

Thermo Scientific Pierce[®] High-Performance Dialysis and Desalting Technical Handbook

Featuring Thermo Scientific Slide-A-Lyzer[®] Dialysis Cassettes




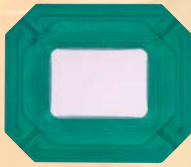

High-Performance Dialysis Product Selection Guide	 10-100 μ l Thermo Scientific Slide-A-Lyzer [®] MINI Dialysis Unit	 0.1-30 ml Thermo Scientific Slide-A-Lyzer Dialysis Cassette	 15-100 ml Thermo Scientific SnakeSkin [®] Dialysis Tubing
	MWCO Membrane	Page 4	Page 5
2K	N/A	X	N/A
3.5K	X	X	X
7K	X	X	X
10K	X	X	X
20K	N/A	X	N/A

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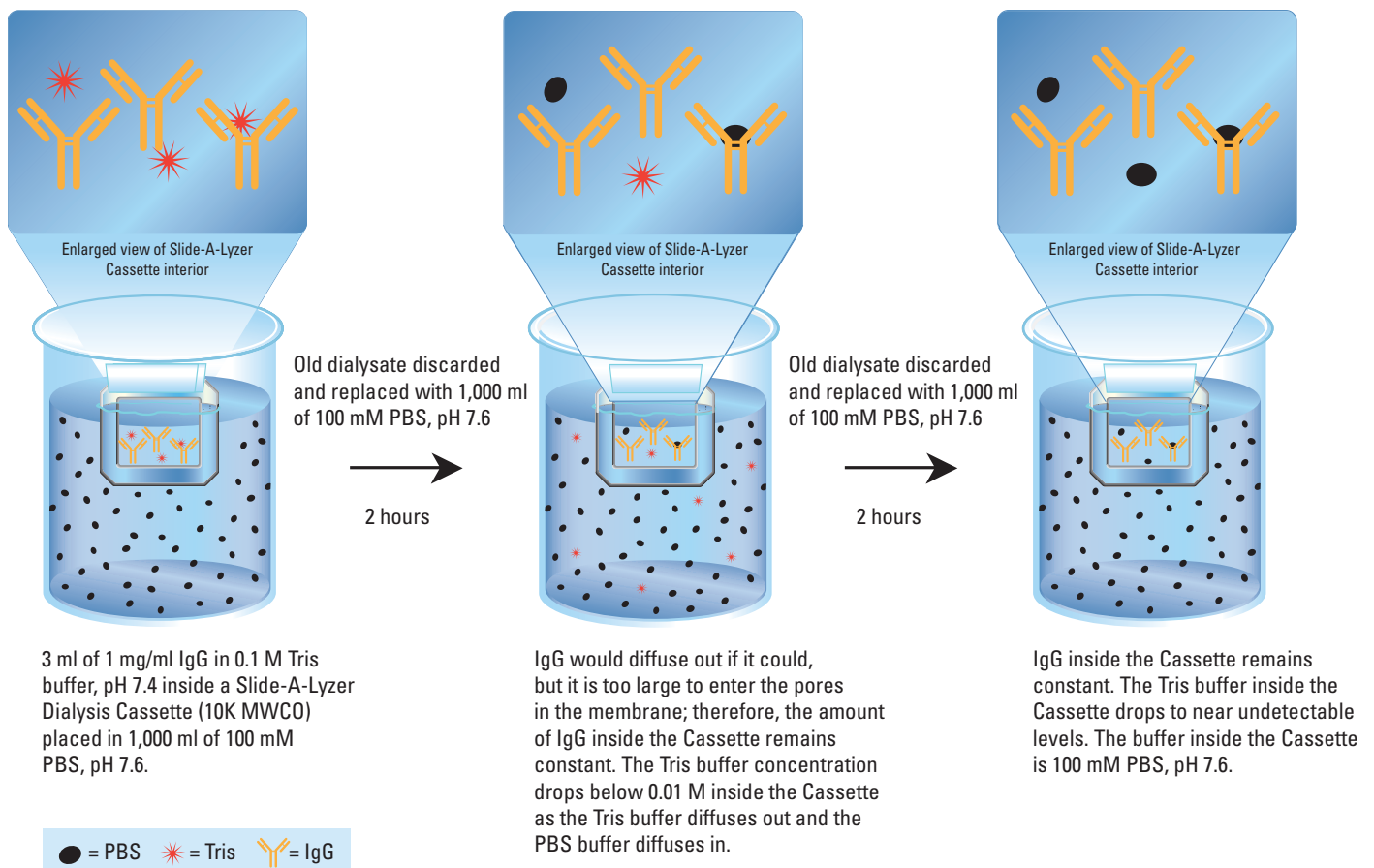
High-Performance Dialysis

Dialysis is a separation technique that gained popularity in life science laboratories during the 1950s. Research papers of that era described dialysis as a new, cutting-edge tool that scientists could use to unravel complex mixtures of biomacromolecules. Many of the dialysis theories established at that time are the cornerstones for contemporary products featured in this brochure. There are, however, two major differences between the dialysis tools of yesterday and today – preparation time and the amount of sample loss due to leaks. Early laboratory dialysis methods involved dedicating a significant amount of time to membrane

preparation; Thermo Scientific Pierce Dialysis Products are essentially ready to use and resist sample leakage.

New developments in dialysis techniques were stagnant during the last few decades, while ultrafiltration systems flourished fueled by advances in non-cellulose membranes and accessibility of bench-top centrifuges. Ultrafiltration via centrifugation was the established convention until we introduced the Slide-A-Lyzer Dialysis Cassette in 1994.

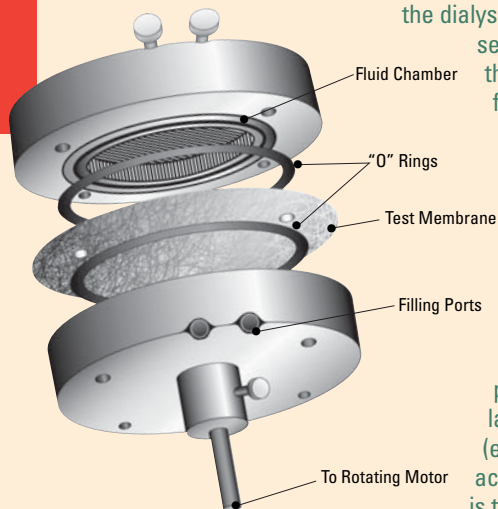
See a product demonstration at www.thermo.com/dialysis



Dialysis: An Overview

Dialysis is the separation of small and large molecules in a solution by selective diffusion through a semipermeable membrane. Typically a sample containing a protein or nucleic acid will contain unwanted small molecular weight (MW) compounds such as a buffer salt (Tris, PBS, etc.), a reducing agent [dithiothreitol (DTT), β -mercaptoethanol (BME), etc.] or a preservative (sodium azide, thimerosal, etc.).

The sample is contained inside the dialysis membrane. A dialysate 200 to 300 times the volume of the sample is outside the dialysis membrane, which creates and maintains a concentration differential across the membrane. Once the liquid-to-liquid interface (sample on one side of the membrane and dialysate on the other) is initiated, all molecules will try to diffuse in either direction across the membrane to reach equilibrium. Dialysis (diffusion) will stop when equilibrium is achieved. Generally the rate of dialysis slows as equilibrium approaches, requiring the dialysate be changed after several hours to re-create the concentration differential that drives the dialysis process.

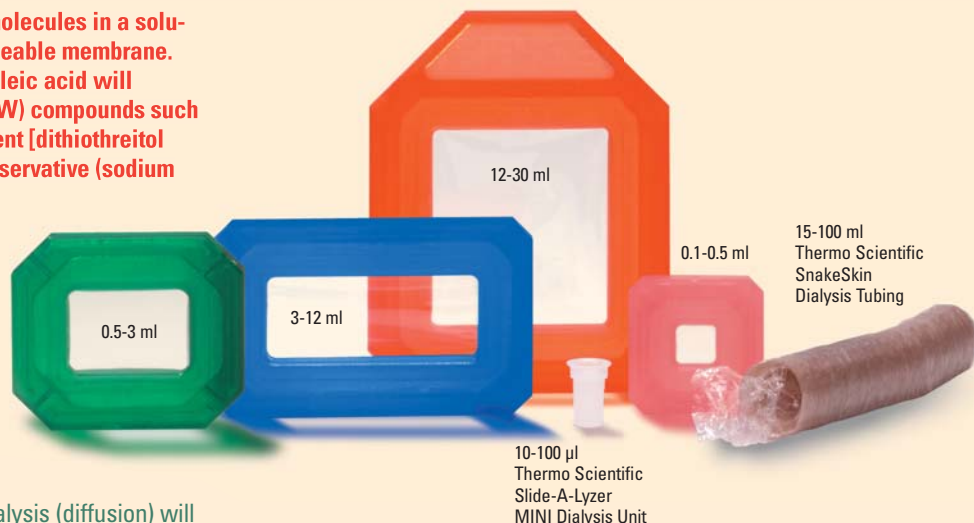


The membrane is the key to dialysis. The semipermeable membrane contains pores of a known size range that are large enough to let small MW compounds pass through, but restrict large MW compounds (e.g., proteins and nucleic acids). The ideal membrane is thin, has numerous pores of uniform diameter, and does not

bind proteins and nucleic acids. What scientists have been using for decades is an extruded regenerated cellulose membrane that is close to an ideal membrane.

However, most scientists often assume too much chromatographic resolution associated with the membrane's molecular weight cut-off (MWCO).

We determine the MWCO of our dialysis membrane by using the rotating batch dialysis cell (see diagram¹ above). In the rotating cell, the membrane to be tested is held in place between two circular cavities of equal size. One side of the cell is partially filled with a solution containing a molecule of known MW. The other side is filled with an equal volume of buffer or saline. The solutions are mixed and kept in contact with the membrane by rotating the cell at a constant speed. The MW standard concentration in each half of the cell is measured after a fixed period of time and the percent retention is calculated. This type of system provides a more accurate MWCO determination than using ultrafiltration methods that measure hydraulic permeability or volumetric flux vs. pressure using saline or buffer alone.



Other important variables are sample and dialysate volume. The ideal scenario is to have a small sample volume and a large dialysate volume to maximize the concentration differential. The sample volume is important because subsequent applications have certain minimum volume requirements. However, after the minimum volume requirements are met, it is not advantageous to dialyze more sample than is needed. Depending on the surface area of a given sample, a small volume sample will dialyze much faster than a large volume sample. Not only is expending additional time wasteful, it can result in sample loss because the longer a sample is in contact with solid-phase surfaces, the more likely proteins or nucleic acids will nonspecifically bind or denature.

Reference

1. Klein, E., et al. DHEW Publication No. 77-1294, p. 17.

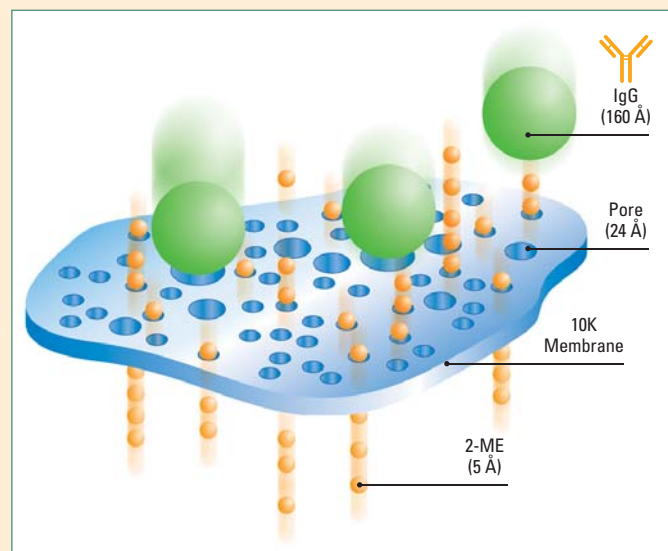


Figure 1. Diffusion of particles through a semi-permeable membrane.

Frequently Asked Questions About Dialysis

1) How precise is the MWCO?



The MWCO is reproducible, but not very precise. When choosing which MWCO membrane to use, it is advisable to have *both* the high MW compounds that you want to retain, and the low MW compounds that you want to diffuse out as far removed from the membrane's MWCO as possible.

Our dialysis products are available with 2K, 3.5K, 7K, 10K and 20K MWCO membranes. The retention profile exhibited is clearly distinct and reproducible for each MWCO membrane when testing compounds of known MW. We do not sell products with regenerated cellulose membranes with MWCOs below 2K and above 20K because they cannot be manufactured to our high-quality standards at this time.

2) Is stirring necessary?



Stirring significantly decreases the dialysis time.

All membranes possess an inner skin, which experts have described as "seaweed-like," and an outer skin. There are no channels of a fixed diameter extending from the sample side through to the dialysate side. Instead, low MW compounds from the sample diffuse into the inner skin pores then through the membrane interior. These low MW compounds exit through a pore in the outer skin of the membrane, to a micro-environment called the Nernst layer. In this layer, which is approximately 200-300 molecules thick, low MW compounds are at a higher concentration in relation to the rest of the dialysate. Stirring, which efficiently breaks up the macro-environment outside the Nernst layer, quickly restores the concentration differential needed to drive the diffusion process.

3) Is temperature important?



Temperature is somewhat important because molecules move and diffuse faster at higher temperatures; however, maintaining the viability of your sample is the priority. So the typical range for dialysis is from ambient to cold-room temperatures.

4) When is my dialysis finished?



There is no easily measured dialysis endpoint. The goal is to reduce the concentration of low MW compounds to a level that will not interfere with subsequent steps in your experiment.

Standard practice has been as follows:

- 1) Dialyze for 2 hours at room temperature (RT),
- 2) Change the dialysate before dialyzing for another 2 hours at RT, and
- 3) Change the dialysate again and dialyze for 1 hour to overnight in the cold room.

