



Analysis of hydrogen and oxygen stable isotope ratios of ecosystem-derived water samples using infrared laser spectroscopy

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Recently introduced commercially available laser spectroscopic instruments allow the direct and simultaneous measurement of the hydrogen and oxygen stable isotopic composition of water ($\delta^2\text{H}$, $\delta^{18}\text{O}$) without prior chemical equilibration as is the case for classical isotope ratio mass spectrometry (IRMS). While measurements of $\delta^{18}\text{O}$ and $\delta^2\text{H}$ in atmospheric air have been successfully implemented and calibrated [e.g., 1], considerable concern exists, however, about the suitability of laser spectroscopy for the analysis of liquid samples other than pure water [2-4]. This is because some organic contaminants such as potentially contained in ecosystem-derived samples like leaf or soil waters may cause erroneous isotope readings on laser spectroscopy instruments due to spectral interference in the region of the target absorption features of the water isotopologues. Here we present data for a wide range of ecosystem waters that were analysed using both wavelength-scanned cavity ring-down spectroscopy (WS-CRDS; model L1102i, Picarro Inc.) and IRMS. The results for $\delta^{18}\text{O}$ and $\delta^2\text{H}$ from both instruments mostly show very good agreement. Treatment of deionised or tap water with 0 to 15 % of activated charcoal resulted in a linearly increasing enrichment of up to ca. 1 ‰ for $\delta^2\text{H}$ compared to untreated water while $\delta^{18}\text{O}$ was not affected. We discuss effects of water extraction technique and sample treatment on the analytical results and the implications for the use of laser spectroscopy for measuring ecosystem-derived water samples.

References

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