Spectra/Por® MacroDialyzer

Spectrum Product Instruction Manual

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Spectra/Por® MacroDialyzer

The Spectra/Por® MacroDialyzers represents a quantitative improvement over conventional dialysis techniques involving a tube or sack of membrane. These dialyzers incorporate a flat sheet of Spectra/Por® dialysis membrane and are provided with tubing connections to allow the dialysate to be continually replenished. The MacroDialyzer cells are also equipped with fittings which allow flow-through dialysis. MacroDialyzers are suitable for equilibrium dialysis, flow dialysis, or dialysis against a continually replenished buffer.

Introduction

The Spectra/Por® MacroDialyzers cell halves are constructed of transparent acrylic so you can visually monitor the separation.

Four different MacroDialyzer cells are available with half-cell capacities of 1, 5, 10, and 50 ml. (total cell volume is twice the half-cell volume)

Each cell half has three sampling ports fitted with a Luer connector. Included with each MacroDialyzer is a set of luer plugs for sealing the connections through which no flow is desired, as well as a set of tubing adapters for the luer connectors, to allow continuous flow through one or both cell halves.

Dialysis

The driving force for the dialysis process is the concentration gradient of permeating molecular species across the membrane. Sufficiently small molecules are allowed to permeate from high concentration on one side of the membrane to lower concentration on the other side while larger molecules are slowed in their permeation, or are prevented from permeating at all. In this manner, separations, purifications and the removal or exchange of salts can be achieved.

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Molecular Weight Cut Off (MWCO)

Spectrum uses the molecular weight cut off (MWCO) as the primary method to indirectly define the membrane pore size and selectivity. This widely used method characterizes the membrane by the solute molecular weight at which 90% of the solute concentration will be retained by the membrane in the original solution (retentate side of the membrane) with 10% or less crossing to the solvent side (diffusate side) of the membrane over a 17-hour dialysis test. Spectra/Por® membranes are characterized by actual dialysis of molecules with known MWCO's.

Dialysis Rate

Dialysis membranes may also be characterized by the rate at which a permeable molecular species passes through the membrane. A rate test may be carried out by placing a solution of known concentration of a permeable species on the retentate side of the membrane and pure solvent on the other side (the diffusate side). Both sides are well-stirred, and the diffusate is constantly changed so that it never contains a significant concentration of the solute. Under these conditions, a first order rate is generally observed, i.e. a plot of the logarithm of retentate concentration versus time is a straight line. The slope of this line contains the rate constant by which membranes may be compared.

A very important variable in the rate of dialysis is the molecular weight of the solute. As the molecular weight of a permeable solute increases, the rate of dialysis decreases. As the solute molecular weight nears the MWCO, the rate will slow dramatically, until finally, the molecules become too large to pass through the membrane. Dialysis rate is also inversely proportional to the thickness of the membrane. Therefore thinner membranes provide the higher dialysis rates.

Membrane MWCO Selection

The effective sizes of many solute molecules are affected by conditions such as the pH and ionic strength and therefore, the MWCO is an approximate guide to the user. To establish the best MWCO for the user's application, it may be necessary to test several MWCO's. For maximum rate of dialysis the user should select a MWCO as large as possible that will still prevent undue loss of the desired species.

Spectra/Por® 1,2,3 & 4

Regenerated Cellulose (RC) Membrane Discs

Spectra/Por® Regenerated Cellulose (RC) membranes are made from highly purified natural cellulose fibers by extruding a solution into a precipitation bath. All efforts are made in the manufacturing process to provide the highest uniformity of wall thickness and permeability. The RC membranes are supplied in a range of MWCO's and sizes to fit Spectra/Por equipment. Spectra/Por RC membranes are supplied dry and contain glycerin as a humectant and plasticizer.

Membrane Handling

Regenerated Cellulose (RC) membrane is gel-like, exhibits some elasticity and may be easily stretched or distorted. A high degree of distortion should be avoided, however, because it can cause changes in the MWCO. When ready to use a membrane, immerse in water to remove the glycerine that acts as a humectant. Immediately place the membrane in a dialysis cell and fill with solution to avoid drying out the membrane. Drying must be avoided because it causes irreparable loss of the membrane's pore structure.

Storage

Spectra/Por® RC membranes may be stored in a dry (non-humid) environment at room temperature, however, 4-10 C° is recommended.

Membrane Use

Spectra/Por® RC membranes may be used over a range of temperatures up to 90 °C (the MWCO may change at the higher temperatures) and pH values from 2 to 10.

Cell Assembly and Disassembly

Caution: Keep fingers clear of the snap clamp catching area.

1. Release the snap clamps. Pull the clamp lever away from the MacroDialyzer body to position 1 (see Figure 2). Then disengage the clamp from the MacroDialyzer. Remove one clamp at a time.

