Molecular Permeability Distribution of Ultrafiltration Membranes

As mentioned in a previous "One Minute Filtration" article (*Retention Efficiency of Ultrafiltration Membranes*) , Ultrafiltration membranes are measured for their retention efficiency using a variety of molecular species such as dextrans, proteins, etc. to determine the Nominal Molecular Weight Cut-Off (NMWCO). This measurement provides a relative measure of their retention efficiency of a particular sized molecule. While this is important to understand how a membrane will reject or concentrate a certain sized molecule it tells us nothing of the membranes performance concerning the rejection of smaller molecules. To better understand a membranes performance on a variety of different sized molecules, an understanding of the membranes molecular permeability distribution is important.

As in the previous article on Ultrafiltration membrane retention, there is no standardized test to measure a membranes molecular permeability distribution. It is typically done using a polydispersed solution of a variety of different sized molecules and measuring the difference in concentration of each upstream and downstream of the challenged membrane. This can be done using a manufactured stream of standard molecules such as different size dextran molecules or by using a naturally occurring solution such as serum or whey proteins. An example of a molecular permeability distribution is shown below:

In the chart shown above, there are three different molecular permeability distributions representing a wide, average and narrow distribution. Each may be more or less desirable for a given application.

A wide distribution is good for applications where the retention of a broad range of molecular species is desired, such as the concentration of as much protein as possible with the highest NMWCO providing the highest permeate rate. An example of this is the concentration of whey proteins for use as a protein additive to foods. In this case, the user wants as much protein as possible and is not concerned as to the protein variety, globulins, albumin, etc.

A narrow distribution is desired when one wants to separate the larger from smaller molecules. An example of this in the same application is the separation of fats from whey proteins. In this case, the user wants all the fat removed but as much of the valued proteins to pass as possible. If a wide molecular permeability distribution membrane was used not only would the fat be retained but also a significant portion of the valued protein, particularly larger proteins such as the globulins.

Membrane manufactures have only recently been designing and developing membranes for specific application where membrane can effectively fractionate solutions by retaining the larger molecules while effectively passing a high percentage of the smaller molecules.

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To discover more about Microfiltration Membranes and Ultrafiltration Membranes register for these short courses. They are each 4 hours long, with Microfiltration offered in the morning and Ultrafiltration offered in the afternoon. Lunch is included.

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