troubleshooting guides for sub-optimal systems, and they enable longitudinal assessment of parameters to shape future preventive maintenance.

How to Develop System Suitability Tests

Many clinical laboratory professionals get their first exposure to an SST when a service engineer runs a generic version after an instrument installation or major service. In such cases the SST solution usually comprises a mixture of generic compounds (typically acidic, basic, polar, and non-polar). The engineer injects the solution into a defined column using simple mobile phases and assesses response to ensure the LC and MS components of the platform meet the vendor-set performance qualification.

While useful, this type of SST has limited utility when assessing system performance on a day-to-day basis in a clinical laboratory. Assay-specific SSTs run immediately prior to submitting a batch best fulfill this role, and the remainder of this article will focus on these specific SSTs.

A specific SST material is made up of the target analyte(s), internal standard(s), and extraction/reconstitution solvent for the assay. For example, an estradiol SST could contain 10 pg/mL estradiol and 10 pg/mL 13C3-estradiol internal standard in a 40% methanol solution. A laboratory would run the SST before submitting a sample batch to ensure that each component of the system (mobile phases, column, pumps, auto-sampler, mass spectrometer, acquisition method, etc.) meet the in-house performance criteria for that method. Ideally a lab would make the SST material in bulk, then aliquot and store it for quick and easy use.

Labs usually run the SST in combination with reagent blank samples as a batch in the following order: 1) reagent blank, 2) reagent blank, 3) SST, 4) reagent blank (carryover blank).

Choosing SST Parameters

Clinical laboratories can include many parameters when assessing the performance of an SST sample, and experience with the specific assay helps determine what the acceptance criteria should be set to (Figure 1). Where possible, investigate the SST response from failed validation batches: These can act as a guide to where criteria should be set. If this data isn’t available, then an educated guess will suffice for initial values and, as a lab gains experience, adjusted to make the acceptance criteria more suitable.

In my own experience, checking the peak intensity, peak shape, retention time, and the initial LC back pressure has been sufficient prior to batch submission. However, for longitudinal assessment purposes, additional parameters recorded by the acquisition software—peak symmetry, signal to noise, plate count, and the LC back pressure trace over the course of the SST sample—have proven useful.

In addition, if auto-sampler imprecision is an issue, expanding the SST batch to include multiple SST injections provides a reproducibility check, with the trade-off being a longer batch to run before a decision can be made to proceed.

Common Questions

When first establishing an SST, a common question is, “what