Thermo Scientific Pierce High-Performance Dialysis Products make the dialysis process faster than ever. The basic principle of the Slide-A-Lyzer MINI Dialysis Unit is to deposit a 10 μ l sample (essentially a monolayer) on a dialysis membrane in contact with a dialysate that is 100,000 times larger than the sample volume. Small MW compounds have an extremely short (< 1 mm) migratory distance to exit the membrane. Also, with a gigantic concentration differential, the dialysis rate is fast (see page 4 Figures 1 and 2.)

5) Is membrane pretreatment necessary?



A short hydration is necessary for some MWCO membranes in the Slide-A-Lyzer Dialysis Cassette product line. Otherwise, the regenerated cellulose membranes are clean and require no pretreatment.

A very small amount of either glycerine or sulfur may be present. These low MW compounds will diffuse out of the membrane and into the dialysate during the normal dialysis process. If necessary, these compounds may be dialyzed ahead of time but this is usually unnecessary.

6) When sample is injected into the Slide-A-Lyzer Dialysis Cassette, the membrane sometimes folds. What causes this?



Because the dialysis membrane is manufactured as a tube, the regenerated cellulose polymer has "memory" and wants to return to that shape even though the tube was cut into a flat membrane.

Therefore, when a membrane is hydrated and the Cassette is filled, the membrane will stretch or pull differently with respect to the X-axis or Y-axis. Although this does have minor implications relative to surface area, these Slide-A-Lyzer Dialysis Cassettes will function just fine.

Thermo Scientific Slide-A-Lyzer MINI Dialysis Units

For sample volumes as small as 10 μ l



Highlights:

- **100% leak-tested**
Patented design does not permit “wicking” that can occur in homemade devices
- **Very affordable**
- **Excellent sample recoveries**
The Slide-A-Lyzer MINI Dialysis Unit generally recovers 9-10 μ l after dialysis of a 10 μ l sample
- **Time of dialysis drastically reduced**
Converts 100 μ l of pH 2.8 buffer to pH 9.4 dialyzing against 1 L bicarbonate buffer, pH 9.4 in less than 10 minutes

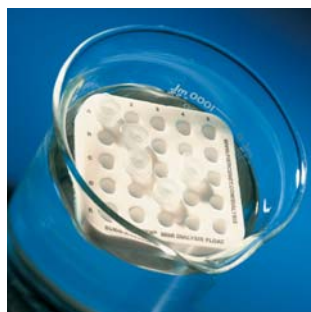
The Slide-A-Lyzer MINI Dialysis Unit is a small disposable cup made of polypropylene and regenerated cellulose. Sample is added and removed easily using a standard laboratory pipette. A float (sold separately) holds the Slide-A-Lyzer MINI Dialysis Unit upright, floating on the dialysate surface with the membrane in contact with the dialysate. Although the device’s patented design is very simple, the easy-to-use Slide-A-Lyzer MINI Dialysis Unit is an invaluable tool for applications, like equilibrium competitive dialysis, for which only 10-100 μ l samples are available.



1. Apply sample with a pipette.



2. Place the Slide-A-Lyzer MINI Dialysis Unit into the float.



3. Insert the float into the beaker containing the dialysate.



4. Recover sample.

See ordering information on pages 8-10.

Dialysis Rate and Sample Recovery

The 3.5K Slide-A-Lyzer MINI Dialysis Unit was used for salt reduction analysis. Samples of 5-100 μ l of 1 M NaCl were placed in the Slide-A-Lyzer MINI Dialysis Unit and dialyzed against 1 L of water for 10 minutes. To recover the smallest (5 μ l and 10 μ l) volumes from the Slide-A-Lyzer MINI Dialysis Unit, the device was tilted and gently tapped on the bottom edge to pool the sample. NaCl standards and samples were diluted in 50 ml ultrapure water and conductivity was measured (Cole-Parmer). The Slide-A-Lyzer MINI Dialysis Unit dialyzes efficiently (Figure 1). Dialysis rate of 100 μ l of 5 M NaCl was also analyzed by conductivity (Figure 2). In a third experiment, the rate of pH exchange in the Slide-A-Lyzer MINI Dialysis Unit was determined and is also rapid. In less than 10 minutes, 100 μ l of IgG Elution Buffer, pH 2.8 is converted to pH 9.4 by dialysis against 1 L of BupH™ Carbonate-Bicarbonate Buffer, pH 9.4 (data not shown).

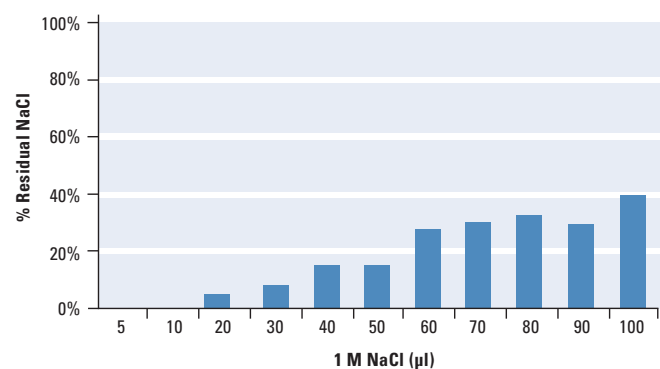


Figure 1. Dialysis efficiency in a Thermo Scientific Slide-A-Lyzer MINI Dialysis Unit. After dialysis against water for 10 minutes, the residual NaCl is 0% for 5-10 μ l samples, < 20% for 20-50 μ l samples and < 40% for 60-100 μ l samples, as measured with a conductivity meter.

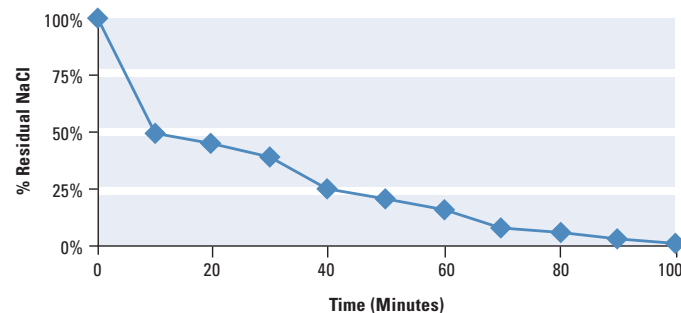


Figure 2. Dialysis time course in a Thermo Scientific Slide-A-Lyzer MINI Dialysis Unit. 100 μ l of 5 M NaCl was dialyzed for up to 100 minutes in a Slide-A-Lyzer MINI Dialysis Unit against 1 L of water. Within 10 minutes, only 50% of the NaCl remained; by 100 minutes, no NaCl remained.

Ren, J. and Chaires, J.B. (2001). Rapid screening of structurally selective ligand binding to nucleic acids. *Method Enzymol.* **340**, 99-108.

Thermo Scientific Slide-A-Lyzer Dialysis Cassettes

Require just half the time of dialysis tubing

Highlights:

- **> 95% sample recovery**
Sample volume remains visible throughout dialysis
- **No knots or clamps to loosen and leak**
Secure design prevents sample loss due to leaks
- **Rigid frame permits smooth sample withdrawal**
Removing every last drop is easy – even for scientists who have never before performed dialysis
- **High surface area/sample volume ratio will dialyze twice as fast as dialysis via conventional tubing**
Patented Cassette design spreads the sample over a large surface area and the double membrane promotes fast dialysis



1. Remove a Cassette from the protective pouch. Fill the Cassette cavity with your sample through one of the guide inlets in the corner of the Cassette. With the syringe still inserted into the cavity, draw up on the syringe to remove air.

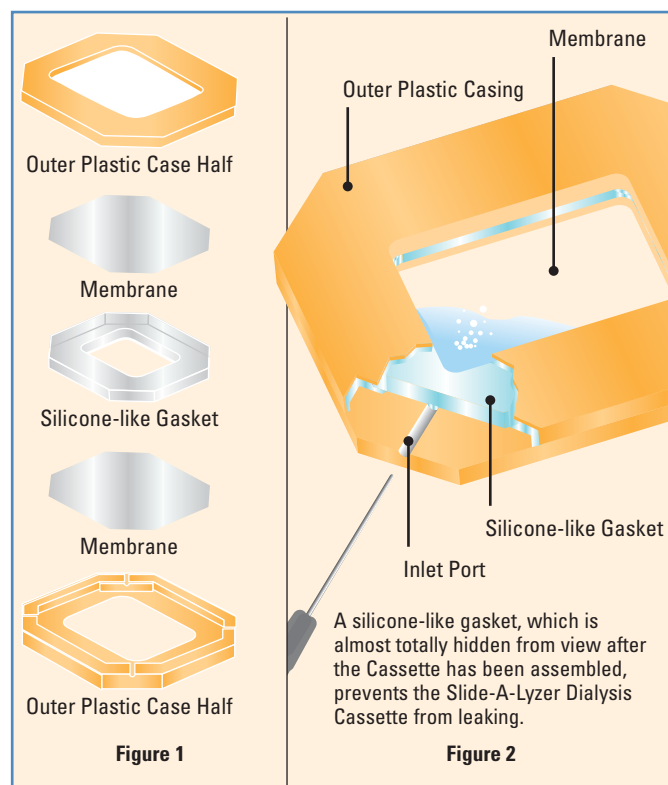


2. Attach a flotation buoy and dialyze. Each buoy serves as an effective flotation device and also as a convenient bench-top stand for the Cassette.



3. Inject the Cassette chamber with air and withdraw your dialyzed sample from the Cassette.

The Slide-A-Lyzer Dialysis Cassette is the product of choice for rapidly dialyzing sample volumes from 100 μ l to 30 ml. The Cassette's patented design, which provides a maximum surface area/sample volume ratio, allows for excellent sample recoveries. Unlike standard flat tubing, the innovative Cassette does not require the use of knots or clips that can lead to leaking and sample loss.



The Slide-A-Lyzer Dialysis Cassette (exploded view) looks like a sandwich (Figure 1). When all of the pieces are compressed together (Figure 2), the outer plastic case halves are welded together sonically, hermetically sealing an inner chamber that can be accessed only via a syringe needle inserted through the inlet port. Because the inert gasket is 10 mm wide, the needle path is sealed completely and tightly when the syringe is withdrawn.

Quantitative Sample Recovery

Three sample volume batches of water (0.5 ml, 1.7 ml and 3.0 ml) were loaded and recovered per the respective manufacturer's instructions in a Slide-A-Lyzer Dialysis Cassette and conventional dialysis tubing to determine the volumes of recovery. Water volume recovered was determined gravimetrically. The following table summarizes the results:

Average Sample Volume Recovery

Sample Volume Loaded	Thermo Scientific Slide-A-Lyzer Dialysis Cassette % Volume Recovery	Traditional Dialysis Tubing % Volume Recovery
3.0 ml	99.47	92.32
1.7 ml	99.30	93.12
0.5 ml	98.76	87.51

See ordering information on pages 7-11.

Thermo Scientific SnakeSkin Dialysis Tubing

Avoid the hassles of large-sample dialysis using flat tubing



Tubing Specifications

Membrane Type:

Regenerated cellulose

Glycerol Content: Varies with MWC0 membrane

Sulfur Content: 0.1%-0.15%

Heavy Metals Content: Trace

Tubing Nominal Dry Thickness*

3.5K MWC0 1.0 mils

7K MWC0 1.2 mils

10K MWC0 0.9 mils

*1 mil = 25 microns

Traditional flat dialysis tubing is difficult to open and often requires a presoak in water or buffer before it can be used. Handling the tubing after the presoak step can be messy and awkward. Thermo Scientific SnakeSkin Dialysis Tubing was developed to simplify large-sample dialysis. SnakeSkin Dialysis Tubing is open, regenerated cellulose dialysis tubing that is pleated (compressed) into a hollow stick. It

is supplied in eight-inch sticks containing 35 feet of 22 mm internal diameter (I.D.) tubing, equivalent to 10.5 meters of 34 mm dry flat width tubing. SnakeSkin Dialysis Tubing can be used for 15-100 ml samples. The hydrated tubing will hold ~3.7 ml of sample per centimeter of length.

The pleated format of SnakeSkin Dialysis Tubing makes it easy to open and ready to use, streamlining dialysis preparation. To use it, a researcher simply pulls out the required length of tubing, cuts it off and applies a closure. The sample is then added through the other end of the dry tubing and the second closure is applied.

We recommend closure using SnakeSkin Dialysis Tubing Clips (sold separately). To use the clips, cut the desired length of tubing, fold one end over twice and apply a clip. Add the sample through the second end of the tubing, fold over twice and attach the second clip.

As an alternative to these clips, SnakeSkin Dialysis Tubing can also be closed with knots. Dip two to three inches of one end of the tubing into water or buffer and tie a knot in the wet membrane. (Dipping is required to assure a good seal at the knot point.) Add the sample to the open, dry end and tie a knot at this end. Because the sample quickly hydrates the membrane, there is no need to pre-wet the second end of the tubing.

The pleating process does not change the tubing's MWC0. Also, any low MW contaminants present are removed during the dialysis process. Because SnakeSkin Dialysis Tubing is made from the same type of regenerated cellulose as flat tubing, its dialysis performance matches that of conventional tubing.

SnakeSkin Dialysis Tubing is available in three MWC0s: 3.5K, 7K and 10K. The product is stored in its original packaging at room temperature, although refrigerated storage may also be used. Properly stored membrane is stable for at least one year.

Ordering Information

Product #	Description	MWC0	Pkg. Size
68035	SnakeSkin Dialysis Tubing	3.5K	22 mm dry I.D. x 35 feet*
68700	SnakeSkin Dialysis Tubing	7K	22 mm dry I.D. x 35 feet*
68100	SnakeSkin Dialysis Tubing	10K	22 mm dry I.D. x 35 feet*

*Equivalent to 10.5 meters of 34 mm dry flat width tubing.

