Posters

Location: **Crane Hall**

Building A1, ground floor

All posters (including those associated with flash talks) will remain on display until Thursday afternoon (three sessions).

See at https://macrowine2025.events.unibz.it/?page_id=20 the provided downloadable files with the complete numbered list of posters, and posters with flash talks.

ID: 102 / Poster session 1: 1
Abstract Submission
Topics: Chemical and biochemical reactions, including grape and wine microorganism's impact
Keywords: Native-yeast, fermentation, wine, aroma.

Potential of Native Uruguayan Yeast Strains for Production of Tannat Wine

Paula Gonzalez Pombo, Stefani de Ovalle, Guillermo Morera
Universidad de la Republica, Uruguay; pgonzale@fq.edu.uy

Poster contribution

Must fermentation is a complex process influenced by various factors, especially microbiological activities. The characteristics and quality of the resulting wine are closely linked to the stages that unfold throughout this progression. Winemakers usually use pure cultures like *Saccharomyces cerevisiae* to ensure a reliable and complete process. Alternatively, the use of commercial wine yeasts is somewhat controversial, as it may lack certain desirable characteristics provided by natural fermentation. A key challenge is finding non-conventional yeasts that complete fermentation while enhancing a wine's uniqueness, complexity, and appeal. In our previous studies, we isolated, identified, and conducted physiological and biochemical characterizations of indigenous yeasts from Tannat grapes in the Maldonado vineyard (1). Three strains demonstrated notable fermentation properties: *Saccharomyces cerevisiae* T193FS, *Saturnispora diversa* T191FS, and *Starmerella bacillaris* T193MS. In this study, we assessed the oenological potential of these strains at a semi-pilot scale during the vinification of a Tannat must with an expected ethanol content of 11-12%. All three native strains consumed around 98% of the must sugars, producing robust ethanol production in the 9-11% range. Pilot-scale trials highlighted the strong fructophilic character of *S. bacillaris*, which left very low residual fructose levels (0.006 g/L compared to ≥0.01 g/L for the other species) while yielding lower ethanol (9%), a profile beneficial for crafting lower-alcohol wines.

Wines with native strains stood out for presenting greater fruity notes, especially *S. bacillaris,* showed enhanced fruity notes like plum, raisins, and candied fruit, linked to higher ester, norisoprenoid, and terpene levels detected by GC-MS. The β-glucosidase activity of these strains was also investigated, as this enzyme enhances aromatic complexity by releasing aroma compounds from glycosidic precursors during fermentation. Given its notably high β-glucosidase activity under acidic conditions of *S. diversa* T191FS, it was subsequently evaluated as a pure starter in Muscat wine fermentation. Volatile compound analysis by GC-MS showed a significant increase in total terpenes compared to the commercial strain *S. cerevisiae* (145 vs. 45 ug/L, respectively). *S. diversa* stood out for its ability to release terpenic varietal aromas.

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ID: 103 / Poster session 1: 2
Abstract Submission
Topics: Analysis and composition of grapes, wines, wine spirits
Keywords: Red wine colloids, Protein-tannin interactions, Asymmetrical Flow-Field Flow Fractionation (AF4), Colour stability

The role of protein-phenolic interactions in the formation of red wine colloidal particles

Matteo Marangon[1], Valentina Marassi[2], Fulvio Mattivi[3], Christine Mayr Marangon[1], Luigi Moio[4], Barbara Roda[2], Luca Rolle[5], Maurizio Ugliano[6], Andrea Versari[7], Sara Zanella[1], Andrea Curioni[1]

[1]Department of Agronomy, Food, Natural Resources Animals and Environment (DAFNAE), University of Padua, Italy; [2]Department of Chemistry "G. Ciamician", University of Bologna, Italy; [3]Metabolomic Unit, Research Innovation Centre, Fondazione Edmund Mach, San Michele all'Adige, Italy; [4]Department of Agricultural Sciences, Division of Vine and Wine Sciences, University of Napoli Federico II, Italy; [5]Department of Agricultural, Forest and Food Sciences, University of Torino, Italy; [6]Department of Biotechnology, University of Verona, Italy; [7]Department of Agricultural and Food Sciences, University of Bologna, Italy; matteo.marangon@unipd.it

Colloids play a crucial role in red wine quality and stability, yet their composition and formation mechanisms remain poorly understood. Recent studies from the D-wines (Diversity of the Italian Wines) project aimed to elucidate the structure, composition, and formation mechanisms of red wine colloids by analysing monovarietal wines from 10 Italian red grape varieties. Colloid-forming molecules, specifically proteins, polysaccharides, and tannins, were examined in over 100 wines Protein, polysaccharide, and tannin levels varied significantly across the wines [1, 2]. Electrophoretic analysis demonstrated that all proteins in the wines exist as high molecular weight aggregates, likely including tannins. Moreover, the wines could be categorized into two groups based on the mobility of the protein

aggregates which seemed related to the quantity of protein-reactive tannins [1]. Asymmetrical Flow-Field Flow Fractionation (AF4) with online multidetection was used to isolate and characterize red wine colloids in their native state, revealing diverse colloidal populations across wines. This diversity was attributed to the varying proportions of proteins, polysaccharides, and phenolics present [3]. A correlation analysis of red wines' compositional data and their colloidal content and structures, as determined by MALS detection, showed that polymeric pigments associated with proteins should be important for red wine colour [2, 4]. Overall, the findings allowed for the proposal of an updated model for colloidal aggregation in red wines, suggesting that this process occurs through the assembly of protein-tannin sub-aggregates and their interaction with polysaccharides. The compactness of these colloidal particles has been linked to the wine protein content, with colloids containing a high protein level being less compact. These findings highlight the central role of proteins in determining red wine colloidal structure and their significance for red wine colour. This work provides an updated framework for understanding how compositional differences among grape varieties, particularly the content of protein-reactive tannins, shape colloidal structures, ultimately impacting key wine quality parameters such as colloidal stability and colour.

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ID: 108 / Poster session 1: 3
Abstract Submission

Topics: Wine, environment, health and sustainability
Keywords: Grape pomace, phenolic compounds, antioxidant activity, sustainable valorisation

Transforming Winemaking Waste: Grape Pomace as a Sustainable Source of Bioactive compounds

Anna Karastergiou, Anne-Laure Gancel, Michael Jourdes, Pierre-Louis Teissedre
Institut des Sciences de la Vigne et du Vin (Université de Bordeaux), France; anna.karastergiou.1@u-bordeaux.fr

Grapevines (*Vitis vinifera* L.) are plants of great economic importance, with over 80% of grape production dedicated to wine production, yielding more than 258 million hectoliters annually [1]. However, the winemaking process generates a substantial amount of by-products, primarily grape pomace (GP), wine lees, and wastewater, posing serious environmental and economic challenges [2]. Efficient strategies for the sustainable valorisation of these residues are therefore essential. Recent research highlights the potential of grape pomace (GP), which has traditionally been considered as a mere waste, as a valuable source of bioactive compounds [3-5]. With up to 70% of the total phenolic content of grapes retained post-vinification [6], GP valorisation aligns with circular economy principles, presenting innovative and sustainable solutions.

This study investigated the phenolic composition and antioxidant capacity of GP from different grape varieties from the Rhône Valley area of France, including red (Alicante, Syrah, Mourvèdre, Grenache Noir), white (Vermentino, Grenache Blanc, Roussanne, Clairette), and rosé (Grenache Rosé) varieties. Total polyphenol content (TPC) was measured using the Folin-Ciocalteu method, while phenolic profiling—covering phenolic acids, flavonoids (flavan-3-ols, anthocyanins, flavonols, flavones, etc.), and stilbenes—was conducted using HPLC-UV-QqQ. Antioxidant capacity was evaluated through DPPH, ABTS, FRAP, and ORAC assays.

The results revealed significant phenolic retention in GP post-vinification, ranging from 15–35 GAE/g DW in fermented (red) GP and 20–25 GAE/g DW in non-fermented (white, rosé) GP. Fermented GP seeds, particularly from Syrah and Alicante varieties, displayed the highest phenolic content, rich in flavan-3-ol monomers and procyanidins, and exhibited superior antioxidant activity compared to GP skins. Non-fermented GP also demonstrated a notable phenolic profile, with elevated flavan-3-ol and flavonol levels and antioxidant capacities comparable to red GP varieties. Correlations between phenolic composition and antioxidant activity were explored to better understand the functional properties of bioactive compounds.

These findings underscore the potential of GP as a low-cost by-product that can be transformed into high-value polyphenolic extracts for applications in nutraceutical, cosmetic, and food industries.

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ID: 111 / Poster session 1: 4
Abstract Submission

Topics: Wine, environment, health and sustainability
Keywords: Maturity grade, nethyl jasmonate, marc grape extract, phenolic compounds

Effect of elicitors and ripening moment on the phenolic composition of Monastrell

ROCIO GIL-MUÑOZ[1], MARIA JOSÉ GIMENEZ-BAÑÓN[1], JUAN DANIEL MORENO-OLIVARES[1], JUAN ANTONIO BLEDA-SANCHEZ[1], ENCARNA GÓMEZ-PLAZA[2]
[1]IMIDA, Spain; [2]University of Murcia, Spain; mariar.gil2@carm.es

Grapevine (*Vitis vinifera* L.) is a globally cultivated crop and economically significant, particularly in the wine industry (Varela et al., 2024). Climate change is already affecting vineyards and is expected to worsen (Averbeck et al., 2019; Dupuis and Knoepfel, 2011). Wine quality relies on the berry's chemical composition, which depends on various metabolites and the synchronization of skin, seed, and pulp ripening. Strategies to enhance grape quality and address the uncoupling of technological and phenolic maturity include using elicitors, which induce secondary metabolite accumulation in response to stress signals (D'Onofrio et al., 2018). Numerous studies have explored the effects of different elicitors on grape phenolic compositions, but information on the impact of methyl jasmonate (MeJA) and grape marc extract on grape ripening is lacking. This research aims to provide insights into how elicitation affects the phenolic composition of grapes and wines, reducing the decoupling between phenolic and technological maturity.

This study was performed over two growing seasons (2022 and 2023) with Monastrell *Vitis vinifera* L.cvon Richter 110 rootstock, which were 7 and 10 years old and planted 2.5 x 3m in an experimental field located in Cehegín (Murcia, Spain). Three treatments were carried out, each in triplicate, at veraison and one week later, with 10 vines per replicate: (i) control (water), (ii) MeJA (10 mM), and (iii) grape marc extract (10 g/L). Grapes were harvested at two ripening moments when they reached 21ºBrix and 23ºBrix, respectively. Different chemical and chromatographic analyses were carried out to evaluate the quality of grapes and wines at harvest and at the end of alcoholic fermentation, respectively.

The results showed how the degree of maturity influenced the different parameters measured. Total anthocyanin content in grapes was higher for all the factors studied—treatment, degree of ripening, and vintage—at 23ºBrix, not showing differences among treatments at 21ºBrix; however, at 23ºBrix, the highest total anthocyanin content was observed in MeJA-treated grapes, and the lowest in marc-treated grapes. Regarding the results obtained for anthocyanins in wines, the differences found were much smaller than in grapes. With respect to flavonols in grapes, treatments did not have any effect, although the highest flavonol content was obtained in control grapes matured at 23ºBrix. However, in wines, the results for flavonols were more pronounced than in grapes, with significant differences found between treatments, maturity, and season.

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ID: 113 / Poster session 1: 5
Abstract Submission

Topics: Analysis and composition of grapes, wines, wine spirits
Keywords: Climate Change/ / drought/ Vitis vinífera/ polyphenols

Development of novel drought-tolerant grape cultivars from Monastrell: enhancing anthocyanin and flavonol content under elevated temperatures

Juan Daniel Moreno-Olivares, María José Giménez-Bañón, Diego José Fernández-López, Ana Cebrián-Pérez, José Cayetano Gómez-Martínez, María Isabel Pérez-Quílez, Luis Javier Pérez-Prieto, Juan Antonio Bleda-Sánchez, Leonor Ruiz-García, Rocío Gil-Muñoz
IMIDA, Spain; mariar.gil2@carm.es

The ongoing challenge of climate change is driving the need for novel oenological approaches aimed at finding effective environmental solutions. While warmer temperatures may benefit viticulture in cooler climates by reducing fungal infections, the impact on regions characterized by arid conditions is potentially harmful. These changes can significantly influence the quality of wines and their organoleptic profiles, making it essential to adapt both viticultural and winemaking practices to mitigate these effects.

Given the persistent nature of climate change, there is an urgent need to continuously explore and implement viticultural strategies that can alleviate its consequences. In this context, it has initiated a long-term breeding program aimed at developing grape varieties more resilient to climate change. Through targeted crosses involving the Monastrell variety and other cultivars such as Cabernet Sauvignon and Syrah, new grape varieties, namely MC16, MC80, and MS104, have been created.

The performance of these new varieties has been assessed over three consecutive seasons (2022–2024) under both strictly dry conditions and those supplemented with irrigation. This study focuses particularly on the macromolecules of interest—**anthocyanins** and **flavonols**—which play a critical role in determining the color, stability, and sensory properties of wine. Following the methodology outlined by Pérez-Porras et al. [1], the results indicate that the newly developed varieties exhibited significantly higher anthocyanin content than their parent varieties (Monastrell, Cabernet Sauvignon, and Syrah), with some varieties showing a two- to threefold increase, especially during the 2022 season. Moreover, it was observed that the highest anthocyanin concentrations were found in grapevines grown under rainfed conditions, as opposed to those subjected to deficit irrigation.

In contrast, the variations in flavonol concentrations were less pronounced than those observed for anthocyanins, suggesting that flavonol content might be influenced by other environmental factors or genetic aspects not yet fully understood.

In conclusion, the findings of this study offer valuable insights into the potential for developing grapevine varieties better suited to the challenges posed by climate change in arid and semi-arid regions. These results underscore the importance of key macromolecules,

such as anthocyanins and flavonols, in shaping wine quality and highlight the potential of these new varieties as a critical tool for the wine industry to address the impacts of climate change.

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ID: 115 / Poster session 1: 6

Abstract Submission

Topics: Analysis and composition of grapes, wines, wine spirits

Keywords: grape tissues, mDP, Pinot noir, tannin, extractability

Managing extraction of colour, tannin and methoxypyrazines in Pinot noir grapes treated by leaf removal

Bin Tian[1], Pradeep Wimalasiri[1], Roland Harrison[1], Ivan Donaldson[2], Belinda Kemp[3]

[1]Lincoln University, New Zealand; [2]Pegasus Bay Winery, New Zealand; [3]NIAB, United Kingdom; bin.tian@lincoln.ac.nz

Managing extraction of tannins and green aroma compounds attributed from methoxypyrazines in winemaking is crucial for producing high quality Pinot noir wine. This study[1] investigated the impact of leaf removal on concentrations of anthocyanins, tannins, and methoxypyrazines in Pinot noir grapes and resultant wines. Leaf removal was conducted at 7 days (LR7), 30 days (LR30), and 60 days (LR60) after flowering, and the no leaf was removed in the control treatment (LRC). Leaf removal could significantly increase the concentration of anthocyanins in Pinot noir grapes and reduce the concentration of methoxypyrazines, especially in grape stems, in comparison with the control treatment. Early leaf removal (LR7 and LR30) showed greater effect on enhancing the colour density, polymeric pigments, and tannin concentration in the resultant wines. LR7 treatment showed significantly higher proportion of skin-derived tannins in resultant wine, compared to LRC. Although the aroma analysis of resultant wines showed significant differences between treatments, the impact of leaf removal on the aroma profiles was not evident by the sensory evaluation. These findings offer valuable insights for managing the extraction of colour, tannin and methoxypyrazines in Pinot noir wines, enabling winemakers to optimize quality through targeted viticultural and winemaking practices.

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ID: 117 / Poster session 1: 7

Abstract Submission

Topics: Analysis and composition of grapes, wines, wine spirits

Keywords: Grape aroma potential, recovered cultivars, water regime, two-dimensional gas chromatography

Free and bound terpene profile of recovered minority white grape varieties by GCxGC-TOFMS

Cristina Cebrián-Tarancón[1], Nuno Martins[2], Argimiro Sergio Serrano-Parra[1,3], Daniela Fonseca[2], Maria João Cabrita[2], Gonzalo Luis Alonso[1], Maria Rosario Salinas[1], Rosario Sánchez-Gómez[1]

[1]Cátedra de Química Agrícola, E.T.S.I. Agronómica y de Montes y Biotecnología, Universidad de Castilla-La Mancha, Avda. de España s/n, 02071 Albacete, Spain.; [2]MED—Mediterranean Institute for Agriculture, Environment and Development, CHANGE—Global Change and Sustainability Institute, Universidade de Évora, Pólo da Mitra, Ap. 94, Évora, 7006-554, Portugal.; [3]Instituto Regional de Investigación y Desarrollo Agroalimentario y Forestal de Castilla-La Mancha (IRIAF).; cristina.ctarancon@uclm.es

Climate change presents a significant challenge for actual viticulture. In this context, recovering minority grape varieties can be a crucial strategy to ensure resilience, particularly those capable of maintaining quality and aromatic complexity under water stress. Many of these varieties have characteristics and specific adaptations to their environment, offering an opportunity to diversify vineyards and secure high-quality wine production in the future. In Castilla-La Mancha, the Spanish region with the largest vineyard area, research is underway white minority varieties with promising potential, such as Azargón, Maquías, and Montonera.

The aroma potential of grapes is key to a wine's aromatic identity, being terpenes one of the most important groups that define this component are terpenes. These are characterized by a low olfactory perception thresholds and pleasant floral aroma and they can exist in two forms: as non-odorous precursors bound to sugar molecules and as volatiles in their free forms. During winemaking and aging, bound terpenes gradually release from the sugar molecules, influencing the wine's aromatic profile. Grape terpene composition is known for its remarkable diversity, complexity, and structural similarities, where even minor molecular differences can lead to significantly distinct aroma profiles. As a result, the use of precise analytical methods, such as the comprehensive two-dimensional chromatography GCxGC-TOFMS, is essential to investigate and understand the role of terpenes.

Therefore, the objective of this work has focused on these three recovered white viniferas, to determine how two different water regimes, drought with survival irrigation and deficit irrigation (20% ETo), affect their terpene composition in both, free and bound forms. To analyze this, GCxGC-TOFMS was used in combination with enzymatic hydrolysis to release terpenes from their precursor compounds[1].

A total of 80 different terpenes were identified, including myrtenol,β-cyclocitral or β-copaene, among others, with significant variations among grape cultivars and water regimes. In general, a higher concentration was found under the drought regime, suggesting a good adaptability of these cultivars in terms of terpene composition to future climate scenarios. Consequently, this study highlights that these recovered minority grape varieties could be promising candidates for cultivation in semiarid regions, where water availability is limited. This approach would support the sustainability of the wine industry while maintaining the aromatic quality of the wines.

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ID: 118 / Poster session 1: 8
Abstract Submission
Topics: Analysis and composition of grapes, wines, wine spirits
Keywords: Climate change, interactions, alcohol, pH/total acidity, sensory quality.

Release and perception of γ-nonalactone and massoia lactone in the red wine matrix: impact of ethanol and acidity

Roberto Salvatore Di Fede, Elisabetta Pittari, Luigi Moio, Paola Piombino
University of Naples Federico II, Italy; robertosalvatore.difede@unina.it

Climate change (CC) is altering grape/wine composition, challenging wine sensory quality. Rising temperatures increase grape sugar levels, with higher wine ethanol (EtOH) contents, reduce total acidity (TA) converging with increased pH and lead to the accumulation of CC odorous markers such as γ-nonalactone (γ-C9) and massoia lactone (ML). These alterations often require acidification to preserve microbial and chemical stability, and taste balance of wines. The objective of this study is to investigate for the first time the sensory impact of matrix-aromas interactions in wines representative of the main CC compositional effects in their whole.

Model wine matrices (9) were reconstituted from deodorized red wine, using a full factorial design based on 3 ethanol levels (12, 14, 16%), 3 pH/TA ratios (3.2/8=0.4, 3.6/6.5=0.55, 4/5=0.8) and spiked with γ-C9 (155 ppb) and ML (26.8 ppb). The combinations simulated progressive CC impact from proper (12%, pH/TA=0.4, no CC effects), to alarm (14%, pH/TA=0.4, CC influencing EtOH levels with TA corrected by acidification) till dangerous (14%, pH/TA=0.8, CC affecting TA without correction; 16%, pH/TA=0.8, extreme CC effects) scenarios of wine quality.

Discriminating (triangle test: TT) and descriptive (RATA) sensory tests and SPME/GC-MS quantitative analyses, were carried out to test the impact of compositional changes applied to the matrix on the perception and release of γ-C9 and ML and to explore perceptual interactions.

TT showed significant differences in γ-C9 and ML perception in wine with 16% of EtOH and corrected by acidification (pH/TA=0.4), indicating in this condition a combined effect of EtOH and acidic profile on their perception likely driven by physical-chemical phenomena. GC-MS analysis of wine headspace confirmed the highest release of γ-C9 and ML in this condition. Moreover, RATA results showed that in extreme CC conditions (16% EtOH, pH/TA=0.8), the addition of γ-C9 and ML led to a shift in aroma profile: red fruit notes, characteristic of the whole wine, were no longer perceived, while sweet notes became dominant, suggesting a significant matrix effect on the olfactory impact of these compounds.

These findings highlight that CC and corrective actions can significantly impact wine sensory quality. Our study points out that adjusting the acidic profile of wine may favor γ-C9 and ML perception linked to CC and premature aroma aging. These results suggest that in a complex matrix like red wine, adjusting a single parameter may be not enough, and a holistic approach should be adopted.

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ID: 120 / Poster session 1: 9
Abstract Submission
Topics: Analysis and composition of grapes, wines, wine spirits, Winemaking processes and oenological practices
Keywords: Moscatel de Setúbal fortified wine, winemaking, phenolic composition, chromatic characteristics

Physical-chemical characterization of Moscatel de Setúbal fortified wines from different vintages

Joana Granja-Soares[1], Sofia Catarino[1,2,3], Jorge Ricardo-da-Silva[1,2]
[1]LEAF – Linking Landscape, Environment, Agriculture and Food Research Center, Instituto Superior de Agronomia, Universidade de Lisboa, Tapada da Ajuda, 1349-017 Lisboa, Portugal; [2]Associate Laboratory TERRA, Instituto Superior de Agronomia, Universidade de Lisboa, Tapada da Ajuda, 1349-017 Lisboa, Portugal; [3]CeFEMA (Centre of Physics and Engineering of Advanced Materials) Research Center, Instituto Superior Técnico, Universidade de Lisboa, Av. Rovisco Pais, 1, 1049-001 Lisboa, Portugal; jgranjasoares@isa.ulisboa.pt

Moscatel de Setúbal is a Portuguese fortified wine with Protected Designation of Origin (PDO Setúbal), made from Moscatel de Setúbal grape variety (Muscat of Alexandria) [1]. The particular winemaking process of this white wine comprises fortification with wine spirit or vinous alcohol after a short period of alcoholic fermentation, followed by a prolonged maceration stage (commonly 5 months) with the skins and grape seeds. After that, traditionally the mixture of free-running wine and press wine is aged in used wooden oak barrels, for a minimum of 18 months [1]. Although highly recognized for its quality, only scarce scientific knowledge is available on this wine. This study aimed to characterize Moscatel de Setúbal wines from different vintages, in terms of general physical-chemical composition, phenolic composition and chromatic characteristics. For that, twenty-seven Moscatel de Setúbal fortified wines from different vintages (1985 and from 1995 to 2020), collected in May 2023, from the corresponding barrels where they are ageing, were analysed regarding chromatic characteristics [Absorbance at 420 nm, CIELab (L*, a*, b*, C, h)], turbidity [2] tanning power [3], and phenolic composition (total phenols [4], monomeric flavanols and proanthocyanidins according to the degree

of polymerization [5] [6]). All analytical determinations were performed in triplicate and the data results were subjected to one-way analysis of variance (ANOVA). Whenever a significant effect ($p<0.05$) of the year of production was observed, the Fisher's minimum significant difference test was used to compare the wines. For the parameters for which there was a significant effect of the vintage year, principal component analysis (PCA) was performed. As expected, it was found that the longer the barrel ageing time, the more intense the colour of these wines. Higher values of total phenols content were observed in the older wines and, simultaneously, the tanning power was higher in wines with longer ageing period. In the older wines, the oligomeric proanthocyanidins and flavanol monomers were found in higher proportion than the polymeric proanthocyanidins. Therefore, two profiles of wines were identified: a first one in which flavanol monomers predominate (vintages from 1985 and 1995 to 2001, except 1997), and a second one with predominance of polymeric proanthocyanidins (vintages from 1997 and 2003 to 2020). The results obtained confirm that the ageing step influences the chromatic characteristics and phenolic profile of this fortified wine. Finally, this study enlarges the very limited knowledge on Moscatel the Setúbal fortified wines.

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ID: 123 / Poster session 1: 10
Abstract Submission
Topics: Analysis and composition of grapes, wines, wine spirits
Keywords: Moravia Agria, glycosidic compounds, recovered cultivars, Tinto Fragoso, water stress

Characterization of intact glycoside aroma precursors of recovered minority Spanish red grape varieties by High-Resolution Mass Spectrometry

Cristina Cebrián-Tarancón[1], Mirko De Rosso[2], Annarita Panighel[2], Riccardo Flamini[2], Gonzalo L. Alonso[1], M. Rosario Salinas[1], Juan L. Chacón-Vozmediano[3], Rosario Sánchez-Gómez[1]

[1]Cátedra de Química Agrícola, E.T.S.I. Agronómica y de Montes y Biotecnología, Universidad de Castilla-La Mancha, Avda. de España s/n, 02071 Albacete, Spain.; [2]Council for Agricultural Research and Economics - Research Center for Viticulture & Enology (CREA-VE), Conegliano, 31015, Italy.; [3]Instituto Regional de Investigación y Desarrollo Agroalimentario y Forestal de Castilla-La Mancha (IRIAF), Ctra. Toledo-Albacete s/n, Tomelloso, 13700, Spain.; rosario.sgomez@uclm.es

In Spain, the wide diversity of red grapevine varieties represents an advantage when choosing the most suitable one for cultivation based on different climatic conditions, without implying a loss of their enological potential. In response to this climatic variability, research is focused on adapting minority varieties, which could be more resistant to water and thermal stress, while maintaining the quality and aromatic complexity of the wines. In this context, Tinto Fragoso and Moravia Agria grapevine varieties have attracted the interest of researchers due to their attractive enological properties, according to preliminary studies.

Among the components that define wine quality, the grapes glycosidic aroma compounds have a significant importance. Such compounds are characterized by a structure with two different parts, a sugar moiety, and an active molecule (aglycone), linked by a glycosidic bond. The varietal aroma of wines is mainly due to the glycosidic aroma precursors of grapes, even though such compounds aren't odorous, the release of their volatile aglycones throughout vinification or wine aging, affect to their aroma and sensory profile. The indirect analysis of this fraction, through determination of the volatile aglycones by hydrolyzing their precursors, may result in chemical artifacts. Additionally, the use of glycosidic enzymes can cause alterations in the sample profile due to their inherent specificity.

The study of the intact glycosidic aroma precursor profile of grape would allow to know the enological potential of recovery varieties. The aim of this work was to study such profile of Moravia Agria and Tinto Fragoso grapes collected from plants cultivated under two water regimes (drought with survival irrigation and deficit irrigation, 20% ETo). The identification and structural characterization of glycosides were performed by high-resolution mass spectrometry using an UHPLC/QTOF analytical system. Compound identification was achieved utilizing a custom-built database (*GrapeAroma*), and the structures identified were validated through MS/MS fragmentation experiments [1]. The main aroma glycosides detected were pentosyl-hexoside derivatives, with the aglycones of belonging to the chemical classes of benzenoids, aliphatic alcohols, monoterpenols, norisoprenoids, and geranic acid. In general, the two varieties accumulated greater levels of glycosidic aroma precursors under water stress conditions, indicating their adaptability to semi-arid environments.

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ID: 124 / Poster session 1: 11
Abstract Submission
Topics: Analysis and composition of grapes, wines, wine spirits, Winemaking processes and oenological practices
Keywords: White wine lees, Antioxidant capacity, Polyphenols, Sulfhydryl compounds

White Wine Lees: Unlocking the Relationship Between Chemical Composition and Antioxidant Potential

Luca Garcia, Benjamin Poulain, Alice Douliez, Eloïse Naud, Josep Valls-Fonayet, Claudia Nioi

1. Univ. Bordeaux, Bordeaux INP, Bordeaux Sciences Agro, INRAE, OENO, UMR 1366, ISVV, F-33140 Villenave d'Ornon, France; luca.garcia@u-bordeaux.fr

The wine-making process generates numerous by-products at each stage (crushing, fermentation, ageing), including wine lees, which account for almost 25% of the total quantity [1]. Despite their well-recognized oenological properties, such as stabilizing the physico-chemical properties of wine [2], few studies have focused on white wine lees. Our recent work demonstrates their interesting antioxidant potential, as evaluated by the DPPH assay [3], though the compounds responsible remain unclear. While the antioxidant potential of lees during ageing appears linked to GSH and sulfhydryl compounds [4], specific compounds responsible for this potential are still under investigation.

To improve the understanding of the antioxidant properties of white wine lees, a set of 41 white wine lees was collected after alcoholic fermentation (different grape variety, yeast strain, condition of fermentation). A full characterisation of the composition was then carried out for the first time. These included tartaric acid, lipids, proteins, polysaccharides, polyphenols and total sulfhydryl compounds. Then, a targeted quantification of polyphenols (phenolic acids, flavanols, flavonols, stilbenoids) and glutathione (reduced and oxidised form) was performed by UHPLC-HRMS. In parallel, the free radical scavenging capacity of white wine lees was evaluated using the DPPH method.

The results revealed significant variability in composition and antioxidant capacity, highlighting the diversity of our collection of white wine lees obtained under different conditions. Subsequently, a Spearman correlation analysis was conducted to study the impact of composition on the radical-scavenging potential of white wine lees. Concerning the global compositional parameters, correlation analysis showed a significant positive impact of total polyphenols ($\rho = 0.66$) and total sulfhydryl compounds ($\rho = 0.53$) on the antioxidant potential. Targeted analysis of polyphenols and glutathione by UHPLC-HRMS confirmed the importance of polyphenols in the antiradical capacity of white wine lees, with a strong correlation observed for phenolic acids and in particular hydroxycinnamic acids ($\rho = 0.80$). However, the absence of a significant correlation with glutathione ($\rho = 0.23$) suggests that other sulfhydryl compounds contribute to the antioxidant potential.

These findings provide valuable insights into the bioactivity of white wine lees. From a valorization perspective, this by-product could be a new source of high added-value antioxidant compounds with promising applications across various industries.

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ID: 126 / **Poster session 1: 12**
Abstract Submission
Topics: Vine science and link with grape and wine quality
Keywords: Fertilizer, vineyard, nanotechnology, grape

Effects of urea and nano-urea foliar treatments on the aromatic profile of Monastrell wines

María José Giménez-Bañon[1], Juan Daniel Moreno-Olivares[1], Juan Antonio Bleda-Sánchez[1], Ana Cebrian-Pérez[1], Belén Parra-Torrejón[2], Gloria-Belén Ramírez-Rodríguez[2], José-Manuel Delgado-López[2], Rocío Gil-Muñoz[1]

[1]IMIDA, Spain; [2]Department of Inorganic Chemistry, Faculty of Science, University of Granada; mariaj.gimenez8@carm.es

Foliar application of urea has proven to be an effective method for increasing the amino acid content in grapes, especially when the vineyard has additional nitrogen needs. These treatments can prevent problems of stucking fermentation during winemaking. Furthermore, the synthesis of different aromatic compounds in wine is partially related to the content of different amino acids in must.

In this work, the effect over wine aromatic profile of foliar treatments with urea and nano-urea in Monastrell vineyards during two vintages, 2020 and 2021, was studied. Foliar treatments were applied at veraison and one week later: i) Control (water), ii) urea and iii) nano-urea. The aromatic profile of wines was analysed by solid phase microextraction (SPME) coupled to a gas chromatograph, using the methodology of Moreno-Olivares [1]. An organoleptic analysis was carried out in order to check whether there were organoleptic differences between control wines and those from the treatments.

Regarding to the results, in 2020 there was no clear effect of the treatments on the aromatic composition of wines, with a decrease in total aromatic concentration with respect to control wine in both treatments, being 14% for urea and 6% for nano-urea. This fall was mainly due to the lower values found in the alcohol family. In contrast, fruity esters were not affected in the urea treatment and increased in the nano-treatment by 12%. On the other hand, 3-methyl-thio-1-propanol was lower for the urea treatment by 17% and unchanged for the nano-treatment.

In 2021 for urea treatment, the effects were opposite to previous year, total aromas were increased by 24%, mainly due to the increment in alcohol family. Moreover, fruity esters were also increased. However, the behaviour of wines from grapes treated with

nano-urea was very similar to that obtained in 2020, showing a 5% decrease in total aromatic composition. Both treatments presented a reduction in 3-methyl-thio-1-propanol compared to control wine, being 16% for urea and 51% for nano-urea treatment.

Finally, during the two years of the study, the organoleptic analysis showed no significant differences between the control wines and the wines from the treated grapes.

In conclusion, the aromatic profile of wines from grapes treated with urea and nano-urea revealed small changes, these variations were dependent on both vintage and treatment, also the sensory characteristics of wines were not modified.

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ID: 151 / Poster session 1: 13

Abstract Submission

Topics: Sensory properties: psychophysics, experimental economy, connections with neurosciences

Keywords: Sensory profiles, Consensus method, social interactions, descriptive analysis

Influence of social interaction levels on panel effectiveness in developing wine sensory profiles using consensus method

Inès Elali[1], Gilles de Revel[1], Laurent Riquier[1], Christophe Loisel[2], Sophie Tempere[1]

[1]Univ. Bordeaux, INRAE, Bordeaux INP, Bordeaux Sciences Agro, OENO, UMR 1366, ISVV, F-33140 Villenave d'Ornon, France; [2]DIAM Bouchage SAS, 3 Rue des Salines, 66400 Céret, France; ines.elali@u-bordeaux.fr

The development of sensory profiles is crucial for quality control and innovation in the wine industry. If quantitative descriptive analysis is the most commonly used method for establishing sensory profiles due to its robustness, it presents significant limitations. Specifically, this approach requires 12 to 15 trained panelists, which can pose logistical challenges. Additionally, the statistical analyses involved are often complex. Alternative methods exist, such as the consensus methodology, which requires only 4 to 6 panelists. Unlike conventional profiling, which relies on individual assessments aggregated statistically, consensus profiling involves collective discussions among panelists to agree on sensory descriptors and intensities (Chambers, 2018). This results in a unique sensory profile, avoiding laborious statistical analyses of individual profiles. This method offers advantages, including faster evaluations and fewer participants (Chambers, 2018), enabling efficient wine assessments by a small panel while providing scientifically robust results.

However, social interaction within the panel can influence the quality and consistency of these profiles. Since exchanges are inherent to this methodology, they introduce bias, as social dynamics can affect judgments and compromise objectivity (Syarief et al., 1985; Meilgaard, 1991). To explore this, six panels of four participants evaluated three white wines, each presented twice, under three interaction modalities. In the first modality, participants engaged in face-to-face discussions. In the second, they interacted verbally without visual contact. In the third, they communicated in writing without seeing one another.

