LC TRAPPING

A Practical Guide to Techniques and Products

OPTIMIZE TECHNOLOGIES, INC.

optimizetechnologies
INNOVATIVE HPLC, UHPLC & LC/MS PRODUCTS

Optimize Technologies is dedicated to providing the highest quality HPLC, UHPLC and LC/MS products available. We combine innovative design and superior performance to create products that are straightforward, yet elegant, solutions to daily issues in the lab.

We are constantly developing new products and expanding existing offerings. Please contact us if you have a design requirement or need support with your scientific instrumentation. Optimize welcomes the opportunity to provide custom design and engineering solutions.

We promise to provide innovative products that offer unmatched performance, quality and ease of use backed with the most responsive and effective customer service in the industry.

OPTIMIZE SERVICE

At Optimize, we take customer satisfaction seriously. Our products are only as good as the support we provide. Customer service is not just a department, but an integral part of our business. Our sales and quality assurance professionals, technical support specialists, machinists, engineers, chemists, and administrative team are available to provide answers to your questions. Contact us directly or locate an authorized dealer in your area. No matter what, Optimize is always here to back you up.

OUR GUARANTEE

Every component and product is designed to offer optimal performance and meet or exceed original equipment specifications. Every Optimize product carries our full guarantee.

OPTI®

Trapping Systems

GUIDES

PRODUCTS

INTRODUCTION

Sample matrix components such as salts, detergents and contaminants present problems for mass spec analysis. Trapping is a chromatography technique that allows for the concentration or purification of a sample. A trap cartridge is a packed column bed loaded with a material to create desirable conditions for separating the target compound from the rest of the sample matrix. This is accomplished by selecting a packing material that has a strong affinity for the target compound, causing the analyte to be retained in the trap while the rest of the sample matrix flows through, or by selecting a material which has no affinity for the target compound but that binds other unwanted matrix components.

Choosing between traps and guard columns is determined by the application. A guard column is a short, disposable pre-column which removes particulates and contaminants that would otherwise shorten the life of the expensive LC column. A guard column protects the primary column. When selecting a guard column, a bonded phase similar to the primary column should be used.

Trap columns are uni-directional or bi-directional and are used either on-line or off-line for sample pre-concentration and clean-up. Trap column bed materials need not be similar to the primary LC column bed materials and can be selected based on sample clean-up needs. Desirable characteristics of a trap include low back pressure, bi-directional flow, robust bed, ability to regenerate the packed bed and low swept volume.

TRAP COLUMNS VS. GUARD COLUMNS

Optimize Technologies offers several trapping options for LC applications. The Opti-Trap line is suitable for medium pressure applications (1,500 psi), the Opti-Pak line for HPLC applications (6,000 psi) and the EXP Trap line for UHPLC applications (20,000 psi). Each line of traps is offered in a range of bed volumes from 0.12uL to 100uL and can be loaded with column bed materials of the customer's choice. Optimize Technologies also offers the Opti-Lynx line, a quick disconnect system for convenient cartridge replacement. The Opti-Lynx line is rated to 6,000 psi.

This publication is a guide to the Optimize product line as well as a primer for the LC or LC/MS technique of off-line and on-line trapping.

100% of all Optimize EXP products are made in the U.S.A. from raw materials originating in the U.S.A. 98% of all Optimize products are made in the U.S.A. from raw materials originating in the U.S.A.

general trapping guide

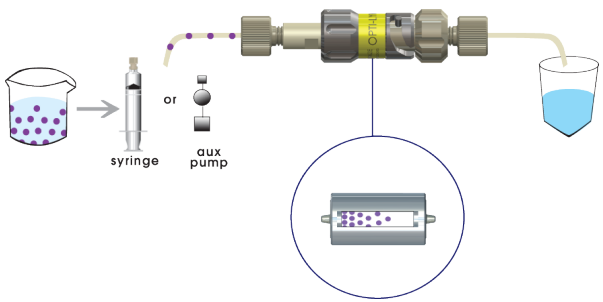
Trapping is a valuable technique for handling a variety of processes such as sample clean-up, purification, pre-concentration, desalting and detergent removal. In order to retain a target compound within a trap cartridge while flushing the sample matrix and any unwanted contaminants to waste, a packed bed with an affinity for the target compound is used. Alternatively, a packed bed with no affinity for the target compound may be used in order to keep the desired analyte unretained while having the undesired contaminant bound to the stationary phase.

In cases where samples are undesirably dilute, it is possible to increase the concentration of the target analyte in a sample either off-line or on-line. Using a trap cartridge allows the reduction of volume of a sample matrix while concentrating the analyte.

