

What are Reference Standards?

Reference Standards are samples of a known concentration of analyte(s). Standards can be used in the identification and confirmation of analytes. A series of standards at known concentrations can be used to produce a calibration curve which can be used for quantitative analysis. See our technical note on the [importance of using analytical standards](#) for more information.

What is an Internal Standard?

An Internal Standard (IS) is a chemical compound which is added at the same concentration to all samples during sample preparation. An internal standard can be added to a sample, extract or a standard solution.

By using an internal standard it allows for variations between samples and the instrument which will affect the target analyte(s) to be taken into account and adjust results to account for these errors. This adjustment is done by using a ratio of the peak area of the target analyte to that of the internal standard and so changes to the measurement of signal from the analyte should be proportional to that of the internal standard:

$$\text{Peak area ratio} = \frac{\text{Peak area of analyte}}{\text{Peak area of IS}}$$

Using an internal standard improves the precision of results. The internal standard normalizes the calculated results to minimize bias in the measurements and decreasing the need to repeat measurements.

For more information on internal standards and how to choose and use them, see our technical note.

What is a Surrogate Standard?

Surrogate Standards (SS) are commonly used in the analysis of organic compounds. Surrogates are organic compounds which are chemically similar and behave in a similar manner to the target analyte(s). Surrogate standards are commonly added, at a known amount, prior to sample preparation and analysis of a field sample or a QC sample. It is important to choose a surrogate that shouldn't be in your sample.

By using a surrogate standard, it allows the sample matrix effects to be assessed by calculating recovery (%):

$$\text{Recovery (\%)} = \left(\frac{\text{Concentration (or amount) found}}{\text{Concentration (or amount) added}} \right) \times 100$$

The surrogate will mimic target analyte behaviour during the sample preparation and analysis. A low recovery (%) can imply that there is an issue with being able to efficiently extract the target analyte(s) from the sample matrix during sample preparation. The recovery could also indicate an issue with the instrument. Surrogate standards are used to determine if the sample matrix is causing any interference to a sample.

What is the difference between Internal and Surrogate Standards?

The main difference between an internal standard and a surrogate standard is that internal standards use peak areas to calculate a ratio which takes into account any variance in response of the target analyte(s) whereas surrogate standards are used to calculate recoveries which can be used to monitor matrix effects but do not correct for the variance.

Internal standards account for matrix effects and variation between sample and the instrument response for the results of the target analytes and surrogates, if appropriate.

Table 1 shows a summary of the difference between an internal standard and a surrogate standard. They can be used separately but together they are a powerful tool to enhance reliability and reproducibility of your analysis and instil confidence in your results.

Table 1 Summary

	Internal Standard	Surrogate standard
Purpose	Accounts for instrument and sample preparation variability	Monitors sample preparation efficiency
Chemical similarity	Similar to analyte	Closely mimics analyte behaviour
Presence in sample	Not present	Not present
Quantification	Normalizes response for accurate quantification	Assesses recovery and matrix effects

