

Editorial

# Featured Papers in the Wine, Spirit and Oenological Product Sections

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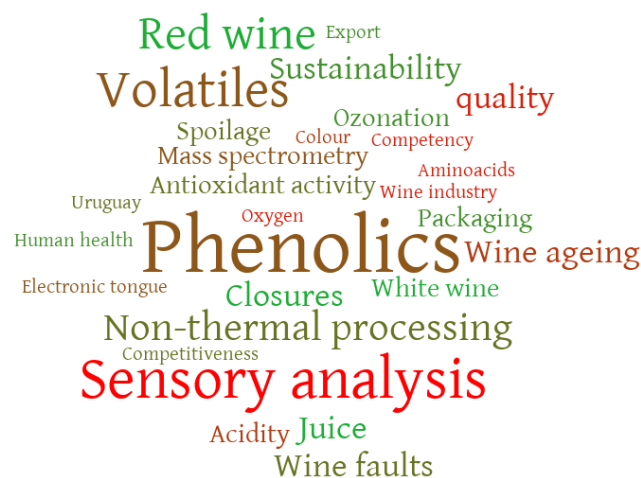
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Current research trends in oenology concerned with contemporary issues that are of utmost important for the success of the wine industry. Some of the key aspects investigated include efforts to propose solutions to increase the sustainability of wine productions, as well as studies aimed at understanding wine composition in order to propose better ways of managing wine quality and safety.

Figure 1 summarizes the key aspects researched in the 10 articles published in this Special Issue.



**Figure 1.** Wordcloud representation of the main key word occurrences in the 10 articles published in this Special Issue, created with worditout.com. Consolidated keywords were created by considering article titles and keywords. The total number of keywords considered was 78, with each word mentioned as follows (number of occurrences enclosed in parentheses): phenolics (10), sensory analysis (7), volatiles (6), red wine (5), non-thermal processing (4), closures (3), juice (3), quality (3), sustainability (3), wine aging (3), wine faults (3), acidity (2), antioxidant activity (2), mass spectrometry (2), ozonation (2), packaging (2), spoilage (2), white wine (2), amino acids (1), color (1), competency (1), competitiveness (1), electronic tongue (1), export (1), human health (1), oxygen (1), Uruguay (1), wine industry (1).

From the wordcloud, keywords such as phenolics, sensory analysis, volatiles and non-thermal processing techniques are the most represented, thus indicating that these were the fields primarily studied. However, it is noteworthy that the 28 keywords reported in Figure 1 are related to different research topics, ranging from the characterization of



**Citation:** Kallithraka, S.; Marangon, M. Featured Papers in the Wine, Spirit and Oenological Product Sections. *Beverages* **2023**, *9*, 34. <https://doi.org/10.3390/beverages9020034>

Received: 13 March 2023

Accepted: 6 April 2023

Published: 13 April 2023



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wine chemical composition in general and resulting from innovative winemaking practices, to the use of sustainable practices and packaging for wine production and the impact of wine consumption on human health.

One of the articles published in this Special Issue originates from New Zealand and the authors reported data on an experiment aimed at understanding the impact that using different fractions of juice obtained at pressing, namely free-run juice, light- and heavy-press juices, could have on the volatile profile and sensory attributes of the resulting Sauvignon blanc wines [1]. Initially, the authors focused their attention on the GC analysis of the different volatile compounds, especially those important for the aroma of Sauvignon blanc, such as polyfunctional mercaptans and methoxypyrazines. Results indicated that compounds such as 3-mercaptohexan-1-ol and 3-mercaptohexyl acetate decreased at increasing pressure, while compounds such as hexyl acetate, hexanol and benzyl alcohol increased. The sensory descriptive analysis of the three wines showed that those produced from free-run juice were fruitier and more floral (e.g., passionfruit and boxwood), but also characterized by green notes (e.g., fresh green capsicum), while wines produced from heavy-pressed grapes were characterized by French vanilla/bourbon, floral and banana attributes. From the analysis of the chemical data, in combination with the sensory data, the authors concluded that pressing regimes can be used as a tool to obtain Sauvignon blanc wines with different profiles.

