



Application Note

Reduction of Matrix Effects from Filter Effluents Using Pall Acrodisc® MS Syringe Filters for LCMS Sample Preparation

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Introduction

Liquid chromatography mass spectrometry (LCMS) is a powerful analytical technique used for various qualitative and quantitative applications. Detection is achieved in the mass spectrometry (MS) via ionization of the analytes in the chromatographic effluent. About 75% of LCMS users utilize Electrospray Ionization (ESI) as the interface between liquid chromatography (LC) and MS. However, despite the versatility of ESI, this ionization technique suffers from a phenomenon known as the matrix effect (ME).

Matrix effect is typically attributable to components present in the sample matrix that co-elute with the compound(s) of interest.¹ This competition may either suppress (ion suppression) or enhance (ion enhancement) the detection efficiency of the target analytes, which often leads to poor accuracy and precision of quantitative results.

One way to minimize the ME is by improving the method for analytical sample preparation, which typically includes sample filtration prior to analysis. If sample filtration is required, it is critical that the filters do not contribute any extractable/leachable materials that may influence the ionization efficiency of the target analytes.

This Application Note compares the cleanliness of the effluents from Pall's Acrodisc MS syringe filters with two other commercially-available, alternative syringe filters from Competitor A (PVDF filter) and Competitor B (hydrophilic PTFE filter) by evaluating the ME due to potentially interfering extractable/leachable compounds in the LCMS analysis of three drug substances.²

Experimental Conditions

Sample solutions were prepared in triplicate by spiking three drug substances (Mometasone Furoate, Verapamil, and Acetaminophen) individually at concentrations of 0.05 ppm, 0.2 ppm, and 1 ppm into the Control (Methanol HPLC-grade) and into the effluents from Pall's Acrodisc MS syringe filter, Competitor A's PVDF filter, and Competitor B's hydrophilic PTFE filter.

The effluents were obtained by passing Methanol HPLC-grade through a total of 25 filters from one lot of each product using a glass syringe and collecting approximately the first 2 mL from each filter. The effluents from each filter were pooled and used as the matrix for the three drug substances.

The solutions were analyzed using a ballistic gradient ultra high performance liquid chromatographic (UHPLC) method coupled with ES-MS (electrospray-mass spectrometry) run in the Selected-Ion-Recording (SIR) mode. The column used was an ACQUITY[®] UPLC BEH C18, 1.7 μ m (Waters Corporation) with Mobile Phase A (LCMS-grade Methanol with 0.01% Formic Acid) and Mobile Phase B (LCMS-grade water with 0.01% Formic Acid). ES(+) was used for the analysis of Mometasone Furoate and Verapamil, and ES(-) for Acetaminophen. The mass ions (parent and/or fragment) monitored for the analyses were selected based on specificity and sensitivity.

Evaluation of Matrix Effects

Evaluation of the ME was performed by comparing the area response of the target analyte spiked into the effluents from the filter (i.e. filtered Methanol) and into the unfiltered Methanol. Matrix effects were calculated as follows:

$$\% \text{ ME} = \frac{\text{Response in Filtered Solution}}{\text{Response in Unfiltered Solution (Control)}} \times 100$$

where

% ME = 100 indicates no matrix effect

% ME > 100 indicates ion enhancement

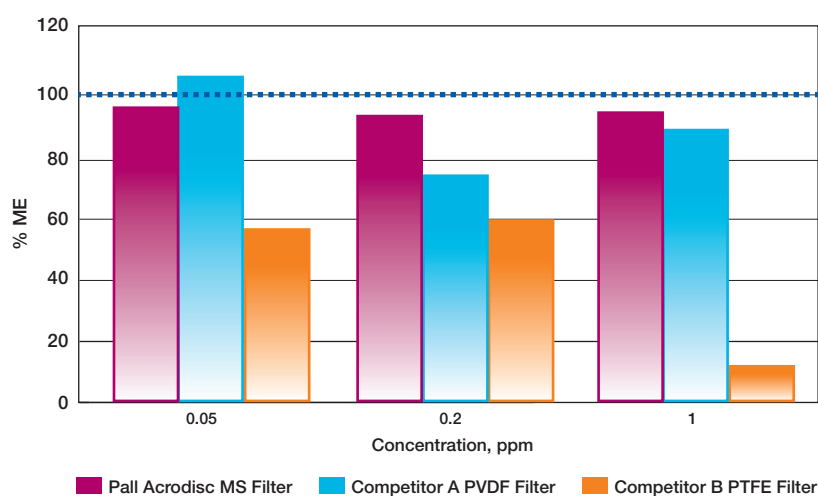
% ME < 100 indicates ion suppression

Results and Discussion

The % MEs observed for each of the three drug substances in the different effluent matrices are given in Figures 1-3. The results show that, in general, the Acrodisc MS syringe filters exhibit the least influence on the detection efficiencies of the three drug substances at the concentration levels studied (% ME = 79-100%) as compared to the PVDF filter from Competitor A (% ME = 76-112%) and the hydrophilic PTFE filter from Competitor B (% ME = 13-175%) under the test conditions used in this study. This indicates that the effluents from the Acrodisc MS syringe filters contain less extractable/leachable materials that may influence the detection efficiencies of target analytes. The high degree of performance exhibited by the Acrodisc MS syringe filters can be attributed to the low level extractable/leachable compounds from the optimized water-wettable PTFE membrane and the materials of construction of the device.

