

From Vineyard to Wine Glass

How Proficiency Testing can help put the
'Quality in Every Glass'



Introduction

The history of the wine trade is filled with stories of wine that has been manipulated, adulterated (substances not related to grapes being added) and even counterfeited. Wine is a particular target for fraudsters as it is a popular, large volume commodity, often associated with a high monetary value. Wine is commonly adulterated by the addition of fruit juices, water and sweeteners, which are not related to the grapes or fermentation process from which the wine was originally produced. The adulterated wine is then labelled and illegally sold as the original product (which is generally, as you would expect, an expensive brand). The integrity of wine is protected by various legislations around the world. In the European Union, for example, European Commission Regulation (EC) No 606/2009 regulates the origin and labelling of wine.

The global wine consumption is expected to exceed 30 billion litres by 2020. This necessitates an economically viable international trade in wine, the quality of which has to be evidenced by high quality analytical data. Analytical testing may be carried out at the winery, by a third-party laboratory (government or private) and by exporters or importers. This mutual recognition of analytical data is the driving force behind improvements in laboratory methods and the associated quality assurance. Both of these factors (method performance and overall quality assurance) can most easily be addressed by the wider application of proficiency testing in the wine industry. At its most basic, this enables more accurate determination of alcohol content and sulphate concentration for labelling purposes. At the other end of the scale is the determination of adulterants, contaminants and authenticity that would affect international trade.

This paper describes the application of a new series of Fapas proficiency tests in support of quality assurance in the wine industry.



Highlights of Emerging Issues reported from HorizonScan (From Jan 2018)

Taking a snapshot from HorizonScan of what emerging issues there have been so far this year, we can see that wine is a commodity that is significantly at risk of adulteration and substitution. HorizonScan intelligence houses data since 1999 to date and is a vital web based food safety alerting tool of raw material and global commodity issues across all food integrity areas.

Date	Commodity	Country of origin	Reason for notifying	Notified by	Hazard
14-May-18	Wines (red, white, rose, sparkling, fortified)	Moldova	Red wine found to have strange taste and smell, caused by aerobic bacteria	The Czech Republic	Decomposition/ altered organolepsis
14-May-18	Wines (red, white, rose, sparkling, fortified)	The Czech Republic	Strange taste and smell in wine suggesting presence of mould	The Czech Republic	Decomposition/ altered organolepsis
14-May-18	Wines (red, white, rose, sparkling, fortified)	The Slovak Republic	Red wine found to have had sucrose added to it	The Czech Republic	Adulteration/ substitution
14-May-18	Wines (red, white, rose, sparkling, fortified)	Slovenia	A transnational criminal network, illegally selling sugar consignments to the wine sector, has been uncovered in Serbia and Slovenia following investigations coordinated by the Naples North Public Prosecutor, and seizures carried by the Guardia di Finanza of Caserta and the inspectors of the ICQRF (Central Inspectorate for the Protection of Quality and Fraud Control of Food Products). The sugar was being sold to the sector for adulteration to wine.	Serbia	Adulteration/ substitution
11-May-18	Wines (red, white, rose, sparkling, fortified)	Moldova	Red wine with strange appearance, scent and taste suggesting oxidation has occurred	The Czech Republic	Decomposition/ altered organolepsis
30-Apr-18	Wines (red, white, rose, sparkling, fortified)	Portugal	Portugal's health and Safety authority ASAE has seized 4,536 bottles of fake sparkling wine worth over €5,000 in Águeda, in northern Portugal.	Portugal	Adulteration/ substitution
19-Apr-18	Wines (red, white, rose, sparkling, fortified)	Moldova	White wine found to have had synthetic aroma added to it	The Czech Republic	Adulteration/ substitution
19-Apr-18	Wines (red, white, rose, sparkling, fortified)	Chile	Red wine found to have had synthetic aroma added to it	The Czech Republic	Adulteration/ substitution
19-Apr-18	Wines (red, white, rose, sparkling, fortified)	Hungary	White wine with strange taste and smell suggesting oxidation has occurred	The Czech Republic	Decomposition/ altered organolepsis
3-Apr-18	Wines (red, white, rose, sparkling, fortified)	France	Prosecutors allege that Grands Vins de Gironde (GVG) illegally blended at least 68,000 cases of wine. Investigators were alerted to the alleged fraud during a routine audit of GVG's cellar in 2014.	France	Adulteration/ substitution
16-Mar-18	Wines (red, white, rose, sparkling, fortified)	Germany	Possibility of bottles of wine bursting due to secondary fermentation	Germany	Other micro contaminants
23-Feb-18	Wines (red, white, rose, sparkling, fortified)	The Czech Republic	Wine found to contain 22% added water	The Czech Republic	Adulteration/ substitution
22-Jan-18	Wines (red, white, rose, sparkling, fortified)	The Czech Republic	Red wine found to have strange taste and smell, caused by aerobic bacteria	The Czech Republic	Decomposition/ altered organolepsis
19-Jan-18	Wines (red, white, rose, sparkling, fortified)	The European Union	White wine found to have had synthetic flavour added	The Czech Republic	Adulteration/ substitution
19-Jan-18	Wines (red, white, rose, sparkling, fortified)	The Czech Republic	Red wine found to have added synthetic dye (azorubine)	The Czech Republic	Adulteration/ substitution
19-Jan-18	Wines (red, white, rose, sparkling, fortified)	Italy	White wine with unauthorised addition of synthetic aroma	The Czech Republic	Adulteration/ substitution
12-Jan-18	Wines (red, white, rose, sparkling, fortified)	The Czech Republic	Red wine found to have had water (25%) and ethanol from sugar added	The Czech Republic	Adulteration/ substitution
12-Jan-18	Wines (red, white, rose, sparkling, fortified)	The European Union	Synthetic flavour found to have been added to red wine	The Czech Republic	Adulteration/ substitution
12-Jan-18	Wines (red, white, rose, sparkling, fortified)	The Slovak Republic	White wine with strange taste and smell, similar to sulphur dioxide	The Czech Republic	Decomposition/ altered organolepsis
12-Jan-18	Wines (red, white, rose, sparkling, fortified)	Spain	White wine with strange taste and smell suggesting presence of mould	The Czech Republic	Decomposition/ altered organolepsis
12-Jan-18	Wines (red, white, rose, sparkling, fortified)	The European Union	Red wine with strange taste, smell and appearance suggesting oxidation has occurred	The Czech Republic	Decomposition/ altered organolepsis