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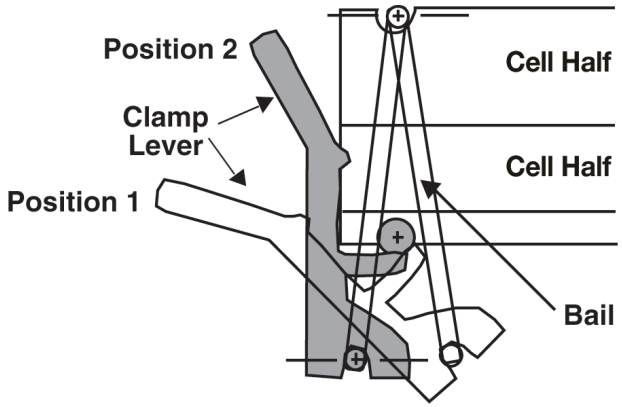

Figure 2. Spectra/Por® MacroDialyzer Snap Clamp and Bail

2. Separate the two half cells and rinse them with water. Either discard or store (as described above) any membrane which may be in the MacroDialyzer. Dry the cell halves with a soft cloth.

3. Position a dialysis membrane evenly over the cell opening. Gently spread the membrane to avoid wrinkles.

4. Align the guide pins with their mating holes and join the two cell halves. The membrane should cover the entire opening and sealing surface.

5.To snap the clamps back into position, arrange the MacroDialyzer and one of the clamps as shown in Figure 2, position 1. To do this, slip the MacroDialyzer through the bail and place the bail into the groove on the sample well plate. Slide the notch on the clamp lever into the groove on the underside of the bottom plate.

6. Then snap the clamp closed by pressing the lever toward the cell.

7. Close the other snap clamp in a similar fashion.

8. Visually inspect the cell to ensure that the cell parts are properly clamped and aligned.

9. The unit is ready to be filled with dialysate.

Equilibrium Dialysis
To operate a Spectra/Por® MacroDialyzer as an equilibrium dialyzer, all six of the Luer sealing plugs will be used.

After the dialyzer has been assembled, as described above, simply fill one chamber with one of the fluids using a syringe, and optionally, a blunt-tipped or flexible needle. Then use the Luer plugs to seal that chamber. The other chamber can then be filled and sealed in a similar fashion to start the dialysis.

Samples may be drawn from either chamber to monitor the progression of the dialysis.

Flow Dialysis
Using two of the Luer tubing adapters provided, the dialysate chamber can be adapted to allow for its continuous exchange. Using a Macroflow pump, the flow in the dialysate chamber can be maintained at its optimal rate of 3 to 10 ml/min.

To perform flow dialysis, first assemble the MacroDialyzer as described above. Then fit two of the Luer fittings on the dialysate half-cell with tubing adapters and the third with a sealing plug. Connect the tubing adapters to the flow system to be used. Finally, fill the sample cell half with sample and use 3 of the Luer sealing plugs to seal that cell half.

The dialysate may then be pumped through the cell to increase the rate of dialysis.

Use with a Water Bath
A constant temperature water bath may be used to control the temperature of the sample and dialysate. Since the cell is water-tight, either flow or equilibrium dialysis may be done with the cell immersed in a constant temperature bath. The membranes supplied for use with the MacroDialyzer are usable over the temperature range of 0 to 37 °C.

Degassing the Dialysis Buffer
The solubility of air in water decreases with increasing temperature, so that bubbles of air may spontaneously form with changes in the temperature of the buffer. Since the MacroDialyzer uses a horizontal membrane, these air bubbles may become trapped underneath it, reducing the dialysis efficiency.

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To prevent the spontaneous formation of air bubbles, it is recommended that the buffer solution be degassed immediately prior to use. The recommended method for degassing the solution is to vacuum filter it, using a Spectrum® Microfiltration System equipped with a 0.2 µm filter.

Cleaning the MacroDialyzer
The following procedure may be used to clean the MacroDialyzer:

1. Disassemble the unit. Rinse the plastic pieces with distilled water. Keep the snap clamps separate from the plastic pieces.

2. Soak the plastic parts overnight in a mild surfactant solution. Avoid scratching or abrading the plastic surfaces.

3. Flush the parts with plenty of distilled water.

4. Rinse the plastic parts with 20% ethanol and dry them with a soft cloth.

Sterilization
The acrylic body should be sterilized with a mild sterilant such as 1% formaldehyde or ethylene oxide gas. This unit should not be autoclaved.

The dialysis membrane may be radiation sterilized.

To radiation sterilize the membrane, expose it to a gamma ray source until they have received a total dose of 2.5 Megarads. During the exposure the temperature should not rise by more than 10 °C and should always remain below 35 °C.

