aSTRAL SCIENTIFIC

Service • Integrity • Quality

PURIFICATION RESINS

Handbook and Selection Guide

Table of Contents

Affinity Purification Resins 2
Affinity Coupling 2
Sulfhydryl Reactive 2
Sulfhydryl Coupling Resin 2
Expoxy Activated Resin 3
Amine Reactive 3
Amine Coupling Resin 3
Sodium Cyanoborohydride 3
CDI Amine Reactive Resin 4
NHS-Activated Agarose (Dry Form) 4
CNBr-Activated Agarose (Dry Form) 5
ECH-Agarose 5
Carboxyl Magnetic Beads 5
Carboxyl Reactive 6
Carboxyl Coupling Resin 6
Amine Magnetic Beads 6
Carbohydrate Reactive 7
Carbohydrate Coupling Resin 7
Active Hydrogen Reactive 7
SDC™ (Steroid/Drug/Compound) Immobilization 7
Avidin-Streptavidin Purification 8
Biotin Resin 8
Iminobiotin Resin 8
Biotin-Tagged Purification 8
Streptavidin Resin 8
Avidin Resin 9
Monomeric Avidin Resin 9
CBP-Tagged Protein Purification 9
Calmodulin Resin 9
C-Reactive Protein Purification 9
Immobilized p-Aminophenyl Phosphoryl Choline 9
GST-Tagged Protein Purification 10
Glutathione Resin 10
Histidine-Tagged Protein Purification 10
Ni IDA Agarose Fast Flow 10
Nickel IDA Resin 11
Ni IDA Agarose Fast Flow 11
Nickel NTA Resin 11
Ni-NTA Magnetic Beads 11
Co IDA Agarose Fast Flow 12
Cobalt IDA Resin 12
Cobalt NTA Resin 12
Copper Chelating Resin 12
Zinc Chelating Resin 12
Immobilized Heparin 13
Immobilized Lectins 13
Immobilized Jacalin 13
Jacalin, Lyophilized 13
Concanavalin A (Con A) Agarose 13
Lectin Purification 14
Immobilized D-Galactose 14
Nucleic Acid Purification 14
Immobilized Boronic Acid 14
Silica Magnetic Beads 14
Protease Purification Resins 15
Immobilized Soybean Trypsin Inhibitor 15
Immobilized Protease Resins 15
Immobilized Trypsin 15
Immobilized Pepstatin 16
Immobilized Papain 16
Immobilized Pepsin 16
Immobilized Ficin 16
Antibody Purification Resins 17
Protein A, Protein G, Protein A/G 17
Protein A Magnetic Beads 17
Immobilized Protein A 17
G-Trap™ rProtein A FF 18
Protein G Magnetic Beads 18
Immobilized Protein G 19
G-Trap™ rProtein A FF 19
Immobilized Protein A/G 20
Pearl™ Purification 20
Pearl™ IgG Purification Resin 20
IgA Purification 21
Immobilized Jacalin 21
Thiophilic Adsorption 21
Thiophilic Resin 21
Gel Filtration/ Size Exclusion Chromatography 22
G-Sep™ Agarose 4B & 6B 22
G-Sep™ Agarose CL-4B & CL-6B 22
G-Sep™ Agarose 6 Fast Flow 22
Hydrophobic Interaction Chromatography (HIC) 23
Butyl Agarose Fast Flow 23
Octyl Agarose Fast Flow 23
Phenyl Agarose Fast Flow 23
G-Trap™ HIC Selection Kit 23
Ion Exchange Chromatography 24
Cation Exchangers 24
G-Sep™ CM Agarose Fast Flow 24
G-Sep™ SP Agarose Fast Flow 24
Anion Exchangers 24
G-Sep™ DEAE Agarose Fast Flow 24
G-Sep™ Q Agarose Fast Flow 24
G-Trap™ Ion Exchange Kit 24
Contamination Removal Resins 25
Detergent Removal 25
DetergentOUT™ GBS10 25
DetergentOUT™ Tween® 26
Endotoxin Removal 26
EndotoxinOUT™ 26
PAGE-Optimizer™ 26
Desalting & Buffer Exchange 27
SpinOUT™ 27
G-Trap™ Desalting Columns 27
C18 Spin Columns 28
Reducing Agent Resins 28
Immobilized Reductant 28
TCEP Reducing Resin 28
Albumin Removal 29
AlbuminOUT™ 29
Disposable Columns 29
Spin Column, <0.1ml 29
Spin Column, 1ml 29
Spin Column, 3ml 30
Spin Column, 5ml 30

Affinity Purification Resins

For the separation & purification of affinity tagged proteins & antibodies

The separation and purification of proteins has been a major challenge for researchers in the early days of proteomic research. The advances in affinity chromatography have enabled researchers to purify large quantities of highly pure proteins for a multitude of analysis techniques, including crystallography, protein to protein studies and in-vitro assays.

Affinity chromatography works by binding a protein, via a reversible interaction, to a specific ligand that is prebound to a solid chromatographic support. The protein(s) are first bound to the column in a buffer that supplies conditions optimal for binding. Unbound, non-specific material is washed away and the protein(s) of interest are then eluted by changing the buffering conditions to induce desorption from the solid support.

We supply two main groups of affinity resins. The first group is for the separation and purification of affinity tagged proteins and the second group is for the binding of immunoglobulin molecules.

A common practice in today's research is the use of molecular biology to clone our protein(s) of interest into a vector that adds a specific tag to the protein. The most versatile and common tags used are glutathione S-transferase (GST), a 6x histidine motif (His-tag), and the calmodulin binding peptide (CBP).

Affinity Coupling

Activated resins have immobilized groups bound to agarose beads that can be used to generate specific affinity columns for protein, antibody and other molecule purification.

Activated resins offered include:

- Sulfhydryl Coupling Resin: Activated iodoacetyl groups for coupling free sulfhydryls
- Amine Coupling Resin: Activated aldehyde groups for coupling primary amines
- CDI Amine Reacitve: Reactive imidazole carbamates to couple primary amines. Ideal for peptide immobilization
- Carboxyl Coupling Resin: Immobilized DADPA (Diaminodipropylamine) generates a free amine to conjugate carboxyls and other moieties with the aid of crosslinkers
- Carbohydrate Coupling Resin: Hydrazide activated agarose for coupling of oxidized carbohydrates
- SDC™ Immobilization: Uses Immobilized DADPA (Diaminodipropylamine)) for the immobilization of steroids, drugs and chemical compounds that lack primary amines, sulfhydryls, carbonyls and other common coupling groups

SULFHYDRYL REACTIVE

Sulfhydryl Coupling Resin

Activated iodoacetyl group for binding free sulfhydryls

The Sulfhydryl Coupling Resin is designed for the simple and efficient coupling of peptides and proteins to a solid 6% agarose support through free sulfhydryl groups (-SH). The iodoacetyl groups of the Sulfhydryl Coupling Resin specifically react with free sulfhydryls to form covalent, permanent thioether bonds. The long spacer arm reduces steric hindrance and ensures greater binding of proteins and antibodies during affinity purification.

The Sulfhydryl Coupling Resin is available as a resin slurry or prealiquoted as five 2ml spin column format.

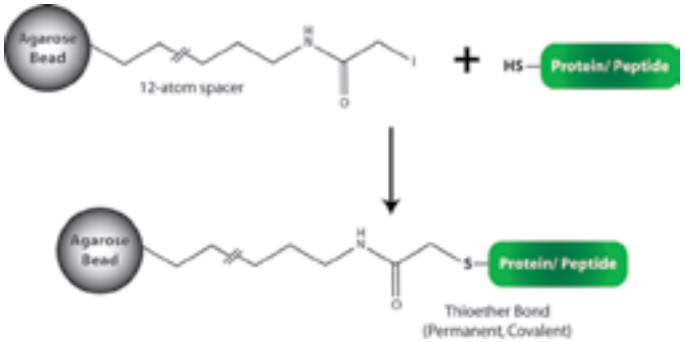


Figure 1: Sulfhydryl Coupling Resin scheme.

FEATURES

- Stable coupling of proteins and peptides, forms covalent thioether bonds
- Couples 1-2mg peptide and 2-20mg protein/ml resin

APPLICATIONS

- For the generation of affinity columns for antibody purification and other affinity chromatography

Cat. No.	Description	Size
786-794	Sulfhydryl Coupling Resin	10ml resin
786-795	Sulfhydryl Coupling Resin	50ml resin
786-796	Sulfhydryl Coupling Resin	250ml resin
786-806	Sulfhydryl Coupling Resin	5 x 2ml columns

Affinity Purification Resins

Expoxy Activated Resin

Activated epoxy group for binding amine, thiol and hydroxyl groups

Epoxy-Activated Agarose is preactivated resin used for affinity chromatography. Epoxy-Activated Agarose comprise of high density epoxy groups that form covalent bonds with ligands containing amine groups, thiol or hydroxyl groups

Epoxide-Acivated Agarose is prepared by immobilization of oxiranes such as 1,4-butanediol diglycidyl ether onto matrix. This pre-activated resin provide hydrophilic 12 atom spacer arm which enables binding of small ligand molecules such as amino acids, monosaccharide, peptides and carbohydrates.

Epoxy-Activated Agarose find widespread application in affinity chromatography involving purification of antigen, antibody, lectin, glycoproteins and many other applications.

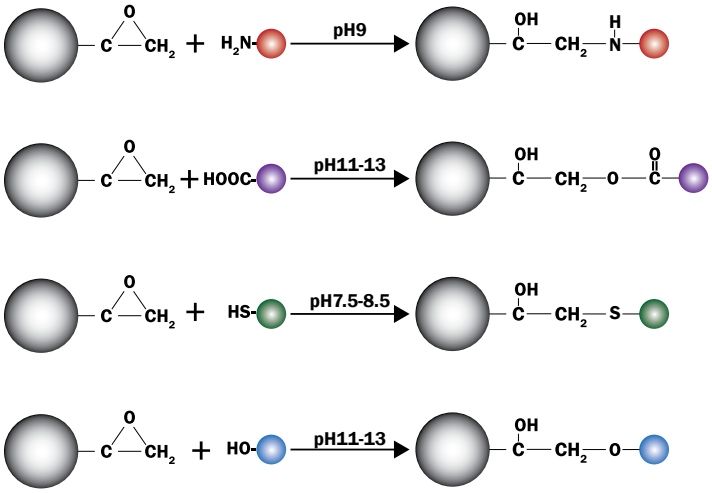


Figure 2: Epoxy activated resin coupling interactions.

FEATURES

- Resin Active group: epoxy
- Resin Active group density: 20-40 µM/ ml hydrated resin.
- Group to be coupled: -NH2, -OH or -SH
- 45-165µm particle size range
- Spherical, highly cross-linked 6% agarose
- Resin spacer arm: 12 atom hydrophilic spacer arm
- Coupling conditions: pH 7.5-8.5 for thiol ligands, pH 9-10 for amine ligands and pH 11-13 for hydroxyl ligands at 4 to 37 °C depending upon ligand stability for 16 hrs
- pH stability: 2-13, ligand dependent
- 1 gm of dry resin swells to 5-6 ml.

APPLICATIONS

- Preactivated resin used for affinity chromatography.
- Couple various molecule ligands via amine, thiol or hydroxyl groups
- Widespread application in affinity chromatography involving purification of antigen, antibody, lectin, glycoproteins

Cat. No.	Description	Size
786-1221	Epoxy-Activated Agarose (Dry Form)	5g
786-1222	Epoxy-Activated Agarose (Dry Form)	15g

AMINE REACTIVE

Epoxy activated resin also reacts with amines and can be found with the sulfhydryl reactive resins.

Amine Coupling Resin

The Amine Coupling Resin is 6% agarose that has been activated to generate reactive aldehyde groups. The aldehyde groups of the agarose react spontaneously with primary amines, located at the N-terminus of proteins or in lysine residues, to form intermediate Schiff Base complexes (Figure 3). These, in turn, are selectively reduced by reductive amination to form stable amine linkages between the agarose and the ligand.

The amine reactive HOOK™ Activated agarose is also supplied in a complete kit for the generation of 5 x 2ml resins.

FEATURES

- Binding capacity: 20mg protein/ml resin
- 6% cross-linked agarose

APPLICATIONS

- Coupling of proteins and peptides to agarose beads
- Suitable for antibody purification

CITED REFERENCES

1. *Lai, J.C. et al (2015) Cell Death Dis. doi:10.1038/cddis.2015.349*
2. *Rudolph, V. et al (2008)J Pharmacol Exp Ther 327:324*

Cat. No.	Description	Size
786-066	HOOK™ Activated Agarose (Amine Reactive)	10ml resin
786-063	HOOK™ Activated Agarose Coupling Kit (Amine Reactive)	5 x 2ml columns

Sodium Cyanoborohydride

Carbonyl groups react with amines to form Schiff base intermediates that are in equilibrium with their free forms. The labile Schiff's base interaction can be stabilized by chemical reduction (figure 3). Sodium cyanoborohydride is preferred over sodium borohydride as the latter will also reduce the reactive aldehydes to hydroxyls. The cyanoborohydride offers five times milder reduction compared to borohydride, reducing only the Schiff's bases.

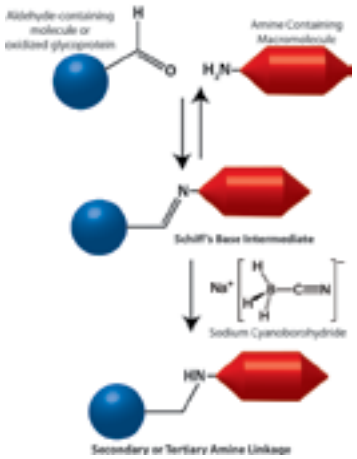


Figure 3: Mechanism of reductive amination

FEATURES

- Linear formula: $NaCNBH_3$
- CAS # 25895-60-7
- Molecular weight: 62.84

Cat. No.	Description	Size
786-061	Sodium cyanoborohydride	0.5g
786-062	Sodium cyanoborohydride	4 x 0.5g

CDI Amine Reactive Resin

G-Biosciences CDI Amine Reactive Agarose consists of 6% cross-linked agarose activated with CDI (1,1'-carbonyl diimidazole) to form reactive imidazole carbamates.

The activation of the resin occurs in solvent and to maintain its activity the resin is supplied in acetone to prevent hydrolysis. Upon reaction of the resin with primary amine containing molecules, i.e. proteins, in basic (pH8.5-10) aqueous buffers the imidazole carbamates lose the imidazole group and form carbamate linkages.

CDI Amine Reactive Agarose is ideal for immobilizing peptides, small organic molecules and certain proteins and reactions can occur in organic solvent making it ideal for water-insoluble ligands.

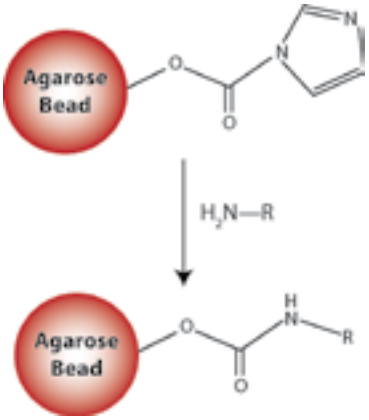


Figure 4: Scheme for the coupling of proteins to CDI Amine Reactive Agarose.

FEATURES

- Proven coupling chemistry
- Easy to use, no secondary coupling agents required
- Stable linkages
- Couple in inorganic buffers for insoluble molecules

APPLICATIONS

- Couple proteins and peptides
- Couple primary amine containing ligands

Cat. No.	Description	Size
786-404	CDI Amine Reactive Resin	10ml resin

NHS-Activated Agarose (Dry Form)

NHS-Activated Agarose consists of 4% cross-linked agarose that has been activated by the addition of a reactive NHS (N-hydroxysuccinimide) group. The NHS group forms covalent, chemically stable amide bonds with ligands that contain primary amines. The NHS-Activated Agarose also contains a spacer arm between the NHS group and the agarose beads, making it suitable for coupling of small proteins and peptides. The long spacer arm minimizes steric hindrance allowing high efficient binding of ligands, including small proteins and peptides.

The 4% highly cross-linked agarose beads are coupled to 6-carbon spacer arm. The terminal carboxyl group of the spacer arm is activated by esterification with the NHS group.

The coupling reaction is performed in an amine-free buffer at pH7-9 and the coupling efficiency is typically >80%, regardless of ligand's pI or molecular weight. Once the ligand is coupled to the resin, the resin can be used for multiple affinity purifications. The resin is suitable for gravity-flow and low- to medium-pressure applications.

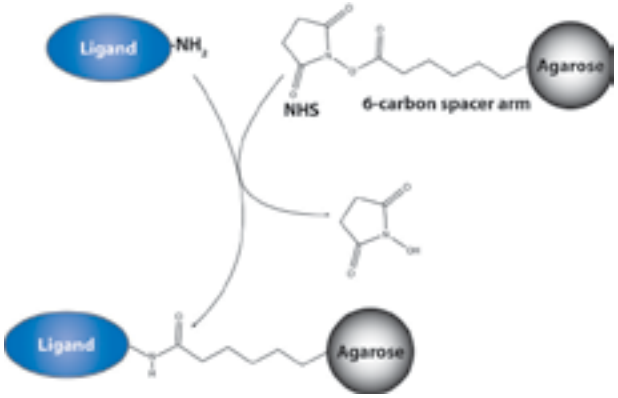


Figure 5: Scheme for the coupling of primary amine containing ligands, including proteins and peptides, to NHS-Activated Agarose.

TECHNICAL

- 90µm average particle size
- 45-165µm particle size range
- Spherical, highly cross-linked 4% agarose
- 16-23µmol NHS/ml drained resin ligand density
- 3-13 pH stability

FEATURES

- High level of activation
- Simple: One step couple reaction
- Stable: Resulting affinity column very stable, especially at pH extremes
- Spacer arm between agarose and reactive group, suitable for small proteins and peptides
- Rapid: >80% coupled in first 30 minutes
- Suitable for any ligand with primary amine
- Reusable affinity chromatography columns generated

APPLICATIONS

- Peptide coupling for antibody purification
- Protein purification
- Antibody purification
- Purify protein interacting partners

Cat. No.	Description	Size
786-1211	NHS-Activated Agarose (Dry Form)	1g
786-1212	NHS-Activated Agarose (Dry Form)	5g
786-1213	NHS-Activated Agarose (Dry Form) with Spin Columns	1g with 5 x1ml Spin Columns
786-1214	NHS-Activated Agarose (Dry Form) with Spin Columns	5 g with 5x 3ml Spin Columns

CNBr-Activated Agarose (Dry Form)

CNBr-Activated Agarose is pre-activated high capacity resin used for covalent coupling of antibodies and large protein molecules for affinity chromatography.

Cyanogen bromide reacts with hydroxyl groups of resin to form cyanate esters which inturn reacts with primary amine ligands to form covalent bonds. G-Bioscience CNBr-Activated Agarose is produced by a method that predominantly produces cyanate estres with little or trace amounts of imidocarbonates.

CNBr-Activated Agarose coupling offers several advantages. It is simple, reproducible, offer multi-point attachment of many protein ligands that results in chemically stable resin for affinity chromatography. CNBr-Activated Agarose is ideal for coupling of enzymes, antibodies and other proteins as the coupling is done under very mild conditions.

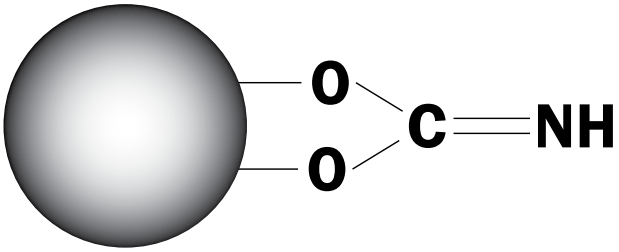


Figure 6: Structure of the CNBr Activated Resin.