Product Accessories

Product #	Description	Pkg. Size.
68011	SnakeSkin Dialysis Tubing Clips	6/pkg.
66432	Slide-A-Lyzer Buoys for 12 ml Slide-A-Lyzer Cassettes	10/pkg.

See a demo of SnakeSkin Tubing at www.thermo.com/dialysis

2K MWCO Membrane Products



Specifications

Membrane Composition:

Regenerated cellulose synthesized by the Viscose method

Hydration Required Before Use:

2 minutes

Glycerol Content:

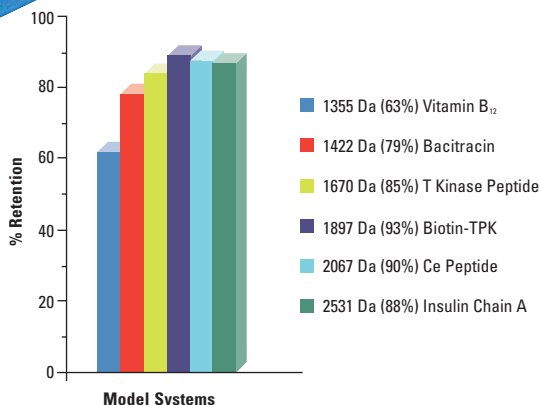
None

Sulfur Content:

0.169%

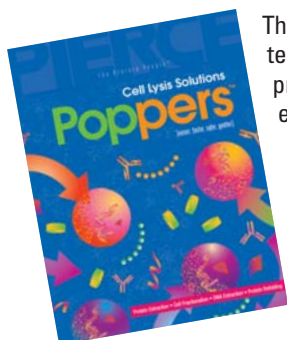
Heavy Metals Content:

Trace



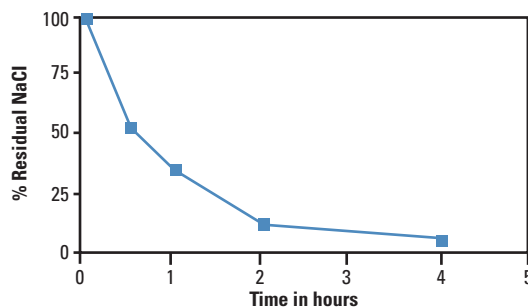
Characterization of membrane pore size. Vitamin B₁₂, bacitracin, tyrosine kinase peptide 1, biotin-TPKs substrate, protein kinase Ce (PKCe) peptide substrate and insulin chain A model systems (0.5-1 mg/ml) in either saline or 0.2 M carbonate bicarbonate buffer pH 9.4 were dialyzed overnight (17 hours) at 4°C. The amount of retentate was estimated using either the Pierce BCA Protein Assay or absorption at 360 nm (for vitamin B₁₂).

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Desalting rate of the membrane for salts. Sodium chloride (1 M) in water was dialyzed at 4°C and the rate of removal of NaCl was determined by measuring the conductivity of the retentate at different time intervals.

Ordering Information

2K MWCO – 0.5 ml Capacity Slide-A-Lyzer Dialysis Cassettes

Product #	Description	Capacity	Pkg. Size
66205	Slide-A-Lyzer Dialysis Cassette	0.2-0.5 ml	10/pkg.

2K MWCO – 3 ml Capacity Slide-A-Lyzer Dialysis Cassettes

Product #	Description	Capacity	Pkg. Size
66203	Slide-A-Lyzer Dialysis Cassette	0.5-3 ml	10/pkg.

2K MWCO – 12 ml Capacity Slide-A-Lyzer Dialysis Cassettes

Product #	Description	Capacity	Pkg. Size
66212	Slide-A-Lyzer Dialysis Cassette	3-12 ml	8/pkg.

2K MWCO – 30 ml Capacity Slide-A-Lyzer Dialysis Cassettes

Product #	Description	Capacity	Pkg. Size
66230	Slide-A-Lyzer Dialysis Cassette	12-30 ml	6/pkg.

Product Accessories

Product #	Description	Pkg. Size
66430	Slide-A-Lyzer Buoys <i>Holds one 0.1-0.5 ml or 0.5-3 ml cassette.</i>	10/pkg.
66431	Slide-A-Lyzer Carousel Buoy <i>Holds ten 0.1-0.5 ml or 0.5-3 ml cassettes.</i>	1/pkg.
66432	Slide-A-Lyzer Buoys <i>Holds one 3-12 ml cassette.</i>	8/pkg.
66494	Slide-A-Lyzer Syringe (1 ml)	10/pkg.
66490	Slide-A-Lyzer Syringe (5 ml)	10/pkg.
66493	Slide-A-Lyzer Syringe (20 ml) <i>Each syringe comes with 18-gauge 1-inch beveled needles.</i>	10/pkg.

3.5K MWCO Membrane Products



Specifications

Membrane Composition:

Regenerated cellulose synthesized by the Viscose method

Hydration Required Before Use:

30 seconds

Glycerol Content:

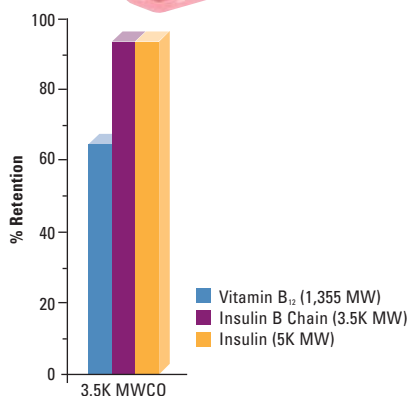
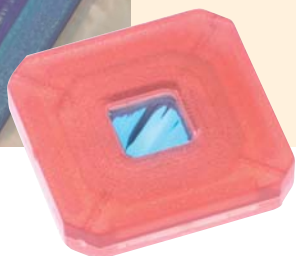
Trace

Sulfur Content:

0.1%–0.15%

Heavy Metals Content:

Trace



Sample retention by the 3.5K MWCO Thermo Scientific Slide-A-Lyzer Dialysis Cassette membrane. Known MW standards were dissolved at a concentration of 1 mg/ml in either 0.15 M sodium chloride or 0.2 M carbonate-bicarbonate buffer, pH 9.4 (Product # 28382). Rotating cells were assembled with the nominal 3.5K MWCO membranes. One half of the cell was filled with MW standard solution and the other half was filled with an equal volume of the plain diluent. Cells were rotated overnight at 100 rpm.

Ordering Information

3.5K MWCO – Slide-A-Lyzer MINI Dialysis Units

Product #	Description	Capacity	Pkg. Size
69554	Slide-A-Lyzer MINI Dialysis Unit Plus Microtubes <i>Sufficient caps are included.</i>	10-100 µl	10/pkg.
69558	Slide-A-Lyzer MINI Dialysis Units and Float <i>Sufficient caps are included.</i>	10-100 µl	10/pkg.
69550	Slide-A-Lyzer MINI Dialysis Unit <i>Sufficient caps are included.</i>	10-100 µl	50/pkg.
69552	Slide-A-Lyzer MINI Dialysis Unit <i>Sufficient caps are included.</i>	10-100 µl	250/pkg.

3.5K MWCO – 0.5 ml Capacity Slide-A-Lyzer Dialysis Cassettes

Product #	Description	Capacity	Pkg. Size
66333	Slide-A-Lyzer Dialysis Cassette	0.1-0.5 ml	10/pkg.
66335	Slide-A-Lyzer Dialysis Cassette Kit <i>Contains 10 cassettes, 10 buoys and 10 syringes.</i>	0.1-0.5 ml	Kit

3.5K MWCO – 3 ml Capacity Slide-A-Lyzer Dialysis Cassettes

Product #	Description	Capacity	Pkg. Size
66330	Slide-A-Lyzer Dialysis Cassette	0.5-3 ml	10/pkg.
66332	Slide-A-Lyzer Dialysis Cassette Kit <i>Contains 10 cassettes, 10 buoys and 10 syringes.</i>	0.5-3 ml	Kit

3.5K MWCO – 12 ml Capacity Slide-A-Lyzer Dialysis Cassettes

Product #	Description	Capacity	Pkg. Size
66110	Slide-A-Lyzer Dialysis Cassette	3-12 ml	8/pkg.
66107	Slide-A-Lyzer Dialysis Cassette Kit	3-12 ml	Kit

3.5K MWCO – 30 ml Capacity Slide-A-Lyzer Dialysis Cassettes

Product #	Description	Capacity	Pkg. Size
66130	Slide-A-Lyzer Dialysis Cassette	12-30 ml	6/pkg.

3.5K MWCO – SnakeSkin Dialysis Tubing

Product #	Description	Pkg. Size
68035	SnakeSkin Dialysis Tubing <i>Equivalent to 10.5 meters of 34 mm dry width.</i>	22 mm dry I.D. x 35 ft

7K MWCO Membrane Products



Specifications

Membrane Composition:

Regenerated cellulose synthesized by the Viscose method

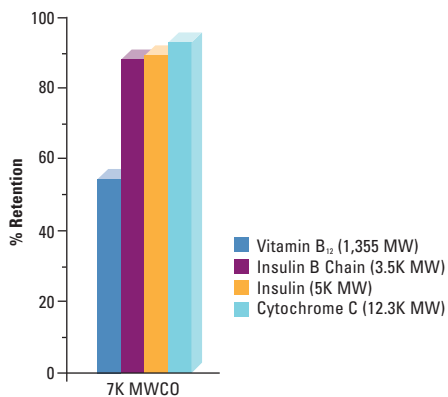
Hydration Required

Before Use: 30 seconds for low-volume samples

Glycerol Content: 13%

Sulfur Content: 0.1%–0.15%

Heavy Metals Content: Trace



Sample retention by the 7K MWCO Thermo Scientific Slide-A-Lyzer Dialysis Cassette membrane. Known MW standards were dissolved at a concentration of 1 mg/ml in either 0.15 M sodium chloride or 0.2 M carbonate-bicarbonate buffer, pH 9.4 (Product # 28382). Rotating cells were assembled with the nominal 7K MWCO membranes. One half of the cell was filled with MW standard solution and the other half was filled with an equal volume of the plain diluent. Cells were rotated overnight at 100 rpm.

Ordering Information

7K MWCO – Slide-A-Lyzer MINI Dialysis Units

Product #	Description	Capacity	Pkg. Size
69560	Slide-A-Lyzer MINI Dialysis Unit <i>Sufficient caps are included.</i>	10-100 µl	50/pkg.
69562	Slide-A-Lyzer MINI Dialysis Unit <i>Sufficient caps are included.</i>	10-100 µl	250/pkg

7K MWCO – 0.5 ml Capacity Slide-A-Lyzer Dialysis Cassettes

Product #	Description	Capacity	Pkg. Size
66373	Slide-A-Lyzer Dialysis Cassette	0.1-0.5 ml	10/pkg.
66375	Slide-A-Lyzer Dialysis Cassette Kit <i>Contains 10 cassettes, 10 buoys and 10 syringes.</i>	0.1-0.5 ml	Kit

7K MWCO – 3 ml Capacity Slide-A-Lyzer Dialysis Cassettes

Product #	Description	Capacity	Pkg. Size
66370	Slide-A-Lyzer Dialysis Cassette	0.5-3 ml	10/pkg.
66372	Slide-A-Lyzer Dialysis Cassette Kit <i>Contains 10 cassettes, 10 buoys and 10 syringes.</i>	0.5-3 ml	Kit

7K MWCO – 12 ml Capacity Slide-A-Lyzer Dialysis Cassettes

Product #	Description	Capacity	Pkg. Size
66710	Slide-A-Lyzer Dialysis Cassette	3-12 ml	8/pkg.
66707	Slide-A-Lyzer Dialysis Cassette Kit <i>Contains 8 cassettes, 8 buoys and 10 syringes.</i>	3-12 ml	Kit

7K MWCO – SnakeSkin Dialysis Tubing

Product #	Description	Pkg. Size
68700	SnakeSkin Dialysis Tubing <i>Equivalent to 10.5 meters of 34 mm dry width.</i>	22 mm dry I.D. x 35 ft

Product Accessories

Product #	Description	Pkg. Size
69588	Slide-A-Lyzer MINI Dialysis Unit Float <i>Holds 25 MINI Dialysis Units</i>	4/pkg.
66430	Slide-A-Lyzer Buoys <i>Each buoy holds one 0.1-0.5 ml or 0.5-3 ml cassette.</i>	10/pkg.
66431	Slide-A-Lyzer Carousel Buoy <i>Each buoy holds ten 0.1-0.5 ml or 0.5-3 ml cassettes.</i>	1/pkg.
66432	Slide-A-Lyzer Buoys <i>Each buoy holds one 3-12 ml cassette.</i>	8/pkg.
66494	Slide-A-Lyzer Syringe (1 ml capacity)	10/pkg.
66490	Slide-A-Lyzer Syringe (5 ml capacity)	10/pkg.
66493	Slide-A-Lyzer Syringe (20 ml capacity) <i>Each syringe comes with 18-gauge 1-inch beveled needles.</i>	10/pkg.
68011	SnakeSkin Dialysis Tubing Clips	6/pkg.