Figure 1

Comparison of % ME Observed for Mometasone Furoate at Different Concentrations in the Effluents from Pall Acrodisc MS Syringe Filters and the Filters from Competitor A and Competitor B



Note: Dashed lines on each chart (-----) indicate no matrix effect (i.e. % ME = 100%).

Figure 2

Comparison of % ME Observed for Verapamil at Different Concentrations in the Effluents from Pall Acrodisc MS Syringe Filters and the Filters from Competitor A and Competitor B

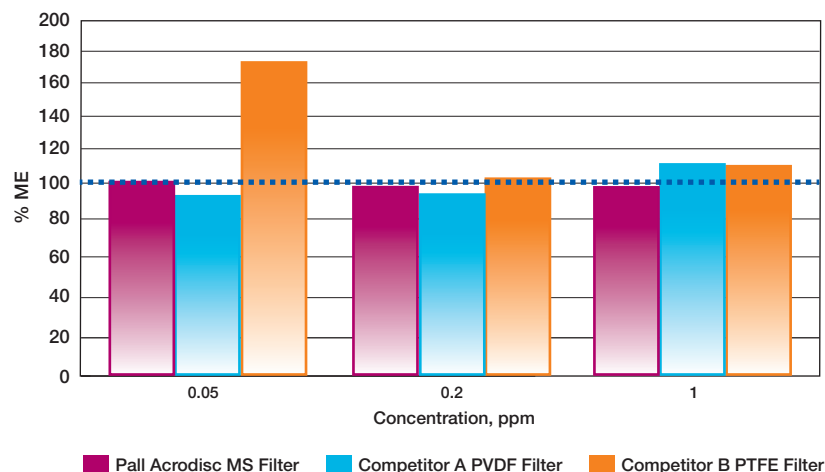
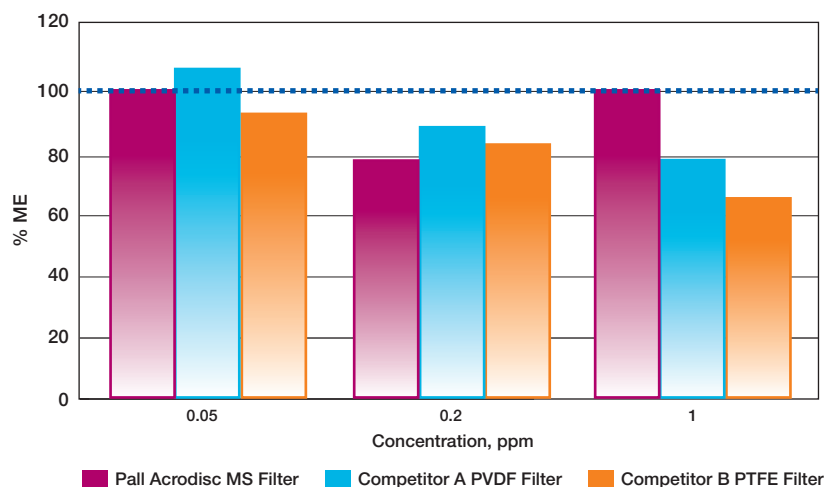


Figure 3

Comparison of % ME Observed for Acetaminophen at Different Concentrations in the Effluents from Pall Acrodisc MS Syringe Filters and the Filters from Competitor A and Competitor B



Conclusions

Cleanliness of filter effluents is an important consideration for LCMS analysis. This study shows that the effluents from Acrodisc MS syringe filters exhibited less ME on the detection efficiencies of the three drug substances tested as compared to those from competitive products under the same test conditions. These results indicate that effluents from Acrodisc MS syringe filters contain less extractable/leachable materials as compared to competitive products.

Ordering Information

Acrodisc MS Syringe Filters

Part Number	Description	Pkg
MS-3201	WWPTFE membrane, 0.2 µm, 25 mm	50/pkg

References

1. Thermo Scientific. *Ion suppression and matrix effects. Technical poster, 2007, www.thermo.com/us.*
2. Pall Corporation Scientific and Laboratory Services, Report No. 16385GT.



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