A second article coming from France also focused on the volatile profile of wine, but in this case, this was carried out by looking into the impact of closures and on the effect of their oxygen permeability on volatile sulfur compounds (VSC), as these are known for their role in modulating the fruity character of red wine. The authors focused their attention on measuring the dimethyl sulfide potential (DMSP) and its degradation product, DMS [2], as the equilibrium between these two compounds impacts the fruity character of wine. The trial was done using four cork types, each used to bottle six red wines, and assessed the VSC by GC-MS/MS after submitting the wines to an accelerated aging protocol (35 °C for 3 months). DMS was the only VSC increasing after aging to become the main VSC in all wines. Accordingly, the DMSP decreased proportionally to the permeability of the closure, an occurrence that indicates that the closure permeability affects the rate of DMSP degradation during aging. In practical terms, to maximize the DMS content in wines, winemakers should use the closure with a low permeability on wines with already high concentrations of DMS, and the opposite on wines with high concentrations of DMSP, so to favor the release of DMS during aging.

The key role of packaging material on wine composition and quality was further explored in a review article published by Thompson-Witrick et al. [3]. In this manuscript, the authors reported data on the different types of packaging materials used in the wine industry, ranging from traditional glass bottles (also the most used and preferred by consumers), to polyethylene terephthalate bottles (PET), bag-in-box (BIB), aluminum cans, and Tetra Pak. For each material, the authors described the evolution of the materials over time, as well as an assessment of their advantages and disadvantages, data on their market diffusion, as well as a discussion on the environmental impact of each packaging material. In the last section of the review, the authors discussed the impacts of packaging materials on wine sensory attributes and flavor profiles, and concluded that glass is still superior to alternative packaging in this respect. The final section of the review looked at the consumers' attitude toward purchasing wine included in alternative packaging, and stressed the relevant role that consumer awareness of environmental impact has on their decisions.

The proanthocyanin profile of Italian red wines was the topic of the paper published by Arapitsas et al. [4]. The authors analyzed a large number of single-cultivar wines originating from 12 Italian red grape varieties. A total of 110 wines were submitted to LC-MS/MS analysis, with a method designed to shed light on their proanthocyanins profiles. The study produced a large body of knowledge that, alongside other papers published on the study of the same set of wines [5,6], contributes to greatly enlarge the compositional information

of well-known Italian red wines. Results of this study depicted a quantitative image of the most abundant classes of polyphenols contained in different red wines, thus showcasing the biodiversity of the Italian oenological productions, and providing key information useful to better understand and valorize Italian red wines.

The article by Pereira et al. [7] proposed an interesting sustainable method to correct must acidity, a step that is becoming increasingly necessary, especially in warm, growing regions [8]. The novelty of the proposed approach lies in the suggestion to harvest unripe grapes (white variety Antão Vaz), process them to obtain a juice with high acidity (pH 2.36), and store it frozen until the harvesting of the grapes from the same vineyard, so that this could be added to the grape juice obtained from processing ripe grapes. The authors conducted a comparative winemaking trial by vinifying a control wine, one from juice acidified with frozen juice from unripe grapes, and one acidified with a mix of organic acids (tartaric, malic and lactic). The chemical composition, the amino acid content, the volatiles and the aroma profiles of the resulting wines were investigated in depth, and the results led the authors to conclude that the use of unripe grape musts can be considered a sustainable acidifier and a promising alternative to the traditional acidity correction methods, as it can enhance the final wine characteristics while lowering the wine alcoholic content, a side effects that can be seen as an added value, as many winemakers aim to produce wines with a lower ethanol content.

Unlike other alcoholic beverages, red wine contains several groups of both flavonoid and non-flavonoid phenolic compounds, such as anthocyanins, flavanols, flavonols, phenolic acids, and stilbenes, etc. These compounds are of high technological interest, since they directly influence wine organoleptic properties and health-promoting benefits. The review article by Nemzer et al. [9] focuses on the existing quantitative analytical methods that can be employed for their routine analysis (including spectrophotometric, chromatographic and spectroscopic techniques). Factors affecting the phenolic content of red wines is another interesting issue that is discussed in this article, paying particular attention to the grape variety and storage conditions, such as barrel aging and the type of bottle closure. It is well known that phenolic compounds are characterized by strong antioxidant activity, which is responsible for several health benefits associated with red wine consumption, such as the prevention of cardiovascular, oncological, neurodegenerative diseases, along with other free-radical-associated injuries *in vivo*. The last part of this article is dedicated to the discussion of the desirable health effects associated with moderate wine consumption, which could be attributed to the scavenging of the free radicals.

