Acrodisc One™ Syringe Filters Compared to Low Cost Hydrophilic PTFE Syringe Filters

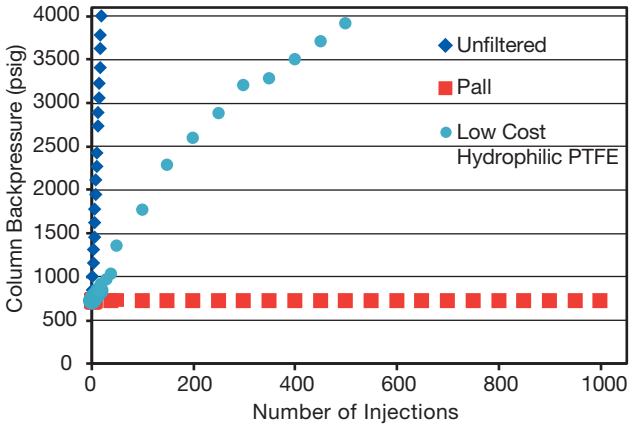
Introduction

In many laboratories, the need to consistently generate high quality data means that laboratory managers and technicians need to ensure their instruments are performing optimally around the clock. Filtration of both the sample and mobile phase prior to analysis helps increase the lifespan of chromatography columns, reduces overall instrument wear, and removes any particles that may interfere with the chromatogram.

Accurate, reproducible data depends upon proper HPLC column performance. Injecting samples containing particulates will eventually block the column inlet and column packing, causing high column back-pressure and shortening the normal service life of the column[1]. Plugging of the HPLC column by particulate matter is the most frequent cause for column failure encountered by analysts. Sample filtration using syringe filters with 0.45 µm (HPLC) or 0.2 µm (UHPLC) pore size membranes, is a time effective and easy to implement method to protect the column. As we have shown previously[1] and depicted in Figure 1, filters with the same nominal rating can vary drastically in their capacity to provide column protection. In fact the Pall Acrodisc One syringe filter extends column life up to at least 52 times over unfiltered samples.

Figure 1

Effects of filters on HPLC column life following injections of unfiltered and filtered 0.05% latex sphere suspensions[1]. With unfiltered samples, the column failed due to plugging after 19 injections. Samples passed through low cost hydrophilic PTFE syringe filters plugged the columns after 500 injections. No increase in backpressure was observed after 1000 injections of samples filtered with Pall Acrodisc One syringe filters with wwPTFE membrane.



In addition to sample filtration, mobile phase filtration through a 0.45 µm or 0.2 µm disc filter is also important to extend the life of the column, and protect the pump, injector, and other components from premature wear. Without filtration, accumulation of particulates cause higher system pressures, shifted retention times, and poor peak shape and separation. Pall also offers the water wettable hydrophillic polytetrafluoroethene (wwPTFE) membrane in 47 mm disc filter format and the SolVac® filter holder to help provide a particle and air bubble free mobile phase.

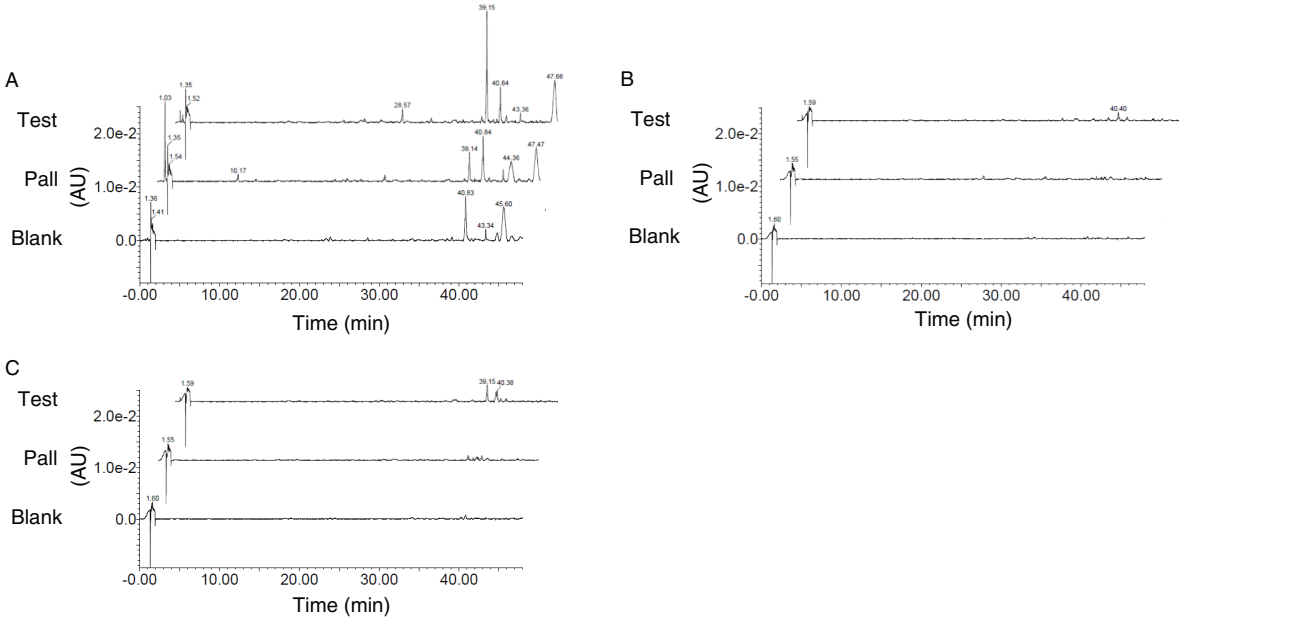
wwPTFE Extractables

The wwPTFE membrane found in the Acrodisc One syringe filter is the next generation of universally compatible analytical membrane. wwPTFE is a low protein and API binding, broadly chemically compatible membrane for use in nearly any HPLC or UHPLC application. The Acrodisc One's high retention efficiency and extremely low levels of potential extractables make the wwPTFE membrane in the Acrodisc One syringe filter the choice for critical applications.

