



The Contichrom[®] HPLC System

A Preparative Twin-Column Purification System
for Batch and Countercurrent Processes

The Contichrom HPLC Platform



The **Contichrom HPLC** is a preparative chromatography system. Supported by its operating software ChromIQ, it offers single-column batch, integrated two-column batch, and unique continuous process capabilities such as MCSGP and N-Rich.

Advantage of Twin Columns

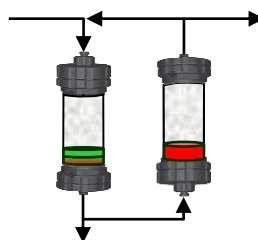
The most efficient processes for any purification challenge

The **Contichrom HPLC** twin column purification system is a powerful tool for the preparative purification of Biologics, synthetic peptides, oligonucleotides and small molecules operating with standard organic solvents and aqueous buffers.

- ❑ The **Contichrom HPLC** allows to address the most difficult separation challenges by combining the resolution of HPLC with small particle resins and the enhancing power of countercurrent processes.
- ❑ Countercurrent loading and elution allow faster processing, better capacity utilization and higher resolution than batch processes.

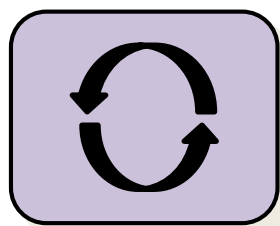


Batch mode

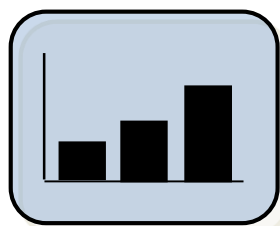


Countercurrent mode

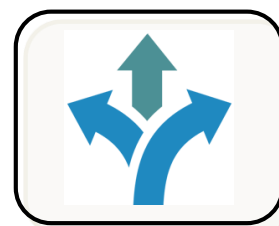
The unique twin column operational design and software offer several process choices for addressing difficult separation and purification challenges, including batch, integrated batch and continuous countercurrent processes.



Run batch and continuous processes with ChromIQ automation software providing automated process optimization and control.