Currently, there is great interest in the search of other preservatives and/or innovative technologies for minimizing the addition of SO<sub>2</sub> in wine. The use of alternative non-thermal technologies and physical methods for wine preservation was the focus of the research conducted by van Wyk et al. [10]. Two white wines (Sauvignon Blanc and Pinot Gris), two red wines (Syrah and Pinot Noir), and one rosé (consisting of Pinot Gris, Merlot and Malbec) produced in New Zealand were treated by high-pressure processing (HPP), pulsed electric fields (PEF), and power ultrasound (US) technologies, and several analytical parameters (such as pH, color, total phenolic content, and antioxidant activity) were determined for each wine after a storage period of two months. In general, the alternative processes examined did not significantly affect the analytical parameters of the wines, except for their antioxidant activity, which was decreased. Among the three treatments examined, the HHP seems the most promising, since it affected the wine composition less, suggesting that it could be an alternative process to reduce SO<sub>2</sub> addition.

Wine quality is linked to wine appreciation, and it is generally easier to perceive than to describe. Although it is characterized by the positive organoleptic attributes, the negative aspects, such as the wine faults, are generally more recognizable [11]. The next two articles by Paup et al. [12] and Modesti et al. [13] of this Special Issue dealt with wine faults due to microbial spoilage and smoke taint, respectively.

Paup et al. [12] studied the effect of microbial spoilage of Merlot wine by the use of electronic tongue (e-tongue) and flash sensory profiling (FP) after inoculation with

*Brettanomyces bruxellensis*, *Lactobacillus brevis*, *Pediococcus parvulus*, or *Acetobacter pasteurianus*. The analyses were conducted on a weekly basis and lasted for 42 days. Although the e-tongue was initially characterized by low discrimination ability, after the third week (21 days), it successfully discriminated the faults caused by the different microorganisms among the samples (discrimination index 91). Regarding the FP technique, the assessors started to discriminate the different wine faults after 28 days, while after 42 days, the use of spoilage terms was significantly higher ( $p < 0.05$ ). The results of this research suggest that the e-tongue might prove to be a useful tool for the early detection of the wine faults (due to the non-volatile compounds produced by the microorganisms), which can be further confirmed by the off-odors perceived by the assessors. These novel techniques may prevent financial losses associated with wine spoilage by early detection and remediation.

Lately, smoke taint is an emerging wine fault due the increasing incidence of vineyard exposure to smoke produced by bushfires near the wine regions. The smoke taint marker compounds are mainly the volatile phenols and their glycosides. The next paper by Modesti et al. [13] evaluates the efficacy of a post-harvest ozonation method as a strategy to mitigate the negative effects of grapevine exposure to smoke. For this purpose, Cabernet Sauvignon grapes were first heavily exposed to smoke and then ozonated (at 1 ppm for 24 h). However, although wines produced by the ozonated grapes contained significantly lower amounts of free and glycosylated volatile phenols, the perceived intensities of smoke-related sensory attributes did not differ significantly between the wines produced by the treated and non-treated grapes. The findings of the current study suggest that the efficacy of O<sub>3</sub> treatment depends on the extent to which the grapes have been tainted by the smoke. In the case of heavily tainted grapes, ozonation might not be effective and the resulting wine might still exhibit a perceivable taint, requiring further amelioration via other relevant methods.

Finally, the paper by Camillo et al. [14] contributes to the knowledge of competitive strategy in wine business research by assessing Uruguay's current positioning of wine production and competitiveness. In more detail, it investigates the competitive position of the Uruguayan wine industry and its potential to become a player in the global wine trade. The research was based on the global business competitiveness theory, adopting an exploratory, holistic, and qualitative research design, applying desk research, cyberethnography, and electronic correspondence with the stakeholders. The results, which are of particular interest for the stakeholders in the Uruguayan wine industry, researchers, and practitioners in the field, showed that although Uruguay is a young wine-producing country, it has the potential to become a global competitor. Geographic location, favorable climate, terrain, hydropower, high density of the hydrographic network, available agricultural land, an available and well-educated workforce, unique land infrastructure, and grape variety (Tannat) are the critical factors identified in the study.

To conclude, this Special Issue consists of eight research and two review articles produced by research groups from France, Portugal, Italy, New Zealand, USA, Australia, and Russia. These papers are dealing with a diversity of wine-related fields, including chemical composition, sensory attributes, novel winemaking practices and preservation techniques, packaging, health benefits, and business. These distinct disciplines are considered complementary key research areas for ameliorating wine quality and increasing the competitiveness of the global wine sector.

**Author Contributions:** Conceptualization, S.K. and M.M.; writing—original draft preparation, review and editing, S.K. and M.M. All authors have read and agreed to the published version of the manuscript.

**Acknowledgments:** All the authors who kindly contributed to this Special Issue are gratefully acknowledged.

**Conflicts of Interest:** The authors declare no conflict of interest.

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