



The objective of these trials was to determine a recommended Bubble Point Ratio value for the Durapore 0.22 μm hydrophilic membrane wetted with 60% isopropyl alcohol/40% water (v/v) at ambient temperature.

Bubble Point Test Method Using Durapore® 0.22 μm Hydrophilic Membrane with 60/40 IPA

Materials

- Durapore 0.22 μm modified PVDF hydrophilic membrane, 47 mm discs (Catalogue No. GVWP 047 00)
 - Bubble point specification with 70/30 Isopropyl Alcohol (IPA) = 18.5 psi
 - Surface area = 13.8 cm^2
- Integritest® II automatic filter integrity test instrument (Catalogue No. XEIT 110 00); used to measure bubble point values.
- Stainless steel holder (Catalogue No. XX44 047 00); used to hold the 47 mm membrane discs.
- Stainless steel 1.5 in. sanitary tee fitting; used between the Integritest II instrument and the 47 mm holder to provide expanded upstream volume.
- Millipore Milli-Q® Synthesis Water Purification System with A10™ TOC Monitor; used to produce 18.2 megohm-cm Type 1 water.
- 60/40 IPA = 60% isopropyl alcohol/40% water (v/v).
- 70/30 IPA = 70% isopropyl alcohol/30% water (v/v); alcohol standard for Durapore 0.22 μm hydrophilic membrane.
- Compressed air.

Bubble Point Test Method

1. The membrane disc was thoroughly wetted with 70/30 IPA.
2. Thorough wetting was ensured by filtration of 5 mL of 70/30 IPA at ambient temperature.
3. The system was immediately connected to the Integritest II instrument and the bubble point program initiated.
4. The bubble point measurement was repeated after membrane rewetting with an additional 5 mL of fresh 70/30 IPA.
5. The membrane disc was dried thoroughly for a minimum of 2 hours.
6. The membrane disc was reinstalled in the holder.
7. The membrane wetting was ensured by filtering 5 mL of the 60/40 IPA test product.
8. The system was immediately connected to the Integritest II instrument and the bubble point program initiated.
9. The bubble point measurement was repeated after membrane rewetting with 5 mL of fresh 60/40 IPA test product.
10. The bubble point measurement was repeated until a stable result was found (<1.0 psi variation between 3 consecutive bubble point readings).
11. Steps 1–10 were repeated for disc samples 2–9.

Results

The bubble point test results were obtained via a series of tests with 9 different Durapore 47 mm membrane discs; 3 each for 3 different lab scale compositions of 60/40 IPA test product. The highest stable values of the tests performed on each membrane disc are considered to be the bubble point. The results obtained with the 70/30 IPA were in agreement with the specifications of the filter device and confirm the integrity of the different membranes tested.

Conclusion

Bubble Point Determination

The data from the Durapore 47 mm membrane discs are used to determine the **Bubble Point Ratio (BPR)** between the 60/40 IPA and 70/30 IPA. The Bubble Point Ratio can be used to determine the bubble point value for Durapore hydrophilic membranes when wetted with a non-standard solution.

The average of all the theoretical calculations of BPR are used to determine the minimum BPR value:

$$BPR = \frac{60/40 \text{ IPA Bubble Point}}{70/30 \text{ IPA Bubble Point}} = \frac{21.6}{20.6} = 1.05$$

The minimum bubble point value of the Durapore 0.22 µm hydrophilic membrane disc wetted with 60/40 IPA will be:

$$PBP_{\min} = 18.5 \text{ psi} \times 1.05 = 19.4 \text{ psi}$$

The non-standard solution can be used as a wetting agent to perform the Bubble Point Integrity Test and the recommended minimum bubble point can be used as an initial specification until the validation process is completed, see discussion below.

Discussion

All Durapore 0.22 µm hydrophilic membrane configurations (e.g. MPGL, MCGL, LAGL, KVGL and CVGL) have the same Bubble Point Ratio (membrane consistency), when they are wetted with the same test solution.

All of this depends, of course, on the uniformity of the non-standard solution. Changes in formulation or concentrations of the components, especially those with surface activity and effects on surface tension, can affect the Bubble Point Ratio.

In PDA Technical Report No. 26, "Sterilizing Filtration of Liquids," it is suggested that a scale-down study is only the first part of bubble point validation; the second part is obtaining additional ongoing solution attribute data. Millipore recommends that the end-user verify the lab generated minimum bubble point with on-site verification or periodic process monitoring.

There are several options for on-site verification including:

- Periodically monitoring the non-standard solution Bubble Point Ratio by comparing pre-use bubble points with post-use bubble points. A Millipore protocol for on-site Bubble Point Ratio determination is available; request Millipore Application Note AN1505EN00.
- Periodically monitoring solution surface tension and comparing to standard.

- Trending bubble point results for consistency.
- End-user determined process specific testing.

Remarks

It should be noted that 70/30 IPA reference bubble point standard specifications for Millipore membranes are based upon data developed from extensive testing using 70/30 IPA under controlled testing conditions.

Bubble point and diffusion testing on specific test solutions are based upon limited testing and may not be statistically representative of all of the test products.

Variability in customer prepared alcohol solutions, customer operating conditions, and environmental conditions may have some impact on the bubble point values. For these reasons, Millipore does not guarantee that the results of these tests are statistically relevant beyond the scope of this report.

For information on Durapore 0.1 µm hydrophilic membrane tested with alcohol solution, refer to Millipore Application Note AN1653EN00.

Bubble Point Data

Disc No.	Product Lot No.	70/30 IPA Bubble Point	60/40 IPA Bubble Point	BPR 60/40 IPA
1	1	20.6	21.6	1.05
2	1	20.5	21.6	1.05
3	1	20.6	21.6	1.05
4	2	20.6	21.6	1.05
5	2	20.6	21.6	1.05
6	2	20.6	21.6	1.05
7	3	20.6	21.6	1.05
8	3	20.6	21.6	1.05
9	3	20.6	21.6	1.05
Overall Avg.		20.6	21.6	1.05
Overall S.D.		0.0	0.0	0.00
Overall C.V.		0.0	0.0	0.00

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