



GasBench II System: Tracking wine adulteration using oxygen isotope fingerprints

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Keywords

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Goal

Demonstrate that wine adulteration by addition of water can be tracked using oxygen isotope fingerprints.

Introduction

One of the most common type of wine adulteration is the addition of cheaper products to the original wine, such as fruit juices, water and sweeteners, which are not related to the grapes or fermentation process from which the wine was originally produced. Adulterated wine is then labeled as the original product, generally an expensive brand, and sold on the market as if the original product. It also relates to the re-labeling of wines, by adding the label of a more expensive wine to a bottle of a different, cheaper version and selling it on the market as an original product. In the European Union, for example, European Commission Regulation (EC) No 607/2009 regulates the origin and labelling of wine, with bilateral agreements in place with Australian, Mexico, Chile, USA, Croatia, Switzerland, amongst others.

In this application brief we report oxygen isotope measurements on wine and show how adulteration by the addition of water can be successfully tracked and identified. This enables the evaluation of wine labels in terms of alcohol content and origin. In addition, analysts can refer to the official wine databank (EU-wineDB), which contains isotopic analysis of authentic and representative wine samples, to compare their data.

Analytical configuration

Under complete software automation, the Thermo Scientific™ GasBench II System interfaced with a Thermo Scientific™ DELTA™ V IRMS analyzed c. 100 µl of CO₂ gas evolved from a wine sample following the OIV-MS-AS2-12 official method. Around 500 µl of wine (not distilled) was placed into a vial and equilibrated with CO₂ for a period of 24 h at 24 °C. Automated multiple loop injection allowed continuous sub-sampling of the gaseous phase from the vial, improving precision of analysis through 10 replicate sub-samples within one data acquisition. Each sub-sample was cleaned-up by micro GC separation ensuring only CO₂ gas from the wine sample was analyzed.

The oxygen isotope fingerprint of wine

Oxygen isotope fingerprints can be used to identify the geographical origin of wine. The grapes, from which wine is produced, carry a local-regional fingerprint primarily derived from the hydrological cycle associated with local-regional rainfall, but can also be influenced by cultivation practices, soil processes and geological characteristics of the local area, altitude and proximity to the shoreline¹. The oxygen isotope fingerprints change in rainfall as you move further inland from the shoreline and with increasing altitude because heavier isotopes are released from the clouds first, meaning heavier isotopes are closer to the coast line compared to further inland^{1,2}. This effect can be tracked in the oxygen isotopic fingerprints of wine because the signature from the grape is maintained throughout the production process.

Was the wine watered down?

Figure 1 shows an example of wine adulteration by the addition of water, which is detected by the change in the oxygen isotopes. A genuine red wine sample was measured initially to provide a baseline before the sample was sequentially adulterated by adding water. The watering technique may be used to reduce alcohol content and increase profits by producing more bottles for sale and thus reduce tax and customs duty on exported products in certain countries.

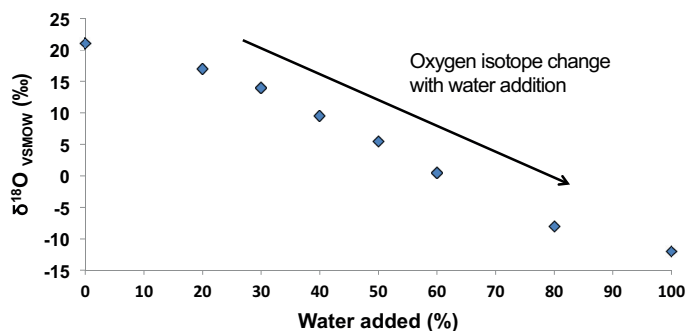


Figure 1. Oxygen isotope fingerprints detect watering of wine.

Summary

The correct labeling of wine affects producer and consumer value and food safety. Laboratories need an analytical technique providing conclusive answers on origin and authenticity of primary ingredients. The oxygen isotope fingerprint of wine allows the identification of water addition in commercial wine, i.e. adulteration. This helps protect producer reputation and consumer confidence by detecting fraudulent activity and supports EC No 606/2009.

By using Thermo Scientific GasBench II System, laboratories gain:

- Reliable, unique isotope fingerprint data allowing the detection of adulterated and mislabeled wine.
- An analytical system providing compliance with the only official method OIV-MS-AS2-12.
- High throughput and low cost analysis.
- Complete analytical and data evaluation automation.

References

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2. Rodrigues, C., Maia, R., Miranda, M., Ribeirinho, M., Nogueira, J.M. F., Aguas, C. M., J. Food Composition Analysis, 22. (2009), 463–471.

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