

9.2.4.2 Detector Response

Detector Sensitivity (S)

The signal output per unit concentration or unit mass of a substance in the mobile phase entering the detector.

In the calculation of detector sensitivity the signal output of the detector is given as peak area in mV min, A s or AU min (AU = absorbance unit). These values are obtained from the *integrated* peak area converted to the units specified.

Alternately, the peak area can also be obtained by multiplying the peak height at maximum (in mV, A or AU) by the peak-width at half height (in time units). The peak area calculated in this way will be 6 % less than the true integrated peak area, assuming that the peak is Gaussian.

In the case of *concentration-sensitive detectors*, sensitivity is calculated per unit concentration in the mobile phase:

$$S = A_i F_c / W_i = E / C_i$$

where A_i is the integrated peak area (in mV min or AU min), E is the peak height (in mV or AU), C_i is the concentration of the particular substance in the mobile phase at the detector (in g cm⁻³), F_c is the mobile phase flow rate corrected to column temperature (in cm³ min⁻¹) and W_i is the mass (amount) of the substance present (in mg). The dimensions of detector sensitivity are mV cm³ mg⁻¹ or AU cm³ mg⁻¹.

In the case of thermal-conductivity detectors, this sensitivity value is also called the *Dimbat-Porter-Stross Sensitivity* of the detector.

In the case of *mass-flow sensitive detectors*, sensitivity is calculated per unit mass of the test substance in the mobile phase entering the detector:

$$S = A_i / W_i = E_i / M_i$$

where A_i is the integrated peak area (in A s), E_i is the peak height (in A), M_i is the mass rate of the test substance entering the detector (in g s⁻¹), and W_i is the mass (amount) of test substance present (in g). The dimension of detector sensitivity is A s g⁻¹ or C g⁻¹.

Relative Detector Response Factor (f)

The relative detector response factor expresses the sensitivity of a detector relative to a standard substance.

It can be expressed on an equal mole, equal volume or equal mass (weight) basis:

$$f_i = (A_i/A_{st})f_{st}$$

where A refers to the peak area of the compound of interest (subscript i) and standard (subscript st) respectively, and f_{st} is the response factor of the standard compound. Usually, an arbitrary value (e.g., 1 or 100) is assigned to f_{st} . Expressing the relative molar responses and using n -alkanes as the standards, the assigned value of f_{st} is usually the number of carbon atoms of the n -alkanes multiplied by 100 (e.g., 600 for n -hexane).

If the relative detector response factor is expressed on an equal mass (weight) basis, the determined sensitivity values can be substituted for the peak area.