The results demonstrate that each of the studied approaches has its own advantages and limitations depending on the study objectives, which will be further discussed. The findings highlight the potential for optimizing consensus methodologies, a robust tool for wine industries to achieve more reliable and precise wine evaluations.

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ID: 128 / Poster session 1: 14

Abstract Submission

Topics: Wine, environment, health and sustainability

Keywords: Greenness metric, environmental impact, sustainability, wine analysis

Evaluating the Greenness of Wine Analytical Chemistry: A New Metric Approach

Vasiliki Thanasi[1,2], Ana Beatriz Lopes[1,2], Paulo Barros[3], Natália Ribeiro[3], Jorge M. Ricardo-da-Silva[1,2], Sofia Catarino[1,2,4]

[1]LEAF-Linking Landscape Environment Agriculture and Food-Research Center, Instituto Superior de Agronomia, Universidade de Lisboa, Tapada da Ajuda, 1349-017 Lisboa, Portugal; [2]Associate Laboratory TERRA, Instituto Superior de Agronomia, Universidade de Lisboa, Tapada da Ajuda, 1349-017 Lisboa, Portugal; [3]Instituto dos Vinhos do Douro e do Porto, I.P., Rua de Ferreira Borges, 27, 4050-253 Porto, Portugal; [4]CeFEMA-Centre of Physics and Engineering of Advanced Materials, Instituto Superior Técnico, Universidade de Lisboa, Av. Rovisco Pais, 1, 1049-001 Lisboa, Portugal; vasilikithanasi@isa.ulisboa.pt

Wine is a complex matrix whose composition depends on climatic, agricultural, and winemaking factors, making quality control and authenticity assessment critical in the global market. To meet the increasing demand for high-quality wines, a range of analytical methodologies has been developed and employed. Simultaneously, sustainability concerns have taken attention, with the International Organisation of Vine and Wine (OIV) demanding scientific innovation aligned with environmental awareness [1]. Detailed frameworks like Life Cycle Assessment (LCA) are already employed to evaluate the environmental impacts associated with all stages of a product's life, special attention is required to the analytical procedures in use, as they play a pivotal role in ensuring sustainability within the wine sector. Existing green analytical metrics, such as Analytical Eco-Scale [2], GAPI [3], and AGREE [4], present limitations in quantifying the environmental impact of analytical procedures, when applied to wine analysis. To bridge these gaps, this study proposes the Green Wine Analytical Procedure Evaluation (GWAPE), a novel framework designed to assess the greenness of wine analytical methods. The GWAPE tool was developed by refining and integrating key aspects of existing greenness metrics to provide quantitative assessments. Some of the previous green criteria of analytical chemistry not applicable to wine analysis were excluded and new principles tailored to enological analysis were introduced. GWAPE metric is structured around 10 principles and includes a Python-based software tool to facilitate its application [5]. The tool was tested on three key analytical procedures in wine analysis: the enzymatic determination of glucose and fructose (OIV-MA-AS311-02, Type II), the determination of reducing substances (OIV-MA-AS311-01A, Type IV), and the FTIR-based determination of glucose and fructose. These evaluations demonstrated the metric's ability to assess and differentiate the eco-friendliness of analytical procedures commonly used in the wine sector, highlighting its practical utility and discriminatory capacity. By addressing the limitations of existing metrics, GWAPE aims to facilitate the adoption of greener analytical practices in the wine sector, by the classification and comparison of methods in terms of environmental responsibility.

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ID: 129 / Poster session 1: 15

Abstract Submission

Topics: Analysis and composition of grapes, wines, wine spirits

Keywords: Alcohol profiling, chemometric modelling, spectroscopy, FTIR

Simultaneous Determination of Ethanol and Methanol in Wines Using FTIR and PLS Regression

Vasiliki Thanasi[1,2], Ilda Caldeira[3,4], Luís Santos[5], Jorge M. Ricardo-da-Silva[1,2], Sofia Catarino[1,2,6]

[1]LEAF-Linking Landscape, Environment, Agriculture and Food—Research Center, Instituto Superior de Agronomia, Universidade de Lisboa, Tapada da Ajuda, 1349-017 Lisboa, Portugal; [2]Associate Laboratory TERRA, Instituto Superior de Agronomia, Universidade de Lisboa, Tapada da Ajuda, 1349-017 Lisboa, Portugal; [3]Instituto Nacional de Investigação Agrária e Veterinária, Polo de Inovação de Dois Portos, Quinta de Almoinha, 2565-191 Dois Portos, Portugal; [4]MED-Mediterranean Institute for Agriculture, Environment and Development, CHANGE—Global Change and Sustainability Institute, Instituto de Investigação e Formação Avançada, Universidade de Évora, Pólo da Mitra, Ap. 94, 7006-554 Évora, Portugal; [5]Centro de Química Estrutural, Institute of Molecular Sciences, Departamento de Engenharia Química, Instituto Superior Técnico, Universidade de Lisboa, Av. Rovisco Pais 1, 1049-001 Lisboa, Portugal; [6]CeFEMA-Research Centre of Physics and Engineering of Advanced Materials, Instituto Superior Técnico, Universidade de Lisboa, Av. Rovisco Pais, 1, 1049-001 Lisboa, Portugal; vasilikithanasi@isa.ulisboa.pt

Wine is a complex hydroalcoholic solution, with ethanol levels serving as a critical quality parameter. Produced by yeast during the fermentation of hexose sugars, namely glucose and fructose, ethanol not only contributes to the sensory attributes of wine but also plays a vital role in influencing interactions with other components, such as tannins and volatile compounds [1]. Methanol, a naturally occurring component in wine, is primarily produced during alcoholic fermentation through the enzymatic breakdown of pectic polysaccharides in grape skins [2]. While methanol levels in wine are typically low and pose minimal toxicological risk, the International Organisation of Vine and Wine (OIV) has established maximum acceptable limits of 400 mg/L for red wines and 250 mg/L for white and rosé wines. Traditional methods for measuring ethanol and methanol include electronic densimetry and gas chromatography with flame ionization detection (GC-FID). While accurate, these methods are time- and labor-intensive, prompting the adoption of more efficient, non-destructive analytical techniques. FTIR is recognized for its rapid, automated, and non-invasive capabilities, making it a valuable tool for modern wineries and laboratories. This study explores the potential of FTIR spectroscopy, enhanced by chemometric approaches, to accurately quantify simultaneously methanol and ethanol in wine samples. To quantify ethanol and methanol in wine samples standard solutions of ethanol in water, methanol in water, and various combinations of both, were used. Duplicate FTIR measurements took place in transmission mode with the use of a Perkin Elmer LQATM 300 FT-IR wine analyzer. A mathematical model was developed using Partial Least Squares (PLS) regression. For external validation purposes, the predicted ethanol and methanol concentrations of 20 wine samples were compared to electronic densimetry for ethanol determination and GC-FID for methanol determination. The developed FTIR model demonstrated the feasibility of simultaneous ethanol and methanol quantification in wine samples, offering the potential for quality control in wine production. Future improvements should include expanding the dataset with samples from diverse wine types, grapevine cultivars, and winemaking techniques across various wineries. To enhance methanol prediction accuracy, samples with higher and varied methanol levels should also be incorporated [3].

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ID: 130 / Poster session 1: 16
Abstract Submission
Topics: Analysis and composition of grapes, wines, wine spirits
Keywords: 137Cs analysis, radioactivity, dating, prestigious vintages, authenticity

137Cs analysis by gamma spectrometry and its potential for dating Portuguese old wines

Vasiliki Thanasi[1,2], Marta Santos[3,4,5], Rosa Marques[3,4], Natália Ribeiro[6], Paulo Barros[6], Jorge M. Ricardo-da-Silva[1,2], Mário Reis[3,4,5], Joe Builth-Williams[7], Nigel A. Spooner[7], Markus Herderich[8,9], Sofia Catarino[1,2,10]

[1]LEAF-Linking Landscape, Environment, Agriculture and Food—Research Center, Instituto Superior de Agronomia, Universidade de Lisboa, Tapada da Ajuda, 1349-017 Lisboa, Portugal; [2]Associate Laboratory TERRA, Instituto Superior de Agronomia, Universidade de Lisboa, Tapada da Ajuda, 1349-017 Lisboa, Portugal; [3]Center of Nuclear Sciences and Technologies (C2TN), Instituto Superior Técnico, Universidade de Lisboa, EN 10 (km 139.7), 2695-066, Bobadela, Portugal; [4]Departamento de Engenharia e Ciências Nucleares (DECN), Instituto Superior Técnico, Universidade de Lisboa, EN 10 (km 139.7), 2695-066 Bobadela, Portugal; [5]Laboratório de Protecção e Segurança Radiológica (LPSR), Instituto Superior Técnico, Universidade de Lisboa, EN 10 (km 139.7), 2695-066 Bobadela, Portugal; [6]Instituto dos Vinhos do Douro e do Porto, I.P., Rua de Ferreira Borges, 27, 4050-253 Porto, Portugal; [7]Prescott Environmental Luminescence Laboratory (PELL), Faculty of Sciences, Engineering and Technology, University of Adelaide, Adelaide, SA 5005, Australia; [8]The Australian Wine Research Institute, P.O. Box 197, Glen Osmond, SA 5064, Australia; [9]Discipline of Wine Science and Waite Research Institute, The University of Adelaide, PMB 1, Glen Osmond, SA 5064, Australia; [10]CeFEMA-Centre of Physics and Engineering of Advanced Materials Research Center, Instituto Superior Técnico, Universidade de Lisboa, Av. Rovisco Pais, 1, 1049-001 Lisboa, Portugal; vasilikithanasi@isa.ulisboa.pt

Analytical methods for dating wines often rely on assessing anthropogenic and cosmogenic radionuclides, including ^{14}C and ^{137}Cs [1,2]. Measurements of ^{137}Cs for dating can be implemented through either a destructive approach involving radiochemical separation or via a non-destructive approach utilizing direct gamma-spectrometry [3]. Given the rarity and historical and commercial value of aged wines, this study explores non-destructive ^{137}Cs detection in bottled wines. The methodology is based on measuring gamma-emitting radionuclides within the energy range of 46.5keV–1836 keV, using Hyper Pure Germanium (HPGe) detectors. A unique calibration system was designed for horizontally positioned wine bottles inside the detector. The method was optimized and validated using model wines after the addition of known levels of ^{137}Cs, confirming the accuracy of the approach. Furthermore, an interlaboratory comparison, employing a Broad Energy Germanium (BEGe) detector demonstrated consistent trends in radioactivity measurements, further corroborating the reliability of the approach. The study represents the first application of ^{137}Cs dating to Portuguese wines, both fortified and non-fortified, from vintages spanning 1947 to 1970. The findings highlighted variations, depending on the region and type of wine. No detectable radioactivity was found in wines produced before 1950 or after 1969. Interestingly, fortified wines exhibited lower ^{137}Cs levels than non-fortified wines, likely due to differences in winemaking practices. This non-destructive and non-invasive method proves effective for distinguishing between wines made before and after the anthropogenic release of radionuclides in the 1950s. It offers additional valuable information to resolve ambiguities in wine dating while maintaining the integrity of the bottled wine.

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ID: 132 / Poster session 1: 17
Abstract Submission
Topics: Winemaking processes and oenological practices
Keywords: Turbidity, grape seed extracts, physico-chemical modification, phenolic compounds.

Exploring the physico-chemical modification of grape seed extracts to improve their clarifying effect in red wine

María José Carrasco Palazón[1], Encarna Gómez Plaza[1], Enrique Pérez Navarro[2], Ricardo Jurado Fuentes[3], Ana Belén Bautista Ortín[1]

[1]Department of Food Technology, Nutrition and Bromatology, Faculty of Veterinary Science. University of Murcia, 30100, Murcia, Spain.; [2]Statistical and Bioinformatics Support Unit of the Biosanitary Research Service (SIB), Scientific and Technical Research Area (ACTI). University of Murcia, 30100, Murcia, Spain.; [3]Agrovin S.A., Avenida de los Vinos s/n, 13600 Alcázar de San Juan, Ciudad Real, Spain.; mariajose.carrasco1@um.es

ŒnoMacrowine 2025 abstract

Oral communication

During winemaking, some byproducts are obtained, such as grape pomace, which represent 13% of winery byproducts [1]. Among grape pomace we can found grape seeds, which have showed promising results in reducing wine turbidity, since they have proteins [2] which interact with turbidity-forming compounds as such polysaccharides [3], polyphenols [4] and other proteins [5] through primarily hydrophobic interactions [6] accelerating their precipitation. However, these seed extracts do not achieve the clarification

effect obtained with other commercial clarifying agents frequently used in winery. For that, in this study, white grape seed extracts were enzymatically, physically and chemically modified and applied on a red wine after malolactic fermentation with the objective of verifying if their effectiveness in the clarification process and in the maintenance of wine quality was improved. The determination of turbidity, chromatic parameters and phenolic content, carried out in wines after a period of contact with different clarifiers, showed that extracts treated with cellulase, ultrasounds and HCl improved its performance in comparison with grape seed extract without treatment, the results being very similar to that obtained with commercial clarifying agents commonly used in wineries. It is clear that some of the treatments carried out on grape seed extracts produced important changes at structural and composition level, making them more reactive and improving their clarifying capacity without affecting red wine quality. Their implementation as new clarifying agents in wine industry would promote the circular economy in the oenological sector.

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ID: 133 / Poster session 1: 18
Abstract Submission

Topics: Winemaking processes and oenological practices
Keywords: Volatile, polyphenolic profile, polysaccharides, sensorial analysis

Exploring the use of high-power ultrasound in white and rosé winemaking

Paula Pérez-Porras[1], Ana Belén Bautista-Ortín[1], Lara Labrador-Fernández[2], María Consuelo Díaz-Maroto[2], Leticia Martínez-Lapuente[3], Zenaida Guadalupe[3], Belén Ayestarán[3], María Soledad Pérez-Coello[2], Encarna Gómez-Plaza[1]

[1]Department of Food Science and Technology, Faculty of Veterinary Sciences, University of Murcia, 30100 Murcia, Spain; [2]Department of Food Technology, Faculty of Chemical Sciences and Technologies, Regional Institute for Applied Scientific Research (IRICA), University of Castilla-La Mancha, Ciudad Real, Spain; [3]Institute of Vine and Wine Sciences, ICVV (University of La Rioja, Government of La Rioja and CSIC), Finca La Grajera, Logroño, Spain; paula.perez2@um.es

ŒnoMacrowine 2025 abstract

Oral communication

Since the approval in 2019 of the use of high-power ultrasound (US) in winemaking to support extractive processes from grape to must [1], the study of this technology in red winemaking has increased significantly, with laboratory and semi-industrial scale studies [2]. Ultrasound in winemaking can be applied as a continuous pretreatment of crushed grapes, the improvement of extraction being the main interest of its use, favouring a more intense wine colour profile [3]. However, the use of this technology in white and rosé winemaking, which has been less studied, shows great promise for reducing or eliminating pre-fermentative maceration processes without losing the high organoleptic quality of the wines [4]. This possibility would not only reduce production time and cost but also ensure that the wines most susceptible to oxidation (those with a high hydrocynnamic acid and flavanol content) suffer less risk of being affected.

High-power ultrasound application essays were conducted on a semi-industrial scale and using a frequency of 30 kHz on crushed grape from Monastrell (for rosé wine) and Viognier (for white wine) varieties, studying the effect on vinifications carried out without pre-fermentation maceration (CPD), with 8 hours of pre-fermentation maceration (CM) and with US application after crushing the grapes and just before pressing (US). These trials showed that the rosé wine made with US had a profile rich in terpenes and norisoprenoids, compounds linked to the floral profile observed in the sensory analysis, as well as red fruit aroma. It also had higher colour intensity, higher presence of phenolic compounds and of polysaccharides rich in arabinose and galactose (PRAG) and homogalacturonans (HL). In white wine, in addition to these compounds, a higher presence of rhamnogalacturonans type II (RG-II) was observed, together with a stronger varietal aromatic profile (increasing the concentration of α-terpineol and linalool in free form) intensified thanks to the extraction benefited by the US, even without any prefermentative contact time, which resulted in raised scores in attributes such as floral, peach and sweet apricot.

Thus, the use of high-power ultrasound not only results in the possibility of reducing the winemaking time without loss of quality, but also in the possible improvement of the colour and varietal aromatic profile of the wines produced.

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ID: 137 / Poster session 1: 19
Abstract Submission

Topics: Analysis and composition of grapes, wines, wine spirits, Winemaking processes and oenological practices
Keywords: Postharvest dehydration, Italian grapes, aroma compounds, straw wines, withering

Study of the volatile aroma profile of five Italian grape varieties submitted to controlled postharvest withering

Jessica Anahi Samaniego Solis[1], Marta Baviera[2], Lorenzo Ferrero[3], Tommy Avesani[1], Enrico Manfron[1], Maurizio Ugliano[1], Daniela Fracassetti[2], Simone Giacosa[3], Davide Slaghenaufi[1]

[1]Univeristy of Verona, Italy; [2]Università degli Studi di Milano; [3]Università degli Studi di Torino; jessicaanahi.samaniegosolis@univr.it

Wines made with grapes submitted to postharvest dehydration are often referred to as "passito" or "straw wines." This distinct style of winemaking consists of a process of water loss that allows the berries to undergo a mild water stress and senescence process [1]. Several factors can influence the dehydration kinetics of grapes, some related to the environmental conditions (temperature and relative humidity) and others to the grape characteristics (surface area/volume ratio, skin thickness) [2]. Postharvest dehydration introduces important physicochemical changes and stress to the cell, triggering modifications of genes involved in the formation pathways of many volatile compounds and their precursors [3]. This work aimed to evaluate the aromatic evolution of five Italian grape varieties ('Aleatico,' 'Corvina,' 'Moscato di Scanzo,' 'Nebbiolo,' and 'Sagrantino') subjected to controlled postharvest dehydration (T 14-15 °C, RH 40-50%). Grapes at different stages of dehydration (0%-fresh, 10%, 20%, and 30% weight loss) were macerated in a hydroalcoholic solution to extract volatiles. Analyses were carried out by GC-MS and SPE/SPME for the identification and quantification of free and glycosidically bound compounds belonging to terpenes, norisoprenoids, volatile phenols, and C_6 alcohol classes. Results were normalized according to weight loss to eliminate a concentration effect. A variety-dependent behavior was found in terms of both accumulation/degradation of aroma compounds and dehydration kinetic. For Sagrantino, the highest levels of terpenes were observed at 30%, while for norisoprenoids and volatile phenols, at 10%. For Nebbiolo, high levels were found for free and bound norisoprenoids (0% and 20%) and for free and bound C_6 alcohols (10% and 30%). For cv. Corvina and Moscato di Scanzo, the highest levels of free compounds were found in fresh grapes; regarding the bound compounds, a similar behavior was observed with a maximum accumulation at 10% and 20%. In Aleatico, the highest levels were found in free and bound norisoprenoids (10%) and free volatile phenols (10%). In conclusion, postharvest dehydration can be an important factor modulating the aroma profile of grapes. This effect is complex and varies depending on the degree of dehydration and the class of compounds. In most of the cases, free compounds decreased at 30%, indicating that at this level, compounds can start to degrade. Instead, glycosidically bound compounds accumulate at 10 and 20%, which can be a source of aroma potential that later can be released during fermentation and aging.

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ID: 140 / Poster session 1: 20
Abstract Submission

Topics: Analysis and composition of grapes, wines, wine spirits, Winemaking processes and oenological practices
Keywords: Carbonation, CO2 solubility, dissolution, sparkling wines

Development of a new lab-scale carbonation method for applications to sparkling wines

Zoé Grolier[1,2,3], Raphaël Vallon[1], Florian Lecasse[1], Clément Jacquemin[1], Frédéric Polak[1], Clara Cilindre[1], Arnaud Massot[2], Virginie Moine[2], Stéphanie Marchand-Marion[3], Gérard Liger-Belair[1]

[1]Université de Reims Champagne-Ardenne, Equipe Effervescence & Champagne (GSMA), UMR CNRS 7331, Reims Cedex 251687, France; [2]Biolaffort, 11 Rue Aristide Berges, 33270 Floirac, France; [3]Université de Bordeaux, Bordeaux INP, Bordeaux Sciences Agro, INRAE, UMR OENO 1366, ISVV, 33140 Villenave d'Ornon, France; zoe.grolier@laffort.com

Carbon dioxide (CO_2) is the gaseous species responsible for the sparkle in all sparkling wines, influencing their visual appearance, aromas and mouthfeel[1]. Behind the industrial-scale production of sparkling wines (and sparkling drinks in general) lies a simple law, known as Henry's equilibrium, which states that the concentration of dissolved CO_2 in the liquid phase is proportional to the pressure of gas-phase CO_2 in a sealed container according to (with being the Henry's constant of CO_2 in the liquid phase, and being the partial pressure of gas-phase CO_2 in the sealed container)[2]. However, precise knowledge of the Henry's constant of CO_2 in complex water/ethanol mixtures such as sparkling wines remains challenging due to the high variability of the multitude of compounds present (such as ethanol, sugars and myriads of small or macromolecules[3,4]).

In the present work, an accurate and reproducible carbonation method for measuring the solubility and dissolution kinetics of CO_2 in model wines was developed. A lab-scale carbonator has been designed to inject gaseous CO_2 in a controlled manner up to concentrations of around 10-12 g/L in standard 75 cL "Champenoise" bottles sealed with crown caps. Various tests were performed with variations in the temperature (at 1, 12 and 19°C), ethanol concentration (at 0, 12 and 40% vol.), and pH (3 and 7) of the model wine solutions. Moreover, increasing addition of yeast cell wall products were also performed (with 10, 20 and 100 cL hL^{-1}, respectively). Preliminary results show that the solubility of CO_2 increases at low temperatures and with moderate ethanol concentrations, while the presence of yeast cell wall products does not significantly impact its solubility, but improved mass transfer up to a threshold where viscosity becomes limiting. This brand-new carbonation method makes it possible to study the effects of the compounds of interest on the quality of sparkling wines (and sparkling drinks in a broader sense), in relation to their foam and effervescence for example. Future perspectives include an in-depth analysis of the impact of various compounds on olfactory and organoleptic properties, indeed crucial to the consumer experience. In short, this method is a powerful tool for analysing production parameters and optimizing the sensory qualities of sparkling beverages. Ultimately, this approach could be extended to other complex carbonated matrices, thus contributing to the development of new formulations of sparkling drinks.

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ID: 144 / Poster session 1: 21
Abstract Submission
Topics: Analysis and composition of grapes, wines, wine spirits
Keywords: GC×GC-ToFMS, volatile composition, free compounds, white varieties

Two Dimensions, one mission: Unlocking grape composition by GC×GC

Nuno Martins[1], Daniela Fonseca[2], Raquel Garcia[1], Pedro Rodrigues[3], Vanda Pedroso[4], António M. Jordão[3], Maria João Cabrita[1]

[1]Mediterranean Institute for Agriculture, Environment and Development & Global Change and Sustainability Institute, University of Évora, Pólo da Mitra, Ap. 94, 7006-554 Évora, Portugal; [2]Mediterranean Institute for Agriculture, Environment and Development & Institute of Research and Advanced Training, University of Évora,Pólo da Mitra, Ap. 94, 7006-554 Évora, Portugal; [3]Polytechnic University of Viseu, Agrarian School (CERNAS Research Centre), 3500-606 Viseu, Portugal; [4]Dão Wine Studies Center - Nelas Innovation Hub (CCDRC), 3520 Nelas, Portugal; mjbc@uevora.pt

Aroma is one of the most important attributes that determine consumer's perception of the sensory quality of wine and varietal typicity. The aroma of grapes consists of big diversity of volatile compounds, including esters, terpenic compounds, C_{13} norisoprenoids, C_6 compounds, benzene derivatives, alcohols, aldehydes, among others. Given the complexity of the grape volatile profile and the trace concentrations of these compounds, employing advanced analytical techniques such as GC×GC-ToFMS is essential. This method enables efficient separation and precise detection of volatile compounds within the intricate grape matrix [1, 2].

This work aims to analyze the volatile composition of three different Portuguese white grape varieties (Terrantez, Encruzado and Malvasia Fina) using HS-SPME-GC×GC-ToFMS. To increase the efficiency of the SPME technique, a detailed optimization of all the steps of the sample preparation technique was carried out. The optimized conditions were 4 g of grapes, 2 g of NaCl, and 2 mL of H_2O. Additionally, the extraction conditions using a carboxen/divinylbenzene/polydimethylsiloxane fiber were also optimized and performing the extraction for 40 minutes at 60 ºC allow to identify more volatile compounds.

As a result, it was possible to identify sixty free compounds, including four C_6 compounds, three benzenoids, twenty-four monoterpenes, twenty-four sesquiterpenes and five C_{13} norisoprenoids. The results showed that there are some compounds in only one variety, for example, β-copaene is only present in the Encruzado variety, as well as *trans*- pyran linalool oxide in the Malvasia Fina variety and, finally, in the Encruzado variety, α-thujone. Compounds such as D-verbenone, δ-elemene, cis-thujopsene, α-muurolene, cubenol, α-cadinene and δ-selinene were only found in the Terrantez and Encruzado varieties, while the compound 5-hexen-2-ol was only found in the Malvasia Fina and Terrantez varieties. Comparing the varieties, Malvasia Fina showed the highest relative total area of C_6 compounds, while Terrantez showed the highest relative total area for benzenoids. In addition, Encruzado revealed the highest relative total area for monoterpenes. Linear discriminant analysis (LDA) further revealed clear differences in the volatile composition between the studied white varieties.

HS-SPME combined with GC×GC-ToFMS provides a suitable and sustainable approach for determining the volatile signature of grapes from different varieties.

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ID: 145 / Poster session 1: 22
Abstract Submission
Topics: Analysis and composition of grapes, wines, wine spirits
Keywords: HPLC-DAD, phenolic profile, irrigation regimes, autochthonous varieties

Adapting Portuguese vineyards to climate change: impact of different irrigation regimes on phenolic composition

Daniela Fonseca[1], Cristina Cebrián-Tarancón[2], Rosario Sánchez-Gómez[2], M. Rosario Salinas[2], Nuno Martins[3], Raquel Garcia[3], José Silva[4], Rui Flores[4], Ana Carina Neto[4], Maria João Cabrita[3]

[1]Mediterranean Institute for Agriculture, Environment and Development & Institute of Research and Advanced Training, University of Évora, Pólo da Mitra, Ap. 94, 7006-554 Évora, Portugal; [2]Cátedra de Química Agrícola, E.T.S. Ingeniería Agronómica y de Montes y Biotecnología, Departamento de Ciencia y Tecnología Agroforestal y Genética, Universidad de Castilla-La Mancha, Avda. de España s/n, 02071 Albacete, Spain; [3]Mediterranean Institute for Agriculture, Environment and Development & Global Change and Sustainability Institute, University of Évora, Pólo da Mitra, Ap. 94, 7006-554 Évora, Portugal; [4]Esporão S.A., Avenida do Restelo 44, 1400-315 Lisboa, Portugal; daniela.fonseca@uevora.pt

Climate change has led to increased extreme weather events, such as severe droughts and intense rainfall, with regions like Alentejo and Algarve in Portugal, being particularly affected. Some grape varieties are better suited to these conditions due to their ability to close stomata under water stress, reducing water loss through evapotranspiration from the leaves, and potentially leading to increased synthesis of phenolic compounds [1, 2]. Understanding the influence of water availability in concentrating phenolic compounds in autochthonous varieties can be an important tool to adapt to water scarcity while preserving wine typicity and water resources.

This work has been carried out, to analyze the profile of phenolic compounds in four Portuguese red grape varieties: Tinta Gorda, Tinta Miúda, Tinta Caiada, and Moreto. These varieties were cultivated in Reguengos de Monsaraz (Alentejo), under three irrigation regimes (water comfort, moderate water deficit and rainfed) and harvested in 2024. The phenolic compounds from the grapes were

extracted after 1 hour of maceration with ethanol and analyzed using high-performance liquid chromatography coupled diode array detector (HPLC-DAD).

Nineteen phenolic compounds were identified and quantified in the studied varieties, including anthocyanins, flavanols, flavonols, phenolic acids and stilbenes. In Tinta Gorda, no significant differences were observed between the moderate water deficit and rainfed regimes, although both significantly differed from water comfort. This variety exhibited higher phenolic concentrations under moderate water deficit and rainfed conditions, highlighting its adaptability to water scarcity. Tinta Miúda was the only variety to display significant differences in total phenolic concentrations in all irrigation regimes, with phenolic levels increasing as water availability decreased. Tinta Caiada showed no significant differences between water comfort and moderate water deficit but had the highest phenolic concentration under rainfed conditions, which was statistically distinct from the other irrigation regimes. Moreto exhibited a similar pattern to Tinta Gorda, but its phenolic concentrations decreased with reduced irrigation, likely due to lower grape ripeness under water-scarce conditions.

In summary, the results reveal that Tinta Gorda, Tinta Miúda, and Tinta Caiada varieties exhibit higher concentrations of phenolic compounds under rainfed conditions. Among these, Tinta Miúda and Tinta Caiada stand out as the most statistically promising varieties in terms of adaptability to water scarcity.

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ID: 146 / Poster session 1: 23
Abstract Submission
Topics: Analysis and composition of grapes, wines, wine spirits
Keywords: Grapeberry ripening, Grapeseed, Wine, Non-targeted metabolomics, Molecular networks

Evolution of grapeseed composition during maturation and characterization of its impact on wine compound using molecular networks

Julien Foisnon, Marie Le Scanff, Amelie Rabot
UMR Oeno, Bordeaux University, ISVV, 210 Chemin de Leysotte, 33140 Villenave d'Ornon, France; julien.foisnon@u-bordeaux.fr

Usually the winemaker consider the grapeberry maturity as an actor of the wine quality. There are frequently consider using marker to consider the grape maturity. The first aim of this study is to obtain a better understanding of the impact of grape seed maturity on the grapeseed and grapeberry composition. Furthermore with the lack of knowledge regarding grapeseeds and research for maturity markers, a part of this work aim to complete the actual way of assessing grapeseed maturity to help winegrower definite the best harvest time. A second goal of this study is to characterize the effect of grapeseed maturity on wine and tried to identify new compound in wine coming from grapeseed. Data for this study were collected from grapeseed picked at different maturity (from bunch closure to 2 week after harvest) and wines made at three harvest time (underripe, ripe and overripe) in 2024 were studied using non-targeted metabolomics. Each grape seed sample was freeze until analysis and then samples were grinded and extracted during 24H in methanol, then they were filter and dried. The wine sample was directly filtered and dried without any prior extraction. Then they were diluted to the same concentration (1 mg/mL) and analysed by HPLC MS/MS. All the results were used to construct a molecular network using the fragmentation pattern and retention time of the molecule[1] using the software MetGem[2]. Then molecules in the molecular network were annotated using MetGem or by personal annotation for the one not found in the database but still seem promising. With the grouping capability of molecular networks, families of molecules were found (polyphenol, AA, nitrogen). Even in the well-known family of molecule (polyphenol), molecule recently discovered (epicatechin vanillate[3]) and potential new molecule were annotated. Not all molecule can be associated in family by molecular networking. Even so, molecules might be studied using semi (SQ) and quantitative approaches to validate markers of ripening evolution in grapeseeds and validate their involvement in grapeberry ripening evaluation as well as in winemaking processes. For example, pantothenic acid is found in grapeseed and contribute to fermentation process[4]. As well, the quantity of indolelactic acid glucoside (found in red wine[5]) appear to increase (SQ approach) in grapeseed during maturity, potentially being a good grapeseed maturity marker. Finally, this work has enabled us to combine the molecular network way and a semi quantitative approach to deepen our knowledge of grapeseed ripening driven by specific markers.

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ID: 156 / Poster session 1: 24
Abstract Submission
Topics: Sensory properties: psychophysics, experimental economy, connections with neurosciences
Keywords: Sparkling wines, Champagne, Gaseous ethanol, CO2, Spectroscopy, Interband Cascade Laser

Unveiling the chemical headspace of sparkling wine glasses by laser spectroscopy

Florian Lecasse[1], Raphaël Vallon[1], Clément Jacquemin[1,2], Vincent Alfonso[1], Clara Cilindre[1], Bertrand Parvitte[1], Virginie Zéninari[1], Gérard Liger-Belair[1]

[1]1. GSMA, UMR CNRS 7331, Université de Reims Champagne-Ardenne, Reims, France; [2]MirSense, 1 rue Jean Rostand, Campus Eiffel, 91400 Orsay, France; florian.lecasse@univ-reims.fr

Right after serving a sparkling wine into a glass, thousands of rising and bursting bubbles convey gas-phase CO_2 and volatile organic compounds (VOCs) in the headspace above the champagne surface, thus progressively modifying the gaseous chemical space perceived by the consumer [1]. Champagne and other traditional method sparkling wines being complex water/ethanol mixtures (with typically 12-13% ethanol by volume), gaseous ethanol is therefore undoubtedly the most abundant VOC in the glass headspace [1]. Yet, both gaseous ethanol and CO_2 are known to have a multimodal influence on wine's perception [2]. As their abundance increases, these two gaseous species stimulate the human trigeminal system, leading to the so-called carbonic bite (induced by excess gaseous CO_2), while gaseous ethanol results in a tingling/burning sensation [2,3]. Monitoring simultaneously gaseous CO_2 and ethanol (in space and time) in the headspace of sparkling wine glasses is therefore crucial to better understand the neuro-physicochemical mechanisms responsible for aroma release and flavour perception during sparkling wine tasting.

Over the past decade, a diode laser infrared spectrometer has been developed and progressively upgraded in our group to accurately monitor gaseous CO_2 through the headspace of champagne glasses [4]. After the addition of a multipath system dedicated to the mapping of CO_2 throughout the glass headspace [5,6], and the design of an optomechanical prototype dedicated to the replication of the human gesture of swirling wine [7], the spectrometer has recently been once again upgraded to monitor gaseous ethanol thanks to the recent interband cascade laser (ICL) technology [8]. From the start of sparkling wine serving, and during the next minutes following, kind of spatial-, temperature-, and glass shape-dependent gas-phase CO_2 and ethanol footprints were revealed in the headspace of glasses. It is noteworthy to mention that accurately quantifying gaseous ethanol in the headspace of wine glasses is a first step towards quantifying the myriads of VOCs responsible for the wine's bouquet, which also paves the way for a better understanding of the role of the glass and overall tasting conditions in the world of wine and spirits in the broad sense.

