SARTORIUS

Product Datasheet

CIMac Analytical Columns

Monolithic Columns for Large Biomolecule HPLC Analytics

Portfolio Overview

CIMac columns combine all the characteristics of CIM® monoliths at analytical scale and are high-performance tools for analysis and control of manufacturing processes, ideal for process analytical technology (PAT). Designed for fast and reproducible HPLC monitoring and quantitation of viruses, viral vectors, nucleic acids, and other large biomolecules, these columns can be operated at high volumetric flow rates, allowing high-resolution separations with quantity and purity information delivered in minutes. CIMac columns have a volume of 0.1 mL (0.3 for CIMac pDNA), can be run at flows from 1 to 30 column volumes/minute (varies by type), and have application-optimized channel widths. CIMac columns are available in 19 different chemistries.

Key Benefits

- Analytical HPLC columns for nucleic acids, viral vectors, viruses, and other biomolecules
- In-process analysis and quantitation, and final product control
- At-line monitoring and control of manufacturing processes (PAT)
- Rapid, high-resolution analysis achieved in minutes
- High sensitivity, accuracy and reproducibility
- No sample carryover

Innovative Analytics for Gene Therapy and Vaccines

In gene therapy and vaccine production, ensuring purity during downstream processing is especially challenging. Fast and efficient tracking of target biomolecules and removal of impurities is critical, as it directly affects product yield and purity. CIMac analytical chromatography column solutions help provide this information in real-time through at-line monitoring of biomolecules, including viruses, pDNA, and mRNA.

- E | F AAV capsid analytics
- Separation of pDNA isoforms and detection of process impurities (e.g. RNA, endotoxins, gDNA)
- Monitoring, characterization, and optimization of complex reaction mixtures e.g. IVT
- Product purity and quantitation (linear range, LOQ and LOD), process impurity detection
- Target molecule analytics in unclarified feed streams via "fingerprinting"
- Rapid and cost-effective alternative to labor intensive methods like ELISA or ddPCR

CIMac analytical columns, with column volumes of 0.1 mL (with the exception of 0.3 mL for pDNA), are available with a broad range of ligands for general use as well as specialized applications.

AAV	Adenovirus	mRNA	pDNA	Other Biomolecules	Proteins
CIMac AAV Full | Emtpy	CIMac Adeno	CIMac PrimaS	CIMac Plasmid DNA	CIMac QA	CIMac C4 A
CIMac SO3		CIMac C4 HLD	CIMac C4 HLD	CIMac DEAE	CIMac IDA
		CIMac Oligo dT18		CIMac COOH	CIMac r-Protein A
				CIMac SO3	CIMac r-Protein L
				CIMac EDA-AEX | Activated	CIMac r-Protein G
				CIMac OH	CIMac HDZ-Affinity
				CIMac H-bond ADC	

Technical Specifications

The CIMac Product Portfolio

CIMac columns are made of the same polymethacrylate monolithic material as CIMmultus columns, and share the features and advantages of this CIM® (Convective Interaction Media) stationary phase:

- Large flow-through channels
- High flow rates
- Low-shear laminar flow
- Convective mass transport
- Flow-independent capacity and resolution
- Designed for working with large biomolecules

CIMac monolithic polymers are supplied in stainless steel housings with column volumes of 0.1 mL (with the exception of 0.3 mL for pDNA) and are available with 19 different chemistries.

IEX	HIC	Mixed-Mode	Affinity
CIMac AAV Full | Emtpy	CIMac OH	CIMac H-bond ADC	CIMac Oligo dT18
CIMac Plasmid DNA	CIMac C4 HLD (mRNA, pDNA)	CIMac PrimaS (mRNA)	CIMac IDA
CIMac Adeno	CIMac C4 A		CIMac r-Protein A
CIMac QA			CIMac r-Protein L
CIMac DEAE			CIMac r-Protein G
CIMac COOH			CIMac HDZ-Affinity
CIMac SO3			
CIMac EDA-AEX | Activated			