10K MWCO Membrane Products



Specifications

Membrane Composition:

Regenerated cellulose synthesized by the Viscose method

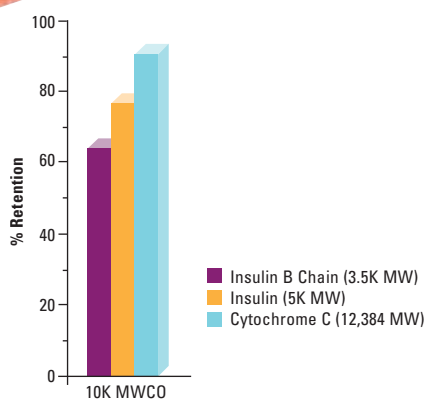
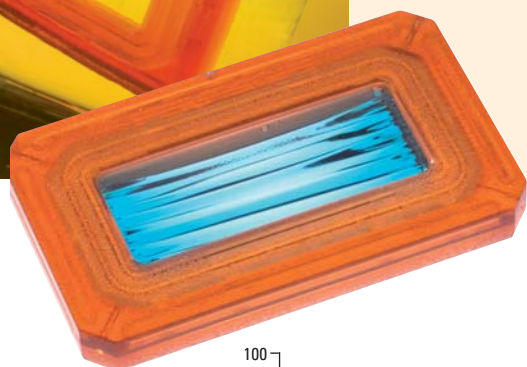
Hydration Required

Before Use: 30 seconds

Glycerol Content: 21%

Sulfur Content: 0.05%

Heavy Metals Content: Trace



Sample retention by the 10K MWCO Thermo Scientific Slide-A-Lyzer Dialysis Cassette membrane. Known MW standards were dissolved at a concentration of 1 mg/ml in either 0.15 M sodium chloride or 0.2 M carbonate-bicarbonate buffer, pH 9.4 (Product # 28382). Rotating cells were assembled with the nominal 10K MWCO membranes. One half of the cell was filled with MW standard solution and the other half was filled with an equal volume of the plain diluent. Cells were rotated overnight at 100 rpm.

Ordering Information

10K MWCO – Slide-A-Lyzer MINI Dialysis Units

Product #	Description	Capacity	Pkg. Size
69574	Slide-A-Lyzer MINI Dialysis Unit Plus Microtubes Sufficient caps are included.	10-100 µl	10/pkg.
69570	Slide-A-Lyzer MINI Dialysis Unit Sufficient caps are included.	10-100 µl	50/pkg.
69572	Slide-A-Lyzer MINI Dialysis Unit Sufficient caps are included.	10-100 µl	250/pkg.
69576	Slide-A-Lyzer MINI Dialysis Unit Plus Float Sufficient caps are included.	10-100 µl	Kit/10 units

10K MWCO – 0.5 ml Capacity Slide-A-Lyzer Dialysis Cassettes

Product #	Description	Capacity	Pkg. Size
66383	Slide-A-Lyzer Dialysis Cassette	0.1-0.5 ml	10/pkg.
66384	Slide-A-Lyzer Dialysis Cassette	0.1-0.5 ml	5 x 10/pkg.
66385	Slide-A-Lyzer Dialysis Cassette Kit Contains 10 cassettes, 10 buoys and 10 syringes.	0.1-0.5 ml	Kit

10K MWCO – 3 ml Capacity Slide-A-Lyzer Dialysis Cassettes

Product #	Description	Capacity	Pkg. Size
66380	Slide-A-Lyzer Dialysis Cassette	0.5-3 ml	10/pkg.
66381	Slide-A-Lyzer Dialysis Cassette	0.5-3 ml	5 x 10/pkg.
66382	Slide-A-Lyzer Dialysis Cassette Kit Contains 10 cassettes, 10 buoys and 10 syringes.	0.5-3 ml	Kit

10K MWCO – 12 ml Capacity Slide-A-Lyzer Dialysis Cassettes

Product #	Description	Capacity	Pkg. Size
66810	Slide-A-Lyzer Dialysis Cassette	3-12 ml	8/pkg.
66811	Slide-A-Lyzer Dialysis Cassette	3-12 ml	5 x 10/pkg.
66807	Slide-A-Lyzer Dialysis Cassette Kit Contains 8 cassettes, 8 buoys and 10 syringes.	3-12 ml	Kit

10K MWCO – 30 ml Capacity Slide-A-Lyzer Dialysis Cassettes

Product #	Description	Capacity	Pkg. Size
66830	Slide-A-Lyzer Dialysis Cassette	12-30 ml	6/pkg.

λ Irradiated 10K MWCO Membrane

Product #	Description	Capacity	Pkg. Size
66454	Slide-A-Lyzer Dialysis Cassette	0.1-0.5 ml	10/pkg.
66455	Slide-A-Lyzer Dialysis Cassette	0.5-3 ml	10/pkg.
66453	Slide-A-Lyzer Dialysis Cassette	3-12 ml	8/pkg.
66456	Slide-A-Lyzer Dialysis Cassette	12-30 ml	8/pkg.

10K MWCO – SnakeSkin Dialysis Tubing

Product #	Description	Capacity	Pkg. Size
68100	SnakeSkin Dialysis Tubing Equivalent to 10.5 meters of 34 mm dry I.D. x 35 ft width.	12-30 ml	22 mm dry I.D. x 35 ft

Product Accessories

Product #	Description	Pkg. Size
69588	Slide-A-Lyzer MINI Dialysis Unit Float	4/pkg.
66430	Slide-A-Lyzer Buoys Holds one 0.1-0.5 ml or 0.5-3 ml cassette.	10/pkg.
66431	Slide-A-Lyzer Carousel Buoy Holds ten 0.1-0.5 ml or 0.5-3 ml cassettes.	1/pkg.
66432	Slide-A-Lyzer Buoys Holds one 3-12 ml cassette.	8/pkg.
66494	Slide-A-Lyzer Syringe (1 ml capacity)	10/pkg.
66490	Slide-A-Lyzer Syringe (5 ml capacity)	10/pkg.
66493	Slide-A-Lyzer Syringe (20 ml capacity) Each syringe comes with 18-gauge 1-inch beveled needles.	10/pkg.
68011	SnakeSkin Dialysis Tubing Clips	6/pkg.

20K MWCO Membrane Products



Specifications

Membrane Composition:

Regenerated cellulose synthesized by the Viscose method

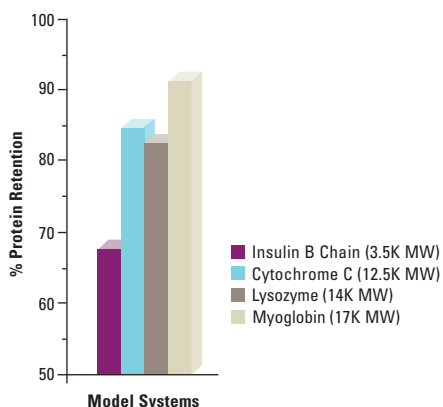
Hydration Required

Before Use: 2 minutes

Glycerol Content: None

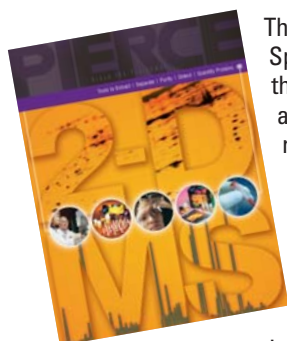
Sulfur Content: 0.04%

Heavy Metals Content: Trace



Characterization of membrane pore size. Insulin B chain, cytochrome C, lysozyme and myoglobin were dialyzed overnight (17 hours) at 4°C in PBS pH 7.4. The amount of retentate was estimated using the Pierce BCA Protein Assay.

View or request our FREE 2D Mass Spec Sample Prep Technical Handbook today!



This 30-page handbook breaks the 2-D/Mass Spec process into five logical steps and then provides protocols and technical and product information to help maximize results. The handbook provides background, helpful hints and troubleshooting advice for cell lysis, 2-D sample prep, detection, mass spec sample prep and downstream applications. Exciting new products include Zeba Micro Desalt Spin Columns, ProteoSeek Albumin and IgG Removal Kits, Imperial™ Protein Stain,

The In-Solution Tryptic Digest and Guanidination Kit, and Deuterated (Heavy) Crosslinkers.

Log on to www.thermo.com/pierce or call 800-874-3723 or 815-968-0747 to request your free copy today! Outside the United States, contact your local branch office or distributor.

Ordering Information

20K MWCO – 0.5 ml Capacity Slide-A-Lyzer Dialysis Cassettes

Product #	Description	Capacity	Pkg. Size
66005	Slide-A-Lyzer Dialysis Cassette	0.1-0.5 ml	10/pkg.

20K MWCO – 3 ml Capacity Slide-A-Lyzer Dialysis Cassettes

Product #	Description	Capacity	Pkg. Size
66003	Slide-A-Lyzer Dialysis Cassette	0.5-3 ml	10/pkg.

20K MWCO – 12 ml Capacity Slide-A-Lyzer Dialysis Cassettes

Product #	Description	Capacity	Pkg. Size
66012	Slide-A-Lyzer Dialysis Cassette	3-12 ml	8/pkg.

20K MWCO – 30 ml Capacity Slide-A-Lyzer Dialysis Cassettes

Product #	Description	Capacity	Pkg. Size
66030	Slide-A-Lyzer Dialysis Cassette	12-30 ml	6/pkg.

Product Accessories

Product #	Description	Pkg. Size
69588	Slide-A-Lyzer MINI Dialysis Unit Float	4/pkg.
66430	Slide-A-Lyzer Buoys <i>Holds one 0.1-0.5 ml or 0.5-3 ml cassette.</i>	10/pkg.
66431	Slide-A-Lyzer Carousel Buoy <i>Holds ten 0.1-0.5 ml or 0.5-3 ml cassettes.</i>	1/pkg.
66432	Slide-A-Lyzer Buoys <i>Holds one 3-12 ml cassette.</i>	8/pkg.
66494	Slide-A-Lyzer Syringe (1 ml capacity)	10/pkg.
66490	Slide-A-Lyzer Syringe (5 ml capacity)	10/pkg.
66493	Slide-A-Lyzer Syringe (20 ml capacity) <i>Each syringe comes with 18-gauge 1-inch beveled needles.</i>	10/pkg.
68011	SnakeSkin Dialysis Tubing Clips	6/pkg.

The RED Device for Rapid Equilibrium Dialysis

A transforming technology for plasma protein-binding assays



Determining the extent to which a molecule binds to plasma proteins is a critical phase of drug development because it influences compound dosing, efficacy, clearance rate and potential for drug interactions. This determination is enabled by equilibrium dialysis, an accepted standard method for reliable estimation of the nonbound drug fraction in plasma. Although it is the preferred method, equilibrium dialysis is labor-intensive, time-consuming, cost-prohibitive and difficult to automate. The RED Device¹ for rapid equilibrium dialysis was developed in close association with

the pharmaceutical industry to specifically address these issues, accelerating lead optimization and reducing attrition rate.

The RED System consists of disposable tube inserts and a 96-well Teflon[®] Base Plate. The unique design of the base plate provides compatibility with automated liquid handling systems while the large dialysis surface area of the tube inserts accelerates equilibrium.

The RED Device has been extensively validated for plasma-binding assays producing results consistent with those reported in the literature (Table 1). Using the RED Device to measure Warfarin binding to plasma (human and rat) proteins at two concentrations of 1 and 10 μM , the RED Device produced results with minimal intra-experimental variability (Figure 1). The RED System offers significant improvements in the ease of use, time requirements, versatility and product reliability compared to competitors (Table 2).

The RED Device Enables:

- Determination of free vs. bound drug to plasma proteins
- Pharmacokinetics studies
- Formulation of drug dosage for *in vivo* studies
- Drug-to-drug interaction studies
- Selection criteria during drug lead optimization

Highlights:

- **Ease of use**
Disposable tubes require no presoaking, assembly or specialized equipment
- **Short incubation time**
Equilibrium can be reached in as few as three hours as a result of the high membrane surface-to-volume ratio
- **96-well format**
Suitable for automated liquid handlers
- **Flexible**
Can be used for the desired number of assays (one to 48 assays/plate) without wasting the entire plate
- **Robust**
Compartmentalized design eliminates potential for crosstalk or leakage
- **Reproducible and accurate**
Validated for plasma-binding assays, producing results consistent with those reported in the literature (Table 1)
- **Versatile**
The high-grade Teflon Base Plate is chemically inert, eliminating nonspecific binding and risk of contamination
- **Validated**
Each lot is functionally tested in a protein-binding assay for guaranteed performance
- **Convenient**
The RED Device membrane has a MWCO of 8K; other MWCO membranes are available upon request

Table 1. Comparison of results obtained using the RED Device with values reported in the literature.

Compound	% Bound	
	Literature Value	RED Device
Ranitidine ¹	10-19	17
Propranolol ²	87-96	84
Warfarin ³	99	99
Naproxen ¹	99	99

1. Jusko, W.J. and Gretch, M. (1976). Plasma and tissue protein binding of drugs in pharmacokinetics. *Drug Metab. Rev.*, **5**(1), 42-139.
2. Colangelo, P.M., et al. (1992). Age and propranolol stereoselective disposition in humans. *Clin. Pharmacol. Ther.*, **51**, 489-94.
3. Chan, E., et al. (1994). Disposition of warfarin enantiomers and metabolites in patients during multiple dosing with rac-warfarin. *Brit. J. Clin. Pharmacol.*, **36**, 563-569.

The RED Device for Rapid Equilibrium Dialysis

A transforming technology for plasma protein-binding assays

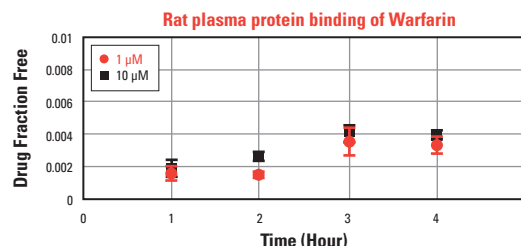
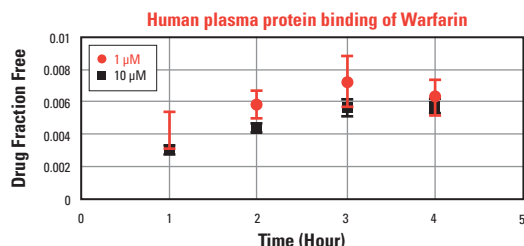


Figure 1. The RED Device binds plasma proteins. More than 99% of Warfarin was consistently bound to plasma protein showing minimal intra-experimental variability. Three replicate RED Device inserts were set up for each tested time point. Warfarin solutions at 1 µM or 10 µM were made in the plasma of choice and added to the insert sample chamber. PBS was added to the buffer chamber. At each time point (1, 2, 3 and 4 hours), 50 µl was removed from the plasma and the buffer chambers and transferred to separate wells of a deep well plate.