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ID: 160 / Poster session 1: 25
Abstract Submission
Topics: Winemaking processes and oenological practices
Keywords: wine, grape, pH, acidity, cation exchange resins

Enhancing Monastrell Wine Quality in a Climate Change scenario: The Role of Cation Exchange Resins in Addressing Acidity Challenges

Ana Leticia Perez-Mendoza[1], Alejandro Martínez-Moreno[1], Encarna Gomez-Plaza[1], Paula Pérez-Porras[1], Paola Sanchez-Bravo[1], Ricardo Jurado[2], Ana Belén Bautista-Ortin[1]

[1]University of Murcia, Spain; [2]Agrovin S.A.; encarna.gomez@um.es

Climate change significantly impacts vine and grape physiology, leading to changes in wine composition, including reduced titratable acidity, elevated ethanol content, and higher pH levels [1]. These effects are particularly problematic in arid and semi-arid regions such as the Mediterranean areas, where high summer temperatures and low rainfall accelerate the degradation of grape acids [2]. This results in wines lacking sufficient acidity to maintain the desired level of freshness and quality. To address this issue, the wine industry employs various techniques to reduce pH and enhance acidity, such as acid addition, ion exchange, blending with high-acidity wines, and biological methods. Among these, cation exchange resins stands out as one of the most widely used and effective approaches. For that, this study explores the effect of treating must with cation exchange resins on the composition and quality of Monastrell red wines, comparing them with wines adjusted to the same pH with tartaric acid and untreated control wines. The results showed that treating part of the must with cation exchange resins (20% and 30%) significantly lowed pH values and increased total acidity compared to the control must. This trend was also observed in wines treated with tartaric acid. The resulting wines showed no significant differences on the concentration of phenolic compounds but must acidification favored the color quality associated to an increase of the color intensity and a decrease in the tone values. Moreover, sensory analysis showed tasters preferred treated wines, particularly those made with must acidified with cation exchange resins, which were perceived as fresher in the mouth. Therefore, must treatment with cation exchange resins may be a good method for lowering the pH and increasing the acidity of Monastrell red wines solving the problem of the significant decrease in acidity that grapes are suffering due to the temperature increase in the semi-arid regions associated to climate change.

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ID: 161 / Poster session 1: 26
Abstract Submission
Topics: Winemaking processes and oenological practices
Keywords: Glycosidase, smoke taint, volatile phenols, lactic acid bacteria

Lactic acid bacteria: a possible aid to the remediation of smoke taint?

Phuti Reginald Lekokotla[1], Rémi Schneider[2], Maret Du Toit[1], Benoit Divol[1]
[1]Stellenbosch University, South Africa; [2]Oenobrands SAS, France; divol@sun.ac.za

With climate change, the occurrence of wildfires has increased in several viticultural regions of the world. Subsequently, smoke taint has become a major issue, threatening the sustainability of the wine industry. Indeed, following smoke exposure, ripening grapes absorb volatile phenols (VPs) arising from the burning of lignified plant material and store them as odourless glycosylated compounds. During the winemaking process, these precursors can be liberated through acidic hydrolysis or through the glycosidase activities of yeasts and lactic acid bacteria (LAB), thereby leading to undesirable odours such as ash tray, burnt, and smoky. Various remediation strategies have been proposed, including spraying kaolin on grapes to prevent absorption of VPs by grapes or various wine treatments by reverse osmosis or carbon addition to remove introduced VPs in wine, but these are currently employed with moderate success. LAB, including *Oenococcus oeni*, possess glycosidase enzymes, but studies have mainly been limited to the breakdown of artificial substrates such as *p*-nitrophenyl-β-glycosides, and their efficacy against smoke-derived VP glycoconjugates in real grape juice has never been truly assessed. Therefore, this study aimed to investigate the ability of a large number of wine-related LAB species to release VPs in real smoke-exposed grape juice. Indeed, the use of LAB with strong glycosidase activity could be used to ameliorate smoke taint, when combined with already proposed remediation strategies that are more effective on free VPs than on glycosylated VPs.

Forty-two LAB isolates were screened for glycosidase activity in sterile smoke-exposed Pinotage grape juice. Volatile phenols were quantified using Gas Chromatography - Mass Spectrometry. All isolates were found capable of releasing free-VPs to various extents. Four LAB isolates, namely *Lactiplantibacillus pentosus* 65.1, *Latilactobacillus sakei* 115, *Lentilactobacillus hilgardii* 87.2 and *O. oeni* 192, released more overall VPs than other investigated isolates in smoked Pinotage juice. Amongst the VPs quantified, isolates of *Lac. plantarum* and *Lac. pentosus* were found to release high levels of 4-ethyl phenol (4-EP), which was then demonstrated to originate not only from the release of smoke-derived glycosylated 4-EP, but also from *de novo* intracellular production. Overall, the study showed that selected LAB isolates secrete glycosidases, with good potential to release free-VPs prior to their removal using agents such as charcoal.

Bibliography
None

ID: 163 / Poster session 1: 27
Abstract Submission
Topics: Analysis and composition of grapes, wines, wine spirits
Keywords: Brandy Italiano, wood toasting, wood seasoning, volatile compounds

Geographical indication “Brandy Italiano”: study on the influence of wood barrel toasting and natural seasoning on endogenous and wood-derived compounds of aged distillates.

Silvia Arduini[1], Fabio Chinnici[1,2]
[1]Department of Agricultural and Food Sciences, University of Bologna, Viale Fanin 40, 40127 Bologna, Italy; [2]Centro Interdipartimentale di Ricerca Industriale Agroalimentare (CIRI AGRO), Via Quinto Bucci 336, 47521 Cesena, Italy; silvia.arduini2@unibo.it

The European geographical indication (GI) *Brandy Italiano* is exclusively reserved to brandy obtained in Italy from the distillation of wine from grapes grown and vinified in the national territory [1]. The product specification regulating the production of this geographical indication establishes a minimum ageing period of 6 months in oak casks with a capacity of less than 1000-L to consider *Brandy Italiano* as marketable [2]. The characteristics of the final product can be influenced by the various treatments that the oak wood undergoes during the cooperage process [3]. This study aimed to assess the influence of different wood toasting levels and natural seasoning duration on the volatile profile of this Italian GI, including wood-related compounds, varietal and fermentative volatiles. The research was conducted on brandies produced from wines obtained from cv. *Trebbiano Romagnolo* grapes, distilled by a two-step discontinuous method and aged in 350-litre oak barrels. Woods for cooperage were naturally seasoned for two different periods of time (24 and 36 months) and were toasted at two different degrees (light and heavy toasting). The brandies were aged for 8 months, i.e. 2 months more than the minimum ageing time required for the GI. The products were analysed by SPE-GC-MS and HPLC-DAD-FLD to determine their volatile composition and to evaluate the main wood-derived compounds according to the EU reference method of analysis of wood compounds in spirit drinks [4]. A two-way analysis of variance (ANOVA) was performed to study effects and interactions for each variable and level. Results demonstrated that the degree of toasting and the duration of seasoning influenced both the release of some aromatic compounds from the wood and the profile of some endogenous compounds. Wood seasoning, in particular, was found to have an impact on the content of individual phenolics and the ratio between lactones while toasting degree affected almost all compounds derived from lignin degradation. The presence of certain endogenous volatiles such as terpenes and esters was also discussed in light of the analytical results.

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ID: 164 / Poster session 1: 28
Abstract Submission
Topics: Sensory properties: psychophysics, experimental economy, connections with neurosciences
Keywords: wine tasting, water/ethanol mixtures, gaseous ethanol, sensor

Towards 2D mapping of gaseous ethanol in the headspace of wine glasses by infrared laser spectrometry

Vincent Alfonso, Raphaël Vallon, Florian Lecasse, Clara Cilindre, Bertrand Parvitte, Virginie Zeninari, Gérard Liger-Belair
Université de Reims Champagne-Ardenne, CNRS, GSMA, Reims, France; vincent.alfonso@univ-reims.fr

Under standard wine tasting conditions, volatile organic compounds (VOCs) responsible for the wine's bouquet progressively invade the chemical space perceived by the consumer in the glass headspace. With usually 7-15% ethanol (EtOH) by volume in wines, gaseous EtOH is thus the most abundant VOC in the headspace of still wine glasses (but after gaseous CO_2 which has already been shown to be the predominant species in the glass headspace throughout the tasting of champagne and other sparkling wines). However, gaseous EtOH plays a multimodal role in the perception of the wine bouquet via the ortho-nasal route. Moreover, as a function of its abundance in the headspace of a wine glass, gaseous EtOH can induce an unpleasant tingling/burning sensation after triggering the human trigeminal system. Monitoring gaseous EtOH in the headspace of wine glasses is therefore crucial to better understand the neuro-physicochemical mechanisms responsible for aroma release and flavor perception throughout wine tasting.

Gaseous EtOH was monitored for the first time in the headspace of champagne glasses by micro-gas chromatography (μGC), but with a very low time-resolution and at a single point in the glass headspace. More recently, a sniffer-camera for visualizing EtOH vapors above a wine glass has been developed by using chemiluminescence from an enzyme-immobilized mesh. These two series of works highlighted an inhomogeneous spatial distribution of EtOH in the headspace of glasses, with higher EtOH concentrations near the rim compared to the center of the wine glass, which could be attributed to the presence of wine tears along the walls of the glass. In the present work, a brand-new EtOH sensor based on the recent interband cascade laser technology was used to better apprehend how the concentration of liquid phase EtOH rules the overall evaporation of EtOH in the headspace above glasses. Real-time monitoring of gaseous EtOH was performed in the headspace of glasses dispensed with water/EtOH mixtures showing increasing concentrations of EtOH (from 0% to 100% vol.). Moreover, real-time monitoring of gaseous EtOH was also performed in the headspace of still wine and sparkling wine glasses. From the start of wine serving, and during the next minutes following, a kind of spatial- and temperature-dependent gaseous EtOH footprint was revealed in the headspace of glasses. Accordingly, the 2D mapping of gaseous EtOH was performed in the headspace of glasses, which was discussed based on the vapor-liquid equilibrium of the water/EtOH mixture combined with a diffusive 2D-model.

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ID: 165 / Poster session 1: 29
Abstract Submission
Topics: Chemical and biochemical reactions, including grape and wine microorganism's impact, Winemaking processes and oenological practices
Keywords: Polysaccharides, Protein, Bentonite, Colloidal Instability

Understanding colloidal instability in white wine through model solutions: a study focused on the effect of polysaccharides and salts onto bentonite protein removal efficiency

Mário Bezerra[1], Miguel Ribeiro[1,2], Luis Filipe Ribeiro[1], Fernanda Cosme[1,3], Fernando M. Nunes[1,4]
[1]Chemistry Research Centre-Vila Real (CQ-VR), Food and Wine Chemistry Laboratory, University of Trás-os-Montes and Alto Douro, Vila Real, Portugal; [2]Genetics and Biotechnology Department, School of Life Sciences and Environment, University of Trás-os-Montes and Alto Douro, Vila Real, Portugal; [3]Biology and Environment Department, School of Life Sciences and Environment, University of Trás-os-Montes and Alto Douro, Vila Real, Portugal; [4]Chemistry Department, School of Life Sciences and Environment, University of Trás-os-Montes and Alto Douro, Vila Real, Portugal; mariojbezerra02@gmail.com

A white wine model solution (12% v/v ethanol, 4 g/L tartaric acid, pH 3.2) was used to study colloidal instability in wine and evaluate the effects of wine components on bentonite performance in protein removal. BSA was used as a protein standard at 500 mg/L [1]. Naturally occurring polysaccharides like arabinogalactans, mannoproteins, and pectin were added at concentrations equivalent to the sum of their monosaccharides [2]. Additionally, KCl and K_2SO_4 were added at the maximum level authorized by the Institute of Vine and Wine (IVV, Portugal) for Cl^- and SO_4^{2-}. Sodium-activated bentonite was chosen for its high efficiency showed in previous studies [2]. Protein and polysaccharide content was measured using the Bradford [2] and the phenol-sulfuric methods [3], respectively. Adsorption isotherm models were performed by fixing bentonite concentration (20 g/hL) and varying the concentration of each polysaccharide and protein from 1 to 500 mg/L. Protein aggregation was studied by particle size measurements using dynamic light scattering (DLS) [5]. Adsorption curves showed that 100 g/hL of bentonite was required for total protein removal however, the addition of KCl and K_2SO_4 reduced bentonite efficiency. The addition of KCl and, to a greater extent, K_2SO_4 induces protein aggregation, making protein/bentonite absorption more difficult. By adding polysaccharides, bentonite efficiency decreased at lower concentrations (20-60 g/hL) due to polysaccharide/bentonite interactions probably occupying bentonite adsorption sites. Arabinogalactans and pectin showed protein interactions by themselves, as evidenced by reductions in protein content to 350 and 287 mg/L, respectively, compared to 436 mg/L in the control. Combining with the fact that polysaccharide content dropped near 0, this interaction was likely due to surface charge interactions. Freundlich isotherm models were applicable, indicating that adsorption occurred on a heterogeneous surface with interactions between adsorbed molecules [4]. Arabinogalactan, mannoprotein, and BSA had 1/n values of 0.9460, 1.0997, and 0.7943, respectively, suggesting that BSA had the most favorable adsorption ($1/n < 1$) onto bentonite, whereas both polysaccharides exhibited (near) irreversible adsorption ($n \approx 1$). Pectin showed no adsorption capacity onto bentonite, which was

expected due to its neutral/negative nature. These results reveal a complex colloidal system, shedding light on the interactions among major wine components and explaining the variability in bentonite efficiency observed in the wine industry.

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ID: 166 / Poster session 1: 30

Abstract Submission

Topics: Analysis and composition of grapes, wines, wine spirits, Winemaking processes and oenological practices

Keywords: Asymmetrical Flow Field-Flow Fractionation, macromolecules, red wine, astringency, TCATA

Modulation of the Tannic Structure of Tannat Wines through maceration techniques : Cross Analytical and Sensory study

Laura LESCOT[1,2,3,4], Elodie GASSIOLLE[2], Fréderic VIOLLEAU[1,3], Marianne GOSSET[4]

[1]Plateforme TFFFC, Université de Toulouse, INP-PURPAN, 75 Voie du Toec, 31076 Toulouse, France; [2]Plaimont R&D, 99 Route de Corneillan, 32400 SAINT-MONT, France; [3]Laboratoire de Chimie Agro-industrielle, LCA, Université de Toulouse, INRA, 4 Allée Emile Monso, 31000 Toulouse, France; [4]Département sciences de l'agroalimentaire et de la nutrition, Université de Toulouse, INP-PURPAN, 75 Voie du Toec, 31076 Toulouse, France; laura.lescot@partner.purpan.fr

The Tannat grape, native to the foothills of the Pyrenees in France, is known for producing wines with intense colour, exceptional tannic structure, and remarkable aging potential. These distinctive characteristics are attributed to its unique genome, making Tannat one of the grape varieties with the highest tannins concentration. While this contributes to the variety's uniqueness, it also presents a challenge for winemakers, who must carefully manage maceration processes to avoid producing wines with excessively harsh tannic structures. In response to this challenge, a study was conducted in Madiran during the 2024 harvest focusing on the vinification of a Tannat plot. The experiment was designed at the 4,6 hl scale, with three distinct maceration protocols (72h pre-fermentation maceration at 17°C (PFM), 5 days maceration at 20°C (MRac) and conventional 14 days maceration at 20°C (MT)). Throughout the vinification process, these three modalities were closely monitored, and physicochemical parameters were measured using standard methods. The Total Polyphenol Index (TPI) value was used as the determining factor to stop maceration for the three processes (20, 40, and 60 for MPF, MRAC, and MT, respectively). Following vinification, the macromolecular structure of the wines was analysed using Asymmetrical Flow FieldFlow Fractionation (AF4). The resulting fractograms clearly revealed distinct profiles corresponding to each maceration treatment, with a notable correlation between the spectra and TPI values. A sensory analysis based on the TCATA method, allowed an expert panel to successfully differentiate the three treatments based on their astringency levels and to identify specific descriptors that characterized the perception of astringency for each modality. These initial findings form the basis for a broader study on the macromolecules responsible for astringency. To better manage their tannic structure, the next phase of this research will explore the relationship between grape quality, vinification techniques, and the molecular compounds that contribute to the astringency of Tannat wines from Madiran.

Bibliography

none

ID: 167 / Poster session 1: 31

Abstract Submission

Topics: Winemaking processes and oenological practices

Keywords: Bleaching, protein hydrolysate, grape seed meal, CIELAB colorimetric parameters

Effect of bleaching with different agents on protein hydrolysate characteristics

María del Rosario Rodríguez-Muñoz, Francisco J. Heredia, M. Lourdes González-Miret, María Jesús Cejudo-Bastante

Universidad de Sevilla; mrodriguez48@us.es

High temperatures can reduce the phenolic content of grapes, especially anthocyanins and copigments involved in colour stabilisation of red wines [1]. This could make it difficult to maintain stable colour during storage [2]. To address this, protein hydrolysates added to red wines during the stabilisation process could preserve colour by forming a protective protein-phenolic complex [3]. However, protein hydrolysates exhibit a brown tonality, which may not be ideal as a colour stabiliser in wine due to the possible undesirable coloration. This study evaluates the effect of different bleaching agents on protein hydrolysate characteristics. The colour has been determined by CIELAB colorimetric parameters (L^*, C^*_{ab}, h_{ab}), the antioxidant activity by DPPH and ABTS, and the protein content by Kjeldahl. First, the defatted grape seed meal was dephenolised to remove phenolic compounds and discard their influence on the colour of the hydrolysates. The hydrolysate from enzymatic hydrolysis was subjected to bleaching using activated carbon (1 g/L, 5 g/L), PVPP (30 g/hL, 150 g/hL), and resin (25%, 50%). It was observed that protein hydrolysates submitted to a higher concentration of each bleaching agent presented a higher colour reduction. In terms of colour, all samples exhibited brown tonalities (h_{ab}, 62-78), except those treated with the combination of 50% resin:5 g/L activated carbon, which displayed the yellowish one (h_{ab}, 84). The lightest samples were those treated with 50% resin (L^*, 63), while the use of 150 g/hL PVPP led to darkest samples (L^*, 30), even more than the control (without bleaching). Additionally, the samples treated with the combination of 50% resin:5 g/L activated carbon, exhibited the lowest chroma value (C^*_{ab}, 12), resulting in a more greyish appearance, which makes it more suitable for not imparting colour to the wine. In addition, protein percentage did not show a significantly ($p > 0.05$) reduction in the treated samples, except for

50% resin and the combination of 50% resin:5 g/L activated carbon, which showed around 20% of reduction. However, the antioxidant activity, by both DPPH and ABTS methods, of almost all samples displayed a significant (p < 0.05) decrease, even more for the combination of 50% resin:5 g/L activated carbon and 50% resin. In conclusion, the 50 % resin and its combination with 5 g/L activated carbon proved to be the most effective in terms of colour reduction, and although the antioxidant activity and protein percentage decrease, the values are considered acceptable compared to the loss of colour involved.

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ID: 168 / Poster session 1: 32

Abstract Submission

Topics: Analysis and composition of grapes, wines, wine spirits, Vine science and link with grape and wine quality

Keywords: Nitrogen deficiency, chemical markers, prediction model

Wine chemical markers assess nitrogen levels in original grape juice

Ágnes Dienes Nagy[1], Matthieu Wilhelm[1], Frédéric Vuichard[1], Danielle Nardone[1], Marie Blackford[1,2], Thibaut Verdenal[1], Sandrine Belcher[1]

[1]Agroscope, Switzerland; [2]Changins, HES-SO University of Applied Sciences and Arts Western Switzerland, College for Viticulture and Enology, Switzerland; agnes.dienes-nagy@agroscope.admin.ch

Nitrogen (N) nutrition of the vineyard plays a crucial role in the composition of must and wine, impacting fermentation, as well as the aroma and taste of the final product. N-deficient grape juice can result in increased astringency and bitterness, and a decrease in pleasant aromas in the wine. N management in vineyards is continually evolving, influenced by climate change and emerging trends in cover crop management. These factors can affect the availability of N to the vines. Yeast-assimilable nitrogen (YAN) in grape juice is a reliable indicator of the N status of vines. Ideally, YAN should be measured at harvest to identify deficiency (YAN < 140 mg/L). However, this practice is not widely adopted, and once the wine is produced, the original YAN levels in the must cannot be determined.

This study proposes a methodology to estimate YAN concentrations in the original grape juice by analysing the wine. Several chemical markers found in wine have been identified as potential indicators of N deficiency in the grape must for the Chasselas cultivar [1]. We suggest using a predictive model based on four of these markers: proline, succinic acid, 2-phenylethanol (PhEtOH), and 2,3-methylbutanol. These markers are known to be present in all grape varieties and remain stable during wine aging.

The study builds several predictive models: a linear model as a baseline, a generalized additive model to handle non-linear relationships, and a random forest model (a flexible machine learning algorithm). We assess their predictive power using a test set (data not used in the training process). The dataset includes results from grape juice and wine analyses of 447 wines from 16 grape varieties grown in Switzerland by Agroscope between 2014 and 2023. The model provides an acceptable estimation of YAN deficiency across all grape varieties. When a single grape variety with a reasonable sample size (129) is considered, the estimation is improved to reach a median relative absolute error of 8.6% (meaning that 50 % of predictions fall within an interval of the observed value ± 8.6 %). The predictive analyses suggest that the markers with highest predictive power are the proline and PhEtOH.

This methodology has the potential to help winegrowers monitor N status post-fermentation and adjust vineyard practices accordingly, leading to improvements in wine quality. In the future, a possible web app' allowing winemakers to make one's own prediction is envisioned.

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ID: 170 / Poster session 1: 33

Abstract Submission

Topics: Analysis and composition of grapes, wines, wine spirits, Winemaking processes and oenological practices

Keywords: Sauvignon blanc, Gewürztraminer, Pinot noir, winemaking practice

Sensory and chemical effects of postharvest grape cooling on wine quality

Ulrich Pedri, Daniela A. Hey, Danila Chiotti, Eva Überegger, Andreas Sölva, Christof Sanoll, Norbert Kofler, Sebastian Lanaro, Peter Robatscher, Andreas Putti

Laimburg Research Centre, Italy; daniela.hey@laimburg.it

Wine cellars are affected by seasonally fluctuating workloads and face challenges especially in the harvest period connected to the required timely processing of the harvested grapes. In particular, wine varieties such as Sauvignon blanc white wine and Pinot noir red wine might increase these challenges due to their elevated cultivated amounts worldwide. In addition, specific regions produce considerable amounts of autochthonous grapes, for example Gewürztraminer in South Tyrol, Italy, which during harvest creates elevated workload for the local cellars. Storing the grapes for a short period of time after harvest might decrease the need for direct processing of the grapes, flattening the workload peak. Our experiments aimed to determine the influence of grape cooling applied

after harvest on the sensory and chemical aroma profile of Sauvignon blanc, Gewürztraminer and Pinot noir wines. While Pinot noir wine mainly changes its aroma profile upon storing the grapes for two days at 20 °C, Sauvignon blanc and Gewürztraminer wine aroma is also influenced when the grapes are stored at lower temperatures of between 4 and 12 °C for two or three days. An additional cold maceration step at 8 °C for 16 hours (Sauvignon blanc) or 5 to 7 days (Pinot noir) shows less influence, especially in the red wine, and might depict an alternative to the storage of the intact grapes. Our study presents a detailed investigation of changes in sensory properties and volatile organic compound concentrations in the wines upon grape cooling and/or maceration of the grapes.

Bibliography

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ID: 172 / Poster session 1: 34
Abstract Submission
Topics: Analysis and composition of grapes, wines, wine spirits
Keywords: Grape Pomace, composition, safety, functional food

Evaluation of the composition of pomace from grapes grown in the slopes of the Popocatépetl volcano (Puebla, Mexico). Feasibility of its application for obtaining functional foods

Samia Andrade Alle[2], Ana Ortega-Regules[2], Ana Belén Bautista-Ortín[1], Encarna Gomez-Plaza[1]
[1]University of Murcia, Spain; [2]Universidad de las Americas Puebla, Mexico; encarna.gomez@um.es

Grape pomace is the main byproduct generated during wine production and is primarily composed of skins and seeds, which are obtained after the pressing stage [1]. This byproduct retains a significant amount of nutrients, such as fiber, phenolic compounds, unsaturated fatty acids, vitamins, and minerals. After being dehydrated and micronized, grape pomace has been incorporated into various foods, such as bread [2], pasta [3], cookies [4], yogurts [5], candy [6], and dressings [7], to enrich them with fiber and phenolic compounds. To determine whether this byproduct is safe for functional food production, this study evaluated Syrah grape pomace from the 2023 and 2024 harvests in the Puebla region, Mexico, whose vineyards are located near the Popocatépetl volcano, active since 1994. Its chemical composition was analyzed using bromatological analysis, and the mineral and heavy metal content was determined using atomic absorption spectroscopy. The results showed no significant differences in protein, total fat, or ash content between the pomace samples from both harvests. However, the 2023 pomace had a significantly higher insoluble fiber content. Regarding the composition of skins and seeds in the pomace samples, significant differences were observed only in fat content. The predominant minerals in all samples were potassium, calcium, and magnesium, with higher concentrations in the skins. Heavy metals, such as lead, mercury, and arsenic, were also detected in the pomace samples from both harvests, exceeding the maximum permissible limits for dietary supplements or powdered products [8]. Therefore, these findings highlight that grape pomace from the Puebla region, Mexico, has the potential to be used as a functional ingredient to enrich foods with fiber and essential minerals like potassium, calcium, and magnesium. However, its addition should be moderated due to the high concentration of heavy metals.

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ID: 174 / Poster session 1: 35
Abstract Submission
Topics: Analysis and composition of grapes, wines, wine spirits
Keywords: Volatilome analysis, Olfactometry, Chasselas grape, Aging

What Defines the Aging Signature of Chasselas Wines?

Marie Blackford[1,2], Ágnes Dienes Nagy[1], Pascale Deneulin[2], Pascal Fuchsmann[1], Vivian Zufferey[1], Gilles Bourdin[1]
[1]Agroscope, Switzerland; [2]Changins, HES-SO University of Applied Sciences and Arts Western Switzerland, College for Viticulture and Enology, Nyon, Switzerland; agnes.dienes-nagy@agroscope.admin.ch

Chasselas is a refined grape variety renowned for its subtlety and its remarkable ability to reflect terroir characteristics [1]. Typically consumed young, it is appreciated for its low acidity and delicate fruity and floral aromas. However, in specific terroirs such as Dézaley (Canton of Vaud, Switzerland) and under particular vinification conditions, Chasselas can evolve with aging, developing complex aromatic profiles with notes of dried fruit and honey. Despite its cultural importance, scientific studies on the aging bouquet of Chasselas remain limited, with most existing knowledge being empirical.

This study investigates the aging potential of Chasselas wines from the Dézaley appellation by comparing the 2009 and 2022 vintages from four different estates known for their quality and historical availability of aged wines. The objective is to analyze the differences between young and aged Chasselas wines and to assess the influence of vintage and estate on their characteristics.

To achieve this, gas chromatography coupled with mass spectrometry (GC-MS), olfactometric analysis, and standard wine analyses were conducted to determine the chemical composition of the wines. Sensory evaluations, including napping and sensory profiling, were also performed to characterize the organoleptic properties of aged Chasselas wines. Key compounds were identified as markers of aging: furfural (bready note) in older wines and isoamyl acetate (fruity, banana note) in younger wines, while 3-ethoxy-1-propanol decreased over time. Olfactometric analysis identified 32 aromatic compounds, revealing that younger wines predominantly exhibit fresh, fruity aromas, whereas aged wines develop richer and more complex profiles. Sensory and olfactometric results findings aligned. The analysis of chemical compounds highlighted the complexity of the composition of aged Chasselas wines, emphasizing the importance of integrating sensory, chemical, and standard analyses to better understand their quality and aging potential.

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ID: 176 / Poster session 1: 36
Abstract Submission
Topics: Analysis and composition of grapes, wines, wine spirits
Keywords: tannins quantification, fluorescence quenching, rhodamine fluorophore

A fast and sensitive method for total tannin determination in wine based on the substoichiometric quenching of silicon-rhodamine conjugates

Daniel Bátora[1,2], Ágnes Dienes Nagy[3], Liming Zeng[4], Christian E. Gerber[1], Jérôme P. Fischer[1], Martin Lochner[1], Jürg Gertsch[1]

[1]Institute of Biochemistry and Molecular Medicine, University of Bern, 3012 Bern, Switzerland; [2]Graduate School for Cellular and Biomedical Sciences, University of Bern, 3012 Bern, Switzerland; [3]Agroscope, Switzerland; [4]University of Applied Sciences and Arts of Western Switzerland (HES-SO), Changins Viticulture and Enology College, 1260 Nyon, Switzerland;
daniel.batora@unibe.ch

Tannins are chemically diverse polyphenols contributing to important sensory attributes of food and beverages. In wine, their structure and quantity depend on several factors, such as the grape variety, climate, soil, viticultural and enological practices and the wine-aging process. Therefore, their accurate and cost-effective quantification is essential to optimize polyphenols profiles during wine making.

Conventional tannin quantification methods are primarily colorimetric, some of which suffer from a high interference with anthocyanidins and therefore are unsuitable for many emerging disease resistant grape varieties. Even though precipitation-based methods remain a relatively good proxy for astringency they are difficult to scale to large number of samples.

Fluorescence or chemiluminescence-based assays could provide a more practical alternative by offering high sensitivity while minimizing interference artefacts.

We recently discovered a novel fluorescence quenching mechanism of synthetic rhodamine fluorophores with a high selectivity towards tannic acid (TA) and catechin-3-gallate (C3G). Specific chemical conjugates of silicon-rhodamine with alkyl linkers attached to bulky apolar moieties (SiR) had a detection limit near 500 pM and a linear range spanning 5–100 nM for TA.

The technique was applied to quantify condensed tannins present in wine and was compared to a methylcellulose precipitation and acidic butanolysis. We validated the assay on 18 distinct red wine samples, which showed high linearity (R2 = 0.92) with methylcellulose precipitation. The variability between the individual measurement points was consistent for SiR-quenching and methylcellulose precipitation for all samples. Additionally, when tested with pure standards, the assay was two orders of magnitude more sensitive towards catechin-3-gallate than to malvidins, making it suitable for wines with high anthocyanin content like new resistant grape varieties.

In conclusion, a novel assay was developed and validated that allows the sensitive and selective quantification of tannins abundant in food and beverages.

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ID: 178 / Poster session 1: 37
Abstract Submission
Topics: Analysis and composition of grapes, wines, wine spirits, Sensory properties: psychophysics, experimental economy, connections with neurosciences
Keywords: Ethyl acetate, sweet wines, detection and complexity threshold, HS-SPME-GC/MS

Evolution and contribution sensory of ethyl acetate in sweet wines

Emilie Paudois, Sophie Tempère, Axel Marchal
Université de Bordeaux, France; emilie.paudois@u-bordeaux.fr

Ethyl acetate (EtOAc) is the main ester present in all wines, generally produced by yeasts during alcoholic fermentation and sometimes by bacteria during barrel ageing. Its odor is characterized by solvent notes, which give wines their acescent note [1]. Empirical observations have shown that in sweet wines, this note is often perceptible when tasting in the bottle, whereas it is not present at the end of barrel ageing. The perception of acescence is explained by an increase in EtOAc of the order of 100 to 150 mg/L in sweet wines. This phenomenon has also been observed in red wines, but its extent remains limited and unexplained [2]. The aim of this study is to establish the concentrations of EtOAc found in sweet wines and to study its sensory influence on their olfactory perception.

To assay the levels of EtOAc in a sensitive and precise way, an HS-SPME-GC/MS method was developed in the laboratory. A series of quantitation was carried out on several samples of sweet wines from *Botrytis cinerea* and “passerillage”. The results revealed great variability in EtOAc, with concentrations ranging from 90 to 300 mg/L, highlighting both an estate effect and a vintage effect. The origin of these high levels compared to other types of wine is unexplained in the literature, and certainly have a non-negligible impact on the sensory space of sweet wines [3]. As EtOAc perception is matrix-dependent, its detection threshold has been determined here at 136 mg/L in a botrytized sweet wine by two different panels. To complement these sensory data and further investigate the contribution of EtOAc, a concept of complexity threshold was introduced and investigated, on the same model as the detection threshold. Samples containing the 95 and 115 mg/L EtOAc additions were judged significantly more complex than the wine with no addition. These results showed that EtOAc can play a role in wine complexity. Both concentrations were infra-threshold, demonstrating that EtOAc has an indirect influence on olfactory perception. When EtOAc was clearly detected, the wine loses

complexity and may even be rejected. These results provide a better understanding of the influence of EtOAc on the sensory space of sweet white wines.

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ID: 182 / Poster session 1: 38
Abstract Submission
Topics: Winemaking processes and oenological practices
Keywords: Fining agent, pinot noir, astringency, bitterness

Impact of fining agents on Swiss Pinot Noir red wines

Liming ZENG[1], Aleksandr Arakelyan[1], Ágnes Dienes-Nagy[2], Lama Aleid-Germanier[3], Kelly Marti[1], Pierrick Rébénaque-Martinez[1], Philippe Mayer[3], Laurent Amiet[2], Stefan Bieri[2], Olivier Viret[3]
[1]Changins college for viticulture and enology, University of Applied Sciences and Arts of Western Switzerland (HES-SO), Route de Duillier 52, 1260 Nyon, Switzerland; [2]Agroscope, Route de Duillier 60, 1260 Nyon, Switzerland; [3]Service de l'Agriculture et de la Viticulture (SAVI), 1110 Morges, Switzerland; liming.zeng@changins.ch

In the context of climate change, excessive bitterness and astringency in wines have become increasingly prevalent. While variety selection and viticultural practices offer long-term solutions, they require considerable time before yielding practical results. In contrast, fining remains an accessible and immediate tool for winemakers. However, many experienced wine professionals still struggle to fully understand the effects of different fining agents on their wines. Additionally, with new European regulations on wine labeling, there is an urgent need to better comprehend the mechanisms of different fining agents across various wine matrices to ensure informed decision-making in cellar.

Fining is a technique commonly used in winemaking to correct the levels of bitterness and astringency in wines. Various fining agents are employed for this purpose, such as gelatin, egg whites, pea protein, potato protein, casein, etc. Studies in this field have shown that each fining agent has a very different impact on the characteristics of the wine, and their effects also depend on the specific composition of the wine [1-3]. To our knowledge, no study in the literature has reported the impact of different fining agents on Pinot Noir wines.

This study evaluated the impact of four commercial fining agents: gelatin, egg albumin, pea protein, and potato protein, on the phenolic composition and sensory properties of two Pinot Noir wines. At the lowest recommended dosage, gelatin was the most effective in reducing total phenolic compounds, condensed tannins, mean degree of polymerization (mDP), yellowness and astringency. Notably, this is the first study demonstrating that mDP in Pinot Noir wines is significantly affected by fining. Pea protein proved to be the most efficient in reducing bitterness, aligning with empirical observations from Swiss Pinot Noir producers. Our results further highlight the significant influence of phenolic richness and maturation stage on the effectiveness of fining. Wines with lower phenolic content were more strongly affected, emphasizing the need for a tailored approach based on wine composition and aging stage. Additionally, the observed reduction in yellowness suggests that oxidized pigments were partially removed during fining. These findings underscore the importance of carefully selecting fining agents and adjusting their dosages according to the maturation stage and the desired wine style, particularly for delicate varieties such as Pinot Noir.