FEATURES

- Binding capacity: > 90 µmol cyanate ester/ml resin
- 45-165µm particle size range
- Spherical, highly cross-linked 6% agarose
- Group to be coupled: -NH2
- Chemical stability: Stable to all commonly used aqueous buffers.
- pH stability: ligand dependent, range – 2 to 11
- 1 gm of dry resin swells to 4-5 ml.
- Storage: 2- 8°C

APPLICATIONS

- CNBr-Activated Agarose is pre-activated high capacity resin used for covalent coupling of primary amine containing ligands for affinity chromatography.

Cat. No.	Description	Size
786-1219	CNBr-Activated Agarose (Dry Form)	5g
786-1220	CNBr-Activated Agarose (Dry Form)	15g

ECH-Agarose

ECH-Agarose contains carboxyl functional group for coupling of affinity ligands via their amine groups for affinity chromatography. ECH-Agarose is prepared by condensation of Carboxyl Coupling Resin (Cat. # 786-797) with succinic anhydride, resulting in 15-atom hydrophilic spacer arm.

Amine groups of the ligands bind to the ECH-Agarose by carbodiimide coupling method. In this coupling method the free carboxyl group of the resin reacts with amine group of the ligand to form a stable peptide bond in the presence of water soluble carbodiimide such as EDC (N-ethyl-N'-(3-dimethylaminopropyl) carbodiimide hydrochloride) at low pH (4-5).

FEATURES

- Resin Active group: -COOH groups
- Group to be coupled: -NH2 groups
- Resin Active group density: 50 µM carboxyl/ ml drained resin.
- 45-165µm particle size range
- Spherical, cross-linked agarose
- Resin spacer arm: 15 atom hydrophilic spacer arm.
- Coupling conditions: at 4°C- 25°C, pH: 4.5 -6 for 1.5 -24 hrs, Coupling could be done in organic solvents.
- No blocking reaction is required after the coupling reaction, saves time
- Storage: 2- 8°C

APPLICATIONS

- For coupling of affinity ligands via their amine groups

Cat. No.	Description	Size
786-1223	ECH-Agarose	15ml
786-1224	ECH-Agarose	50ml

Carboxyl Magnetic Beads

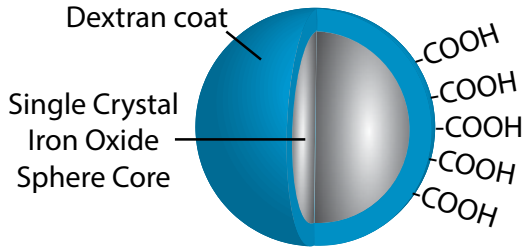


Figure 7: Carboxyl Magnetic Bead.

G-Biosciences' Carboxyl Magnetic Beads are a magnetic version of the ECH-Agarose. They are 1µm, uniform magnetic beads with surface functional group -COOH. The magnetic bead consists of a single-crystal Fe_3O_4 sphere core and dextran coating layer. Through chemical modification of dextran, the carboxyl groups (-COOH) are joined to the magnetic beads through a short hydrophilic linker. The hydrophilic surface ensures the magnetic beads excellent dispersion ability and easy handling property in a wide variety of buffers.

FEATURES

- 1µm beads
- ~50mM ligand density
- Rapid binding at neutral to high pH
- No centrifugations required
- Dextran coating for low non-specific binding

APPLICATIONS

- Isolation of proteins and peptides
- C-terminal coupling of peptides

Cat. NO.	Description	Size
786-908	Carboxyl Magnetic Beads	1ml resin
786-909	Carboxyl Magnetic Beads	5ml resin

CARBOXYL REACTIVE

Carboxyl Coupling Resin

Carboxyl Coupling Resin, an equivalent of EAH-Sepharose, consists of 6% cross-linked agarose with covalent linked diaminodipropylamine (DADPA) to generate a free primary amine at the end of a long spacer arm.

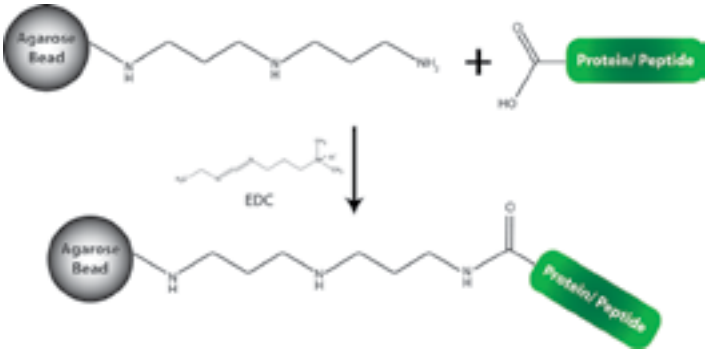


Figure 8: Carboxyl Coupling Resin scheme.

Molecules, including proteins and peptides, are covalently coupled to the free primary amines, and the stable columns are ideal for affinity purification of antibodies and other interacting partners. Molecules can be coupled to the free amine by numerous amine-reactive methods; however the use of the carbodiimide EDC allows coupling of free carboxyl groups. The resulting amide bond is highly stable and greatly reduces the chance of leaching of the affinity tag. The long spacer arm reduces steric hindrance and ensures greater binding of proteins and antibodies during affinity purification.

The Carboxyl Coupling Resin kit is supplied with 5 x 2ml columns of resin and the EDC and coupling buffers for optimal coupling of amine containing ligands.

FEATURES

- Immobilized DADPA (diaminodipropylamine)
- 6% cross-linked agarose
- Long spacer arm to limit steric hindrance

APPLICATIONS

- Couple peptides for antibody purification
- Couple peptides and proteins to purify interacting molecules

Cat. NO.	Description	Size
786-797	Carboxyl Coupling Resin (Immobilized DADPA (Diaminodipropylamine))	25ml resin
786-809	Carboxyl Immobilization Kit	For 5 x 2ml column

Amine Magnetic Beads

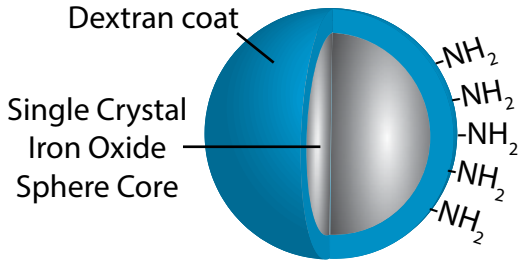


Figure 9: Amine Magnetic Bead.

G-Biosciences' Amine Magnetic Beads are 1µm, uniform magnetic beads with an amine (-NH_2) surface functional group. The magnetic beads consist of a single-crystal Fe_3O_4 sphere core and dextran coating layer. Through chemical modification of dextran, the primary amino group (-NH_2) are joined to the magnetic beads through a short hydrophilic linker. The hydrophilic surface ensures the magnetic beads excellent dispersion ability and easy handling property in a wide variety of buffers.

The magnetic beads with surface-reactive amino groups allow immobilization of ligands such as proteins, peptides, carbohydrates or other target specific molecules. Immobilization of ligands can be through reductive amination of aldehyde or ketones without prior activation of the bead surface. Alternatively, carbodiimide cross-linkers can be used to couple ligands to the amines via their carboxyl groups. Finally, amine reactive heterobifunctional cross-linkers can be used to introduce other functional groups for coupling ligands.

Carbodiimide activation of carboxyl groups produces a very labile intermediate that hydrolyzes quickly, meaning the ligand needs to be added rapidly. Alternatively, a two step protocol using N-hydroxysuccinimide (NHS) can be employed to produce a less labile intermediate that reacts over a longer time period.

FEATURES

- 1µm beads
- ~50mM ligand density
- Rapid binding at neutral to high pH
- Compatible with amine reactive cross-linking reagents
- No centrifugations required
- Dextran coating for low non-specific binding

APPLICATIONS

- Isolation of proteins and peptides
- C-terminal coupling of peptides

Cat. NO.	Description	Size
786-906	Amine Magnetic Beads	1ml resin
786-907	Amine Magnetic Beads	5ml resin

CARBOHYDRATE REACTIVE

Carbohydrate Coupling Resin

Immobilize glycoproteins through carbohydrates

For the covalent immobilization of carbohydrate containing molecules, including glycoproteins, to agarose beads.

Carbohydrate-containing molecules are treated with sodium meta-periodate to oxidize their cis-diol groups to aldehydes. The aldehydes spontaneously react with the hydrazide goups on the agarose beads to form stable covalent bonds. The stable nature allows the affinity resin to be used multiple times.

Ideal for the coupling of polyclonal antibodies as it allows for the optimal orientation of the antibodies for affinity purification.

The Carbohydrate Coupling kit includes 5 x 2ml Carbohydrate Coupling spin columns, SpinOUT™ desalting columns and sodium meta-periodate.

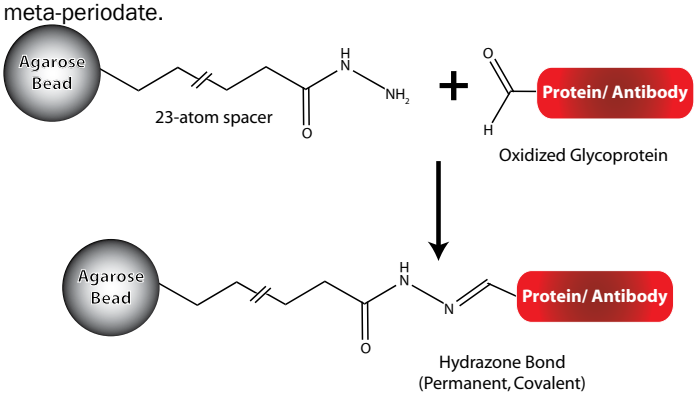


Figure 10: Carbohydrate Coupling Resin scheme.

FEATURES

- Hydrazide activated agarose
- Capacity: 1-5mg antibody/ml resin

Cat. No.	Description	Size
786-807	Carbohydrate Coupling Kit	For 5 columns
786-808	Carbohydrate Coupling Resin	10ml resin

ACTIVE HYDROGEN REACTIVE

SDC™ (Steroid/Drug/Compound) Immobilization

Designed for the immobilization of steroids, drugs and chemical compounds that lack primary amines, sulfhydryls, carbonyls and other common coupling groups to a solid-phase agarose support for the use in affinity purification. The kit uses Immobilized DADPA (diaminodipropylamine) resin to bind steroids, drugs and chemicals through their active hydrogens.

The coupling uses the Mannich reaction, which is described as the condensation of formaldehyde with ammonia, in the form of its salt, and another compound containing an active hydrogen. The SDC™ Immobilization kit replaces the ammonia with the primary amine on the DADPA and the active hydrogen is supplied by the steroid, drug or chemical to be coupled. Ideal for the generation of five 2ml affinity columns.

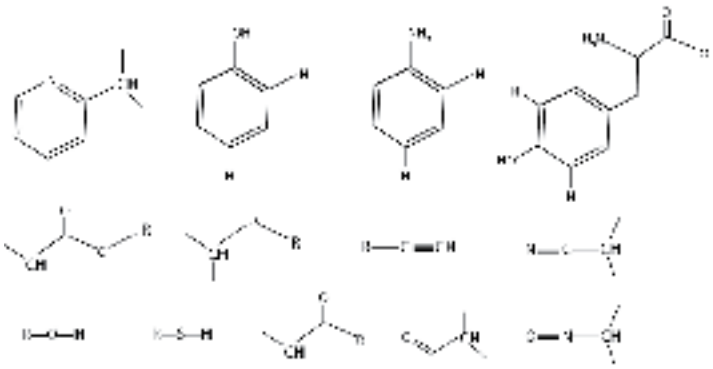


Figure 11: Active hydrogen containing compounds.

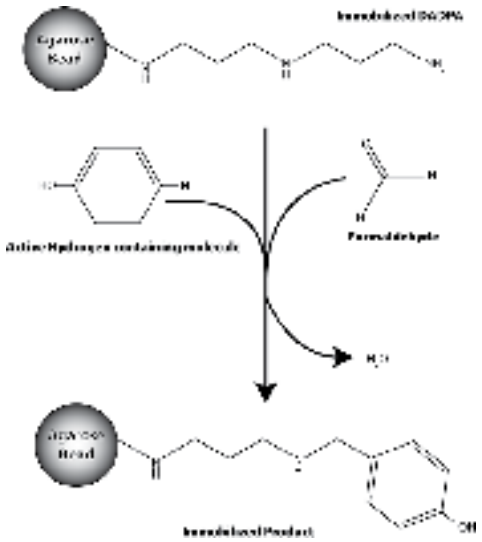


Figure 12: SDC™ (Steroid/ Drug/ Compound) Immobilization scheme.

FEATURES

- Uses Immobilized DADPA (diaminodipropylamine) resin
- Stable, covalent linkage

APPLICATIONS

- Immobilization of drugs, steroids and small metabolites through active hydrogens
- Ideal for compounds lacking primary amines, sulfhydryls, carbonyls and other common coupling groups

Cat. NO.	Description	Size
786-271	SDC™ (Steroid/Drug/Compound) Immobilization	5 reactions

Affinity Purification Resins

Avidin-Streptavidin Purification

Designed for the high affinity chromatography purifications of avidin, streptavidin and Neutravidin protein.

Biotin Resin

Immobilized Biotin Resin is designed for the high affinity chromatography purifications of avidin, streptavidin and Neutravidin protein. The resin consists of biotin coupled to 6% cross-linked agarose.

Biotin, a 244 Dalton vitamin (Vitamin H) molecule, exhibits an extraordinary binding affinity for avidin ($Ka=10^{15}M^{-1}$) and streptavidin. Biotin and avidin interaction is rapid and once the bond is established it can survive up to 3M guanidine-hydrochloride and extremes of pH. Biotin-avidin bonds can only be reversed by denaturing the avidin protein molecule with 8M guanidine-hydrochloride at pH1.5 or by boiling in SDS PAGE sample loading buffer.

FEATURES

- Strong affinity for avidin, streptavidin and Neutravidin
- Reusable resin, at least 10 times
- Covalently coupled to limit leaching

APPLICATIONS

- Isolation of avidin, streptavidin and Neutravidin coupled molecules
- Immunoprecipitations with avidin, streptavidin and Neutravidin coupled antibodies

Cat. No.	Description	Size
786-598	Immobilized Biotin	5ml resin

Iminobiotin Resin

Consists of iminobiotin, a cyclic guanido analog of biotin, covalently coupled to 6% crosslinked agarose. The resin allows for the purification of avidin, streptavidin and Neutravidin and their subsequent gentle elution using non-denaturing elution buffers.

The normal biotin-avidin complex requires strong denaturing buffers, i.e. 8M guanidine•HCl, to denature the avidin and release the biotin, which obviously destroys the native and functional aspects of the avidin. The iminobiotin-avidin complex will form at >pH9.5 and can be dissociated at pH4.0 with gentle elution buffers, including 50mM ammonium acetate, pH4.0 with 0.5M NaCl.

FEATURES

- Biotin Binding Capacity: >2mg avidin/ml resin
- No requirement for strong, denaturing elution buffers
- Elutes at pH4.0

APPLICATIONS

- Isolation of avidin, streptavidin and Neutravidin complexes

Cat. No.	Description	Size
786-599	Immobilized Iminobiotin	5ml resin

Biotin-Tagged Purification

Biotin, a 244Da vitamin (Vitamin H) molecule, exhibits an extraordinary binding affinity for avidin ($Ka=10^{15}\ M^{-1}$) and streptavidin ($Ka=10^{15}\ M^{-1}$). Biotin and (strept)avidin interaction is rapid and once the bond is established it can survive up to 3M guanidine-hydrochloride and extremes of pH. Biotin-avidin bonds can only be reversed by denaturing the avidin protein molecule with 8M guanidine-hydrochloride at pH1.5 or by boiling in SDS Page Sample Loading Buffer.

Streptavidin Resin

High binding affinity for biotin labeled proteins & molecules

Streptavidin is a tetrameric protein containing 4 biotin binding sites. Streptavidin in many respects is similar to avidin except that it has no carbohydrate and has a slightly lower molecular weight of about 60kDa. The solubility of streptavidin (isoelectric pH5) in aqueous buffer is much lower than avidin, but the binding of streptavidin to biotin is similar to that of avidin. The advantage of streptavidin is that the lack of carbohydrates significantly reduces the amount of non-specific binding.

The streptavidin used for immobilization on porous 6% crosslinked agarose is a recombinant form with a mass of 53kDa and near neutral pI. The streptavidin is covalently coupled to the agarose resulting in minimal leaching and is stable over pH2-11.

The Steptavidin Resin is designed for the single step small and large scale affinity purification of proteins and antibodies with a biotin tag. The resin can also be used for immunoprecipitations using biotin labeled antibodies. Supplied as a resin slurry or in a 1ml spin column format.

Specific Binding and Elution Buffers are also available.

The Streptavidin Resin is available as resin alone or supplied in a kit format containing:

- 5ml resin
- 100ml Streptavidin Binding/Wash Buffer (20mM $NaPO_4$, 0.15M NaCl, pH7.5)
- 100ml Streptavidin Elution Buffer (8M Guanidine.HCl pH1.5)
- 5 empty 1ml spin columns
- 5 empty <5ml gravity flow columns

The buffers are also available separately.

FEATURES

- Recombinant streptavidin covalently coupled to ~6% cross linked agarose.
- Minimal Leaching
- Ligand Density >1mg/ml
- Binding capacity 15-30µg biotin/ml resin

APPLICATIONS

- Immunoprecipitation with biotinylated antibodies
- Pull down assays with biotinylated proteins
- Purification of biotinylated molecules, including proteins, antibodies, DNA and carbohydrates

CITED REFERENCES

1. *Dong D. et al (2016) Mol Pharm DOI: 10.1021/acs.molpharmaceut.6b00265*

Cat. No.	Description	Size
786-590	Immobilized Streptavidin Resin	2ml resin
786-390	Immobilized Streptavidin Resin	5ml Resin
786-591	Immobilized Streptavidin Resin	10ml resin
786-592	Immobilized Streptavidin Resin	5 x 1ml
786-555	Streptavidin Resin Kit	1
786-548	Streptavidin Binding Buffer	100ml
786-549	Streptavidin Elution Buffer	100ml

Affinity Purification Resins

Avidin Resin

High binding affinity for biotin labeled proteins & molecules

Avidin is a glycoprotein with approximately 10% of its total mass coming from carbohydrates. Avidin has a molecular weight of 67kDa and contains four identical 128 amino acid subunits that each has a single biotin binding domain. Avidin is a basic protein with an isoelectric pH of 10-10.5 and is readily soluble in aqueous buffers containing a wide range of salt, pH (2-11), temperature and other laboratory agents. This wide range of tolerance makes avidin suitable for a wide variety of analytical applications. Avidin has extraordinary binding affinity for biotin ($Ka=10^{15}M^{-1}$).

The avidin in covalently coupled to the agarose resulting in minimal leaching and is stable over pH2-11.

The Avidin Resin is designed for the single step small and large scale affinity purification of proteins and antibodies with a biotin tag. The resin can also be used for immunoprecipitations using biotin labeled antibodies. Supplied as a 50% resin slurry.

Specific Binding and Elution Buffers are also available.