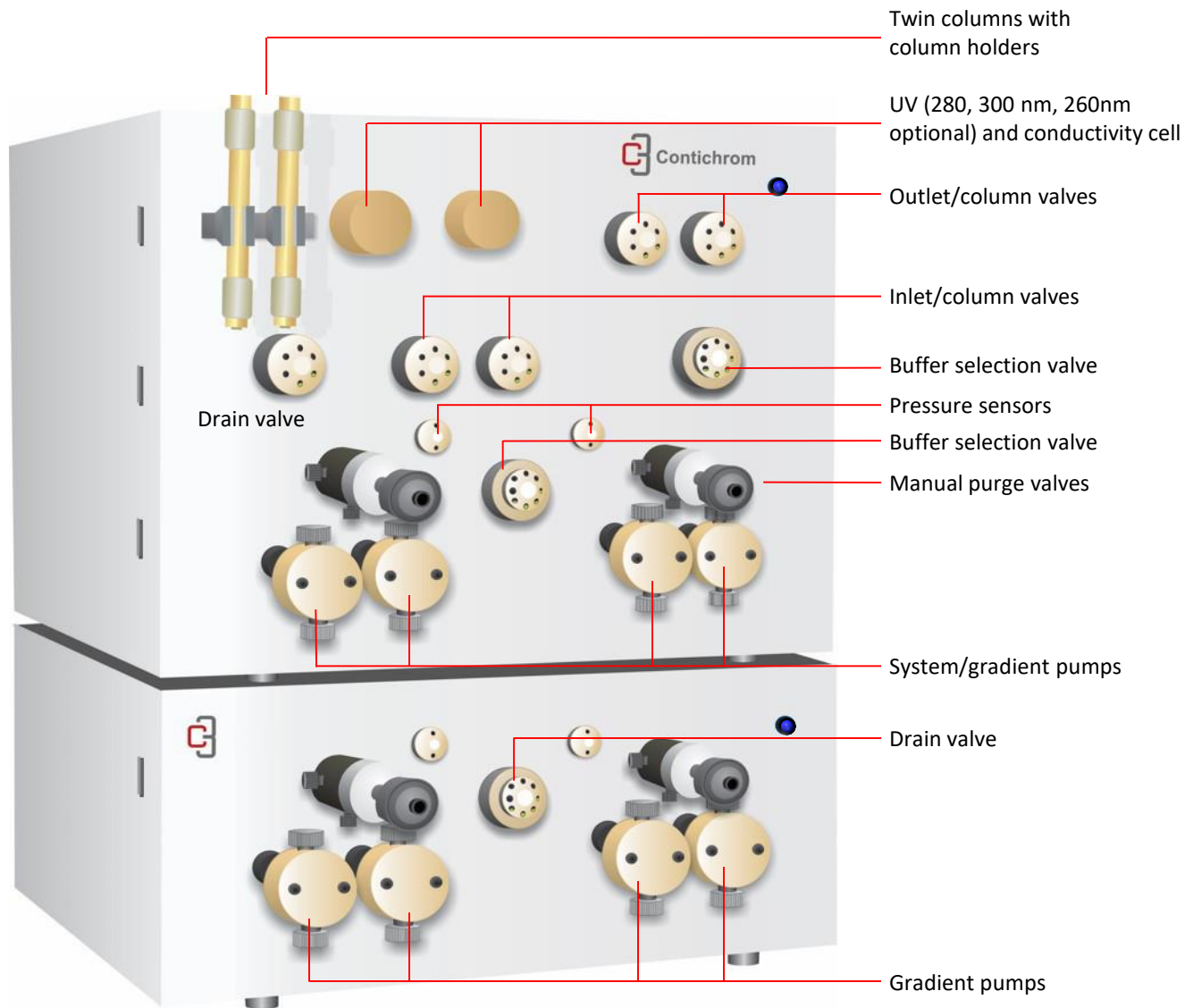


Get up to 80% more yield than batch with the same target purity and much greater throughput. Isolate efficiently minor components of a complex mixture.



Choose the best process for your separation challenge and get analytical resolution at preparative scale.

Powerful Functionalities



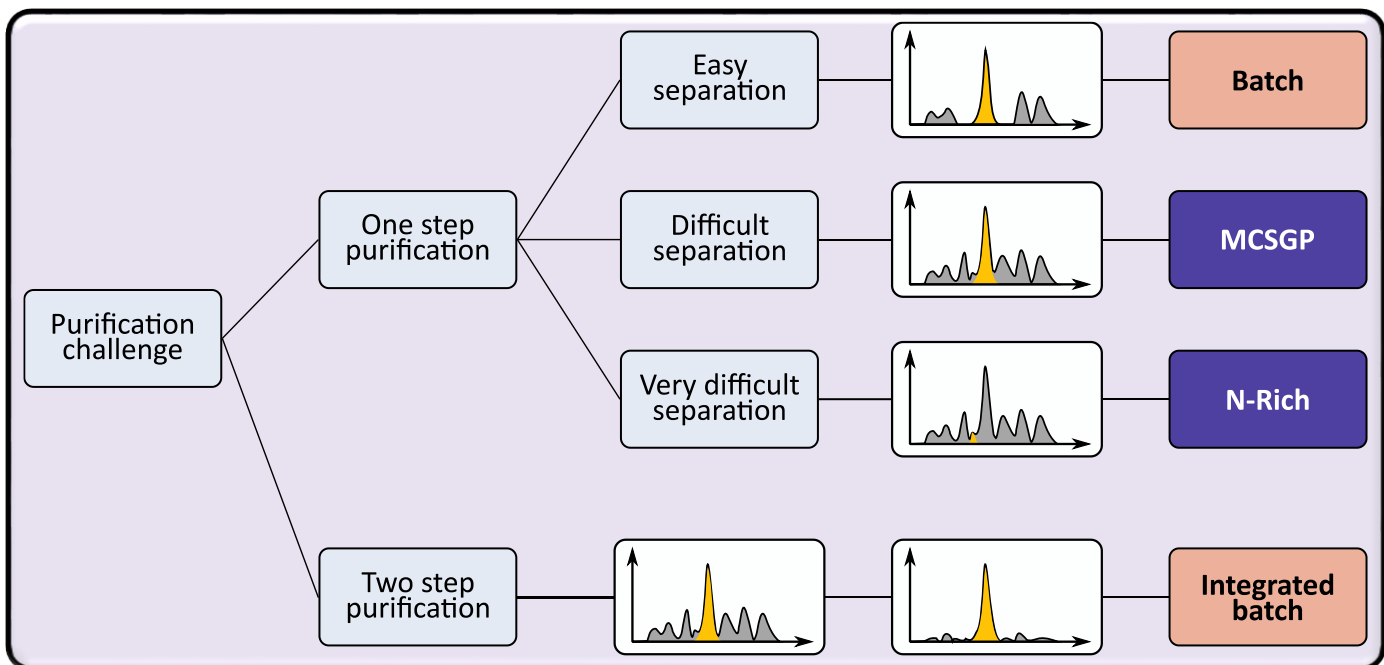
- compact benchtop design
- large buffer tray
- clear easy-to-access interface
- high visibility tubing inlets and outlets
- flexible tubing connections
- high performance pumps (36 or 100 mL/min)
- easy-mount clip-in column supports
- 2 integrated long life LED UV detectors each at 280 nm and 300 nm; 260 nm optional
- optional: additional external variable wavelength detectors (190-500 nm or 190-700 nm)
- easy plug-in installation
- pH detector
- 2 conductivity flow cells
- laptop and desktop computer options

Flexible Process Capabilities

The **Contichrom HPLC** has batch process capabilities like any preparative chromatography system. In addition, it has enhanced process capabilities for integrated batch, where two batch steps can be executed consecutively with an in-line dilution in between.