What is Proficiency Testing?

Individuals and organisations often commission laboratories to perform analyses on food items. The laboratories are responsible for running the appropriate analysis and providing the results. However, an important question to consider is: **How much can you trust the results the laboratory has provided?**

“There’s a mechanism by which you can find out how good a laboratory is, and that is proficiency testing,” says Mark Sykes, the scientific advisor of proficiency testing for Fapas, the proficiency testing arm of Fera Science Ltd located in the UK. Fapas was the first organisation to introduce laboratory proficiency tests to the food industry.

Sykes likens a proficiency test to an exam that one might take in university. “A proficiency test is a practical exam for professional laboratories,” he says “proficiency testing provides laboratories with objective evidence of their ability to produce accurate and precise data by independently testing laboratory procedures”.

The Benefits of Proficiency Testing

- Demonstrates the quality of your tests and services to clients
- Gives you confidence in your services and products, supply chain, analytical methods, and staff
- Helps you to identify and resolve issues related to testing/calibration early on
- Allows your laboratory to gain and maintain ISO/17025 accreditation

How the Process Works

Fera sends each lab an aliquot of the same test sample along with instructions describing what the particular proficiency test is looking for and how to submit results.

Once the participating labs submit their result, Fera provides them with assessments based on how accurate their results were. Each lab receives a z-score, which is a common metric that indicates how close or far their result was from the correct one.

“One test done at one particular moment in time doesn’t necessarily reflect the ongoing performance of a laboratory,” says Sykes. That’s why Fera recommends labs take part in multiple proficiency tests throughout the year to obtain a long-term assessment of their performance.

Results Assessment Guidelines

- A z-score of 0 means result was absolutely correct
- A positive z-score indicates an overestimate
- A negative z-score indicates an underestimate
- A z-score between – 2 and +2 is considered satisfactory
- A z-score between – 3 and – 2 or between +2 and +3 indicates further tests are needed
- A z-score below – 3 or above +3 is considered unsatisfactory



Proficiency Testing for Wine

Proficiency testing helps to ensure safety and quality in the food and beverage industry. The global market for food testing services is projected to grow substantially over the next five years.

The high value of wine motivates sellers to undertake testing to help ensure the quality of their product. Although wine tasting is a prevalent means of assessing wine quality, it is a non-standard, opinion-based, and potentially biased analysis method. Organoleptic testing cannot detect trace level contaminants such as heavy metals, methanol or processing contaminants.

Bringing Innovation to the Table

Working in partnership with the Italian Wine Federation and Star Ecotronics, Fera has recently developed a myriad of new wine proficiency tests. The programme, which is now available, is relevant to everyone in the wine industry, from independent wineries to large, multi-site laboratories. Tests will span the range of red wine, white wine, and sparkling wine and cover more than 60 analytes. To their existing wine proficiency tests for alcohol content and acidity, Fera is adding tests for alcohol-related congeners, inorganic ions, organic acids, quality indexes including colour, sugars, sulphur dioxide, heavy metals, nutritional elements, and oxygen-18 isotope ratio. “The new proficiency tests are much wider in scope than anything we’ve done before,” says Sykes.

New Defence Technologies to Support Brand Protection

Each laboratory can choose to test any or all of the properties, depending on the laboratories’ needs and capabilities. Individual reports provide an in-depth look at the testing round, while investigating method dependency in the PT performance.