FEATURES

- Avidin covalently coupled to ~6% cross linked agarose
- Minimal Leaching
- Binding capacity 15-20µg biotin/ml resin

APPLICATIONS

- Immunoprecipitation with biotinylated antibodies
- Pull down assays with biotinylated proteins
- Purification of biotinylated molecules, including proteins, antibodies, DNA and carbohydrates

CITED REFERENCES

1. *Wang, Y. et al (2014) ACS Chem. Biol. 9:635–642*

Cat. No.	Description	Size
786-593	Immobilized Avidin Resin	5ml resin
786-594	Immobilized Avidin Resin	25ml Resin

Monomeric Avidin Resin

0offers a distinct advantage over native avidin, a tetrameric molecule, and streptavidin as it has a much lower biotin binding affinity, $Kd=10^{-7}$ as opposed to $Kd=10^{-15}$ for native avidin. This lower binding affinity allows elution of molecules with mild elution buffers (2mM D-Biotin in 1X PBS), as opposed to the strong denaturing buffers (8M Guanidine•HCl, pH 1.5) used with native avidin.

The covalent attachment of monomeric avidin ensures no detectable leaching of the avidin during biotin purification and offers a wide tolerance to chemicals. This ensures the resin can be reused at least 10 times with no loss of function.

Available as a 50% resin slurry or as a complete kit containing a reusable monomeric avidin column and the respective buffers for successful purification of biotinylated molecules.

FEATURES

- 6% cross linked agarose.
- Minimal Leaching
- Binding capacity 1.2mg biotinylated BSA/ml resin
- Non Denaturing: Elute biotinylated molecules with free biotin
- Reusable: Reuse the resin at least 10 times (2.5% loss of binding/regeneration)
- Specific: Retains avidins high specificity for biotin molecules

Cat. No.	Description	Size
786-595	Immobilized Monomeric Avidin	5ml resin
786-596	Immobilized Monomeric Avidin	10ml resin
786-597	Immobilized Monomeric Avidin	Kit

CBP-Tagged Protein Purification

Calmodulin Resin

Calmodulin Resin for the affinity purification of calmodulin binding proteins (CBP), including recombinant proteins with a CBP tag and calmodulin-regulated proteins in eukaryotic cells. The resin is 4% agarose coupled to calmodulin and has a ligand density of approximately 1mg calmodulin/ml resin.

The Calmodulin Resin is available as resin alone or supplied in a kit format containing 5ml resin, 100ml Calmodulin Binding/Wash Buffer (50mM Tris-HCl (pH7.5), 200mM NaCl, 2mM $CaCl_2$), 100ml Calmodulin Elution Buffer (50mM Tris-HCl (pH7.5), 200mM NaCl, 2mM EGTA), 5 empty 1ml spin columns and 5 empty <5ml gravity flow columns. The buffers are also available separately.

FEATURES

- For the purification of calmodulin binding proteins
- Binds CBP tagged recombinant proteins
- High capacity: ~1-3mg/ml
- Bead size: 50-160µm
- Bead Structure: 4% highly cross-linked agarose
- Ligand density: 0.9-1.2mg calmodulin/ml resin

APPLICATIONS

- Affinity purification of proteins with a calmodulin binding protein (CBP) motif.

Cat. No.	Description	Size
786-282	Calmodulin Resin	10ml resin
786-552	Calmodulin Resin Kit	1
786-546	Calmodulin Binding/ Wash Buffer	100ml
786-547	Calmodulin Elution Buffer	100ml

C-Reactive Protein Purification

Immobilized p-Aminophenyl Phosphoryl Choline

Immobilized p-Aminophenyl Phosphoryl Choline consists of a phosphoryl choline covalently linked to beaded agarose and is designed for the purification of C-reactive protein from plasma, ascites and other biological fluids.

CRP, C-reactive protein, is a pentameric protein found in the blood, the levels of which rise in response to inflammation, making CRP an acute-phase protein. Its physiological role is to bind to phosphocholine expressed on the surface of dead or dying cells (and some types of bacteria) in order to activate the complement system.

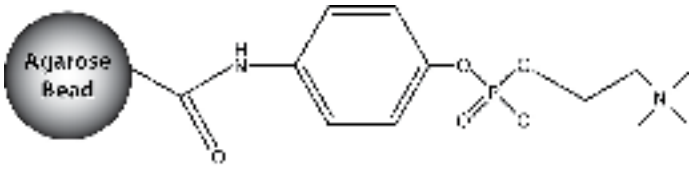


Figure 13: Immobilized Aminophenyl Phosphoryl structure

FEATURES

- Uses a phosphorylated protein binding spin column
- Ligand: p-aminophenyl phosphoryl choline
- Support: 6% crosslinked agarose
- Binding Capacity: >3mg human CRP/ml resin
- Reusable

Cat. No.	Description	Size
786-821	Immobilized p-Aminophenyl Phosphoryl Choline	1ml

GST-Tagged Protein Purification

Glutathione Resin

For the isolation of GST recombinant proteins

Designed for the affinity purification of proteins with a glutathione S-transferase (GST) tag. The resin consists of reduced glutathione (GSH) covalently coupled to 4% cross-linked agarose, via a 10-carbon spacer arm. The resin has a binding capacity of ~40mg GST/ml resin. Supplied as slurry in 20% ethanol.

Glutathione Resin is available as resin alone or supplied in a kit format. Binding/ Wash and Elution buffers are available, in addition to reduced glutathione for elution.

The spin columns are supplied with a resin bed volume of 0.2, 1 and 3ml with total column volumes of 1, 8 and 22ml respectively. Columns can be used as a spin format of gravity flow columns. A 96-well plate format is also available

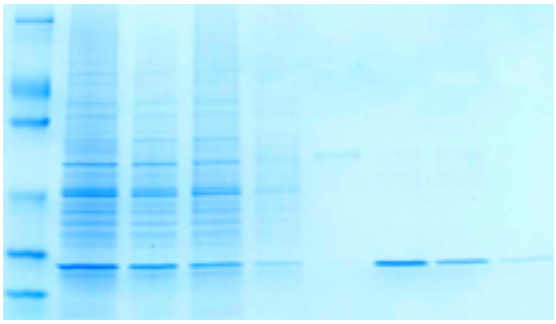


Figure 14: Bacteria expressing a GST-tagged protein were lysed with Bacterial PE-LB™ and the recombinant protein was purified with HOOK™ GST Protein Spin Purification kit. Lane 1: PAGEmark™ protein ladder; 2: Cleared lysate; 3: Flow through; 4-6: Washes; 7-9: Elutions.

FEATURES

- High capacity (~40mg/ml)
- Bead size: 50-160µm
- Bead structure: 4% cross-linked agarose
- 10 carbon spacer arm

CITED REFERENCES

1. *Sanyal, S.K. et al (2016) Plant Sci. 254:28*
2. *Thomas, L.L. and Fromme, J.C. (2016) J. Cell Biol. DOI: 10.1083/jcb.201608123*
3. *Zhang, M. et al (2015) Oncol Lett. http://dx.doi.org/10.3892/ol.2015.3424*
4. *Richardson, B.C. and Fromme, J.C. (2015) Meth. Cell Biol. doi:10.1016/bs.mcb.2015.03.020*
5. *Cheerathodi, M. et al (2015) J. Proteome Res. doi:10.1016/j.jprot.2015.04.033*
6. *Wang, P et al (2013) JCB. 202:277*
7. *Saha, M. et al (2012) Biochem. J. 447:159*
8. *Cheerathodi, M. et al (2011) J. Proteome Res. 10:4453*

Cat. No.	Description	Size
786-280	Glutathione Resin	12.5ml resin
786-310	Glutathione Resin	25ml resin
786-311	Glutathione Resin	100ml resin
786-312	Glutathione Resin	500ml resin
786-714	Glutathione Resin, 0.2ml Spin Column	25 columns
786-715	Glutathione Resin, 1ml Spin Column	5 columns
786-716	Glutathione Resin, 3ml Spin Column	5 columns
786-993	Glutathione Resin Spin Plates	2 plates
786-540	GST Binding/ Wash Buffer	100ml
786-541	GST Elution Buffer	100ml
786-587	Glutathione, Reduced	1g
786-588	Glutathione, Reduced	5g

Histidine-Tagged Protein Purification

Immobilized metal affinity chromatography resins for 6X His tagged protein purification

A large selection of resins and kits for the isolation of His tagged recombinant proteins are available:

NICKEL CHELATING RESIN

The most commonly used IMAC purification resin for the purification of 6X His recombinant proteins that offers high binding efficiency and low non-specific binding.

COBALT CHELATING RESIN

Growing increasingly popular due to its advantage over Nickel Chelating Resin. Although 6X His recombinant proteins bind with a slightly lower efficiency compared to Nickel Chelating Resin there is a significant reduction in non-specific binding. Cobalt resins have a higher selectivity for poly-His sequences, however have a low loading capacity, therefore Cobalt Chelating Resin should be used for valuable recombinant proteins in limited quantities.

ZINC CHELATING RESIN

For the purification of zinc binding and 6X His tagged proteins.

COPPER CHELATING RESIN

For the purification of copper binding pand 6X His tagged proteins.

Cobalt has the highest selectivity of the resins followed by Zinc, Nickel then Copper, but has the lowest loading capacity. Copper has the highest loading capacity, followed by Nickel then Zinc.

Ni IDA Agarose Fast Flow

G-Sep™ Ni IDA Agarose Fast Flow (FF) resin is nickel ions immobilized onto highly cross-linked 6% agarose beads using iminodiacetic acid groups (IDA). The G-Sep™ IDA Agarose Fast Flow (FF) resins have high chemical stability, allowing well proven cleaning-in-place (CIP) and sanitization protocols. Supplied as our G-Sep™ resin or G-Trap™ 1 and 5ml FPLC columns.

FEATURES

- Matrix: Cross-linked agarose beads, 6%
- Bead form: Spherical, diameter 50-160µm
- Spacer: Epichlorohydrin
- Chelating Agent: Iminodiacetic acid
- Active group: Ni^{2+}
- Ni^{2+} density: 20-40µmol /ml
- Binding Capacity: 5-10mg His-tagged protein/ml medium
- pH stability Working Range: 3-12
- pH stability Cleaning-in-Place (CIP): 2-14
- Maximum Flow Velocity: 450cm/h
- Exclusion limit (globular proteins): 4 x 10^6
- Physical Stability: Negligible volume variation due to changes in pH or ionic strength
- Chemical Stability: Stable to all commonly used aqueous buffers, 6M urea & 8M guanidine hydrochloride
- Autoclavable: 121°C, pH 7, for 30 min
- Storage Conditions: 2 to 8°C, 20% Ethanol

Cat. No.	Description	Size
786-973	G-Sep™ Ni IDA Agarose Fast Flow	5ml resin
786-974	G-Sep™ Ni IDA Agarose Fast Flow	25ml resin
786-975	G-Sep™ Ni IDA Agarose Fast Flow	100ml resin
786-976	G-Sep™ Ni IDA Agarose Fast Flow	500ml resin
786-1021	G-Trap™ Ni IDA Agarose Fast Flow	5 x 1ml columns
786-1022	G-Trap™ Ni IDA Agarose Fast Flow	5 x 5ml column

Affinity Purification Resins

Nickel IDA Resin

Immobilized metal affinity chromatography (IMAC) resin utilizing nickel (Ni^{2+}) for 6X histidine tagged protein purification.

This resin binds to six histidine residues (6X His), a common tag used in protein purification. The resin consists of iminodiacetate (IDA) coupled to 6% cross-linked agarose beads. The iminodiacetate binds divalent nickel ion with a capacity of 20-40µmoles Ni^{2+}/ml resin.

The Nickel Chelating Resins are supplied as resin or in prepackaged spin columns. Spin columns with resin bed volumes of 0.2, 1 and 3ml are available. The total column volumes are 1, 8 and 22ml respectively.

FEATURES

- For the purification of 6X His proteins
- High capacity: >50mg/ml
- Ligand density: 20-40µmoles Ni^{2+}/ml resin
- Bead Structure: 6% cross-linked agarose

CITED REFERENCES

1. *Gagnon, J. A. et al (2014) PLOS. DOI: 10.1371/journal.pone.0098186*
2. *Rajput, R. and Gupta, R. (2014) Ann. Microbiol. 64:1257*
3. *Rajput, R. et al (2013) Extremophiles. 17:29*
4. *Bruni, R. and Kloss, B. (2013) Curr. Prot. Prot. Sci. 74:29.6:29.6.1–29.6.34*
5. *Azizi, A. et al (2012) Appl. Envir. Microbiol. 78:2638*
6. *Shukla, S. et al (2011) Eukaryot Cell 10:1357*
7. *Topp, S. et al (2008) RNA 14:2498*

Cat. No.	Description	Size
786-281	Nickel Chelating Resin	10ml resin
786-407	Nickel Chelating Resin	100ml resin
786-408	Nickel Chelating Resin	500ml resin
786-429	Nickel Chelating Resin	2 x 500ml resin
786-392	Nickel Chelating Resin, 0.2ml Spin Column	25 columns
786-393	Nickel Chelating Resin, 1ml Spin Column	5 columns
786-394	Nickel Chelating Resin, 3ml Spin Column	5 columns

Ni IDA Agarose Fast Flow

G-Sep™ NI NTA Agarose Fast Flow (FF) resin is nickel ions immobilized onto highly cross-linked 6% agarose beads. The G-Sep™ NTA Agarose Fast Flow (FF) resins have high chemical stability, allowing well proven cleaning-in-place (CIP) and sanitization protocols. G-Sep™ Ni NTA Agarose Fast Flow (FF) resin using cobalt is also available. For G-Trap™ FPLC column specifications see G-Trap™ section.

FEATURES

- Matrix: Cross-linked agarose beads, 6%
- Bead form: Spherical, diameter 50-160µm
- Spacer: Epichlorohydrin
- Chelating Agent: nitrilotriacetic acid (NTA)
- pH stability Working Range: 3-12
- pH stability Cleaning-in-Place (CIP): 2-14
- Maximum Flow Velocity: 450cm/h
- Exclusion limit(globular proteins): 4 x 106
- Physical Stability: Negligible volume variation due to changes in pH or ionic strength
- Chemical Stability: Stable to all commonly used aqueous buffers: 6M urea, 8M guanidine hydrochloride,
- Autoclavable: 121°C, pH 7, for 30 min
- Storage Conditions: 2 to 8°C, 20% Ethanol

Cat. No.	Description	Size
786-1040	G-Sep™ Ni NTA Agarose Fast Flow	5ml
786-1041	G-Sep™ Ni NTA Agarose Fast Flow	25ml
786-1042	G-Sep™ Ni NTA Agarose Fast Flow	100ml
786-1043	G-Sep™ Ni NTA Agarose Fast Flow	500ml

Nickel NTA Resin

The Ni-NTA resin can be used to purify 6X His tagged proteins under native and denaturing conditions. Proteins bound to the resin can be eluted with low pH buffer or competition with imidazole or histidine.

The Ni-NTA resin uses nitrilotriacetic acid (NTA), a tetradenate chelating ligand, in a highly cross-linked 6% agarose matrix. The NTA binds Ni^{2+} ions by four coordination sites.

This resin has a capacity of 20-40µmoles Ni^{2+}/ml resin. The protein binding capacity is >50mg protein per ml resin. We have demonstrated binding of >100mg of a 50kDa 6XHis tagged proteins to a ml of resin.

The spin columns are supplied with a resin bed volume of 0.2, 1 and 3ml with total column volumes of 1, 8 and 22ml respectively. Columns can be used as a spin format or gravity flow columns.

FEATURES

- Uses nitrilotriacetic acid (NTA), a tetradenate chelating ligand
- For the purification of 6x His proteins
- High capacity: >50mg/ml
- Ligand density: 20-40µmoles Ni^{2+} /ml resin
- Bead Structure: 6% cross-linked agarose

CITED REFERENCES

1. *Tripathi, S. et al (2016) J. Neurochem. DOI: 10.1111/jnc.13879*
2. *Anand, G. et al (2016) Sci Rep. 6: 29185.*
3. *Kaur, G. et al (2015) J. Biopen. 2:9*
4. *Kaur, G. et al (2015) PLOS. DOI: 10.1371/journal.pone.0136692*

Cat. No.	Description	Size
786-939	Ni-NTA Resin	10ml Resin
786-940	Ni-NTA Resin	100ml Resin
786-941	Ni-NTA Resin	500ml Resin
786-942	Ni-NTA Resin	2 x 500ml Resin
786-943	Ni-NTA Resin, 0.2ml Spin Column	25 columns
786-944	Ni-NTA Resin, 1ml Spin Column	5 columns
786-945	Ni-NTA Resin, 3ml Spin Column	5 columns
786-994	NI-NTA Spin Plates	2 Plates

Ni-NTA Magnetic Beads

G-Biosciences' Nickel NTA Magnetic Beads are 3µm beads designed for the rapid purification of 6x His-tagged proteins. Nickel NTA Magnetic Beads have nitrilotriacetic acid (NTA) groups with charged nickel covalently bound to the surface dextran of the beads. Due to the high affinity, Nickel NTA Magnetic Beads can be used for capturing 6xHis-tagged proteins.

Bound 6xHis-tagged proteins can be temporarily immobilized under magnetic attraction, so non-tagged proteins in the supernatant can be removed easily and efficiently. Bound proteins can be directly used in downstream applications or be eluted off the beads. The capacity of purified 6xHis-tagged proteins (~35kDa) captured by G-Biosciences' Nickel NTA Magnetic Beads is ≈5 mg/ml.

FEATURES

- Uses nitrilotriacetic acid (NTA), a tetradenate chelating ligand
- Covalently bound to the surface dextran
- Fe_3O_4 beads coated with dextran
- Average 3µm in diameter
- Supplied in 20% ethanol

Cat. No.	Description	Size
786-910	Ni-NTA Magnetic Beads	1ml
786-911	Ni-NTA Magnetic Beads	5ml

Affinity Purification Resins

Co IDA Agarose Fast Flow

Cobalt ions immobilized onto highly cross-linked 6% agarose beads using iminodiacetic acid groups (IDA). The G-Sep™ IDA Agarose Fast Flow (FF) resins have high chemical stability, allowing well proven cleaning-in-place (CIP) and sanitization protocols. Supplied as our G-Sep™ resin or G-Trap™ 1 and 5ml FPLC columns.

FEATURES

- Matrix: Cross-linked agarose beads, 6%
- Bead form: Spherical, diameter 50-160µm
- Spacer: Epichlorohydrin
- Chelating Agent: Iminodiacetic acid
- Active group: Co^{2+}
- Co^{2+} density: 20-40µmol /ml
- Binding Capacity: 5-10mg His-tagged protein/ml medium
- pH stability Working Range: 3-12
- pH stability Cleaning-in-Place (CIP): 2-14
- Maximum Flow Velocity: 450cm/h
- Exclusion limit (globular proteins): 4×10^6
- Physical Stability: Negligible volume variation due to changes in pH or ionic strength
- Chemical Stability: Stable to all commonly used aqueous buffers, 6M urea & 8M guanidine hydrochloride
- Autoclavable: 121°C, pH 7, for 30 min
- Storage Conditions: 2 to 8°C, 20% Ethanol

Cat. No.	Description	Size
786-977	G-Sep™ Co IDA Agarose Fast Flow	5ml
786-978	G-Sep™ Co IDA Agarose Fast Flow	25ml
786-979	G-Sep™ Co IDA Agarose Fast Flow	100ml
786-980	G-Sep™ Co IDA Agarose Fast Flow	500ml
786-1019	G-Trap™ Co IDA Agarose Fast Flow	5 x 1ml columns
786-1020	G-Trap™ Co IDA Agarose Fast Flow	5 x 5ml columns

Cobalt IDA Resin

Specifically designed for the purification of proteins that associate with Cobalt ions, including 6X histidine tagged proteins. Although 6X His tagged proteins bind with a slightly lower efficiency compared to Nickel Chelating Resin there is a significant reduction in non-specific binding. Cobalt resins have a higher selectivity for poly-His sequences, however have a low loading capacity, therefore it is ideal for valuable recombinant proteins in limited quantities.