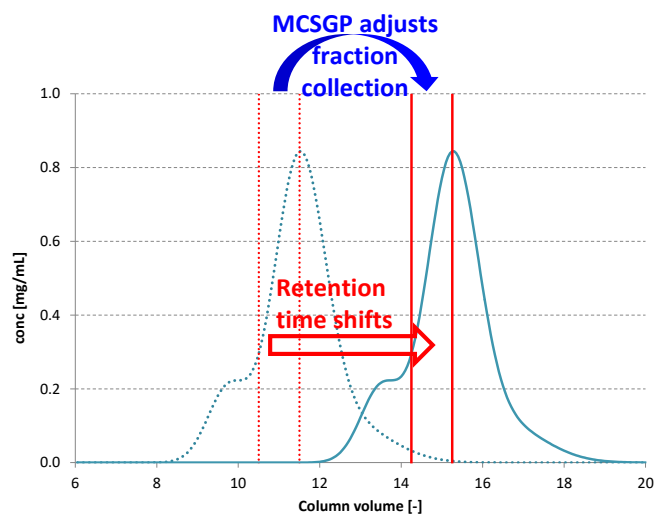
The **Contichrom HPLC** systems also offer continuous operating modes using twin column configurations:

- **MCSGP**: a powerful polishing process that increases yield while maintaining target purity by recycling impure product fractions.
- **N-Rich**: a process to enrich and isolate minor compounds from complex mixtures. N-Rich is an ideal tool for the fast isolation of low concentrated product-related impurities, for example for pre-clinical testing.



MControl: Dynamic process control for MCSGP

The outcome of chromatographic runs can be influenced by various parameters such as temperature, buffer quality, conductivity, pH and quality of the stationary phase (bed height, resin aging, packing variation) leading to variability. To counteract such effects, we have developed a control algorithm allowing to keep the MCSGP runs always at an optimum by compensating for variations. The resulting MCSGP process is very robust and will run at an optimum without sacrificing productivity.



Applications



Purification of Omega-3-Fatty Acids

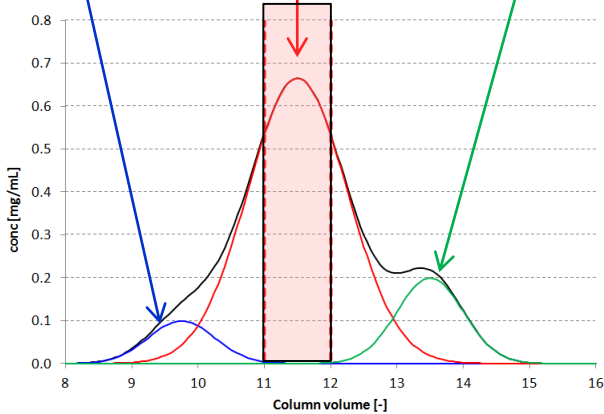
Project goal: Obtain the maximum yield of the ethyl ester of the ω -3-fatty acid of eicosapentaenoic acid with at least 97% purity from crude fish oil.

Batch chromatography: high purity **or** high yield

Weakly adsorbing impurities mixed with product

Collected product

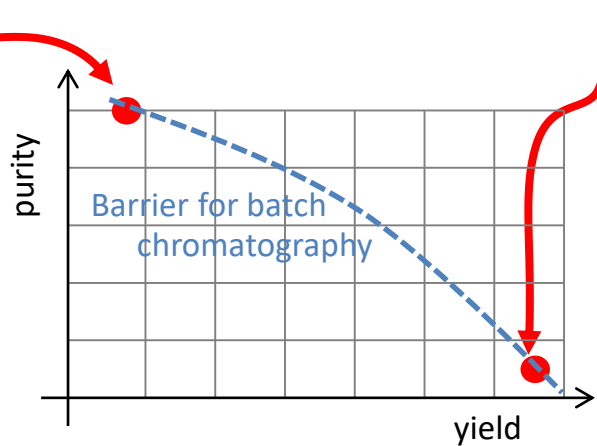
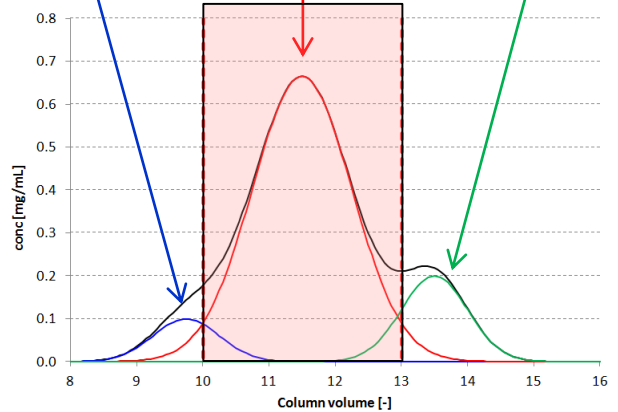
Strongly adsorbing impurities mixed with product