Potential levels of extractables were compared in 0.2 µm Acrodisc One syringe filters with wwPTFE against low cost syringe filters with hydrophillic PTFE membrane. Methanol was used as the solvent; and filtrate analyses for extractables were carried out using UHPLC. Only the first mL of filtrate per filter was collected to enhance the ability to detect extractable materials. Potential variability was minimized by collecting the first mL filtrates of three syringe filters in an HPLC autosampler vial. All filtrations and analyses were performed in accordance to any publicly available instructions for use.

Figure 2

Solvent extractable properties of syringe filters equipped with 0.2 µm wwPTFE or low cost hydrophilic PTFE membrane. Ten microliter injection volumes of the methanol solvent blank (Blank) and filtrates obtained with the Pall Acrodisc One syringe filter (Pall) or commercially available syringe filters (Test) were analyzed using a Waters Acquity◆ UPLC H-Class system with a Diode Array Detector and a Nova-Pak 4 µm C18, 4.6 mm x 150.0 mm column. The filtrates and solvent blanks with an injection volume of 50 µL were analyzed under gradient conditions with a mobile phase consisting of water and acetonitrile with a flow rate of 1.0 mL/min and a column temperature of 30 °C. Initial conditions of 5% acetonitrile were held for 3 min, followed 100% acetonitrile, during which data was collected at 214 nm, 254 nm, and 280 nm (Panels A, B, and C, respectively). ***Results may differ.***



As shown in Figure 2, the Pall Acrodisc One syringe filters with wwPTFE membrane provided a clean chromatogram following extraction with methanol. The other syringe filter samples tested show several unidentified compounds leaching from the devices shown by additional peaks at all evaluated wavelengths. The presence of the additional peaks can greatly complicate data analysis and reporting, requiring the analyst to identify these compounds and exclude them as originating from the sample. Because the Pall Acrodisc One syringe filters with wwPTFE membrane do not contribute such extractables, the analyst can be confident that the data generated is accurate without being compromised by the presence of unwanted chemicals.

Particulate Retention of wwPTFE Membrane Syringe Filters

Retention efficiency shows a strong relationship to column life extension. We therefore determined the ability of 0.45 µm Acrodisc One syringe filters with wwPTFE membrane and low cost commercially available syringe filters with hydrophilic PTFE membrane to retain polystyrene latex beads by filtering suspensions of beads with average diameters of 0.46 µm. This was achieved by passing through each syringe filter a 3 mL volume of a 0.05% (w/w) polystyrene latex bead (Sigma) suspension in 0.1% Triton◆ X-100 (Sigma). For each filter, a total of five test pieces were evaluated. The bead concentrations of the challenge suspension and the filtrates were determined spectrophotometrically and used to calculate the latex bead retention efficiency.

Figure 3

Latex sphere retention of syringe filters with 0.45 µm pore size ratings. ***Results may vary.***

Filter	Pall	Test
1	98.0	67.3
2	89.8	87.8
3	93.9	53.1
4	95.9	79.6
5	93.9	98.0
Average	94.3	77.1
Std Dev	3.03	17.52

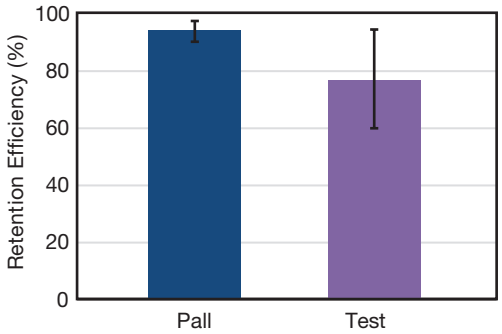


Figure 3 shows the latex sphere retention of Pall Acrodisc One and low cost hydrophilic PTFE syringe filters with 0.45 µm pore size ratings. The Acrodisc One syringe filter with wwPTFE membrane achieved more retention of 0.45 µm spheres with less variability. By injecting a cleaner sample into your LC system you extend the working life of the column, resulting in more instrument up time. The higher bead retention of the Acrodisc One syringe filter with wwPTFE membrane will result in improved column life performance over unfiltered samples. Pall's Acrodisc One with wwPTFE membrane removed on average more than 94% of challenge particles, resulting in a column that can last more than 52 times longer than without filtering.

Conclusions

The choice of whether to filter is an easy one to make. The benefits that filtration provide to instrument operation, data quality, and overall laboratory function are evident. However, the choice of which filter is the right filter is more difficult. Even when considering nominally equivalent filters, performance can vary drastically.

The wwPTFE membrane is the universal membrane of choice for many chromatographic applications, however we have shown that not all hydrophilic PTFE materials are equivalent. The presence of additional peaks in samples filtered with low cost commercially available syringe filters with hydrophilic PTFE membrane show that differences in formulation and manufacturing can have a tangible result on your data. The high retention efficiency of the Pall Acrodisc One syringe filter is directly correlated to longer column life, saving time and money.

The Pall Acrodisc One syringe filter with wwPTFE membrane:

- Provides better column protection than low cost commercially available syringe filters with hydrophilic PTFE membrane syringe filters
- Shows no contaminants following extraction with methanol

When column protection and low extractables all are taken into consideration, it becomes clear that the Pall Acrodisc One syringe filter with wwPTFE membrane is the filter of choice.

References

1. Analytical Technical Guide; Including HPLC and Dissolution Testing, Pall Laboratory

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