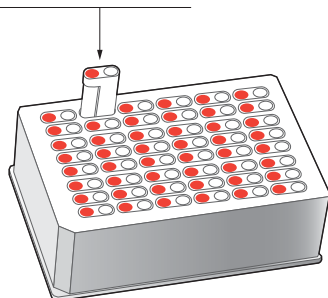
After all the time points were collected, 50 µl of blank plasma was added to every buffer sample and 50 µl buffer was added to every plasma sample. After precipitation buffer was added, vortexed and centrifuged, the supernatants were analyzed by LC/MS/MS (API4000). A standard curve of the drug of interest was prepared along with the samples. The concentration of each sample was determined from the standard curve.

Table 2. A comparison of critical attributes for equilibrium devices.^{††}

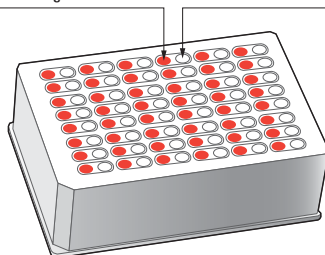
Device (Source)	Hours to reach Equilibrium	Leakage	Disposable	Labor Intensity	Automation Accessible	Volume Shift
RED (Rapid Equilibrium Dialysis) Device (Thermo Scientific)	4	None	Yes	•	Yes	None
Multi-Equilibrium Dialyzer (Harvard Apparatus)	3-4	Minimum	No	••••	No	Minimum
96-well Equilibrium DIALYZER (Harvard Apparatus)	16	20%	Yes	•••	Possible	Yes
96-well Micro Equilibrium Dialysis Block (HTDialysis, LLC)	6	Some	No	•••	Possible	Yes
24-Multiwell Dialysis (BD Biosciences)	24	Not measured	Yes	••	Possible	Not measured

^{††} Li, S.,¹ Xiong, B.,² Huang, T.,² Li, L.,² Donovan, J.,³ Lee, F.,¹ Yu, S.,¹ Miwa, G.¹ and Yang, H.¹ Validation of a novel rapid equilibrium dialysis (RED) device for high throughput plasma protein binding determination. 1. DMPK/Drug Safety & Disposition; 2. Linden Bioscience, 35A Cabot Road, Woburn, MA 01801, USA; and 3. Process Technology, Millennium Pharmaceuticals, Inc., 40 Landsdowne Street, Cambridge, MA 02139 USA.

1. Place RED Device Inserts into the Teflon Plate.



2. Place 200 µl of sample (mixture of compound with plasma at appropriate concentrations) in the plasma chamber indicated by the red ring.



3. Add appropriate amount of buffer to the buffer chamber. Cover plate and incubate. Equilibrium is often reached in four hours or less.

4. After dialysis, remove equal volumes from both chambers. Proceed to sample preparation before LC/MS/MS analysis.

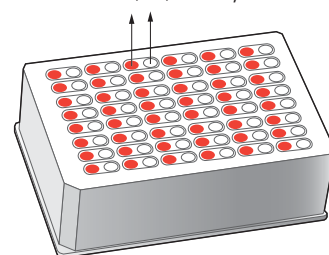


Figure 2. Schematic protocol for the RED Device.

Ordering Information

Product #	Description	Pkg. Size
89809	RED Device Inserts	50/pack
89810	RED Device Inserts	250/case
89811	Teflon Base Plate	1 plate
89812	RED Device Insert Removal Tool	1 remover

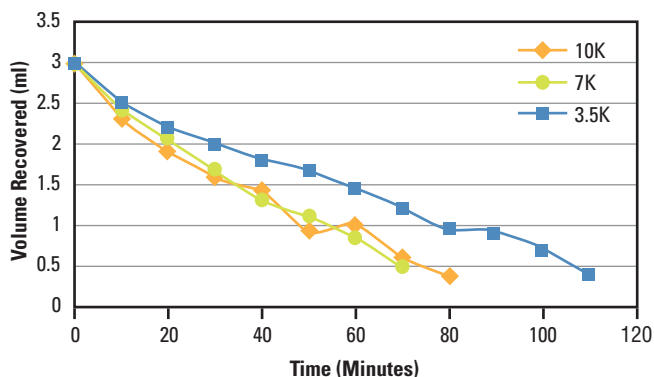
[†] The RED Device is manufactured by Linden Bioscience. Patent Pending on RED Device by Linden Bioscience.

Thermo Scientific Slide-A-Lyzer Concentrating Solution



Thermo Scientific Slide-A-Lyzer Concentrating Solution is a proprietary, hygroscopic, high MW compound that pulls water through dialysis membrane quickly. Other concentrating solutions concentrate and contaminate samples with a compound of similar MW that is difficult to remove by dialysis or other means. These contaminants absorb strongly at 280 nm, distorting protein measurements using the tyrosine absorption method. The Slide-A-Lyzer Concentrating Solution special formulation is free of low MW compounds that could cross the membrane to contaminate the sample.

Many samples will take on water or buffer during the dialysis process. To return the sample to its original concentration, or to concentrate it even further, the Slide-A-Lyzer Concentrating Solution is ideal. To concentrate the sample, the Slide-A-Lyzer Dialysis Cassette containing the sample is placed in a small plastic bag containing the concentrating solution. By diffusion, water and other small molecules are drawn out of the cassette, into the bag. The large molecular size of the concentrating solution prevents it from crossing the membrane and entering the cassette. Therefore, a one-way flow of water and other small molecules out of the Cassette results in concentration of the sample.



The Slide-A-Lyzer Concentrating Solution quickly reduces a starting volume of 3 ml of sample inside the Slide-A-Lyzer Dialysis Cassette to 0.5 ml in about 50 minutes. This is comparable to other concentration methods such as centrifuge-driven membrane devices.

Highlights:

- **Dialysis and concentration occur in one device**
Avoids protein loss by using a single device
- **Faster concentration**
A starting volume of 3 ml is reduced to 0.5 ml in about 75-80 minutes
- **Easy to use**
Just pour the Slide-A-Lyzer Concentrating Solution into the small plastic bag provided and drop in the Slide-A-Lyzer Dialysis Cassette containing the sample
- **Improved formulation and protocols**
Improved product makes concentration easier with rocking-platform protocols
- **The process can be monitored**
Because both the concentrating solution and the bag are clear, the sample concentration can be easily monitored, something that is not possible with closed-system centrifuge-type devices

Ordering Information

Product #	Description	Pkg. Size
66528	Slide-A-Lyzer Concentrating Solution <i>For use with 0.5-3 ml cassettes.</i>	200 ml
66529	Slide-A-Lyzer Concentrating Solution <i>For use with 3-30 ml cassettes.</i>	500 ml
66530	Slide-A-Lyzer Concentrating Solution <i>For use with Slide-A-Lyzer MINI Dialysis Units</i>	25 ml



Concentrating with the Thermo Scientific Slide-A-Lyzer MINI Dialysis Unit

Slide-A-Lyzer Concentrating Solution works on even very small samples using the Slide-A-Lyzer MINI Dialysis Unit. Samples from 10 to 100 μ l are placed in the Slide-A-Lyzer MINI Dialysis Unit and then placed in a microcentrifuge tube that contains Slide-A-Lyzer Concentrating Solution at a minimum ratio of 3:1 (Concentrating Solution to sample).

Thermo Scientific Pierce Microdialyzer System

Dialyze multiple small volume samples with minimal protein loss – in less than one hour!

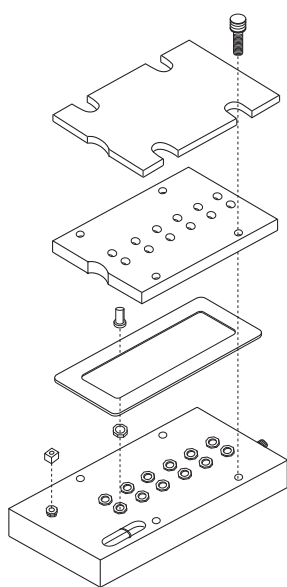


Highlights:

- Wide range of MWCOs available, 1K to 50K
- Handy lid to prevent evaporation
- Stir bar to increase dialysis efficiency
- Unique one-way valve system to provide more efficient regulation of buffer exchange
- Design allows access to dialysate chamber and channels “air bubbles” to a vent valve

Applications:

- Purifying membrane proteins
- Removing protein-modification reagents and crosslinkers
- Removing oligosaccharides from protein solutions
- Dialyzing prior to electrophoresis
- Exchanging, collecting and/or analyzing buffer during dialysis
- Blotting for immunochemistry



Many dialysis methods are time-consuming and result in substantial sample loss – a critical concern when dealing with small sample volumes. The Thermo Scientific Microdialyzer System offers quick, simple methods for sample desalting or buffer exchange. These units require only about one hour to complete the dialysis procedure, and they minimize the loss or dilution of precious samples. They virtually eliminate the need for awkward, time-consuming dialysis procedures.

The Microdialyzer System is ideal for dialyzing small samples. The Microdialyzer System 100 is designed for the simultaneous dialysis of twelve 20-100 μ l

samples. The Microdialyzer System is equipped with a lid to prevent sample evaporation and a unique inlet/outlet system for easy buffer exchange.

The Microdialyzer System offers minimal protein loss and excellent sample recovery. In addition, Delrin® Well Plates are available for autoclaving applications with the System 100. Precut and pre-framed cellulose acetate membranes of varying MW cutoffs are also available for added convenience.

Ordering Information

Product # Description

66315 **Microdialyzer System 100**
For simultaneous dialysis of 12 x 20 μ l-100 μ l samples.

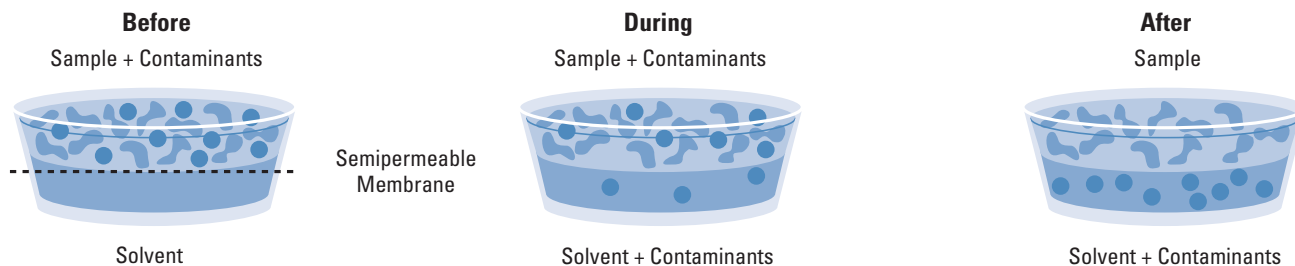
Microdialyzer System Accessories

Product # Description

66322 **Delrin 2 Sample Well Plate For System 100**
For autoclaving applications with Microdialyzer System 100.

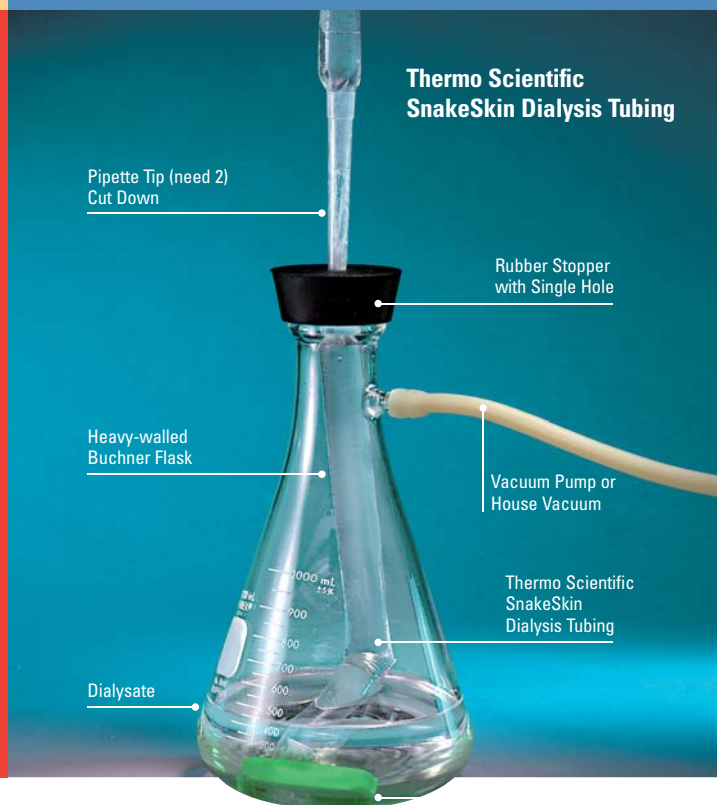
Pre-Framed Dialysis Membranes

Product #	Description	MWCO	Pkg. Size
66306	Pre-Framed Dialysis Membranes	1K	10/pkg.
66307	Pre-Framed Dialysis Membranes	3K	10/pkg.
66310	Pre-Framed Dialysis Membranes	8K	10/pkg.
66312	Pre-Framed Dialysis Membranes	20K	10/pkg.
66313	Pre-Framed Dialysis Membranes	50K	10/pkg.