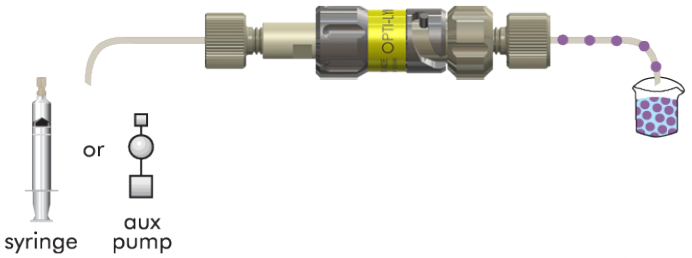
TRAP CARTRIDGES AS SAMPLE PRE-CONCENTRATION

OFF-LINE SAMPLE PRE-CONCENTRATION

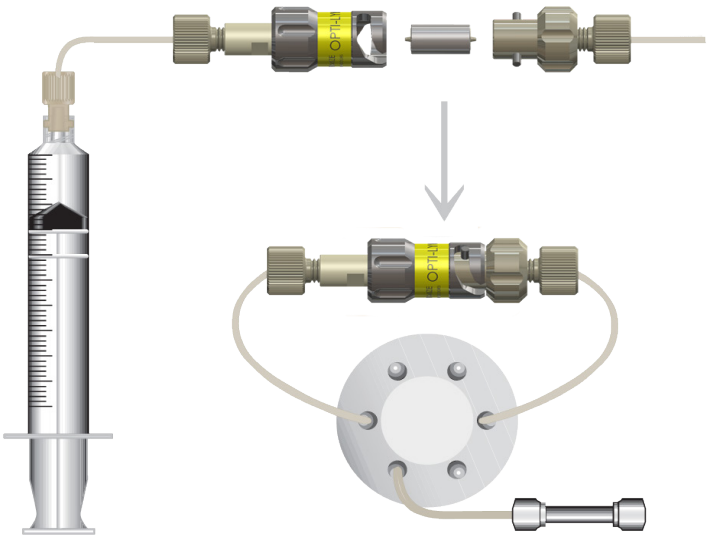
Using a syringe or a small pump along with a trap cartridge that has an affinity for the target analyte, a sample matrix is driven across the trap bed at a flow rate within the recommended range. A slower flow rate is generally considered better.



The sample matrix will be sent to waste while having the target analyte retained within the trap. The target analyte is now able to be eluted in a small volume of stronger solvent.

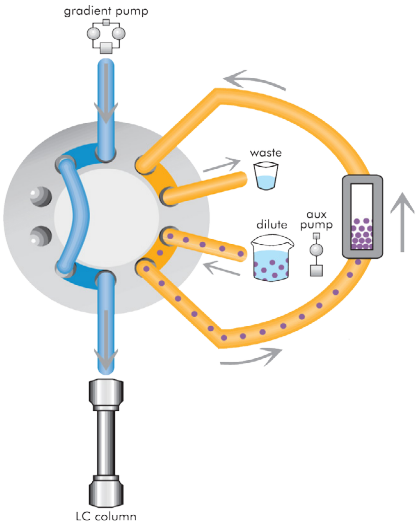


A quick rinse step prior to the elution step would be advantageous if salts were present in the sample matrix. Elution could take place either by manual delivery of solvent or by installing the trap cartridge into a holder in-line upstream from an analytical column or within an injection loop.



ON-LINE SAMPLE PRE-CONCENTRATION

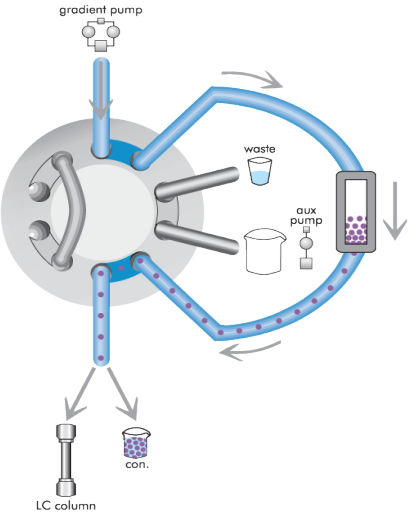
Pre-concentration can be automated by placing a trap cartridge in-line in the loop of an injection or switching valve. This setup allows two different sources to push solvents through the trap depending on the position of the valve.



The sample solution is pushed through the trap bed by an auxiliary pump during the loading phase. After the sample matrix is flushed to waste, it may be beneficial to wash the trap bed with a salt-free solution, ensuring that any buffer salts are rinsed away.

Additional sample may be collected by repeating the sample-loading step with a flushing solvent in order to ensure that any additional sample remaining in the tubing makes it across the packing material during elution.

Using a small volume of suitably strong organic solvent, the concentrated sample can now be eluted.



Eluent can be sent directly to a mass spectrometer or to an analytical column for further separation. If the analyte contains a complex mixture of proteins and peptides, it may be desirable to follow the pre-concentration step with a two-dimensional LC configuration.

DETERGENT REMOVAL

DETERGENT REMOVAL VIA TRAPPING

Detergents may be present as a result of SDS PAGE analysis or as additions in order to help solubilize a sample. Prior to LC or LCMS analysis, these detergents must be removed.

Many detergent removal methods are time-consuming off-line and may result in a significant loss of sample. An on-line trap provides a more convenient and efficient method for detergent removal.

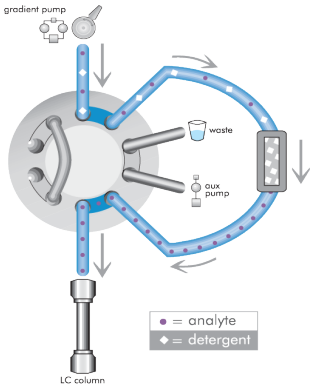
The type of detergent present in a protein sample affects the method of removal. Generally, there are three types of detergents that may be present in a sample: ionic, zwitterionic and non-ionic. Regardless of the method used, the idea is the same: trap the protein, wash detergent to waste and elute the protein or trap the detergent while allowing the protein to pass through.

SDS & IONIC DETERGENT REMOVAL

Ionic detergents such as SDS (sodium dodecyl sulfate) may be removed using a simple ion exchange trap. The packing material used in the trap must have an affinity for the type of charge on the polar head group of the detergent. Anionic detergents require the use of a strong anion exchange (SAX) phase such as a quaternary amine. Alternatively, cationic detergents require use of a strong cation exchange (SCX) phase such as benzenesulfonic acid.

SDS removal is done by use of a polymer-based anion exchanger. Mobile phase with a pH of 4.4 or less is used in order to provide conditions where the trap has a maximum affinity for SDS and minimal affinity for the protein sample. The low pH ensures protonated anionic side chains of a protein, reducing the chance of protein interaction with the packing material. Polymeric supports are a more resilient option at a low pH than silica-based anion exchangers. Selective binding of SDS to the trap should occur as the sample is pumped through the trap.