Weakly adsorbing impurities mixed with product

Collected product

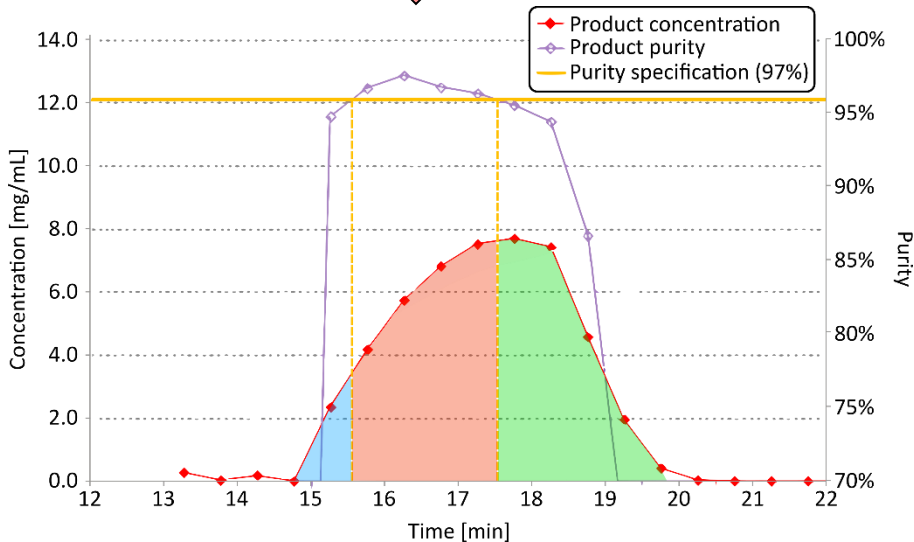
Strongly adsorbing impurities mixed with product



Applications

MCSGP: high purity **and** high yield

by automatic recycling of impure product-containing side fractions



While batch chromatography could only access the red area while meeting purity specifications, MCSGP makes the green and blue areas accessible by recycling the product containing fractions.

Project outcome: The MCSGP process could realize a decrease in resin and solvent costs by 80% compared to batch chromatography.

A conceptual study for a 100 ton/year production with a renowned engineering company has been completed.

SMB versus MCSGP

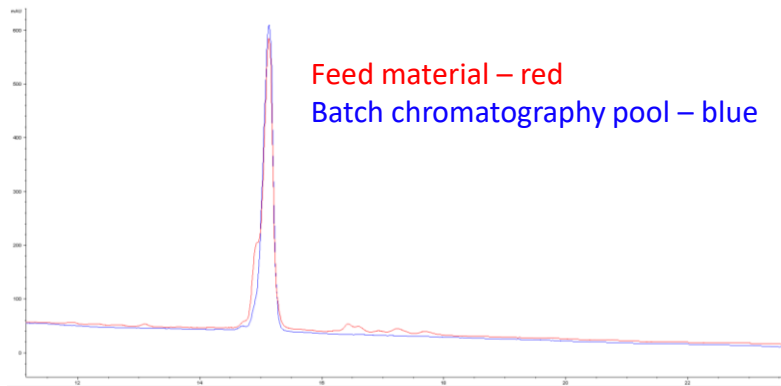
In the presented example, compared to simulated moving bed (SMB) processes, MCSGP achieves

- a fourfold higher productivity
- lower production costs
- Gets product of comparable quality from lower feed quality
- Does not dilute the isolated product
- Has significantly lower equipment complexity and CAPEX.

	MCSGP	Batch	Improvement by MCSGP
Purity [%]	>97%	>97%	
Yield [%]	90%	36%	+ 250%
Productivity (Throughput) [(g product)/(L resin)/(h operation time)]	65	11	+ 590%
Solvent Consumption [L solvent/g product]	0.8	3.2	- 75%