CIMac Column Design

Attribute	
Housing Material	Precision-engineered stainless steel
Connector	10 – 32 UNF coned port, 1/16" OD connection; standard, straightforward connection to any HPLC
Flow Design	Symmetrical, operation in both directions possible, axial flow
Operation	With HPLC | FPLC systems

CIMac Columns Technical Specifications

CIMac Analytical IEX Columns

Attribute	AAV E/F	pDNA	Adeno	QA
Chemistry	Quaternary amine, strong AEX	Weak AEX	Strong AEX	Quaternary amine, strong AEX
Application | Feature	Separation of empty viral capsids, aggregated and damaged particles; all serotypes	Separation of pDNA isoforms	Monitoring and quantitation of any type of Adenovirus	High capacity for virus particles, IgM exosomes; efficient removal of endotoxin and DNA
Monolith Dimensions	5.2 ID × 4.95 L mm; 0.1 mL volume	5.2 ID × 15 L mm; 0.3 mL volume	5.2 ID × 4.95 L mm; 0.1 mL volume	5.2 ID × 4.95 L mm; 0.1 mL volume
Channel Width	1.3 µm	1.4 µm	2 µm	1.3 µm
Operating Flow Rates	2 - 30 CV/min (0.2 -3 mL/min)	0.67–10 CV/min (0.2 -3 mL/min)	2–30 CV/min (0.2–3 mL/min)	2–30 CV/min (0.2–3 mL/min)
Max. Pressure	15 mPA, 150 bar, 2,175 psi	10 mPA, 100 bar, 1,450 psi	15 mPA, 150 bar, 2,175 psi	15 mPA, 150 bar, 2,175 psi
Operating Temperature	4–40°C	4–40°C	4–40°C	4–40°C
Chemical Stability	All commonly used aqueous buffers; 1 M NaOH, 0.1 M HCl, 8 M urea, 6 M guanidine hydrochloride, and 20% ethanol solution. Avoid oxidizing agents. Avoid prolonged use of concentrated acids (more than 0.5 M), such as hydrochloric, sulphuric, or acetic acid.	All commonly used aqueous buffers; 1 M NaOH, 0.1 M HCl, 8 M urea, 6 M guanidine hydrochloride, and 20% ethanol solution. Avoid oxidizing agents. Avoid prolonged use of concentrated acids (over 0.5 M), such as hydrochloric, sulphuric, or acetic acids.	All commonly used aqueous buffers; 1 M NaOH, 0.1 M HCl, 8 M urea, 6 M guanidine hydrochloride, and 20% ethanol solution. Avoid oxidizing agents. Avoid prolonged use of concentrated acids (more than 0.5 M), such as hydrochloric, sulphuric, or acetic acid.	All commonly used aqueous buffers; 1 M NaOH, 0.1 M HCl, 8 M urea, 6 M guanidine hydrochloride, and 20% ethanol solution. Avoid oxidizing agents. Avoid prolonged use of concentrated acids (more than 0.5 M), such as hydrochloric, sulphuric, or acetic acid.
Recommended pH	Working range: 2–13; CIP: 1–14	Working range: 3–9; CIP: 1–14	Working range: 2–13; CIP: 1–14	Working range: 2–13; CIP: 1–14
Storage Conditions	20% EtOH	20% EtOH	20% EtOH	20% EtOH
Shelf Life	5 years	5 years	5 years	5 years