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ID: 186 / Poster session 1: 39
Abstract Submission
Topics: Analysis and composition of grapes, wines, wine spirits
Keywords: Redox state, wine oxidation, electrochemistry

Studying the redox state of wines under oxidative processes with a multi-parametric analysis

Alice DAUPHIN[1], Samuel GUILBAULT[1], Fabrice MEUNIER[2], Arnaud MASSOT[2], Virginie MOINE[2], Stéphane ARBAULT[1]
[1]Univ. Bordeaux, CNRS, Bordeaux INP, CBMN, UMR 5248, F-33600 Pessac, France; [2]Biolaffort, 11 rue Aristide Berges, 33270 Floirac, France; stephane.arbault@u-bordeaux.fr

The detection of reducing compounds such as phenolic acids, anthocyanins or tannins is of prime importance to decipher on the antioxidant and anti-aging properties of wines. Spectrophotometric methods (ABTS, DPPH) are the reference methods, but their major limitation is their interference with other reducing compounds present in wines.[1] In this context, electrochemical methods are of great interest, as they are fast, easy to use and well selective for such species. Various procedures are described in the literature, based on voltammetric techniques associated with carbon electrodes, in some cases functionalized to improve detection sensitivity and/or increase selectivity towards interfering compounds.[2-4] Approaches based on the use of screen-printed disposable sensors (PolyScan Vinventions) made also possible to obtain a fingerprint and/or classification of certain phenolic compounds, or to study different alternatives to oak wood for the wine industry.[5,6] The research performed by RedoxWine joint laboratory (CBMN - Biolaffort) is first devoted to the development of analytical protocols based on electrochemical methods to detect some key molecules in wine and define a signature or fingerprint of its redox state in real time. Several electrochemical sensors are developed to study the relationships between reductants, i.e. concentrations of sulfite, phenols and derivatives, and the levels of oxidants, first oxygen and

daughter Reactive Oxygen Species (H_2O_2, O_2°-), generated or provided in a controlled manner. We are thus studying wine responses under controlled oxidative stress, starting from normoxic conditions to chemically forced conditions (additions of known concentrations of O_2, H_2O_2 or by direct electrochemical oxidation of the wines) to accelerate matrix ageing processes. The evolution of the wines redox chemistry was monitored using a combination of spectroscopic and electrochemical techniques: redox state, sulfites, dissolved O_2, pH, color (CieLab parameters) or thiols.[7]

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ID: 192 / Poster session 1: 40
Abstract Submission

Topics: Analysis and composition of grapes, wines, wine spirits, Chemical and biochemical reactions, including grape and wine microorganism's impact
Keywords: Aging, Catechin, Mass spectrometry, Oxidation

Identification of compounds produced by reactions of flavonoids and acetaldehyde in wine

Ezekiel Warren, Ryan J. Elias, Misha T. Kwasniewski
The Department of Food Science, The Pennsylvania State University, United States of America; erw5235@psu.edu

During aging, wine consumes small amounts of oxygen. This oxygen intake triggers a series of reactions that lead to flavonoid elongation, which is known to reduce bitterness and astringency while enhancing color stability. The oligomers and polymers formed during aging differ from those produced in the non-aging reactions, as they contain ethylidene-bridges, —a result of acetaldehyde formation, an oxidation product of ethanol [1]. High oxygen ingress can lead to off-flavors, depending on the wine's stability, with excessive exposure potentially resulting in vinegar formation. Acetaldehyde, a key intermediate in this cascade of reactions, could potentially be added exogenously after fermentation to induce aging qualities without the associated risk of high oxidation. To investigate the effect of this, exogenous acetaldehyde was initially added to model wine (12.5% EtOH, 250 mg/l Catechin, pH 3.5) at 0, 50 and 250 mg/l, at two temperatures (4 and 35 ℃) and with or without SO_2. Samples were collected over 21 days and analyzed using LC-MS/MS, utilizing multiple-reaction-monitoring for ethylidene bridged catechin oligomers. Higher temperature and acetaldehyde concentration accelerated the formation of ethylidene-bridged products. However, sequential acetaldehyde addition did result in a final difference in product formation. Furthermore, the addition of SO_2 as KMBS at 250 mg/l did not completely inhibit elongation but rather slowed the reaction. To further confirm that the observed products were the result of acetaldehyde bridging, acetaldehyde-d_4 was reacted with catechin using the same solution. Ions with an *m/z* value 4 higher than those in the previous experiment were observed, indicating that acetaldehyde was being consumed in the reaction. Ions resulting from the addition of both acetaldehyde and acetaldehyde-d_4 were identified using a LC-MS metabolomics workflow, demonstrating the formation of multiple products. Combinations of catechin, procyanidin B2, malvidin-3-O-glucoside and acetaldehyde or acetaldehyde-d_4 were reacted in model wine and the predicted ions associated with polymerization via acetaldehyde were detected. Acetaldehyde was also added to Cabernet Sauvignon wine, and MRM methods were used to detect if ions corresponding to ethylidene bridges. Overall, this research could provide winemakers with a new tool for chemically modifying their wines, enhancing desirable aging characteristics while minimizing the risks associated with excessive oxidation.

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N/A

ID: 197 / Poster session 1: 41
Abstract Submission

Topics: Analysis and composition of grapes, wines, wine spirits
Keywords: Metal reducing agents, off-odors, sulfur compounds, polysulfides.

Metal reducing agents (Fe and Al) as possible agents to measure the dimensions of the hydrogen sulfide (H_2S) pool of precursors in wines

Susana Ainsa-Zazurca, Vicente Ferreira
Laboratory of Aroma Analysis and Enology (LAAE) associated with AgriFood Institute of Aragon (IA2). University of Zaragoza. Zaragoza, 50009, Spain.; sainsa@unizar.es

Reductive wine fault is characterized by the presence of odors such as rotten eggs or spoiled camembert cheese, originating from hydrogen sulfide (H_2S) and methanethiol (MeSH) [1]. These compounds stabilize in polysulfide forms, creating a complex pool of precursors that will revert to both molecules when the environment becomes anoxic [2]. A recent study [3], confirmed by ongoing

research [4], suggests that wines could contain between 1 and >2.6 mg/L of H_2S precursors. However, there are no methods to determine the dimensions of this pool within a reasonable timeframe, as its development through spontaneous reduction takes more than 3 months at 75ºC. The aim of this study was to evaluate whether metallic reducers, such as Fe and Al, could serve as an effective alternative to evaluate the pool of H_2S and MeSH precursors.

Methods: Wines (reals and models) were incubated in containers holding vials with CuCl-based trapping solutions. Traps were analyzed by GC-SCD to determine H_2S and MeSH levels; and replaced by fresh trapping solutions [3]. Effects of wine pH (3 to 5.5), SO_2 (0-150 mg/L), temperature (ambient and 50°C), metal dose (between 8 and 40 cm of Fe wire per 80 mL), and acetaldehyde concentration (1-4 g/L for Fe and 1-10 g/L for Al) were evaluated.

Results: In all cases, SO_2 was a strong interference, as it is reduced to H_2S by both metals. However, its reduction can be partially limited by the addition of acetaldehyde, pH adjustment, and regulating the amount of metal present. Al was particularly sensitive to SO_2 interference, as its production could not be completely avoided even with 10 g/L of acetaldehyde. Additionally, Al was highly inefficient in reducing H_2S precursors, leading to the conclusion that it is not suitable for this assay. Contrary, Fe was significantly more effective, though it was also capable of reducing SO_2. At room temperature, at pH 4.5 with 2 g/L of acetaldehyde, the amount of SO_2 reduced to H_2S was marginal (<0.5 µg/L/day per 10 mg/L of SO_2 present). However, under these conditions, the pool of precursors could not be effectively reduced, yielding no more than 0.4 mg/L of H_2S and 16 µg/L of MeSH after 10 days of incubation. At 50°C, it was necessary to add 4 g/L of acetaldehyde to limit the reduction of SO_2 to H_2S (<2 µg/L/day per 10 mg/L of SO_2 present). Under these conditions the total reduction of the pool of precursors appears to be achieved within 10 days, allowing for a reasonable estimation of the H_2S and MeSH pool of precursors.

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ID: 198 / Poster session 1: 42
Abstract Submission
Topics: Analysis and composition of grapes, wines, wine spirits
Keywords: Terroir, tradition, Vitis vinifera, heritage, phenotypes

South American Creole grapevines: new varieties identified in the Caravelí Valley (Peru) and their aromatic profile

Naíssa Prévide Bernardo[1], Keith Díaz[2], Renata Vieira da Mota[3], Eduardo Purgatto[4,5], Sebástian Debernardi Ruiz-Eldredge[6], Gustavo A. Aliquó[7], Yasser Hidalgo[8]

[1]Department of Biotechnology, University of Verona, Villa Lebrecht, via della Pieve 70, 37029 San Pietro in Cariano (VR), Italy; [2]Ingeniero Agrónomo. Consultor en Viticultura y Enología; [3]Minas Gerais Agricultural Research Agency (EPAMIG), Experimental Field of Caldas, Grape and Wine Technological Centre, Avenida Santa Cruz, 500, postal code 33, 37780-000, Caldas, Brazil; [4]Department of Food Science and Experimental Nutrition, School of Pharmaceutical Sciences, University of São Paulo, Avenida Prof Lineu Prestes, 580, bl 14, 05508-000, São Paulo, Brazil; [5]Food Research Centre, University of São Paulo, São Paulo, Brazil; [6]Ingeniero Agrónomo, Consultor en Viticultura y Enología; [7]Instituto Nacional de Tecnología Agropecuaria (INTA), Mendoza, Argentina. Master en Viticultura y Enología; [8]Ingeniero de Industrias Alimentarias, Asesor Enológico y Consultor en Bioprocesos;
naissa.previdebernardo@univr.it

The valley of Caravelí (Peru) received the first vine plants in colonial times and the tradition of cultivation is maintained thanks to its *terroir* and artisanal techniques. In order to maintain the tradition and pass it on to the next generations, the vines were geo-referenced (1780 m,18 L 678350 8253911), and DNA tests were carried out, where two non-catalogued varieties were identified [1]. The non-catalogued varieties are Jaén (white grape) and Cantarilla (red grape), which had a genetic profile inherited from the varieties Moscatel de Alejandría and Listan Prieto, and it is a heritage from Perú. To test the potential of these varieties for wine production, the researchers made varietal wines from them and a very important attribute that gives quality and character to the wines is the aromatic profile [2]. For the aromatic analysis of these two varieties, the wine samples were injected in triplicate and analysed by HS-SPME/GC-MS. Even if these two varieties are new clones from Listan Prieto and Moscatel de Alejandría, they present different phenotypes, and it can also be evaluated in the aromatic profile of them. Jaén cultivar showed higher amounts of terpenoid compounds (α-terpineol, linalool, ß-damascenone, nerol oxide), ethyl esters and their precursors volatile fatty acids (C6, C8, C10, C12), which contributes to the wine of this variety showing aromas of pineapple, manzanilla, pear, peach, variety in which the fruity character (citrus and stone fruit) stands out. On the other hand, the Cantarilla variety presents a lower quantity of these compounds and stands out for its floral aroma, due to the higher quantity of the phenethyl alcohol compound that smells of rose. The attributes of the varietal wines were evaluated by sommelier professionals and the descriptors pointed by them were very similar to the chemical data. Thus, besides additional harvests that should be done to characterize the aroma and phenolic profiles of these varieties, Jaén and Cantarilla varietal wines have a great potential to be produced and marketed by Peruvian winemakers.

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ID: 199 / Poster session 1: 43
Abstract Submission
Topics: Analysis and composition of grapes, wines, wine spirits
Keywords: Table grapes, volatile compounds, GC-MS, methyl anthranilate, Vitis labrusca

Aroma profile evaluation in whole grape juices

Naíssa Prévide Bernardo[1], Laura Franco Carvalho Lucas[2], Angélica Bender[2], Francisco Mickael de Medeiros Câmara[2], Claudia R. de Souza[2], Gabriela Fontes Alvarenga[2], Lucas Bueno do Amaral[2], Eduardo Purgatto[3,4], Renata Vieira da Mota[2]

[1]Department of Biotechnology, University of Verona, Villa Lebrecht, via della Pieve 70, 37029 San Pietro in Cariano (VR), Italy; [2]Minas Gerais Agricultural Research Agency (EPAMIG), Experimental Field of Caldas, Grape and Wine Technological Centre, Avenida Santa Cruz, 500, postal code 33, 37780-000, Caldas, Brazil; [3]Minas Gerais Agricultural Research Agency (EPAMIG), Experimental Field of Caldas, Grape and Wine Technological Centre, Avenida Santa Cruz, 500, postal code 33, 37780-000, Caldas, Brazil; [4]Food Research Centre (FoRC), University of São Paulo, São Paulo, Brazil; naissa.previdebernardo@univr.it

Table grapes (*Vitis labrusca* and hybrids) are widely cultivated in Brazil [1] due to the climate, their resistance to disease and the way they are consumed and commercialized, either in-natura or for processing, producing whole juices, jams and table wines. Focusing on juices, the diversity of cultivars is interesting due to their specific organoleptic characteristics [2] to increase consumption. The aim of this study was to evaluate the volatile composition profile of 9 grape juices produced in the summer harvest 22/23 using the enzymatic method [3] in the microprocessing laboratory of EPAMIG in Caldas/Brazil. The juices of Bordô Clone Bocaína, BRS Carmem, BRS Concord Clone 30, BRS Cora, Isabel, Isabel Precoce, BRS Magna, BRS Rúbea and BRS Violeta cultivars were analyzed by HS-SPME/GS-MS and a total of 118 free compounds were identified among the varieties. Among the classes of compounds that stand out most for their pleasant sensory characteristics are benzenoids, terpenoids, furanoids and esters, and it is possible to see differences in these classes between the cultivars. For Isabel Precoce, Bordô, Isabel and Concord Cl 30 cultivars, the classes that stand out are the benzenoids, mainly the phenethyl alcohol compound with a rose aroma, and the terpenoids, the α-terpineol and linalool compounds, with a lilac and pleasant flower smell, respectively, as well as the combination of other compounds in smaller quantities. In the Cora and Violeta cultivars, the esters were more prominent, with ethyl 2-butenoate having a caramelized, fruity smell. Furanoids such as mesifuran (sweet, baked caramel, strawberry) and to a lesser extent furfural (sweet, almond, baked bread), and terpenoids linalool and ß-damascenone (fruity, sweet, honey) in the juice of Rúbea cultivar. For Carmem juice, furanoids stand out, especially the compound furfural; and for Magna juice, esters and terpenoids, ethyl 2-butenoate, ethyl phenylacetate (odor suggestive of honey), ß-damascenone and linalool. Studies have shown that the main compounds in *Vitis labrusca* and hybrid grapes are methyl anthranilate and furaneol, which have a foxy, earthy and sweet aroma; nevertheless, methyl anthranilate and ethyl anthranilate were evaluated in greater quantities in the Bordô cl Bocaína and Concord cl 30 juices and furaneol in the juice of Concord Cl 30 cultivar. Thus, the volatile compounds evaluated on this first harvest showed the peculiarities on the aromatic profile of grape juices from 9 different cultivars, demonstrating the potential to diversify grape juices production.

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ID: 201 / Poster session 1: 44

Abstract Submission

Topics: Analysis and composition of grapes, wines, wine spirits

Keywords: Lipids profiling, Musts, Yeast nutrition, Settling

Comprehensive Lipid Profiling of Grape Musts: Impact of Static Settling

Louise Ramousse[1], Zandile Mlamla[2], Jean-Paul Pais de Barros[2,3,4], Hervé Alexandre[1], Chloé Roullier-Gall[1]

[1]Université Bourgogne Europe, Institut Agro, INRAE, UMR PAM F-21000 Dijon, France; [2]Plateforme DiviOmics, US 58 BioSanD, Université Bourgogne Europe, Dijon, France; [3]UMR1231, Inserm/Université Bourgogne Europe, Dijon, France; [4]LipSTIC Labex, Dijon, France; louise_ramousse@etu.u-bourgogne.fr

Lipids are crucial in alcoholic fermentation, influencing yeast metabolism by providing nutrients and modulating membrane composition [1]. They also serve as precursors to aromatic compounds shaping wine sensory profiles [2]. While sterols and unsaturated fatty acids have been extensively studied, the overall lipid composition in grape musts remains poorly understood. Many lipid families, including phospholipids, sphingolipids, and glycolipids, have been largely overlooked. This study aims to provide a comprehensive lipid profile by identifying as many species as possible, beyond the commonly studied sterols and fatty acids.

Clarification, a widespread winemaking process, significantly reduces lipid availability, potentially leading to slow or stuck fermentations and undesirable aromas [4-6]. This study examines white grape musts from eight varieties and the impact of static settling on lipid composition. Initially, untargeted LC-MS QToF was used to capture a broad lipid spectrum, guiding targeted quantification methods. Free fatty acids, total fatty acids, and sterols were quantified via GC-MS, while phosphatidylcholine, phosphatidylethanolamine, phosphatidylinositol, steryl esters, glycerolipids, and ceramides were analyzed by LC-MS.

For the first time in grape must analysis, an untargeted LC-MS QToF approach enabled the detection of 562 lipid compounds, 112 of which were confirmed as sphingolipids, fatty acids, phospholipids, glycerolipids, and sterols. Some lipid subclasses, such as (lyso)phosphatidylethanolamines, (lyso)phosphatidylinositols, and steryl esters, had never been reported in grape musts. Targeted quantification by GC-MS and LC-MS identified 375 lipids across nine subclasses, with 297 displaying significant differences (ANOVA α=0.05). Clarification significantly affected lipid concentrations, impacting 73% of detected species (Kruskal-Wallis α=0.05), particularly sterols, fatty acids, and phospholipids—key molecules for yeast metabolism.

These findings underscore the importance of studying the full complexity of lipid composition in grape musts and suggest that revising clarification practices could help preserve essential lipids, thereby improving fermentation efficiency and wine quality. Overall, this study provides new insights into the lipid composition of grape musts and the nutritional challenges yeast may face during fermentation.

Bibliography

None

ID: 203 / Poster session 1: 45
Abstract Submission
Topics: Analysis and composition of grapes, wines, wine spirits, Chemical and biochemical reactions, including grape and wine microorganism's impact
Keywords: Wine, Lactic Acid Bacteria, Malolactic fermentation, Metabolomic

The role of malolactic bacteria metabolism on the organoleptic qualities of wines

Amaury Aumeunier[1,2], Chloé Roullier-Gall[1], Benjamin Leroux[2], Magali Deleris-Bou[2], Stéphanie Weidmann[1]
[1]Université de Bourgogne Europe, Institut Agro, INRAE, UMR PAM, F-21000 Dijon, France; [2]LALLEMAND S.A.S, Blagnac, France; amaury_aumeunier@etu.u-bourgogne.fr

Lactic acid bacteria (LAB) are essential microorganisms in winemaking due to their role in malolactic fermentation (MLF) [1]. This process not only ensures the biological stabilization of wine through the decarboxylation of malic acid into lactic acid but also contributes to modifications in the chemical composition of the wine [2][3]. While the metabolic activity of LAB is known to influence key wine properties, the detailed metabolomic impact of different LAB strains in varying wine matrices remains poorly understood.

This study aimed to investigate metabolomic profiles resulting from the activity of nine LAB strains across four distinct wine matrices, using advanced metabolomic tools such as liquid chromatography-mass spectrometry (LC-MS) [4]. First the untargeted analysis focused on major families of compounds, including phenolic compounds, lipids, amino sugars, peptides, and carbohydrates. Then a targeted approach using KEGG libraries allowed to identify molecules of interest.

The results reveal different metabolic profiles, which can be attributed to the specific metabolic characteristics of the strains tested. Indeed, some of the tested LAB strains exhibited higher activity on phenolic compounds, potentially impacting wine stability and mouthfeel, while others were more associated with changes in lipids, carbohydrates or peptides fractions, which could influence downstream fermentation processes or the physicochemical properties of wine. The composition of the starting wine matrix was also found to play a critical role, as certain matrices favored the production or transformation of specific families of compounds within the same strain.

These findings provide new insights into the metabolic diversity of LAB and their interactions with the chemical environment of wine. Thus, the selection of specific LAB strains could be a powerful tool for tailoring the metabolic profile of wines, depending on the initial composition of the wine and the desired characteristics.

Further exploration could be undertaken into how LAB metabolism can be harnessed to achieve specific enological objectives.

Bibliography
None

ID: 204 / Poster session 1: 46
Abstract Submission
Topics: Chemical and biochemical reactions, including grape and wine microorganism's impact
Keywords: Wine oxidation, Yeast peptides, Antioxidant activity, Autolysis

Antioxidant Activity of Yeast Peptides released during fermentation and autolysis in model conditions

Alberto De Iseppi[1,2], Matteo Marangon[1,2], Sara Zanella[1], Andrea Curioni[1,2]
[1]Department of Agronomy, Food, Natural Resources, Animals and Environment (DAFNAE), University of Padova, Viale dell'Università 16, 35020 Legnaro, Italy; [2]Interdepartmental Centre for Research in Viticulture and Enology (CIRVE), University of Padova, Viale XXVIII Aprile 14, 31015 Conegliano, Italy; sara.zanella.3@phd.unipd.it

Aging wine on lees benefits different wine sensory and technological properties including an enhanced resistance to oxidation. Several molecules released by yeast, such as membrane sterols and glutathione, have been previously proposed as key factors for this activity [1]. However, recent research testing various yeast extracts from wine lees reported that the improved oxidative stability did not appear to be related to membrane lipids nor directly correlated with glutathione concentration [2,3]. Conversely, chemical and electrochemical tests indicated the extract's low molecular weight fraction, containing yeast-derived peptides beyond glutathione, as the primary in slowing catechin oxidation in model wine [2]. A subsequent study investigated the peptides' release under model conditions during synthetic must fermentation and up to six months of lees contact, revealing the release of a significant peptide fraction (~1 g/L) composed of over 2300 sequences identified via LC-MS/MS, whose antioxidant activity was not tested [4]. Building on this approach, the present study examined peptides released after 7 and 240 days from inoculum. After ultrafiltration (MWCO 3 kDa) and purification using C18 cartridges, peptides were quantified with Pierce Quantitative Peptide Assays and their antioxidant activity was assessed with DPPH assay and by measuring their effect in reducing the browning due to the oxidation of catechin in model wine.
Results showed an increase in peptide concentration from 0.19 g/L at 7 days to 0.44 g/L at 240 days. Despite the lower concentration, the 7-day peptide fraction exhibited slightly higher antioxidant activity than the 240-day one (0.32 vs. 0.21 mM Trolox equivalents, respectively). When both peptide fractions were added at the same concentration (0.3 g/L) to a model wine enriched with catechin and exposed to oxygen at 13°C for 50 days, browning development (measured as A450nm) was 10 times lower than that of the untreated control. These results suggest that yeast-derived peptides capable of protecting catechin from oxidation were already present in the system at the end of fermentation.
These findings highlight the role of yeast-derived peptides in protecting wine from oxidation, explaining the reasons behind the application of lees aging and the addition of inactivated yeast extracts for this purpose. Future research will focus on identifying the peptides with antioxidant activities, and also those with antimicrobial properties, providing a wider understanding of the role of yeast peptides in the wine matrix.

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ID: 206 / Poster session 1: 47
Abstract Submission

Topics: Analysis and composition of grapes, wines, wine spirits, Winemaking processes and oenological practices
Keywords: Mannoproteins; Polysaccharide characterization; Non-Saccharomyces strains; Colloidal stability.

Colloidal Color Stabilization in Wine: A Comparative Study of Saccharomyces and Non-Saccharomyces Mannoproteins

Saul Assunção Bicca[1], Océane Quideau[1], Nathalie Sieczkowski[2], Rémi Schneider[3], Julie Mekoue[2], Céline Poncet-Legrand[1], Thierry Doco[1]

[1]Unité Mixte de Recherche Sciences Pour l'Œnologie, Institut Agro, INRAE, Université de Montpellier, Montpellier, France; [2]Lallemand, SAS, 19 rue des Briquetiers, BP 59, 31702 Blagnac, France.; [3]Oenobrands, Parc Scientifique Agropolis 2196 boulevard de la Lironde, 34980 Montferrier-sur-Lez, France.; saul.assuncao@supagro.fr

Structure-function relationships between the polysaccharide part of *S. cerevisiae* Mannoprotein Pools (MPs) and their potential to interact with anthocyanins and Protein-Tannins aggregates was previously assessed [1,2]. Herein, MPs from nine yeast strains including *Saccharomyces* and non-*Saccharomyces* species were evaluated by their potential to stabilize Colloidal Coloring Matter (CCM) of red wines. β-glucanases extraction procedure preserved mannoproteins native structure to their uttermost extent. The strains comprised a wild-type (MP-WT) *S. cerevisiae* strain and its mutants ΔMnn2 (MP-Mnn2) and ΔMnn4 (MP-Mnn4) – linear N-glycosylated backbone and absence of mannosyl-phosphate groups, respectively; non-*Saccharomyces* strains of 3 different species: *Hanseniaspora vineae* (MP-Hv), *Torulaspora delbrueckii* (MP-Td), and *Schizosaccharomyces japonicus* (MP-Sj) all grown in anaerobiosis; and three enological *Saccharomyces cerevisiae* strains grown in different metabolic conditions: MP-C1 (anaerobiosis), and MP-IC1 and MP-IC2 (aerobiosis). MPs colloidal stabilization properties were evaluated at first by their capacity to stabilize $K_4[Fe(CN)_6]$ (Prussian Blue) in presence of $CaCl_2$ [3], then by their capacity to inhibit turbidity increases (ΔNTU) of young Merlot and oxidized Marselan wines stored for 2 days at 4 °C. Wine samples after cold test were centrifuged and the color parameters of the supernatant were assessed.

Prussian blue control samples lost complete absorbance at 750 nm 24 hours after $CaCl_2$ addition at 0.8 $g.L^{-1}$. MP-Sj and MP-IC2 accelerated blue color loss. Other MPs had a stabilization effect whose efficiency depended on the MP. MP-Mnn2/MP-Mnn4 stabilized 90-100% of color followed by MP-Hv/MP-WT (~80%), and MP-C1/MP-IC1 (~60%). Increases in MP concentration did not systematically lead to increased stability, which indicates that several physico-chemical interactions were taking place simultaneously.

Concerning the stability tests in real wine conditions, MP-Sj and MP-IC2 had the same effect as in model conditions (Prussian blue) while the positive impact on colloidal stability was dependent on the wine matrix and MP concentration. In Marselan wines, MPs had a mild impact on ΔNTU at a concentration of 1 $g.L^{-1}$ whereas in Merlot wines, at the same concentration, MP-Hv, MP-Td, and MP-IC1 reduced ΔNTU of 2 to 3-fold in comparison with control samples.

Associated with the characteristics of each MP polysaccharide moiety, our findings help discover the interaction mechanisms involved in CCM and how MPs can improve its stability.

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ID: 209 / Poster session 1: 48
Abstract Submission

Topics: Analysis and composition of grapes, wines, wine spirits, Winemaking processes and oenological practices
Keywords: phenolic acids, wine by-products, antioxidant activity, oxidative degradation, HPLC-DAD-MS

Effect of polysaccharide extracts from grape pomace on the oxidative evolution of hydroxycinnamic acids

Iván Puerta-García, María Teresa Escribano-Bailón, Ignacio García-Estévez

Grupo de Investigación en Polifenoles, Facultad de Farmacia, Universidad de Salamanca, Salamanca E37007, Spain; ivanp@usal.es

Phenolic acids are especially sensitive to oxidation, so they can greatly impact wine sensory characteristics and stability [1]. Furthermore, extracts derived from grape pomace have been previously postulated as possible oenological adjuvant for wine protection [2].

Thus, in this work, the oxidative evolution of the main three hydroxycinnamic acids (HA) present in wine (caffeic, *p*-coumaric and ferulic acids) was studied for two months by means of HPLC-DAD-MS [3], identifying and quantifying their degradation products. Samples were oxygen-saturated with air, and oxygen consumption was monitored. Additionally, the effect of soluble polysaccharidic extracts (PS), obtained from white (WPS) or red grape pomace (RPS), on the evolution of the media was studied. These PS were fully characterized and their antioxidant activity was assayed by the ABTS and FRAP methods [4]. The antioxidant activity of HA in the presence of PS was also studied and ITC experiments were performed to elucidate the nature of the interactions between HA and PS.

All HA decreased their concentration with time and oxygen consumption, especially in the presence of PS. Several degradation products of HA were identified. These degradation products could, therefore, be used as oxidation markers in wines rich in phenolic acids, such as white or rosé wines, especially prone to oxidation. Ferulic acid, followed by *p*-coumaric acid, greatly decreased in concentration, achieving a reduction of around 90% with PS addition (WPS and RPS). RPS showed greater antioxidant activity than WPS, and its presence in the HA evolution assays resulted in a greater degradation of HA.

PS acid hydrolysis and HPLS-DAD-MS analysis revealed the presence of polyphenolic residues that cannot be removed, only released after PS hydrolysis, including cyanidin and delphinidin derived from their proanthocyanidin precursors. In RPS, malvidin was also found, so the anthocyanin content could explain the difference in antioxidant activity.

In the presence of transition metals (like Fe^{3+} and Cu^{2+}), some polyphenols can act as prooxidants [4], favouring the oxidative degradation of phenolic acids. In this experiment, the absence of other antioxidants in the matrix (such as free anthocyanins or tannins) can explain the faster degradation of HA, stimulated by the polyphenols in the PS, contrary to what it is believed to be the overall protective effect of polysaccharides seen in wine. The findings in HA degradation and their relationship with PS provides a deeper insight in wine oxidation and the molecular interactions in its matrix.

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ID: 211 / Poster session 1: 49
Abstract Submission

Topics: Winemaking processes and oenological practices
Keywords: Withering, postharvest dehydration, red straw wines, fermentation

Impact of grape ripening and post-harvest withering on must composition and fermentation kinetics

Marta Baviera[1], Giulio Staffieri[1], Lorenzo Ferrero[2], Jessica Samaniego Solis[3], Ivano De Noni[1], Antonio Tirelli[1], Simone Giacosa[2], Davide Slaghenaufi[3], Daniela Fracassetti[1]

[1]Università degli Studi di Milano, Dipartimento di Scienze per gli Alimenti, la Nutrizione e l'Ambiente. Via Celoria 2, 20133 Milano, Italy; [2]Università degli Studi di Torino, Dipartimento di Scienze Agrarie, Forestali e Alimentari. Corso Enotria 2/C, 12051 Alba, Italy; [3]Università degli Studi di Verona, Dipartimento di Biotecnologie. Via della Pieve 70, 37020 San Floriano-San Pietro in Cariano, Italy;
marta.baviera@unimi.it

Postharvest dehydration is a widely employed technique in winemaking to enhance sugar concentration and secondary metabolites from grapes. Different grape varieties exhibit varying responses in terms of dehydration rate and the resulting chemical composition. Additionally, the harvest time, reflecting different ripeness levels, can significantly influence the process [1]. This study aimed to investigate the impact of ripening level on the composition of must and the resulting straw wine. *Vitis vinifera* L. cv 'Corvina', 'Moscato di Scanzo' and 'Nebbiolo' were harvested at three ripeness levels: low (LR; 18°Bx), medium (MR; 21°Bx) and high (HR; 23°Bx). Grapes were subjected to controlled postharvest dehydration until achieving 20% grape weight loss. Musts were produced and sugar concentration, readily assimilable nitrogen, pH, titratable acidity were evaluated. Micro scale winemaking trials were performed with skin maceration, monitoring the inoculated fermentation by weight decrease. At the end of alcoholic fermentation, the wines were racked, stabilized and bottled. The sugar concentration in musts increased from the samplings at LR to MR, while decreased in grapes harvested at HR. This could be due to the glucose respiration occurring during the withering that seemed to be facilitated for more ripe grapes [2]. Readily assimilable nitrogen varied by variety: it increased in 'Corvina', but decreased in the others varieties. The pH rose of about 0.3 units from LR to HR in all varieties, while the titratable acidity remained stable in 'Corvina' and it reached its lowest level in the HR harvested sample for 'Moscato di Scanzo' and 'Nebbiolo'. The musts obtained from grapes harvested at LR completed the alcoholic fermentation within 10–11 days for all the grape varieties. Similar fermentation rates were found for 'Corvina' musts from withered grapes harvested at MR and HR being complete within 12–13 days. In contrast, the fermentation was completed in 16 days for 'Nebbiolo' musts, while the musts from 'Moscato di Scanzo' withered grapes collected at MR and HR did complete the fermentation at day 20. From an applicative point of view, the grapes harvested at the higher ripening level resulted more susceptible to pathogen infection suggesting that the ripest grapes are less adapted to the withering even if this process took shorter time. This study expands the knowledge on the varietal effect in grape postharvest dehydration, covering red varieties majorly used in this production technique.

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ID: 212 / Poster session 1: 50
Abstract Submission

Topics: Analysis and composition of grapes, wines, wine spirits
Keywords: Timorasso, Sensory Analysis, Wine Typicity, Volatile Organic Compounds

Aroma typicity of Timorasso wines: influence of ageing on volatile organic compounds and sensory descriptors

Maria Alessandra Paissoni[1,2], Micaela Boido[1], Pietro Margotti[3], Simone Giacosa[1,2], Susana Río Segade[1,2], Vincenzo Gerbi[1,2], Luca Rolle[1,2], Christoph Schuessler[3], Stefanie Fritsch[4], Beata Beisert[4], Silvia Brezina[4], Doris Rauhut[4], Rainer Jung[3], Andrii Tarasov[3]

[1]Department of Agricultural, Forest, and Food Sciences, University of Torino, Corso Enotria 2/C, 12051 Alba, Italy;
[2]Interdepartmental Centre for Grapevines and Wine Sciences, University of Torino, Corso Enotria 2/C, 12051 Alba, Italy;
[3]Department of Enology, Hochschule Geisenheim University (HGU), Von-Lade-Straße 1, 65366 Geisenheim, Germany;
[4]Department of Microbiology and Biochemistry, Hochschule Geisenheim University, Von-Lade-Straße 1, 65366 Geisenheim, Germany; luca.rolle@unito.it

'Timorasso' is an autochthonous white grape variety from southern Piedmont (Italy) used for producing wines in the Colli Tortonesi product designation of origin (PDO). Over the last decade, there has been a notable rise in its production, due to the increased interest of wine enthusiasts who prized its wine distinctive ageing notes [1].

The aim of this study was to investigate Timorasso wines belonging to vintages 2015-2021, using sensory and analytical methods, through two research stages: *i*) a preliminary sensory examination of 31 wines by an expert panel to determine Timorasso wine relevant descriptors; *ii*) a detailed analysis of free volatile organic compounds (VOCs) in a selected subsample of 18 wines, quantifying varietal VOCs (terpenes and C_{13}-norisoprenoids) and fermentation-related VOCs (esters, higher alcohols, fatty acids) by HS-SPME/GC-MS techniques, whereas low molecular weight sulphur compounds (LMWSCs) were analysed by HS-GC-PFPD [2]. This stage also included a descriptive sensory analysis (DA) with a trained panel on pre-defined relevant descriptors.

The experts panel most frequently characterized Timorasso wines with "Kerosene" (27.9% of citation), "White flowers" (15.5%) and "Yellow pulp fruits" (14.8%) categories. "Kerosene", "Balsamic" (10.8%), and "Empyreumatic" (5.5%) were positively correlated with aroma typicity (rated by the expert panel) of Timorasso wines, and they were found to be particularly relevant for wines aged for 5-6 years. Fruity-floral notes characterized the young wines (2021) but were not considered typicity markers. The VOCs analysis of 18 selected wines confirmed that the younger wines (2021) had significantly higher acetate esters content (and "Fruity" descriptors intensity in the DA). Six terpenes were detected, but in moderate concentrations and usually below sensory thresholds. C_{13}-Norisoprenoids found were β-damascenone, vitispirane, and 1,1,6-trimethyl-1,2-dihydronaphthalene (TDN). TDN was detected above the recognition threshold (10-12 ng/L) in some Timorasso wines [3], which is remarkable because it has previously been found mainly in Riesling wines. Higher concentrations of TDN were noticed in older wines (2017 vintage), which also showed a higher intensity of "Kerosene/beeswax" descriptor according to the DA. The "Empyreumatic" descriptor in the DA was relevant for the 2019 vintage. Some LMWSCs may be involved in the higher empyreumatic scores of certain wines. Understanding the chemical markers may help future research on the winemaking approaches to better express the Timorasso wines varietal typicity.

