



Technical Article

Effect of Filtration Using Pall Acrodisc® MS Syringe Filters on the Lifespan of Ultra High Performance Liquid Chromatography Columns

Summary

Because clogging reduces the lifespan of Ultra High Performance Liquid Chromatography (UHPLC) columns at significant cost, the 0.2 μm rated Acrodisc MS syringe filter (PN MS-3201) was developed to extend the life of these expensive columns with minimal extractables and adsorption of active ingredients. We assessed the protective properties of this 0.2 μm rated syringe filter relative to 0.45 μm rated filters by repeatedly applying a dilute suspension of 0.31 μm (average diameter) polymer microspheres to a UHPLC column. The unfiltered suspension was used as a reference control. The lifespan of the UHPLC column was deduced by monitoring column backpressure. Use of the Acrodisc MS syringe filter resulted in consistent maintenance of column pressure when the polymer suspensions were repeatedly injected. Column clogging was not detected even after 1,000 injections. By contrast, when the suspensions were filtered through Pall's 0.45 μm Acrodisc PSF syringe filter with nylon membrane prior to column loading, there was a rapid and significant increase in the UHPLC column backpressure. The efficiency of the 0.2 μm Acrodisc MS syringe filter at removing particulates that will plug a UHPLC column is superior to that of the 0.45 μm filter. Use of Pall's 0.2 μm Acrodisc MS syringe filter affords significant protection from clogging and extends the lifespan of the UHPLC column at least 50-fold.

Background

The Acrodisc MS syringe filter was designed by Pall Life Sciences specifically to extend the lifespan of UHPLC columns used in Liquid Chromatography/Mass Spectrometry (LC/MS) analytical sample preparation without adding significant extractables and with minimal analyte adsorption. These filters are constructed with a water-wettable polytetrafluoroethylene (WWPTFE) membrane in high density polyethylene (HDPE) housings. The efficiency of the filters at removing particulates was examined using 0.05% polymer microsphere suspensions with an average diameter of 0.31 μm .

Materials and Methods

1. Waters HPLC system with binary pump model 1525 and autosampler model 2707
2. Acquity UPLC[◆] BEH C18 column, 50 mm x 2.1 mm, 1.7 μm particle size (Waters Corp., PN 186002350, Lot No. 020232030157)
3. Pall 0.2 μm Acrodisc MS syringe filters (PN MS-3201, Lot No. 21779983)
4. Pall 0.45 μm Acrodisc PSF syringe filters with nylon membrane (PN AP-4502, Lot No. 21770864)
5. Polymer microsphere, 0.31 μm , 10% w/w suspension (Thermo Scientific[◆], PN 5031A, Lot No. 39215)
6. Triton[◆] X-100 (Sigma-Aldrich, PN 21568, Lot No. 21568-0010)
7. Acetonitrile, BAKER ANALYZED[◆] HPLC ultra gradient solvent (J.T. Baker[◆], PN 9017, Lot No. K29811)
8. Water ChromAR[◆], HPLC-grade (Macron Fine Chemicals[◆], PN 6795, Lot No. K41E03)

The mobile phase for HPLC was water:acetonitrile (33:67, v/v), the flow rate was 0.3 mL/min. The injection volume was 8 μL , and the column temperature was maintained at 35 $^{\circ}\text{C}$ (95 $^{\circ}\text{F}$).

Procedure

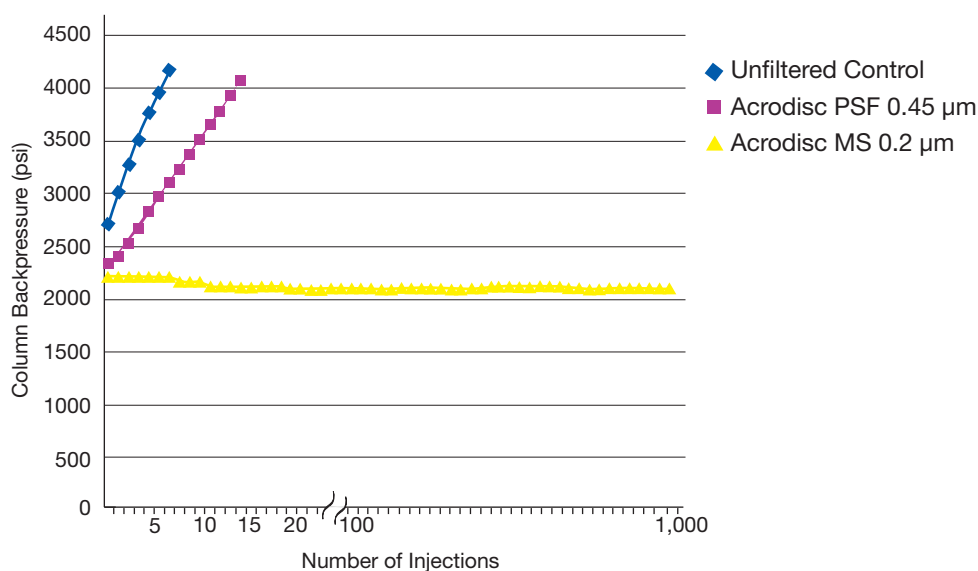
A 0.05% microsphere suspension (average diameter 0.31 μm) in 0.002% Triton X-100 (prepared from a 10% w/w polymer stock), was filtered using either 0.2 μm Acrodisc MS syringe filters or 0.45 μm Acrodisc PSF syringe filters with nylon membrane. Effluents were collected in 1.5 mL aliquots and 20 replicate effluent samples were repeatedly loaded onto a UHPLC column; the unfiltered material was used as a negative control. The initial UHPLC column backpressure was approximately 2,000 psi for all three samples (unfiltered control and effluents from the 0.2 μm Acrodisc MS syringe filters and 0.45 μm Acrodisc PSF syringe filters with nylon membrane). Injections were stopped when the pressure reached approximately 4,000 psi.

Test Results and Discussion

Injection of the unfiltered and the 0.45 μm filtered suspensions resulted in a rapid and significant increase in the backpressure of the Acquity UPLC column, after 9 and 16 injections, respectively. By contrast, column plugging was not observed even after 1,000 injections of the effluents from the Acrodisc MS syringe filters. The results are summarized in Figure 1.

Figure 1

Effect of Filtration on UHPLC Column Lifetime



Conclusions

These results demonstrate the efficiency of the 0.2 µm Acrodisc MS syringe filters at extending UHPLC column life. Based on measurements of column backpressure following repeated sample injections, filtration using the Acrodisc MS syringe filter prolongs the lifespan of the UHPLC column at least 50-fold relative to filtration using 0.45 µm syringe filters and over 100 fold compared to use of unfiltered samples. The cost-savings generated by this simple filtration step is thus likely to be very significant.



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