Forced Dialysis for Sample Concentration

Concentrates 100 ml down to 12 ml in six hours



Small samples dialyze much faster than larger samples because the concentration differential is much higher and the migratory diffusion distance is shorter. With a 100 ml dilute sample, it is often prudent to concentrate down to 12 ml with forced dialysis using SnakeSkin Tubing before dialysis in a Slide-A-Lyzer Dialysis Cassette. The following forced dialysis SnakeSkin Tubing application has been adapted from the method described in:

Doonan, S. (ed.) (1996). Protein Purification Protocols in *Methods in Molecular Biology*, 59, 97-101.

Method

- 1) Cut off and discard the bottom of two pipette tips (2.5-5 ml) so SnakeSkin Tubing easily fits through the pipette tip.
- 2) Insert one pipette through the rubber stopper.
- 3) Cut off the desired length of SnakeSkin Dialysis Tubing (for larger volumes, the membrane will extend above the flask).
- 4) Thread the SnakeSkin Dialysis Tubing (dry) through the rubber stopper containing the pipette tip.
- 5) Clip or tie several knots in the lower end of the SnakeSkin Tubing.
- 6) Pour the sample to be concentrated through the top of the open end of the SnakeSkin Tubing. (Before you completely fill the SnakeSkin Tubing, place the second pipette tip inside the SnakeSkin Tubing to create a secure seal between the SnakeSkin Dialysis Tubing and the first pipette tip.) Fill with remaining sample.
- 7) Place 3-4 cm of buffer in the flask.
NOTE: Most of the SnakeSkin Tubing will not be exposed to buffer.
- 8) Clip or tie the open end of the SnakeSkin Dialysis Tubing to ensure a closed vacuum system.
- 9) Connect the side arm to house vacuum.
- 10) Concentrate sample until desired volume is reached.

Sample Results

- 1) A 1 mg/ml solution of bovine serum albumin was prepared in phosphate-buffered saline, pH 7.4.
- 2) Approximately 30 cm of SnakeSkin Dialysis Tubing was used and assembled as described previously.
- 3) After six hours, the starting sample volume (100 ml) was concentrated to 12 ml with an estimated protein recovery of 65%.

Evaporation for Sample Concentration

Water inside a Slide-A-Lyzer Dialysis Cassette will evaporate. The cassette is ideally suited for sample concentration via evaporation because of the dual membranes and high surface area. Place a sample in the cassette, then withdraw the air inside. Place two buoys on the cassette as shown at the left. Let your sample evaporate on the bench top (using a fan to increase air-flow across the membrane will speed up the process), making sure to check every 10 minutes or less to prevent evaporation to dryness. When concentrating by evaporating the water from your sample, the small molecules (buffer salts, reducing agents, etc.) will also be concentrated because no diffusion occurs.



Desalting Columns and Plates



Thermo Scientific
Zeba Micro Desalt
Spin Columns

96-well Desalt Plates



Protein Desalting
Spin Columns

Gel Filtration

Gel filtration involves the chromatographic separation of molecules of different dimensions based on their relative abilities to penetrate into a suitable stationary phase. A chromatographic resin, usually consisting of very small, uncharged porous particles in an aqueous solution, is packed into a column and then used for the separation.

Different levels of separation can

be achieved based on the pore size of the resin. The resin can be chosen to totally exclude proteins or large molecules, while still including small solutes. Large molecules are excluded from the internal pores of the resin and emerge first from the column in the "void volume." The smaller molecules are able to penetrate the pores, then progress through the column at a slower rate. These smaller molecules emerge from the column after the target sample.

Desalting and buffer exchange are two of the most widely used applications of gel filtration chromatography.

Desalting

Desalting involves the chromatographic separation of macromolecules in the void volume from smaller molecules that penetrate the gel bed.

Applications:

- Removing salts from protein solutions
- Removing phenol from nucleic acid preparations
- Separating excess crosslinker from conjugate preparations
- Removing excess derivatizing agents from modified proteins
- Removing unreacted dye from fluorescent antibodies
- Removing free radiolabel from labeled proteins

Buffer Exchange

Buffer exchange is used to place a protein solution into a more appropriate buffer prior to applications such as electrophoresis, ion exchange or affinity chromatography. In both desalting and buffer exchange, the macromolecular components are recovered in equilibrium with the same buffer used to equilibrate the column. If water is used for equilibration, the components will be desalted. If another buffer is used, a buffer exchange will result.

Thermo Scientific D-Salt™ Columns (page 19) are ready-to-use gel filtration columns with a unique stop-flow characteristic that prevents the gel from drying. The columns all work using gravity flow, so there is no need for a pump. A polyethylene disc has been inserted both above and below the column resin bed, so that when the buffer is applied, the meniscus will stop at the top disc. This allows control of the fraction collection time and fraction size, and it prevents sample loss.

Thermo Scientific Zeba Desalt Spin Columns

Highlights:

- Exceptional protein recovery
- Wide product offering accommodates your sample needs
- Easy to use with no cumbersome column preparation or equilibration
- No screening fractions for protein or waiting for protein to emerge by gravity flow
- Minimal sample dilution

Although numerous techniques and resins for desalting are available, most have many drawbacks, including significant sample loss, long processing times and the need to collect multiple fractions. Zeba Desalt Spin Columns provide excellent protein recovery without the limitations associated with other desalting methods. Zeba Desalt Spin Columns are available in micro^l, 0.5, 2, 5 and 10 ml formats and allow processing of samples ranging from 2 μ l to 4 ml (Table 1).

Table 1. Recommended sample volumes for Thermo Scientific Zeba Spin Columns.

Resin Bed	Sample Volume
75 μ l (micro) column	2-12 μ l
0.5 ml column	30-130 μ l
2 ml column	200-700 μ l
5 ml column	600-2,000 μ l
10 ml column	1,500-4,000 μ l
96-well	20-100 μ l

The easy-to-use Zeba Spin-Column Format dramatically improves results over standard drip-column methodologies, eliminating the need to wait for samples to emerge by gravity flow and the need to monitor fractions for protein recovery. Zeba Desalt Columns require no chromatographic system, cumbersome column preparation or equilibration and they can process multiple samples in ~8 minutes.

Desalting Columns and Plates

Zeba Desalt Spin Columns contain a high-performance desalting resin that offers exceptional desalting and protein-recovery characteristics compared to other commercially available resins (Figure 1). Samples containing as low as 25 µg/ml of protein can be processed, providing exceptional protein recovery and ≥ 95% retention of salts and other small molecules (< 1,000 MW).

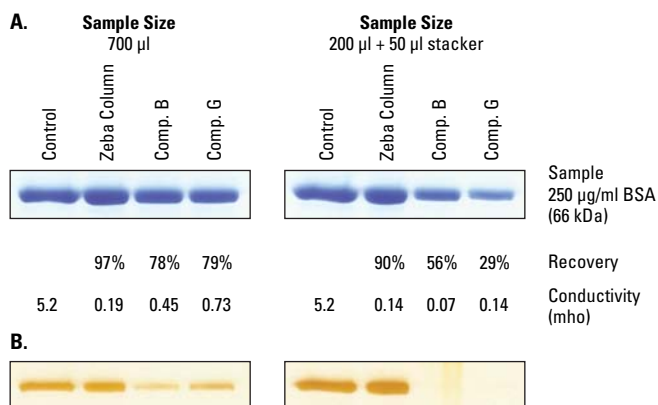


Figure 1. Increased protein recovery with Thermo Scientific Zeba Desalt Spin Columns. Samples of bovine serum albumin (BSA) at **Figure 1A**, 250 µg/ml and **Figure 1B**, 25 µg/ml in 1 M NaCl were desalted with the 2 ml Zeba Desalt Spin Columns and other commercial desalting resins using similar formats. A portion of the recovered sample (10 µl) was analyzed by SDS-PAGE. The remaining sample was used for conductivity measurements and Pierce BCA Protein Assay (Product # 23225) was performed to determine protein concentration. Zeba Desalt Resin provides significantly greater protein recovery under all conditions tested. Conductivity and protein recovery values after desalting are indicated for 250 µg/ml samples.

Ordering Information

Product #	Description	Pkg. Size
89877	Zeba Micro Desalt Spin Columns†	25/pack
89878	Zeba Micro Desalt Spin Columns†	50/pack
89882	Zeba Desalt Spin Columns, 0.5 ml	25/pack
89883	Zeba Desalt Spin Columns, 0.5 ml	50/pack
89889	Zeba Desalt Spin Columns, 2 ml	5/pack
89890	Zeba Desalt Spin Columns, 2 ml	25/pack
89891	Zeba Desalt Spin Columns, 5 ml	5/pack
89892	Zeba Desalt Spin Columns, 5 ml	25/pack
89893	Zeba Desalt Spin Columns, 10 ml	5/pack
89894	Zeba Desalt Spin Columns, 10 ml	25/pack

Handee™ Spin Columns (No Resin)

Product #	Description	Pkg. Size
89879	Handee Micro Spin Columns	50/pack
89868	Handee Spin Columns, 0.5 ml	25/pack
89896	Handee Spin Columns, 2 ml	25/pack
89897	Handee Spin Columns, 5 ml	25/pack
89898	Handee Spin Columns, 10 ml	25/pack

Thermo Scientific Zeba 96-Well Desalt Spin Plates

Highlights:

- Desalt protein in one fraction with no dilution
- Exceptional protein recovery
- Easy to use with no cumbersome plate preparation or equilibration
- Minimal sample dilution

The new Thermo Scientific Zeba 96-Well Desalt Spin Plates provide high-throughput removal of salt and small molecules from samples, preparing them for downstream analysis, including mass spectrometry, HPLC, capillary electrophoresis, metabolite screening and assay development.

The Zeba 96-Well Desalt Spin Plates contain a high-performance resin that provides exceptional desalting and protein recovery characteristics. Process small (20-100 µl) sample volumes and achieve exceptional protein recovery (Table 1) and > 95% removal of salts and other small molecules (< 1,000 Da) such as DTT, biotin, FITC or biotin-FITC. The Zeba 96-Well Desalt Spin Plates require no resin dispensing or hydration. One plate of 96 samples can be processed in 5 minutes.

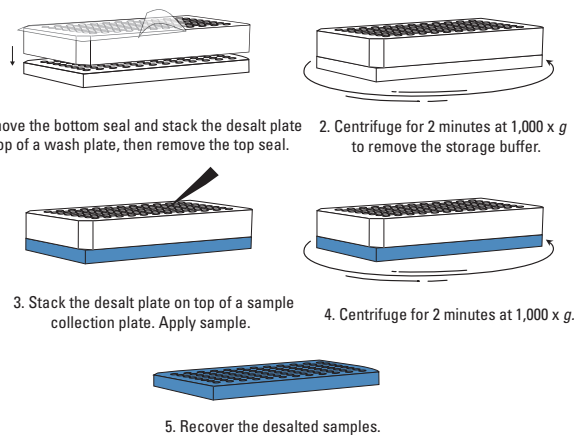


Figure 1. Thermo Scientific Zeba 96-Well Desalt Spin Plates are easy to use.

Table 1. Protein recovery and desalting efficiency.

Protein	% Protein Recovery	% NaCl Removed
BSA (66 kDa)	98.5	> 95
α-Lactalbumin (14.1 kDa)	91.5	> 95
Ubiquitin (8.6 kDa)	85	> 95

Protein samples (1 mg/ml) were prepared in 1.0 M NaCl and 100 µl samples were desalted using Zeba Desalt Spin Plates. Results were analyzed by Pierce BCA Protein Assay and conductivity measurements.



Desalting Columns and Plates

Ordering Information

Product #	Description	Pkg. Size
89807	Zeba 96-well Desalt Spin Plates Each well contains ~550 µl resin slurry and can process 20-100 µl samples. The package contains two wash plates and two collection plates.	2 plates
89808	Zeba 96-well Desalt Spin Plates Each well contains ~550 µl resin slurry and can process 20-100 µl samples. The package contains two wash plates and four collection plates.	4 plates
89934	Pierce Desalting Chromatography Cartridges Each cartridge is packed with 1 ml Zeba Desalting Resin. Recommended for processing compounds > 7K MW.	5 x 1 ml
89935	Pierce Desalting Chromatography Cartridges Each cartridge is packed with 5 ml Zeba Desalting Resin. Recommended for processing compounds > 7K MW.	5 x 5 ml



Thermo Scientific
Pierce Desalting
Chromatography
Cartridges

Thermo Scientific D-Salt Columns

D-Salt Exc ellulose™ Desalting Columns

Desalt proteins with excellent sample recoveries.

D-Salt Exc ellulose Desalting Columns are pre-packed with small, porous cellulose beads. These columns have a wet bead diameter of 100-200 µm and an exclusion limit of 5 kDa. Exc ellulose Resin is extremely stable to heat, freeze-thaw cycles, organic solvents and acidic or basic conditions. It also demonstrates excellent mechanical stability and offers excellent sample recoveries as a result of the slow flow rate.

D-Salt Dextran Desalting Columns

Exhibits excellent stability and flow properties.

D-Salt Dextran Desalting Columns (5K MWCO) are pre-packed with crosslinked dextran. The wet bead diameter is 50-150 µm. The resin has good rigidity for easy handling and excellent flow properties. The D-Salt Dextran Gel is stable in water, salt solutions, organic solvents and alkaline or weakly acidic solutions. It is heat-stable and can be autoclaved dry or in solution at a neutral pH for 30 minutes at 120°C without affecting its chromatographic properties.

D-Salt Polyacrylamide Desalting Columns

Eliminate the possibility of enzymatic degradation and microbial growth.

D-Salt Polyacrylamide Desalting Columns are prepacked with porous polyacrylamide beads. D-Salt 6K Columns have a wet bead diameter of 90-180 µm. D-Salt Polyacrylamide 1.8K Desalting Columns have a wet bead diameter of 45-90 µm. These columns are ideal for separating low MW compounds with a fractionation range of 100-1,800. The D-Salt Polyacrylamide Beads are not subject to enzymatic degradation and will not serve as a nutrient for microbial growth. The resin is very hydrophilic, so there should be little interaction with sample molecules. Contamination with low MW sugars (which may occur with crosslinked dextran) is not a concern when using D-Salt Polyacrylamide Resin.