The following chart of chemical resistance is intended as a general guide, however, variables in temperature, concentrations, duration of exposure and other conditions may affect the use of the product. Consequently, you may wish to test the membrane under your own conditions.

Classification

G - Good chemical resistance
F - Fair chemical resistance (pore swelling or shrinkage may occur)
N - Not recommended

	Spectra/Por® 1-4	Buna-N	Acrylic
Hydrocarbons			
Hexane, xylene	G	N	N
Toluene, benzene	G	N	N
Kerosene, gasoline	G	G	G
Tetralin, decalin	G	G	G
Halogenated Hydrocarbons			
Methylene chloride	G	N	N
Chloroform	G	N	N
Carbon tetrachloride	G	F	N
Trichloroethylene	G	F	N
Perchloroethylene	G	F	N
Monochloro-benzene, Freon	G	F	N
Alcohols			
Methanol, 98%	G	G	N
Ethanol, 98%	G	F	N
Ethanol, 70%	G	F	F
Isopropanol, n-Propanol	G	F	F
Amyl alcohol, butanol	G	F	F
Benzyl alcohol	G	F	N
Propylene glycol	G	G	F
Ethylene glycol	G	G	F
Glycerol	G	G	F
Ketones			
Acetone,cyclohexanone	G	N	N
Methyl ethyl ketone	G	N	N
Isopropylacetone	G	N	N
Esters			
Ethyl acetate,methyl acetate	G	N	N
Amyl, propyl,butyl acetate	G	N	N
Propylene glycol acetate	G	N	N
2-Ethoxyethyl acetate	G	N	N
Methyl cellosolve acetate	G	N	N

Benzyl benzoate	G	N	N
Isopropyl myristate	G	N	N
Tricresyl phosphate	G	N	N
Oxides			
Ethyl ether	G	N	N
Dioxane,tetrahydrofuran	G	N	N
Dimethylsulfoxide	F	N	N
Solvents containing nitrogen			
Dimethyl formamide	F		
Dimethylacetone	G		
Triethanolamine	G	G	
Aniline	G	N	N
Pyridine	G	N	
Acids			
Hydrochloric acid, 30%	N	F	F
Hydrochloric acid, 25%	N	F	F
Nitric acid, 65%	N	N	N
Nitric acid, 25%	N	N	F
Sulfuric acid, 96%	N	N	F
Sulfuric acid, 25%	F	N	G
Phosphoric acid, 25%	F	N	F
Formic acid, 100%	G	N	N
Formic acid, 25%	G	N	F
Acetic acid, 100%	G	F	N
Acetic acid, 25%	G	F	F
Trichloroacetic acid, 10%	G		
Trichloroacetic acid, 25%	G		
Perchloric acid, 25%	N		
Hydrofluoric acid, 25%	F	F	
Alkalies			
Ammonium hydroxide, 25%	F	N	G
Ammonium hydroxide, 1N	F	N	G
Sodium hydroxide, 1N	F	F	G
Potassium hydroxide, 1N	N	F	G
Miscellaneous			
Aqueous phenol, 10%	N	N	
Solvent E 33 (Hoechst)	G		
Methyl cellosolve	F	F	N
Formaldehyde solution, 30%	G	F	N
Turpentine, castor oil	G	G	G
Peanut oil	G	G	G
Silicone oil, mineral oil	G	G	G
Hydrogen peroxide, 30%	G	F	G

Ordering Information
MacroDialyzers

Part No.	Cell volume (ml) Half-Cell	Cell Chamber Dia. x Depth (mm)	Membrane Disc (mm)
132374	1.0	20 x 10	33
132376	5.0	38 x 10	47
132377	10.0	38 x 20	47
132379	50.0	80 x 20	100

Replacement Kits for MacroDialyzers

Part No.	Description
132338	Replacement kit for 1.0 ml Macrodialyzer; 6 luer fittings, 3 two-way valves, 2 bottom O-rings.
132339	Replacement kit for 5.0 and 10 ml Macrodialyzers; 6 luer fittings, 3 two-way valves, 2 bottom O-rings
132340	Replacement kit for 50 ml Macrodialyzer; 6 luer fittings, 3 two-way check valves, 2 bottom O-ring
132380	O-ring for product No.132374
132381	O-ring for Product No.132376 and 132377

Spectra/Por Regenerated Cellulose Discs

	MWCO	33mm Dia	47mm Dia	100mm Dia
S/P1	6-8 kd	132478	132476	132474
S/P2	12-14 kd	132482	132480	132477
S/P3	3.5 kd	132488	132486	132484
S/P4	12-14 kd	132498	132496	132494

To place an order go to www.spectrumlabs.com or:

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