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ID: 213 / Poster session 1: 51
Abstract Submission
Topics: Analysis and composition of grapes, wines, wine spirits
Keywords: NIR, spectroscopy, wine, must, PLS-R, volatile compounds

UV-VIS-NIR Spectroscopy as a Tool for Predicting Volatile Compounds in Grape Must

Marta Pinillos, Jose Ignacio Manzano, Mar Vilanova de la Torre
ICVV-CSIC, Spain; mar.vilanova@csic.es

The wine sector is one of the most significant industries worldwide, with Spain being a leading country in wine production and export. A key factor in wine quality is its aroma, which is directly influenced by the volatile compounds present in the grape, with terpenes being among the most significant contributors. These compounds are responsible for the floral and fruity aromas characteristic of wine (1). Analytical methods for grape and wine analysis, particularly for volatile metabolites, often involve costly instrumentation and labor-intensive extraction procedures. In contrast, vibrational spectroscopy techniques, such as ultraviolet-visible (UV-Vis), and near-infrared (NIR) spectroscopy, have gained recognition as valuable analytical tool due to their simplicity, speed, and non-destructive nature. Currently, there is a notable scarcity of studies presenting accurate predictive models for terpene compounds in grape must (2). The objective of this work is to ascertain the viability of applying a wide range spectrum spectroscopy (UV-Vis-NIR) to develop precise models capable of predicting the terpene composition of the grape must. Our investigation specifically targets on the determination of glycosylated terpenes, including Z-8-hydroxylinalool, cis-furan linalool oxide, cis-pyran linalool oxide, geraniol (trans), HO-trienol (3,7-dimethyl-1,5,7-octatrien-3-ol), linalool, trans-furan linalool oxide, trans-pyran linalool oxide, and α-terpineol. Partial Least Squares Regression (PLSR) was employed to construct models. The results showed satisfactory predictive models for linalool (r^2 = 0.8; RMSE = 0.89), geraniol (r^2 = 0.8; RMSE = 8.63), and α-terpineol (r^2 = 0.84; RMSE = 2.56). The remaining predictive models developed showed acceptable coefficients of determination. UV region was identified as the most relevant region for the construction of the PLS-R models. These findings highlight the potential of this innovative technique to revolutionize the wine industry by enabling faster and cost-effective analysis of volatile compounds in must, thereby optimizing the winemaking process and improving product traceability.

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Tannat Grapes and Feasibility of the Near Infrared Spectroscopy Application for Their Prediction. Food Analytical Methods, 6(1), 100-111

ID: 214 / Poster session 1: 52
Abstract Submission
Topics: Analysis and composition of grapes, wines, wine spirits
Keywords: purification, enzymatic digestion, biochemistry, oxidative stability

Bioanalytical workflow for exploring the chemical diversity and antioxidant capacity of grape juice peptides

John Carlos[1], Laurence Noret[1], Camille Loupiac[1], Régis Gougeon[1], Sarah Foley[2], Maria Nikolantonaki[1]
[1]Institut Universitaire de la Vigne et du Vin (IUVV) – Jules Guyot, UMR PAM 1617, Université de Bourgogne Europe/Institut Agro/INRAE, 2 Rue Claude Ladrey, BP 27877, 21000 Dijon, France; [2]Laboratoire Chrono-Environnement – UMR 6249 CNRS/UFC, Université Marie & Louis Pasteur, Campus de la Bouloie, 16 rue de Gray, 25030 Besançon, France; John_Carlos@etu.u-bourgogne.fr

The oxidative stability of white wines is related to a flow of chemical reactions involving a number of native wine containing compounds composing their antioxidant metabolome. Our research group could define wine antioxidant metabolome as the sum of molecular antioxidant markers characterized by their radical scavenging and nucleophilic properties [1–3]. The significant share of sulfur-containing peptides in wines antioxidant metabolome and their variation according to the vintage, the grape variety and the pre-fermentation oenological practices, shows the need to better explore the grape juice peptidic composition.

In the present work, by the application of biochemical technics, including low pressure purification, protein digestion, gel electrophoresis and size-exclusion chromatography coupled with a light scattering detector, qualitative and quantitative analysis of grape juice derived peptides were performed. Here we describe the optimization of a double digestion protocol used for peptide mapping of grape juice which addresses the challenge of balancing maximum digestion efficiency with minimum artificial modifications. The parameters on which we focused include, digestion time and temperature, as well as the source of acid protease used which are pepsins and Aspergillopepsins I, derived from the controlled fermentation of a selected strain. Using the optimized protocol we generated a pool of peptide compounds, which allowed us to firstly, determine its antioxidant capacity (DPPH essay) and secondly, to explore its chemical diversity by applying LC-MSq-Tof based metabolomics.

The proposed approach allows the validation of a workflow for complete description of peptide composition and antioxidant capacity in grape juices, and opens a new pathway to better manage wines oxidative stability already at the vineyard stage.

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ID: 215 / Poster session 1: 53
Abstract Submission
Topics: Winemaking processes and oenological practices
Keywords: Yeast derivatives, alcoholic fermentation, volatile compounds, design of experiment

Further insight on the use of Yeast Derivative Products as alcoholic fermentation enhancers

Alessio Altomare[1], Giulio Staffieri[1], Denis Allieri[1], Maria Manara[2], Daniela Fracassetti[1]
[1]1Università degli Studi di Milano, Dipartimento di Scienze per gli Alimenti, la Nutrizione e l'Ambiente. Via Celoria 2, 20133 Milano, Italy.; [2]Ricerca e Sviluppo, Dal Cin S.p.a., Via I Maggio 67, 20863 Concorezzo (MB), Italy.; alessio.altomare1@unimi.it

Issues that can arise during the alcoholic fermentation are frequently attributed to imbalances or deficiencies in the nutrient composition of the fermentation medium. In particular, insufficient levels of assimilable nitrogen,high ethanol concentrations and certain yeast metabolic by-products, such as short and medium-chain fatty acids, could cause fermentation issues by inhibiting yeast activity [1]. Yeast derivative products (YDPs) have been widely employed in order to minimize these issues as they could supplement assimilable nitrogen. YDPs can also detoxify the fermentation matrix by neutralizing short and medium-chain fatty acids. Previous studies indicated that YDPs could release of long-chain fatty acids, which may improve membrane transport activity in yeast cells [2]. YDPs were also used in winemaking in order to enhance the rehydration of active dry yeast (ADY), thereby improving fermentation kinetics and reducing its duration. This could be due to the release of yeast cell wall fragments containing sterols which integrates in the membranes of ADY cells, facilitating their repairment after the damages sustained during the dehydration process [3].

In this study, the impact of YDPs on alcoholic fermentation was investigated.

Trials were carried out with 6 YDPs belonging to different classes added either in must or during the rehydration of ADY. In addition, a Response surface methodology approach was performed considering 3 different musts fermented at 3 different temperatures, in the presence of 3 YDPs added at 3 concentrations. The fermentation kinetics were monitored and the resultant wines were characterized in terms of chemical parameters, color parameters, volatile compounds (VOCs) and sensory characteristics.

Results showed no relevant difference in fermentation kinetics and chemical parameters due to the YDPs addition performed both in must and during the rehydration. Similarly, increasing concentration of YDPs did not affect neither the fermentation kinetics nor the general composition. This could be probably due to adequate content of readily assimilable nitrogen of the must. However, the determination of VOCs and the sensory analysis evidenced the YDPs led to changes of volatile profile and appreciation. These aspects were influenced by the addition of YDPs in must or in pied de cuve, the concentration employed and the fermentation temperature. The interactions between these parameters should be carefully considered during the winemaking operations as they could play a relevant impact on the characteristics of the resulting wine.

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ID: 217 / Poster session 1: 54

Abstract Submission

Topics: Sensory properties: psychophysics, experimental economy, connections with neurosciences

Keywords: Smoke taint, recognition threshold, ashy flavor, thiophenols

Determining the impact of thiophenols on ashy flavor recognition in smoke-affected wines

Jenna Fryer, Jillian Thrall, Camilla Sartori, Elizabeth Tomasino

Oregon State University, United States of America; elizabeth.tomasino@oregonstate.edu

Wildfires are an increasing concern for wine-producing regions worldwide, as they generate smoke containing volatile organic compounds that can be transported over long distances and can be absorbed by wine grapes [1]. Wines produced with smoke-impacted grapes are found to have uncharacteristic smoky, burnt, and dirty flavors, with an ashy aftertaste being a particularly distinctive and negative attribute [2].

While volatile phenols are well-documented contributors to smoke-related flavors in wine, recent research suggests that thiophenols play a key role in the perception of ashy off-flavors [3]. The objective of this study was to determine the concentration at which thiophenols induce the perceptual "ashy" attribute in different styles of Pinot noir and Cabernet sauvignon wines. Using an adaptive staircase procedure, ashy flavor recognition thresholds for total thiophenols were assessed in wines containing varying levels of smoke-related volatile phenols (45 µg/L, 135 µg/L, 450 µg/L). Psychometric curves were fitted to estimate threshold distributions across individuals to be able to determine risk levels of a consumer perceiving a wine as ashy.

Results indicated that an inverse relationship was found between phenol and thiophenol concentration to produce a perceptual ashy flavor. This is important to be understood by the wine industry, as volatile phenols can be introduced to a wine during other parts of the winemaking process. Additionally, differences in recognition between styles were evident at the lowest phenol concentration, but at higher phenol concentrations, threshold variability decreased. This allows for better guidance of interpretation of chemical markers for potential sensory descriptors. These findings provide critical insight for winemakers and industry stakeholders, enabling informed decision-making regarding smoke-affected vintages. Beyond threshold determination, this study underscores the broad range of individual sensitivities to smoke-related compounds, highlighting the importance of consumer perception in mitigating economic losses due to wildfire events. Understanding these sensory impacts will help guide strategies to reduce waste and optimize wine quality in the face of increasing wildfire challenges.

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ID: 219 / Poster session 1: 55

Abstract Submission

Topics: Winemaking processes and oenological practices

Keywords: Protein stabilization, bentonite alternatives, white wine clarity, volatile organic compounds, wine composition

Exploring the behavior of alternatives to montmorillonite clays in white wine protein stabilization

Marco Lagori[1], Matteo Marangon[2,3], Simone Vincenzi[2,3], Beatrice Cordero[1], Negin Seif Zadeh[1], Maria Alessandra Paissoni[1], Susana Río Segade[1], Simone Giacosa[1], Giuseppina Sandri[4], César Viseras Iborra[5], Luca Rolle[1]

[1]Department of Agricultural, Forest, and Food Sciences, University of Torino, 12051 Alba, Italy; [2]Department of Agronomy, Food, Natural Resources, Animals and Environment (DAFNAE), University of Padova, 35020 Legnaro, Italy; [3]Interdepartmental Centre for Research in Viticulture and Enology (CIRVE), University of Padova, 31015 Conegliano, Italy; [4]Department of Drug Science, University of Pavia, 27100 Pavia, Italy; [5]Department of Pharmacy and Pharmaceutical Technology, University of Granada, 18071 Granada, Spain; marco.lagori@unito.it

Visual clarity in wines is crucial for commercial purposes [1]. Potential protein haze in white wines remains a constant concern in wineries, commonly addressed using bentonite [2]. Despite its effectiveness, bentonite's lack of specificity leads to several drawbacks [3], including negative impacts on aroma and phenolic compounds, product loss due to sludge formation after treatment [4], and health and safety concerns related to its production [5]. Thus, interest in alternatives to bentonite has grown in recent decades. In this study, we tested for the first time two alternative clays (sepiolite and palygorskite), comparing their effects, at an equivalent stabilizing dose, with two commercial bentonites and an experimental montmorillonite. The comparison was based on deproteinizing capacity (assessed via protein quantification using HPLC), basic parameters, CIELab color coordinates, volatile organic compounds (VOCs) analyzed by GC-MS, and phenolic compounds (assessed via spectrophotometric indexes) in a white wine from cv. 'Moscato bianco'. The required stabilization dose with commercial bentonites and experimental montmorillonite was 10 g/hL, while the tested clays needed a sixfold higher dose. No significant differences were observed in pH, whereas slight differences were detected in total acidity. Regarding color, all treatments decreased absorbance at 420 nm compared to the control, except for one commercial bentonite. Significant differences were found among products, with the tested clays showing the lowest absorbance value. Although significant differences were found in CIELab coordinates, none of the treatments led to visual differences compared to the control. Among the 54 detected VOCs, only ethyl butanoate, methyl decanoate, octyl acetate, and dodecanoic acid showed significant differences, with

no consistent trend. These results confirm that bentonite does not affect varietal compounds (terpenes and C_{13}-norisoprenoids), and that, at low doses, its negative effects on VOCs are minimal [6]. All treatments significantly reduced the total polyphenols index (TPI) compared to the control. Notably, a highly significant correlation ($r^2 = 0.63$) was found between removed proteins and the decrease in TPI, confirming protein-mediated phenolics removal [7].

These results highlight the challenges of finding viable alternatives to bentonite and suggest that bentonite, when used at low doses, can stabilize white wine without compromising its qualitative traits.

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ID: 220 / Poster session 1: 56

Abstract Submission

Topics: Analysis and composition of grapes, wines, wine spirits

Keywords: White wine, maceration, RATA, sensory analysis

Colour, phenolic, and sensory characteristics of commercial monovarietal white wines produced with maceration

Anastasiia Kasianova[1], Micaela Boido[1], Lorenzo Ferrero[1], Giorgia Botta[1], Susana Río Segade[1,2], Simone Giacosa[1,2], Luca Rolle[1,2], Maria Alessandra Paissoni[1,2]

[1]Department of Agricultural, Forest, and Food Sciences, University of Torino, Corso Enotria 2/C, 12051 Alba, Italy;
[2]Interdepartmental Centre for Grapevines and Wine Sciences, University of Torino, Corso Enotria 2/C, 12051 Alba, Italy;
anastasiia.kasianova@unito.it

White wines produced with skin and seed contact are of great interest in the wine sector. Maceration, whether performed prior to or concurrently with alcoholic fermentation, or even extended beyond its completion, significantly impacts the chromatic, mouthfeel, and aroma characteristics of these wines [1]. However, little information is available in the scientific literature on macerated white wine characteristics. This research is a descriptive study of the physicochemical and sensory parameters of 36 commercial Italian monovarietal white wines (cv. 'Arneis', 'Catarratto', 'Erbaluce', 'Malvasia Istriana', 'Vermentino') produced with different maceration times: short (≤3 days), medium (4-7 days), long (8-30 days), "orange wine" style (>1 month), and non-macerated controls (2 for each cultivar). The sensory analysis was conducted with an expert panel that generated the terminology and was trained on 20 aroma and 5 mouthfeel descriptors. The formal evaluation was performed using the Rate-All-That-Apply (RATA) technique [2]. Panellists also evaluated turbidity, colour intensity and hue. Instrumental analysis involved basic composition parameters, total polyphenols index (TPI), condensed tannins (methylcellulose precipitation assay, MCP), and colour by CIELab coordinates [3]. Among the investigated aroma descriptors, 15 differentiated the samples. The intensity of *Citrus*, *Pineapple*, and *White flowers* was evaluated higher in control samples compared to macerated ones, regardless of the variety. In contrast, *Prune*, *Dry figs*, *Clove*, and *Liqueur* were rated higher in macerated wines. *White pepper* was a characterising note of "orange wines". Varietal effects were significant for *Vanilla*, *Toasted*, and *Kerosene* descriptors. The effect of maceration time on aroma descriptor intensity was variable, with wines presenting the longest maceration time showing non-linear changes. This pattern was also observed in mouthfeel descriptors, where *Astringency* increased from non-macerated to long-macerated wines but was lower in "orange wines". Sensory results were supported by instrumental TPI and MCP. The same tendency was observed in *Colour hue*, evaluated from straw (0) to brown (10), and a*, b*, and absorbance at 420 nm instrumental parameters, with "orange wines" showing decreasing trend when compared to medium and long macerated samples. These first outcomes will be supplemented with volatile organic compounds analysis by GC-MS and individual phenolic composition by HPLC-UV, providing further insights into the changes occurring with maceration of different lengths.

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ID: 226 / Poster session 1: 57

Abstract Submission

Topics: Analysis and composition of grapes, wines, wine spirits, Winemaking processes and oenological practices

Keywords: Schiava wine, wine color, volatile compounds, polyphenols, sensory profile

Effects of winemaking variables on the chemical and sensory quality of Schiava wines up to one year storage in bottle

Aakriti Darnal[1,2], Adriana Teresa Ceci[1], Simone Poggesi[3], Tanja Mimmo[1,4], Emanuele Boselli[1,5], Edoardo Longo[1]

[1]Faculty of Agricultural, Environmental and Food Sciences, Free University of Bozen-Bolzano, Piazza Università 1, 39100 Bolzano, Italy; [2]Laimburg Research Centre, Laimburg 6 - Pfatten (Vadena), 39040 Auer (Ora), BZ, Italy; [3]Food Experience and Sensory Testing (Feast) Lab, Massey University, Palmerston North 4410, New Zealand; [4]Competence Centre for Plant Health, Free University of Bolzano, Bolzano, Italy; [5]International Competence Centre on Food Fermentations, Free University of Bolzano, Bolzano, Italy; Aakriti.Darnal@student.unibz.it

The interactive effects of three major enological variables were evaluated on the quality of Schiava wine up to one year of storage in bottle. Differing from most red varieties, 'Schiava' grapes contain peonidin-3-glucoside as the main anthocyanin; together with other factors (e.g. low tannin content, high pH), the loss of peonidin-3-glucoside is thought to be a main cause for discolouration in the derived wines [1,2]. A primary objective was to test specific variables (e.g. grape freezing), for their possible ability to increase the extraction of pigments from the grapes, or to increase the colour stability in wine. Secondarily, potential interactive effects of variables such as grape freezing and the malolactic fermentation were targeted, as it previously showed to cause differences in the phenolic and volatile profiles of white wines made with other grape varieties [1]. The evaluated variables were: (1) grapes frozen or not for 2 weeks at -20 °C; (2) fermentation with or without fermentative maceration; (3) inoculum with *Saccharomyces cerevisiae*, or co-inoculum with *S. cerevisiae* and *Oenococcus oeni*. The storage in bottle was conducted in darkness at 4 °C for one year. Basic oenological parameters, colour, spectroscopical parameters [3,4], volatile profile, and polyphenols were monitored overtime. The sensory analysis was conducted after storage. The fermentative maceration was here excluded as a factor to use for comparison. The major trends associated with the grape freezing and the co-inoculum manifested in differences in the volatiles, condensed tannins, and colour profiles. Wines made without fermentative maceration presented a neat effect from the grape freezing; this was not so clear for wines made with fermentative maceration. In wines made without fermentative maceration, the grape freezing factor was associated to distinctive visual sensory attributes such as 'light pink' and 'pink salmon', and aroma descriptors such as 'nutty/almond' and 'tropical/banana'. Despite the higher initial content of peonidin-3-glucoside extracted from frozen grapes, no significant difference was found after bottle storage in relation to grape freezing. Interestingly, the colorimetric and visual parameters were instead positively impacted by grape freezing; this was attributed to the extraction from the frozen grapes of more chemical components participating in the colour stabilization. Overall, these factors greatly influenced the wine quality, offering the winemakers strategies to modulate the colour of Schiava wine even after one year of storage.

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ID: 229 / Poster session 1: 58
Abstract Submission
Topics: Analysis and composition of grapes, wines, wine spirits, Vine science and link with grape and wine quality
Keywords: Polyphenols, nuclear magnetic resonance spectroscopy, Pinot Noir, method development

A facile and robust method for the quantification of polyphenols in red wine via NMR

Felix Bacher[1], Francesca Tilocca[1,3,4], Alberto Ceccon[2], Edoardo Longo[3,4], Emanuele Boselli[3,4], Peter Robatscher[1]
[1]Laboratory of Flovours and Metabolites, Laimburg Research Centre, Italy; [2]Labroatory of NMR Spectroscopy, Laimburg Research Centre, Italy; [3]Oenolab, NOI TechPark,Italy; [4]Faculty of Agricultural, Environmental and Food Sciences, Free University of Bolzano, Italy; felix.bacher@laimburg.it

Nuclear magnetic resonance spectroscopy (NMR) is a high-tech analytical method that recently found its way into the field of wine analysis with special focus on wine authentication.[1] NMR has several advantages including a strictly linear relationship between signal intensity and concentration, fast sample preparation, fast measurement and high repeatability. The biggest disadvantage of NMR in comparison to other analytical techniques is its relatively low sensitivity. Mostly untargeted NMR approaches are used and the obtained results lack cross-validation with established methods such as GC- and HPLC-MS.[2] Very few studies for the quantification of wine analytes via NMR have been reported and focused on main wine analytes, such as diols, triols, main acids, amino acids and monomeric sugars present in the 100 to 10,000 ppm range.[3,4] This study aims to develop a quantitative NMR based method for the compound class of polyphenols. Polyphenols (e.g. flavonoids such as catechin, benzoic acid derivatives such as gallic acid, cinnamic acid derivatives such as caffeic acid) are present in wine at concentration below 100 ppm (with some exceptions), therefore the wine needs to be concentrated before NMR measurement. An extraction method based on diethyl ether has been developed in this context. The novel method is easy to use and very robust, with a reliable standard deviation typically in the scale of 3% to 6% for the concentration of many analytes. The recovery rate of the method has been tested against an inhouse prepared standard reference material, emulating the composition of a typical Pinot Noir wine. Quantitative and near quantitative recovery rates (> 80 %) have been reached for many analytes.

A total of 20 Pinot Noir wines from South Tyrol, Italy, of different origins and, in some cases, different vintages from the same provenance, have been analysed to test the capacity of the method for the determination of significant differences. Additionally, the method was tested against an already established HPLC-MS methodology. Method parameters are evaluated to identify strengths and weaknesses of the new method. The method can be used in a variety of contexts such as control of authenticity and quality amongst others.

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ID: 230 / Poster session 1: 59
Abstract Submission
Topics: Winemaking processes and oenological practices
Keywords: Grape seed protein, Fining agent, Sustainability

Optimized Grape Seed Protein Extraction for Wine Fining

Shuyan Liu, Simone Vincenzi
Interdepartmental Centre for Research in Viticulture and Enology, University of Padova, Conegliano (TV) 31015, Italy; shuyan.liu@unipd.it

Extracting proteins from grape seeds revalorizes by-products of the wine industry. As a natural endogenous fining agent, grape seed protein improves wine clarification without requiring label declaration, enhancing sensory properties by reducing vegetal notes in rosé wine and balancing acidity and astringency in red wine [1]. It matches potassium caseinate in Chardonnay wine, improves colour stability, reduces turbidity in white wine, and lowers phenolic compounds in red wine, outperforming gelatin [1]. As a sustainable, low-cost alternative, it reduces reliance on allergenic proteins and supports circular economy principles by reintegrating waste into production. This study optimized the grape seed protein extraction method proposed by Vincenzi et al. (2013) [2], focusing on three key aspects: 1) reducing water consumption by half without significantly affecting protein purity, 2) introducing a hexane defatting step, which significantly improved sensory properties while confirming no impact on protein structure (SDS-PAGE analysis), and 3) enhancing protein extract purity, achieving final values of 68.38–74.71 % of protein as requested by OIV for vegetal proteins (> 65%). The fining capacity of the extracted proteins was then evaluated in white and rosé wines, assessing their effects on wine colour and total phenol content.

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ID: 233 / Poster session 1: 60
Abstract Submission
Topics: Analysis and composition of grapes, wines, wine spirits, Wine, environment, health and sustainability
Keywords: Grape stalks, polyphenols, recovery, hydrothermal carbonization, biofuels

Integrated approach to grape stalks valorization: Sustainable recovery of bioactive compounds and biofuel production

Edoardo Longo[1], Sara D'Aronco[1], Francesco Patuzzi[2], Giacomo Zuccon[1], Alberto Ceccon[3], Marco Baratieri[2], Emanuele Boselli[1,4]
[1]Faculty of Agricultural, Environmental and Food Sciences, Free University of Bozen-Bolzano, Piazza Università 1, 39100 Bolzano, Italy; [2]Faculty of Engineering, Free University of Bozen-Bolzano, Piazza Università 1, 39100 Bolzano, Italy; [3]Laimburg Research Centre, Laimburg 6 - Pfatten (Vadena), 39040 Auer (Ora), BZ, Italy; [4]International Competence Center for Food Fermentations, Free University of Bozen-Bolzano, Piazza Università 5, 39100 Bolzano, Italy; sara.daronco@unibz.it

Grape stalks are a byproduct of the winemaking process and represent a valuable and inexpensive source of bioactive compounds. While their direct use in whole bunch fermentation is known [1,2], the majority of grape stalks are discarded, posing environmental and economic challenges. Notably, this byproduct contains a diverse array of extractable polyphenolic compounds, including phenolic acids, flavanols, flavonols, and condensed tannins [3]. Among polyphenols, quercetin-3-glucuronide, catechin, caftaric acid, and astilbin have been identified [4]. However, the high lignocellulosic content in grape stalks limits the direct extraction of a large portion of the polyphenolic component just by conventional methods. Lignin, a major structural component, consists in fact of a complex network of polymerized phenolic units. Structural analysis of grapes lignin revealed a predominance of β-O-4′ structures, with moderate amounts of β-5′, β-β, β-1′, 5-5′, and 4-O-5′ structures. The condensation degree in grape stalks is higher than that of other lignin from other agricultural residues. Grape stalks lignin was shown to contain on average a 3:71:26 molar proportion of *p*-hydroxyphenyl, guaiacyl, and syringyl phenolic units [5]. Several strategies have been investigated to yield a partial or even total breakdown of the lignocellulosic fraction, with subsequent extraction of the depolymerization products, providing an inexhaustible source of phenolic compounds from a practically inexpensive source material.

In this contribution, we are presenting preliminary results from an integrated approach based on tuning hydrothermal carbonization (HTC) conditions to facilitate a partial breakdown of lignin, then to increase the efficiency of extraction of polyphenolic compounds. HTC was further tested to investigate the application of grape stalks residues for producing hydrochar, also testing the process for the valorization of unextracted residues as biofuels, contributing to a fully circular bioeconomy. Our approach highlights the potential for grape stalks applications, demonstrating a sustainable approach to repurposing this underutilized resource.

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ID: 234 / Poster session 1: 61
Abstract Submission
Topics: Winemaking processes and oenological practices
Keywords: Yeast derivatives, aroma compounds, sorption, polyphenols

Sorption of aroma compounds by commercial specific yeast derivatives and the influence of polyphenols

Laurie Favieres[1,2], Céline Poncet-Legrand[1], Aude Vernhet[2], Nathalie Sieczkowski[2], Peggy Rigou[1]
[1]INRAE, France; [2]Lallemand SAS, 19 rue des briquetiers, 31702 Blagnac Cedex, France; laurie.favieres@supagro.fr

Specific inactivated yeast derivatives (SYDs) from S. cerevisiae are obtained through thermal, mechanical, and enzymatic processes and are used to enhance wine quality. Their impact on wine sensory properties varies depending on SYD type, fraction, matrix interactions and time, as they can modify aroma compounds' volatility or concentration (1). Some studies have examined SYDs' sorption of undesirable aroma compounds (2) but the sorption of key aroma compounds remains underexplored, particularly in relation to wine macromolecules such as polyphenols. Furthermore, no comparative study was found on the sorption capacity of different SYDs.

The aim of this research was to evaluate the sorption capacities of different SYDs in model wine conditions and to investigate the influence of polyphenols on such interactions with aroma compounds.

Three selected SYDs provided by Lallemand — inactivated yeast (IY), selected cell walls (CW), yeast protein extracts (YPE) — were fractionated based on solubility criteria. Insoluble fractions were added at 1 g/L to model wines containing 21 aroma compounds (esters, terpenoids, norisoprenoids, alcohols, aldehydes, phenols, sulphur compounds) in order to investigate their sorption according to functional groups and structural characteristics. Equilibrium sorption time was determined at 15°C, under constant agitation by monitoring free aroma concentrations in the supernatant over time. Aroma compounds were quantified by GC-MS (SIM mode) using external calibration for each compound, and after their liquid extraction with dichloromethane in presence of specific internal standards. Under equilibrium conditions, the impact of polyphenols was assessed using a 2 g/L polyphenol pool isolated from Syrah wine.

Sorption equilibrium was reached within 4 hours, and all insoluble fractions of SYDs exhibited aroma sorption capacity. The sorption capacity of the insoluble fraction of SYDs was influenced by their physicochemical properties and YPE showed the highest capacity, followed by IY and CW. Aroma compounds hydrophobicity played a key role since the most hydrophobic compounds within chemical groups (except for norisoprenoids), were preferentially sorbed, but structural properties have also shown an effect. Notably, polyphenols reduced sorption for some compounds, highlighting the importance of the wine matrix in SYD-aroma interactions. These findings provide insight into SYDs' functionality and their potential application in aroma modulation during winemaking processes.

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ID: 235 / Poster session 1: 62
Abstract Submission
Topics: Analysis and composition of grapes, wines, wine spirits
Keywords: Sulfur dioxide, headspace analysis, pulsed fluorescence detector, free SO2

The use of pulsed fluorescence detector to quantify free SO2 in wines via the headspace.

Charles Jean-François Chappuis, Liming Zeng, Arnaud Pernet, Eric Grand, Benoit Bach
Changins Viticulture and Enology College, University of Applied Sciences and Arts of Western Switzerland (HES-SO), Switzerland; charles.chappuis@changins.ch

Pulsed fluorescence SO_2 analyzers are widely used for atmospheric monitoring. They are accurate, portable, sensitive and their price are reduced compared to advanced techniques like gas chromatography with sulfur chemiluminescence detection (GC-SCD). These instruments also allow for continuous and non-destructive measurements. In this study, we explored the potential of pulsed fluorescence detection to quantify free SO_2 in wine via the headspace (HS-PFD) and developed a method to minimize disturbances to SO_2 equilibrium.

Our approach involves injecting wine into a syringe, adding nitrogen to create a headspace, and gradually releasing the gas phase into the SO_2 analyzer. Molecular SO_2 levels are determined using a calibration curve based on model wine spiked with potassium metabisulfite, while free SO_2 is calculated considering temperature, pH, and alcohol by volume (ABV) with the equations described in [2]. The method demonstrated high sensitivity, with detection and quantification limits of 0.012 mg/L and 0.032 mg/L, respectively—equivalent to roughly 0.5 and 1.3 mg/L of free SO_2 in a wine with pH 3.5 and 10% ABV. The coefficients of determination of calibration curves ranged from 0.99 to 0.999, and the method's precision, assessed across 18 wines measured in triplicate, yielded an average relative standard deviation of 3.5% (ranging from 1.2% to 8%).

We analyzed 81 Swiss commercial wines using HS-PFD and corrected iodometric titration (CIT). Results from both methods were comparable for white and rosé wines (white: N = 29, slope = 0.9, R^2 = 0.96; rosé: N = 9, slope = 0.98, R^2 = 0.95). However, HS-PFD consistently measured lower free SO_2 in red wines compared to CIT (N = 43, slope = 0.61, R^2 = 0.85). Further analysis of 20 selected wines using CIT, aeration-oxidation (A-O), HS-PFD and acidification-HS-PFD (Acid-HS-PFD) demonstrated that methods acidifying wine samples (CIT, A-O and Acid-HS-PFD) overestimate free SO_2 in red wines, as acidification released weakly bound SO_2. The amount of released SO_2 correlated positively with the total and SO_2-bleachable anthocyanin content of wines.

Our results align with previous literature and demonstrate that the HS-PFD method delivers performance comparable to high-end analytical techniques like GC-SCD and GC-MS, but at a significantly lower cost. Future developments and automation possibilities will be discussed.

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ID: 236 / Poster session 1: 63

Abstract Submission

Topics: Analysis and composition of grapes, wines, wine spirits

Keywords: Pinus halepensis, Light-strike, Terpenes, GC-MS/MS

Photodegradation of Retsina Wine: Does Pine Resin Protect Against Light-Induced Changes?

Georgios Polymeros[1], Silvia Carlin[2], Francesco Reale[2], Evangelos Nikolou[1], Urska Vrhovsek[2], Vasileios Nikolou[1], Panagiotis Arapitsas[1,2]

[1]University of West Attica, Greece; [2]Fondazione Edmund Mach, Italy; parapitsas@uniwa.gr

Retsina is a wine deeply rooted in Greek tradition but often misunderstood, largely due to the poor quality associated with past production. Historically, pine resin was used to seal wine transport containers, and over time, its distinctive aroma led to its intentional incorporation into winemaking. While Retsina has a long history, it gained widespread popularity after World War II as an inexpensive, highly aromatic, and widely consumed wine. Today, Retsina is classified under the Designation of Traditional Appellation and is exclusively produced in Greece as a white or rosé dry wine, using the traditional method of adding pine resin to the must. Typically, retsina wine is bottled in flint glass bottles, and although is know that light can damage wine aroma compounds [1], the effect of light in aromatised wines, like Retsina, has never been studied before. It remains unknown whether the enrichment of the wine with resin-derived phenolic compounds (antioxidants) and terpenes can protect it from photodegradation. To address this gap, this project aimed to study the behaviour of Retsina's volatile components when stored in flint glass bottles. For this purpose, 12 Retsina wines, prepared with three levels of resin addition (0.1, 0.3, and >0.5 g/L), were stored for four weeks at room temperature under two conditions: a) Exposed to natural and artificial light in flint glass bottles, b) Stored in a box without any light exposure. After this period, the wines were analyzed using a state-of-the-art fast GC-MS/MS method, recently published [2]. The results were categorized into four groups: i) compounds that increased with resin addition, ii) compounds that decreased with resin addition, iii) compounds that increased due to light exposure, and iv) compounds that decreased due to light exposure. Notably, several terpenes increased with resin addition but decreased due to light exposure, while norisoprenoids decreased under light exposure. Some esters were reduced due to resin addition, and 2-AAP (2-aminoacetophenone) was increased by light exposure.

In conclusion, this study demonstrated that the addition of resin significantly influences the aroma profile of Retsina, affecting both primary and secondary volatile metabolites. Furthermore, flint glass should be avoided for bottling, as resin does not provide sufficient protection against photodegradation.