Oxidizing agents can be removed without destroying the support. This resin is susceptible to hydrolysis of amide groups under extreme pH conditions, so an operating pH of 2-10 is recommended at room temperature. The D-Salt Polyacrylamide Resin can also be autoclaved at pH 5.5-6.5 for 30 minutes at 120°C.

Ordering Information

D-Salt Exc ellulose Desalting Columns

Product #	Description	MWCO	Pkg. Size
20439	D-Salt Exc ellulose Desalting Columns	5K	5 x 2 ml
20449	D-Salt Exc ellulose Desalting Columns	5K	5 x 5 ml

D-Salt Dextran Desalting Columns

Product #	Description	MWCO	Pkg. Size
43230	D-Salt Dextran Desalting Columns	5K	5 x 5 ml
43233	D-Salt Dextran Desalting Columns	5K	5 x 10 ml

D-Salt Polyacrylamide Desalting Columns

Product #	Description	MWCO	Pkg. Size
43426	D-Salt Polyacrylamide Desalting Columns	1.8K	5 x 5 ml
43240	D-Salt Polyacrylamide Desalting Columns	6K	5 x 5 ml
43243	D-Salt Polyacrylamide Desalting Columns	6K	5 x 10 ml
89849	Protein Desalting Spin Columns	7K	25 x 0.5 ml
89862	Protein Desalting Spin Columns	7K	50 x 0.5 ml

Cell Lysis Reagents

Table 1. Thermo Scientific Pierce Cell Lysis Reagents selection guide.

Description	Organisms/Samples	Dialyze ¹	Compatibility
B-PER Reagent[†] 78243, 165 ml 78248, 500 ml	Gram(-) bacteria, <i>S. aureus</i> , <i>H. pylori</i> , <i>E. coli</i> strains BL21(D3)> JM109> DH5α >M15, Archaeobacteria, nematodes and <i>Acinetobacter</i> sp.	Yes	Reporter assays, IPs ² , Western blot, GST- and histidine-tag purification
B-PER II Reagent 78260, 250 ml (A 2X version of B-PER Reagent)	Gram(-) bacteria, <i>S. aureus</i> , <i>H. pylori</i> , <i>E. coli</i> strains BL21(D3)> JM109> DH5α>M15, Archaeobacteria, nematodes and <i>Acinetobacter</i> sp.	Yes	Reporter assays, IPs ² , Western blot, GST- and histidine-tag purification
B-PER PBS Reagent 78266, 500 ml	Gram(-) bacteria, <i>S. aureus</i> , <i>H. pylori</i> , <i>E. coli</i> strains BL21(D3)> JM109> DH5α>M15, Archaeobacteria, nematodes and <i>Acinetobacter</i> sp.	Yes	Reporter assays, IPs ² , Western blot, GST- and histidine-tag purification
Y-PER Reagent 78991, 200 ml 78990, 500 ml	<i>S. cerevisiae</i> , <i>Schizo-saccharomyces pombe</i> , <i>C. albicans</i> , <i>B. subtilis</i> , <i>E. coli</i> , <i>P. pastoris</i> , <i>Strep. avidinii</i> and <i>Acinetobacter</i> sp.	No	IPs ² , Western blot, β-Gal enzyme assays, IEF after dialysis, GST- and histidine-tag purification
Y-PER Plus Reagent 78998, 25 ml 78999, 500 ml	Yeast (<i>S. cerevisiae</i>) and <i>Acinetobacter</i> sp.	Yes	GST- and histidine-tag purification, Western blot
M-PER Reagent 78503, 25 ml 78501, 250 ml 78505, 1 L	Cultured mammalian cells, COS-7, NIH3T3, Hepa 1-6, 293, CHO, MDA, MB231 and FM2	Yes	Luciferase, β-Gal (low signal), CAT, kinase assays, ELISAs, immobilized glutathione, Western blot
P-PER Plant Protein Extraction Reagent 89803, Kit	Multiple plant organs (leaf, stem, root, seed and flowers); multiple plant species (<i>Arabidopsis</i> , tobacco, maize, soybeans, peas, spinach, rice and other plant tissues); and fresh, frozen and dehydrated plant tissues	No	1-D and 2-D gel electrophoresis, Western blotting, activity assays and protein affinity purifications*
T-PER Reagent 78510, 500 ml	Heart, liver, kidney and brain	Yes	Luciferase, β-Gal, CAT, kinase assays, Western blot, ELISAs, immobilized glutathione
I-PER Reagent 89802, 250 ml	Baculovirus-infected insect cells grown in suspension or monolayer culture	No	Western blot, 6xHis-tagged protein purification, protein assays and ion-exchange chromatography
NE-PER Reagent 78833	Tissue: calf liver. Cultured cells: epithelial (HeLa), fibroid (COS-7), kidney (NIH3T3), liver (Hepa 1) and brain (C6)	No (CER) Yes (NER)	EMSA (if using < 3 μl or 10%, otherwise dialyze first in SAL MINIs ³), Western blot, reporter assays, IEF (after dialysis to reduce salt concentration) and 2-D ⁶
Mem-PER Reagent 89826	Cultured cells: brain (C6), epithelial (HeLa), fibroblasts (NIH3T3) and yeast (<i>S. cerevisiae</i>)	Yes ⁴	Western blot and 2-D ⁶
Mitochondria Isolation Kit for Cultured Cells[†] 89874	Mammalian cells	Yes ⁷	Western blot, 2-D Western blots, electrophoresis. Applications include apoptosis, signal transduction and metabolic studies.
Mitochondria Isolation Kit for Tissue[†] 89801	Heart, liver, kidney and brain		
Radiolmmuno Precipitation Assay (RIPA) Buffer 89900, 100 ml 89901, 250 ml	Cultured mammalian cells and cytoplasmic, membrane and nuclear proteins	Yes	Reporter assays, protein assays, immunoassays and protein purification
Lysosome Enrichment Kit for Tissues and Cultured Cells 89839	Tissues and Cultured Cells	N/A	2D/MS, electron microscopy, disease profiling, gene expression, signal transduction, and interaction or localization studies
Peroxisome Enrichment Kit for Tissue 89840	Heart, liver, kidney and brain	N/A	2D/MS, electron microscopy, disease profiling, gene expression, signal transduction, and interaction or localization studies
Nuclei Enrichment Kit for Tissue 89841	Heart, liver, kidney and brain	N/A	2D/MS, electron microscopy, disease profiling, gene expression, signal transduction, and interaction or localization studies

1. The detergent can be removed by dialysis

2. Immunoprecipitation

3. Halt Protease Inhibitor Cocktail, Product # 78410 and 78415 (EDTA-free)

4. Samples prepared in Mem-PER Reagent can be dialyzed if the buffer contains detergent (e.g., CHAPS), otherwise use PAGEprep[®] Advance Kit (Product # 89888)

5. Slide-A-Lyzer MINI Dialysis Units

6. 2-D Sample Prep for Nuclear Proteins (Product # 89863) and 2-D Sample Prep for Membrane Proteins (Product # 89864) are designed using our popular NE-PER and Mem-PER Reagents.

7. Need to lyse mitochondria first.

*Although kit works without liquid nitrogen/freeze-grinding, Dounce homogenization, blade-shearing or glass-bead agitation for cell disruption, it is compatible with these alternative mechanical aids

Cell Lysis Reagents

Protein Assay Compatibility	Notes
Pierce BCA Assay and Coomassie Plus Assay	Protease inhibitors ³ may be added to prevent protein degradation. Salts, chelating agents and reducing agents can be added for more efficient lysis. Do not exceed 0.5 M NaCl. Better lysis if cells are frozen in B-PER Reagent.
Pierce BCA Assay and Coomassie Plus Assay after Compat-Able Protein Assay Reagent Set (Product # 23215) or dilute two to four times	Protease inhibitors ³ may be added to prevent protein degradation. Salts, chelating agents and reducing agents can be added for more efficient lysis. Better lysis if cells are frozen in B-PER Reagent.
Pierce BCA Assay and Coomassie Plus Assay after Compat-Able Protein Assay Reagent Set (Product # 23215) or dilute two to four times	Protease inhibitors ³ may be added to prevent protein degradation. Salts, chelating agents and reducing agents can be added for more efficient lysis. Better lysis if cells are frozen in B-PER Reagent.
Pierce BCA Assay	Protease inhibitors ³ may be added to prevent protein degradation. Use at room temperature. Double incubation time for use at 4°C. Use log-phase cells. For stationary phase cells, add 0.1 M DTT or 20-50 mM TCEP. Will work with 1 mM EDTA. Does not lyse spores. Cannot use with ion exchange columns.
Pierce BCA Assay and Coomassie Plus Assay	Protease inhibitors ³ may be added to prevent protein degradation. The addition of up to 2 M NaCl may result in increased efficiency of lysis and protein yield.
Pierce BCA Assay and Coomassie Plus Assay	Protease inhibitors ³ may be added to prevent protein degradation. Adding 150 mM NaCl results in increased efficiency of lysis and higher protein yield in some cells lines. A PBS rinse of cells prior to lysis removes contaminants such as phenol red and increases protein yield.
Pierce BCA Assay, Reducing Agent-Compatible Not compatible with Bradford, Coomassie or Pierce BCA Assay	Kit lyses most plant cells without harsh mechanical lysis aids; extremely fibrous tissues such as woody stems may require mechanical grinding by devices not included in this kit. P-PER Extracts can be quantified using the Pierce BCA Protein Assay Kit, Reducing Agent Compatible (Product # 23250).
Pierce BCA Assay (dilute 1:1) and Coomassie Plus Assay	Protease inhibitors ³ may be added to prevent protein degradation. Mechanical disruption of the tissue is still required. Can also be used for cultured cells.
Pierce BCA Assay	Protease inhibitors ³ may be added to prevent protein degradation.
Pierce BCA Assay and Coomassie Plus Assay (dilute CER Reagent mixture four times)	Protease inhibitors ³ may be added to prevent protein degradation. Packed cell vol.: 2 x 10 ⁶ HeLa cells = 10 µl = 20 mg. Tissue yield (calf liver): 3-4 mg cytoplasmic protein/100 mg tissue; 1-1.5 mg nuclear protein/100 mg tissue. Cell yield (HeLa): 300-400 µg cytoplasmic protein/10 ⁶ cells; 40-60 µg nuclear protein/10 ⁶ cells. Positive controls tested: cytoplasmic (β-Gal, PKC, Hsp90); nuclear (Oct-1, p53, DNA polymerase).
Pierce BCA Assay and Coomassie Plus Assay; hydrophobic phase needs to be dialyzed first; see instruction book	Protease inhibitors ³ may be added to prevent protein degradation. Can dialyze against another detergent (e.g., CHAPS). Extraction efficiency is generally > 50% with the cell lines tested (having proteins with up to two transmembrane segments).
Pierce BCA Assay (after lysis)	Protease inhibitors may be added to prevent protein degradation. Douncing will increase isolation efficiency vs. detergent alone; however, multiple samples can be processed simultaneously using the reagent-based methods.
Pierce BCA Assay	Protease inhibitors ³ may be added to prevent proteolysis and maintain phosphorylation of proteins
Coomassie Plus – The Better Bradford Assay Kit	Protease inhibitors ³ may be added to prevent proteolysis and maintain phosphorylation of proteins
Coomassie Plus – The Better Bradford Assay Kit	Protease inhibitors ³ may be added to prevent proteolysis and maintain phosphorylation of proteins
Coomassie Plus – The Better Bradford Assay Kit	Protease inhibitors ³ may be added to prevent proteolysis and maintain phosphorylation of proteins

Ordering Information

SnakeSkin Dialysis Tubing

Product #	Description	MWCO	Pkg. Size	U.S. Price
68035	SnakeSkin Dialysis Tubing	3.5K	22 mm dry I.D. x 35 feet*	\$118
68700	SnakeSkin Dialysis Tubing	7K	22 mm dry I.D. x 35 feet*	\$118
68100	SnakeSkin Dialysis Tubing	10K	22 mm dry I.D. x 35 feet*	\$118

*Equivalent to 10.5 meters of 34 mm dry flat width tubing.

