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Calculation of delta values with reference materials

IRMS measures the relative abundance of isotopes in a sample, and the calibration of the data is a crucial aspect of any measurement routine. When calculating delta values, the ratio of heavy to light isotope of the sample of interest is compared to that in a reference material. Delta values are calculated as shown in equation 1; the results are expressed in parts per thousand, or per mil.

$$\delta_x = \left(\frac{R_x - R_{iRM}}{R_{iRM}} \right)$$

Equation 1, where R is the ratio of the heavy to light isotope (D/H or $^2\text{H}/^1\text{H}$, $^{13}\text{C}/^{12}\text{C}$, $^{15}\text{N}/^{14}\text{N}$, $^{18}\text{O}/^{16}\text{O}$ and $^{34}\text{S}/^{32}\text{S}$), iRM denotes the isotopic reference material and x denotes the sample

These delta values are then calibrated via a multipoint calibration to international reference materials of known isotopic value, the reference materials used should be matrix matched to the sample and should encompass the range of delta values one expects to measure.

Sercon instruments give ultimate flexibility in the choice of using either gas from a cylinder or a reference material when calculating delta values. If a cylinder gas is used, this should itself be calibrated to known international reference materials, but should not be relied upon to give final delta values. A multipoint calibration should always be carried out with matrix matched reference materials to convert measured delta values into scale normalized delta values.

However, with Sercon instruments a cylinder gas is not necessary for delta values to be calculated - instead a reference material may be used at regular intervals within the sample run. This reference material may also be used to tune the source, by using Sercon's trapping loop technology. Using the trapping loop, the reference material is treated in the same way as a sample, held in a trapping loop, and bled into the source slowly for source tuning.

This novel technique avoids the need for a cylinder gas, and may be especially useful in environments where gas storage is restricted, for example when SO_2 or CO cylinders are not allowed inside the lab due to health and safety restrictions.

For more information about Sercon's innovative systems contact sales@sercongroup.com