CDRWineLab®

De-alcoholized Wine: New Frontiers in Winemaking

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According to the OIV definition, wine is "exclusively the beverage resulting from the complete or partial alcoholic fermentation of grapes, whether crushed or not, or of grape must. Its actual alcoholic strength must not be less than 8.5% vol." [1]. However, in recent years, an alternative to traditional wine has been gaining ground: de-alcoholized wine.

De-alcoholized wine is a beverage obtained by partially or completely removing the alcohol from traditional wine while largely preserving its aroma and flavor. This result is achieved through advanced technologies, such as reverse osmosis or vacuum evaporation, which help maintain the wine's organoleptic characteristics.

An expanding market

The market for de-alcoholized wine is growing rapidly, especially on an international level, where the consumption of this alternative is already well established. The primary target audience consists of individuals aged 25 to 45, who are particularly receptive to innovations in the sector, with a significant presence in the United States. Countries like Germany, the United States, and the United Kingdom are experiencing increasing interest in NOLO (*no and low alcohol*) options, driven by a greater focus on well-being and reduced alcohol consumption [2]. In Italy, however, the spread of this type of wine is progressing more slowly, hindered by the country's strong winemaking tradition.

How Is De-alcoholized Wine Made?

De-alcoholized wine as defined by the European Directive 2021/2117, has an alcohol content of no more than 0.5% vol., whereas "partially dealcoholized wine" has an alcohol content between 0.5% and 9%.

Currently, three officially recognized techniques are used to remove ethanol from wine. These methods can be applied individually or in combination and include vacuum evaporation, reverse osmosis, and distillation.

In the vacuum evaporation process, alcohol evaporates in a vacuum environment. Ethanol normally evaporates at a lower temperature than water (78°C), but under vacuum conditions, this temperature drops to around 20°C. This technique employs spinning cones, which allow for the complete dealcoholization of only a portion of the wine to preserve its aromatic profile.

Reverse osmosis, on the other hand, uses a nanofiltration membrane. Under high pressure, phenolic and aromatic compounds are extracted before the dealcoholization process to preserve them, and they are later reintroduced into the final product.

The last recognized technique is distillation, which is also carried out in a vacuum environment. This process consists of two phases: first, the wine is placed in a distillation column where volatile compounds are extracted at around 30°C; in the second phase, the process is repeated to remove the alcohol completely [3].

How to Assess Product Quality?

De-alcoholized wine generally has a lighter and less structured taste, with a shorter aftertaste compared to traditional wine. One of the most intriguing aspects of wine dealcoholization is that compounds associated with health benefits, such as tannins and anthocyanins, are preserved, while there is a significant reduction in volatile substances responsible for the product's aroma [4].Taste is a crucial factor, but to fully understand the structure of wine, it is equally important to analyze its chemical profile. Addressing the quality challenges of this new category of products requires reliable, fast, and accessible analytical tools. CDRWineLab® offers a versatile and intuitive solution, suitable for all types of producers, from small artisans to large wineries, ensuring both precision and ease of use.

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Key Chemical Parameters in De-alcoholized Wine

One of the most critical aspects of analyzing dealcoholized wine is determining its alcohol content. According to Italian and European regulations, a wine is classified as "dealcoholized" if its alcohol content is below 0.5% vol., while it falls into the "partially dealcoholized" category if it has an alcohol content between 0.5% and 8.5% vol. Accurate measurement of low alcohol concentrations is essential to ensure regulatory compliance and product quality. Traditional analytical methods, such as distillation and densimetry, may have limited accuracy, while FTIR spectroscopy requires an additional step for continuous calibration. CDR WineLab[®] provides an effective alternative, enabling high-sensitivity analysis to detect residual alcohol traces with exceptional precision and operational simplicity.