The resin consists of iminodiacetate coupled to 6% cross-linked agarose beads, which binds cobalt ion with a capacity of 20-40µmoles Co^{2+}/ml resin. Protein binding capacity is >50mg protein per ml resin.

Supplied as a 50% slurry or in prepackaged spin columns. Spin columns with resin bed volumes of 0.2, 1 and 3ml are available. The total column volumes are 1, 8 and 22ml respectively.

FEATURES

- High capacity: >50mg/ml
- Ligand density: 20-40µmoles Co^{2+}/ml resin
- Bead Structure: 6% cross-linked agarose

CITED REFERENCES

1. *Ma, H. and O'Kennedy, R. (2013) Methods. doi.org/10.1016/j.ymeth.2016.11.008*

Cat. No.	Description	Size
786-286	Cobalt Chelating Resin	10ml resin
786-402	Cobalt Chelating Resin	100ml resin
786-403	Cobalt Chelating Resin	500ml resin
786-600	Cobalt Chelating Resin	2 x 500ml resin
786-454	Cobalt Chelating Resin, 0.2ml Spin Column	25 columns
786-455	Cobalt Chelating Resin, 1ml Spin Column	5 columns
786-456	Cobalt Chelating Resin, 3ml Spin Column	5 columns

Cobalt NTA Resin

The Co-NTA resin can be used to purify 6X His tagged proteins under native and denaturing conditions. Proteins bound to the resin can be eluted with low pH buffer or competition with imidazole or histidine. The resin is high affinity and selectivity for recombinant fusion proteins that are tagged with six tandem histidine residues. Although 6X His tagged proteins bind with a lower efficiency compared to nickel chelating resins there is a significant reduction in non-specific binding.

The Co-NTA resin uses nitrilotriacetic acid (NTA), a tetradenate chelating ligand, in a highly cross-linked 6% agarose matrix. The NTA binds Co^{2+} ions by four coordination sites.

This resin has a capacity of 20-40µmoles Co^{2+}/ml resin. The protein binding capacity is >50mg protein per ml resin. We have demonstrated binding of >100mg of a 50kDa 6XHis tagged proteins to a ml of resin.

The spin columns are supplied with a resin bed volume of 0.2, 1 and 3ml with total column volumes of 1, 8 and 22ml respectively. Columns can be used as a spin format or gravity flow columns.

FEATURES

- Uses nitrilotriacetic acid (NTA), a tetradenate chelating ligand
- High capacity: >50mg/ml
- Ligand density: 20-40µmoles Co^{2+} /ml resin
- Bead Structure: 6% cross-linked agarose

Cat. No.	Description	Size
786-932	Co-NTA Resin	10ml Resin
786-933	Co-NTA Resin	100ml Resin
786-934	Co-NTA Resin	500ml Resin
786-935	Co-NTA Resin	2 x 500ml Resin
786-936	Co-NTA Resin, 0.2ml Spin Column	25 columns
786-937	Co-NTA Resin, 1ml Spin Column	5 columns
786-938	Co-NTA Resin, 3ml Spin Column	5 columns

Copper Chelating Resin
Zinc Chelating Resin

For the isolation of 6X His recombinant proteins

Specifically designed for the purification of proteins that associate with copper or zinc ions, including 6X histidine tagged proteins.

The resin consists of iminodiacetate coupled to 6% cross-linked agarose beads, which binds divalent copper ion with a capacity of 20-40µmoles Cu^{2+} or Zn^{2+}/ml resin. The protein binding capacity is >50mg protein per ml resin.

FEATURES

- Purification of copper or zinc binding proteins, including 6x His proteins
- High capacity: >50mg/ml
- Ligand density: 20-40µmoles Cu^{2+} or Zn^{2+}/ml resin
- Bead Structure: 6% cross-linked agarose

CITED REFERENCES

1. *Ma, H. and O'Kennedy, R. (2013) Recombinant antibody fragment production, Methods. doi.org/10.1016/j.ymeth.2016.11.008*
2. *Stohl, E. A. et al (2015) J Bacteriol. DOI: 10.1128/JB.00540-15*
3. *Kohler, P.L. et al (2013) J. Baceriol. 195:1666*

Cat. No.	Description	Size
786-285	Copper Chelating Resin	10ml resin
786-287	Zinc Chelating Resin	10ml resin

Immobilized Heparin

Immobilized Heparin is a ready-to-use purification resin for a wide range of proteins. The resin consists of 4% cross-linked agarose covalently coupled to heparin through amide bonds. The coupling chemistry used generates a highly stable purification resin that is stable most commonly used buffers and denaturants.

Heparin is a linear glycosaminoglycan composed of equimolar quantites of glucosamine and glucuronic acid, alternatively linked by α(1→4) glycosidic bonds. A number of its hydroxyl groups are esterified with sulfuric acid moieties and the molecule has a single reducing sugar terminus.

Due to its structure and biochemical role, Heparin is able to bind a number of proteins, enzymes and polycationic organic compounds. The binding is either ionically or more specific protein-ligand or enzyme-inhibitor (or enzyme-activator) interactions.

Several classes of proteins can bind to heparin, including:

- Coagulation Factors: ATIII, Factors IX, VII, XI, XII and XIIa
- Lipoprotein Lipases: By ionic interactions
- Lipoproteins: LDL, VLDL, VLDL apoprotein, HDL
- Growth Hormones
- Growth Factors: FGF, ECGF
- DNA- & RNA- Related Enzymes
- Enzymes: Collagenase, hyaluronidase, lysozyme, proteases

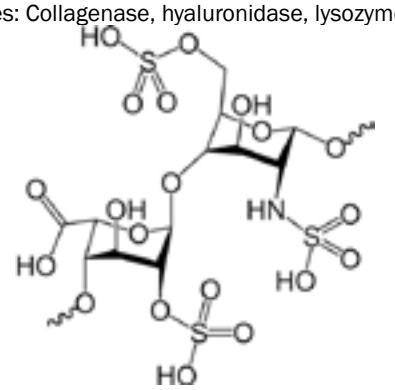


Figure 15: Heparin structure

Cat. No.	Description	Size
786-842	Immobilized Heparin	5ml

Immobilized Lectins

Immobilized Jacalin

Ideal for IgA purification

Jacalin, or *Artocarpus integrifolia* lectin, is a tetrameric two-chain lectin with a molecular weight of 66kDa. Jacalin is a α-D-galactose binding lectin purified from jack-fruit (*Artocarpus integrifolia*) seeds. Applications include isolating IgA from human serum and colostrums, isolating human plasma glycoproteins and histochemistry. Jacalin also binds IgD.

FEATURES

- Binding Capacity: 1-3mg human IgA/ml resin
- Loading: ≈4.5mg jacalin/ml of resin
- Support: 6% cross-linked agarose

APPLICATIONS

- Preparing Human IgA free of contaminating IgG

CITED REFERENCES

1. Lu, L. et al (2013) Int. J. Biochem. Cell biol. 45:2530

Cat. No.	Description	Size
786-167	Immobilized Jacalin	2ml resin

Jacalin, Lyophilized

Jacalin, or *Artocarpus integrifolia* lectin, is also available as a lyophilized protein.

Cat. No.	Description	Size
786-473	Jacalin, lyophilized	10mg

Concanavalin A (Con A) Agarose

Concanavalin A (Con A) Agarose consists of Con A coupled to 4% agarose by the cyanogen bromide method. Con A is a tetrameric metalloprotein lectin isolated from Canavalia ensiformis (jack bean).

Con A is used for the purification of glycoproteins, polysaccharides and glycolipids as it binds molecules containing α-D-mannopyranosyl, α-D-glucopyranosyl and sterically related residues. Con A agarose has also be used in other application areas including purification of enzyme-antibody conjugates, purification of IgM and separation of membrane vesicles.

As stated above, Con A is a metalloprotein and to maintain its binding characteristics the presence of both Mn^{2+} and Ca^{2+} is essential. Each subunit of Con A utilizes one calcium and one manganese ion and these cations can be removed under acidic conditions abolishing the carbohydrate-binding activity.

FEATURES

- Binds α-D-mannopyranosyl, α-D-glucopyranosyl and sterically related residues
- Ligand Density: 10-16mg Con A/ml resin
- Capacity: 20-50mg thyroglobulin/ml resin
- Bead structure: 4% agarose

APPLICATIONS

- Purification/ enrichment of of glycoproteins, polysaccharides and glycolipids

Cat. No.	Description	Size
786-208	Concanavalin A (Con A) Agarose	10 x 0.75ml columns
786-216	Concanavalin A (Con A) Agarose	5ml resin
786-217	Concanavalin A (Con A) Agarose	25ml resin
786-218	Concanavalin A (Con A) Agarose	100ml resin

Lectin Purification

Immobilized D-Galactose

Purify lectins and galactose binding molecules

Designed for the rapid purification of lectins, galactosidases and other galactose-binding molecules. Ideal for the purification of agglutinins, lectins, toxins, glactose-binding, N-acetylgalactosamine-binding or carbohydrate binding molecules.

Immobilized D-Galactose consists of agarose covalently coupled to D-galactose.

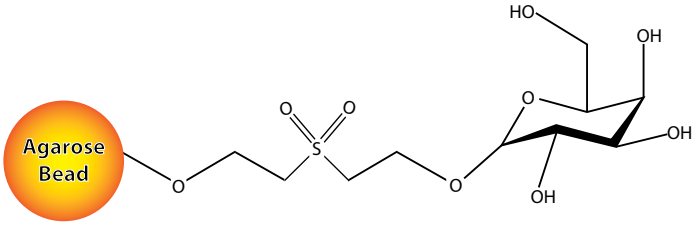


Figure 16: Immobilized D-Galactose structure.

FEATURES

- Ligand: Thio-α-D-galactose
- Binding Capacity: >20mg Jacalin/ml resin

APPLICATIONS

- Purification of Lectins
- Purification of galactosidases
- Purification of endotoxins
- Purification of other galactose-, N-acetylgalactosamine- or carbohydrate binding molecules

Cat. No.	Description	Size
786-391	Immobilized D-Galactose	5ml resin

Nucleic Acid Purification

Immobilized Boronic Acid

Isolation of ribonucleotide and oligonucleotide RNA

The resin consists of boronic acid covalently linked to a polyacrylamide support that offers simple isolation of small molecular weight compounds that have cis-diol groups.

Mechanism: The boronic acid interacts with the cis-diol groups, found in the sugar portion of nucleotides, forming a reversible five member ring complex. Impurities are washed away and then the complex dissociated by low pH or presence of sorbitol.

The polyacrylamide support excludes >6000 Da molecules from entering the resin bed and therefore is suitable only for small molecules..

FEATURES

- Polyacrylamide gel
- >1.2meq/g boronate load capacity
- >130µmol sorbitol/ml gel binding capacity
- 6,000Da exclusion limit
- 45-90µm wet bead size

Cat. No.	Description	Size
786-314	Boronate Resin (Dry Beads)	5g
786-315	Boronate Resin (Dry Beads)	50g
786-317	Boronate Resin (Dry Beads)	100g
786-313	Boronate Resin (Suspension)	10ml resin
786-823	Boronate Resin (Suspension)	2ml resin

Silica Magnetic Beads

Isolation of ribonucleotide and oligonucleotide RNA

G-Biosciences Silica Magnetic Beads are Fe_3O_4 magnetic beads coated with a silicon dioxide (SiO_2) layer. Since silica is able to bind to the nucleic acids, G-Biosciences Silica Magnetic Beads serve as a simple and efficient tool for plasmid DNA purification for transfection or sequencing applications, genomic DNA purification for research or clinical applications, RNA purification for qPCR analysis, or PCR product clean-up for downstream analysis.

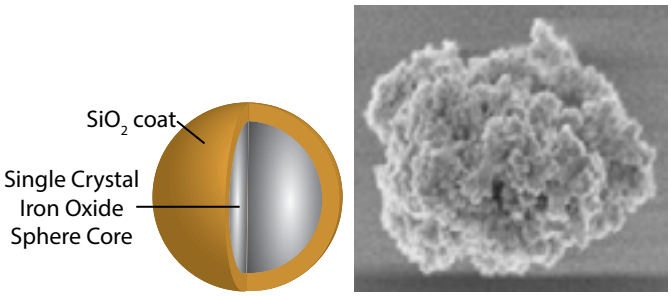


Figure 17: Silica Magnetic Bead representaiton and TEM image.

FEATURES

- Capacity: >4mg DNA/ml beads
- 2.5-4.5µm particle size
- Simple, short procedure
- No costly columns required
- No time consuming centrifugations required

APPLICATIONS

- plasmid DNA isolation
- genomic DNA isolation
- RNA purifcation for qPCR
- PCR product clean up

Cat. No.	Description	Size
786-915	Silica Magnetic Beads	5ml resin
786-916	Silica Magnetic Beads	25ml resin
786-917	Silica Magnetic Beads	100ml resin

Protease Purification Resins

Immobilized Soybean Trypsin Inhibitor

Immobilized Soybean Trypsin Inhibitor (STI) resin is designed for the efficient removal of trypsin, chymotrypsin and elastase proteases from protein digests. The action of the Immobilized STI resin will stop enzymatic reactions, in addition to removing the proteases and simplifying the analysis of the digested peptides.

The resin consists of the 20kDa Soybean Trypsin Inhibitor covalently coupled to agarose resin. The resin can be reused up to 10 times without significant loss in activity.

FEATURES

- Binding Capacity: >6mg trypsin/ml resin
- Support: 4% Agarose
- Ligand: Soybean Trypsin Inhibitor

APPLICATIONS

- Eliminating trypsin from protein digests
- Purification of trypsin, elastase and chymotrypsin

Cat. No.	Description	Size
786-843	Immobilized Soybean Trypsin Inhibitor	2ml resin

ρ-Aminobenzamidine Agarose

ρ-Aminobenzamidine Agarose primary application is for the removal and/or purification of trypsin-like proteases. ρ-aminobenzamidine (PAB) is a synthetic inhibitor of trypsin-like proteases and has been covalently coupled to 6% cross-linked agarose.

For recombinant protein purification, the ρ-Aminobenzamidine Agarose can be used to remove the serine proteases (thrombin and enterokinase) that are used for cleavage of recombinant protein purification tags.

The ρ-Aminobenzamidine Agarose also contains a 6- carbon spacer arm between the ρ-Aminobenzamidine group and the agarose beads, making it suitable for coupling of small proteins and peptides. The long spacer arm minimizes steric hindrance allowing high efficient binding of ligands, including small proteins and peptides.

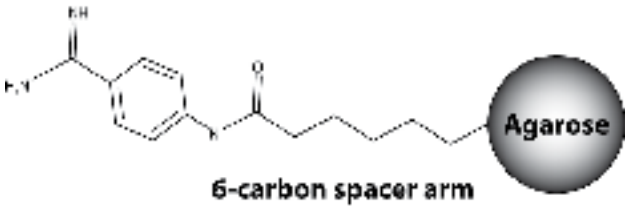


Figure 18: ρ-Aminobenzamidine Agarose structure

FEATURES

- 90µm mean particle size
- 45-165µm particle size range
- Spherical, highly cross-linked 6% agarose
- 8-14mg trypsin/ml drained resin binding capacity
- 8µmol ρ-aminobenzamidine/ml drained resin ligand density
- 3-13 pH stability

APPLICATIONS

- Removal and purification of trypsin, trypsin-like serine proteases.
- Removal and purification of zymogens, incldluing urokinase and prekallikrein.
- Removal of thrombin and factor Xa have cleavage of tags from recombinant proteins

Cat. No.	Description	Size
786-692	ρ-Aminobenzamidine Agarose	25ml resin

Immobilized Protease Resins

Immobilized Trypsin

Immobilized Trypsin is TPCK Treated Trypsin immobilized on 4% agarose that eliminates the contamination of protein digests by the trypsin. The immobilized trypsin is readily removed by separating the agarose from the digestion solution. Trypsin is a serine endopeptidase that specifically cleaves peptide bonds on the carboxy side of s-aminoethyl cysteine, arginine and lysine residues and typically there is little or no cleavage at arginyl-proline and lysyl-proline bonds. The distribution of these residues in proteins allows trypsin digestion to produce peptides that are readily identified by mass spectrometry. The Trypsin is TPCK treated to inactive the interfering chymotrypsin activity and the resulting protein is affinity purified. Immobilzed Trypsin is supplied as a 50% slurry containing glycerol and sodium azide as a preservative.

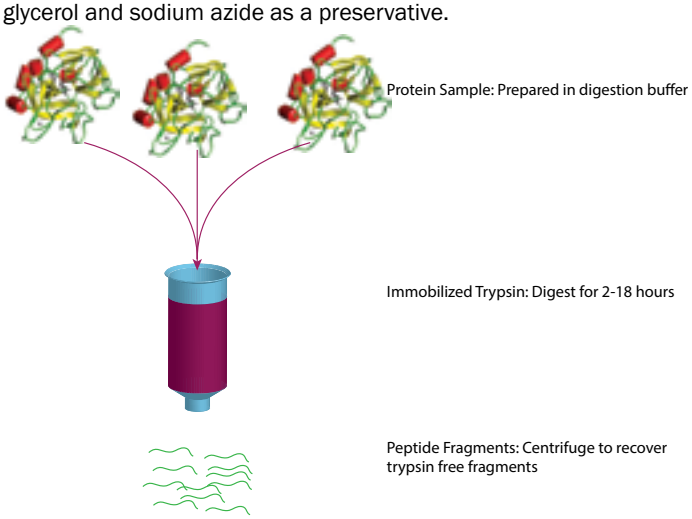


Figure 19: Immobilized Trypsin Scheme.

FEATURES

- Eliminate contamination with trypsin
- Source: Bovine
- Activity: ≥200 TAME units/ml resin (1 unit= 1µmole TAME (p-toluenesulfonyl-L-arginine methyl ester) hydrolyzed/min at pH8.2, 25°C)
- Support: 4% Cross-linked Agarose

Cat. No.	Description	Size
786-792	Immobilized Trypsin	2ml Resin

Immobilized Pepstatin

Immobilized Pepstatin is for the purification of cathepsins, pepsin, bacterial aspartic proteases, HIV proteases and other molecules that bind pepstatin.

Pepstatin is isovaleryl-Val-Val-AHMHA-Ala-AHMHA where AHMHA= (3S, 4S)-4-amino-3-hydroxy-6-methyl-heptanoic acid and is a potent inhibitor of various aspartic proteases, including cathepsin D, renin, pepsin, bacterial aspartic proteases and HIV proteases.

The resin consists of 6% beaded agarose that is covalently coupled to pepstatin through a diaminodipropylamine spacer arm and has a binding capacity of 1-2mg pepsin per millimeter of settled resin.

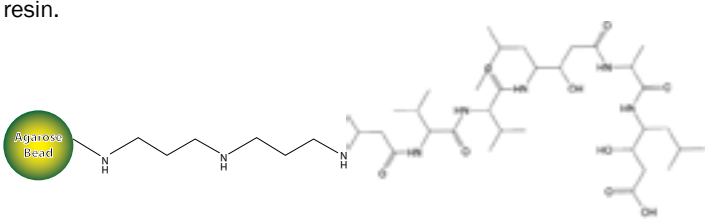


Figure 20: Immobilized Trypsin Scheme.

FEATURES

- Capacity: 1-2mg pepsin/ml resin
- 6% beaded agarose
- Diaminodipropylamine spacer arm

CITED REFERENCES

1. *Bee, J.S. et al (2015) Biotechnol Prog DOI: 10.1002/btpr.2150*

Cat. No.	Description	Size
786-789	Immobilized Pepstatin	5ml resin

Immobilized Papain

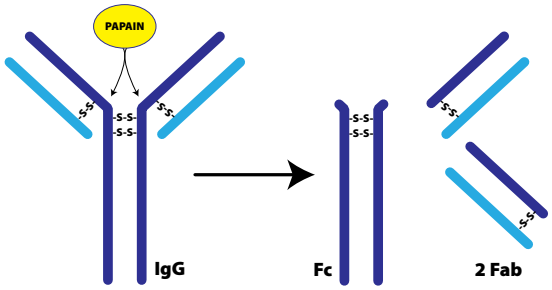


Figure 21: Digestion of Immunglobulin G with Papain.

