

# WINE AND SPIRITS

## **EN-TAG™:**

Ultra-miniaturized labels for authentication  
and temperature monitoring applications



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## 1. THE PROBLEM WITH COUNTERFEIT WINE AND SPIRITS

In the last few years, the wine and spirit sector has been a favorite target of counterfeiters. Increased demand in emerging markets and the limited supply of fine wine in the world are both contributing to driving up prices and creating a global environment of limited supply and high value - an ideal scenario for counterfeiters. In some Asian countries, including China, wine is becoming a fashionable drink, a phenomenon that is also fueled by the perceived health benefits of red wine, to the extent that it has become part of a socially and culturally sophisticated lifestyle – a status symbol for those who can afford it.

One of the reasons why the wine and spirit sector is attractive to counterfeiters is because of the globalization of its supply chain. Wine and spirits travel long distances and change hands frequently before they reach the final consumer, a system which makes it difficult to determine how much of a particular product should still be in circulation. With so many different brands competing for a market position, it is also relatively easy to create brand confusion, especially among the growing population of new, inexperienced consumers. Generally speaking, the older the vintage, the more difficult it may be to disprove authenticity.

The damage caused by counterfeit products to producers can be substantial. Fake products are an economical burden to the producer, damage brand quality and may expose consumers to health risks.



Brand damage is especially concerning to those producers who have already been affected by counterfeit products, since a great deal of time and marketing dollars are spent on establishing a brand's image. When a customer buys counterfeit wine, for example, he/she may no longer want to buy or recommend the brand.

## INTRODUCTION

While it is true that most producers are not responsible for counterfeit products, the indirect costs for conducting follow-up investigations, working with regulators, consulting with legal and fraud attorneys and/or educational efforts can be substantial. All of these activities require skills that are not typically found in a winery, which translates into additional costs.

Counterfeit wines and spirits are a threat to human health. This year, UK authorities discovered counterfeit bottles of Arctic Ice vodka containing methanol, chloroform and isopropanol. In the media, there have been several reported cases of deaths due to drinking products containing chemicals such as methyl alcohol or butyrolactone (a substance commonly used in the production of industrial chemicals). Disclosure of toxic or harmful chemicals in a bottle of wine or liquor can be catastrophic to a winery's reputation and affect sales for many years.

Wine industry experts estimate that about 5% of rare vintages sold on the secondary market are counterfeit. While counterfeit bottles of trophy vintages get sensational press, counterfeiting occurs across many price points - from premium wines down through the mid-range wines.

Canadian Icewine for instance is very popular in Taiwan and China, where it is estimated that up to 50% of the Icewine sold in these markets is fake. Canadian winery Vineland Estates lost 95% of its Icewine sales to China to counterfeiters over a five year period.



## 2. TEMPERATURE EFFECTS ON WINE QUALITY

Since wine does not have a “sell-by” or “consume by” date, it is easy to forget how far a bottle of wine can travel before it reaches the final consumer, or how many storage and transit locations, geographical climates or seasonal changes it may experience post-bottling. Some reports indicated that ~90% of quality faults in wine are caused by excessive heat at some point between producer and consumer.

In general, the ideal temperature range for long-term storage of wine is ~13-15°C, yet a large percentage of wine purchased today is exposed to higher temperatures during transport. A body of evidence shows that temperatures in excess of 30°C can permanently degrade wine’s chemical and analytical properties as well as sensory qualities, including flavor, aroma and color. For a bottle of wine kept at 40°C, it is only a



matter of days until visual and sensory changes begin to occur. Equally, extremely low temperatures (at or near the freezing point) can damage wine’s quality and integrity by forming crystals, pushing the cork out or even breaking the bottle.

