.1 M NaCl solution or the appropriate buffer. Equilibrate at ambient temperature for one hour.
- Gently stir. If required place under vacuum to degas.
- Column
 - A column is prepared according to the instructions from the column supplier.
 - The bed support should be wetted in a packing solution or 20% ethanol before use to remove air.
 - Pour the packing solution into the column tube and it check that solution flows out from the column exit. Shut the exit valve when approximately 0.5 to 1cm height of the solution remains.

6. Carefully pour the slurry into the column without creating air bubbles. Depending on the volume, a filler tube may be necessary.
7. Mount the top adapter on the top of column. (Be careful to not entrain air)
8. Open the column outlet and begin pumping elution buffer for 10 min at 1000 cm/h or 0.3M pa. Caution: do not exceed the operation pressure limit for the selected column.
9. Mark the gel bed height. Stop the pump and shut the column outlet valve.
10. Disconnect the top adapter line from the pump. Loosen the adaptor seal and move the top adapter down to mark the gel bed reached at packing.
11. After the bed stabilizes, lock the adapter and reconnect the line from the pump. Equilibrate with 10 column volumes of adsorption buffer before sample loading.

Packing to the fixed length column

1. Calculate volume required of the desired bed dimension.
 - (a) Packed bed volume= column cross sectional area (cm²) x bed height (cm)
 - (b) Required sedimented gel volume=Packed bed volume x 1.15
 - (c) Note: When using a packing connector, the amount of excess gel corresponds to the required sedimentary gel volume.
 - (d) The slurry concentration in the bottle of Cellufine MAX CM is approximately 50% in 20% ethanol.
2. Wash the gel with water, 0.1 M NaCl solution or the appropriate buffer.
3. Prepare 40– 60 % (v/v) slurry with water, 0.1 M NaCl solution or the appropriate buffer. Equilibrate at ambient temperature for one hour.
4. Gently stir. If required place under vacuum to degas.
5. Column
 - (a) A column is prepared according to the instructions from the column supplier.
 - (b) The bed support wetted in a packing solution or 20 % ethanol before use to remove air.
 - (c) Pour the packing solution into the column tube and it check that solution flows out from the column exit. Shut the exit valve when approximately 0.5 to 1 cm high of the solution remains.
6. Carefully pour the slurry into the column and packing connector without creating air bubbles. Depending on the volume, a filler tube may be necessary.
7. Mount the top adapter on the top of packing connector.
8. Open the column outlet and begin pumping elution buffer for 10 min at 1000cm/h or 0.3 MPa. Caution: do not exceed the operation pressure limit for the selected column.
9. Stop the pump and shut the column outlet valve.
10. Disconnect the top adapter line from the pump. Remove the packing connector. Before remove excess medium from the packing connector, if necessary.

11. Mount the top adapter, lock the adapter and reconnect the line from the pump. Equilibrate with 10 column volumes of adsorption buffer before sample loading.

Evaluation of packing

See appendix 1

Operating Guidelines

General Operation

Typically, adsorption to Cellufine MAX Cation Exchange medium occurs in relatively low ionic strength (e.g., below 0.1 M NaCl) in the pH range from 4.0-9.0 below the *pI* of the target protein.

The binding capacity is strongly affected by pH and conductivity. Under these conditions, proteins with neutral or net negative charge will bind. Bound components are then resolved by stepwise elution with buffers containing progressively higher salt concentration or by elution with a linear salt gradient.

Sample Preparation and Load

Prepare sample by centrifugation or microfiltration to remove insoluble material. Samples should be prepared to a concentration of 1 – 20 mg/ml, in binding buffer or at comparable conditions of ionic strength and pH. If necessary, exchange sample buffer using dialysis, diafiltration or desalting chromatography.

Recommended Buffers

Adsorption buffer: 0.01–0.05 M sodium acetate (pH 4 to 6) or 0.01-0.05 M phosphate or Tris-HCl (pH 6 to 9)

Elution buffer: 0.1 – 2.0 M sodium chloride in adsorption buffer.

Other common buffer systems may be used. For additional information on chromatographic methods of protein purification, see References.

Regeneration and equilibration

After separation, wash the binding material with over 5-bed volumes of high ionic strength solution (1-2 M NaCl). After washing the column, pump an additional 5-bed volume of adsorption buffer, or until the column eluate will be stable pH and conductivity values.

Depyrogenation

Wash the column with 5-bed volumes of 0.2 M NaOH, let stand for 16 hours, and then wash with endotoxin-free water or equilibration buffer.

- 0.2 M NaOH-20% EtOH is effective for endotoxin removal. Moreover 0.2 M NaOH-90% EtOH can rapidly decrease LPS, with contact for at least 2 hours.

Chemical and Physical Stability

Stable in:

Most salts (NaCl, (NH₄)₂SO₄, etc.), Alcohol (30 % (v/v) IPA, 70 % (v/v) EtOH), Urea (6M) and Guanidine-HCl (6 M)
pH 2-13 at 20°C, 1 week

Cleaning-in-place (CIP)

Cellufine MAX CM performance remains constant for at least 100 CIP operating cycles employing 0.5 M NaOH by 10 CV washing.