A cysteine protease enzyme (EC 3.4.22.2) immobilized on 4% agarose, cleaves immunoglobulin G antibody molecules in the hinge region, generating three ~50kDa fragments; two Fab domains and a Fc domain. The papain-digested antibody is unable to promote agglutination, precipitation, opsonization, and lysis.

FEATURES

- Generate Fc and Fab from IgG
- Eliminates contamination with papain enzyme
- Can be used in virtually all scenarios using free papain

CITED REFERENCES

1. *Tolbert, W. D. et al (2016) Structure: 24*

Cat. No.	Description	Size
786-790	Immobilized Papain	5ml Resin

Immobilized Pepsin

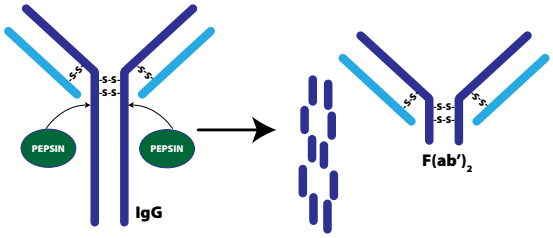


Figure 22: Digestion of Immunglobulin G with Pepsin.

A proteolytic enzyme immobilized on 4% agarose that is routinely used for the generation of $F(ab')_2$ fragments from immunoglobulin G (IgG). The pepsin has the ability to cleave the heavy chains near the hinge region. One or more of the disulfide bonds that join the heavy chains in the hinge region are preserved, so the two Fab regions of the antibody remain joined together, yielding a divalent molecule (containing two antibody binding sites), hence the designation $F(ab)_2$. The light chains remain intact and attached to the heavy chain, whereas the Fc fragment is digested into small peptides.

The Immobilized Pepsin offers the distinct advantage of eliminating enzyme contamination of the $F(ab)_2$ fragments.

FEATURES

- Generate $F(ab)_2$ fragments
- Eliminate contaminating pepsin enzyme
- Can be used in virtually all scenarios using free pepsin

Cat. No.	Description	Size
786-791	Immobilized Pepsin	5ml Resin

Immobilized Ficin

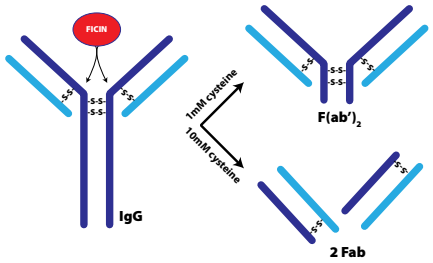


Figure 23: Digestion of Immunglobulin G with Ficin.

Ficin (or Ficain) is a cysteine protease enzyme (EC 3.4.22.3) isolated from fig latex is that has the endopeptidase activity to cleave immunoglobulin G molecules in the hinge region. Ficin is typically used to cleave mouse IgG_1 as this is difficult to cleave with papain and pepsin. In the presence of 1mM or 10mM cysteine, ficin generates $F(ab)_2$ and Fab fragments respectively. Immobilized Ficin is a convenient reagent for producing Fab and $F(ab)_2$ fragments as it avoids the need to remove the ficin enzyme after digestion.

FEATURES

- Generate Fab and $F(ab')_2$ fragments
- For digestion of mouse IgG1
- Eliminates contamination by Ficin

Cat. No.	Description	Size
786-793	Immobilized Ficin	5ml Resin

PROTEIN A, PROTEIN G, PROTEIN A/G

Protein A Magnetic Beads

G-Biosciences' Protein A Magnetic Beads are Fe_3O_4 beads coated with dextran to produce highly uniform, 1µm beads. Recombinant Protein A is covalently coupled to the dextran coat to produce an enhanced alternative to agarose slurries for immunoprecipitation experiments.

The use of Magnetic beads offers several distinct advantages of traditional immunoprecipitation experiments include a significant reduction in time and non-specific protein binding.

A simple protocol involves the addition of your antibody of choice to the beads, which bind the Fc region (See Table 1) during a short incubation. The tube is placed on a magnet and the supernatant is removed by aspiration. The antibody bound magnetic beads can be used in a variety of downstream processes including:

- Immunoprecipitations
- Co-immunoprecipitations
- Chromatin immunoprecipitation (ChIP)
- Small-scale IgG Purification and antibody labeling
- Protein Isolation

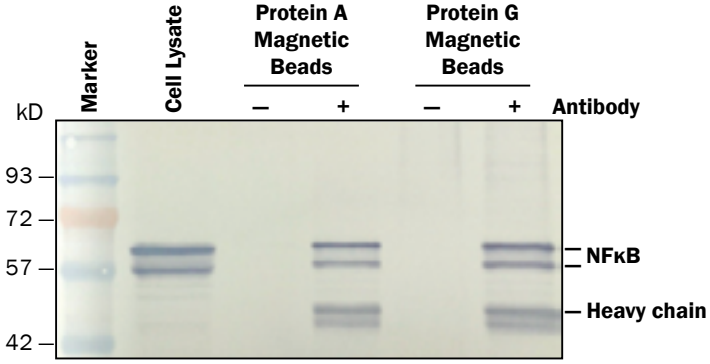


Figure 24: Protein A and G Magnetic Bead Immunoprecipitation of NFκB.

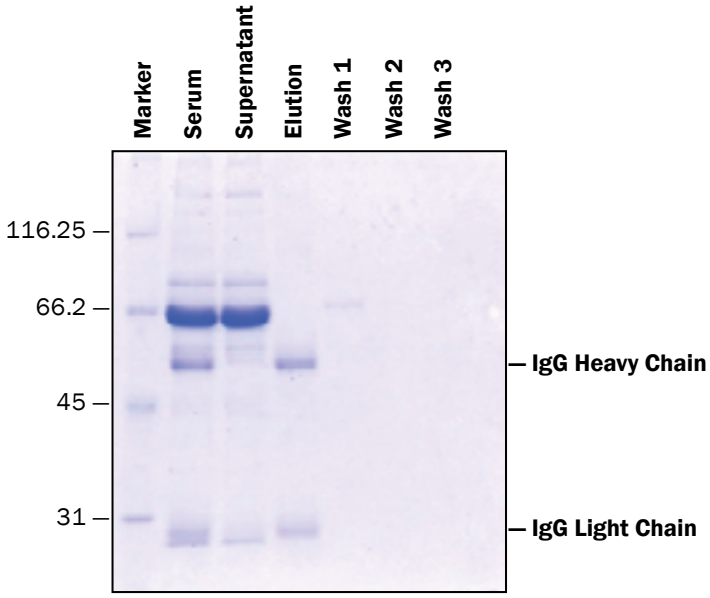


Figure 25: Purification of immunoglobulins with Protein A magnetic beads

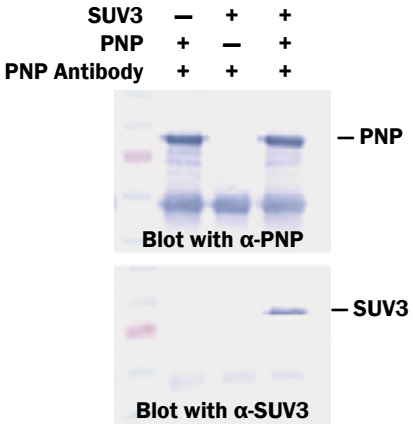


Figure 26: Pulldown assay using Protein A Magnetic Beads

FEATURES

- 1µm beads
- 260µg human IgG/ml
- Significant reduction in background due to non-specific binding
- Simple, short procedure
- No costly columns required
- No time consuming centrifugations required
- Gentle separation preserves native protein interactions

Cat. No.	Description	Size
786-902	Protein A Magnetic Beads	1ml resin
786-903	Protein A Magnetic Beads	5ml resin

Immobilized Protein A

For binding the constant domains of immunoglobulin (Ig) molecules (Table 1). Protein A is coupled to agarose beads by a reductive amination method that provides high coupling efficiency and minimal protein A leaching (<5ng protein A/ml). Immobilized Protein A Resin is available as resin alone, prepacked columns or supplied in 10 x 0.2ml column or 5 x 1ml column kit formats containing columns, wash and elution buffers. A 96 well spin plate format is also available.

FEATURES

- High binding capacity: >40mg human IgG/ml resin
- Ligand: Recombinant Staphylococcal Protein A lacking the albumin-binding domain produced in E. coli
- Bead size: 45-165µm
- Bead Structure: 4% highly cross-linked agarose

CITED REFERENCES

1. *Izawa, T. et al (2016) J Immunol doi:10.4049/jimmunol.1600822*
2. *Yang, Z. et al (2012) J. Neurosci.32:17241*
3. *Schoenherr, J.A. et al (2012) PLOS Genet. DOI: 10.1371/journal.pgen.1002725*
4. *Shi, L. et al (2012) PLOS. DOI: 10.1371/journal.pone.0043091*
5. *Kumari, S. et al (2012) PLOS. DOI: 10.1371/journal.pone.0044126*
6. *Shi, L. et al (2009) J Biol Chem 284:3966*

Cat. No.	Description	Size
786-283	Immobilized Protein A Resin	5ml resin
786-824	Immobilized Protein A Resin	25ml resin
786-827	Immobilized Protein A Resin	10 x 0.2ml columns
786-828	Immobilized Protein A Resin Kit	10 x 0.2ml columns
786-825	Immobilized Protein A Resin	5 x 1ml columns
786-826	Immobilized Protein A Resin Kit	5 x 1ml columns
786-996	Protein A Resin Spin Plate	1 Plate

Antibody Purification Resins

G-Trap™ rProtein A FF

G-Trap™ rProtein A FF are prepacked ready to use columns for purification of IgG antibodies. The column is packed with fast flow resin, which is covalently coupled to recombinant Protein A. Recombinant Protein A is coupled covalently by proprietary coupling method to highly crosslinked 6% agarose.

The recombinant Protein A, produced in E. coli, has been genetically engineered to enhance its binding capacity to the antibodies.

Figure 27: G-Biosciences FPLC Columns

FEATURES

- Mean particle size: 90 µM
- Bead Structure: Highly cross-linked 6% agarose
- Ligand: Recombinant Staphylococcal Protein A from E.coli
- Binding capacity:>40 mg Human IgG/ ml resin
- Recommended working flow rate:1 ml/min and 5 ml/min for 1 ml and 5 ml column respectively.
- Chemical Stability:Stable in all commonly used buffers
- pH stability: Long term: pH 3-9, short term pH 2-9
- Storage: 2°C to 8°C in 20% ethanol

G-Trap™ rProtein A, 1 ml columns

- Column Volume: 1 ml
- Columns Dimension: 0.7 x 2.5 cm
- Column Harware Pressure Limit: 0.5 MPa
- Column Hardware: Polypropylene (Biocompatible)

G-Trap™ rProtein A, 5 ml columns

- Column Volume: 5 ml
- Columns Dimension: 1.6 x 2.5 cm
- Column Harware Pressure Limit: 0.5 MPa
- Column Hardware: Polypropylene (Biocompatible)

Cat. No.	Description	Size
786-1029	G-Trap™ rProtein A FF	5 x 1ml columns
786-1030	G-Trap™ rProtein A FF	1 x 5ml columns
786-1031	G-Trap™ rProtein A FF	2 x 1ml columns
786-1032	G-Trap™ rProtein A FF	5 x 5ml columns

Protein G Magnetic Beads

G-Biosciences' Protein G Magnetic Beads are Fe_3O_4 beads coated with dextran to produce highly uniform, 1µm beads. Recombinant Protein G is covalently coupled to the dextran coat to produce an enhanced alternative to agarose slurries for immunoprecipitation experiments. G-Biosciences magnetic beads compare well to leading magnetic beads.

The use of Magnetic beads offers several distinct advantages of traditional immunoprecipitation experiments include a significant reduction in time and non-specific protein binding.

A simple protocol involves the addition of your antibody of choice to the beads, which bind the Fc region (See Table 1) during a short incubation. The tube is placed on a magnet and the supernatant is removed by aspiration. The antibody bound magnetic beads can be used in a variety of downstream processes including:

- Immunoprecipitations
- Co-immunoprecipitations
- Chromatin immunoprecipitation (ChIP)
- Small-scale IgG Purification and antibody labeling
- Protein Isolation

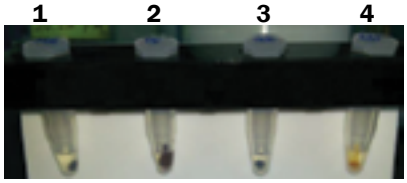


Figure 28: Comparison of G-Biosciences Protein G Magnetic Beads (1) to Life Technologies (2), GE Life Sciences (3) and Millipore (4).

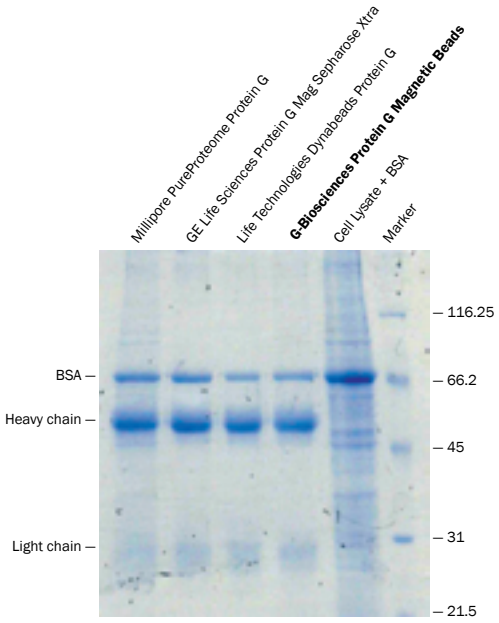


Figure 29: Comparison of G-Biosciences Protein G Magnetic Beads to Life Technologies, GE Life Sciences and Millipore .

FEATURES

- 1µm beads
- 260µg human IgG/ml
- Significant reduction in background due to non-specific binding
- Simple, short procedure
- No costly columns required
- No time consuming centrifugations required
- Gentle separation preserves native protein interactions

Cat. No.	Description	Size
786-904	Protein G Magnetic Beads	1ml resin
786-905	Protein G Magnetic Beads	5ml resin

Immobilized Protein G

For binding the constant domains of immunoglobulin (Ig) molecules (Table 1). Protein G, a bacterial cell wall protein isolated from group G Streptococci, binds to mammalian IgGs mainly through Fc regions. Native protein G has 3 IgG binding domains and also sites for albumin and cell-surface binding. The latter have been eliminated from our recombinant protein G to reduce nonspecific binding. Although protein G has very similar tertiary structures to protein A, their amino acid compositions differ significantly, resulting in different binding characteristics (Table 1). Immobilized Protein G Resin is available as resin alone prepacked columns, including a 96-well plate format or supplied in kit formats containing columns, wash and elution buffers.

FEATURES

- High binding capacity: 38mg human IgG/ml resin; >20mg sheep IgG/ml resin
- Ligand: Recombinant Streptococcal Protein G lacking the albumin-binding domain produced in E. coli
- Bead size: 50-165µm
- Bead Structure: 4% highly cross-linked agarose

CITED REFERENCES

1. *Izawa, T. et al (2016) J Immunol doi:10.4049/jimmunol.1600822*

Cat. No.	Description	Size
786-829	Immobilized Protein G Resin	2ml resin
786-284	Immobilized Protein G Resin	5ml resin
786-830	Immobilized Protein G Resin	10ml resin
786-834	Immobilized Protein G Resin	10 x 0.2ml columns
786-835	Immobilized Protein G Resin Kit	10 x 0.2ml columns
786-832	Immobilized Protein G Resin	5 x 1ml columns
786-833	Immobilized Protein G Resin Kit	5 x 1ml columns
786-997	Protein G Resin Spin Plate	1 Plate

G-Trap™ rProtein A FF

G-Trap™ Protein G are prepacked ready to use columns for affinity purification of Immunoglobulins G. The column is packed with resin, which is covalently coupled to recombinant Protein G.

Recombinant Protein G is coupled covalently by proprietary coupling method to highly crosslinked 6% agarose. The coupling chemistry used shows high coupling efficiency and low Protein G leaching and thus high binding efficiency. The recombinant Protein G, produced in E. coli, has been designed to genetically remove albumin and cell surface binding regions of the protein.

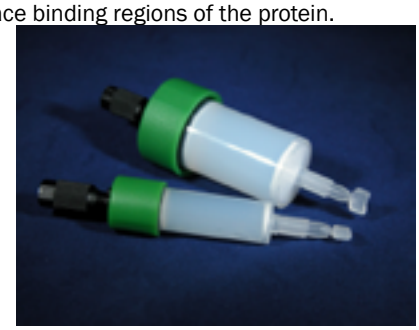


Figure 30: G-Biosciences FPLC Columns

FEATURES

- Mean particle size: 90 µM
- Bead Structure: Highly cross-linked 6% agarose
- Ligand: Recombinant Streptococcal Protein G lacking the albumin binding domain produced in E. coli
- Binding capacity: 38mg human IgG/ml resin ; >20mg sheep IgG/ml resin
- Maximum flow rate: 1000 cm/hr
- Chemical Stability:Stable in all commonly used buffers
- pH stability: Long term: pH 3-9, short term pH 2-9
- Storage: 2°C to 8°C in 20% ethanol

G-Trap™ Protein G, 1 ml columns

- Column Volume: 1 ml
- Columns Dimension: 0.7 x 2.5 cm
- Column Harware Pressure Limit: 0.5 MPa
- Column Hardware: Polypropylene

G-Trap™ Protein G, 5 ml columns

- Column Volume: 5 ml
- Columns Dimension: 1.6 x 2.5 cm
- Column Harware Pressure Limit: 0.5 MPa
- Column Hardware: Polypropylene

Cat. No.	Description	Size
786-1033	G-Trap™ Protein G	5 x 1ml columns
786-1034	G-Trap™ Protein G	1 x 1ml columns
786-1035	G-Trap™ Protein G	1 x 5ml columns
786-1036	G-Trap™ Protein G	2 x 1ml columns
786-1037	G-Trap™ Protein G	5 x 5ml columns

Immobilized Protein A/G

For binding the constant domains of immunoglobulin (Ig) molecules (Table 1). Immobilized Protein A/G consists of recombinant protein A/G ligand covalently immobilized onto 4% highly cross-linked agarose. The dynamic binding capacity will vary depending on several factors such as target antibody, flow rate etc.

Protein A/G binds well to IgG subclasses but does not bind IgA, IgM or serum albumin. This makes Protein A/G an excellent tool for purification and detection of monoclonal antibodies from IgG subclasses, without interference from IgA, IgM and serum albumin. Individual subclasses of monoclonals are likely to have a stronger affinity to the chimeric Protein A/G than to either Protein A or G.

FEATURES

- High binding capacity: 38mg human IgG/ml resin; >20mg sheep IgG/ml resin
- Ligand: Recombinant Streptococcal protein A/G lacking the albumin binding sites expressed in E. coli
- Bead size: 50-165µm
- Bead Structure: 4% highly cross-linked agarose

CITED REFERENCES

1. *McCabe, K. E. et al (2014) Cell Death Dis. DOI: 10.1038/cddis.2014.448*

Cat. No.	Description	Size
786-836	Immobilized Protein A/G Resin	3ml resin
786-837	Immobilized Protein A/G Resin	15ml resin
786-840	Immobilized Protein A/G Resin	10 x 0.2ml columns
786-841	Immobilized Protein A/G Resin Kit	10 x 0.2ml columns
786-838	Immobilized Protein A/G Resin	5 x 1ml columns
786-839	Immobilized Protein A/G Resin Kit	5 x 1ml columns

PEARL™ PURIFICATION

Pearl™ IgG Purification Resin

For the one-step purifiication of the immunoglobulin G (IgG) antibodies from serum. The resin binds the high abundant, non-IgG proteins (i.e albumin) and allows the IgG molecules to pass through in a physiological buffer. The purified IgG molecules can be stored or used in further downstream applications without further clean-up, such as ammonium sulfate precipitation.