The literature on the temperature effects on wine quality is relatively scarce. One such study was led by Dr. Anthony Robinson and his colleagues at the University of California Davis and Murdoch University in Australia, in which the researchers examined the effects of storage conditions on four varieties of white wines and four red wines. The wines were exposed to either 20°C, 40°C or 20/40°C (reflecting diurnal cycle in temperatures). A fourth sample of wines was kept in the trunk of a car for three weeks. Results of this study showed that high temperatures produced higher concentrations of vitispirane 1 and 2, TDN, and *p*-cymene and reduced several esters which are characteristic of aged wines. Constant exposure of wine to 40°C temperatures significantly affected the aromatic properties of the wines, with the “most significant differences among the white wines by increasing diesel, oxidized, and rubber aromas and decreasing citrus, floral, and tropical fruit aromas. The magnitude of the effect was significant, although less pronounced in the red wines with increased dried fruit and canned vegetable aromas.”

## INTRODUCTION

Unfortunately, news articles are filled with anecdotal stories of poor shipping conditions and inadequate storage facilities. There have been cases of products that were shipped by air in temperature-controlled containers and subsequently placed for days in regional delivery trucks that were not temperature-controlled. Wine bottles can spend a significant amount of time at shipping ports, where containers may be delivered days in advance of scheduled shipping. Also, modern container ships (“reefers”) carry thousands of wine containers stacked onto one another, so it is not uncommon for these cases to be exposed to varying degrees of temperature, depending on their specific placement within the vessel (e.g. above deck, near fuel tanks etc.).

But the signs of neglect are not limited to transportation. Quite commonly, wine bottles are shelved in unsuitable conditions, a situation which is particularly problematic in warm climates where air conditioning systems are either not existing or malfunctioning, or they may be turned-on in the daytime during peak temperatures and shut-off in the night. To save money, in some cases retailers do not offer warehouse facilities for wine storage, and bottles may even be exposed to direct sunlight.

The real problem with temperature excursions and fluctuations is that it can be difficult to distinguish a well-preserved wine from one that has been inadequately stored.



*Although wine experts may be able to detect subtle organoleptic differences in taste, color, or aroma, the average consumer is unlikely able to recognize such differences, and he/she is more likely to label a given brand as “bad wine”, never to be purchased again.*

### 3. BRAND PROTECTION METHODS

Common ways of protecting the quality and authenticity of wine and spirits include tracking sales on the secondary market, using vintage-dated corks and applying labels and individual numbers to the bottle. Trade techniques for authentication may also include examining the cork, glass, label, fill level, provenance and storage, and in some cases sampling the product as well.

As the issue of counterfeit wine became a broader public issue, many companies have either developed or marketed technologies specifically geared towards the wine industry. As a result, there are a number of advanced technologies on the market today, some of which are more practical and economical than others.

Examples of existing technologies include stick-on or specialty labels (Prooftag, Collotype Labels), multi-colored holograms (Kurz), invisible markers (Eastman Kodak) and DNA markers (Applied DNA Sciences, CertiLogo). For thermal monitoring applications in particular, eProvenance ([www.eprovenance.com](http://www.eprovenance.com)) has developed a unique RFID solution technology for authenticating and tracking wine cases from producer to consumer, as well as monitoring and recording the storage temperature and collecting the pedigree of each case in a secure online database.

For a producer, the cost for purchasing and implementing a new security solution is as important as the security of the brand, since current prices of available technologies can range from a few pennies per bottle (e.g. holograms) to several dollars per bottle (e.g. RFID, DNA markers). In addition to the cost factor, new technologies must be able to authenticate products, possibly in the field (or on-the-spot) in a way that is rapid, commercially feasible and applicable to various levels of the distribution chain.

### 4. A NEW CLASS OF MULTI-FUNCTIONAL LABELS

#### 4.1 EN-TAG™ Product Overview

EN-TAG™ is a covert, ultra-miniaturized data matrix technology for brand authentication and thermal monitoring applications. EN-TAG™ is a tamper-proof solution that can be made invisible to human or electronic eyes. At any point in the supply chain, an optical reader or mobile phone can indicate in a matter of seconds whether the bottle is authentic and whether it has been shipped or stored within an acceptable temperature range.

