Application Note

Evaluation of Particulate Retention and Solvent Extractable Properties of Pall Acrodisc® Syringe Filters with PTFE Membrane

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]. In fact, 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. However, filters with the same nominal rating can vary drastically in their capacity to provide column protection.[1]

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

PTFE Retention

Depending on the chemical nature of the analyte, solvents other than an aqueous solution must be used. For many large organic molecules, including hydrocarbons, their hydrophobic nature means they must be used with aggressive organic solvents. In order to filter these samples, the filter itself must be physically robust enough to withstand the attack by the solvents, but also chemically inert enough to not leach any unwanted extractables into the sample.

When comparing performance differences between PTFE products, the retention efficiencies or ability to protect the column were closely examined. The retention efficiency of manufacturer rated 0.2 µm syringe filters were determined 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) with an average diameter of 0.24 µm. For each filter, a total of five test pieces were evaluated. Spectrophotometrically determined bead concentrations of the challenge suspension and the filtrates were used to calculate the latex bead retention efficiency.

Figure 1

Latex sphere retention of syringe filters with pore size ratings of 0.2 µm. Shown are data for Pall PTFE syringe filters (Pall) and commercial sample syringe filters (CS1-4). The data is normalized to the Pall filter retention. The data is an average of five filters and the bars represent the standard deviation. ***Results may vary.***

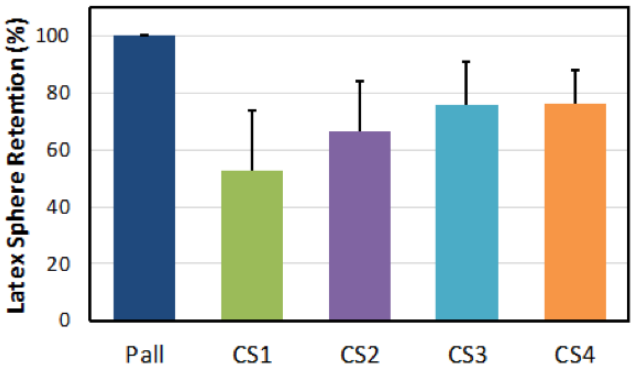


Figure 1 shows the latex sphere retention of syringe filters with pore size ratings of 0.2 µm. The data shows that the Pall PTFE syringe filters (Pall) have higher retention efficiencies than other commercial syringe filters with PTFE membranes (CS1-4).

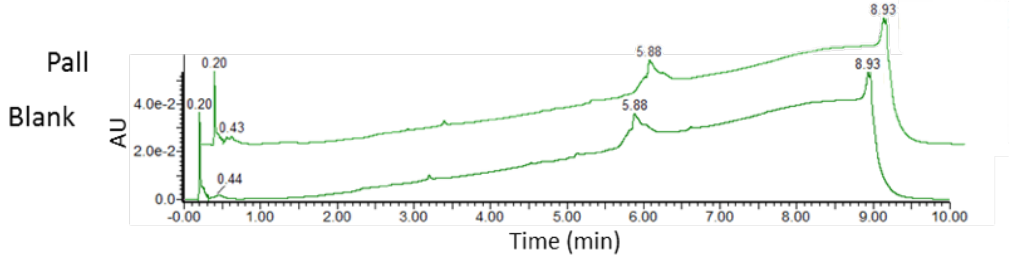
PTFE Extractables

Extractables, unwanted chemicals coming from the filter, are another area of concern. The polymeric resins, solvents, pore formers, housing materials, and other chemical components utilized during device manufacturing may potentially leach chemicals or residues into a sample if they are not compatible with the fluid being filtered. The cleanliness and chemical compatibility of a syringe filter can directly affect data quality. Extractable materials can jeopardize analytical results through extraneous peaks and coelution. Using an incompatible syringe filter can negatively impact data to the extent that it may be better not to use a syringe filter at all.

To determine if solvent extractables were present in 0.2 µm Acrodisc syringe filters with PTFE membrane, extractions were carried out with acetonitrile as the solvent followed by UHPLC analysis of the filtrates. 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.

Figure 2

Solvent extractable properties of Pall Acrodisc syringe filters with 0.2 µm hydrophobic PTFE membrane. Filtrate (Pall) and solvent blank (Blank) (10 µL injection volume) were analyzed using a Waters Acquity◆ UPLC◆ H-Class system with a Tunable UV Detector and a 2.1 x 50 mm, 1.7 µm Waters Acquity UPLC BEH C18 reverse phase column under gradient conditions with a mobile phase consisting of water and acetonitrile with a flow rate of 0.6 mL/min and a column temperature of 35 °C. Initial conditions of 5% acetonitrile were held for 0.5 min, followed by a linear gradient of 5-100% acetonitrile over 6.9 min, and then to remain at 100% acetonitrile for 0.9 min. Data was collected at a wavelength of 214 nm. ***Results may vary.***



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As shown in Figure 2, the Pall Acrodisc syringe filter with PTFE membrane provides a clean chromatogram following extraction with acetonitrile. By having little to no effect on the sample, the analyst can be confident that the data generated is accurate and has not been compromised by the presence of unwanted chemicals.

Conclusions

The choice of whether to filter is an easy one to make. The benefits that filtration provide to the instrument and data help keep the laboratory running. However, choosing the right filter requires more consideration.

Retention efficiency of the syringe filter is key to getting the best protection for chromatography columns, ensuring optimum performance, and data integrity. Particulate build up is directly related to increased column back pressure and poor peak resolution. In addition, data quality can also be compromised by filter materials that add extractables affecting the data integrity by coelution or adding extraneous peaks.

Pall's Acrodisc syringe filters with PTFE membrane:

- Provide higher particle retention than other PTFE membranes
- Shows no detectable contaminants following extraction with acetonitrile

When deciding which PTFE syringe filter is best for their application, column protection and low extractables are critical to a lab analyst. When these are taken into consideration, it becomes clear that the Pall Acrodisc syringe filter with PTFE membrane is the filter of choice.

References

1. Analytical Technical Guide, Pall Laboratory

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