Purifies IgG in <15 minutes, which is more rapid than the commonly used Protein A and Protein G resins. The performance of the Pearl™ IgG Purification Resin is comparable or better than the Protein A and Protein G resins (Table 1).

Pearl™ IgG Purification (Spin Format) kit is ideal for the rapid, small scale purification of IgG. The kit is supplied with 3ml Pearl™ IgG Purification Resin, IgG Isolation Buffer and 20 spin columns. Suitable for purifying up to 25mg IgG.

Pearl™ IgG Purification kit is supplied with 25ml Pearl™ IgG Purification Resin and IgG Isolation Buffer and is suitable for the isolation of IgG from ~100ml serum (~200mg IgG).

A Pearl™ Monoclonal IgG Purification kit for the rapid purification of antibodies from cell culture supernatant and ascites fluid and a Pearl™ Antibody Clean Up kit for the rapid clean up of antibody solutions are available.

FEATURES

- Simple 1-step purification
- High recovery (>90%) & Purity (>80%)

APPLICATIONS

- Purification of IgG (Immunoglobulin G) molecules
- Purify IgG from sources not compatible with Protein A & G

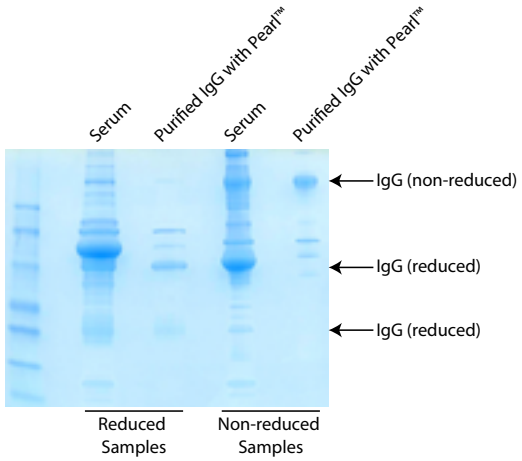


Figure 31: Pearl™ IgG Purification Resin rapidly purifies IgG molecules. Rabbit serum was dialyzed for 2 hours against IgG Purification Buffer and treated with IgG Purification Resin. The serum and flowthrough were compared under reducing and non reducing conditions.

CITED REFERENCES

1. *Ayyub, A. et al (2015)Int. J. Biochem. Cell Biol.doi:10.1016/j.biocel.2015.11.006*
2. *Lu, T. et al (2014) J Innate Immun. (DOI:10.1159/000360478)*

Cat. No.	Description	Size
786-800	Pearl™ IgG Purification Resin	3ml resin
786-801	Pearl™ IgG Purification Resin	25ml resin
786-798	Pearl™ IgG Purification (Spin Format) Kit	For 25mg IgG
786-799	Pearl™ IgG Purification Kit	For ~200mg IgG
786-802	Pearl™ Monoclonal IgG Purification Kit	1 kit
786-803	Pearl™ Antibody Clean Up	10 x 0.5ml samples
786-995	Pearl™ IgG Purification Resin Spin Plates	2 Plates

Species	Antibody Class	Protein A	Protein G	Protein A/G	Pearl™ IgG Purification Resin
Mouse	Total IgG	*****	*****	*****	*****
	IgM	-	-	-	
	IgG_1	*	***	***	
	IgG_{2a}	*****	*****	*****	
	IgG_{2b}	*****	*****	*****	
	IgG_3	*****	*****	*****	
Human	Total IgG	*****	*****	*****	*****
	IgG_1	*****	*****	*****	
	IgG_2	*****	*****	*****	
	IgG_3	*	*****	*****	
	IgG_4	*****	*****	*****	
	IgM	*	-	*	
	IgD	-	-	-	
	IgA	*	-	*	
	Fab	*	*	*	
	ScFv	*	-	*	
Rat	Total IgG	*	***	***	*****
	IgG_1	*	***	***	
	IgG_{2a}	-	*****	*****	
	IgG_{2b}	-	*	*	
	IgG_{2c}	*****	*****	*****	
Rabbit	Total IgG	*****	****	*****	*****
Goat	Total IgG	*	*****	*****	*****
	IgG_1	*	*****	*****	
	IgG_2	*****	*****	*****	
Cat	Total IgG	*****	*	*****	
Chicken	Total IgY	-	-	-	-
Cow	Total IgG	*	*****	*****	*
	IgG_1	*	*****	*****	
	IgG_2	*****	*****	*****	
Dog	Total IgG	*****	*	*****	
Guinea Pig	Total IgG	*****	*	*****	*****
Hamster	Total IgG	**	**	**	*****
Horse	Total IgG	*	*****	*****	*****
	IgG(ab)	*	-	*	
	IgG(c)	*	-	*	
	IgG(T)	-	*****	*****	
Pig	Total IgG	*****	*	*****	*****
Sheep	Total IgG	*	*****	*****	**
	IgG_1	*	*****	*****	
	IgG_2	*****	*****	*****	

Table 1: Affinity of Protein A, G and A/G and Pearl resin for immunoglobulins.

IgA PURIFICATION

Immobilized Jacalin

FEATURES

- Binding Capacity: 1-3mg human IgA/ml resin
- Loading: ≈4.5mg jacalin/ml of resin
- Support: 6% cross-linked agarose

APPLICATIONS

- Preparing Human IgA free of contaminating IgG

Cat. No.	Description	Size
786-167	Immobilized Jacalin	2ml resin

THIOPHILIC ADSORPTION

Thiophilic Resin

For thiophilic adsorption of IgG, IgM, IgY and protein purification

Thiophilic adsorption or thiophilic chromatography is a routinely used technique for the low cost, simple purification of immunoglobulins. Thiophilic adsorption was first developed by Porath et al in 1984 and is a group specific, salt-dependent purification technique that has distinct affinity towards immunoglobulins and α_2-macroglobulins. The thiophilic adsorption works on the principle that some proteins in high salt are able to bind to an immobilized ligand that contains a sulfone group in proximity to a thioether group. The bound proteins are then eluted in decreasing salt concentrations.

The thiophilic resin binds immunoglobulins, including IgG, IgY and IgM, from serum, ascites or tissue culture supernatants and the purified immunoglobulins are then eluted in a near neutral aqueous buffer. The thiophilic resin has a high binding capacity (~20mg/ml human IgG/ml resin) and a broad specificity for various species' immunoglobulin molecules.

Thiophilic adsorption has been used to purify other proteins including horseradish peroxidase[2], glutathione peroxidase[3], lactate dehydrogenase[4] and allergens[5].

Supplied with protocols for IgG purification, IgM purification, IgY purification and general protein purification.

The Thiophilic Adsorption kit is supplied with the thiophilic resin and all the necessary buffers for the rapid purification of immunoglobulin G (IgG) antibodies.

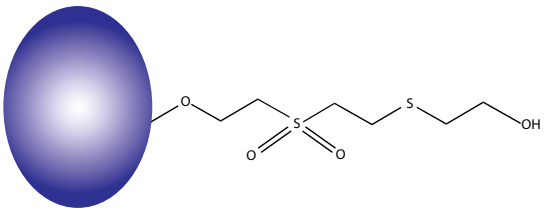


Figure 32: Structure of thiophilic group on agarose beads.

FEATURES

- Purify wide range of immunoglobulin molecules, including IgG, IgM and IgY
- High binding capacity (20mg human IgG/ml resin)
- Binds chicken immunoglobulin (IgY)
- Gentle elution conditions in very low salt and near neautral pH
- Adaptable to other proteins
- Enrichment alternative to ammonium sulfate precipitation

APPLICATIONS

- Purify immunoglobulins, including IgG, IgM and chicken IgY

REFERENCES

1. *Porath, J. et al (1984) In Physical Chemistry of Colloids and Macromolecules, Ed. Ranby, B. (Upsala, Sweden), p. 137*
2. *Chaga, G. et al (1992) Biomed. Chromatogr. 6:172*
3. *Huang, K. et al (1994) Biol. Trace Elem. Res. 46:91*
4. *Kminkova, M. & Kucera, J. (1998) Prep. Biochem. Biotechnol. 28:313*
5. *Goubran-Bostros, H. et al (1998) J. Chromatogr. B. Biomed. Sci. Appl. 710:57*

Cat. No.	Description	Size
786-266	Thiophilic Adsorption Kit	1 Kit
786-267	Thiophilic Resin	10ml resin
786-268	Thiophilic Resin	100ml resin

Gel Filtration/Size Exclusion Chromatography

Size exclusion chromatography (SEC) or gel filtration is used to separate a wide range of molecules according to size, including proteins (enzymes), polysaccharides and nucleic acids.

There are two major categories of SEC; Group separation and Fractionation.

In group separation, for example desalting, samples are separated into two major groups. For desalting select a resin that excludes the larger molecules from the pores of beads, whiles smaller molecules (salts) are retained in the pores.

Fractionation is used to separate macromolecules of different sizes. Here the fractionation range of the resin defines the range of molecular weights that can be separated. Applications that use fractionation by SEC include, preparative purification, analysis of aggregates and molecular weight determination of proteins and nucleic acids.

G-Sep™ Agarose 4B & 6B

G-Sep™ Agarose 4B and 6B are gel filtration matrixes formed from agarose beads that is available with 4% or 6% agarose content, designated G-Sep™ Agarose 4B or 6B

The resin is a proven gel filtration base matrix and is routinely modified by researchers to couple affinity ligands. The resin is not pre-activated.

FEATURES

- See table below

APPLICATIONS

- Gel filtration media
- Base matrix for coupling affinity ligands

Cat. No.	Description	Size
786-952	G-Sep™ Agarose 4B	1L
786-955	G-Sep™ Agarose 6B	1L

G-Sep™ Agarose CL-4B & CL-6B

G-Sep™ Agarose CL-4B and CL-6B resins are a cross-linked versions of our G-Sep™ Agarose. Cross-linking of the agarose results in chemically and physically more stable agarose beads that offer the same selectivity, but with better flow characteristics. Cross-linked agarose beads are resistant to organic solvent. The resin is a proven gel filtration base matrix and is routinely modified by researchers to couple affinity ligands. The resin is not pre-activated.

FEATURES

- See table below

APPLICATIONS

- Gel filtration media
- Base matrix for coupling affinity ligands

Cat. No.	Description	Size
786-953	G-Sep™ Agarose CL-4B	1L
786-956	G-Sep™ Agarose CL-6B	1L

G-Sep™ Agarose 6 Fast Flow

G-Sep™ Agarose 6 Fast Flow (FF) is a gel filtration matrix formed from agarose beads that is based on our cross-linked 6% agarose.

The modification to the cross-linked 6% agarose to fast flow results in improved physical stability and chromatographic qualities. The modification makes the resin an ideal base resin for high throughput applications and industrial process separations. The improved rigidity permits higher flow rates resulting in improved resolution in minimum time. The resin can also be used for the immobilization of ligands for improved affinity chromatography.

FEATURES

- See table below

APPLICATIONS

- Gel filtration media
- Base matrix for coupling affinity ligands

Cat. No.	Description	Size
786-954	G-Sep™ Agarose 6 Fast Flow	1L

	4B	6B	CL-4B	CL-6B	6 Fast Flow
Matrix	Agarose , 4%	Agarose , 6%	Cross-linked Agarose, 4%	Cross-linked Agarose, 6%	Highly cross-linked Agarose, 6%
Bead form	Spherical, diameter 50-160µm				
pH stability Working Range	4-9		3-13		
pH stability Cleaning-in-Place (CIP)	4-9		2-14		
Maximum Pressure (MPa)	0.008	0.02	0.012	>0.02	0.3
Maximum Flow Velocity	11cm/h	14cm/h	26cm/h	30cm/h	450cm/h
Fractionation [Mr] Globular Proteins	6×10^4-2×10^7	1×10^4-4×10^6	6×10^4-2×10^7	1×10^4-4×10^6	
Physical Stability	Negligible volume variation due to changes in pH or ionic strength				
Chemical Stability	Stable to: 6M urea, 8M guanidine hydrochloride		Stable to: 6M urea, 8M guanidine hydrochloride, ethanol, DMF, THF, acetone, DMS, chloroform, dichloromethane, dichloroethane, pyridine, triethyl phosphate and acetonitrile.		
Sterilization	Chemical		Autoclavable, 121°C, pH 7, for 20 min		
Storage Conditions	4 to 30°C, 20% Ethanol				

Table 2: Agarose 4B, 6B, CL-4B, CL-6B and 6 Fast Flow Specifications

Hydrophobic Interaction Chromatography (HIC)

Biomolecules are separated on the HIC column based upon the hydrophobicity of the ligand attached to the resin, the distribution of surface-exposed hydrophobic amino acids present on the protein or enzyme to be separated and the concentration and type of salt used in binding or start buffer. In HIC, the binding of biomolecules to the column (ligand) is facilitated by using higher concentrations of anti-chaotropic salts such as ammonium sulfate, sodium sulphate etc in the binding buffer or start buffer.

Straight alkyl chains ligands such as butyl, octyl show pure hydrophobic character whereas aryl ligands such as phenyl show mixed mode behavior where aromatic, hydrophobic as well as lack of charge play role in protein/biomolecules adsorption to the column.

Supplied as our G-Sep™ resin or G-Trap™ FPLC columns.

Butyl Agarose Fast Flow

G-Sep™ Butyl Agarose Fast Flow (FF) is a 6% cross-linked agarose with butyl groups for Hydrophobic Interaction Chromatography (HIC). The resin is used to separate biomolecules on the basis of relative hydrophobicity.

FEATURES

- See table below

Cat. No.	Description	Size
786-957	G-Sep™ Butyl Agarose 6 Fast Flow	25ml
786-958	G-Sep™ Butyl Agarose 6 Fast Flow	200ml
786-1001	G-Trap™ Butyl Agarose 6 Fast Flow	5 x 1ml columns
786-1002	G-Trap™ Butyl Agarose 6 Fast Flow	5 x 5ml columns

Octyl Agarose Fast Flow

G-Sep™ Octyl Agarose Fast Flow (FF) is a 6% cross-linked agarose with Octyl groups for Hydrophobic Interaction Chromatography (HIC). The resin is used to separate biomolecules on the basis of relative hydrophobicity.

FEATURES

- See table below

Cat. No.	Description	Size
786-963	G-Sep™ Octyl Agarose 6 Fast Flow	25ml
786-964	G-Sep™ Octyl Agarose 6 Fast Flow	200ml
786-1003	G-Trap™ Octyl Agarose 6 Fast Flow	5 x 1ml columns
786-1004	G-Trap™ Octyl Agarose 6 Fast Flow	5 x 5ml columns

Phenyl Agarose Fast Flow

G-Sep™ Phenyl Agarose Fast Flow (FF) is a 6% cross-linked agarose with phenyl groups for Hydrophobic Interaction Chromatography (HIC). The resin is used to separate biomolecules on the basis of relative hydrophobicity. G-Sep™ Phenyl Agarose Fast Flow is available in two levels of ligand substitution degree to help to find the optimal selectivity and binding capacity for a given application.

FEATURES

- See table below

Cat. No.	Description	Size
786-959	G-Sep™ Phenyl Agarose 6 Fast Flow (High Sub)	25ml
786-960	G-Sep™ Phenyl Agarose 6 Fast Flow (High Sub)	200ml
786-961	G-Sep™ Phenyl Agarose 6 Fast Flow (Low Sub)	25ml
786-962	G-Sep™ Phenyl Agarose 6 Fast Flow (Low Sub)	200ml
786-1005	G-Trap™ Phenyl Agarose 6 Fast Flow (High Sub)	5 x 1ml columns
786-1006	G-Trap™ Phenyl Agarose 6 Fast Flow (High Sub)	5 x 5ml columns
786-1007	G-Trap™ Phenyl Agarose 6 Fast Flow (Low Sub)	5 x 1ml columns
786-1008	G-Trap™ Phenyl Agarose 6 Fast Flow (Low Sub)	5 x 5ml columns

G-Trap™ HIC Selection Kit

G-Trap™ HIC Selection Kit consists of 4 prepacked 1 ml columns (G-Trap™ HIC Columns) with matrix or resin for hydrophobic interaction chromatography. The kit consists G-Trap™ Butyl Agarose 6 Fast Flow, G-Trap™ Octyl Agarose 6 Fast Flow, G-Trap™ Phenyl Agarose 6 Fast Flow (High Sub) and G-Trap™ Phenyl Agarose 6 Fast Flow (Low Sub).

G-Trap™ HIC Selection Kit allows for initial screening of appropriate ligand/matrix and conditions for isolation of a specific protein or biomolecule. Once appropriate resin/medium is determined, individual G-Trap™ HIC Column in 1 ml or 5 ml sizes can be used.

Cat. No.	Description	Size
786-1009	G-Trap™ HIC Kit	4 x 1ml

	Butyl Agarose (FF)	Phenyl Agarose (FF) (High Sub)	Phenyl Agarose (FF) (Low Sub)	Octyl Agarose (FF)
Matrix	Highly cross-linked Agarose, 6%			
Bead form	Spherical, diameter 50-160µm			
Ligand	Butyl	Phenyl		Octyl
Ligand Concentration	About 40µmol/ml		About 25µmol/ml	About 5µmol/ml
Binding Capacity	About 20mg HSA/ ml resin	About 40mg HSA/ ml resin	About 20mg HSA/ ml resin	About 30mg HSA/ ml resin
pH stability Working Range	3-13			
pH stability Cleaning-in-Place (CIP)	2-14			
Maximum Pressure (MPa)	0.3			
Maximum Flow Velocity	450cm/h			
Exclusion Limit (Globular Proteins)	4×10^6			
Physical Stability	Negligible volume variation due to changes in pH or ionic strength			
Chemical Stability	Stable to all commonly used aqueous buffers:1 M NaOH, 8 M urea, 8 M guanidine hydrochloride, 70% ethanol			
Sterilization	Autoclavable, In 1M NaOH,121 °C, pH 7, for 30 min			
Storage Conditions	4 to 30°C, 20% Ethanol			

Table 3: Butyl, Phenyl and Octyl Agarose Fast Flow Specifications

Ion Exchange Chromatography

Ion Exchange Chromatography separates biomolecules, including proteins and nucleotides on the basis of their charge. Our G-Sep™ Ion Exchange Chromatography agaroses have charged functional groups that bind molecules with an opposite charge. Bound molecules are eluted from the medium by displacement, via the application of an increasing concentration of a similarly charged molecule.

The resins are available with the weak exchange groups DEAE and CM, and the strong exchange groups Q and SP attached to a highly cross-linked 6% agarose beads. Supplied as our G-Sep™ resin or G-Trap™ FPLC columns.

CATION EXCHANGERS

G-Sep™ CM Agarose Fast Flow

G-Sep™ CM Agarose Fast Flow (FF) resin is a weak cation exchanger composed of highly cross-linked 6% agarose beads, with Carboxymethyl (CM) weak cation exchange groups.

FEATURES

- See table below

Cat. No.	Description	Size
786-965	G-Sep™ CM Agarose Fast Flow	25ml
786-966	G-Sep™ CM Agarose Fast Flow	500ml
786-1010	G-Trap™ CM Agarose Fast Flow	5 x 1ml columns
786-1011	G-Trap™ CM Agarose Fast Flow	5 x 5ml columns

G-Sep™ SP Agarose Fast Flow

G-Sep™ SP Agarose Fast Flow (FF) resin is a strong cation exchanger composed of highly cross-linked 6% agarose beads, with sulphopropyl (SP) strong cation exchange groups.

