Designation: E 1343 – 90 (Reapproved 2001)

Standard Test Method for Molecular Weight Cutoff Evaluation of Flat Sheet Ultrafiltration Membranes[1]

This standard is issued under the fixed designation E 1343; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ϵ) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This test method covers the evaluation of the molecular weight cutoff of flat sheet ultrafiltration membranes with cutoffs between 4500 and 1 000 000 daltons. The nonadsorbing characteristics of the test penetrant utilized by this test method permit the test to be performed on a wide variety of membrane substrates, excluding those which strongly adsorb dextran, from highly hydrophilic to highly hydrophobic. This test method is not applicable for microfiltration membranes with pore sizes of 0.01 µm or larger, nor for reverse osmosis or dialysis membranes with less than 4500 molecular weight cutoff. (It is possible that this test method could be modified to expand the range from 100 to 2 000 000 daltons.) This test method is not applicable to membrane materials that strongly adsorb dextrans since these materials will potentially change the value of the measured molecular weight cutoff and hence will invalidate the test results.

1.2 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

2. Summary of Test Method

2.1 The membrane is rinsed with purified water and installed in the test cell. The precalibrated dextran *T*-fraction feed is pumped through the cell and the flux through the membrane is set at the value of 0.0001 cm/s and an ultrafiltrate sample taken and compared to a sample of the feed for molecular weight distribution. Gel permeation chromatography is used to compare the feed to the permeate and the rejection at each 3-s data slice is calculated. The resulting rejection is then plotted as a function of the molecular mass average of the sample for the data slice.

3. Significance and Use

3.1 This test method provides a convenient, rapid, reproducible method of comparing the intrinsic properties of ultrafiltration membranes. The use of nonfouling dextrans allows a direct comparison of membranes without interference from materials that may foul one membrane and not affect another. The degree of correlation between this test and actual performance on a commercial feed stream has not been completely established; however, a membrane can be exposed to the fouling solution in question and then the effect of that foulant determined by then running the test and comparing to the results on an appropriate unfouled membrane. It should be made clear that this test method does not substitute for the actual testing of a commercial or experimental membrane on a feed stream of interest. The low transmembrane pressures, lack of adsorption of the test permeants onto the membrane, and low recovery/pass are intended to eliminate interferences such as polarization and fouling that mask the properties of the membrane. It is likely that any system operated in a commercial fashion will experience fouling, adsorption, and polarization to some degree as well as a "compaction" phenomenon over the first several h of operation.

4. Apparatus

4.1 The basic membrane test system consists of the following:

4.1.1 *Standard Flat Membrane, Stirred Ultrafiltration Test Cell*, for 62-mm membrane disc, modified as shown in Fig. 1,[2]

4.1.2 *Diaphragm Pump*, approximately 0 to 200 mL/min variable pumping range, 30 psig pressure capability at 100 mL/min, all wetted parts of 316 stainless steel and polyfluorocarbon construction,[3]

4.1.3 *Back Pressure Regulator and Pressure Gage*, 0 to 30 psig, 316 stainless steel,

4.1.4 *Electronic Digital Flowmeter*, with direct readout of volumetric flow in the approximate range 0.06 to 5 mL/min,

4.1.5 *Magnetic Stirplate with Tachometer,*[4]

4.1.6 *Magnetic Stir Plate, Stirbar, and Container*, (1000 cm^3 Erlenmeyer) for test solution,

4.1.7 *Pulse Dampener*, 500-Ml, 316 stainless steel,

[1] This test method is under the jurisdiction of ASTM Committee E48 on Biotechnology and is the direct responsibility of Subcommittee E48.03 on Unit Processes and Their Control.

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[2] Membrane equipment, model 8200 or equal, available from Amicon Division of W. R. Grace, 1114-T Avenue of the Americas, New York, NY 10036, has been found suitable for this purpose.

[3] Diaphram pump, model EP-C40 or equal, available from CHEM/TECH International Industries, 1655-T Des Peres P.O. Box 31000, St. Louis, MO 63131, has been found suitable for this purpose.

[4] Stirplate, model 4650-54, or its equivalent, available from Cole Parmer Spincadet, 7427-T N. Oak Park Ave., Chicago, IL 60648, has been found suitable for this purpose.

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