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ID: 238 / Poster session 1: 64

Abstract Submission

Topics: Analysis and composition of grapes, wines, wine spirits, Winemaking processes and oenological practices
Keywords: Mannoproteins, tartaric stability, wine colour, phenolic composition

Mannoproteins from oenological by-products as tartaric stabilization and color agents in white and red wines

Diana M. Bosch-Crespo, Elvira Manjón, Rebeca Ferreras-Charro, María Teresa Escribano-Bailón, Montserrat Dueñas
Department of Analytical Chemistry, Nutrition and Food Science, Universidad de Salamanca, Salamanca, E 37007, Spain; dbosch@usal.es

Climate change is drastically modifying grape composition and wine quality. As consequence, must and wines are becoming unbalanced, with high sugar concentration, increased alcohol content, lower acidity, excessive astringency, color instability and also a rise in the incidence of tartaric instability is being showed. The winemaking industry generates large quantities of byproducts, such as skins, grape pomace and lees, which represents an important environmental impact. In recent years, there has been increasing interest in the valorization of these byproducts, since contain high value-added compounds, such as polysaccharides among others [1]. Therefore, the obtention of polysaccharides from wine industry byproducts could diminish the environmental impact, enhance the sustainability in the wine industry byproducts, and also promote the circular economy due to the subsequent application in the winemaking process [2]. The aim of this study was to obtain mannoproteins from wine lees resulting from different winemaking processes and origins, as well as from the vinification of both white and red grapes, and to evaluate their influence on tartaric stability, color and phenolic composition in white and red wines. Thirteen different mannoproteins extracts (issued from wine lees) were characterized by SDS-PAGE, HPLC-RID and HPLC-MS. The analysed mannoproteins presented molecular weights between 160 kDa and 213 kDa and their protein content was ranging from 15 to 31% and had notable differences in their monosaccharide composition. Four mannoproteins with the highest and lowest average molecular weight and protein content were selected and each selected individual mannoprotein was added at a concentration 500 mg/L to white wine (cv Verdejo) and red wine (cv Tempranillo) in order to their effect on tartaric stability and phenolic composition at 0, 7, 14 and 40 days. Tartaric stability was assessed by a Cryosmart 2.0 equipment and color and phenolic compounds using CIELAB and HPLC-DAD-MS, respectively. The results showed that the addition of mannoproteins had an effect on the tartaric stability of white and red wines that depends on the structural characteristics of the mannoprotein. Similarly, differences in the phenolic profile and on color of the different wine samples were observed, that could be attributable to the effect of the mannoproteins and related to the differences presented in their structure.

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ID: 239 / Poster session 1: 65
Abstract Submission
Topics: Winemaking processes and oenological practices
Keywords: White wine, maceration, oxidation, polyphenols

Assessing the potential of fermentative skin contact in white winemaking on phenolic, colour, and sensory traits

Lorenzo Ferrero[1], Marco Lagori[1], Anastasiia Kasianova[1], Micaela Boido[1], Giorgia Botta[1], Beatrice Cordero[1], Maria Alessandra Paissoni[1,2], Susana Río Segade[1,2], Luca Rolle[1,2], Simone Giacosa[1,2]
[1]Università degli Studi di Torino, Dipartimento di Scienze Agrarie, Forestali e Alimentari. Corso Enotria 2/C, 12051 Alba, Italy; [2]Centro Interdipartimentale di Ricerca sulla Filiera Viticoltura e Vino (CONViVi), Università degli Studi di Torino, Corso Enotria 2/C, 12051 Alba (CN), Italy; lor.ferrero@unito.it

Fermentative maceration in white wine production, involving extended contact with grape skins and seeds, has gained interest in recent years [1]. The impact of this winemaking technique on wine composition and sensory properties remains underexplored. This study investigates the influence of maceration time on the basic parameters, phenolic composition, colour, and sensory attributes of white wines from two Italian autochthonous varieties, ‘Arneis’ and ‘Erbaluce’. Laboratory-scale fermentations were conducted at 18 °C with maceration lasting 0 (control), 2, 7, and 14 days. After maceration, wines were analysed and subjected to oxygenation via air saturation followed by 1-month storage to evaluate oxygen exposure effects. Phenolic compounds were monitored using spectrophotometric and HPLC analyses, focusing on (+)-catechin, (–)-epicatechin, quercetin, quercetin-3-glucoside, condensed tannins, and polymeric flavanol structure. Wine sensory analysis was performed using the Rate-All-That-Apply (RATA) technique [2]. Wine colour was significantly influenced, with increased absorbance at 420 nm in wines subjected to prolonged maceration and air saturation. Total phenolic content increased with maceration time, as previously found [3], doubling after 2 days and quadrupling after 14 days compared to the control, with no significant variations post-oxygenation. The concentrations of (+)-catechin and (–)-epicatechin increased with maceration, while monomeric flavan-3-ols were not detected in control wines. Wine condensed tannins were found only in 7 and 14-day macerated samples, reaching 513 mg/L in Arneis and 708 mg/L in Erbaluce wines for the longest maceration time tested. Although the mean degree of polymerization (mDP) was unaffected by maceration, galloylation significantly increased in Arneis wines with longer maceration time. At the end of fermentation, free acetaldehyde levels were highest in control wines, decreasing with maceration and further declining after air saturation. Oxygenation notably increased condensed tannins (+20.3% on average) accompanied by a decrease in monomeric flavan-3-ols, thus suggesting the possible formation of polymeric flavanols [4] but no mDP differences were found. Sensory evaluation confirmed that longer maceration increased colour intensity, hue, and astringency, while a decline in white and yellow pulp fruit aroma descriptors was observed. These findings improve the understanding of maceration impact on white wine phenolics and sensory traits, offering insights for optimizing maceration to achieve desired wine profiles.

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ID: 240 / Poster session 1: 66
Abstract Submission
Topics: Analysis and composition of grapes, wines, wine spirits
Keywords: Nebbiolo, isoquercetin, anthocyanins, pH

Quantification of quercetin and quercetin-3-glucoside in Nebbiolo red wines

Lorenzo Ferrero[1], Maria Alessandra Paissoni[1,2], Susana Río Segade[1,2], Luca Rolle[1,2], Simone Giacosa[1,2]
[1]Dipartimento di Scienze Agrarie, Forestali e Alimentari, Università degli Studi di Torino, Corso Enotria 2/C, 12051 Alba (CN), Italy; [2]Centro Interdipartimentale di Ricerca sulla Filiera Viticoltura e Vino (CONViVi), Università degli Studi di Torino, Corso Enotria 2/C, 12051 Alba (CN), Italy; simone.giacosa@unito.it

Quercetin-3-glucoside, a grape flavonol defence metabolite, is extracted during winemaking and may undergo subsequent degradation in wines. Hydrolysation reactions lead to the formation of the aglycone quercetin, which presents limited solubility in the wine matrix and can induce visible precipitations. This issue potentially affects a wide range of wines. Red wines with low anthocyanin content, such as those produced from cv. Sangiovese grapes, seem more prone to quercetin instability [1]. Few cases of quercetin precipitation have been recently observed in wines from cv. Nebbiolo, a grape variety often destined to the production of monovarietal wines presenting a high content of phenolic compounds but low and oxidation-prone red colour pigments [2].

In this preliminary assessment, the quercetin-3-glucoside and (aglycone) quercetin contents were evaluated in 60 cv. Nebbiolo wines (containing a minimum varietal content of 90% or as monovarietal) covering a range of variability in terms of growing zones (Langhe, Roero, and Valtellina terroirs in northern Italy), production stages (bottle, tank, cask), and vintages (2012 to 2023), with most wines belonging to the last four vintages. Wine acidity and pH, as well as colour and key phenolic traits were also determined to investigate possible relations [1-3].

The average quercetin-3-glucoside and quercetin contents found were 1.8 and 8.0 mg/L, respectively, with high coefficients of variation (above 65%). Moreover, 18 wines presented quercetin amounts above 12 mg/L, with the highest detected concentration being 18.0 mg/L. For quercetin-3-glucoside, the maximum value was 10.8 mg/L, while no residual content was found in 37 wines, although these latter preserved a variable aglycone presence (5.6 ±5.0 mg/L). No relevant correlations for quercetin were found with total anthocyanin content or colour intensity, however a strong negative correlation between wine pH and quercetin concentration was evidenced (p<0.001). The role of pH is highlighted as a possible influencing factor concerning wine quercetin content and its stabilization.

Acknowledgments

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ID: 241 / Poster session 1: 67
Abstract Submission
Topics: Winemaking processes and oenological practices
Keywords: light struck defect, yeast nitrogen nutrition, volatile sulfur compound

Photo-oxidative stress and light-struck defect in Corvina rosé wines: influence of yeast nutritional strategies

Olga Melis[1], Marco Papuzzi[1], Leonardo Vanzo[1], Giovanni Luzzini[1], Arnaud Massot[2], Virginie Moine[2], Maurizio Ugliano[1]
[1]Università degli studi di Verona, Italy; [2]Biolaffort, France; olga.melis@univr.it

Light exposure is one of the major factors affecting the sensory quality of rosé wines and resulting in the light-struck fault. The photochemical reaction between methionine and riboflavin leads to the light-struck fault resulting in volatile sulfur compounds such as methanethiol (MeSH) and dimethyl disulfide (DMDS) that are responsible for off-odors with descriptors of onion and cooked cabbage.

The study investigates the chemical processes that lead to modifications of the volatile chemical profile of Corvina-based rosé wines following light exposure, with a particular focus on the role of yeast nitrogen nutrition.

The study tested seven different nitrogen supplementations: a control (no nutrients), inorganic nitrogen (DAP), organic nitrogen sources (Organic and Organic+Methionine), and combinations of organic and inorganic nitrogen (Mix).

The wines were produced in laboratory scale, all fermentations were carried out in triplicate, in 3 L volumes, at a temperature of 16°C.

After fermentation, the wines were divided into two groups. The first group was bottled into amber bottles then stored in the dark at 16°C temperature for 30 days. The second group was bottled in flint bottles and stored under direct exposure to light for 30 days at a temperature of 16°C.

Volatile compounds were analyzed by the mean of HS-SPME-GC-MS techniques. In total 38 volatile compounds were analyzed belonging to different biochemical classes such as volatile sulfur compounds, esters, fatty acids, alcohols, C6 alcohols, terpenes, norisoprenoids, benzenoids.

The results showed that light exposure decreased esters, terpenes (linalool, α-terpineol), and norisoprenoids (β-damascenone) while concurrently raising the amount of sulfur compounds linked to light struck defect, like MeSH, DMDS, DMTS.

Finally, a sorting task was conducted to evaluate olfactory similarities among the samples subjected to the nitrogen supplementation after light exposure. It showed that organic nitrogen nutrition strategies clustered together, exhibiting increased attributes of cooked vegetables. These wines showed higher concentrations of sulfur compounds (DMDS, DMTS, MeSH) and a lower content of fruity and floral volatile compounds (α-terpineol, β-damascenone) compared to those in the other cluster, which included the other nitrogen nutrition combinations.

These findings highlighted the importance of nitrogen supplementation sources and management and suitable packaging choices to mitigate the occurrence of light-struck fault in rosé wines, according to the insurgence of faults over the supply chain.

Bibliography

N/A

ID: 242 / Poster session 1: 68

Abstract Submission

Topics: Analysis and composition of grapes, wines, wine spirits

Keywords: Aromatic profile, typicality, wine aging, sensorial analyses

Chemical characterization of distinctive aroma profiles of Valpolicella and Amarone wines

Petra Piva, Giacomo Cristanelli, Giovanni Luzzini, Davide Slaghenaufi, Maurizio Ugliano

Department of Biotechnology, University of Verona, 37039, San Pietro in Cariano (VR) Italy; petra.piva@univr.it

Valpolicella is an Italian wine producing region, famous for the production of high-quality red wines. A distinctive characteristic of this region is the extensive use of post-harvest withering. The Valpolicella PDOs include different wine styles based on this technique, with two opposite interpretations being "*Valpolicella*", a dry red wine for which no grape withering is foreseen, and "*Amarone della Valpolicella*", a dry red wine obtained by the same grape varieties submitted to withering up to a weight loss of about 30% (Paronetto & Dellaglio, 2011). Moreover, the production regulations for Valpolicella PDOs divide the region in three areas: Valpolicella Classica, Valpolicella orientale and Valpantena (Consorzio Tutela Vini Valpolicella, 2014).

The present study had different aims: first to evaluate the differences among the chemical volatile profile of Valpolicella and Amarone; second, to identify, within each PDO, different styles according to chemical and sensory features of the wines. Finally, to evaluate the impact of grape origin on aroma profile of studied wines. Free volatile compounds and glycosidic precursors were analyzed with gas chromatography mass spectrometry (GC-MS) analysis coupled with different SPE and SPME extractions techniques. Enological parameters and phenolic composition were analyzed with different spectrophotometry techniques. Sensory characteristics of the wines have been investigated through sorting tasks conducted by a semi-trained panel.

Amarone and Valpolicella showed major differences due to the different production techniques, vintages and aging periods. Amarone showed higher concentration of cyclic terpenes, branched esters, and lactones, while Valpolicella, resulted richer in linear terpenes (Accordini, 2013; Luzzini et al., 2022). Concerning stylistic differentiation, the application of multivariate data analysis allowed the identification of volatile chemical profiles that defined the distinct enological styles of the two Valpolicella production areas. Differences were particularly evident in Valpolicella wines, where Valpolicella Classica wines showed the presence of higher alcohols, fatty acids and sulphur compounds, while Valpolicella orientale wines were higher in terpenes and norisoprenoids. The sorting task identified two clusters, one representative of Valpolicella Classica. with wines primarily described as green, fruity, tobacco and red fruit, descriptors linked to esters, fatty acids and higher alcohols, while the other cluster was described as floral, balsamic and spicy, with higher content of terpenes.

Bibliography

N/A

ID: 244 / Poster session 1: 69

Abstract Submission

Topics: Winemaking processes and oenological practices, Wine, environment, health and sustainability

Keywords: sustainable wine packaging, Wine-on-tap, kegged wine, conservation, sensory quality

Kegged Wine as a Sustainable Alternative: Impact on Conservation and Sensory Quality

PIERRICK REBENAQUE-MARTINEZ[1], MARC SARRAZIN[2], BENOIT BACH[1]

[1]CHANGINS, Viticulture and Enology, HES-SO University of Applied Sciences and Arts Western Switzerland, Nyon, Switzerland;
[2]BIBARIUM S, C/O Hôtel Management Corporation SA, Route de Lausanne 301, 1293 Bellevue, Switzerland;
pierrick.rebenaque@changins.ch

Wine is not just a beverage; it represents an entire ecosystem in winemaking regions and is deeply linked to economic, social, and environmental factors. As global consumers increasingly prioritize sustainability, ethics, and health in their food and beverage choices, the wine industry is under pressure to develop greener production, distribution, and consumption models [1] [2]. While sustainability has become a key focus for the industry, there is limited academic research on the technological, ecological, and economic benefits of kegged wine and how industry stakeholders perceive them [3] [4].

The ECOFASS-vin project, initiated in 2017 under the Interreg program, aimed to evaluate the suitability of Ecofass® kegs—recyclable HDPE containers with internal aluminum pouches—for long-term wine storage and service. This study examined their impact on oenological and sensory quality over several months, analyzing different storage conditions, dispensing gases (nitrogen

vs. compressed air), and pouch materials (PETMET vs. EVOH). Key parameters such as free SO_2 and CO_2 levels were monitored, along with sensory evaluations.

The results confirm that kegged wine can offer a viable conservation method, with PETMET pouches providing better oxidation protection and nitrogen gas preserving wine quality more effectively than compressed air. However, significant sensory differences were observed depending on storage conditions, highlighting the importance of material selection and gas composition. These findings suggest that properly optimized kegging systems could reduce SO_2 requirements, enhance wine preservation, and offer a sustainable alternative to traditional packaging.

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ID: 246 / Poster session 1: 70
Abstract Submission
Topics: Chemical and biochemical reactions, including grape and wine microorganism's impact
Keywords: Microorganisms, isolation, grape, identification

Exploring non-Saccharomyces wine yeasts native from Castilla-La Mancha (Spain) to enhance bioprotection and quality of wines

José Pérez-Navarro[1,2], Tania Paniagua-Martínez[1,3], Vanesa Mancebo-Campos[1,3], Sergio Gómez-Alonso[1,3], Mónica Fernández-González[1,2]

[1]University of Castilla-La Mancha, Regional Institute for Applied Scientific Research (IRICA), Avda. Camilo José Cela, 1, 13071, Ciudad Real, Spain; [2]University of Castilla-La Mancha, Higher Technical School of Agronomic Engineering. Ronda de Calatrava, 7, 13071, Ciudad Real, Spain; [3]University of Castilla-La Mancha, Faculty of Chemical Sciences and Technologies. Avda. Camilo José Cela, 10, 13071, Ciudad Real, Spain; jose.pnavarro@uclm.es

The current tendency to reduce SO_2 in winemaking, due to its adverse effects in sensitive individuals [1], has led to the development of new techniques to mitigate SO_2 absence and to exert the same antimicrobial and antioxidant effects. Bioprotection is defined as the use of microorganisms or metabolites derived from them for the adequate preservation of food, reducing the use of chemicals [2,3]. Several studies showed the ability of different microorganisms to preserve and improve food quality [3]. More specifically, non-*Saccharomyces* yeasts have shown numerous positive effects, preserving and improving the organoleptic characteristics of wines [4,5,6].

Thus, this work addressed the isolation and identification of non-*Saccharomyces* yeasts from different viticultural areas within the Castilla-La Mancha Spanish region, in order to use them as a bioprotection tool in winemaking. Serial dilutions of 27 samples obtained from grapes and musts were seeded onto WL agar plates supplemented with biphenyl (150 mg/L) and chloramphenicol (100 mg/L) and incubated at 25°C for three days.

A total of 214 yeast colonies were isolated and identified to species level by PCR (ITS-5.8S rDNA)-RFLP [7]. Then, one or two isolates of each molecular profile were sequenced using the D1/D2 domains of the 26S region to confirm their identity, obtaining 27 different species of which the most prevalent was *Aerobasidium pullulans*, followed by *Hanseniaspora uvarum*, *Hanseniaspora guillermondii* and *Metschnikowia pulcherrima.* In addition, other species of interest such as *Torulaspora delbrueckii, Lachancea thermotolerans* or *Pichia kluyveri* were also isolated in a minority proportion. The 214 isolates were also evaluated in terms of their acetic acid and hydrogen sulfide production, as well as tolerance to 25 mg/L of SO_2 [8], reducing the number to 39 isolates from 16 different species. Based on these results, these yeasts will be further evaluated depending on their metabolism and possible beneficial effects on wine quality.

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ID: 247 / Poster session 1: 71
Abstract Submission
Topics: Analysis and composition of grapes, wines, wine spirits, Wine, environment, health and sustainability
Keywords: Climate change, wine profiling, mass spectrometry

Discrimination of South Tyrol's wines by their cultivation practices: A detailed mass spectrometric approach

Nahikari PREVOST[1,2,3], Edoardo LONGO[1,2], Emanuele BOSELLI[1,2], Matteo SCAMPICCHIO[2], Peter ROBATSCHER[4], Josep VALLS-FONAYET[3,5]

[1]Oenolab, NOI TechPark Alto Adige/Südtirol, Via A. Volta 13B, 39100 Bolzano, Italy; [2]Faculty of Agricultural, Environmental and Food Sciences, Free University of Bozen-Bolzano, Piazza Università 5, 39100 Bolzano, Italy; [3]UMR 1366 Œnologie; Université de Bordeaux, INRAE, OENO, Bordeaux INP, Bordeaux Sciences Agro , 33140, Villenave d'Ornon, France; [4]Laimburg Research Centre, 39040 Ora, Provincia Autonoma di Bolzano – Südtirol, Italy; [5]Bordeaux Metabolome, MetaboHUB, PHENOME-EMPHASIS; Villenave d'Ornon, 33140, France; nahikari.prevost.pro@gmail.com

Climate change is having a profound effect on viticulture by altering the conditions under which vines grow, leading to increased water stress and earlier harvests, which in turn affect the quality and character of wines [1]. Climatic variations also influence the concentration of phenolic compounds, essential for wine structure and colour, forcing winegrowers to adapt their practices [2]. In addition, diseases such as powdery mildew, downy mildew and grey rot, favoured by these climatic changes, threaten harvests and wine quality [3]. The excessive use of pesticides to combat them presents significant environmental and health challenges, negatively affecting biodiversity and human health. Faced with these challenges, winegrowing is moving towards more sustainable approaches, such as biological control, disease-resistant/tolerant grape varieties and preventive techniques [4]. New disease-resistant grape varieties promise to produce quality wines while significantly reducing pesticide use. Studies indicate that wines from these varieties have phenolic, anthocyanin, and volatile profiles comparable to traditional *Vitis vinifera* wines while also displaying distinctive compositional differences [5].

Our global project, carried out jointly by the University of Bordeaux and the University of Bolzano, aims to establish a comparison of French (Bordeaux & Pays d'Oc) and Italian (South Tyrol) wines from different cultivars (local and international), terroirs and different conditions (organic/conventional wines) and develop interlaboratory comparisons of targeted and non-targeted analysis methods based on the use of NMR and MS, coupled with HPLC and GC. An initial targeted and non-targeted profiling of 61 commercial monovarietal wines from Pays d'Oc (France), using UHPLC-HRMS/MS has already been carried out. The targeted analysis was conducted using a calibration curve of over 45 polyphenols, while the untargeted approach was based on a Full Scan HRMS acquisition with data-dependent fragmentation. The initial results showed a clear discrimination between wines based on the grape variety and cultural practices.

The same strategy is now being used on an additional dataset of 59 monovarietal wines from South Tyrol (Italy), coupled with HS-SPME-GCxGC-ToF/MS for their volatile profile and HPLC-QQQ-MS for anthocyanins, polyphenols, and proanthocyanidins profiles. These multi-omics approaches should provide new knowledge and methodologies for discriminating wines based on their cultural practices [6].

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Abstract Submission
Topics: Analysis and composition of grapes, wines, wine spirits
Keywords: Nebbiolo, terroir, wine typicity, chemical analyses

Exploring typicity in Nebbiolo wines across different areas through chemical analysis

Ana Catarina Cunha[1], Maria Alessandra Paissoni[1,2], Micaela Boido[1], Giulia Scalzini[1], Susana Río Segade[1,2], Luca Rolle[1,2], Vincenzo Gerbi[1,2], Simone Giacosa[1,2]

[1]Department of Agricultural, Forest, and Food Sciences, University of Torino, Corso Enotria 2/C, 12051 Alba, Italy;
[2]Interdepartmental Centre for Grapevines and Wine Sciences, University of Torino, Corso Enotria 2/C, 12051 Alba, Italy;
anacatarina.cabralvaledacunha@unito.it

"Nebbiolo" is a red winegrape variety well known to produce monovarietal wines in Piemonte, Valle d'Aosta, and Lombardia regions, taking part to 7 DOCG (Denominazione di Origine Controllata e Garantita) and 22 DOC (Denominazione di Origine Controllata) protected designations of origin (PDO) [1,2]. In a context affected by climate change and its repercussions on wine quality, identifying typicity markers is essential to preserve this heritage. The *terroir* concept encompasses the varietal identity, the geographic area, and related environmental factors, as well as the impact of the viticultural and oenological practices resulting in distinctive products [3]. Recent studies on different *terroirs* showed how physico-chemical and sensory characterizations help differentiate the deriving wines and identify varietal traits [4,5]. To this aim, a comprehensive study on more than 150 Nebbiolo based wines from different areas (North Piemonte and Valle d'Aosta, South Piemonte, Lombardia), designations (Barbaresco, Barolo, Canavese, Carema, Gattinara, Ghemme, Roero, *Sfursat* or Sforzato di Valtellina), and vintages (2015-2022, ageing 1-9 years) is being performed to characterize their matrix composition, color, and phenolic characteristics. Various parameters were determined, with a special focus on polyphenol content. The Nebbiolo wine population showed pH values ranging 3.01-3.86, alcohol strength 12.2-17.0% v/v, dry net extract 22.4-36.5 g/L, and total acidity 4.65-7.76 g/L (as tartaric acid). Phenolic analysis revealed a total polyphenol index ranging from 2682 to 6412 mg/L as (–)-epicatechin, and total flavonoids from 1091 to 3554 mg/L as (+)-catechin. These findings confirm the bold phenolic richness of Nebbiolo wines, predominantly flavanols. Low total anthocyanin content was evidenced, with values between 45.3 and 203.9 mg/L as malvidin-3-*O*-glucoside chloride. This last factor contributes to the low values of color intensity parameter (average 5.1) typical of Nebbiolo wines [5]. This values ranges from 2.43 to 9.42 depending on wine ageing and wine style. The results will be further evaluated considering their geographical origin, different designations, and ageing time and modality.

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ID: 252 / Poster session 1: 73

Abstract Submission

Topics: Analysis and composition of grapes, wines, wine spirits

Keywords: Phenolic compounds, fluorescence spectroscopy, winemaking monitoring, chemometrics

Validating a portable ad-hoc fluorescence spectrometer for monitoring phenolic compounds during wine fermentation

Daniel Schorn-García[1], Wessel du Toit[1], Gurthwin Bosman[2,3], Jose Luis Aleixandre-Tudó[4]

[1]South African Grape and Wine Research Institute, Department of Viticulture and Oenology, Stellenbosch University, 7600, South Africa; [2]Stellenbosch Photonics Institute, Physics Department, Stellenbosch University, Stellenbosch, South Africa; [3]National Institute for Theoretical and Computational Sciences (NITheCS), Stellenbosch, South Africa; [4]Instituto de Ingeniería de Alimentos (Food-UPV), Departamento de Tecnología de Alimentos (DTA), Universitat Politecnica de Valencia (UPV), Valencia, Spain;
dschorng@sun.ac.za

Phenolic compounds are essential to wine quality, impacting colour, mouthfeel, stability, and ageing potential [1]. Their extraction and evolution during fermentation significantly influence the final sensory profile, necessitating precise monitoring to guide winemaking decisions. Traditional techniques like high-performance liquid chromatography (HPLC) and UV-Vis spectrophotometry, though accurate, are time-consuming and unsuitable for real-time monitoring due to complex protocols and laboratory dependencies. Fluorescence spectroscopy, known for its high sensitivity and non-destructive nature, offers a promising alternative [2]. However, existing instruments are not optimized for winemaking, limiting their practical use on-site. This study validates a portable fluorescence spectrometer designed for direct measurement of phenolic compounds in wine without dilution or sample treatment, enabling real-time monitoring throughout fermentation. The analytical performance of the spectrometer was assessed based on sensitivity, selectivity, repeatability, and robustness under typical winemaking conditions. Using phenolic standards representing key wine polyphenols, figures of merit, such as LOD, limit of quantification LOQ, linearity, and reproducibility, were evaluated, all demonstrating strong performance. Controlled fermentations using diverse grape musts tested the instrument's ability to quantify and differentiate phenolic profiles. Fluorescence single excitation multiple emission matrices were analysed using advanced chemometric methods, including PLS Regression and non-linear prediction algorithms [3]. These models accurately predicted total polyphenols, anthocyanins, and tannins, with correlation coefficients higher than 80%, particularly in single cultivar fermentations where spectral signals showed clearer associations with reference measurements. The results underscore the transformative potential of custom-designed analytical equipment in winemaking, offering an efficient, cost-effective, and practical alternative to traditional methods. Unlike general-purpose fluorescence instruments, this tailor-made spectrometer is optimized for winery environments, facilitating real-time decision-making without reliance on central laboratories. Its versatile measuring chamber supports multiple configurations and direct wine analysis, streamlining integration into the production process as an effective process analytical technology. This innovation paves the way for enhanced process control, refined blending and ageing strategies, and improved wine quality.

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ID: 253 / Poster session 1: 74

Abstract Submission

Topics: Sensory properties: psychophysics, experimental economy, connections with neurosciences

Keywords: Consumer survey, NOLO wines, consumer preferences

Sensory and Consumer Perceptions, and Consumption Barriers of Low and No-alcohol Wines in Trentino/Alto Adige

Wasim Akhtar[1,2], Edoardo Longo[1,2], Emanuele Boselli[1,2,3]

[1]Oenolab, NOI TechPark Alto Adige/Südtirol, Via A. Volta 13A, 39100 Bolzano, Italy; [2]Faculty of Agricultural, Environmental and Food Sciences, Free University of Bozen-Bolzano, Piazza Università 5, 39100 Bolzano, Italy; [3]International Competence Center on Food Fermentations, Faculty of Agricultural, Environmental and Food Sciences, Free University of Bozen-Bolzano, Italy;
wakhtar@unibz.it

The growing demand for non-alcoholic beverages, driven by health-conscious consumers and shifting social norms, has positioned dealcoholized wines as a promising alternative in the global beverage industry (Kakroo, 2024). Despite increasing interest, limited research explores consumer motivations, perceptions, and demographic trends influencing acceptance (Shaw et al., 2023). This

study explores awareness, perceptions, and situational preferences for dealcoholized wines through a survey of over 300 adults in the Italian region of Trentino/Alto Adige, which is situated at the crossroads between Italian and German wine cultures, focusing on demographic disparities and actionable factors influencing consumption. A structured online survey was administered via Survey Monkey, capturing demographic data (age, gender, income, occupation) and responses to address the familiarity, purchase behavior, sensory expectations, and social perceptions of NOLO wines. Descriptive analysis of percentage-based results revealed that despite low familiarity with NOLO wines, a significant 74% of total respondents expressed willingness to recommend it, highlighting promising potential. Major key drivers for trying NOLO wines included wine-tasting opportunities 75%, positive reviews 54%, promotions 32%, and package design 12% while smooth mouthfeel 65% and similarity to traditional wines 71% were critical sensory expectations for the NOLO wines. However, social and practical barriers, such as limited availability and ingrained habits, contributed to 80% never purchasing these wines. The study revealed a surprising gap as many are willing to recommend these wines despite few having actually tried it 72%, especially among younger consumers. To close this gap, producers should focus on offering tasting opportunities to overcome concerns about taste and quality while promoting the NOLO wine.

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ID: 254 / Poster session 1: 75

Abstract Submission

Topics: Vine science and link with grape and wine quality

Keywords: Near-infrared (NIR) spectroscopy, grafting compatibility, nutrient profiling, precision viticulture

Portable NIR Spectroscopy for Nutrient Profiling in Rootstock and Scion Material: Enhancing Decision-Making in the Grafting Industry

Daniel Schorn-García[1], Erna Blancquaert[1], Jose Luis Aleixandre-Tudo[1,2]

[1]South African Grape and Wine Research Institute, Department of Viticulture and Oenology, Stellenbosch University, 7600, South Africa; [2]Instituto de Ingeniería de Alimentos (Food-UPV), Departamento de Tecnología de Alimentos (DTA), Universitat Politecnica de Valencia (UPV), Valencia, Spain; dschorng@sun.ac.za

The success of grafting in viticulture is heavily influenced by the nutrient composition of both rootstock and scion materials. Key nutrients, such as nitrogen and carbohydrates, play vital roles in graft compatibility, establishment, and overall plant vigour [1]. Traditional methods for assessing nutrient content are often time-consuming, destructive, and resource-intensive, limiting their usefulness for rapid decision-making in commercial settings. Consequently, grafting industries frequently adopt a non-selective approach, performing grafts without prior nutrient assessment and evaluating post-grafting outcomes to determine success. This practice results in inefficiencies, resource wastage, and variability in plant quality. NIR spectroscopy has emerged as a non-destructive, rapid, and reliable tool for compositional analysis in various agricultural sectors.

This study investigates the use of NIR spectroscopy to assess nutrient profiles in rootstock and scion materials, aiming to enable data-driven grafting decisions. Three NIR spectrometers were evaluated: a benchtop unit, a commercially available portable spectrometer, and a handheld prototype. These devices were used to analyse grapevine rootstock and scion samples collected from three nurseries, representing diverse sites, cultivars, and clones. The final dataset included 1,000 samples, analysed both on the outer layer and the cross-sectional area of the shoot, following a fresh transverse cut to minimise bark interference. An independent dataset that maintained the proportional representation of different cultivars was used to ensure model reliability across varied genetic material. Multivariate calibration models were developed for each instrument using PLS Regression. Given the large volume of spectral data, not all samples underwent wet-chemical analysis. Instead, a recursive PLS approach was applied, where an initial subset was chemically analysed to build preliminary models, which were then used to predict additional samples. These new samples were iteratively added to refine the models [2].

All three NIR spectrometers successfully predicted nitrogen and carbohydrate content, with the benchtop unit achieving the highest accuracy. However, both the portable and handheld devices demonstrated acceptable predictive performance, making them practical for industry use. Prediction errors remained within acceptable limits for effective decision-making in grafting operations.These findings highlight NIR spectroscopy's potential as a rapid, non-destructive method for nutrient profiling in viticulture.

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ID: 255 / Poster session 1: 76

Abstract Submission

Topics: Winemaking processes and oenological practices, Wine, environment, health and sustainability

Keywords: Ozone, white wines, aroma compounds, colour characteristics

Effect of ozone treatments in wine production on colour traits, volatile composition, and sensory characteristics of young and short-term aged white wines

Giorgia Botta[1], Beatrice Cordero[1], Micaela Boido[1], Negin Seif Zadeh[1], Maria Alessandra Paissoni[1,2], Gianmarco Alfieri[3], Simone Giacosa[1,2], Luca Rolle[1,2], Francesca Borghini[4], Stefano Ferrari[4], Andrea Bellincontro[3], Susana Río Segade[1,2]

[1]Department of Agricultural, Forest and Food Sciences, University of Turin, Corso Enotria 2/C, 12051 Alba, Italy; [2]Interdepartmental Centre for Grapevines and Wine Sciences, University of Turin, Corso Enotria 2/C, 12051 Alba, Italy; [3]Department of Biological AgroFood and Forest Systems, University of Tuscia, Via De Lellis, 01100 Viterbo, Italy; [4]ISVEA, Via Basilicata 1/3/5, 53036 Poggibonsi, Italy; giorgia.botta@unito.it

The main aim of WiSSaTech project (PRIN P2022LXY3A), supported by the Italian Ministero dell'Università e della Ricerca and European Union-NextGenerationEU, is to investigate eco-friendly and safe alternatives to sulphur dioxide (SO_2) in wine production. Three treatments were compared on two Italian white wines produced from grapes cv. Fiano and Vermentino: ozone treatment of grapes and cellar equipment either alone (O_3) [1] or following the Purovino® method (PV) [2], and conventional use of SO_2. Colour characteristics (CIELab coordinates [3]), total polyphenols (absorbance at 280 nm and Folin-Ciocalteu method [4]), antioxidant activity (DPPH, ABTS, FRAP, and CUPRAC methods [4]), and volatile organic compounds (HS-SPME-GC-MS method [5]) were determined. Moreover, sensory analysis was conducted using descriptive analysis [6]. All analyses were carried out on the obtained wines (T0), after accelerated aging at 35 °C for one week (T1),and after six months of conventional aging at 18 °C (T6). Results showed that the antioxidant activity for Vermentino was higher in SO_2-added wines at T0, T1, and T6 followed by O_3-treated samples whereas total polyphenols were higher in the latter. Similar trends were observed for the antioxidant activity in Fiano wines, showing lower values for the PV treatment. Ozone treatments also influenced the VOCs profile. For Fiano, total free VOCs concentration decreased in PV and O_3 wines at T0 compared to SO_2 trial. Particularly, esters and acids diminished for PV treatment whereas benzenoids, terpenes, and norisoprenoids increased. However, benzenoids and terpenes decreased for O_3-treated samples, as also occurred at T1 and T6, whereas norisoprenoids increased. All increasing trends were confirmed at T6. For Vermentino wines, higher concentrations of benzenoids, terpenes, and norisoprenoids were also obtained for both PV and O_3 treatmentsat T0 and T1, but differences were observed between them at T6 leading to a higher total VOCs concentration in PV-treated samples. Sensory analysis revealed higher fruity and floral notes (*green apple* descriptor at T1, *pear, yellow pulp fruit, pineapple* at T6) in O_3 samples for Vermentino and Fiano, probably due to a higher citation of oxidation/reduction faults evidenced in the other wines. Higher sensory perceived colour hue in PV samples was in agreement with instrumental parameters (lower L* and higher b*), showing the highest colour differences (ΔE*) with SO_2 treatments, that were perceived more green at the three sampling stages.