FEATURES

- See table below

Cat. No.	Description	Size
786-971	G-Sep™ SP Agarose Fast Flow	25ml
786-972	G-Sep™ SP Agarose Fast Flow	300ml
786-1016	G-Trap™ SP Agarose Fast Flow	5 x 1ml columns
786-1017	G-Trap™ SP Agarose Fast Flow	5 x 5ml columns

ANION EXCHANGERS

G-Sep™ DEAE Agarose Fast Flow

G-Sep™ DEAE Agarose Fast Flow (FF) resin is a weak anion exchanger composed of highly cross-linked 6% agarose beads, with diethylaminoethyl (DEAE) weak anion exchange groups.

FEATURES

- See table below

Cat. No.	Description	Size
786-967	G-Sep™ DEAE Agarose Fast Flow	25ml
786-968	G-Sep™ DEAE Agarose Fast Flow	500ml
786-1012	G-Trap™ DEAE Agarose Fast Flow	5 x 1ml columns
786-1013	G-Trap™ DEAE Agarose Fast Flow	5 x 5ml columns

G-Sep™ Q Agarose Fast Flow

G-Sep™ Q Agarose Fast Flow (FF) resin is a strong anion exchanger composed of highly cross-linked 6% agarose beads, with quaternary ammonium (Q) strong anion exchange groups.

FEATURES

- See table below

Cat. No.	Description	Size
786-969	G-Sep™ Q Agarose Fast Flow	25ml
786-970	G-Sep™ Q Agarose Fast Flow	300ml
786-1014	G-Trap™ Q Agarose Fast Flow	5 x 1ml columns
786-1015	G-Trap™ Q Agarose Fast Flow	5 x 5ml columns

G-Trap™ Ion Exchange Kit

Kit contains the above different types of 1ml G-Trap™ Ion Exchange Agarose Fast Flow Columns which are used for initial screening of the suitable ion exchange resin.

Cat. No.	Description	Size
786-1018	G-Trap™ Ion Exchange Kit	4 x 1ml

	G-Sep™ CM Agarose	G-Sep™ SP Agarose	G-Sep™ DEAE Agarose	G-Sep™ Q Agarose
Matrix	Cross-linked agarose beads, 6%			
Ligand	Carboxymethyl	Sulphopropyl	Diethylaminoethyl	Quaternary ammonium
Ion Exchanger	Weak cation exchanger	Strong cation exchanger	Weak anion exchanger	Strong anion exchanger
Bead form	Spherical, diameter 50-160µm			
Ionic Capacity	0.09-0.13 mmol (H^+)/ml	0.18-0.25 mmol (Na^+)/ml	0.11-0.16mmol (Cl^-)/ml	0.18-0.25mmol (Cl^-)/ml
Binding Capacity	70mg lysozyme /ml medium		90mg HSA/ml medium	
pH stability Working Range	4-12	2-12	2-9	2-12
pH stability Cleaning-in-Place (CIP)	2-14			
Maximum Flow Velocity	450cm/h			
Maximum Pressure	0.3MPa			
Exclusion limit(globular proteins)	4×10^6			
Physical Stability	Negligible volume variation due to changes in pH or ionic strength			
Chemical Stability	Stable to all commonly used aqueous buffers:1M NaOH, 8M urea, 8M guanidine hydrochloride, 70% ethanol			
Autoclavable	With Na+ as counter Ions, at 121 °C, pH 7, for 30 min in 0.2M sodium acetate for autoclaving		With Cl^- as counter Ions, at 121°C, pH 7, for 30min	
Storage Conditions	4 to 30°C, 20% Ethanol	4 to 30°C, 20% Ethanol containing 0.2M sodium acetate	4 to 30°C, 20% Ethanol	

Table 4: CM, SP, DEAE and Q Agarose Fast Flow Specifications

DETERGENT REMOVAL

G-Biosciences offers a range of detergent removal systems that use either a rapid column based system or a precipitation system.

Our products are designed to remove a wide variety of detergents, including SDS, Tween® 20, Triton® X-100, Triton® X-114, Nonidet® P-40, CTAB, CHAPS, deoxycholate and Lubrol®.

DetergentOUT™ GBS10

Detergents are essential for protein solubility during protein extraction and sample preparation, especially when working with hydrophobic proteins. The presence of high concentrations of detergents in protein samples can impair ELISA, IEF, protease digestion of proteins and suppress peptide ionization when analyzed by mass spectrometry.

DetergentOUT™ GBS10 resin removes free, unbound anionic, nonionic or zwitterionic detergents (e.g. SDS, Triton® X-100 or CHAPS) from aqueous protein and peptide samples with minimal sample loss.

The DetergentOUT™ GBS10 columns were shown in independent studies to be fully compatible with DI-QTOF and LC-MS/MS. The use of the DetergentOUT™ GBS10 columns significantly increased the number of peptide spectra detected. In addition, the DetergentOUT™ GBS10 columns have a high binding capacity for detergents, i.e. 6mg SDS and 14mg Triton® X-100 by every ml settled resin.

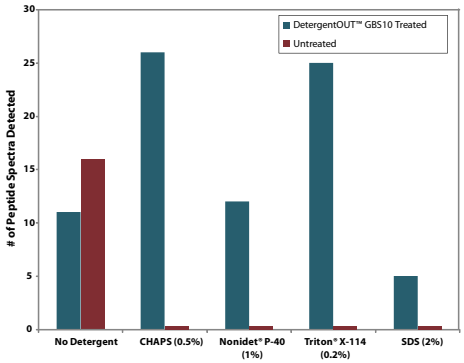


Figure 33: DetergentOUT™ GBS10 removes detergent & allows detection of peptide fragments by mass spectrometry. 500µg phosphorylase B was digested in solution & the indicated amount of detergent was added. Samples were treated with DetergentOUT™ GBS10. Number of peptide spectra were determined as per the protocol of Alvarez, S. et al.

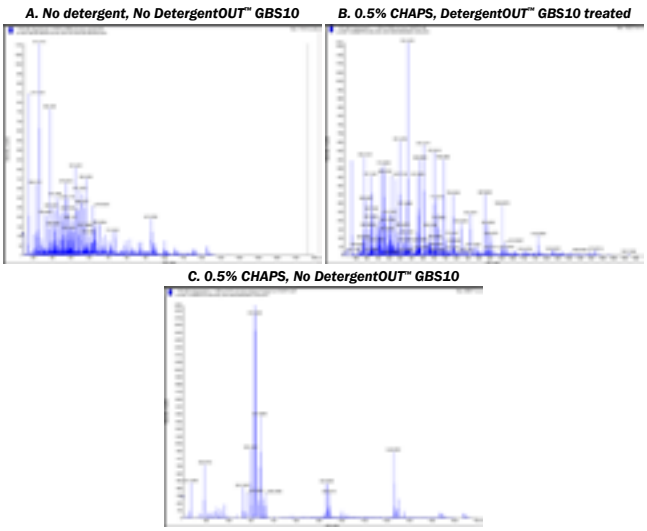


Figure 34: DetergentOUT™ GBS10 enhances mass spectrometry spectra. 5µg/µl protein mixture (BSA, cyctochrome C & phosphorylase B) in water (Panel A) was supplemented with 0.5% CHAPS (Panel B & C). The CHAPS containing sample was treated with DetergentOUT™ GBS10 & compared to an untreated sample (Panel C). Spectra were generated per Alvarez et al.

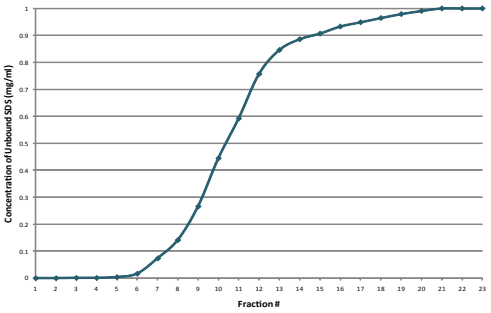


Figure 35: DetergentOUT™ GBS10 retains ≤6mg SDS per ml settled resin. SDS solution was continuously applied to DetergentOUT™ GBS10 column. The graph depicts the amount of SDS detected in the flow-through. SDS was not detected until fraction 7, so after 12mg SDS had been retained by the 2ml of DetergentOUT™ GB-S10 resin, resulting in a 6mg/ml settled resin binding capacity.

Detergent	% Removed	BSA	Phosphorylase B	Cytochrome C	E.coli Lysate
Triton X-100, 2%	>99	>90	>91	>92	>93
Triton X-114, 2%	>96	>99	>98	>97	>91
Nonidet P-40, 1%	>96	>93	>95	>91	>91
Brij 35, 1%	>99	>98	>99	>97	>91
SDS, 2.5%	>99	>96	>97	>92	>90
Sodium deoxycholate, 5%	>99	>99	>99	>98	>95
CHAPS, 3%	>99	>92	>95	>92	>91
Octyl glucoside, 5%	>99	>93	>95	>96	>91
Lauryl maltoside, 1%	>97	>99	>99	>99	>91

Table 5: Comparison of detergent removal rates & percentage of protein recovery with DetergentOUT™ GBS10

FEATURES

- Easy-to-use, spin-format columns
- Rapid removal of free detergents
- Minimal sample loss
- Suitable for anionic, non-ionic & zwitterionic detergents
- Available for sample volumes ranging from 10µl to 1,250µl

APPLICATIONS

- Detergent removal from protein & peptide solutions
- Detection of peptide fragments by Mass spectrometry
- Enhances Mass spectrometry Spectra
- Ideal for downstream analysis by mass spectrometry & other techniques

CITED REFERENCES

1. Min, L. et al (2015) Electrophoresis. DOI: 10.1002/elps.201400579
2. Valente, K. N. et al (2014) Biotechnol Bioeng. DOI: 10.1002/bit.25515
3. Hou, S. et al (2013) Methods. 61:269
4. Higgins, D. et al (2005) Anitmicrob. Agents Chemother. 49:1127
5. Hashii, N. et al (2005) Proteomics. 5:4665

Cat. No.	Description	Sample Size (µl)	Resin (µl)	Size
786-154	DetergentOUT™ GBS10-125	10-30	125	10 columns
786-155	DetergentOUT™ GBS10-800	30-200	800	10 columns
786-156	DetergentOUT™ GBS10-3000	200-750	3,000	10 columns
786-157	DetergentOUT™ GBS10-5000	500-1,250	5,000	10 columns
786-159	DetergentOUT™ GBS10 Resin	-	-	10ml resin

Contamination Removal Resins

DetergentOUT™ Tween®

Removal of Tween® (polysorbate) detergents

A spin column format detergent removal resin for polysorbate or Tween® detergents or surfactants. DetergentOUT™ Tween® specifically removes polysorbate detergents without significant loss of proteins, dilution of the protein solution, or change to the buffer composition of the protein solution.

For other detergents, we highly recommend our DetergentOUT™ GBS10 columns and resin. The DetergentOUT™ GBS10 shows greater efficiency of detergent removal and protein recovery for other detergents, including SDS, CHAPS, Triton®, Nonidet® and Brij®.

CITED REFERENCES

1. *Einsle, O. et al (2002) Acta Sryst. D58:341*
2. *Fisher, J. and Margulies, S. (2002) Am J Physiol Lung Cell Mol Physiol 283:L737*
3. *Baizman, E. et al (2000) Microbiol 146:3129*

Cat. No.	Description	Size
786-214	Detergent*OUT*™ Tween®, Micro	10 columns
786-215	Detergent*OUT*™ Tween®, Medi	10 columns

ENDOTOXIN REMOVAL

EndotoxinOUT™

For the rapid removal of endotoxins/pyrogens (LPS, lipopolysaccharides) from samples.

EndotoxinOUT™ consists of 6% cross-linked agarose covalently linked to polymyxin B to bind and remove harmful pyrogens from a solution. Polymyxin B is a family, polymyxin B1 and B2, of antibiotics that bind to the negatively charged site of the lipid A portion of bacterial lipopolysaccharide layer neutralizing the endotoxic activity.

The covalent coupled agarose and polymyxin B is a stable matrix that resists leaching. An ideal product for the clean up of buffers, cell culture media, protein solutions, nucleic acid (DNA) samples and pharmacological components.

FEATURES

- Polymyxin B Sulfate immobilized on 6% cross-linked agarose
- Capacity: ≥9995 endotoxin units (EU) removed by 1ml resin from 5ml test containing 10,000EU
- ≥99.95% removal
- Reusable at least 10 times

Cat. No.	Description	Size
786-367	EndotoxinOUT™	10ml resin
786-368	EndotoxinOUT™	1L resin
786-369	EndotoxinOUT™	5 x 1ml columns

PAGE-Optimizer™

Clean up resin for SDS-PAGE gels

PAGE-Optimizer™ is a unique, spin column for the preparation of samples for SDS-PAGE. The columns contain a proprietary separation matrix that removes contaminants such as salts, detergents, cellular agents and other common buffering agents.

PAGE-Optimizer™ helps eliminate smeared lanes, distorted and/or smiling bands and swollen lanes. PAGE-Optimizer™ has also been shown to reveal protein bands previously masked by the above interfering agents.

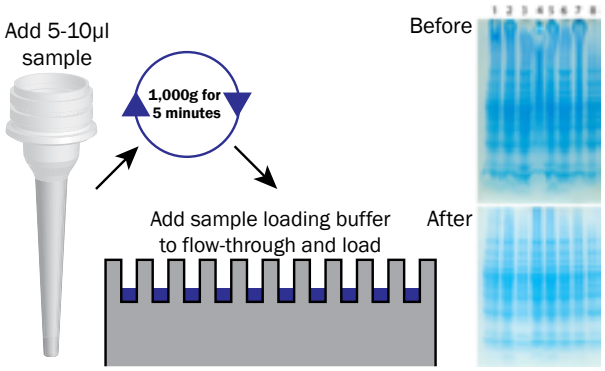


Figure 36: PAGE-Optimizer™ Scheme

Figure 37: PAGE-Optimizer™ helps resolves several SDS-PAGE issues

FEATURES

- Just spin to a perfect gel
- 5 minute protocol

APPLICATIONS

- Clean up samples for SDS-PAGE for improved band resolution.

Cat. No.	Description	Size
786-947	PAGE-Optimizer	10 columns
786-948	PAGE-Optimizer	30 columns

DESALTING & BUFFER EXCHANGE

SpinOUT™

For desalting and buffer exchange

The SpinOUT™ GT-100, GT-600 and GT-1200 columns are versatile, spin-format columns for the desalting and buffer exchange of peptide, protein and nucleic acid solutions ranging from 5µl to 4ml sample volumes.

The SpinOUT™ columns are available in three MWCO sizes for >700, >6,000 or >30,000 Dalton peptides or proteins and are suitable for samples containing as little as 20µg protein/ml.

The SpinOUT™ columns are easy to use; simply apply the protein sample and centrifuge to recover proteins and nucleic acids with the column retaining more than 95% of the salts and small molecules (<100Da for SpinOUT™ GT-100, <1,000Da for SpinOUT™ GT-600 and <1,500Da for SpinOUT™ GT-1200).

- SpinOUT™ GT-100 is for the purification of peptides and proteins >700Da.
- SpinOUT™ GT-600 is for the purification of proteins >6kDa and nucleic acids larger than 10bp.
- SpinOUT™ GT-1200 is for the purification of proteins >30kDa and removal of molecules >1,500Da. The columns are ideal for separating proteins from peptides.

FEATURES

- 5 sizes available for sample volumes of 5µl to 4ml
- Spin format for rapid purification

CITED REFERENCES

1. *Fedosejevs, E.T et al (2014) J Biol Chem. 289: 33412*
2. *Shane, M.W. et al (2013) Plant Physiol. 161:1634*
3. *Tripodi, K. et al (2005) Plant Physiol 139:969*
4. *Wickremasinghe, N. C. et al (2014) Biomacromolecules. DOI: 10.1021/bm500856c*
5. *Vitrac, H. et al (2013) PNAS 110:9338*
6. *Singh, J. et al (2012) Gastroenterology. 143:1308*
7. *Singh, J. et al (2009) Am.Physiol.-Gastr. L. 297:G1206*
8. *Gibbons, A.M. et al (2009) J. Microencaps. 26:513.*
9. *Cryan, S. et al (2006) Mol. Pharm. 3:104*
10. *Taggart, C. et al (2005) J Exp Med 202:1659*

Cat. No.	Description	Size	Resin Bed (ml)	Sample Load (ml)
786-865	SpinOUT™ GT-100, 0.1ml	25 columns	0.1	0.005-0.02
786-866	SpinOUT™ GT-100, 1ml	10 columns	1	0.05-0.1
786-867	SpinOUT™ GT-100, 3ml	10 columns	3	0.1-0.5
786-868	SpinOUT™ GT-100, 5ml	5 columns	5	0.5-2
786-869	SpinOUT™ GT-100, 10ml	5 columns	10	0.5-4
786-703	SpinOUT™ GT-600, 0.1ml	25 columns	0.1	0.005-0.02
786-170	SpinOUT™ GT-600, 1ml	10 columns	1	0.05-0.1
786-171	SpinOUT™ GT-600, 3ml	10 columns	3	0.1-0.5
786-704	SpinOUT™ GT-600, 5ml	5 columns	5	0.5-2
786-705	SpinOUT™ GT-600, 10ml	5 columns	10	0.5-4
786-706	SpinOUT™ GT-1200, 0.1ml	25 columns	0.1	0.005-0.02
786-172	SpinOUT™ GT-1200, 1ml	10 columns	1	0.05-0.1
786-173	SpinOUT™ GT-1200, 3ml	10 columns	3	0.1-0.5
786-707	SpinOUT™ GT-1200, 5ml	5 columns	5	0.5-2
786-708	SpinOUT™ GT-1200, 10ml	5 columns	10	0.5-4

G-Trap™ Desalting Columns

For desalting and buffer exchange

G-Trap™ Desalting Columns are prepacked ready to use column for separation of low molecular weight substances from high molecular weight substances based on size exclusion chromatography. The G-Trap™ Desalting Columns are mostly used for removal of salt or buffer exchange before or after different chromatographic steps. They can also be used for separation of proteins based on their sizes. Available in three MWCO sizes for >700, >6,000 or >30,000 Dalton peptides or proteins.

- G-Trap™ GT-100 is for the purification of peptides and proteins >700Da.
- G-Trap™ GT-600 is for the purification of proteins >6kDa and nucleic acids larger than 10bp.
- G-Trap™ GT-1200 is for the purification of proteins >30kDa and removal of molecules >1,500Da. The columns are ideal for separating proteins from peptides.

FEATURES

	G-Trap™ GT-100	G-Trap™ GT-600	G-Trap™ GT-1200
Bead Size (µm)	55-165	20-130	35-200
Void Volume (ml)	~0.3 ml for 1 ml column and ~1.5 ml for 5 ml colum		
Load Volume (ml)	0.03 ml-0.3 ml for 1 ml column and 0.75-1.5 ml for 5 ml column		
Exclusion limit (M_r)	700	6000	30000
Flow rate (ml/min)	1 ml/min for 1 m column and 5 ml/min for 5 ml column		
Chemical Stability	All commonly used buffers, 8M urea, 6M guanidine hydrochloride and all non-ionic detergents. Lower alcohols such as methanol, ethanol and propanol can be added to buffers at lower than 25 V/V %		
pH Stability	2-13		
Storage	20 % ethanol at 4°C t 30°C		

Figure 38: G-Biosciences FPLC Columns

Cat. No.	Description	Size
786-1025	G-Trap™ GT-100	5 x 1ml columns
786-1026	G-Trap™ GT-100	5 x 5ml columns
786-1023	G-Trap™ GT-600	5 x 1ml columns
786-1024	G-Trap™ GT-600	5 x 5ml columns
786-1027	G-Trap™ GT-1200	5 x 1ml columns
786-1028	G-Trap™ GT-1200	5 x 5ml columns

C18 Spin Columns

G-Biosciences C18 Spin Columns are ready-to-use micro centrifuge columns for peptide clean up and concentration. The columns consist of porous C18 reverse-phase resin that has a particle size if ~15µm and a pore size of 300Å. The resin offers highly efficient binding and recovery of peptides and is ideal for mass spectrometry and other peptide related applications.