CIMac Analytical HIC Columns

Attribute	OH	C4 HLD
Chemistry	Hydroxy, neutral ligand	Butyl, high ligand density
Application | Feature	Retains very large solutes in the presence of precipitating salts or PEG and elutes them with high resolution in order of increasing size	Highly effective for removing proteins from nucleic acids
Monolith Dimensions	5.2 ID × 4.95 L mm; 0.1 mL volume	5.2 ID × 4.95 L mm; 0.1 mL volume
Channel Width	1.3 or 2 µm	2 µm
Operating Flow Rates	2–30 CV/min (0.2–3 mL/min)	2–30 CV/min (0.2–3 mL/min)
Max. Pressure	15 mPA, 150 bar, 2,175 psi	15 mPA, 150 bar, 2,175 psi
Operating Temperature	4–40°C	4–40°C
Chemical Stability	All commonly used aqueous buffers, 1 M NaOH, 0.1 M HCl, 8 M urea, 6 M guanidine hydrochloride and 20% ethanolsolution. Avoid oxidising agents. Avoid prolonged exposure to concentrated acids (over 0.5 M) such as hydrochloric, sulphuric or acetic acids	All commonly used aqueous buffers, such as 1 M NaOH, 0.1 M HCl, 3 M ammonium sulphate, 8 M urea, and 6 M guanidine hydrochloride. Avoid oxidizing agents and organic solvents, such as methanol, ethanol, acetonitrile, and 2-propanol. Avoid prolonged use of concentrated acids (more than 0.5 M), such as hydrochloric, sulphuric, or acetic acid.
Recommended pH	Working range: 3–13; CIP: 1–14	Working range: 3–13; CIP: 1–14
Storage Conditions	20% EtOH	20% EtOH
Shelf Life	5 years	5 years

DEAE	COOH	SO3	EDA-AEX/Activated
Diethylamino, weak AEX	Carboxylate, weak CEX	Sulfonyl, strong CEX	Ethylenediamine, weak AEX
High capacity for pDNA	High capacity for virus and VLP particles		Contains free 1° amines (unlike DEAE or QA); high capacity for pDNA
5.2 ID × 4.95 L mm; 0.1 mL volume	5.2 ID × 4.95 L mm; 0.1 mL volume	5.2 ID × 4.95 L mm; 0.1 mL volume	5.2 ID × 4.95 L mm; 0.1 mL volume
1.3 µm	1.3 µm	1.3 µm	1.3 µm
2 – 30 CV/min (0.2 – 3 mL/min)	2 – 30 CV/min (0.2 – 3 mL/min)	2 – 30 CV/min (0.2 – 3 mL/min)	2 – 30 CV/min (0.2 – 3 mL/min)
15 mPA, 150 bar, 2,175 psi	15 mPA, 150 bar, 2,175 psi	15 mPA, 150 bar, 2,175 psi	15 mPA, 150 bar, 2,175 psi
4 – 40°C	4 – 40°C	4 – 40°C	4 – 40°C
All commonly used aqueous buffers; 1 M NaOH, 0.1 M HCl, 8 M urea, 6 M guanidine hydrochloride, and 20% ethanol solution. Avoid oxidizing agents. Avoid prolonged use of concentrated acids (more than 0.5 M), such as hydrochloric, sulphuric, or acetic acid.	All commonly used aqueous buffers; 1 M NaOH, 0.1 M HCl, 8 M urea, 6 M guanidine hydrochloride, and 20% ethanol solution. Avoid oxidizing agents. Avoid prolonged use of concentrated acids (more than 0.5 M), such as as hydrochloric, sulphuric, or acetic acid.	All commonly used aqueous buffers; 1 M NaOH, 0.1 M HCl, 8 M urea, 6 M guanidine hydrochloride, and 20% ethanol solution. Avoid oxidizing agents. Avoid prolonged use of concentrated acids (more than 0.5 M), such as hydrochloric, sulphuric, or acetic acid.	All commonly used aqueous buffers; 1 M NaOH, 0.1 M HCl, 8 M urea, 6 M guanidine hydrochloride, and 20% ethanol solution. Avoid oxidizing agents. Avoid prolonged use of concentrated acids (more than 0.5 M), such as hydrochloric, sulphuric, or acetic acid.
Working range: 2 – 10; CIP: 1 – 14	Working range: 5 – 12; CIP: 1 – 14	Working range: 2 – 13; CIP: 1 – 14	Working range: 2 – 10; CIP: 1 – 14
20% EtOH	20% EtOH	20% EtOH	20% EtOH
5 years	5 years	5 years	5 years