Product Code	Matrix	Analytes	Quantity	Test Dates
Wine				
ECOHS-DRA13	Wine	Volumic Mass at 20°C, Alcoholic Strength (real), Alcoholic Strength (apparent), Methanol, Ethanal (acetaldehyde), 4-Ethyl-Guiacole, 4-Ethyl-Phenol, 2,4,6-Tribromoanisole, 2,4,6-Trichloroanisole, 2-PyrroliLatoone, 1-Vinyl-2-PyrroliLatoone, 1-Vinylimidazole, Total Polyphenol Index, Total Polyphenol (expressed as gallic acid), Carbonic Anhydride, pH, Total Acidity (expressed as tartaric acid), Total Volatile Acidity (expressed as acetic acid), Nitrates (total, ionic), Chloride (expressed as NaCl), Sulphates (total, as K2SO4), Phosphates (total, ionic), Overpressure, Ash, Ash Alkalinity (0.1N HCl) (as CaCO3), Dissolved Oxygen, Turbidity, Filtration Index, Folin-Ciocalteu Index, Colour Intensity, Colour Tone, Total Sugars, Glucose + Fructose (sum), Fructose, Sucrose, Citric Acid, Gluconic Acid, Lactic Acid, Malic Acid, Shikimic Acid, Sorbic Acid, Tartaric Acid, Glycerine, Dry Extract, Sulphur Dioxide (free), Sulphur Dioxide (total), Histamine, Ochratoxin A, Arsenic, Cadmium, Calcium, Copper, Iron, Lead, Lithium, Magnesium, Potassium, Silver, Sodium, Zinc, Isotope Ratio Oxygen-18	4x250ml	30 Apr 19 12 Nov 19

Fera Wine Services

Fera is a global supplier of diagnostic products for wineries and wine laboratories providing accurate and reliable testing solutions to ensure quality in every glass. Analytical chemistry is an essential part of the winemaking process, ensuring not only the safety of the final product, but also the quality. Fera offers a wide range of analyses which means wine makers can measure the acidity, sugars, sulphites and metals, as well as levels of potassium, glycerol and ethanol during the winemaking process including proficiency testing, promoting excellence in every glass.

Excellence in Every Glass

Fera is the UK Government Lab for Wine Analysis and represents UK at technical meetings relating to wine control at the EU. To comply with Commission Regulation (EC) No 555/2008 of 27 June 2008 laying down detailed rules for implementing Council Regulation (EC) No 479/2008 on the common organisation of the market in wine as regards support programmes, trade with third countries, production potential and on controls in the wine sector, we analyse micro-vinified wines for inclusion in the EU Wine Databank.

Natamycin (macrolide antibiotic, used to control the growth of yeasts and moulds) Screen

Presence detection – Within this screen we regard a positive result as being above 5µg/L. As an optional addition to this test we are able to provide quantification if positive results are found.

Regulation – Not permitted for use in wines that are prepared or sold in the EU

[Find out more](#)

Chemical Profiling ANALYSIS

Non-Targeted analysis – Analysis of wine samples using high resolution fingerprinting techniques
1H NMR spectroscopy

The application of this technology is currently being discussed at an EU level

3-MPD & Cyclic Diglycerols

Glycerol addition prohibited – The flavour and full bodied taste can be enhanced by addition of industrial glycerol

[Find out more](#)

Isotope Ratio

Our wide range of analysis activities are underpinned by our UKAS ISO 17025 accredited stable isotope analysis methods. These are performed to detect chaptalisation with either C3 or C4 sugars, as well as highlighting the addition of water. Our insights can verify the authenticity of your products, strengthening your brand and putting your customers at ease.

[Find out more](#)

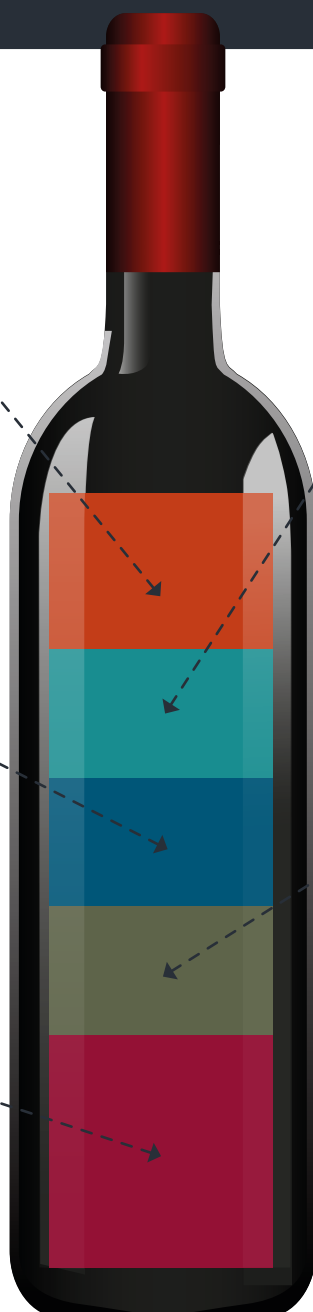
DNA Profiling ANALYSIS

Metagenomics – Analysis of DNA within a wine sample

Technique – Next generation DNA sequencing

UTILISATION

Research – The application of this technology is currently being considered within Fera for varietal purity and geographical origin





Original thinking... applied

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