Each spin column can be used to process between 10 to 150µl peptide samples in about 30 minutes without the need for specialized equipment. Each column can bind between 10ng to 30µg of protein peptides, although sensitivity and detection limits are dependent on selected downstream applications.

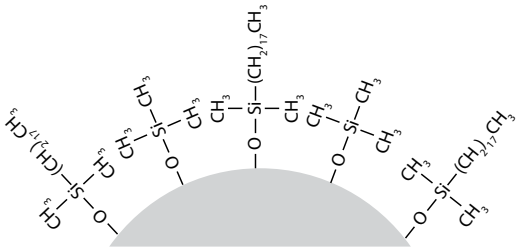


Figure 39: Structure of C18 Spin Column resin

FEATURES

- Rapid peptide purification
- Yields high quality spectra with significant noise reduction
- Easy to handle, no specialized equipment required
- End capped to block reactive surface sianol groups
- 10mg C18 resin/ spin column

APPLICATIONS

Purification of peptides prior to:

- Matirx-assisted laser desorption ionization (MALDI)
- Electrospray ionization (ESI) mass spectrometry (MS)

Cat. No.	Description	Size
786-930	C18 Spin Columns	25 columns
786-931	C18 Spin Columns	50 columns

REDUCING AGENT RESINS

Reducing agents are used in the reduction of disulfide bonds of proteins and peptides. It is often necessary to remove the reducing agents from the protein/peptide solutions to prevent them from interfering with subsequent procedures. However, for small proteins, and particularly peptides, it is almost impossible to remove the reducing agent from the protein/peptide using the standard practice of gel filtration, as the small proteins and peptides elute with the reducing agents.

Immobilized Reductant

Reduce Proteins & Peptides with No Contamination

Immobilized Reductant is perfect for the reduction of small proteins and peptides as the reducing agent remains securely bound to the resin. Immobilized Reductant is an immobilized form of cysteine thiolactone, covalently coupled to agarose beads, that allows for a fast and reliable reduction of disulfide bridges in protein and peptide solutions. Samples remain free from contamination from soluble reducing agents, i.e. DTT, TCEP or ß-Mercaptoethanol, without the need for a gel filtration or other clean up step to remove the reductant.

Our Immobilized Reductant is supplied as 2ml resin (a 50% slurry with 0.05% sodium azide as a preservative) in a spin-format column which can be regenerated and reused for a total of five uses.

FEATURES

- No contamination from reducing agents
- No gel filtration or other clean up step required
- Regenerating, reusable column

Cat. No.	Description	Size
786-148	Immobilized Reductant	2ml resin

TCEP Reducing Resin

Reduce Proteins & Peptides with No Contamination

The resin allows for the efficient reduction of peptide and protein disulfide bonds and consists of Tris[2-carboxyethyl] phosphine covalently coupled to 4% crosslinked beaded agarose. The advantage of immobilizing the TCEP to resin is that the reducing agent can rapidly be removed from the reaction and limit downstream interference.

TCEP is a water-soluble, odorless, non-toxic and stable protein reductant. The reduction potency of TCEP is twice as high as that of DTT, and TCEP is effective in reducing proteins over a wider range of pH conditions, including lower acidic pH ranges (pH 2-11), compared to other reductants.

FEATURES

- Highly versatile: For peptides and proteins in various environments
- Odorless: Eliminate nasty odors
- Stable
- Save time with rapid removal of TCEP

Cat. No.	Description	Size
786-822	TCEP Reducing Resin	1ml resin

ALBUMIN REMOVAL

AlbuminOUT™

Samples that contain a large abundance of albumin, such as plasma and cerebrospinal fluid, tend to mask identification and discovery of other less abundant proteins in2D gel electrophoresis and other studies. AlbuminOUT™ has been specifically developed for substantial removal of albumin from such samples.

The albumin removal method is based on binding of albumin with Cibachron™ Blue dye. AlbuminOUT™ has been optimized for removal of human albumin from samples. AlbuminOUT™ uses a rapid spin column method, where each column contains 0.2ml dye bound resins with capacity of >2mg human albumin per column. AlbuminOUT™ will remove >98% albumin from 5-50µl human plasma.

Spin column format allows removal of albumin within 10 minutes. High capacity blue-dye binding resin allows instantaneous binding and removal of albumin from human, pig, sheep, dog, rabbit, rat, and bovine samples. AlbuminOUT™ may also be used for removal of albumin from other species. Suitable for processing 25 or 50 samples.

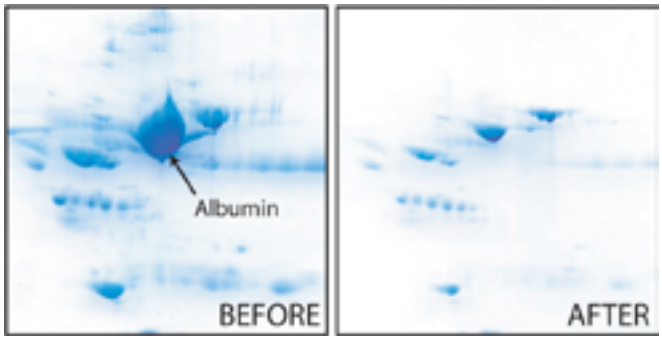


Figure 40: 2D analysis of whole human serum before (left) and after (right) treatment with AlbminOUT™.

FEATURES

- Removal of albumin from samples in less than 10 minutes
- Based on binding of albumin with Cibachron™ Blue dye
- Column capacity >2mg human albumin per column
- Removes >98% albumin from 5-50µl human plasma

APPLICATIONS

- Removal of albumin from biological samples such as plasma and cerebrospinal fluid

CITED REFERENCES

1. *Sandilands, E.A. et al (2012) BMC Clin. Pharmacol. 12:3*
2. *De Palma, A. et al (2010) J. Chroma A. 1217:5328*

Cat. No.	Description	Size
786-251	AlbuminOUT™	25 preps
786-252	AlbuminOUT™	50 preps

DISPOSABLE COLUMNS

Below are the disposable columns offered by G-Biosciences. Table 6 shows a comparison of the columns.

Spin Column, <0.1ml

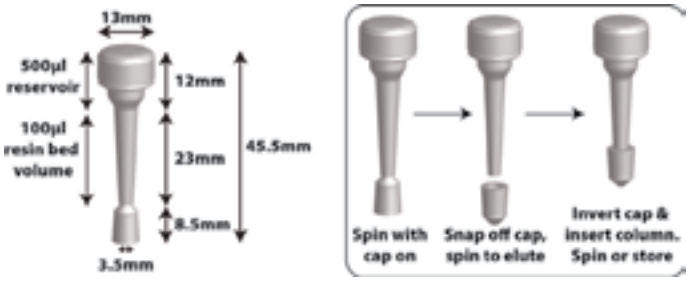


Figure 41: Spin Column, <0.1ml.

Unique design with the snap off end converting to a closure for the column for easy manipulation and use.

FEATURES

- Column volume: 600µl
- Resin volume: 5-100µl
- Filter type: Polyethylene filter, ~30µm pore size
- Fits in 1.5 and 2ml centrifuge tubes

Cat. No.	Description	Size
786-718	Spin Column, <0.1ml	25
786-719	Spin Column, <0.1ml	50

Spin Column, 1ml

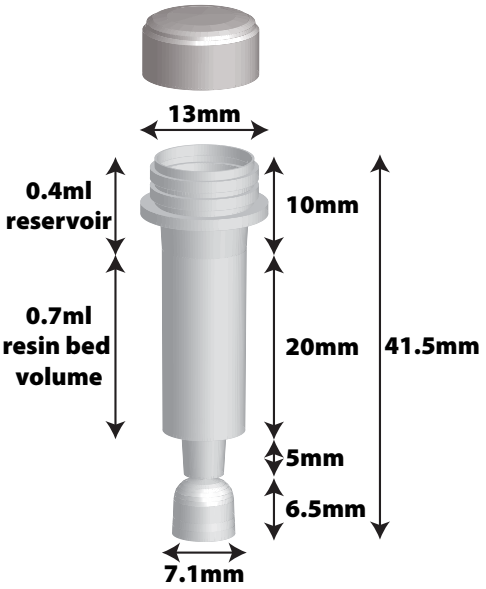


Figure 42: Spin Column, 1.1ml.

Unique design with the snap off end converting to a closure for the column for easy manipulation and use.

FEATURES

- Column volume: 1.1ml
- Resin volume: 700µl
- Filter type: Hydrophilic polyethylene filter, ~30µm pore size
- Caps included
- Fits in 1.5 and 2ml centrifuge tubes

Cat. No.	Description	Size
786-810	Spin Column, 1ml	25
786-811	Spin Column, 1ml	50

Spin Column, 3ml

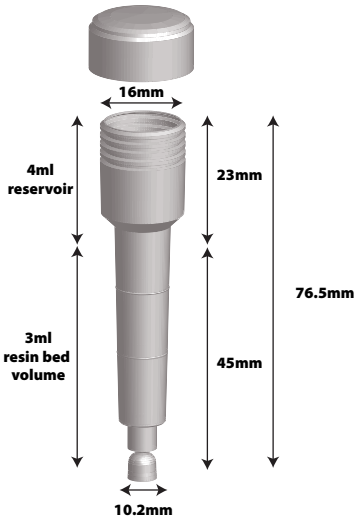


Figure 43: Spin Column, 3ml.

FEATURES

- Column volume: 5ml
- Resin volume: 3ml
- Filter type: Polyethylene filter, ~30µm pore size
- Cap and rubber stoppers included
- Fits 15ml conical centrifuge tubes

Cat. No.	Description	Size
786-724	Spin Column, 3ml	25
786-725	Spin Column, 3ml	50

Spin Column, 5ml

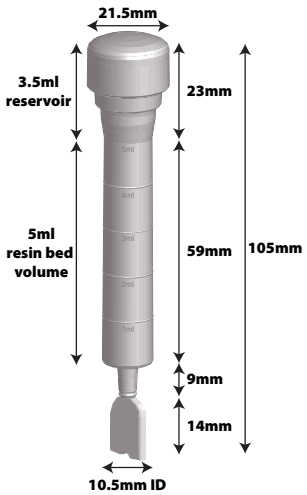


Figure 44: Spin Column, 5ml.

FEATURES

- Total volume: 8ml
- Resin volume: 5ml
- Graduated
- Filter type, pore size: Polyethylene filter, ~30µm pore size
- Fits 15ml conical centrifuge tubes
- Cap and rubber stoppers included

Cat. No.	Description	Size
786-726	Spin Column, 5ml	10
786-981	Spin Column, 5ml	25
786-982	Spin Column, 5ml	50

Spin Column, 10ml

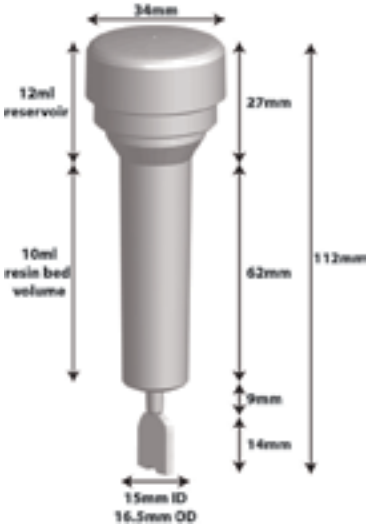


Figure 45: Spin Column, 10ml.

FEATURES

- Total volume: 22ml
- Resin volume: 10ml
- Filter type, pore size: Polyethylene filter, ~30µm pore size
- Fits 50ml conical centrifuge tubes
- Cap and rubber stoppers included

Cat. No.	Description	Size
786-727	Spin Column, 10ml	10
786-983	Spin Column, 10ml	25
786-984	Spin Column, 10ml	50

Chromatography Column, 5ml

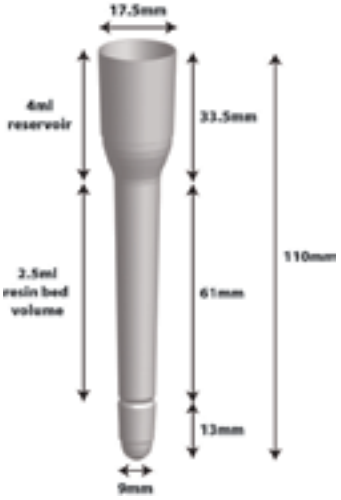


Figure 46: Gravity Flow Column, 5ml.

These narrow body 5ml Columns have an internal volume of 6.5ml and are designed for small scale gravity flow purifications.

FEATURES

- Total Volume: 6.5ml
- Resin Volume: 2.5ml
- Reservoir Volume: 4ml
- Closure: Plastic Stopper
- Cap: Push in cap
- Frit: 1.5mm ~30µm hydrophobic polyethylene

Cat. No.	Description	Size
786-169	Column, 5ml	25

Chromatography Column, 20ml

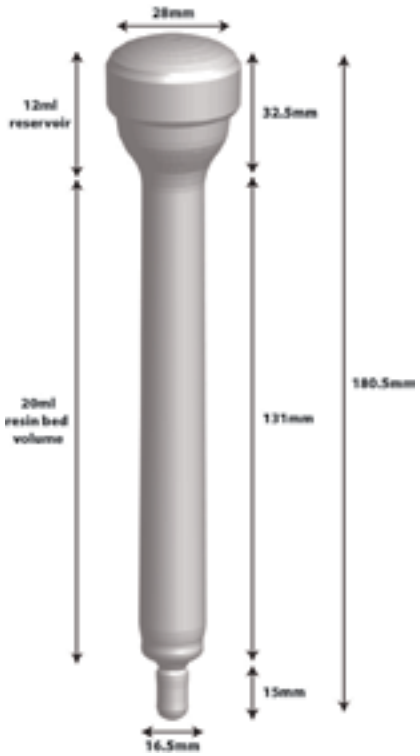


Figure 47: Gravity Flow Column, 20ml.

The 20ml Columns have an internal volume of 32ml and is designed for small scale gravity flow purifications. The resin bed volume is 20ml. Supplied with screw caps and stoppers.

FEATURES

- Total Volume: 32ml
- Resin Volume: 20ml
- Reservoir Volume: 12ml
- Graduated
- Closure: Plastic Stopper
- Cap: Screw cap
- Frit: 3mm ~30µm hydrophobic polyethylene

Cat. No.	Description	Size
786-197	Column, 20ml	25

Accessories

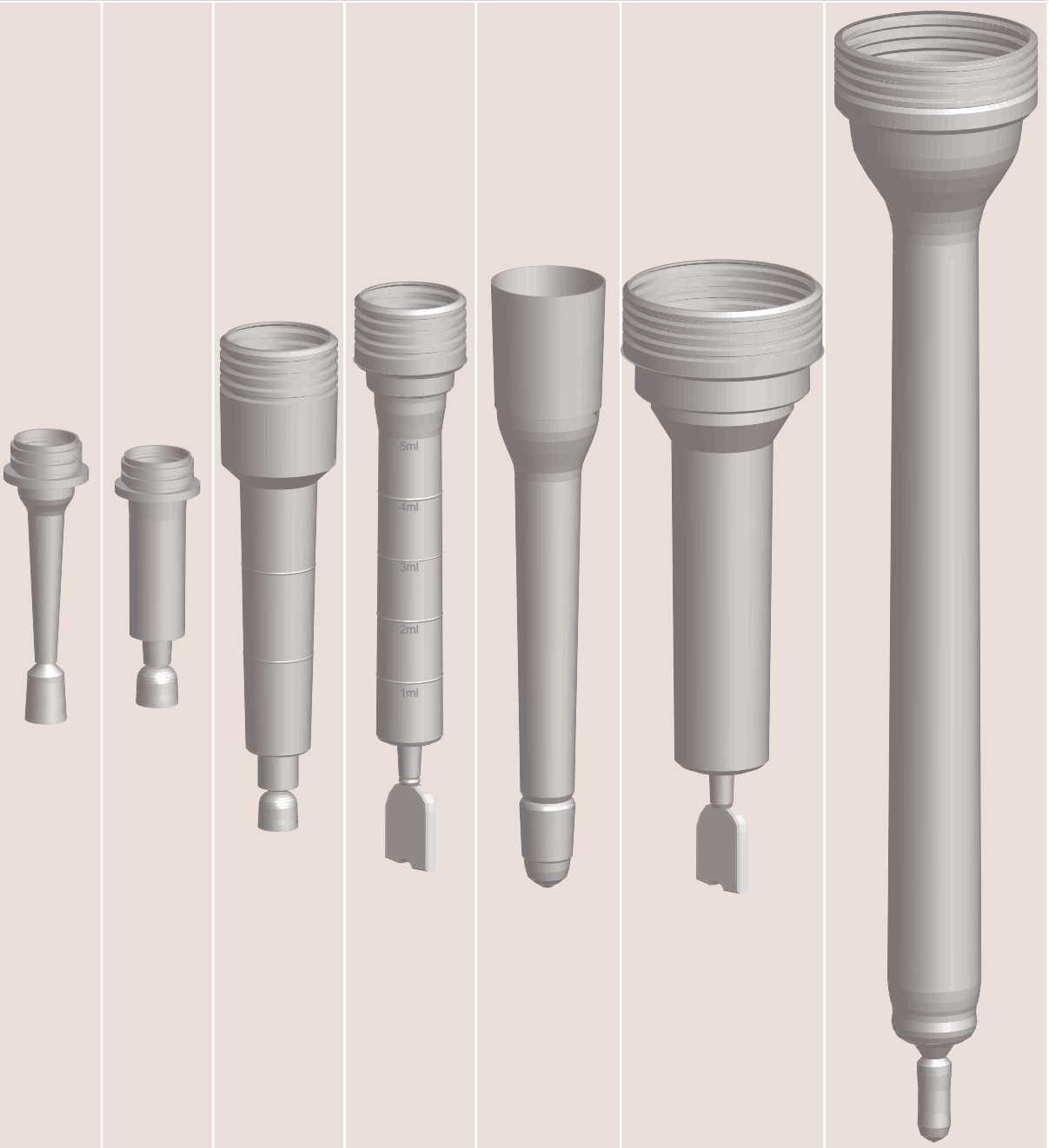
	0.1ml Column	1ml Column	3ml Column	5ml Column	5ml Column (Narrow body)	10ml Column	20ml Column
							
Total Volume	0.6ml	1.1ml	5ml	8ml	6.5ml	22ml	32ml
Resin Volume	5-100µl	700µl	3ml	5ml	2.5ml	10ml	20ml
Reservoir Volume	~550µl	400µl	2ml	3ml	4ml	12ml	12ml
Column Material	Polypropylene						
Filter Type	Hydrophilic polyethylene				Hydrophobic polyethylene	Hydrophilic polyethylene	Hydrophobic polyethylene
Pore Size	~30µm						
Top Closure	Screw cap				Push cap	Screw cap	
Bottom Closure	Snap off end converts to cap	Plastic/Rubber stoppers					
Collection Tube Size	1.5-2ml centrifuge tubes	15ml centrifuge tubes				50ml centrifuge tube	N/A

Table 6: Comparison of G-Biosciences' Columns