Applications

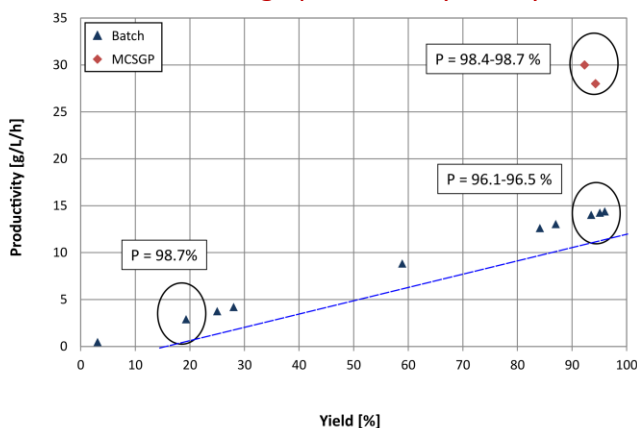
Purification of Synthetic Peptides



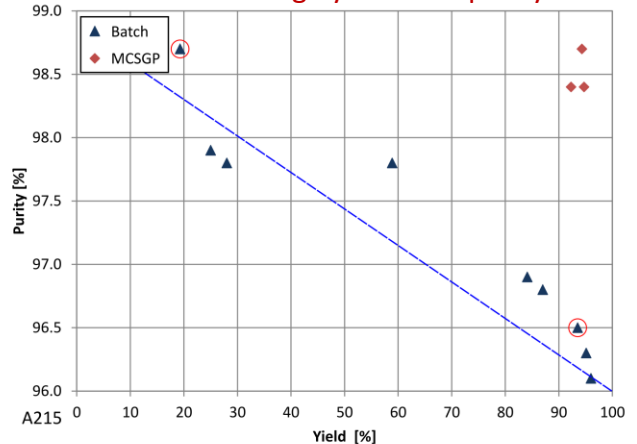
Project goal: Improve the purification of a 30 amino acid long peptide; feed purity ca. 60%.
Reference batch: 96.4% purity, 94% yield, 14 g/L/h productivity. See above.
Goal purity: 99%.

Project outcome: Batch yield of 19% at target purity (99%).
MCSGP achieved a yield of 93% at the target purity of 99%.
Overall, MCSGP achieves better yield, purity, and productivity than the optimized batch process with up to 70% lower solvent consumption than batch chromatography.

MCSGP: high productivity AND yield



MCSGP: high yield AND purity

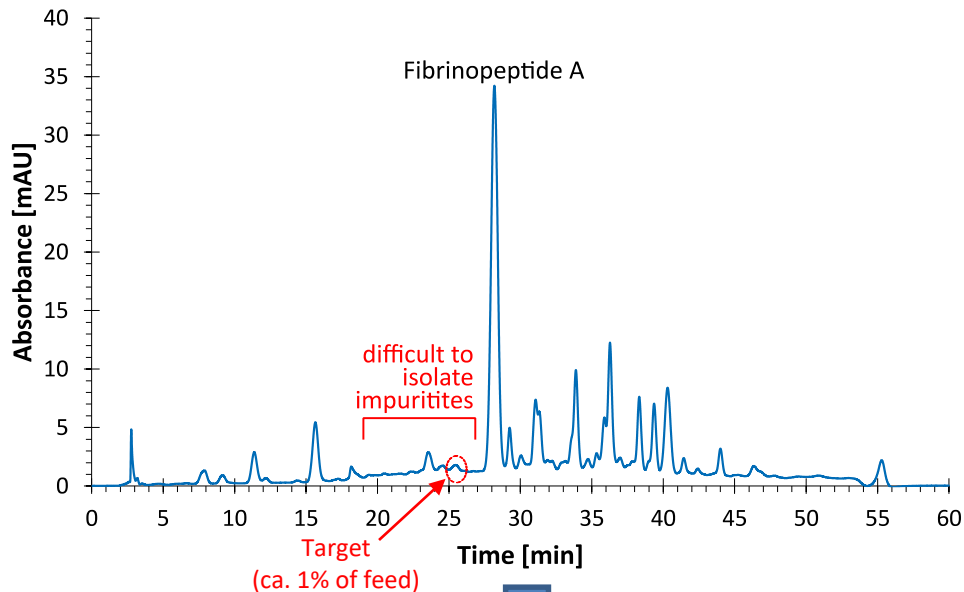


**With MCSGP, longer peptides can be obtained with reasonable yields at high purity.
MCSGP allows to expand the boundaries of peptide manufacturing.**

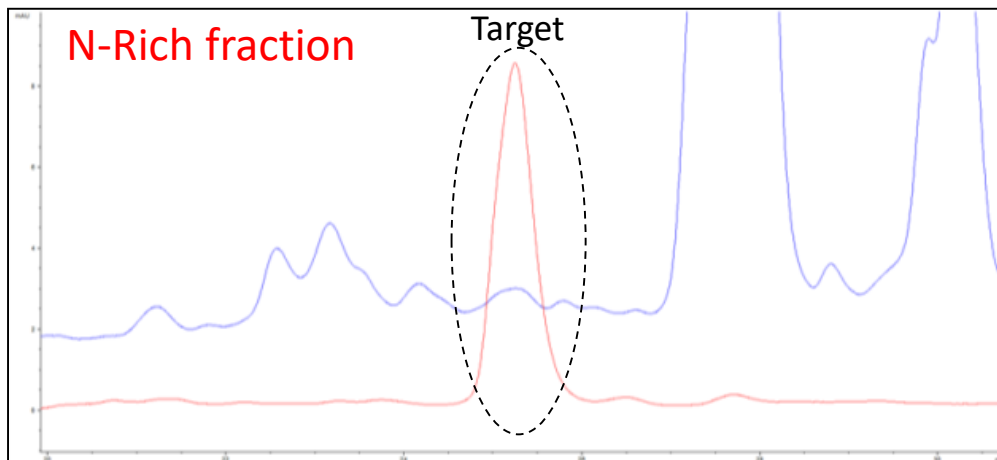
Reference: T. Müller-Späh¹, G. Ströhlein¹, O. Lyngberg², D. Maclean³, *Chim. Oggi* **2013**, *31*, 56–60.
¹ChromaCon AG; ²Bristol-Myers Squibb; ³KAI Pharmaceuticals.

