

Open-source hardware: a pathway to accelerate method development in stable isotope measurements

M. C. Carvalho^{1*}

¹ Southern Cross Analytical Research Services, Southern Cross University, Lismore, NSW, Australia

*Presenting Author Email: mcarvalh@scu.edu.au

The development of open - source hardware (OSH) solutions for science has become very fast in the last 5 years. OSH has the obvious advantage of being a cheaper alternative to commercial scientific equipment, but a less visible advantage is the time saved. For most institutions, acquiring expensive gear is an elaborate bureaucratic process, while small expenses are often easier to be approved. This simple difference can significantly speed up the development of new methods, especially when they are in their earlier stages, and it is more difficult to convincingly justify the investment of large sums. In our lab, two new methods for stable isotope measurements have recently been developed with the aid of OSH. The first is the adaptation of an elemental analyzer (EA) to perform dissolved organic ¹³C measurements in saline waters [1], which presents unique challenges. Here, we made use of a variation of an OSH autosampler [2] to automate sample introduction on the EA. The second example of OSH aiding method development is the reprogramming of a 3D-printer to work as a fraction collector for liquid chromatography [3], for the measurement of ¹³C in carbohydrates using an EA. In addition to these two new methods, OSH has been used in our lab to increase productivity using a microbalance autosampler [4], compatible with different brands of microbalances [5]. Other similar developments can be expected with the popularization of the OSH approach, which should significantly speed up method development for stable isotope measurements.

References

- [1] Carvalho, M.C. (2023) Adapting an elemental analyser to perform high-temperature catalytic oxidation for dissolved organic carbon measurements in water. *Rapid Communications in Mass Spectrometry* **37**, e9451.
- [2] Carvalho, M.C. & Murray, R.H. (2018) Osmar, the open source microsyringe autosampler. *HardwareX* **3**, 10-38.
- [3] Carvalho, M.C. & Oakes, J.M. (2023) Turning a 3D Printer into a HPLC Fraction Collector: A Tool for Compound-Specific Stable Isotope Measurements. *Hardware* **1**, 29-53.
- [4] Carvalho, M.C. (2023) Automated weighing in the stable isotope lab: When less is more. *MethodsX* **10**, 102207.
- [5] Carvalho, M.C. (2016) Practical Laboratory Automation Made Easy with Autolt. Wiley VCH. 290 p.