SnakeSkin Dialysis Tubing Accessory

Product #	Description	Pkg. Size	U.S. Price
68011	SnakeSkin Dialysis Tubing Clips	6/pkg.	\$ 47

Slide-A-Lyzer Dialysis Cassette Accessories

Product #	Description	Pkg. Size	U.S. Price
69588	Slide-A-Lyzer MINI Dialysis Unit Float	4/pkg.	\$ 20
66430	Slide-A-Lyzer Buoys	10/pkg.	\$ 26
66431	Slide-A-Lyzer Carousel Buoy	1/pkg.	\$ 37
66432	Slide-A-Lyzer Buoys	8/pkg.	\$ 21
66494	Slide-A-Lyzer Syringe (1 ml)	10/pkg.	\$ 21
66490	Slide-A-Lyzer Syringe (5 ml)	10/pkg.	\$ 21
66493	Slide-A-Lyzer Syringe (20 ml)	10/pkg.	\$ 22

Rapid Equilibrium Dialysis

Product #	Description	Pkg. Size	U.S. Price
89809	RED Device Inserts	50/pack	\$ 350
89810	RED Device Inserts	250/case	\$1,500
89811	Teflon Base Plate	1 plate	\$ 320
89812	RED Device Insert Removal Tool	1 remover	\$ 80

Slide-A-Lyzer Concentrating Solution

Product #	Description	Pkg. Size	U.S. Price
66528	Slide-A-Lyzer Concentrating Solution	200 ml	\$ 80
66529	Slide-A-Lyzer Concentrating Solution	500 ml	\$186
66530	Slide-A-Lyzer Concentrating Solution	25 ml	\$ 30

Microdialyzer System

Product #	Description	U.S. Price
66315	Microdialyzer System 100	\$499

Microdialyzer System Accessory

Product #	Description	U.S. Price
66322	Delrin 2 Sample Well Plate For System 100	\$ 65

Pre-Framed Dialysis Membranes

Product #	Description	MWCO	Pkg. Size	U.S. Price
66306	Pre-Framed Dialysis Membranes	1K	10/pkg.	\$119
66307	Pre-Framed Dialysis Membranes	3K	10/pkg.	\$119
66310	Pre-Framed Dialysis Membranes	8K	10/pkg.	\$119
66312	Pre-Framed Dialysis Membranes	20K	10/pkg.	\$119
66313	Pre-Framed Dialysis Membranes	50K	10/pkg.	\$119

Desalting Columns, Plates and Cartridges

Zeba Spin Columns and Plates

Product #	Description	Pkg. Size	U.S. Price
89877	Zeba Micro Desalt Spin Columns	25/pack	\$103
89878	Zeba Micro Desalt Spin Columns	50/pack	\$185
89882	Zeba Desalt Spin Columns, 0.5 ml	25/pack	\$ 93
89883	Zeba Desalt Spin Columns, 0.5 ml	50/pack	\$169
89889	Zeba Desalt Spin Columns, 2 ml	5/pack	\$ 36
89890	Zeba Desalt Spin Columns, 2 ml	25/pack	\$169
89891	Zeba Desalt Spin Columns, 5 ml	5/pack	\$ 47
89892	Zeba Desalt Spin Columns, 5 ml	25/pack	\$215
89893	Zeba Desalt Spin Columns, 10 ml	5/pack	\$ 56
89894	Zeba Desalt Spin Columns, 10 ml	25/pack	\$255
89807	Zeba 96-well Desalt Plate	2 plates	\$190
89808	Zeba 96-well Desalt Plate	4 plates	\$360

Desalting Chromatography Cartridges

Product #	Description	Pkg. Size	U.S. Price
89934	Pierce Desalting Chromatography Cartridges	5 x 1 ml	\$138
89935	Pierce Desalting Chromatography Cartridges	5 x 5 ml	\$158

Handee Spin Columns

Product #	Description	Pkg. Size	U.S. Price
89879	Handee Micro Spin Columns	50/pack	\$ 49
89868	Handee Spin Columns, 0.8 ml	25/pack	\$ 54
89896	Handee Spin Columns, 2 ml	25/pack	\$ 35
89897	Handee Spin Columns, 5 ml	25/pack	\$ 40
89898	Handee Spin Columns, 10 ml	25/pack	\$ 45

Protein Desalting Spin Columns

Product #	Description	Pkg. Size	U.S. Price
89849	Protein Desalting Spin Columns	25/pkg.	\$ 99
89862	Protein Desalting Spin Columns	50/pkg.	\$163

D-Salt Desalting Columns

Product #	Description	MWCO	Pkg. Size	U.S. Price
20439	D-Salt Excellulose Desalting Columns	5K	5 x 2 ml	\$ 96
20449	D-Salt Excellulose Desalting Columns	5K	5 x 5 ml	\$106
43230	D-Salt Dextran Desalting Columns	5K	5 x 5 ml	\$ 74
43233	D-Salt Dextran Desalting Columns	5K	5 x 10 ml	\$ 81
43426	D-Salt Polyacrylamide Desalting Columns	1.8K	5 x 5 ml	\$ 75
43240	D-Salt Polyacrylamide Desalting Columns	6K	5 x 5 ml	\$ 71
43243	D-Salt Polyacrylamide Desalting Columns	6K	5 x 10 ml	\$ 85

Pierce Protein Concentrators

Product #	Description	MWCO	Pkg. Size	U.S. Price
89884	Pierce Concentrators, 7 ml	9K	25/pkg.	\$129
89885	Pierce Concentrators, 20 ml	9K	25/pkg.	\$232
89886	Pierce Concentrators, 7 ml	20K	25/pkg.	\$129
89887	Pierce Concentrators, 20 ml	20K	25/pkg.	\$232

Cell Lysis Reagents

Product #	Description	Pkg. Size	U.S. Price
78243	B-PER Reagent	165 ml	\$129
78248	B-PER Reagent	500 ml	\$245
78260	B-PER II Reagent	250 ml	\$245
78266	B-PER PBS Reagent	500 ml	\$245
78991	Y-PER Reagent	200 ml	\$116
78990	Y-PER Reagent	500 ml	\$249
78998	Y-PER Plus Reagent	25 ml	\$ 29
78999	Y-PER Plus Reagent	500 ml	\$246
78503	M-PER Reagent	25 ml	\$ 53
78501	M-PER Reagent	250 ml	\$217
78505	M-PER Reagent	1 L	\$589
89803	P-PER Plant Protein Extraction Reagent	Kit	\$225
78510	T-PER Reagent	500 ml	\$242
89802	I-PER Reagent	250 ml	\$165
78833	NE-PER Reagent	Kit	\$185
89826	Mem-PER Reagent	Kit	\$185
89874	Mitochondria Isolation Kit for Cultured Cells	Kit	\$185
89801	Mitochondria Isolation Kit for Tissue	Kit	\$199
89900	Radiolmmuno Precipitation Assay (RIPA) Buffer	100 ml	\$ 60
89901	Radiolmmuno Precipitation Assay (RIPA) Buffer	250 ml	\$130
89839	Lysosome Enrichment Kit for Tissues and Cultured Cells	Kit	\$250
89840	Peroxisome Enrichment Kit for Tissue	Kit	\$250
89841	Nuclei Enrichment Kit for Tissue	Kit	\$250

Ordering Information

2K MWCO Membrane Products

0.5 ml Capacity Slide-A-Lyzer Dialysis Cassettes

Product #	Description	Pkg. Size	U.S. Price
66205	Slide-A-Lyzer Dialysis Cassette	10/pkg.	\$ 73

3 ml Capacity Slide-A-Lyzer Dialysis Cassettes

Product #	Description	Pkg. Size	U.S. Price
66203	Slide-A-Lyzer Dialysis Cassette	10/pkg.	\$ 73

12 ml Capacity Slide-A-Lyzer Dialysis Cassettes

Product #	Description	Pkg. Size	U.S. Price
66212	Slide-A-Lyzer Dialysis Cassette	8/pkg.	\$ 94

30 ml Capacity Slide-A-Lyzer Dialysis Cassettes

Product #	Description	Pkg. Size	U.S. Price
66230	Slide-A-Lyzer Dialysis Cassette	6/pkg.	\$ 75

3.5K MWCO Membrane Products

Slide-A-Lyzer MINI Dialysis Units

Product #	Description	Capacity	Pkg. Size	U.S. Price
69554	Slide-A-Lyzer MINI Dialysis Unit Plus Microtubes	10-100 µl	10/pkg.	\$ 49
69558	Slide-A-Lyzer MINI Dialysis Units and Float	10-200 µl	10/pkg.	\$ 53
69550	Slide-A-Lyzer MINI Dialysis Unit	10-100 µl	50/pkg.	\$126
69552	Slide-A-Lyzer MINI Dialysis Unit	10-100 µl	250/pkg.	\$384

0.5 ml Capacity Slide-A-Lyzer Dialysis Cassettes

Product #	Description	Capacity	Pkg. Size	U.S. Price
66333	Slide-A-Lyzer Dialysis Cassette	0.1-0.5 ml	10/pkg.	\$ 73
66335	Slide-A-Lyzer Dialysis Cassette Kit	0.1-0.5 ml	Kit	\$ 88

3 ml Capacity Slide-A-Lyzer Dialysis Cassettes

Product #	Description	Capacity	Pkg. Size	U.S. Price
66330	Slide-A-Lyzer Dialysis Cassette	0.5-3 ml	10/pkg.	\$ 73
66332	Slide-A-Lyzer Dialysis Cassette Kit	0.5-3 ml	Kit	\$102

12 ml Capacity Slide-A-Lyzer Dialysis Cassettes

Product #	Description	Capacity	Pkg. Size	U.S. Price
66110	Slide-A-Lyzer Dialysis Cassette	3-12 ml	8/pkg.	\$ 94
66107	Slide-A-Lyzer Dialysis Cassette Kit	3-12 ml	Kit	\$115

30 ml Capacity Slide-A-Lyzer Dialysis Cassettes

Product #	Description	Capacity	Pkg. Size	U.S. Price
66130	Slide-A-Lyzer Dialysis Cassette	12-30 ml	6/pkg.	\$ 76

7K MWCO Membrane Products

Slide-A-Lyzer MINI Dialysis Units

Product #	Description	Capacity	Pkg. Size	U.S. Price
69560	Slide-A-Lyzer MINI Dialysis Unit	10-100 µl	50/pkg.	\$126
69562	Slide-A-Lyzer MINI Dialysis Unit	10-100 µl	250/pkg.	\$394

0.5 ml Capacity Slide-A-Lyzer Dialysis Cassettes

Product #	Description	Capacity	Pkg. Size	U.S. Price
66373	Slide-A-Lyzer Dialysis Cassette	0.1-0.5 ml	10/pkg.	\$ 73
66375	Slide-A-Lyzer Dialysis Cassette Kit	0.1-0.5 ml	Kit	\$ 88

3 ml Capacity Slide-A-Lyzer Dialysis Cassettes

Product #	Description	Capacity	Pkg. Size	U.S. Price
66370	Slide-A-Lyzer Dialysis Cassette	0.5-3 ml	10/pkg.	\$ 73
66372	Slide-A-Lyzer Dialysis Cassette Kit	0.5-3 ml	Kit	\$102

12 ml Capacity Slide-A-Lyzer Dialysis Cassettes

Product #	Description	Capacity	Pkg. Size	U.S. Price
66710	Slide-A-Lyzer Dialysis Cassette	3-12 ml	8/pkg.	\$ 94
66707	Slide-A-Lyzer Dialysis Cassette Kit	3-12 ml	Kit	\$115

10K MWCO Membrane Products

Slide-A-Lyzer MINI Dialysis Units

Product #	Description	Capacity	Pkg. Size	U.S. Price
69574	Slide-A-Lyzer MINI Dialysis Unit Plus Microtubes	10-100 µl	10/pkg.	\$ 50
69570	Slide-A-Lyzer MINI Dialysis Unit	10-100 µl	50/pkg.	\$126
69572	Slide-A-Lyzer MINI Dialysis Unit	10-100 µl	250/pkg.	\$394
69576	Slide-A-Lyzer MINI Dialysis Unit Plus Float	10-100 µl	Kit/10 pkg.	\$ 53

0.5 ml Capacity Slide-A-Lyzer Dialysis Cassettes

Product #	Description	Capacity	Pkg. Size	U.S. Price
66383	Slide-A-Lyzer Dialysis Cassette	0.1-0.5 ml	10/pkg.	\$ 73
66384	Slide-A-Lyzer Dialysis Cassette	0.1-0.5 ml	5x10/pkg.	\$340
66385	Slide-A-Lyzer Dialysis Cassette Kit	0.1-0.5 ml	Kit	\$ 88

3 ml Capacity Slide-A-Lyzer Dialysis Cassettes

Product #	Description	Capacity	Pkg. Size	U.S. Price
66380	Slide-A-Lyzer Dialysis Cassette	0.5-3 ml	10/pkg.	\$ 73
66381	Slide-A-Lyzer Dialysis Cassette	0.5-3 ml	5x10/pkg.	\$340
66382	Slide-A-Lyzer Dialysis Cassette Kit	0.5-3 ml	Kit	\$102

12 ml Capacity Slide-A-Lyzer Dialysis Cassettes

Product #	Description	Capacity	Pkg. Size	U.S. Price
66810	Slide-A-Lyzer Dialysis Cassette	3-12 ml	8/pkg.	\$ 94
66811	Slide-A-Lyzer Dialysis Cassette	3-12 ml	5x10/pkg.	\$440
66807	Slide-A-Lyzer Dialysis Cassette Kit	3-12 ml	Kit	\$115

30 ml Capacity Slide-A-Lyzer Dialysis Cassettes

Product #	Description	Capacity	Pkg. Size	U.S. Price
66830	Slide-A-Lyzer Dialysis Cassette	12-30 ml	6/pkg.	\$ 76

λ-Irradiated 10K MWCO Membrane

Product #	Description	Capacity	Pkg. Size	U.S. Price
66454	Slide-A-Lyzer Dialysis Cassette	0.1-0.5 ml	10/pkg.	\$ 99
66455	Slide-A-Lyzer Dialysis Cassette	0.5-3 ml	10/pkg.	\$109
66453	Slide-A-Lyzer Dialysis Cassette	3-12 ml	8/pkg.	\$100
66456	Slide-A-Lyzer Dialysis Cassette	12-30 ml	6/pkg.	\$ 78

20K MWCO Membrane Products

0.5 ml Capacity Slide-A-Lyzer Dialysis Cassettes

Product #	Description	Pkg. Size	U.S. Price
66005	Slide-A-Lyzer Dialysis Cassette	10/pkg.	\$ 70

3 ml Capacity Slide-A-Lyzer Dialysis Cassettes

Product #	Description	Pkg. Size	U.S. Price
66003	Slide-A-Lyzer Dialysis Cassette	10/pkg.	\$ 70

12 ml Capacity Slide-A-Lyzer Dialysis Cassettes

Product #	Description	Pkg. Size	U.S. Price
66012	Slide-A-Lyzer Dialysis Cassette	8/pkg.	\$ 90

30 ml Capacity Slide-A-Lyzer Dialysis Cassettes

Product #	Description	Pkg. Size	U.S. Price
66030	Slide-A-Lyzer Dialysis Cassette	6/pkg.	\$ 72



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