Testing the use of sealable bags as an alternative and less expensive method for tracing isotopes in plant matter

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Methods

- Gather stopcocks, nuts, ¼ leurxs, a sealer (parafilm, rubber washers, etc.), hole punch, and gas tight, sealable bags.
- Assemble the bags by poking a hole 6 to 7 cm down from the seal in middle of bag. Place sealer, then leurx, then stopcock.
- Once the bags are assembled, collect the samples. With gloves on, obtain a small branch (between 20 and 30 grams), strip the bark from it, cut it in half and then down the middle. Place the sample in the bag being sure not to touch the sides of the bag. Write the time of collection on the bag and heat seal it (figure 3).
- Also make water baseline bags (figure 6). For every 6 plant samples run, a 25mL baseline of tap water, light water and heavy water should also be run (3 bags).
- Fill the bag with dry air and place it in a temperature controlled room, about 23 degrees Celsius. Let the samples sit for 24 hours before they are run through the LGR (figure 4).

Results

- This experiment was done at the University of Arizona’s Biosphere 2 (figure 1) in the rainforest (figure 2). The main purpose of the research was to find a less expensive method for sampling isotopes from plants by testing direct vapor equilibration laser spectroscopy as an alternative and less expensive method for tracing isotopes in plant matter. Currently, water isotopes are traced with an infrared spectroscopy (IR) machine which costs about $8 a sample while this new method costs about $2 a sample and takes less time per sample.

Discussion

- After the first test, a tracer of deuterium was added to the rainfall in the Biosphere 2 rainforest.
- Data to the left of the RF water line were likely subjected to evaporation in not fully suberized plant twigs and/or emitted more contaminants.
- The slope of outdoor data was steeper (figure 5).
- The water baseline (figure 7) matched with the rainforest water baseline and also shows that the machine had a slight drift over time.
- R² values averaged at 0.92 which means the data is agreeable.

Conclusions and Future Work

- This was reproducible and with more testing and analysis could be a less expensive and more accessible method to tracing water isotopes.
- Possible points of error include organic contamination, fractionation and equalization.
- The addition of deuterium halfway through the testing makes running statistical tests hard because some of the deuterium levels are very low and some are then very high making them look unrepresentable.
- For future tests, collect samples to be run in the IR machine as well to get data from a known method to compare to the bag method data.

Bibliography


Acknowledgements

This material is based upon work supported by the National Science Foundation through the Robert Noyce Teacher Scholarship Program under grant #1534230.

Any opinions, findings, and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the National Science Foundation.

The research was made possible by the California State University STEM Teacher Researcher Program in partnership with California Polytechnic University and the University of Arizona’s Biosphere 2. Thank you!