Material Brief: Hollow Fiber – Pore Size – Porometer 3Gzh

A hollow fiber was analyzed by capillary flow porometry on the Porometer 3G. The resulting bubble point, pore size and pore flow distributions were calculated from the data.

1 Introduction

Hollow fibers are typically created by spinning synthetic polymers. Properties such as temperature and composition of the polymer and solvent, speed at which the fiber is spun, and the dimensions of the apparatus through which the fiber is spun, among others, can be altered to fine tune both the pore size and membrane thickness. Hollow fibers are used for a variety of different applications such as in the biomedical field (blood fractionation, tissue engineering, etc.), bioseparations, bioreactors, water purification and desalination, and gas separations.

As in any filtration process, pore size is the important parameter that controls what can and cannot pass through the membrane. In particular, the through pore size – pores that start at one side of the membrane and terminate at the other side – needs to be properly measured to ensure the hollow fiber meets the needs of the application. The Porometer 3Gzh was used to measure the flow and pore size properties of a hollow fiber fabricated for use in biofiltration.

2 Experimental

Sample Preparation

A hollow fiber was attached to the Porometer 3Gzh external sample holder for *inside-out* measurement as given in [1].

Sample Analysis

Porofil was used as the wetting fluid. The sample was saturated in Porofil prior to starting the measurement. The data was measured in the pressure range from 6.5 to 16 bar. Further analysis parameters are shown in Table 1.

3 Results

Figure 1 shows the wet run and dry run curves for the hollow fiber. The bubble point pressure is 9.85 bar corresponding to a pore size of 0.065 µm. The minimum pore size is 0.043 µm. The pore size distribution is shown in Figure 2. The pore size is calculated from the pressure-flow curve using the Washburn equation, which relates pressure to expel liquid from the pores to the size of the pore (Equation 1).

4 References

1. Anton Paar application report: Measuring Pore Size in the Walls of Hollow Fiber Membranes

5 Equations, Figures, and Tables

$$Pr = 2\gamma \cos\theta$$

Equation 1 (Washburn):
P is pressure
r is pore radius
γ is surface tension of the wetting fluid
θ is contact angle of the wetting fluid

Table 1: Hollow fiber measurement parameters

Parameter	Setting	Parameter	Setting
Wetting Fluid	Porofil	*Surface Tension*	16.00 dyn/cm
Size Factor	0.640	*Fluid Density*	1850.00 kg/m^3
Shape Factor	1	*# Data Points*	256
Tortuosity	1	*Run Mode*	Pore Size, Wet Then Dry
Contact Angle	0.00°	*Run Type*	Normal Equilibration Run

