Sulfate sulfur ($\delta^{34}S$) isotope measurements by MC-ICP-MS

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A new method implementing an isotope calibration curve correction for sulfate-sulfur (S_{SO4}) isotope ratio measurements, $^{34}S/^{32}S$ ($\delta^{34}S$), using a desolvating nebulizer and a laser ablation (LA) introduction system coupled to a multi-collector inductively coupled plasma mass spectrometer (MC-ICP-MS) was developed to improve accuracy of $\delta^{34}S$ measurements. Standard sample bracketing (SSB) is a mass bias correction method utilizing a single standard, typically for narrow range (per mil) isotope systems commonly measured by MC-ICP-MS. However, variations in $\delta^{34}S$ for natural samples (as great as 80‰) exceed the mass bias correction capability of a single S_{SO4} isotope standard. This study demonstrated improved accuracy using SSB isotope calibration curve correction for SO_4 $\delta^{34}S$ over a large $\delta^{34}S$ range for both solution and solid samples. Two National Institute of Standards and Technology (NIST) S_{SO4} isotope standards and a USGS M-158 reference material were evaluated using both SSB and SSB isotope calibration curve correction (Fig 1). The $\delta^{34}S$ is reported to CDT (±0.2‰).

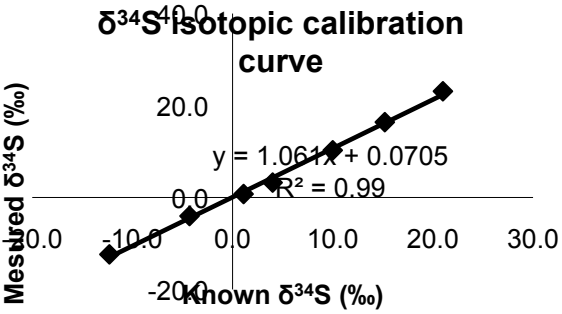

Figure 1: S_{SO4} calibration curve for $\delta^{34}S$ from -12.4‰ to +21.0‰ for solution SO_4 reference materials (SSB=10.0‰).

Sample	SSB	$SSB_{correction}$	Reported
NIST 8553	17.6‰	16.8‰	16.9‰
NIST 8556	17.8‰	17.1‰	17.1‰
USGS M-158	0.2‰	1.4‰	1.4‰

Analyses by LA-MC-ICP-MS resulted in similar calibration curves and isotope corrections as the solution samples. The isotope calibration curve correction method is necessary to accurately measure solution and solid S_{SO4} isotopic composition by MC-ICP-MS when using S_{SO4} as a SSB.