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ID: 256 / Poster session 1: 77
Abstract Submission
Topics: Analysis and composition of grapes, wines, wine spirits, Winemaking processes and oenological practices
Keywords: Grape dehydration, dehydration temperature, polyphenols, extractability

Effects of fast dehydration at low temperature and relative humidity on the phenolic composition of Nebbiolo grapes

Beatrice Cordero[1], Negin Seif Zadeh[1], Alessandro Biglia[1], Maria Alessandra Paissoni[1,2], Simone Giacosa[1,2], Davide Ricauda Aimonino[1], Luca Rolle[1,2], Susana Río Segade[1,2]

[1]Department of Agricultural, Forest and Food Sciences, University of Turin, Largo Paolo Braccini 2, 10095 Grugliasco, Italy;
[2]Interdepartmental Centre for Grapevines and Wine Sciences, University of Turin, Corso Enotria 2/C, 12051 Alba, Italy;
beatrice.cordero@unito.it

Grape postharvest dehydration is a widely used technique for the special wines production, where genetic features, ripeness degree and environmental factors strongly influence the metabolic processes [1]. Low temperatures allow a better preservation of secondary metabolites by limiting oxidation reactions, but relative humidity and airflow are also important parameters in regulating the dehydration rate, which induces metabolic responses to water stress [1]. In this study, a cold dryer system (FD), operating at an air temperature and relative humidity of 15 °C and 40%, respectively, was tested for fast grape dehydration. This system was compared to long-term dehydration at 10 °C (LD), allowing better anthocyanin preservation [2], and to an uncontrolled process at 25 °C (MD) to assess the effect on the preservation and extraction of polyphenols in dehydrated grapes. 'Nebbiolo' winegrapes were used and samples from all trials were collected when a 35% of berry weight loss was reached. Standard parameters, total anthocyanins (TA), total flavonoids (TF), condensed tannins (PRO), flavanols reactive to vanillin (FRV) and colour traits were determined [3]. The potential phenolic content in skins and seeds [4] and the extracted content during 14 days of simulated maceration with a model wine solution [4] were determined. The results showed that dehydration was faster for FD, requiring only 15 days to reach 35% berry weight loss compared to 55 days for LD and 27 days for MD. The latter showed higher potential phenolic contents in skins for TA, TF and PRO than FD, LD and fresh grapes (prevailing concentration effect), whereas presented similar extracted concentrations to LD, showing FD samples the lowest values. Extracted TA contents peaked at 24 h of maceration and then decreased, whereas TF remained constant due to the progressive extraction of PRO and FRV. FD samples also showed the lowest potential and extracted FRV contents in skins, with a decrease of around 50% compared to fresh grapes. On the other hand, the potential FRV and PRO contents in seeds increased in dehydrated grapes, particularly for FD, but the extracted content increased similarly across the three treatments for PRO and achieved the highest values for FRV in FD. This study highlights that the dehydration rate, either too fast or too slow, rather than temperature could promote cell-wall degradation releasing phenolic compounds but inducing oxidation reactions that lead to significantly lower contents and red pigments loss.

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ID: 259 / **Poster session 1: 78**
Abstract Submission
Topics: Sensory properties: psychophysics, experimental economy, connections with neurosciences
Keywords: Consumer, PIWI, sustainability, climate change, home-use test

Consumer Perception and Preferences Regarding Grape Varieties Resilient to Climate Change.

Alejandro Suárez[1], Natalia Santamaría-López[1], Anna Claret[2], Luis Guerrero[2], Anna Gomis-Bellmunt[3], Joan-Miquel Canals[4], Enric Nart[1]
[1]VITEC – Centre Tecnològic del Vi, Crtra. De Porrera, km. 1, 43730, Falset, Spain; [2]IRTA-Food Quality and Technology, Finca Camps i Armet s/n, Monells, Girona, E-17121, Spain; [3]INCAVI - Institut Català de la Vinya i el Vi. Plaça Àgora, 2., 08720 Vilafranca del Penedès, Spain; [4]Departament de Bioquímica i Biotecnologia, Facultat d'Enologia, Universitat Rovira i Virgili, C/Marcel·li Domingo, 1, 43007, Tarragona, Spain; alejandro.suarez@vitec.wine

Innovative solutions have been developed for winemakers to adopt in their cultivation practices [1]. Two of the implementations addressed in this study are the use of strains adapted to arid climates (AAC) and the use of varieties resistant to fungal diseases (PIWIs). Both not only allow adaptation to current climatic conditions but also reduce the environmental impact of viticulture [2] and could contribute to creating a competitive advantage in the wine market [3].

249 consumers answered an online survey assessing the degree of acceptance of alternative varieties in order to mitigate the effects of climate change. The questionnaire was divided into two phases, one without and another with detailed information about the varieties. Subjective knowledge, support to produce wines made from these alternative grape varieties compared to conventional ones (CON), purchase intention and acceptance level attributes were taken into account. Additionally, consumer neophobia toward emerging trends in wine was considered.

On the other hand, a Home-Use Test (HUT) with 71 participants evaluated the sensory acceptance of a set of 10 wines made with studied varieties. For the interpretation of the data, analysis of variance on the variables contemplated was used. It was observed that the higher the level of subjective knowledge and the lower the level of neophobia, the more consumers tended to accept the varieties studied ($p < 0.05$). However, there were no intragroup differences between these factors. Acceptance levels varied significantly, with conventional varieties (CON) being the most accepted, followed by PIWIs, and finally AACs ($p < 0.01$). This preference pattern aligned with purchase willingness and support for winemaking with these varieties. Additionally, providing information significantly increased consumer acceptance for all types of varieties ($p < 0.01$).

Regarding sensory acceptance from the HUT test (carried out without information), there is a contrast with the levels of acceptance obtained in the online questionnaire, since PIWIs were more accepted than ACAs and CONs ($p < 0.01$). Consumer preferences, as assessed through an online questionnaire, indicated a higher acceptance towards conventional varieties, followed by PIWIs and ACA varieties. However, findings from HUT revealed that, in a blind tasting context, PIWIs were the most

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ID: 260 / **Poster session 1: 79**
Abstract Submission
Topics: Analysis and composition of grapes, wines, wine spirits, Winemaking processes and oenological practices
Keywords: Dealcoholized wine, canned wine, physicochemical analysis, wine ageing

Chemical and sensory evolution of total and partial dealcoholized wine in a can

Inés Horcajo[1], Alejandro Suárez[1], Victoria Castillo[1], Rubén Pedregosa[2], Enrico Bocca[2,3], Anna Brull[2,3], Miquel Puxeu[1]
[1]VITEC – Centre Tecnològic del Vi, Crtra. De Porrera, km. 1, 43730, Falset, Tarragona, Spain; [2]Celler Castelo de Pedregosa, BP-2151, Km 10, 08770 Sant Sadurní d'Anoia, Barcelona, Spain; [3]Vason Ibérica, Travesia Don Quijote, nave 13, 13700, Tomelloso, Spain; alejandro.suarez@vitec.wine

In recent years, wine consumption has been evolving towards new trends. On the one hand, awareness of health and responsible consumption has been growing, and with it, the demand for wines with lower or without alcohol content [1]. The World Health Organization in its Global Alcohol Action Plan 2022-2030 promoted initiatives to reduce the harmful use of alcohol as a public health priority and to improve the health and well-being of populations around the world, thus urging the alcoholic beverage industry to position itself for the development of products with lower alcohol content [2]. In addition, climate change is having a direct impact on the increase in the alcohol content of wines, increasing the sugars accumulation on grapes resulting in a higher alcoholic content [3]. On the other hand, packaging is key to the wine economy [4]. Therefore, the industry is looking for alternatives to glass, such as cans, for their practicality, lower cost and lower environmental impact. Wine in cans therefore aims to compete with soft drinks and beer, including non-alcoholic options. Recent studies have shown that its market is expected to grow from $235.7 million in 2021 to $570 million in 2028 [5], enabling lighter and more sustainable consumption in non-traditional settings.

In this study, we focused on evaluating the evolution of partially and totally dealcoholized wine in cans. For this purpose, the same white wine was partially and totally dealcoholized from a hydrophobic membrane up to 5.11 % vol. and 0.63 % vol. respectively. Subsequently, the wine was refined by correcting taste sensations and finally it was canned. The analyses performed were focused on basic physicochemical tests and color characteristics to see the impact of dealcoholisation process and ageing in a can. Reduction flavours and the total content of metals in the wine were monitorized to know the impact of zero oxygen transmission packaging on wine and monitor the can film status to prevent the contact between wine and aluminium. In addition, fermentative analyses were carried out to monitor the global impact on aromatic perceptions. Sensory analysis on time were used to monitor taste and flavours evolution and know the preference of the consumers. All the analysis were carried out at 0, 3 and 6 months. This study and their results could improve product quality and consumer acceptance of low and non-alcoholic wines in cans. It would also open up new markets among health-conscious consumers and encourage advances in dealcoholization, winemaking and preservation.

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ID: 262 / Poster session 1: 80

Abstract Submission

Topics: Winemaking processes and oenological practices

Keywords: Oenological tannins, volatile organic compounds, colour traits, fermentation

Effect of pre-fermentative addition of oenological tannins on the volatile composition and colour characteristics of white wines

Negin Seif zadeh[1], Maria Alessandra Paissoni[1,2], Micaela Boido[1], Giorgia Botta[1], Domen Škrab[1], Carlo Montanini[3], Simone Giacosa[1,2], Luca Rolle[1,2], Susana Río Segade[1,2]

[1]Department of Agricultural, Forest and Food Sciences, University of Turin, Corso Enotria 2/C, 12051 Alba, Italy; [2]Interdepartmental Centre for Grapevines and Wine Sciences, University of Turin, Corso Enotria 2/C, 12051 Alba, Italy; [3]AEB S.p.A., Via Vittorio Arici 104, 25134 Brescia, Italy; negin.seifzadeh@unito.it

This study investigates the effect of pre-fermentative addition of oenological tannins on basic physicochemical parameters, total polyphenols index (TPI), antioxidant activity (DPPH method), colour traits, and volatile organic compounds (VOCs) of white wines made from 'Vermentino' or 'Erbaluce' grapes (*Vitis vinifera*). Six oenological tannins were used, including hydrolysable (ellagitannins, gallotannins) and condensed tannins (derived from grape skins, grape seeds, quebracho, and acacia), at a dose allowing a similar increase in the TPI value. Nano-vinifications (300 mL) under controlled conditions were evaluated at three alcoholic fermentation stages (80 g/L, 20 g/L, < 2 g/L of reducing sugars; fermentation lasting 18 days). Tannins addition did not significantly influence the basic physicochemical parameters and fermentation kinetics, but it increased TPI and antioxidant activity as expected. In the final wine, the highest TPI value was observed for grape seed tannin, while the grape skin and grape seed tannins exhibited the greatest DPPH values in Vermentino and Erbaluce wines. Colour characteristics determined according to CIELab system [1] showed that the acacia tannin trial resulted in the greater colorimetric difference (ΔE^*) with respect to non-added samples in the pre-fermentative stage (lower L* and higher b* colour coordinates). In Vermentino and Erbaluce wines, these colour differences diminished in most of cases, with gallotannin and grape skin tannin having the least impact.

Free VOCs were determined by HS-SPME-GC-MS at the three stages of fermentation [2] and possible changes in volatility were evaluated by simulating the fermentation conditions [3]. Regarding Vermentino, the wines obtained using quebracho tannin showed the highest concentration of all VOCs classes, particularly ethyl esters and acids, increasing total VOCs concentration by up to 28% compared to the control sample. Esters and acids also increased in wines resulting from acacia and grape skin tannin trials but the concentration of terpenes and norisoprenoids was negatively affected. Moreover, grape seed tannin better preserved higher alcohols (mainly 2-phenylethanol), acids, and norisoprenoids. Regarding Erbaluce, the effects were less pronounced. Ellagitannin, quebracho, and grape seed tannins increased the concentration of esters by around 5% whereas tannins from exotic woods decreased that of benzenoids by 10%. Individual VOCs results showed that oenological tannins can significantly improve wine aroma complexity but a varietal effect was observed.

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ID: 265 / Poster session 1: 81

Abstract Submission

Topics: Analysis and composition of grapes, wines, wine spirits

Keywords: Chardonnay, Fenton reaction, EPR, 1-HER

Evaluation of the hydroxyethyl radical formation kinetic and Strecker aldehydes distribution for assessing the oxidative susceptibility of Chardonnay wines

Pei HAN[1,2], Alexandre PONS[1,2,3]

[1]Univ. Bordeaux, Bordeaux INP, INRAE, OENO, UMR 1366, ISVV, F-33140 Villenave d'Ornon, France; [2]Bordeaux Sciences Agro, Bordeaux INP, INRAE, OENO, UMR 1366, ISVV, F-33170 Gradignan, France; [3]Seguin Moreau France, Z.I. Merpins, BP 94, 16103 Cognac, France; pei.han@u-bordeaux.fr

Over the last decade, much attention has been paid on the oxidative susceptibility of white wines, given its key role in determining their ageing potential. Some wines may undergo premature oxidative ageing, during which the oxidative cascade can trigger the formation of hydroxyl radicals producing 1-hydroxyethyl radicals (1-HER) [2] and Strecker aldehydes (SA), such as methional and phenylacetaldehyde [1]. To date, the potential relationship between SA and the kinetics of 1-HER formation (K1-HER) is poorly documented.

The electron paramagnetic resonance (EPR) technique, dedicated for radical analysis, has been used in enological studies [3], [4]. Based on the literature, we recently proposed an optimized version of the EPR-spin trap approach to study K1-HER in Chardonnay wines [6]. New indexes derived from a log-normal model of kinetic curve were proposed. These analytical indexes were validated in terms of repeatability and reproducibility (RSD < 8 %). In parallel, a strategy inspired from literature [5] was slightly modified to analysis free and total SA (methional and phenylacetaldehyde) by SPE-GC-MS.

In a first experiment we analyzed twenty young commercial Chardonnay wines (2019-2022) from various appellations. Total and free methional levels ranged from 4-40 µg/L and 0.1-3 µg/L, respectively, whereas the bounded form represented 60 to 90% of the total methional content. Distinct EPR signatures were obtained allowing us to classify the wines according to their EPR signals and the SA content.

Additional slow oxidation experiments carried out in controlled conditions with different stoppers showed that after, at least six years of bottle aging, wines with a higher EPR index (≥30%) tended to exhibit elevated levels of both free and total methional. Finally, the EPR approach was applied on young wines made from grapes harvested at four ripening levels. Microvinifications (50 L, n=3) were carried out at the BIVB located in Burgundy. The first results showed the impact of the maturity level of the grapes on the capacity of young white wines to produce free radicals and SA. Although these results suggest that the EPR index may serve as a reliable predictor of wine susceptibility to oxidation, additional experiments will be carried out to validate these observations.

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ID: 268 / Poster session 1: 82
Abstract Submission
Topics: Analysis and composition of grapes, wines, wine spirits
Keywords: Benchtop-NMR-Spectroscopy, Chemical analysis, Quality assessment, Quantum mechanics

Quantitative Assessment of Must Composition Using Benchtop NMR Spectroscopy: Comparative Evaluation with FTIR and Validation by Reference

Julian Felix Dirk Lueck[1,2], Billy Salgado[3,4], Patrick Nickolaus[1,2], Fabian Jirasek[3,4], Erik von Harbou[5], Ulrich Fischer[1,2,6], Jörg Fahrer[6], Kerstin Münnemann[6], Lena Keller[1,2,7]

[1]Weincampus Neustadt, Germany; [2]Institute for Viticulture and Oenology, Dienstleistungszentrum Ländlicher Raum Rheinpfalz (DLR Rheinpfalz), Germany; [3]Laboratory of Engineering Thermodynamics (LTD), University of Kaiserslautern-Landau (RPTU), Germany; [4]Laboratory of Advance Spin Engineering - Magnetic Resonance (LASE-MR), University of Kaiserslautern-Landau (RPTU), Germany; [5]Laboratory of Reaction and Fluid Process Engineering (LRF), University of Kaiserslautern-Landau (RPTU), Germany; [6]Division of Food Chemistry and Toxicology, Department of Chemistry, University of Kaiserslautern-Landau (RPTU), Germany; [7]Department of Applied Logistics and Polymer Sciences, Kaiserslautern University of Applied Sciences, Germany;
julian.lueck@dlr.rlp.de

The foundation of wine production lies in the use of high-quality grapes. To produce wines that meet the highest standards, a fast and reliable analytical assessment of grape quality is essential. Many wineries currently employ Fourier-Transform Middle-Infrared Spectroscopy (FTIR) for this purpose. However, this technique demands frequent and intricate calibration with authentic reference samples, and its indirect quantification approach raises concerns about reliability for certain parameters. Additionally, FTIR has high detection limits for key indicators of grape rot, such as gluconic acid and volatile acids.

Nuclear magnetic resonance spectroscopy (NMR), on the other hand, enables the direct measurement of these compounds, eliminating the need for calibration and enabling precise quantification. However, conventional high-field NMR systems are associated with high acquisition and maintenance costs, limiting their widespread use. Continuous development has optimised benchtop NMR spectrometers providing a cost-effective alternative. Although these devices operate at lower magnetic field strengths and therefore have reduced resolution, they are a viable alternative. To overcome this limitation, we use a spectral correction and peak analysis algorithm based on quantum mechanical calculations and pattern recognition [1,2].

In this study, the must components were analysed quantitatively using benchtop NMR. The results obtained were compared with FTIR measurements and validated against established reference methods, including photochemical and titrations. The measurements showed good agreement with the reference values, demonstrating higher precision and possibly even better accuracy than conventional methods. This is to be verified in more detail by further gravimetric investigations. In addition, the sample preparation process was considerably simplified, as initial tests showed insensitivity to known interfering factors such as turbidity. This indicates a robust and efficient analysis method with reduced preparation effort.

Our results suggest that this method could be integrated into automated grape reception processes, allowing wineries and cooperatives to obtain important quality data in a timely manner. Further validation is required in order to conclusively assess its suitability for routine use.

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no recent publications

ID: 269 / Poster session 1: 83
Abstract Submission
Topics: Chemical and biochemical reactions, including grape and wine microorganism's impact, Wine, environment, health and sustainability
Keywords: Catechins, NMR, Huntington's disease, protein aggregation modulation

Modulation of Huntingtin protein aggregation by (+)-catechin: an NMR study on kinetic mechanisms

Giacomo Zuccon[1,2], Edoardo Longo[1], Emanuele Boselli[1,3], Alberto Ceccon[2]
[1]Free University of Bozen-Bolzano, Italy/ Oenolab, NOI TechPark Alto Adige/Südtirol; [2]Laimburg Research Centre, Laimburg 6 - Pfatten (Vadena), 39040 Auer (Ora), BZ, Italy.; [3]International Competence Center for Food Fermentations, Free University of Bozen-Bolzano, Piazza Università 5, 39100 Bolzano, Italy; giacomo.zuccon@student.unibz.it

Catechins, a subclass of flavonoids widely found in plants and plant-based foods and beverages such as wine and tea, not only exhibit significant antioxidant properties [1], as extensively documented in the literature, but can also inhibit amyloid protein aggregation [2], a key process implicated in the onset of neurodegenerative diseases such as Parkinson's, Alzheimer's, and Huntington's.

Observations of kinetics profiles suggested that amyloid fibrils formation could be modelled by a sigmoidal function, reflecting the fact that this process consists primarily of two stages: nucleation and elongation.

Detailed studies on this kind of polymerization have shown that the mass concentration of polymer in solution frequently increases more rapidly than predicted by the classical model, suggesting the extension including secondary nucleation pathways, which can contribute to the increase in the number of polymers in addition to that produced by the straightforward homogeneous nucleation [3]. More specifically, monomer-dependent secondary nucleation [4] and monomer-independent secondary nucleation in the form of fragmentation [5] emerged as a key factor in the propagation.

Our study aims to elucidate the mechanisms by which flavonoids, starting with (+)-catechin (2R,3S) —the most common catechin isomer— modulate the aggregation kinetics of Huntingtin protein exon 1 (the portion of the protein directly involved in the aggregation) encoding CAG/polyglutamine repeat expansion. To achieve this, we integrated NMR spectroscopy with computational analysis. Building on existing literature, we have developed a comprehensive mathematical framework that incorporates primary nucleation, elongation, and secondary nucleation stages of protein aggregation, incorporating additionally the presence of a generic binding molecule by considering all interaction pathways through which it may influence aggregation kinetics. By fitting this model to NMR experimental data, we seek to determine the specific stage within the aggregation cascade where catechin exerts its influence, thereby shedding light on its potential anti-amyloid mechanism of action.

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ID: 270 / Poster session 1: 84
Abstract Submission
Topics: Winemaking processes and oenological practices
Keywords: Oenological tannins, volatile composition, sensory analysis, white wine

Chardonnay white wine bottled with different oenological tannins: effect on colour traits, volatile composition and sensory attributes during shelf-life

Susana Río Segade[1,2], Micaela Boido[1], Beatrice Cordero[1], Maria Alessandra Paissoni[1,2], Mar Vilanova[3], Simone Giacosa[1,2], Carlo Montanini[4], Luca Rolle[1,2]
[1]Department of Agricultural, Forest and Food Sciences, University of Turin, Corso Enotria 2/C, 12051 Alba, Italy; [2]Interdepartmental Centre for Grapevines and Wine Sciences, University of Turin, Corso Enotria 2/C, 12051 Alba, Italy; [3]Instituto de Ciencias de la Vid y del Vino (ICVV-CSIC), Carretera de Burgos Km. 6, Finca La Grajera; 26007 Logroño, Spain; [4]AEB S.p.A., Via Vittorio Arici 104, 25134 Brescia, Italy; susana.riosegade@unito.it

The use of oenological tannins during winemaking has been mostly studied for improving colour traits and stability on red wines. Their effectiveness mainly depends on the tannin composition, grape variety and winemaking approach [1]. However, few studies have been conducted for white varieties on the ability of exogenous tannins to preserve wines against oxidation and their influence on sensory properties [2,3]. Therefore, the aim of this research was to evaluate the effect of six tannin formulations (ellagic, gallic, acacia, quebracho, grape skin and grape seed tannins) on a 'Chardonnay' white wine during shelf-life. Each formulation was added at bottling at a dose allowing an equal increase in total polyphenols with respect to the non-added control. Standard parameters, colour characteristics, total polyphenols, antioxidant activity, volatile organic compounds (VOCs) and sensory properties were determined.

The antioxidant activity (DPPH method) decreased for most of treated wines during storage, except for both quebracho and grape seed tannins that showed a lower total polyphenols content after 9 months. After tannin addition and 1 month after bottling, an increased yellowish hue (higher absorbance at 420 nm) was observed in all wines, except for gallotannins. In the wines treated with ellagitannins or grape seed tannins, absorbance at 420 nm decreased after 9 months with small colour differences from control ($\Delta E^* < 2.5$) whereas acacia and skin tannins contributed stronger to wine colour. Regarding sensory traits, there were some differences at 1 month after bottling, gallotannins and ellagitannins gave wines with higher aroma intensity (*banana* and *pear* being mostly cited descriptors), particularly compared to skin, quebracho and seed tannins (*green apple* discriminating the last two wines from the others). In agreement with aroma intensity, the best preservation of varietal VOCs was observed for gallotannnins-treated wines at 1 month after bottling, including terpenes and norisoprenoids. The wines treated with skin and seed tannins were more astringent but

less bitter than control. After 9 months of shelf-life, the differences among the wines tested were reduced, gallotannins-added wines showing the lowest aroma intensity, whereas quebracho and seed tannins gave the most astringent wines. At this time, most of VOCs decreased for all tannin formulations but some esters and higher alcohols increased compared to control. These results highlight that oenological tannins can modulate aroma composition during wine shelf-life.

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ID: 271 / Poster session 1: 85
Abstract Submission

Topics: Chemical and biochemical reactions, including grape and wine microorganism's impact
Keywords: Nero d'Avola wine, non-Saccharomyces yeasts, fermentation, wine composition

Comparison between non-Saccharomyces yeasts for the production of Nero d'Avola wine

Denis Allieri[1], Iklima Odabaşı[1], Carmen Cris De Oliveira Nobre Bezerra[2], Nicholas Bonacina[2], Stefano Ferrari[3], Francesca Borghini[3], Ileana Vigentini[2], Daniela Fracassetti[1]

[1]Department of Food, Environmental and Nutritional Sciences (DeFENS), Università degli Studi di Milano, Italy; [2]Department of Biomedical, Surgical and Dental Sciences (DSBCO), Università degli Studi di Milano, Italy; [3]ISVEA S.r.l., Italy; denis.allieri@unimi.it

Wine production with non-*Saccharomyces* yeasts is getting larger application due to the positive impact of these yeasts on wine composition. Previous studies showed notably differences in chemical composition of Merlot wines obtained with *Torulaspora delbrueckii* [1]. Similarly, *Lachancea thermotolerans* led to produce Tempranillo wines with lower ethanol content and enhanced wine structure [2]. This study investigated the chemical composition and sensory attributes of Nero d'Avola wines produced by sequential inoculum with *T. delbrueckii* (TD)*, Metschnikowia pulcherrima* (MP) and *L. thermotolerans* (LT). Four batches of Nero d'Avola grape were collected in three different areas of Sicily (Palermo, Catania, Caltanissetta) in harvest 2024. The must fermentation was carried out with sequential inoculum of non-*Saccharomyces* starter yeasts and *S. cerevisiae*, the latter being inoculated 48 hours after the non-*Saccharomyces* strains. Microvinifications with maceration were performed monitoring the microbial population during the alcoholic fermentation (AF). At the end of AF, the experimental wines were racked, stabilized, and bottled. The wines were characterised for general chemical parameters (residual sugars, titratable acidity, acetic acid, malic acid, lactic acid, acetaldehyde, glycerol), flavonoids and anthocyanins, colour index, monomers (vanillin index) and tannins (methylcellulose index). The sensory analysis and the aroma profiles were also assessed. The sugar consumption during the first two days of AF was higher for TD and LT in comparison to MP. As expected, the sugar consumption rate increased when the *S. cerevisiae* strain was inoculated in all the winemaking conditions adopted. The wines obtained with LT showed the highest amounts of lactic acid as well as, in most of the cases, of acetic acid. Differences of phenolic composition were also revealed with higher content of flavonoids and anthocyanins, and lower content of monomers in wines produced with MP and TD. These wines showed also a higher colour intensity in most of the cases. From the sensory point of view, the descriptors mostly affected by the investigated non-*Saccharomyces* strains were 'ripe fruits' and 'floral' for the olfactory sensations, 'body' and 'sour' for the mouthfeel sensations and 'floral' for aftertaste sensations. The study provides further evidences of the impact of non-*Saccharomyces* yeasts on wine composition and their possible use for the differentiation of the Nero d'Avola style.

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ID: 273 / Poster session 1: 86
Abstract Submission

Topics: Analysis and composition of grapes, wines, wine spirits, Wine, environment, health and sustainability
Keywords: Grenache wine, aroma composition, maturity stages, climatic influence, climate change

Towards Faultless Grenache Wines: Impact of Climate and Maturity

Mónica Bueno[1], María Buñuel-Escudero[1], Roberto Serrano-Notivoli[2], Cristina Peña[1], Ignacio Arias-Pérez[3], María-Pilar Sáenz-Navajas[3], Purificación Fernández-Zurbano[3], Carolina Castillo Rio[3], Ana Escudero[1], Elisabeth Carlier[4], Olivier Geffroy[4], Ignacio Ontañón[1]

[1]Laboratorio de Analisis del Aroma y Enología (LAAE). Department of Analytical Chemistry, Universidad de Zaragoza, Instituto Agroalimentario de Aragón (IA2) (UNIZAR-CITA), Spain; [2]Departamento de Geografía y Ordenación del Territorio, Instituto Universitario de Ciencias Ambientales (IUCA), University of Zaragoza, Zaragoza, Spain; [3]Department of Enology, Instituto de Ciencias de la Vid y del Vino (UR-CSIC-GR), Logroño, Spain; [4]PPGV – Physiologie, Pathologie et Génétique Végétale, Toulouse INP-Purpan, 31076 Toulouse, France; mobueno@unizar.es

Climate change is affecting wine production and inducing significant variability in wine composition between vintages. These effects are often seen in altered precipitation patterns and higher temperatures during maturation, leading to a decoupling between technological and phenolic maturations, which results in delays, high sugar concentrations and aromatic defects at harvest. Such phenomena are particularly evident in Grenache, a cultivar well-represented in France and Spain within the POCTEFA Pyrenean

foothills. The aim of this study was to investigate over two consecutive seasons, the impact of climate and maturity on the aroma of wines made from this cultivar.

For the main Protected Designation of Origin (PDO) areas with Grenache cultivars located in the POCTEFA region (Aragn, La Rioja, Navarra, País Vasco, Cataluña and Pyrénées-Orientales), climatic data from 1981 to 2010 were collected and used to calculate several bioclimatic variables. Data were analysed using k-means clustering to identify three homogenous climatic zones. A stratified sampling approach was employed to select 30 Grenache vineyards across Spain and France (20/10), corresponding to the three previously identified climatic zones (10/10/10). For each site, grape samples were harvested at three maturity stages: the first at a sugar concentration of 21.0 ± 2.0 °Brix (P1), the second one (P2) 12 ± 2 days after P1, and the third (P3) 12 ± 2 days after P2. These grapes were used to determine classical oenological parameters, to monitor phenolic composition according to the Cromoenos® method, to obtain a berry volatile fingerprint through SIFT-MS analysis and to produce hydrolysed mistelle – a model to predict the aroma potential of grapes by GC-MS [1]. At P1 and P2, experimental wines were produced under minivinification techniques to analyse wine aroma composition using GC-MS techniques and to perform sensory analysis.

Currently, only data from the 2024 harvest are available. The findings emphasize the importance of climate and maturity on aroma composition and enable to determine optimal climatic conditions to avoid the appearance of aromatic defects. In a future, these findings will also be useful to identify new viticultural regions, more suitable for the future production of faultless wines in a context of changing climate.

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ID: 274 / Poster session 1: 87
Abstract Submission
Topics: Chemical and biochemical reactions, including grape and wine microorganism's impact
Keywords: wine spoilage, biofilm formation, Brettanomyces, spoilage treatment

Isolation, biofilm formation and control of the wine spoilage yeast Brettanomyces bruxellensis

Aikaterini Tzamourani, Nikolaos Mourdoukoutas, Maria Dimopoulou
Department of Wine, Vine and Beverage Sciences, School of Food Science, University of West Attica, 28 Agiou Spiridonos Str., 12243 Egaleo, Greece; mdimopoulou@uniwa.gr

Brettanomyces bruxellensis, commonly referred to as "Brett," is one of the most notorious microorganisms implicated in wine spoilage. This yeast species has developed a noteworthy resistance to sulfur dioxide, a widely used preservative in winemaking, prompting the wine industry to seek new antimicrobial agents. The development of *B. bruxellensis* in wine can change the sensory properties of wine due to the production of undesirable aromas. The present work focuses on i) the biofilm-forming ability of *B. bruxellensis*, derived from Greek wines, on stainless steel surfaces ii) the ability of the adhered cell to cause wine spoilage iii) new treatment to handle the contamination. Three wines from different regions of Greece were collected and subjected in molecular analyses and identification at species level. RAPD (Random Amplified Polymorphic DNA) genomic fingerprinting with the oligo-nucleotide primer M_{13} was used, combined with Matrix Assisted Laser Desorption Ionization–Time of Flight Mass Spectrometry (MALDI-TOF MS) technique. Strain differentiation of *B. bruxellensis* different strains was achieved by rep-PCR fingerprinting method with the oligo-nucleotide primer GTG_5. For the biofilm formation assay, stainless steel coupons were placed in test tubes containing sterilized Ringer solution and pure cultures of the different *B. bruxellensis* strains was inoculated at an initial population of approximately 10^7 CFU/mL. The tubes were incubated at 28 °C for 3 hours to allow attachment of the yeast cells onto the coupons surface. Biofilm growth was evaluated with the bead vortexing method. Finally, different treatments were applied in order to prevent the adherence of *B. bruxellensis* strains to the coupons. Overall, we showed that the attachment and biofilm formation capacity of the spoilage yeast is influenced by the strain effect and tree different types of adherences were noticed. Additionally, all tested treatments achieved to decrease the attached yeast cells proposing a new way of handling *B. bruxellensis* contamination.

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ID: 277 / Poster session 1: 88
Abstract Submission
Topics: Wine, environment, health and sustainability
Keywords: wine lees, antimicrobial molecules, grapevine pathogens

Profiling and evaluating wine lees by-products from various yeast strains against grapevine pathogens

Maria Dimopoulou[1], Alexandra Evangelou[1], Gkizi Danai[1], Aikaterini Tzamourani[1], Kasioura Angeliki[1], Tsioka Artemis[1], Ntourtoglou George[1], Vrhovsek Urska[2], Arapitsas Panagiotis[1]

[1]Department of Wine, Vine and Beverage Sciences, School of Food Science, University of West Attica, 28 Ag. Spyridonos St., 12243 Egaleo, Greece; [2]Metabolomic Unit, Edmund Mach Foundation, San Michele all Adige, Italy; mdimopoulou@uniwa.gr

Wine lees are the sediment that settles at the bottom of wine barrels, tanks, or bottles during the winemaking process and represent the second most significant by-product of wineries. Wine lees consist primarily of dead yeast cells which contain a complex mixture of both organic and inorganic molecules, such as proteins, peptides, polysaccharides, sterols, and long-chain fatty acids. This study aimed to evaluate the potential role of wine lees in combating grapevine pathogens. Six different wine yeast species were tested in fifteen fermentation schemes under monoculture and mixed-culture conditions. Fermentations were conducted in a laboratory medium that mimicked wine conditions (grape juice medium). The fermentation rate was monitored daily using an enzymatic method (Glucose/Fructose) following the OIV official protocol along with CO_2 emission measurements. Following fermentation, yeast biomass was autolyzed and digested to produce High Molecular Weight Biomolecule Mixtures (HMW-BM) and Low Molecular Weight Biomolecule Mixtures (LMW-BM). These biomolecule mixtures were then evaluated in vitro for their ability to inhibit the growth of Botrytis cinerea, Aspergillus carbonarius, Phaeomoniella chlamydospora, and Phaeoacremonium minimum. Our results indicate that the most effective biomolecule mixture with a protective mode of action against grapevine pathogens was LMW-BM.

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ID: 278 / Poster session 1: 89

Abstract Submission

Topics: Artificial Intelligence in the vine and wine sector

Keywords: Linear Voltammetry, enological tannins, oxygen consumption, Machine Learning

Predicting oxygen consumption rate in wine through Linear Sweep Voltammetry and Machine Learning models.

Rosario Pascale, Davide Slaghenaufi, Maurizio Ugliano

Università di Verona, Italy; rosario.pascale@univr.it

Oxygen plays a key role in wine quality, with its consumption depending on storage conditions, rackings, aging materials, and bottle closure. Polyphenols are the main oxidation substrates, form quinones, which react with wine compounds, altering its composition (Ugliano, 2013).Thus, assessing oxidative potential is essential for better winemaking management.