Selective Impurity Amplification

Selectively amplifying and isolating an impurity with N-Rich



N-Rich isolation



Applications

- Isolation of product-related impurities for development, stability and formulation studies, preparation of analytical standards
- Mining of proteomes and metabolomes
- Discovery of biomarkers
- Isolation of active compounds from natural extracts

Process Economics

Batch and integrated batch chromatography

The Contichrom equipment contains all hard- and software tools to run normal batch processes such as capture and polishing steps with isocratic, step and gradient elution. The batch software wizard facilitates process design significantly. Due to the twin-column setup you can run two process steps consecutively in an integrated way, even with an in-line dilution between the first and second column steps, allowing to purify quickly compounds in a two-step purification protocol.

MCSGP

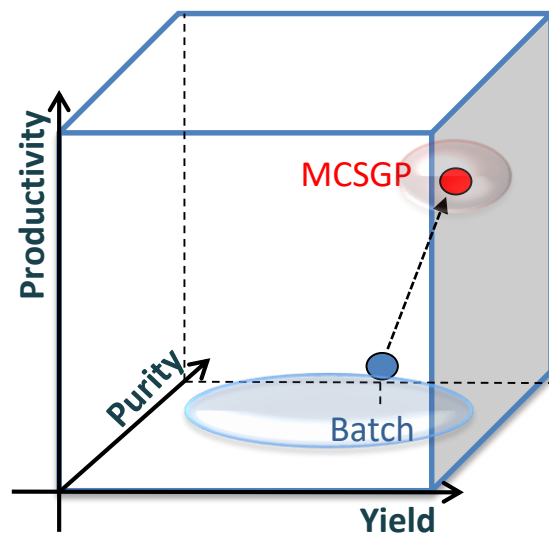
ENABLES

Isolation of pure components from complex mixtures; with MControl allowing to operate the process robustly at an optimum.

50-90% more yield and higher purity;
up to 10x faster processing than batch.

SAVES

Up to 30% CAPEX, 50% OPEX, 70% buffer consumption.



N-Rich

ENABLES

N-Rich enables the enrichment of a minor compound while simultaneously depleting the large excess of interfering compounds. It is particularly useful for isolation of product-related impurities. It is also useful for proteomics, metabolomics.

SAVES

Tedious repetitive analytical separations to isolate the compound of interest.

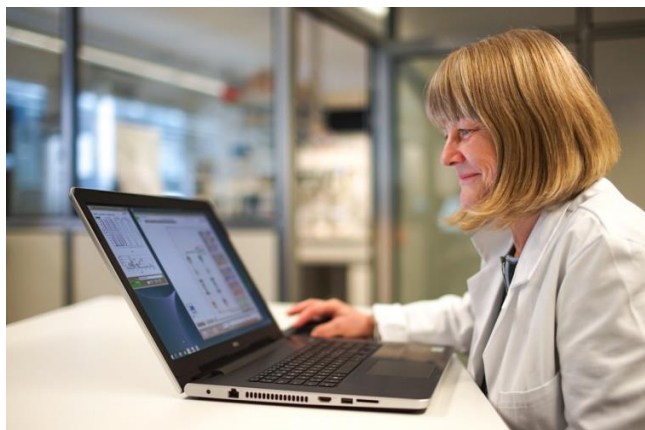
With batch processes, up to several hundred analytical injections are needed to isolate sufficient amounts for further characterizations. With N-Rich, this can be achieved overnight.

ChromIQ Software

The ChromIQ operating software controls the **Contichrom HPLC** system. It supports batch and continuous processes and tools for separation and purification with an intuitive, user-friendly interface.

ChromIQ has easy step-by-step wizards to help you design batch chromatography runs and to convert them to the more efficient Contichrom processes. ChromIQ also includes the AutomAb toolbox for optimization of the CaptureSMB process.

ChromIQ includes a number of features that are particularly helpful for continuous processes such as a buffer tank management system and cycle overlay display options.



- ✓ Drag-and-drop method creation
- ✓ Wizards for convenient method creation
- ✓ Interactive process picture
- ✓ Single-click evaluation
- ✓ Easy data export (xlsx, csv, jpg)
- ✓ Pre-defined user groups with individual rights management
- ✓ Password protected user accounts
- ✓ Logging with time stamp and user name
- ✓ Electronic signature with checksum of log and measurement files

Wizards for the design of batch, integrated batch, MCSGP (shown below), and N-Rich processes are part of the ChromIQ software. The processes can be designed and run without expert knowledge by simply following a 4 step procedure.