Analysis of Residual Sugars

During dealcoholization, alcohol is removed, but <u>fermentable sugars</u> (glucose and fructose) remain unchanged. Their concentration tends to be slightly higher than in traditional wine and, most importantly, can vary depending on the type of wine produced. Monitoring the sugar content in dealcoholized wine is crucial to prevent unwanted refermentation. With **CDR WineLab**[®], it is possible to keep the entire production process under control to achieve a high-quality product.

Analysis of Acidity

The taste balance of dealcoholized wine is also influenced by <u>total</u> and <u>volatile acidity</u>. It is essential to consider that alcohol removal can alter acidity levels. <u>pH control</u> is equally crucial, as it affects the chemical and microbiological stability of the wine, making it more susceptible to oxidation and contamination. Thanks to rapid and precise tests, **CDR WineLab®** helps prevent these risks, ensuring accurate monitoring of product stability.

The Role of Sulfites

With the reduction of alcohol, which acts as a natural preservative, **sulfites** (<u>free</u> and <u>total SO₂</u>) play an even more crucial role in preventing

oxidation and microbial proliferation. Regulatory limits, such as those established by **EU Regulation 1169/2011**, require strict monitoring, also to meet the needs of consumers sensitive to sulfites.

Polyphenol Monitoring

Additionally, dealcoholization can affect the stability of phenolic compounds, altering the **color** and structure of the wine, particularly in reds. This has a direct impact on the product's visual and sensory acceptability. Instead of traditional methods for <u>determining color tone</u>, such as UV-Vis spectrophotometry or the <u>Folin-Ciocalteu method for total polyphenols</u>, CDR WineLab® offers rapid and sensitive tests, eliminating the need for glassware or additional solvents.

The CDR WineLab® Analysis System

<u>CDR WineLab®</u> is a comprehensive solution comprising an analyzer and pre-calibrated reagents supplied in pre-filled cuvettes. This integrated system minimizes errors during sample preparation and testing.



Key Benefits:

- **Comprehensive Testing Panel**: With a single instrument, perform all essential tests for complete monitoring of the winemaking process.
- Rapid Analyses: The analyses are extremely fast, and the methods employed are correlated with reference standards.
- Ease of Use: The simplicity and speed of the method allow anyone to perform the tests.

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 Versatile Testing: CDR WineLab[®] can be used not only in a laboratory but also directly in the cellar or on the production line, as it does not require traditional laboratory equipment.

Thanks to its versatility and ease of use, CDR WineLab® proves to be a strategic ally for producers of all sizes, helping them ensure the quality, stability, and safety of dealcoholized wine. This product represents a growing niche and, more importantly, an opportunity for companies to diversify their offerings, compete with soft drinks, and attract new customers.

Conclusions

Chemical analyses represent a fundamental component of quality control in the production of dealcoholized wine. Rapid and easy-to-use analysis systems allow for constant monitoring of critical parameters—such as residual alcohol content, sugars, acidity, and sulfites—ensuring product stability and safety. By implementing these analysis systems, producers can quickly address any variations, maintaining the wine's organoleptic properties and complying with current regulations. In this way, analytical control not only optimizes the production process but also becomes a strategic factor for offering a highquality dealcoholized wine that meets consumers' growing demands.

References

[1] OIV -

https://www.oiv.int/it/press/12_mesi_12_risoluzioni_la_definizione_di_vino#:~:text=La%20definizione%20 di%20vino%20dell,o%20di%20mosti%20di%20uve.

[2] Non-Alcoholic Wines: A Rapidly Growing Market. International Data and Trends https://www.italianfoodnews.com/en/news/196-alcohol-free-wines-a-rapidly-growing-marketinternational-data-and-trends.

[3] Vendemmie - https://vendemmie.com/news/vino-dealcolato-che-cose-e-come-si-produce/.

[4] Kumar, Y., Ricci, A., Parpinello, G.P. et al. *Dealcoholized Wine: A Scoping Review of Volatile and Non-Volatile Profiles, Consumer Perception, and Health Benefits.* Food Bioprocess Technol 17, 3525–3545 (2024). https://doi.org/10.1007/s11947-024-03336-w.