EN-TAG™ technology offers the highest level of security combined with high information content. By way of comparison, the information content of a single EN-TAG™ is over 100 times higher than that offered by a 2D data matrix. EN-TAG™ technology equips each bottle with a counterfeit-proof data carrier label for authentication and traceability purposes. It was designed to enhance the security features of reflective surfaces by means of a digital read-only memory that can hold data such as text, pictures, etc..

Temperature monitoring with EN-TAG™ is achieved through the use of a proprietary thermo-sensitive polymeric layer (T-TAG) which enables the detection of subtle optical changes when the tag is exposed to temperatures exceeding a pre-set threshold. Threshold temperatures are fully customizable to specific temperature requirements. Importantly, exposing an EN-TAG™ to higher-than-threshold temperatures does not alter the secure information contained in it.



A 3x3 mm<sup>2</sup> EN-TAG™ on a wine label for thermal monitoring and authentication applications

## 4.2 Features

- **Flexibility.** EN-TAG™ micro-labels can be integrated into any reflective surface (e.g. front and back labels, bottle tops, metallized paper, etc.) with no aesthetical disruption. Flexible size range between 1-10 mm, depending on information content requirements.
- **Robustness.** Suitable for temperatures up to 80°C and robust to wear and tear, accidental or intentional scratching.
- **Size.** Storage capacity for a data volume of up to 30 kB per cm<sup>2</sup>. For example, a 1 mm<sup>2</sup> tag may contain ~300 text characters.
- **Content.** Storage data may include images (e.g. logo) or any text information (e.g. pedigree data) in any language.
- **Security.** The encrypted data provides protection against unauthorized access.
- **Cost.** Low-cost solution and suitable for use with products manufactured in large quantities (mass production).
- **Sensing Functionality.** Standard bar codes or holograms contain no sensing functionality. EN-TAG™ can monitor the thermal history of each bottle of wine during transport or storage.
- **Optically readable.** EN-TAG™ labels are optically readable thanks to an advanced nano-patterning technology and proprietary software. Information content can be read with a modified optical reader and/or cell phone featuring a camera.



EN-TAG™ on wine labels – practical examples

### 4.3 Benefits

The EN-TAG™ technology offers a number of benefits and advantages to wine and spirit producers:

- Proprietary, patent-protected technology.
- Laser printing and optical reading customizable on-demand for bottle serialization purposes.
- Low price – price comparable to that of a standard hologram.
- First-in-class security feature to monitor the thermal history of a wine bottle.
- Empowers consumers to check for themselves the authenticity and temperature history of wine. This connection establishes trust among consumers and producers.



EN-TAG™ on bottle cap (for illustration purposes it is highlighted by a purple square)

### 5. Conclusion

While it is difficult to measure the financial impact of counterfeit wine and spirits on the industry, recent reports indicate that it is likely to be in the order of hundreds of millions of dollars each year. Similarly, the adverse effects of elevated storage temperature is becoming a growing concern to both winemakers and consumers, especially since so little is known about how temperature fluctuates during shipping or how it affects the chemical and sensory attributes of wines sold through retail outlets or directly to consumers.

A number of advanced anti-fraud technologies are available to the producer, though there are very few options for thermal monitoring application at the unit level. Some of these technologies have been successfully adopted, perhaps as a way to differentiate one's brand from a competing brand. Ultimately, the onus is on the producer to choose and implement a security solution that best meet their needs based on a cost/benefit assessment.

EN-TAG™ technology is a brand security feature for the responsible producer of fine wine and spirits. EN-TAG™ is a cost-effective solution that ensures a bottle's authenticity and quality. For the winemaker, highly secure labels such as EN-TAG™ deter counterfeiters, offer protection to the consumer and fulfill a marketing function. EN-TAG™ is easily applied to a bottle's front label or cap using a non-disruptive laser printing method that neither affects the aesthetics of the label, nor can it be seen or duplicated.

If you would like to know more about EN-TAG™, please do not hesitate to contact:

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