STEP 1:

Load chromatogram of batch run and select product range and recycling fractions by Drag & Drop

STEP 2:

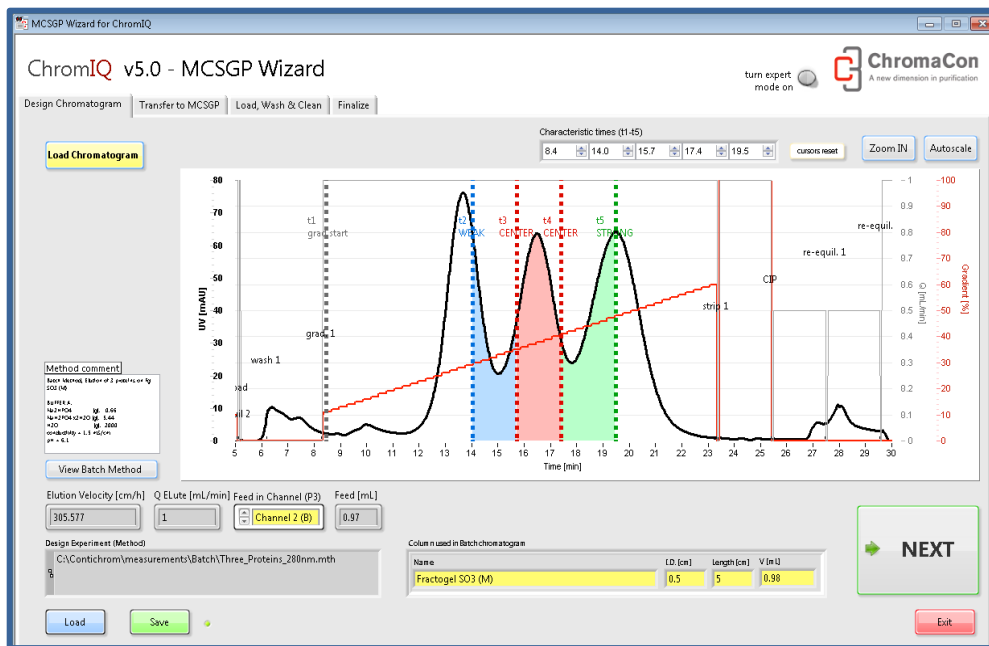
Set column size and feed volume

STEP 3:

Set desired washing and cleaning protocol

STEP 4:

Finalize method: Set number of cycles and fractionation



CUBE System Accessories

Enhancing System Performance and Convenience

Additional accessories include two external multi-wavelength detectors (190-500 nm), a sample loop system for feed loading, an optional external loading valve with sample injection loops of 500 μ L up to 20 mL, a screening valve for column screening addressing up to 6 columns and stable, re-usable transport boxes.



Teledyne-Isco fraction collectors Foxy R-1 and R-2



Valve system with 6 positions for column screening



Injection valve system with injection loops of 500 μ L up to 20 mL allowing to apply different sample volumes



Preparative flow cells in PEEK or Steel



External variable wavelength detector (190-500nm)



External variable multi-wavelength detector (190-700nm)

GMP Scale-Up

Twin-column pilot-process scale

Customized GMP production scale HPLC



LEWA designed, automated and manufactured process scale HPLC

- System designed for cGMP operation and validation
- Audit trail for compliance with CFR 21, part 11 specifications and performer/verifier traceability for cGMP operations and compliance
- FDA approved USP Class VI materials and seals
- Compliance to ASME-BPE
- LEWA hygienic metering pumps are EHEDG certified
- OSHA (Accordance with all OSHA Guidelines)
- ASME Section IX (Welding)
- BPE (Bio Processing Equipment) Welding Specifications

Further information and system quotes can be obtained from <http://www.lewapt.com/>

After Sales Services

Training, Maintenance, and Repair

Having a reliable and cost-effective service network

Purchasing an FPLC System and operating it is only part of a customer's value proposition. After sales support such as Preventive Maintenance (PM) and total life cycle costs are an important consideration in a system's procurement evaluation.

We offer PM, repair and system validation and qualification support including IQ-OQ and a generic PQ testing schemes. We also offer an annual Software PM package.

We perform on-site and off-site training, webinar-based product support and we organize annual workshops on continuous chromatographic purification.



We offer comprehensive and cost-effective Preventive Maintenance and Repair Service packages.



Worldwide Preventive Maintenance and Repair Service packages. On-site and off-site service with fast turnaround times.