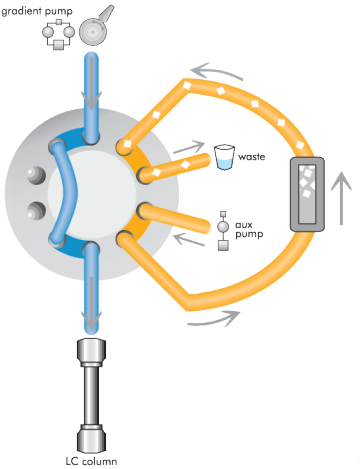
The protein should pass through unretained and may be sent for immediate analysis, or subjected to further on-line purification steps, such as concentration and desalting.



Detergent(SDS) binds to trap while protein/peptide travels to LC column.

This can be accomplished with a mobile phase that has a high concentration of organic eluent and is strongly acidic. A pH below 2 and an organic content above 90% should be sufficient.

The anion exchange trap will have a finite capacity for SDS and must be regenerated before that capacity is exceeded.

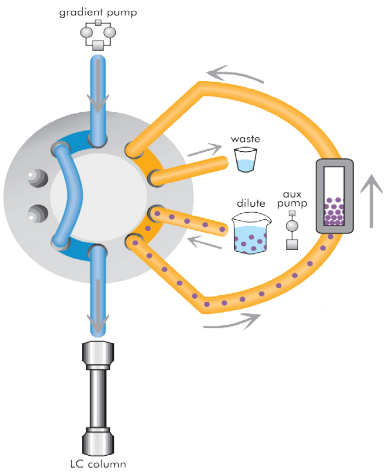


NON-IONIC DETERGENT (NID) REMOVAL

Non-ionic detergents have hydrophobic characteristics and no charge. Therefore, ion-exchange approaches cannot be used. In NID removal, it is best to temporarily adsorb the protein within a trap while detergent is flushed to waste.

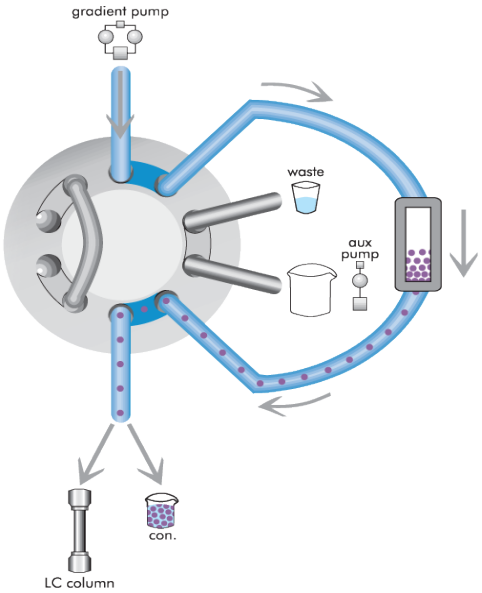
A packed bed with affinity for the target protein and little to no affinity for non-ionic detergents is used for separation. This packed bed may consist of a single phase such as silica or polymeric SCX or even a mixture of phases such as SCX/SAX. The most beneficial chemistry for a particular protein sample may need to be determined empirically.

Generally, a sample is delivered to a trap using a mobile phase with a low percentage of organic modifier. The proteins should bind to the packing material while the NID passes through unretained.



If the isoelectric point (pI) of a protein is at or near the pH of a mobile phase, it may pass through the column unretained. If the pI of a protein is known, pH should be kept below pI for optimal interaction with an SCX trap, and either above or below for a mixed mode SCX/SAX trap. A salt solution of 0.5M concentration can be used to elute the protein after all

of the detergent has passed through the trap. A reverse phase bed can be used to desalt the protein before sending it to an MS. In order to keep the desalting trap out of the flow stream during detergent removal, switching valves are required.



Employing a "normal phase" trap is also a method for getting rid of NID. The protein is loaded in high concentrations of organic solvent (80-95% acetonitrile) onto a highly polar stationary phase. The highly organic matrix is introduced in order to maximize the affinity of the sample for the polar stationary phase, and ensures near-complete binding of the sample and elimination of detergent. A gradient of decreasing organic or increasing salt concentration is then used to elute the protein.

TRAP specifics

SMALL MOLECULE CONCENTRATION & DESALTING TRAP

This trap contains a small pore, large particle, hydrophilic C18 silica (ODS-AQ) reverse-phase packing material and is designed to bind small molecules (0.1-10 kD). This includes many organic molecules such as pharmaceuticals, petrochemicals and natural products. Concentration of samples is possible with maximum efficiency. This trap removes salts (8M) and non-volatile buffers and is used at a pH range of 2-7.5.

QUICK REFERENCE

1. Clean the trap with 5-10 trap volumes of "B solvent" (typically 90/10/0.005-0.1% acetonitrile/H_2O/ion-pairing acid such as *trifluoroacetic acid* or *heptafluorobutyric acid*).
2. Equilibrate the trap with 5-10 trap volumes of "A solvent" (typically 2/98/0.005-0.1% acetonitrile/H_2O/ion-pairing acid such as *trifluoroacetic acid* or *heptafluorobutyric acid*).
3. Add appropriate amount of acetonitrile and ion-pairing acid to sample to equal the composition of "A solvent."
4. Load sample onto trap at a loading rate within the recommended speed of loading for the size of trap in use. Do not overload the trap.
5. Remove salts from trap and flush to waste by washing with approximately 5 trap volumes of "A solvent."
6. Elute small molecules from trap. If performing on-line trapping, actuate the valve to the *INJECT* position and then run an increasing gradient of acetonitrile. For manual trapping, flush the trap with 1-2 trap volumes of 65-90% acetonitrile or "B solvent."
7. For full regeneration, flush the trap with several trap volumes of IPA.

