Performance PerSPECtives

Waters® 2487 Dual λ Absorbance Detector

Signal to Noise Ratio

DEFINITIONS OF SENSITIVITY

In an HPLC system, detector sensitivity can be defined in several ways:

Signal-to-noise ratio - The signal-to-noise (S/N) ratio is the ratio of peak height (from a given mass load) to baseline noise. This is the most meaningful definition of sensitivity for the HPLC user and is the easiest to measure. (See Performance PerSPECtives WPP01.) There are essentially two methods of improving sensitivity; increase the signal or decrease the noise.

Limit of detection - This is the lowest level an analyte can be detected, not necessarily quantitated under the analytical conditions. This is usually defined as a signal-to-noise ratio of 2:1 or 3:1.

Limit of quantitation - This is the lowest level an analyte can be quantitated with an acceptable level of precision and accuracy. This is usually defined as a signal-to-noise ratio of 10:1.

DECREASED NOISE

Noise specification - The Waters 2487 absorbance detector has been designed to provide the lowest noise specification of any TUV detector available today. A noise specification of <+/- 0.35 x 10-5 AU, without sacrificing signal, generates the best possible sensitivity. This noise value is determined under one set of specified conditions, e.g. 254 nm in a *dry* flow cell. These conditions will not necessarily reflect what will be obtained during chromatography. This superior specification can be attributed to "Performance by Design"**,** where the engineering of the Waters 2487 has led to superior sensitivity by delivering reduced noise and increased signal across all wavelengths. These features include:

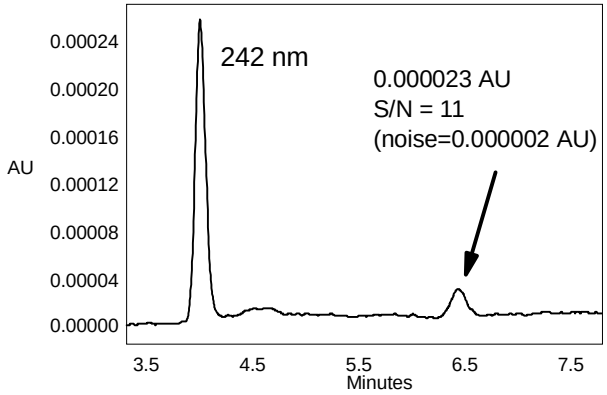
1. New TaperSlit™ flow cell with 10 mm pathlength and 10 µL volume
2. Lamp Optimization software on power-up
3. Improved noise performance to $<\pm 0.35 \times 10^{-5}$ AU at 254 nm, dry cell
4. Improved state of the art electronics and optics

For more details on these features see the Waters 2487 Brochure WB094.

Waters

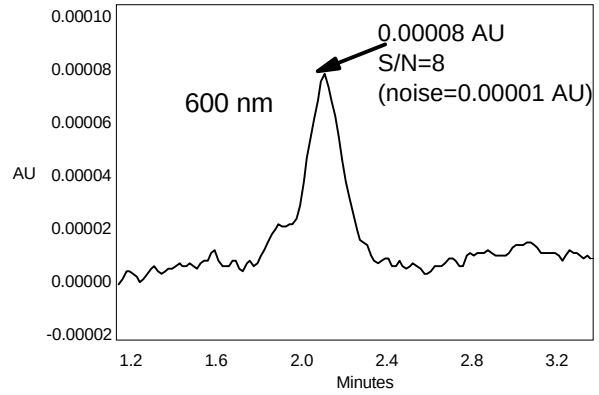
Waters Corporation 34 Maple Street Milford, MA 01757 508 478-2000

UV Sensitivity



Alliance ™HPLC System
Waters 2690
Waters 2487
Millennium 2010
Symmetry® C18 3.9x150 mm column
Mobile phase: 60:40 Methanol:water
Flow rate: 1 mL/min
Wavelength: 242 nm
Sample: Propiophenone and butyrophenone

Visible Sensitivity



Alliance™ HPLC System
Waters 2690
Waters 2487
Millennium 2010
Symmetry® C18 3.9x50 mm column
Mobile phase: 30% Acetonitrile+ 0.1% phosphoric acid
Flow rate: 1 mL/min
Wavelength: 600 nm
Sample: Blue food dye

The examples above demonstrate the exceptional low noise performance of the Waters 2487 Dual Absorbance Detector in both the UV and visible regions

Sensitivity is not solely a function of the detector. For ultimate sensitivity, the user must optimize the complete HPLC system to minimize baseline noise. The smoothness of solvent delivery will impact the baseline noise (see WPP213). The choice of wavelength and mobile phase can decrease noise if the mobile phase is transparent at the chosen wavelength. In high sensitivity analysis, baseline disturbances can interfere with detection. Sources of unwanted UV absorbance, "baseline noise", can be caused by poor quality HPLC water or other solvents, dirty glassware, or contaminated columns. Maintenance of constant temperature with a column heater is essential to prevent baseline drift.

The above discussion addresses increasing sensitivity (S/N) by decreasing noise through detector design. Sensitivity can also be increased by increasing the peak signal (see WPP01). This can be done by increasing the injection volume (mass load). The increased sensitivity of the Waters 2487 is combined with an increased linear dynamic range (2.5 AU). This allows injections of larger mass loads with quantitation of both major components and minor impurities within the same chromatographic run.

The Waters 2487 absorbance detector is designed to provide the highest chromatographic sensitivity with a wide linear dynamic range and wavelength range to meet challenging applications needs.