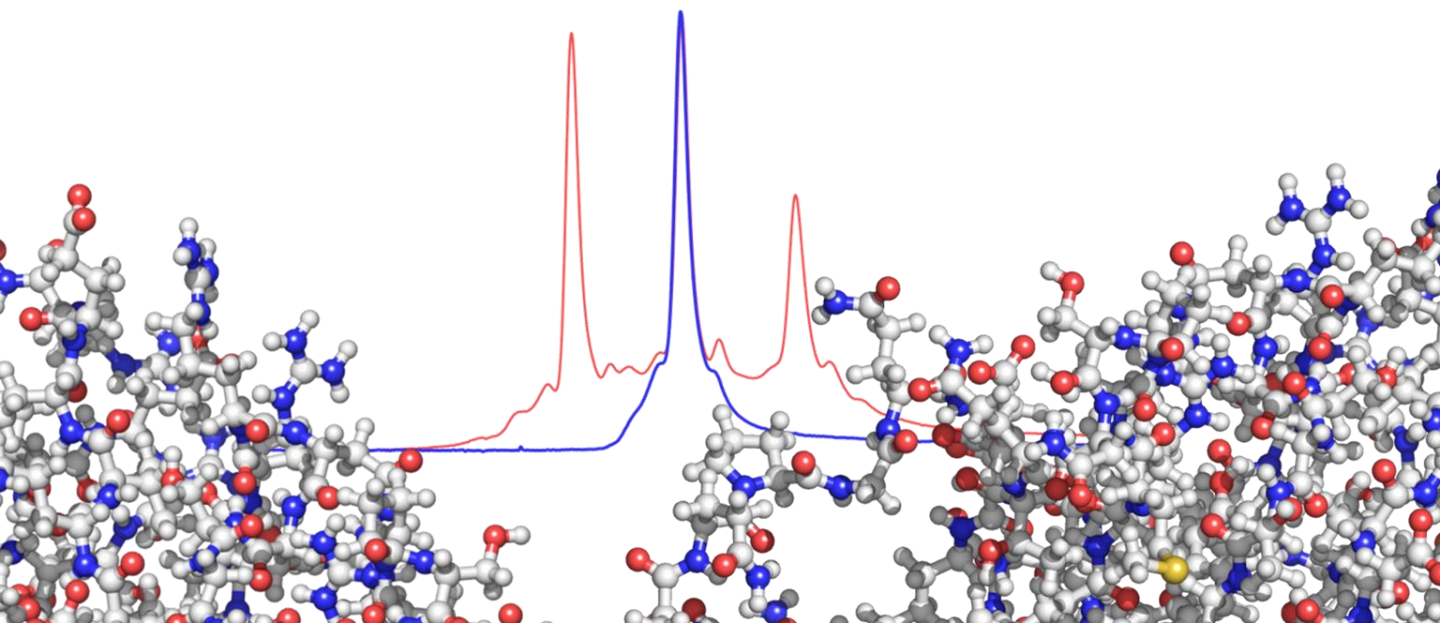
For details please require a quote at your local ChromaCon representative.

Technical Specifications

Process capabilities:	Batch (isocratic, gradient), integrated batch, MCSGP, N-Rich, MControl
Operating software	User-friendly operating software with step-by-step wizards to help you to design batch chromatography runs and to convert them into more efficient Contichrom processes, such as MCSGP and N-Rich. ChromIQ also includes the MControl toolbox for keeping MCSGP at an optimum.
Software compliance	ChromIQ software with essential elements of 21 CFR Part 11 compliance: <ul style="list-style-type: none">• Pre-defined user groups, administrators, R&D and production users• Rights management for individual user groups• User accounts are password protected• Logging with time stamp and user name (non-deletable)• Electronic signature with checksum of log and measurement files
Pressure rating	100 bar (10 MPa)/ 1450 psi
Flow rate range	<ul style="list-style-type: none">• 0.1 – 36 mL/min (Contichrom HPLC 30)• 0.1 – 100 mL/min (Contichrom HPLC 100)
Buffer selection	16 inlets (2 x 8-fold buffer selection valve) 4 outlets
Dynamic mixer volume	<ul style="list-style-type: none">• 1740 µL (Contichrom HPLC 30)• 5.9 mL (Contichrom HPLC 100)
UV, fixed wavelength	2 Long lifetime LED UV detectors, each with 280 & 300 nm recorded simultaneously (260 nm optional). Optional: two external additional variable wavelength 190-500 nm detectors
Conductivity monitoring	2 Conductivity sensors (1-300 mS/cm)
pH monitoring	1-14
Pump type	High precision double-piston-pumps with active seal wash 4 pumps
Valves	4 reliable multi-position valves 2 automated drain valves
Computer hardware	Stand-alone laptop computer (Windows, 64 bit, full HD resolution, 1920 x 1080 or higher) with ChromIQ software
Other	Cold room compatible Large buffer tray Portable & compact Runs resins and membrane stationary phases
Dimensions	Main module: 450 mm x 509 mm x 370 mm Secondary module: 450 mm x 509 mm x 214 mm
Weight	Main module: 30 kg (67lb) Secondary module: 17 kg (38lb)
Materials	<ul style="list-style-type: none">• All biocompatible and compatible with standard HPLC solvents• High pressure side capillaries: PEEK• Low pressure side tubing: PTFE• Fittings: PEEK

The system is delivered ready-to-use with fully mounted tubing and pre-delivery IQ/OQ testing.

Contact



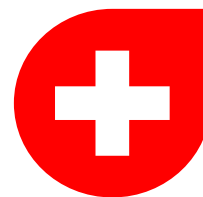
Contact us now to find out how you can solve your separation challenges more easily

Your contact at ChromaCon:

Email: info@chromacon.com

Web: www.chromacon.com

Your local representative:



**SWISS
Design &
Development**

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