PEPTIDE CONCENTRATION & DESALTING TRAP

Small biological molecules ranging from 0.5-50 kD can be bound and concentrated with a peptide concentration & desalting trap. This is done by using a medium pore, large particle, polymeric reversed-phase packing material with retention similar to a C8 phase. Operating at a pH range of 1-13, this trap removes salts (8M) and non-volatile buffers.

QUICK REFERENCE

1. Clean the trap with 5-10 trap volumes of "B solvent" (typically 90/10/0.005-0.1% acetonitrile/H_2O/ion-pairing acid such as *trifluoroacetic acid* or *heptafluorobutyric acid*).
2. Equilibrate the trap with 5-10 trap volumes of "A solvent" (typically 2/98/0.005-0.1% acetonitrile/H_2O/ion-pairing acid such as *trifluoroacetic acid* or *heptafluorobutyric acid*).
3. Add appropriate amount of acetonitrile and ion-pairing acid to sample to equal the composition of "A solvent."
4. Load sample onto trap at a loading rate within the recommended speed of loading for the size of trap in use. Do not overload the trap.
5. Remove salts from trap and flush to waste by washing with approximately 5 trap volumes of "A solvent."
6. Elute peptides from trap. If performing on-line trapping, actuate the valve to the *INJECT* position and then run an increasing gradient of acetonitrile. For manual trapping, flush the trap with 1-2 trap volumes of 65-90% acetonitrile or "B solvent."
7. For full regeneration, flush the trap with 70:30 formic acid:IPA.

TRAP specifics

PROTEIN CONCENTRATION & DESALTING TRAP

When working with large biological molecules ranging from 5-500 kD, a protein concentration and desalting trap may be used for concentration or removal of salts (8M) and non-volatile buffers. The packed bed consists of a large pore, large particle, polymeric reversed-phase packing material with retention similar to a C4 phase. This functions at a pH range from 1-13.

QUICK REFERENCE

1. Clean the trap with 5-10 trap volumes of "B solvent" (typically 90/10/0.005-0.1% acetonitrile/H_2O/ion-pairing acid such as *trifluoroacetic acid* or *heptafluorobutyric acid*).
2. Equilibrate the trap with 5-10 trap volumes of "A solvent" (typically 2/98/0.005-0.1% acetonitrile/H_2O/ion-pairing acid such as *trifluoroacetic acid* or *heptafluorobutyric acid*).
3. Add appropriate amount of acetonitrile and ion-pairing acid to sample to equal the composition of "A solvent."
4. Load sample onto trap at a loading rate within the recommended speed of loading for the size of trap in use. Do not overload the trap.
5. Remove salts from the trap and flush to waste by washing the trap with approximately 5 trap volumes of "A solvent."
6. Elute proteins from the trap. If performing on-line trapping, actuate the valve to the *INJECT* position and then run an increasing gradient of acetonitrile. For manual trapping, flush the trap with 1-2 trap volumes of 65-90% acetonitrile or "B solvent."
7. For full regeneration, flush the trap with 70:30 formic acid:IPA.

SDS REMOVAL TRAP

A large pore, large particle, polymeric strong anion exchange packing material is used for these traps. They are designed to bind anionic detergents such as sodium dodecyl sulfate (SDS) at low pH (2-4). This trap removes SDS at concentrations as high as 1%. If higher concentrations of SDS are present in a sample, the risk of forming micelles that trap analytes along with the SDS micelle complex. Such samples must be diluted below 1% first. The trap works at a pH range of 1-13.

QUICK REFERENCE

1. Clean the trap with 5-10 trap volumes of "B solvent" (typically 90/10/0.005-0.1% acetonitrile/H_2O/ion-pairing acid such as *trifluoroacetic acid* or *heptafluorobutyric acid*).
2. Equilibrate the trap with 5-10 trap volumes of "A solvent" (typically 2/98/0.005-0.1% acetonitrile/H_2O/ion-pairing acid such as *trifluoroacetic acid* or *heptafluorobutyric acid*).
3. Add an appropriate amount of acetonitrile and ion-pairing acid to sample to equal the composition of "A solvent." Note: pH must be between 2 and 4.
4. Load sample onto trap at a loading rate within the recommended speed of loading for the size of trap in use. Do not overload the trap. SDS will bind to the trap while proteins pass through.
5. Capture proteins as they pass through the SDS removal trap for further analysis. If performing on-line trapping, add 5-10 trap volumes of "A solvent" to allow concentration and desalting of proteins on the protein trap (refer to plumbing diagram). If performing manual SDS removal, add 1-2 trap volumes of "A solvent" to allow all proteins to pass through SDS removal trap.

6. Actuate the valve to the *INJECT position* and elute proteins from concentration and desalting trap by running an increasing gradient of acetonitrile. While in the inject position, also clean the SDS trap and route retained SDS to waste by flushing with 5-10 trap volumes of 90% acetonitrile/ 0.1% HCl.
7. Fully regenerate trap by flushing with 90% acetonitrile/ 0.1% HCl.

NID (NON-IONIC DETERGENT) REMOVAL TRAP

Using a mixed bed of large pore, large particle, silica-based weak anion and weak cation exchange packing material, this trap is designed to bind charged proteins and/or peptides. This trap removes non-ionic detergents such as Triton X-100 and Tween-80 by allowing the uncharged detergents to pass through. The trap works at a pH range of 2-7.5.

