Research shows the capability of cavity-enhanced laser spectrometry to identify counterfeit wines

Los Gatos Research (LGR)

How LGR’s patented analyzing technique, Off-Axis Integrated Cavity Output Spectroscopy (OA-ICOS), is used to quantify δ¹⁸O and ethanol content in wines

Measurement made easy

Introduction

According to some estimates, up to 5% of wines sold at auctions or secondary markets are fraudulently watered, labeled, blended, or contain unauthorized additives. Recently, measurements of the ¹⁸O/¹⁶O stable isotope oxygen ratio (expressed as δ¹⁸O) of water in wine have served to authenticate wine, resulting in the development of extensive databases of these isotope ratios. But techniques for determining this ratio, such as isotope ratio mass spectrometry, are often complex, time-consuming and costly.

Research published in the International Journal of Wine Research (September 5, 2013) discussed cavity-enhanced laser spectrometry for quantifying δ¹⁸O and ethanol content in wines. The commercially available analyzing technique used in these studies, called off-axis integrated cavity output spectroscopy (OA-ICOS), is patented by Los Gatos Research, a member of the ABB group.

For more information

Further details of ABB Measurement & Analytics products are available for free download from: www.abb.com/measurement

or by scanning this code:
Using LGR OA-ICOS analyzers to monitor trace concentrations

OA-ICOS analyzers from LGR monitor trace concentrations by means of a sensitive optical absorption measurement. The technique uses a tunable laser diode that delivers a detailed scan of a specific spectral region. Off-axis ICOS has many advantages over other conventional laser-based techniques. These analyzers are insensitive to optical alignment, can make very rapid measurements and are cost-effective. For the wine studies, the sample were flash evaporated to generate water vapor and the measured cavity-enhanced absorption spectra were analyzed to yield the δ\(^{18}\)O isotope ratio.

The researchers compared ratios measured with OA-ICOS with values measured by isotope ratio mass spectrometry. The δ\(^{18}\)O values measured by the two techniques agreed to within ±0.63‰ (1σ). Agreement improved to ±0.30‰ (1σ) by implementing LGR processing software to correct for organic contaminants, using measured values of broad- and narrow-band metrics. The research demonstrated the utility of OA-ICOS for identifying fraudulent watered and mixed wines.

The researchers first tested 14 red and white wines from major wine growing regions in North and South America, Europe and Australia. These samples were not isotopically-characterized.

The tests proved that the OA-ICOS analyzer could measure δ\(^{18}\)O values with adequate precision and minimal effects from sample memory and contamination. The measurements also showed that broadband metrics could be used to determine ethanol concentration, useful for identifying watered wines.

The analyzer then tested eight wine samples obtained from the Centro di Ricerca per l’Enologia in Asti, Italy. The δ\(^{18}\)O values of these samples had been previously measured by isotope ratio mass spectrometry according to industry standards. Researchers found that the precision and repeatability of the δ\(^{18}\)O values measured by the OA-ICOS analyzer exceeded those required by the international wine standards organization (OIV).

The LGR analyzer also measured the isotope ratios and spectral metrics for two mixed wines. Two wines of the eight mentioned above were mixed to produce samples of varying percentages. The mixtures showed measured and corrected isotope ratio values that fell between the two wines and the analyzer could identify samples that contained more than 10 % of the other wine.

Results of this research indicated that the OA-ICOS analyzer from Los Gatos Research could be used to authenticate other beverages, such as fruit juice extracts, concentrated spirits and other food applications.