APPLICATION NOTE #102

trap cartridges as sample pre-concentrators

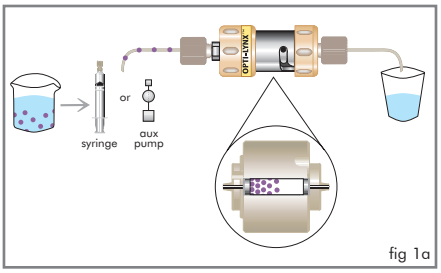

fig 1a

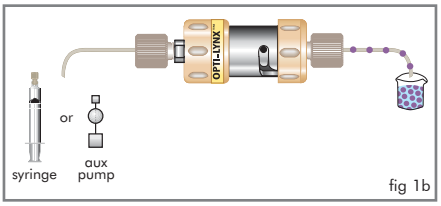

fig 1b

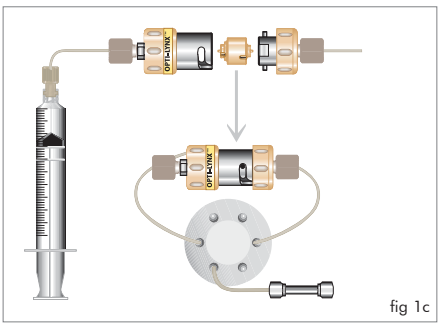

fig 1c

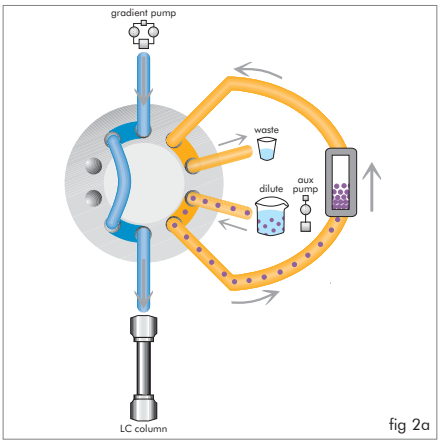

fig 2a

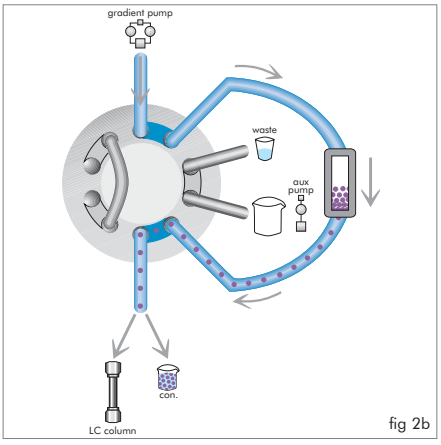

fig 2b

Often, samples arrive for LCMS analysis in concentrations that are undesirably low. For instance, picograms or even femptograms of a protein of interest may be present in a few milliliters of solvent, resulting in a sample concentration that is below the detection limit of the instrumentation being used. In addition, the matrix itself may be less than optimal for injection onto an LCMS system (non-volatile, buffered, etc.)

In these situations, it is of course desirable to increase the concentration of the target analyte in the sample. The most practical way to achieve that goal is to reduce the volume of the sample matrix without losing any of the target analyte dissolved within it. By using a trap cartridge as a sample pre-concentrator either on or off-line, this can be achieved conveniently, and with a minimal amount of manual sample handling.

OFF-LINE SAMPLE PRE-CONCENTRATION

This simple method allows for manual off-line pre-concentration of samples without requiring additional valve-switching capability. A trap cartridge chemistry is selected with affinity for the target analyte, and the sample is manually driven across the trap bed with a syringe, or a small pump (syringe, peristaltic, etc.) Flow should be steady, and within the range of typical LC flow rate for the trap bed diameter being used – slower is generally better. As the sample passes through the trap, the target analyte is retained on the trap bed while the sample matrix is sent to waste (fig 1a).

Once the sample has passed through the trap, the target analyte can be eluted in a small volume of stronger solvent(fig 1b). If salts were present in the sample matrix, a quick rinse step with a non-buffered solution prior to the elution step would be advantageous. Elution could also take place via manual delivery of solvent, but it would also be easy to remove the trap cartridge from the manual loading rig and install it into a holder already in-line upstream from an analytical column or within an injection loop (fig 1c).

ON-LINE SAMPLE PRE-CONCENTRATION

For a more convenient and automated means of pre-concentrating samples, a trap cartridge can be placed in-line in the loop of an injection or switching valve, providing a means of partial or complete automation. The injection valve is plumbed in a way that allows solvents from two different sources to flow through the trap depending on the position of the valve (fig 2a).

During the loading phase, the sample solution is pumped across the trap bed using an auxiliary pump (peristaltic, piston or syringe pump would be fine). Sample matrix is flushed to waste. Again, it may also be desirable to wash the trap bed with a salt-free solution after loading, to ensure that any buffer salts have been rinsed away.

Once the entire sample has been pumped through the trap cartridge, the elution step can commence. Prior to elution, it might be a good idea to follow the sample-loading step with a flushing solvent to ensure that any sample remaining in tubing leading to the trap cartridge makes it across the packing material.

The trapped and concentrated sample can now be eluted from the trap bed using a small volume of suitably strong organic solvent (fig 2b). Eluent from the trap can be sent directly to a mass spectrometer, or on to an analytical column for further separation. It might even be desirable to follow the pre-concentration step with a 2DLC scheme if the analyte contains a complex mixture of proteins and peptides.