QUICK REFERENCE

1. Clean the trap with 5-10 volumes of 10% acetonitrile/0.5M NaCl.
2. Equilibrate the trap with 5-10 trap volumes of 10% acetonitrile/10mM buffer, pH7.0 (or some other pH not corresponding to the pI of proteins).
3. Add appropriate amount of acetonitrile and buffer solution to sample to allow sample to contain 10% acetonitrile buffered at pH 7.0 (or at some other pH not corresponding to the pI of proteins).
4. Load sample onto trap at a loading rate within the recommended speed of loading for the size of trap in use. Do not overload the trap. NID will pass through the trap while proteins remain on the NID removal trap.

5. Release proteins from the NID removal trap using 1-2 trap volumes of 10% ACN/0.5M NaCl. If performing on-line trapping, then load 5-10 trap volumes of "A solvent" (typically 2/98/0.005-0.1% acetonitrile/H_2O/ion-pairing acid such as *trifluoroacetic acid* or *heptafluorobutyric acid*) to allow concentration and desalting of proteins on the protein trap. Note: some proteins require up to 5% ACN in "A solvent."
6. Actuate the valve to the *INJECT position* and elute proteins from concentration and desalting trap by running an increasing gradient of acetonitrile.
7. Fully regenerate trap by flushing with 10% acetonitrile/0.5M NaCl.

SCX (STRONG CATION EXCHANGE) TRAP

A packed bed consisting of silica-based strong cation exchange material with medium pores and large particles is designed to bind small positively charged molecules from 0.5 to 50 kD. At a pH of 2.7-3.0, peptides will lose their negative charge and have a net positive charge. The trap is used in a pH range of 2.7 to 7.0. A pH of less than 2.7 will destroy the phase.

QUICK REFERENCE

1. Clean the trap with 5-10 trap volumes of "High salt buffer, pH 3" of choice. Example: 5mM NaH_2PO_4, pH 3.0, with 25% acetonitrile and 0.25M KCl. Note: If using a peptide concentration and desalting trap in tandem with SCX trap for 2D analysis, a good buffer is 5/90/2.5/2.5/0.05% acetonitrile/H_2O/30% ammonium hydroxide/formic acid/HFBA ("D buffer").

2. Equilibrate the trap with 5-10 trap volumes of "Low salt buffer." Example: 5mM NaH_2PO_4, pH 3.0, with 25% acetonitrile. Note: If using a peptide concentration and desalting trap in tandem with SCX trap for 2D analysis, a good buffer is 5/95/0.1/0.005% acetonitrile/H_2O/formic acid/HFBA ("C buffer").
3. Add an appropriate amount of acetonitrile and buffer to the sample to obtain pH 3.0 and 25% acetonitrile to match the "C buffer."
4. Load sample onto trap at a loading rate within the recommended speed of loading for the size of trap in use. Do not overload the trap.
5. Release peptides from the trap using 1-2 trap volumes of "high salt buffer" or perform salt steps with increasing concentrations of salt. If performing on-line trapping, then load 5-10 trap volumes of "C buffer" to allow concentration and desalting of peptides on peptide trap.
6. Actuate the valve to the *INJECT position* and elute peptides from concentration and desalting trap by running an increasing gradient of acetonitrile.
7. For full regeneration, flush the trap with a high salt buffer of choice.

ISRP PROTEIN REMOVAL TRAP

This technique utilizes an Internal Surface Reversed Phase trap, which contains a very small pore, large particle, silica-based internal surface, reversed-phase packing material. This trap is designed to bind small

molecules (0.1-5 kD) onto C18 chains within the internal surface of the pores of the packing material. Protein removal from plasma, urine and serum samples is possible by excluding the proteins from the shielded hydrophobic phase. This allows them to pass through the interparticulate spaces. This works at a pH range of 2-7.5.

QUICK REFERENCE

1. Clean the trap with 5-10 trap volumes of "B solvent" (typically 90/10/0.005-0.1% acetonitrile/H_2O/ion-pairing acid such as *trifluoroacetic acid* or *heptafluorobutyric acid*).
2. Equilibrate the trap with 5-10 trap volumes of equilibration buffer, pH 7.0. Example buffer: 5/95 acetonitrile/180mm ammonium acetate.
3. Add appropriate amount of acetonitrile and buffer to sample to equal the composition of the equilibration buffer.
4. Load sample onto trap at a loading rate within the recommended speed of loading for the size of trap in use. Do not overload the trap.
5. Remove proteins and salts from trap and flush to waste by washing with approximately 5 trap volumes of equilibration buffer.
6. Elute small molecules from trap. If performing on-line trapping, actuate the valve to the *INJECT position* and then run an increasing gradient of acetonitrile. For manual trapping, flush the trap with 1-2 trap volumes of 65-90% acetonitrile or "B solvent."
7. Fully regenerate the trap by flushing it with IPA.

OPTI™-TRAP

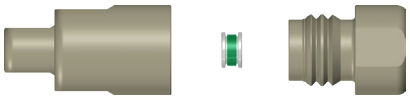
The Opti-Trap is a bi-directional trap cartridge system which is used individually or in a series for sample concentration and purification. The Opti-Trap system features a durable biocompatible trap holder assembly made of either PEEK® (0.5uL configuration) or stainless steel with a PEEK flow path (5uL and 50uL configurations). Opti-Traps have low back pressure and are loaded and eluted manually with a syringe or on-line when plumbed into the sample injection valve. Opti-Traps include titanium frits for full biocompatibility.

