Waters® Alliance® HPLC System Reduced Sample Carryover by Design

Waters has recently re-designed the lower needle wash body and wash frit of the Alliance System's new 2695 Separations Module to reduce sample carryover between injections. In addition, enhancements to the operating software of the 2695 Separations Module enables users to further reduce sample carryover by increasing needle wash times. This Performance PerSPECtive discusses how these changes impact sample carryover.

What is sample carryover: Simply put, sample carryover is a term used to describe the presence of material from a prior injection that appears in subsequent injections. This contamination can compromise the quality of data obtained from even the most robust chromatographic methods. This is especially true when detection of very low concentrations of impurities and other minor constituents is required in the analysis. Sample carryover can be caused by several factors including those related to separation chemistry (e.g., incomplete desorption of material from a column during a gradient separation) as well as inadequate cleaning of the HPLC injector components between analyses. The impact sample carryover has on laboratory operations is application specific. In some cases, it is simply a minor inconvenience while in other scenarios unacceptable sample carryover levels can reduce laboratory productivity by requiring retesting of the samples.

How is carryover measured: Performance PerSPECtive entitled: "Accuracy and Carryover Considerations in a Sample Manager" (WPP222 / 720000302) details the rigorous methods used at Waters to evaluate sample carryover. Briefly, the HPLC system is stressed with six consecutive injections of a concentrated propyl paraben solution followed by a column wash step. Six consecutive injections of a blank solution are then made. Sample carryover is expressed as both percent (%) and nanoliters of carryover from an average of the six blank injections. Below are representative results using the conditions detailed in the previously published Performance PerSPECtive. Note the superior sample carryover performance of the 2695 Separations Module.

	Alliance (2690 Separations Module)	Alliance (2695 Separations Module)	Competitor's HPLC without Needle Wash Vial	Competitor's HPLC with Needle Wash Vial
% Carryover	0.0380	0.0022	0.2280	0.0220
nL Carryover	9.61	0.54	56.92	5.45
Injection Time delay with needle wash	0 sec	0 sec	N/A	42 sec

Table 1: Sample carryover detected after six, 25 µL injections of 1 mg/ml of propyl paraben

erformance PerSPECtives

How the Alliance 2695 Separations Module reduces sample carryover: Compared to the previously published Performance PerSPECtive, a significant reduction in sample carryover is achieved via the implementation of the new lower needle wash body and one-piece cast frit design found on the 2695 Separations Module (See Table 1). This new design also allows users to quickly and easily replace the single wash frit, without tools, since the assembly is accessible from within the sample manager compartment. (Note: Choice of needle wash solvent can affect sample carryover values. It is important to select a needle wash solvent that is appropriate for the specific application in order to maximize needle wash efficiency.)

Firmware enhancements: Waters 2695 Separations Module allows users to select from three, pre-programmed needle wash times (normal, double, and extended) to further reduce sample carryover. As seen in Figure 1, use of increased needle wash times decreases sample carryover relative to the normal needle wash time. (Note: Selecting double or extended wash times will increase injection cycle time by 13 or 39 sec respectively.)

Fig.1: Effect of programmed needle wash time on sample carryover from a 2695 Separations
Module



Summary:

• Sample carryover from inadequate autosampler cleaning between injections is a measurable performance characteristic of all HPLC injectors.

• A re-designed lower needle wash body and one-piece cast frit design has significantly lowered sample carryover in the Alliance System's 2695 Separations Module.

• Technology contained in the 2695 Separations Module can further reduce sample carryover by changing needle wash times to enhance chromatographers' confidence in collected data.

• Sample carryover levels on existing 2690 Separations Modules can be reduced by installing the new lower needle wash body and one-piece cast frit assembly.

Waters, Alliance, Symmetry, and Millennium are registered trademarks of Waters Corporation. Copyright 2001 Waters Corporation Printed in the U.S.A.