C4 A
Butyl, low ligand density
Weakly hydrophobic surface for HIC of proteins
5.2 ID × 4.95 L mm; 0.1 mL volume
1.3 µm
2 – 30 CV/min (0.2 – 3 mL/min)
15 mPA, 150 bar, 2,175 psi
4 – 40°C
All commonly used aqueous buffers; 1 M NaOH, 0.1 M HCl, 8 M urea, 6 M guanidine hydrochloride, and 20% ethanol solution. Avoid oxidizing agents. Avoid prolonged use of concentrated acids (more than 0.5 M), such as hydrochloric, sulphuric, or acetic acid.
Working range: 3 – 13; CIP: 1 – 14
10 mM NaOH
5 years

CIMac Analytical Mixed-Mode Columns

Attribute	H-Bond ADC	PrimaS
Chemistry	Multimodal hydrogen donor-acceptor	AEX-hydrogen bonding
Application | Feature	Size-based separation of product and contaminants at acidic pH	Purification of ssRNA at RT
Monolith Dimensions	5.2 ID × 4.95 L mm; 0.1 mL volume	5.2 ID × 4.95 L mm; 0.1 mL volume
Channel Width	2 µm	2 µm
Operating Flow Rates	2 – 30 CV/min (0.2 -3 mL/min)	2 – 30 CV/min (0.2 -3 mL/min)
Max. Pressure	15 mPA, 150 bar, 2,175 psi	15 mPA, 150 bar, 2,175 psi
Operating Temperature	4 – 40°C	4 – 40°C
Chemical Stability	All commonly used aqueous buffers; 1 M NaOH, 0.1 M HCl, 8 M urea, 6 M guanidine hydrochloride, and 20% ethanol solution. Avoid oxidizing agents. Avoid prolonged use of concentrated acids (more than 0.5 M), such as hydrochloric, sulphuric, or acetic acid.	All commonly used aqueous buffers; 0.1 M HCl, 500 mM acetic acid, 500 mM phosphoric acid, 2% benzyl alcohol, 0.1 M NaOH (tested up to 120 min), and 20% ethanol solution. Avoid oxidizing agents. Avoid prolonged use of concentrated acids (more than 0.5 M), such as hydrochloric or sulphuric acid. Avoid > 0.1 M NaOH solution.
Recommended pH	Working range: 2 – 10; CIP: 1 – 14	Working range: 2 – 11; CIP: 1 – 13
Storage Conditions	20% EtOH	20% EtOH
Shelf Life	5 years	1 year

CIMac Analytical Affinity Columns

Attribute	Oligo-dT18	r-Protein A	r-Protein L
Chemistry	deoxythymine 18-mer with 6 or 12C linker	r-Protein A from E. coli	r-Protein L from E. coli
Application | feature	Hybridization affinity for polyA of mRNA	Qualitative and quantitative analysis of IgG	Affinity for kappa light chain, scFv, Fab and F(ab)'2
Monolith dimensions	5.2 ID × 4.95 L mm; 0.1 mL volume	5.2 ID × 4.95 L mm; 0.1 mL volume	5.2 ID × 4.95 L mm; 0.1 mL volume
Channel width	2 µm	2 µm	1.3 µm
Operating flow rates	2 – 30 CV/min (0.2 – 3 mL/min)	2 – 30 CV/min (0.2 – 3 mL/min)	2 – 30 CV/min (0.2 – 3 mL/min)
Max. pressure	15 mPA, 150 bar, 2,175 psi	15 mPA, 150 bar, 2,175 psi	15 mPA, 150 bar, 2,175 psi
Operating temperature	4 – 30 °C	4 – 40°C	4 – 40°C
Chemical stability	Fuctionality retained after exposure to 0.1 M NaOH for a few hours.	All commonly used aqueous buffers; 8 M urea, 6 M guanidine hydrochloride, and 20% ethanol solution.	All commonly used aqueous buffers; 8 M urea, 6 M guanidine hydrochloride, and 20% ethanol solution.
Recommended pH	Linkage stability pH 2 - 13. Ligand stability not tested.	working range: 2 – 11; CIP: 2 – 13	working range: 2 – 10; CIP: 2 – 12.5
Storage conditions	20% EtOH	20% EtOH in 20 mM TRIS pH 7.4	20% EtOH in 20 mM TRIS pH 7.4
Shelf life	1 year	2 years	2 years