ADVANTAGES OF THE opti-trap

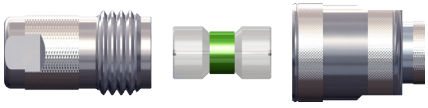
- Rated hand-tight for use up to 1,500 psi (100 bar)
- Low back pressure, for syringe loading/eluting or on-line trapping
- Transparent cartridge allows for visual inspection of bed
- Bi-directional cartridge for flushing and bed regeneration
- Color coded band for identification of packing material
- PEEK and Titanium flow path for biocompatibility

MANUAL HOLDER KIT

3mm: 10-02-04747
1mm: 10-02-04745
Capillary: 10-02-04749



CAPILLARY HOLDER HOLDER KIT
(Includes fittings and tubing)
P/N: 10-02-04808



MICRO / MACRO TRAP HOLDER KIT
(Includes fittings and tubing)
P/N: 10-02-04751

Please use the table below to find bed volume and phase. **Example:** a six pack of 5µL Cartridges packed with a Peptide phase refers to part number 10-04816-TN.

OPTI-TRAP CARTRIDGE SELECTION GUIDE

	Capacity	Bed Volume	Suggested Max Load Rate*	Dimensions	Dimension Code
SINGLES	2µg	0.5µL	5-20µL/min	0.5 x 2mm	0 4 8 1 3
	20µg	5µL	50-200µL/min	1 x 8mm	0 4 8 1 5
	200µg	50µL	500-2000µL/min	3 x 8mm	0 4 8 1 7
6 PACKS	2µg	0.5µL	5-20µL/min	0.5 x 2mm	0 4 8 1 4
	20µg	5µL	50-200µL/min	1 x 8mm	0 4 8 1 6
	200µg	50µL	500-2000µL/min	3 x 8mm	0 4 8 1 8

Phase Code	Phase	Band
TM	Protein	Black
TN	Peptide	Green
TO	NID	Blue
TP	SCX	Orange
ES	Custom	

10 - ☐☐☐☐☐ - ☐☐

Part Number

*Note: use this speed of loading for optimal recoveries.

OPTI-PAK®

The Opti-Pak is ideal for low volume applications. Due to the unique proprietary frit placement, the Opti-Pak can be placed directly into the sample flow path, eliminating all excess swept volume. Elimination of swept volume equates to less sample dispersion and dilution: providing better chromatography when used as a vented trap or in a uni-directional manner before the HPLC column. The Opti-Pak will thread into any 10-32 standard injector port. Its design features a PEEK® holder with an automatically adjusting stem which ensures zero-dead-volume connections to ports such as Vici®/ Valco®, Parker®, Rheodyne® and Waters®. The Opti-Pak is offered in bed volumes ranging from 0.12uL to 5uL. For larger bed volumes applications, refer to the Opti-Lynx product line.

ADVANTAGES OF THE opti-pak

- For low volume applications
- PEEK holder and auto-adjusting stem
- Threads into any standard 10-32 port
- Provides a Zero-Dead-Volume with every connection
- Uni-directional and bi-directional

OPTI-PAK TRAP COLUMN SELECTION GUIDE

Includes: 5 disposable holders & cartridges

Capacity	Bed Volume	Suggested Max Load Rate	Dimension Code	Phase Code	Phase
0.5µg	0.12µL	1.25-5µL/min	0 3 3 2 8	TA	C18
				TB	C18AQ
1.0µg	0.25µL	2.5-10µL/min	0 3 3 2 4	TC	C8
				TD	C4
2.0µg	0.5µL	5.0-20µL/min	0 3 3 1 7	TE	SCX
				TF	SAX
4.0µg	1.0µL	10-40µL/min	0 3 2 2 5	TG	DVB
				ES	Custom
8.0µg	2.0µL	20-80µL/min	0 3 2 2 9		
20µg	5.0µL	50-80µL/min	0 3 2 3 3		

10 - ☐☐☐☐ - ☐☐

Part Number

Please use the table above to find bed volume and phase.
Example: a standard 10-32 Opti-Pak Trap Column with a 0.12µL bed volume, packed with C8 refers to part number 10-03328-TC.

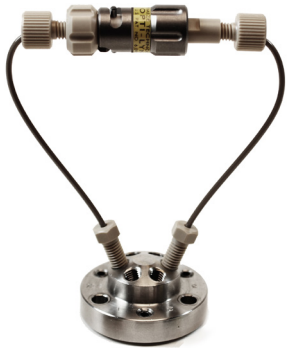
OPTI-LYNX™ micro

Combining a versatile selection of packed beds and the use of a convenient quick-connect holder, Opti-Lynx provides numerous options for chromatographers for on-line or off-line sample clean-up and pre-concentration. Two styles of holders are available: The Opti-Lynx Micro BC offers full biocompatibility as the in-line version while the direct-connect configuration threads conveniently into all 10-32 ports. Bed volumes range from 4uL to 40uL along with a wide range of standard and custom packings. Opti-Lynx traps are the ideal tool for optimizing your technique, whether you want to separate a peptide digest from its matrix for further analyses, or prepare a dilute small molecule sample for LC injection without loss of sample. These columns may be loaded and regenerated repeatedly for maximum value.

ADVANTAGES OF THE opti-lynx micro

- Quick-connect system in-line (BC) or direct-connect versions
- 6,000 psi with hand-tight quarter turn, no tools needed
- Low back pressure design
- Bi-directional
- Bio compatible cartridges and in-line holder
- Larger bed volumes available upon request

IN-LINE HOLDER CONFIGURATION



opti-lynx HOLDERS

11-04824-AA	opti-lynx Direct Connect Holder (backend Opti-Lok fitting included only)
11-03924-AA	opti-lynx In-Line Holder (fittings and tubing included)

OPTI-LYNX CARTRIDGE SELECTION GUIDE

	Capacity	Bed Volume	Suggested Max Load Rate**	Dimensions	Dimension Code	Phase Code	Phase
5 PACKS	16µg	4.0µL	40-160µL/min	1.0 x 5mm	0 4 7 5 5	TA	C18
						TB	SCX
						TD	C18AQ
	40µg	10µL	100-500µL/min	1.5 x 5mm	0 4 7 5 7	TE	SAX
						TF	C8
	80µg	20µL	200-800µL/min	2.1 x 5mm	0 4 7 5 9	TG	C4
						TH	DVB
						DQ	DVB/SCX
	160µg	40µL	0.4-1.6mL/min	3.0 x 5mm	0 4 8 0 7	ES	CUSTOM