Flow Rate

Cellufine MAX CM is based on highly cross-linked cellulose gel, and are stable at high flow velocities.

1,000 cm/h in a 2.2 cm diameter column with 20 cm bed height at < 0.3 MPa.

Over 500 cm/h 30 cm diameter column with 20 cm bed height at < 0.3 MPa.

Storage

Store unopened container at ambient temperature. Do not freeze.

Short-term storage for bulk and column (2 weeks or less) can be at a room temperature with pH 2 to pH 12. It is possible to store under alkaline condition at less than 20 °C as recommendation.

0.5 M NaOH ; for less than 2 weeks, at 20 °C

Longer storage should be in neutral buffer containing 20 % ethanol, at 2 – 25 °C. Do not freeze.

Shelf Lifetime:

5 years from date of manufacture

References

1. Harris, E.L.V. and Angal, S., *Protein Purification Methods: A practical Approach*. New York: Oxford University Press, 1989.
2. Janson, J.-C. and Ryden, L., *Protein Purification: Principles, High Resolution Methods, and Applications*. 2nd ed. New York: John Wiley & Sons, Inc., 1998

Product Ordering Information (Catalogue No.)

Media type	Pack Size					
	MC* 1mL x 5	MC 5mL x 5	100 mL	500 ml	5 L	10 L
Cellufine™ MAX CM	20900-51	20900-55	20900	20901	20902	20903

MC = Mini-Column

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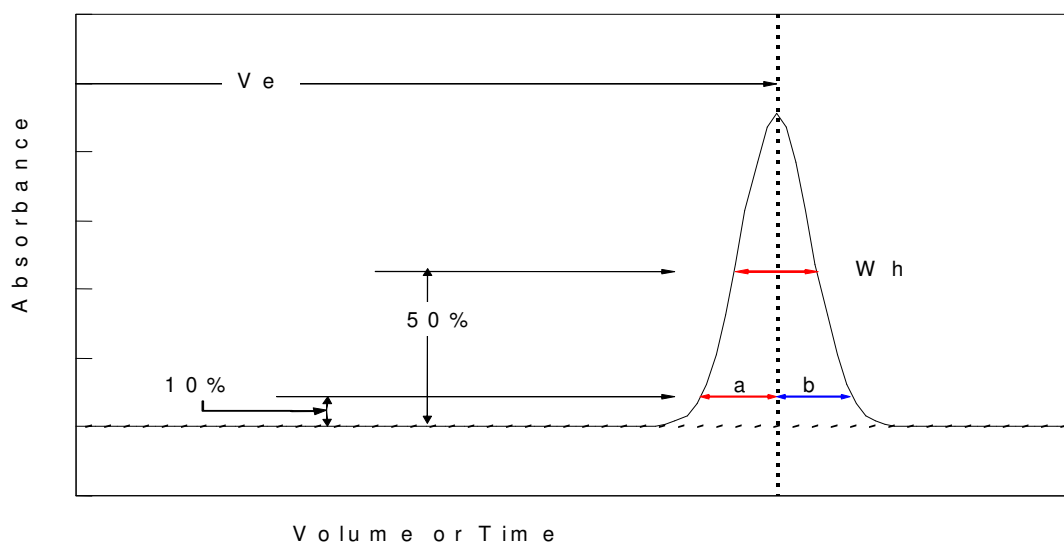
<https://www.jnc-corp.co.jp/fine/en/cellufine>

Appendix 1: Evaluation of column packing of Cellufine

Evaluation methods for the packing status of a column can employ indices, such as the number of (theoretical) plates (N), the height equivalents to a theoretical plate (HETP), and a symmetry factor (As).

The selected evaluation indices are affected by the measurement condition. For example, they vary with changes in the difference between the diameter/height of a column, the difference in piping, solvent sample volume, the flow velocity, temperature, etc. Therefore, it is necessary to use the same measurement conditions each time.

Conditions	
Sample volume	1% (MAX2.5%) of column bed volume
Sample concentration	1-2%(V/V)acetone (mobile phase: water)
	1M NaCl (mobile phase: 0.1-0.4M NaCl aq)
Flow rate	~30cm/h (X mL/hr/column cross section)
Detector	UV, conductivity



Formula
 $HETP = L/N$
 $N = 5.54 \times (V_e/W_h)^2$
 $As = b/a$

L	Column length [cm or m]
V_e	Elution time or volume
W_h	Half of width of peak
a,b	Peak width of 10% peak height (a)front, (b)rear
Note	V_e, W_h and a, b should have same dimensional units

(Note)

Generally, a larger value of N is good. (Likewise a smaller value of HETP is good.)

The asymmetry factor value (As) should be close to 1. Generally, acceptable symmetry values range from 0.8-1.6.

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