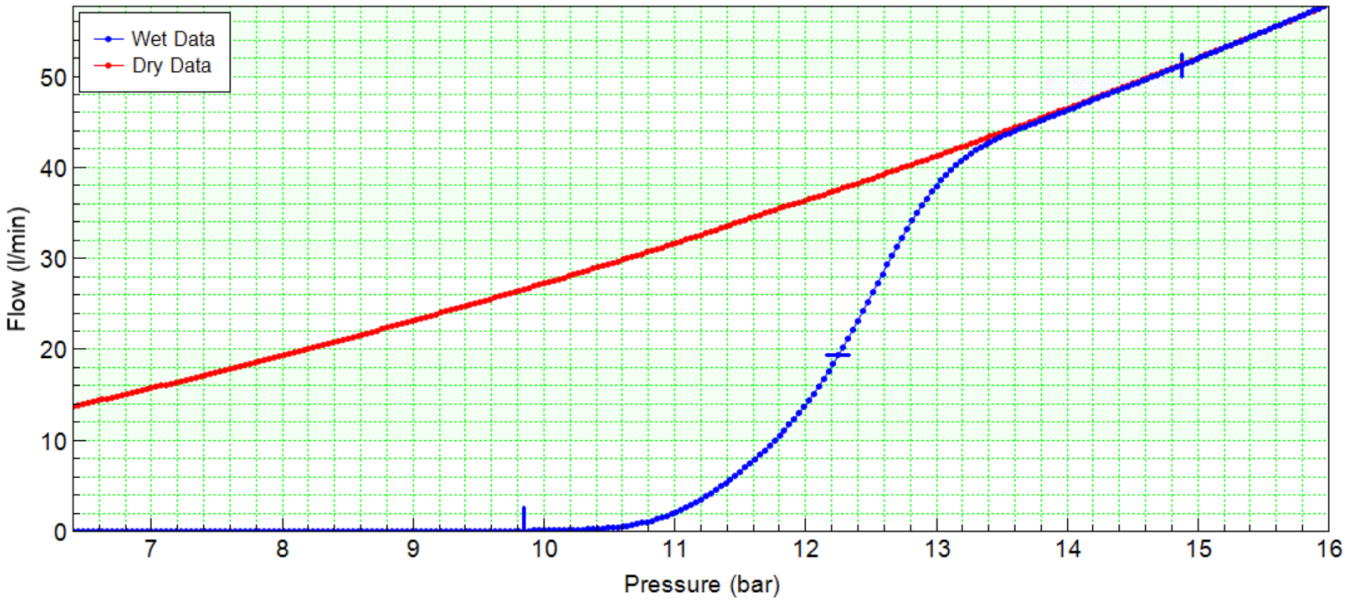

Figure 1: Wet and dry runs for the hollow fiber sample

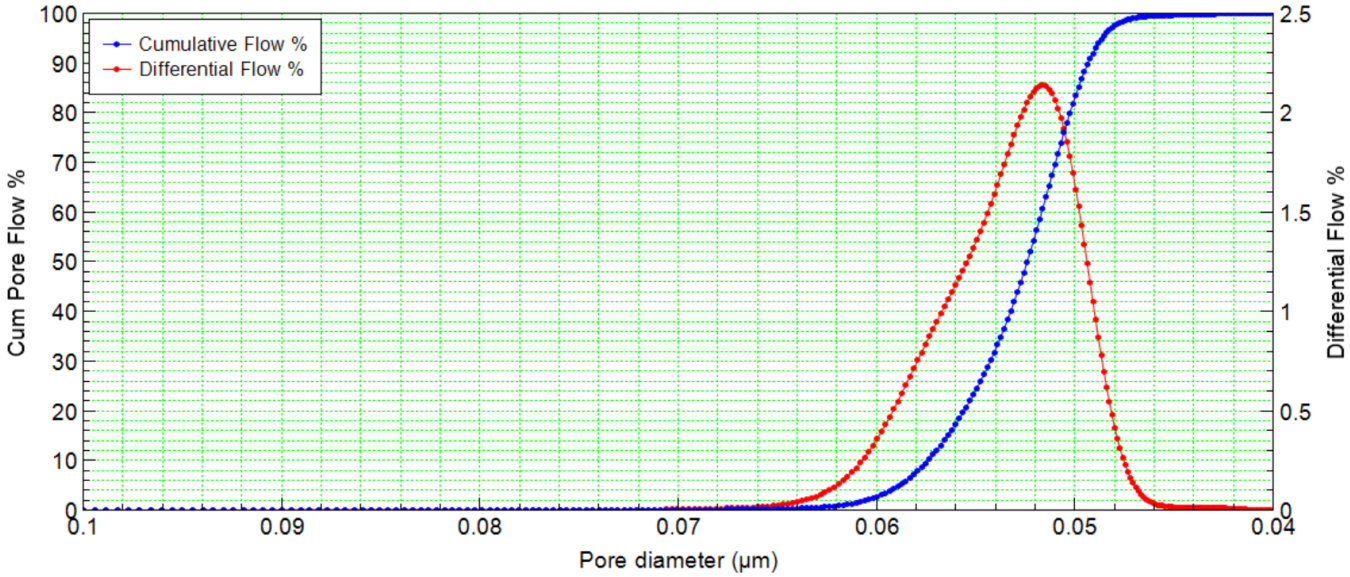

Figure 2: Pore size (flow) distribution

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