11 - ☐☐☐☐☐ - ☐☐

Part Number

Please use the table above to find bed volume and phase. **Example:** an OPTI-LYNX trap with a bed volume of 4.0µL packed with C8 refers to part number 11-04755-TF

EXP®2 Nano Trap

The next-generation EXP2 Nano Trap System is a breakthrough in trapping hardware design and provides the finest low-volume hardware and connections to minimize extra column effects and sample dispersion. The EXP2 Nano Trap packed bed is extremely versatile: robust for applications calling for trapping in one direction followed by elution in the reverse while adding the absolute lowest swept volume for vented-trap applications where the trap is loaded and eluted in the same direction. Applications for the EXP2 Nano Trap include general sample cleanup, sample concentration and removal of detergents or salts at UHPLC pressures.

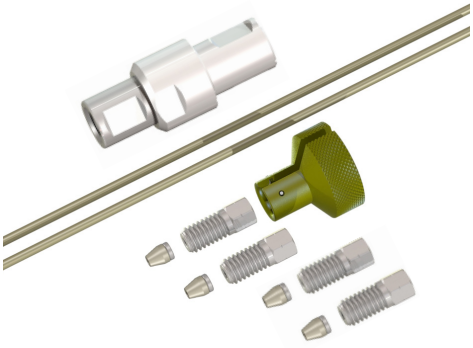
EXP2 Nano Traps are available in 3 formats: 10-32 threaded connections for 1/16" tube ports and 6-40 or 6-32 threaded connections for 1/32" tube ports. Multiple bed volumes and bonded phases allow customizable formats to achieve the separation, clean-up, and concentration that will be effective for your specific method.

The new hand-tight EXP2 fittings from Optimize allow the Nano Trap to achieve the highest performance at UHPLC pressures while maintaining a small profile to fit tight spaces in switching or injection valves. The Nano Trap is best coupled with narrow bore (25um, 50um, 100um) PEEKsil tubing to deliver top performance. The EXP2 Nano Trap is available as individual packed beds or as a kit with PEEKsil Tubing, EXP2 fittings and EXP2 Driver.

ADVANTAGES OF THE EXP2 Nano Trap

- Rated to 20,000+ psi (1,400+ bar)
- Reduced column volume for superior performance
- Available as a .125uL bed volume. Call for other sizes.
- Kits include EXP2 Ti-Lok fittings for repeated ZDV hand-tight connections
- For multi-directional and uni-directional trapping
- Lowest swept volume design for peak sharpness

EXP2 NANO TRAP KIT



Includes: 1 EXP2 Nano Trap, 4 EXP2 Fittings and 2 pieces of 50um i.d. X 100mm PEEKsil tubing (1/32" OD for 6-32 / 6-40 THD and 1/16" OD for the 10-32 THD style).

EXP2 NANO TRAP SELECTION GUIDE

Example: a 6-40 Nano Trap Kit with HALO C18 would have part number 15-04954-HA.

		Bed Volume	Dimensions	Dimension Code
KIT	6-32 Nano Trap	0.125µL	180µm x 5mm	0 4 9 5 3
	6-40 Nano Trap	0.125µL	180µm x 5mm	0 4 9 5 4
	10-32 Nano Trap	0.125µL	180µm x 5mm	0 4 9 5 5
SINGLE TRAP	6-32 Nano Trap	0.125µL	180µm x 5mm	0 4 8 5 6
	6-40 Nano Trap	0.125µL	180µm x 5mm	0 4 8 6 2
	10-32 Nano Trap	0.125µL	180µm x 5mm	0 4 8 7 3

Phase Code	Phase	
H P	C18	5.0µm HALO®
H Q	C8	
H R	HILIC	
H S	Phenyl-Hexyl	
H U	ES-CN	
H V	Penta-HILIC	
H A	C18	2.7µm HALO®
H B	C8	
H D	HILIC	
H E	RP-Amide	
H F	Phenyl-Hexyl	
HN	Peptide ES-C18	
H G	C18	3µm EXP®
H H	C8	
H I	C4	
H J	HILIC	
H K	Phenyl-Hexyl	
H L	SAX	
H M	SCX	
E S	Custom	

15 - ☐☐☐☐☐ - ☐☐

Part Number

* Please visit www.optimizetech.com or call us to learn more about other EXP2 Nano Trap sizes and configurations. *

EXP® Stem Trap

The entire EXP Stem Trap and reusable holder are only slightly larger than a standard HPLC fitting. Its slim architecture allows it to easily fit into crowded instrument compartments or to connect directly to tightly-spaced injection ports. When tightened by hand, the EXP Stem Trap seals to 8,700+ psi. All configurations incorporate wrench-flats to enable flawless sealing to 20,000+ psi (1,400+ bar). The unique packed floating stem installs directly into any 10-32 port and automatically adjusts to provide a perfect ZDV connection.

Our specialized features, patented technology, precision engineering and state-of-the-art manufacturing make the new EXP Stem Trap an unbeatable choice for ultra high-pressure trapping applications.