r-Protein G	HDZ	IDA
r-Protein G from E. coli	Activated: hydrazide	iminodiacetic acid; metal chelate affinity
Binds Fc portion of IgG, not light chain. Binds IgG3.	Site-directed immobilization of Abs and other glycoproteins	His-tagged proteins; available metal-free (standard) or preloaded (custom)
5.2 ID × 4.95 L mm; 0.1 mL volume	5.2 ID × 4.95 L mm; 0.1 mL volume	5.2 ID × 4.95 L mm; 0.1 mL volume
1.3 µm	1.3 µm	1.3 µm
2 – 30 CV/min (0.2 – 3 mL/min)	2 – 30 CV/min (0.2 – 3 mL/min)	2 – 30 CV/min (0.2 – 3 mL/min)
15 mPA, 150 bar, 2,175 psi	15 mPA, 150 bar, 2,175 psi	15 mPA, 150 bar, 2,175 psi
4 – 40°C	8 – 35°C	4 – 40°C
All commonly used aqueous buffers; 8 M urea, 6 M guanidine hydrochloride, and 20% ethanol solution.	N/A	All commonly used aqueous buffers, 1 M NaOH, 0.1 M HCl, 8 M urea, 6 M guanidine hydrochloride, and 20% ethanol solution. Avoid using reducing agents, such as DTT. Avoid prolonged use of concentrated acids (more than 0.5 M), such as hydrochloric, sulphuric, or acetic acid.
working range: 2 – 11; CIP: 2 – 13	working range: 4 – 10	working range: 3 – 13; CIP: 1 – 14
20% EtOH in 20 mM TRIS pH 7.4	20% EtOH at 2 – 8°C	20% EtOH
2 years	6 months	5 years

Ordering Information

CIMac Columns

Item	Order Number
CIMac r-Protein A 0.1 mL Analytical Column (Recombiant Protein A) (2 µm channels)	110.1004-2
CIMac QA 0.1 mL Analytical Column (Quaternary Amine) (1.3 µm channels)	110.5113-1.3
CIMac QA 0.1 mL Analytical Column (Quaternary Amine) (6 µm channels)	110.5113-6
CIMac DEAE 0.1 mL Analytical Column (Diethylamino) (1.3 µm channels)	110.5114-1.3
CIMac EDA 0.1 mL Analytical Column (Ethylene Diamino) (1.3 µm channels)	110.5116-1.3
CIMac EDA 0.1 mL Analytical Column (Ethylene Diamino) (2 µm channels)	110.5116-2
CIMac SO3 0.1 mL Analytical Column (Sulfonyl) (1.3 µm channels)	110.6157-1.3
CIMac Adeno 0.1 mL Analytical Column (2 µm channels)	110.8502-2
CIMac AAV 0.1 Empty | Full 0.1 mL Analytical Column (1.3 µm channels)	110.8503-1.3
CIMac Pack of 3 (Chemistry of choice)	146.0001
CIMac pDNA 0.3 mL Analytical Column (1.4 µm channels)	150.8501-1.4
CIMac Oligo dT18 0.1 mL Analytical Column (C6 Linker) (2 µm channels)	110.1218-2
CIMac Oligo dT18 0.1 mL Analytical Column (C12 Linker) (2 µm channels)	110.1219-2
CIMac OH 0.1 mL Analytical Column (Hydroxyl) (1.3 µm channels)	110.8140-1.3

Related Products

Item	Description	Order Number
PATfix® model HPG	PATfix® analytical HPLC system HPG	PAT0022
PATfix® model LPG	PATfix® analytical HPLC system LHPG	PAT0021
PATfix® pDNA Platform	PATfix® analytical at-line HPLC system for pDNA process development and production	PAT0029

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For more information about Biomolecule Analysis Tools, visit
www.sartorius.com/en/products/process-analytical-technology/analytical-chromatography

For more information about At-line HPLC and CIMac™ Analytical Columns, visit
www.sartorius.com/en/products/process-analytical-technology/analytical-chromatography#id-742556

Status: 07 | 22 | 2021