ADVANTAGES OF THE EXP Stem Trap

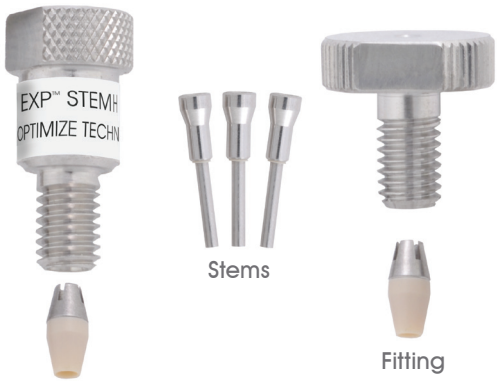
- Rated to 20,000+ psi (1,400+ bar)
- Hand-tight and wrench-tight configurations
- Custom packing available
- Available in bed volumes from 0.17µL to 2.6µL
- Low-volume, low-dispersion cartridges
- Auto-adjusting ZDV connection
- Intended for many repeat uses

EXP STEM HOLDER

15-02-03996	**EXP** Stem Holder (fittings included)

actual size

EXP STEM TRAP KIT



Please use the table below to find the bed volume and phase you require. **Example:** a three pack of 0.17µL Stem Traps with HALO C8 would have part number 15-03992-HB.

EXP STEM TRAP SELECTION GUIDE

	Bed Volume	Suggested Max Load Rate**	Dimensions	Dimension Code
Stem Trap Kit	0.17µL	60µL/min	125µm x 13.5mm	0 3 9 9 7
Replacement Stems*	0.17µL			0 3 9 9 2
Stem Trap Kit	0.33µL	120µL/min	180µm x 13.5mm	0 4 0 0 3
Replacement Stems*	0.33µL			0 4 0 0 1
Stem Trap Kit	0.68µL	250µL/min	250µm x 13.5mm	0 4 0 0 9
Replacement Stems*	0.68µL			0 4 0 0 8
Stem Trap Kit	1.5µL	500µL/min	350µm x 13.5mm	0 4 0 1 5
Replacement Stems*	1.5µL			0 4 0 1 4
Stem Trap Kit	2.6µL	1mL/min	500µm x 13.5mm	0 4 0 2 1
Replacement Stems*	2.6µL			0 4 0 2 0

Phase Code	Phase	
H P	C18	5µm HALO®
H Q	C8	
H R	HILIC	
H S	Phenyl-Hexyl	
H T	PFP	
H U	ES-CN	
H V	Penta-HILIC	
H A	C18	2.7µm HALO®
H B	C8	
H D	HILIC	
H E	RP-Amide	
H F	Phenyl-Hexyl	
HN	Peptide ES-C18	
H G	C18	3µm EXP®
H H	C8	
H I	C4	
H J	HILIC	
H K	Phenyl-Hexyl	
H L	SAX	
H M	SCX	
E S	Custom	

15 - [ ][ ][ ][ ][ ] - [ ][ ]

Part Number

* Includes 3 replacement stems. To be used with reusable EXP Stem Holder only.
** Suggested max load rate is based on 60/40 Acetonitrile/Water Mobile phase.

EXP® Trap Column

The patented hand-tight EXP Trap Column is rated for use up to 20,000+ psi (1,400+ bar). This unique design connects directly to any injection valve (with 10-32 threads) or in-line with 1/16" stainless tubing for unparalleled convenience and efficiency.

The EXP Cartridge System enables chemists to quickly remove detergents or salts which can affect the ionization process in MS work. This trapping technique can concentrate the sample directly on-line thus allowing for increased recovery of precious sample material compared to off-line techniques. On-line trapping readily lends itself to automation for high-throughput analysis in UHPLC/MS applications. Free-Turn® architecture allows the user to change cartridges by hand without breaking fluid connections on the holder inlet/outlet.

ADVANTAGES OF THE EXP Trap Column

- Hand-tight to 20,000+ psi (1,400+ bar)
- Hand-tight trap replacement - NO TOOLS
- Uni-directional cartridge
- Custom packing available
- Available in bed volumes from 4µL to 100µL
- Hardened stainless steel end cap eliminates galling
- Auto-adjusting ZDV connections

EXP HOLDERS

15-02-03956	**EXP** Direct Connect Holder (fittings included)
15-02-03946	**EXP** In-Line Holder (fittings included)
15-02-04041	**EXP** All-In-One Holder Kit (includes: In-Line + Direct-Connect Holder Components and fittings)

Ultra High Pressure (20,000psi / 1,400bar)

EXP In-Line Holder

EXP Direct Connect Holder

Please use the table below to find the bed volume and phase you require. **Example:** a three pack of 4µL Cartridges with HALO C8 would have part number 15-03964-HB.

EXP TRAP CARTRIDGE SELECTION GUIDE

3 PACKS

Bed Volume	Suggested Max Load Rate*	Dimensions	Dimension Code
4µL	2mL/min	1.0 x 5mm	0 3 9 6 4
10µL	4mL/min	1.5 x 5mm	0 3 9 6 9
20µL	6mL/min	2.1 x 5mm	0 3 9 7 3
40µL	8mL/min	3.0 x 5mm	0 3 9 7 8
100µL	10mL/min	4.6 x 5mm	0 3 9 8 3

Phase Code	Phase	
H P	C18	5µm HALO 5
H Q	C8	
H R	HILIC	
H S	Phenyl-Hexyl	
H T	PFP	
H U	ES-CN	
H V	Penta-HILIC	
H A	C18	2.7µm HALO®
H B	C8	
H D	HILIC	
H E	RP-Amide	
H F	Phenyl-Hexyl	
HN	Peptide ES-C18	
H G	C18	3µm EXP
H H	C8	
H I	C4	
H J	HILIC	
H K	Phenyl-Hexyl	
H L	SAX	
H M	SCX	
E S	Custom	

15 - [ ][ ][ ][ ][ ] - [ ][ ]

Part Number

* Suggested max load rate is based on 60/40 Acetonitrile/Water Mobile phase. Custom packing is also available, please contact us for details.

OPTI® information

Trademarks

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Patents

U.S. Pat. No.s 8,696,902 B2, 8, 201,854 and other U.S. and foreign patents pending.

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