To address this, linear voltammetry (LV) was employed to evaluate oxygen consumption in Corvina red wine with added tannins. 43 enological tannins from oak, grapeseed, and gallnut were tested at 0.5 g/L, in wines without SO_2 and with 25 mg/L of free SO_2, generating 86 samples. After oxygen saturation by handshaking, samples were stored at 25°C, and oxygen consumption was monitored every 24 hours until levels dropped below 1 mg/L.

The hourly oxygen consumption rate data were subjected to clustering analysis, which divided the samples into two groups, which have been called “Fast” and “Slow”. A Kruskal-Wallis test was performed to verify that the oxygen consumption rate between the two groups was statistically different. The voltammograms of the samples were used to train machine learning (ML) models to predict whether a sample would consume oxygen at a fast or slow rate based on these initial measurements. LV is a quick, simple, and cost-effective analytical technique. However, its primary drawback lies in the interpretability of voltammograms. In studies like Ugliano et al., 2020, a convolutional analytical approach was applied to accentuate differences in voltammograms that might hold crucial interpretive information.

A dataset was created by combining the LV data with their first and second derivatives. A Random Forest was employed to avoid feature redundancy during training, followed by Recursive Feature Elimination (RFE) for precise feature selection. The resulting dataset was used to train a Support Vector Machine (SVM).

The SVM model achieved an overall accuracy of 94% on the test set, with mean precision and recall of 96% and 92%, respectively. The AUC-ROC score was 1.00, indicating perfect discrimination between the "Fast" and "Low" oxygen consumption classes. These results demonstrate the effectiveness of the feature selection and hyperparameter optimization approach in this context and highlights the potential of LV, combined with ML techniques, to provide valuable insights into the oxidative potential of wine.

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ID: 279 / Poster session 1: 90
Abstract Submission
Topics: Chemical and biochemical reactions, including grape and wine microorganism's impact
Keywords: light-strike, oxidation, thermal stress, rosé wine, stress resistance

Rationalising the impact of time, light, temperature, and oxygen on the evolution of rosé wines by means of a Response Surface Methodology approach

Leonardo Vanzo, Margherita Diella, Davide Slaghenaufi, Maurizio Ugliano
Department of Biotechnology, University of Verona, Italy; leonardo.vanzo@univr.it

The widespread use of flint glass bottles for rosé wines is driven by consumer preference for color as a key choice factor. However, these bottles do not offer protection to light exposure that, along with temperature and oxygen, is the key factor affecting wine evolution, making rosé wines particularly prone to rapid degradation during storage. While the impact of light-struck fault has been extensively studied in white wines, research on rosé wines remains limited.

This study aimed to evaluate the relative effects of light, temperature, and oxygen on the color and volatile composition of rosé wines, employing a Response Surface Methodology (RSM) approach. Two different wines were subjected to varying levels of oxygen (1-5 mg/L), temperature (15-40°C), light (0-4000 lux), and time (15-60 days), resulting in 31 experimental points per wine. Key variables analyzed were free and total SO_2, catechins, polyphenols, CIELAB color parameters, and 40 volatile organic compounds (VOCs), including low molecular weight sulfur compounds (LMWSCs), polyfunctional thiols (PFTs), terpenes, and norisoprenoids.

Results showed that free and total SO_2were primarily affected by oxygen, while color parameters were influenced by light (L* and b*), temperature (b*), and oxygen (a*). LMWSCs were influenced by light, time, and temperature, with light affecting methanethiol and dimethyl disulfide, and temperature influencing dimethyl sulfide. PFTs and norisoprenoids were significantly influenced by light exposure, with TDN and vitispirane also affected by temperature, and β-damascenone by oxygen. Temperature also influenced the concentration of various terpenes, including nerol, linalool, β-myrcene, and β-pinene.

Within the experimental range studied, light exposure had the greatest impact on color, LMWSCs, PFTs, and norisoprenoids. Temperature played a key role in modulating the evolution of several volatile compounds over time, with its effect always associated with time, indicating a progressive impact throughout storage. In contrast, no interaction between light or oxygen and time was observed, suggesting that their effects were already completed before the minimum time assessed (15 days). These results provide an insight into the mechanisms involved in the evolution of rosé wines under different storage conditions.

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ID: 282 / Poster session 1: 91
Abstract Submission
Topics: Analysis and composition of grapes, wines, wine spirits, Vine science and link with grape and wine quality, Wine, environment, health and sustainability
Keywords: Aminoacids, heat, drought, 'Monastrell'

Grapes aminoacidic profile: Impact of Abiotic Factors in a Climate Change Scenario

M. Esperanza Valdés Sánchez[1], M. Victoria Alarcón Sánchez[2], Laura Martín Blanco[3], M. del Mar Alguacil García[4]
[1]CICYTEX, Spain; [2]CICYTEX, Spain; [3]CICYTEX, Spain; [4]CSIC-CEBAS, Spain; esperanza.valdes@juntaex.es

Amino acids play a crucial role in determining grape and wine quality [1]. Recently, research has suggested their metabolism is key to plant abiotic stress tolerance [2]. Therefore, the study of amino acid accumulation in grape berries and its response to environmental factors is of both scientific and economic importance. This study investigates the influence of increased temperature, reduced rainfall and the combination of both effects on the content and amino acidic profile of grapes cv. Monastrell from a goblet-trained conventional managed and rainfed vineyard located in Jumilla, (Murcia, southeastern Spain). For this purpose, open top chambers and rainout shelters simulated warming (~2-7 ºC, W) and rainfall reduction (~30%, RR). A combination of both treatments (W+RR) was also used. Vines without top chambers or rainout shelters were considered as control (C). The experiment was established in February of 2023, and all vines were manually harvested at 28-09-2023. The aminoacidic identification and quantification were performed by HPLC analysis [3]. Total free (FAN), yeast-assimilable (YAN) and aromatic precursor (PAN) nitrogen content were calculated according to Valdés et al. [3]. The results were subjected to one-way (C *vs* W *vs*, RR *vs* C+W-RR) and two-way ANOVA (W, R and W*R effect) and Tukey's test for comparison of means. No changes in the amino acid profile were found, and high proline and arginine levels, specially in W treatments, were observed, as previously was reported [4]. In fact, these compounds were the predominant amino acids in all treatments. Their concentrations reached 116.85, 96.26, 33.19, and 24.52 mgN/L, as well as 76.27, 55.77, 16.57, and 8.3 mgN/L in W-RR, W, C, and RR, respectively, accounting for about 50 % and 25 % of the total FAN. The concentrations of the remaining identified and quantified amino acids were far below of these two and lower than 2 mgN/L in all cases. FAN, YAN, PAN and Ammonia contents followed the WRR > W > C > RR trend, with significant differences observed between the first two treatments and the rest in all cases. The analysis of the combined effects of increase of temperature and rainfall reduction indicated a significant effect of these environmental factors on the contents of the parameters analyzed. W caused the highest percentage of differences between samples (more than 80% in all cases). However, probably due to the low rainfall during the season, the RR treatment resulted in minimal differences.

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ID: 284 / Poster session 1: 92
Abstract Submission
Topics: Analysis and composition of grapes, wines, wine spirits
Keywords: withered grapes, volatile compounds, Valpolicella, GC-MS

Impact of dried stems in winemaking on Veneto passito wines

Naíssa Prévide Bernardo, Giovanni Luzzini, Loris Colognato, Leonardo Vanzo, Jessica Anahi Samaniego Solis, Rosario Pascale, Beatrice Perina, Giacomo Cristanelli, Maurizio Ugliano, Davide Slaghenaufi
Department of Biotechnology, University of Verona, Villa Lebrecht, via della Pieve 70, 37029 San Pietro in Cariano (VR), Italy; slaghenaufi.davide@univr.it

The use of stems during fermentation is generally avoided due to the herbaceous off-odors they can impart to the wine. [1]. On the other hand, nowadays some researchers and winemakers are re-evaluating their use with the aim first of all to reduce the alcohol content of wines, and secondly to enrich the wine in phenolic compounds and complexity. [1,2]. While most of the studies focused on fresh stems, this study aimed to investigate the impact of withered stems on the chemical and sensory profile of 4 Veneto *passito* wines, 3 red and 1 white. The grapes Corvina, Corvinone, Rondinella and Garganega were harvested in 2022 and fermented in presence of withered stems. Total polyphenols and pH were influenced by the use of stems. Nevertheless, the red wines fermented with stems presented a lower content of ethanol, probably due to the absorption of these molecules on the stems surface [3], even if only one of them was a significative difference. Regarding volatile compounds, dried stems significantly decreased methanethiol content, likely due to adsorption phenomena. Minor differences were observed in acetate esters, terpenes, and norisoprenoids, though these were not consistent across all wine types. Methoxypyrazine were found in wine in concentration well below the odor threshold, suggesting a limited release of these compounds from dried stems. Thus, this work demonstrated the potential to use withered stems on the vinification of Passito wines, on the oenological and volatile parameters.

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ID: 285 / Poster session 1: 93
Abstract Submission
Topics: Sensory properties: psychophysics, experimental economy, connections with neurosciences
Keywords: Sensory analysis, wine quality assessment, tasting panels, methodological standardization

Sensory Analysis in Oenology: The Role of Methodological Differences in Expert Panel Evaluations

Natalia Santamaría-López, Alejandro Suárez, Enric Nart
VITEC – Centre Tecnològic del Vi, Crtra. De Porrera, km. 1, 43730, Falset, Tarragona, Spain; alejandro.suarez@vitec.wine

Sensory analysis is an essential component of oenology, offering valuable insights into wine quality that influence decision-making in viticulture and winemaking. Its ability to detect and assess organoleptic characteristics is directly linked to the expertise of the professionals performing the analysis. However, the lack of a universally accepted standard for descriptors, scales, and thresholds presents a challenge for the comparison and interpretation of sensory data across different contexts [1].

A comprehensive understanding of the methodological variations in sensory analysis is crucial for moving toward a more unified system of evaluation. By coordinating sensory tests across different expert panels, it is possible to evaluate their performance, refine techniques, and ultimately increase the reliability and consistency of sensory data [2]. Such an approach not only improves the accuracy of wine evaluations but also enhances quality control. and consequently, the validity of results and issued reports.

To explore these differences, a network of thirteen expert panels in Spain, each comprising between 6 and 15 tasters, participated in sensory evaluations of wine samples using three distinct but commonly applied methods [3] [4]. These methods, grounded in established interlaboratory sensory exercises, were tested over three separate sessions throughout 2024. The objective was to investigate the impact of methodological differences on the results and assess how these variations might influence the consistency of wine evaluation across panels.

The results revealed notable discrepancies in the application of intensity scales and defect identification. While panels generally agreed on the detection of common wine faults, the concentration levels at which these defects were identified varied significantly. Additionally, while there was some consistency in recognizing specific aromatic families, the identification of individual aromas was much more variable across panels. These findings highlight the inherent challenges in sensory analysis and the importance of standardizing evaluation criteria to ensure comparability and enhance the reliability of wine assessments.

The study underscores the need for a more cohesive approach in sensory oenology. Standardized descriptors, scales, and thresholds would not only improve the consistency of sensory data but also support quality assurance measures and foster greater confidence among consumers and industry stakeholders alike.

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ID: 286 / Poster session 1: 94
Abstract Submission
Topics: Sensory properties: psychophysics, experimental economy, connections with neurosciences
Keywords: Consumer behaviour, wine faults, sensory acceptance, product returns

Evaluation of Consumer Behaviour, Acceptance and Willingness to return of Faulty Wines

Alejandro Suárez[1], Natalia Santamaría-López[1], Anna Claret[2], Luis Guerrero[2], Anna Gomis-Bellmunt[3], Joan-Miquel Canals[4], Enric Nart[1]

[1]VITEC – Centre Tecnològic del Vi, Crtra. De Porrera, km. 1, 43730, Falset, Tarragona, Spain; [2]IRTA-Food Quality and Technology, Finca Camps i Armet s/n, Monells, Girona, E-17121, Spain; [3]INCAVI - Institut Català de la Vinya i el Vi. Plaça Àgora, 2., 08720 Vilafranca del Penedès, Spain; [4]Departament de Bioquímica i Biotecnologia, Facultat d'Enologia, Universitat Rovira i Virgili, C/Marcel·li Domingo, 1, 43007, Tarragona, Spain; alejandro.suarez@vitec.wine

The analysis of consumer attitudes towards wine, especially towards wines perceived as faulty, is an aspect that requires more research than has been carried out so far [1]. This study aims to analyse consumer behaviour in situations involving the consumption of faulty wines and to assess the level of acceptance of such wines.

An online survey with 193 respondents included questions about consumers' reaction to faulty wines. The study explored factors affecting wine returns depending on consumers' trust level in sellers, their propensity to return products, after-sales behaviour and tolerance to sensory faults. Additionally subjective [2] and objective knowledge, about these faults were assessed. In addition, 100 people carried out home-use test (HUT) in order to evaluate sensory acceptance and the willingness to return In addition, 100 people participated in a home-use test (HUT) to evaluate sensory acceptance and the willingness to return spiked wines containing seven compounds designed to simulate wine-related faults: 2,4,6-Trichloroanisole, Dimethyl Sulfide, 4-Ethylphenol and 4-Ethylguaiacol, Acetic Acid and Ethyl Acetate, 2-Isobutyl-3-methoxypyrazine, Acetaldehyde, and Ellagic Tannin.

Consumers were shown to have a greater willingness to return a faulty wine, particularly among men aged 51 to 65 with higher education, regarding a situation with a high level of confidence with the seller. On the other hand, in a situation with less confidence with the seller, there is greater indecision among the participants. In relation to after-sales behaviour, consumers would not buy wine again if they considered it to suppose a risk to health, was a low-quality wine or did not like the wine. On the other hand, if the wine has any fault, they may eventually end up purchasing it again. On the other hand, no significant differences were observed according to the level of subjective knowledge (Cronbach's $\alpha = 0.85$) or objective.

Results from sensory evaluation showed that the level of acceptance of the samples with faults were significantly different with regarding the level of acceptance and the predisposition to return to the control samples.

In this study, a vision of the perception of different defects of wine by consumers has been obtained, as well as a better interpretation of their behaviour in the situation of returning the product.

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ID: 287 / Poster session 1: 95
Abstract Submission
Topics: Analysis and composition of grapes, wines, wine spirits
Keywords: Design of experiment, cold soak, temperature, polyphenols

Effect of maceration conditions during the winemaking of withered Corvina grapes on wine polyphenols and anthocyanins

Naíssa Prévide Bernardo[1], Jessica Anahi Samaniego Solis[1], Marta Baviera[2], Micaela Boido[3], Giulio Staffieri[2], Daniela Fracassetti[2], Simone Giacosa[3], Davide Slaghenaufi[1]

[1]Department of Biotechnology, University of Verona, Villa Lebrecht, via della Pieve 70, 37029 San Pietro in Cariano (VR), Italy; [2]Department of Food, Environmental and Nutritional Sciences, Università degli Studi di Milano, Via G. Celoria 2, Milan 20133, Italy; [3]Department of Agricultural, Forest and Food Sciences, Università degli Studi di Torino, Corso Enotria 2/C, 12051 Alba (CN), Italy; naissa.previdebernardo@univr.it

Amarone is an Italian red wine with worldwide recognition and high added value. In Amarone wines, grapes undergo a withering process before vinification; this leads to a modification in the concentrations of sugars, acids, and secondary metabolites. Most of the research has focused on the influence of yeasts and the drying process on Amarone quality [1-4], but little has been done on the influence of maceration during vinification on this type of wine. Therefore, a design of experiment approach was used to investigate the impact of cold soak, fermentation temperature (20 ºC or 27 ºC), and maceration time (skin and seed contact for 10 or 30 days) on the winemaking of withered 'Corvina' grapes. Fermentation was carried out with *Saccharomyces cerevisiae* EC1118 strain, and each experiment was performed in triplicate. Chemical and oenological parameters were evaluated on the 3rd, 10th, and 30th day, as well as at bottling. The Principal Component Analysis (PCA)showed that the samples differed mainly based on maceration time and, to a lesser extent, on maceration temperature. Fermentation at 27 ºC allowed for greater extraction of polyphenolic compounds, in line with previous literature [5-7]. Besides maceration time and temperature, another possible explanation for the higher polyphenol content could be the ethanol content in these samples (above 15% v/v). Apart from phenolic compounds, anthocyanin concentration, colour intensity, and shade are important parameters that impact sensory properties [6]. Longer maceration time is the main factor that negatively affects anthocyanins, but it has a positive impact on the wine shade. For colour intensity, the 48-hour cold soak had a

huge impact on the increase of this parameter. The initial data of this work provide interesting insights into improving the quality of Amarone wines. Further analysis will focus on profiling polyphenolic and aromatic compounds.

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ID: 288 / Poster session 1: 96
Abstract Submission
Topics: Analysis and composition of grapes, wines, wine spirits
Keywords: Dealcoholisation, Reverse Osmosis, Aroma Profile, Wine

Comparison of the aroma profile in total and partial dealcoholisation of white and red wines by reverse osmosis

Luís Moreira, Juliana Milheiro, Sandrine S. Ferreira, Fernanda Cosme, Fernando M. Nunes
Food and Wine Chemistry Lab, Chemistry Research Centre – Vila Real, University of Trás-os-Montes and Alto Douro, Portugal.; luismoreira@utad.pt

The increasing demand for low-alcohol and non-alcoholic wines has led to the development of advanced dealcoholisation techniques aimed at preserving wine quality while reducing ethanol content. Reverse osmosis is one of the most widely used membrane-based processes for the selective removal of ethanol [1]. This separation technique uses a semi-permeable membrane to create an osmotic pressure gradient between two solutions. Normally, water moves through the membrane from a low to a high concentration solution to maintain equilibrium. However, applying sufficient pressure to the high-concentration side reverses this flow, allowing the solvent to move to the lower concentration side [2].

This study investigates the impact of total and partial dealcoholisation on the aroma profile of white and red wines treated by reverse osmosis. Wines were subjected to two levels of dealcoholisation: partial dealcoholisation, in which ethanol content was reduced by approximately 50%, and total dealcoholisation, in which ethanol content was reduced to approximately 0.5% v/v in white wine and 2% v/v in red wine. The volatile compound composition of treated and untreated wines was analysed using gas chromatography-mass spectrometry (GC-MS) coupled with multiple headspace solid-phase microextraction (MHS-SPME) [3]. The analysis focused on key aroma compounds, including esters, alcohols, and acids, which contribute to the wine's overall sensory characteristics.

The results showed that partial dealcoholisation retained a higher concentration of volatile aroma compounds compared to total dealcoholisation. While reverse osmosis effectively removed ethanol, it also led to the loss of key aroma compounds, with total dealcoholisation resulting in a more pronounced decrease in esters. These compounds, responsible for fruity and floral aromas, were significantly reduced, altering the wine's aromatic profile.

This study highlights the influence of the degree of dealcoholisation on wine aroma and demonstrates that partial dealcoholisation better preserves the volatile compounds essential for aromatic complexity. These findings improve the understanding of how the extent of dealcoholisation affects the aromatic composition of wine and provide valuable insights for winemakers seeking to develop reduced-alcohol wines with minimal losses of aromatic quality. Further research should explore optimisation strategies to enhance the retention of key aroma compounds during the dealcoholisation process.

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ID: 289 / Poster session 1: 97
Abstract Submission
Topics: Analysis and composition of grapes, wines, wine spirits
Keywords: Dealcoholisation, GoLo technology, Aroma Profile, Wine

Impact of GoLo technology on the aroma profile of red and white wines after total and partial dealcoholisation

Juliana Milheiro, Luís Moreira, Sandrine S. Ferreira, Fernanda Cosme, Fernando M. Nunes
Food and Wine Chemistry Lab., Chemistry Reseach Centre - Vila Real, University of Trás-os-Montes and Alto Douro, Portugal; julianaf@utad.pt

Wine dealcoholisation has been practised since the early 1900s and has gained importance due to climate change and shifting consumer preferences for lower-alcohol beverages. Rising temperatures are accelerating grape ripening, increasing sugar content and, consequently, raising the alcohol strength of wines. In addition, health concerns related to alcohol consumption have also contributed to the growing demand for dealcoholised wines [1].

Dealcoholisation techniques can be applied at different stages of winemaking. Post-fermentation techniques physically remove alcohol and include membrane-based methods such as nanofiltration, reverse osmosis, and osmotic distillation, as well as non-filtration techniques such as vacuum distillation, spinning cone columns, and multi-stage membrane systems [2]. GoLo, a low-temperature vacuum distillation technology, operates similarly to the spinning cone column but integrates multiple separation steps

into a continuous system. It efficiently removes nearly 100% of the volatile aroma compounds—allowing their reintegration—and reduces the alcohol strength to as low as 0.05% (v/v) [3].

This study investigates the effects of total and partial dealcoholisation using GoLo technology on the aromatic composition of both red and white wines. The wines underwent two levels of dealcoholisation: partial dealcoholisation, reducing the alcohol strength to approximately 7.5% v/v, and total dealcoholisation, lowering the alcohol strength to 0.5% v/v. The volatile compound profile of both treated and untreated wines was analysed using gas chromatography-mass spectrometry (GC-MS) combined with multiple headspace solid-phase microextraction (MHS-SPME) [4]. The analysis focused on key aroma compounds, including esters, alcohols, and acids, which play a crucial role in the wine's aromatic profile.

The results showed that GoLo technology was effective in reducing alcohol strength; however, total dealcoholisation led to a significant loss of aroma compounds. Partial dealcoholisation consistently preserved more of the original aromatic complexity in both wines.

This study emphasises the impact of ethanol removal on wine aroma and underscores the benefits of partial dealcoholisation in preserving sensory characteristics.

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ID: 292 / Poster session 1: 98
Abstract Submission

Topics: Sensory properties: psychophysics, experimental economy, connections with neurosciences
Keywords: Vitis vinifera L. cv Grenache, maturity, climate change, sensory analysis

Sensory changes in wines associated with the ripening of Grenache grapes from vineyards in different climatic zones

Ignacio Arias-Perez[1], Carolina Castillo[1], María-Pilar Sáenz-Navajas[1], Purificación Fernández-Zurbano[1], María Buñuel-Escudero[2], Cristina Peña[2], Roberto Serrano-Notivoli[3], Olivier Geffroy[4], Elisabeth Carlier[4], Ana Escudero[2], Mónica Bueno[2], Ignacio Ontañón[2]

[1]Instituto de Ciencias de la Vid y el Vino (ICVV), Spain; [2]Laboratorio de Analisis del Aroma y Enología (LAAE). Department of Analytical Chemistry, Universidad de Zaragoza, Instituto Agroalimentario de Aragón (IA2) (UNIZAR-CITA); [3]Departamento de Geografía y Ordenación del Territorio, Universidad de Zaragoza, 50009 Zaragoza, Spain; [4]PPGV – Physiologie, Pathologie et Génétique Végétale, Toulouse INP-Purpan, 31076 Toulouse, France; ignacio.arias@icvv.es

Climate change is introducing a high variability on grape ripening, causing uncertainty, excessive spending on pesticides and eventually frustrating results in terms of the quality of the vintage, with the increasingly frequent appearance of aromatic problems associated with overripeness, raisining and greenness, which sometimes only appear in bottled wines. These effects are particularly evident in Grenache, a variety widely grown in France and Spain. This study aimed to explore the effects of climate and maturity on the sensory characteristics of wines made from Grenache over two consecutive harvests of the Pyrenean foothills.

Firstly, historical climatic data (1981 – 2010) were gathered to calculate various bioclimatic variables. The data was analysed using k-means clustering to identify three distinct climatic areas. Then, 28 Grenache vineyards (20 from Spain and 8 from France) were selected, ensuring representation across the three identified climatic zones. At each vineyard, grape samples were collected at two maturation stages: the first when sugar concentration reached 21.0 ± 2.0 °Brix (P1), and the second 10-14 days later (P2). Microvinification of the collected grapes followed the same fermentation protocol. To explore the sensory space of the wines, two Sorting Tasks were carried out, one per ripening. MultiDimensional Scaling (MDS), Agglomerative Hierarchical Clustering (AHC) and Corresponding Analysis (CA) were used to manage the sensory data. The most different wines were selected to carry out a Descriptive Analysis (DA). In order to interpretate sensory data, analysis aroma compounds in wine were carried out. The preliminary results of year 2024 indicate that wines from grapes from different climatic zones evolve differently with ripening. Descriptors with vegetal and oxidative notes are found in the cooler climatic zones, specially at point 1. This could be related to a lack of phenolic maturity and an increase in oxidation-linked compounds such as aldehydes, as previously described in the literature [1]. Whereas more fruity and overripe aromas are found in warmer areas. These attributes have been found in all climate zones at maturity point 2. The outcomes of this research will highlight the influence of climate and maturity on wine aroma composition, help determinate the ideal climatic conditions and create tools to mitigate the effects of climate change.

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ID: 293 / Poster session 1: 99
Abstract Submission

Topics: Wine, environment, health and sustainability, Artificial Intelligence in the vine and wine sector
Keywords: climate change, winegrowers, drones, precision agriculture

The Economic Impact of Drones on Viticultural Processes

Sofia Kalakou, Maria Monteiro

Iscte- Business School, Portugal; mgvdcm@gmail.com

Nowadays there are many challenges facing both winegrowers and workers, in other agricultural practices, related to the growing demand for food products, the safety and quality of these products, and the preservation of the environment… [1].

In addition to these concerns, it is also possible to notice the occurrence of climate change, where temperatures have risen, rainfall has become more irregular, atmospheric C02 has increased, leading to soil degradation and desertification [2].

In case the negative impact of climate change is not properly mitigated, crop productivity and berry quality are affected, vine growth stages are prejudiced, leading to greater fragility in the plant, enhancing the occurrence of pests and diseases.

Consequently, technologies began to emerge, in order to enable grape producers to continue with their practices while dealing with climate change, without harming the environment and well managing the rise in production costs. Precision agriculture thus emerged as the answer to optimizing processes, assisting in making them faster, cutting production costs and reducing input waste, to decrease the environmental impact of agricultural practices [3].

Therefore, drones (unmanned aerial vehicles) are playing an important role in precision agriculture, starting to become essential for decision support in viticulture processes. Specifically, in the processes of monitoring irrigation and controlling pests and diseases.

This study aimed to assess the economic effectiveness of drones in these processes, to quantify the costs of incorporating drones in them. In order to carry out this research, flowcharts were used to design the two processes, allocating costs to each stage of the process. For the analysis, the costs of each process were compared without and with the inclusion of these technologies.

In conclusion, we seek to show winegrowers the economic impact that the use of drones can have when inserted into grape growing processes. This could lead to greater adherence to these technologies, contributing to the adaptation of producers to the innovations that lead to the development of the wine sector

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ID: 296 / Poster session 1: 100
Abstract Submission
Topics: Analysis and composition of grapes, wines, wine spirits
Keywords: Flavonol composition, minority grape varieties, CIELAB colour parameters, wine.

Flavonol and anthocyanin potential of Spanish minority grapes and its relationship with wine colour.

Cristina Alcalde-Eon[1], Rebeca Ferreras-Charro[1], Eva Cuesta-Sánchez[1], Alberto Martín-Baz[1,2], María-Teresa Escribano-Bailón[1], Ignacio García-Estévez[1]
[1]University of Salamanca, Spain; [2]Instituto Tecnológico Agrario de Castilla y León (ITACyL), Valladolid, Spain;
crisalcaldeon@usal.es

Global climate change is currently affecting vine phenology and causing a decoupling between technological and phenolic maturity of the grapes [1]. Wine industry has to face the challenge of making quality wines from grapes with an unbalanced phenolic composition. Minority autochthonous grape varieties are nowadays attracting the attention of scientists and oenologists due to their greater adaptation potential to the changing environmental conditions [2]. In the Spanish “Castilla y León” region, a significant number of minority grape varieties have been properly identified and conserved in a Germplasm Bank [3]. Among them, some show a good oenological potential [4]. However, their recovery to produce quality wines must be supported by a deep knowledge of their phenolic composition, since these compounds are directly related to wine colour and astringency. Regarding colour, the anthocyanin potential of 7 of these minority varieties has been recently studied in our laboratory. However, wine colour will also depend on the copigmentation interactions occurring between these anthocyanins and copigments present in wine, among which, the flavonols are the most effective ones. Thus, the main objective of the present study was to determine the skin’s flavonol composition of these varieties by means of HPLC-DAD-MS^n and to find if there is any relationship between this composition, the grape anthocyanin composition and the colour expressed by the wines made from these grapes. Furthermore, this study also aims at establishing if the varietal typicity is maintained when the grapes are grown in regions different from their native ones. Total flavonol contents ranged from 80 to 300 mg/kg of grape and were, in most cases, greater than the contents reported for common varieties such as Tempranillo or Syrah [5]. The growing location affected flavonol total content and profile, but varietal typicity was quite maintained among locations. The ratio methoxylated/non-methoxylated flavonols was found to be a useful varietal marker. The results of the CIELAB colour measurements in the wines made from these grapes showed that the darkest wines with the greatest bluish hues were not those elaborated with the grapes with the greatest anthocyanin potential, but those showing greater percentages of methoxylated flavonols. These results highlight the usefulness of studying the flavonol composition along with that of anthocyanins in grape skins to reach a deeper knowledge of the potential of grapes to produce wines with better colour characteristics.

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ID: 297 / Poster session 1: 101
Abstract Submission

Topics: Analysis and composition of grapes, wines, wine spirits, Chemical and biochemical reactions, including grape and wine microorganism's impact, Winemaking processes and oenological practices
Keywords: Yeast interactions, Non-Saccharomyces, Saccharomyces cerevisiae, Greek wines

Exploring microbial interactions between Saccharomyces cerevisiae and non-Saccharomyces yeast starters in vinification

Aikaterini Tzamourani, Panagiotis Arapitsas, Angeliki Kasioura, Artemis Tsioka, George Ntourtoglou, Danai Gkizi, Alexandra Evangelou, Maria Dimopoulou

Department of Wine, Vine and Beverage Sciences, School of Food Science, University of West Attica, 28 Ag. Spyridonos St., 12243 Egaleo, Greece; ktzamourani@uniwa.gr

Winemaking is a complex microbial process involving the co-existence and interactions of various microorganisms [1]. Although, commercially available *Saccharomyces cerevisiae* strains could be inoculated and accomplish a well-controlled must fermentation, the growing recognition of the role of non-*Saccharomyces* yeasts, increases the interest in using diverse species in mixed inoculated fermentations, where yeast interactions are crucial [2]. The aim of this study was to investigate the microbial interactions between indigenous and commercial *S. cerevisiae* strains and two commercial and one indigenous non-*Saccharomyces* species used as fermentation starters under laboratory conditions. The microbial combinations were assessed for their fermentation kinetics and population dynamics. Subsequently, fermentations were conducted using three monovarietal grape musts from Greek varieties, monitoring CO_2 emissions and microbial population dynamics throughout the process [3]. The resulting wines were analyzed for their oenological properties and evaluated through sensory descriptive analysis [4]. Overall, all fermentation were completed successfully. More specifically, sequential inoculation with the first commercial non-*Saccharomyces* exhibited a significantly lower fermentation rate (~0.4 g/L/h) and rapid population reduction within 24 hours, while the other two strains enhanced fermentation rates and persisted until the completion of the process. Notably, sequential inoculation with the indigenous non-*Saccharomyces* strain resulted in the predominance of this species (~8.5 log CFU/mL), followed by *S. cerevisiae* population (~8 log CFU/mL). The second commercial non-*Saccharomyces* strain exhibited neutral interactions with *S. cerevisiae*, making it the most promising for further study. Moreover, wines fermented with the latter non-*Saccharomyces* strain maintained neutral interactions with *S. cerevisiae* strains and showed no significant differences in oenological properties, including total acidity, volatile acidity, ethanol yield and pH values, compared to those fermented with *S. cerevisiae* monocultures. Sensory analysis revealed that the inoculation strategy influenced the aromatic profile, with co-inoculated fermentations enhancing floral attributes.

Aknowledgements

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ID: 298 / Poster session 1: 102
Abstract Submission
Topics: Winemaking processes and oenological practices
Keywords: Rosé wine, Red Wine, Polyphenol, Anthocyanin Tanin

Oenological Potential of cv. Tortojona: A Minority Grape Variety from Extremadura, Southwest Spain

M. Esperanza Valdés Sánchez[1], Belén Nuñez García[2], Raquel Pavo Rico[3], Balbina Palacios Santiago[4], Daniel Moreno Cardona[5]

[1]CICYTEX, Spain; [2]CICYTEX, Spain; [3]CICYTEX, Spain; [4]CICYTEX, Spain; [5]CICYTEX, Spain; esperanza.valdes@juntaex.es

This work, included in the VAVEGEX project, aims to evaluate the oenological, phenolic, chromatic and sensory characteristics of the grapes, must and wines produced from cv. Tortojona, minority variety grown in Extremadura region (Southwest, Spain). For this purpose, in 2024 season, four types of wines were performed following the traditional methods: (i) red wine, spontaneous fermentation (RWE); (ii) red wine, inoculation with *Saccharomyces cerevisiae* (RWSC); (iii) red wine, co-inoculation (mixed culture of *Saccharomyces cerevisiae* and *Torulaspora delbrueckii* (RWMix) and (iv) rosé wines (PWMix), inoculation with the mixed culture. Total polyphenol and anthocyanin (TPG, TAntG) were determined in grapes and additionally, in the must, total soluble solids (TSS) and yeast assimilable nitrogen (YAN). pH, titratable acidity (TA) and tartaric and malic acid (TAR, MAL) were analyzed in must and wines [1,2]. The characterization of wines included the determination of alcoholic strength (AS), volatile acidity, dry extract, total polyphenols, anthocyanins, catechins, tannins, and co-pigmented anthocyanins (TPP, Ant, Cat, Tan, and %C-Ant) and color intensity (CI) and hue [1,2]. When TSS of cv. Tortojona grapes reached 24.2 ºBrix, (typical harvest criterion for this region), YAN, TAR and MAL values reached 252.2 mg/L, 4.25 and 2.6 g/L respectively. These values are suitable for the production of both red and rosé wines. However, the pH (3.8) exceeded the optimal range (3.4–3.6), and the TPG (<1000 mg/L) and TAntG) (<150 mg/L) were lower than that observed in other cultivars grown in the area [1]. The AS values were from 12.9 (RWSC) to 13.7 %v/v (RWMix and PWMix) and the volatile acidity was <0.3 g acetic/L in all cases. In red wines, the mean values of TPP, Ant, Cat, and Tan for red wines were 1280, 194, 573, and 1308 mg/L, respectively. In general, these values are lower than those observed in wines produced from other widely cultivated grape varieties and, in consequence the IC values were low. All of the red wines received a positive evaluation from the judges, the most appreciated was RWMix for the highest intensity and aromatic complexity. The values of phenolic parameters or rosé monovarietal cv. Tortojona wine were characteristics of this type of wine [2]. It was highly appreciated by the judges for their colour and particularly by the complexity of their aromas. They identified certain aromatic descriptors characteristic and very

appreciated in rosé wines as raspberry strawberry. The results of this research are very promising for the wine industry in Extremadura and further studies are needed to validate these findings.

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ID: 299 / Poster session 1: 103

Abstract Submission

Topics: Analysis and composition of grapes, wines, wine spirits, Wine, environment, health and sustainability

Keywords: Lees, Metabolomic, Peptidomic, By-product Reuse, Sustainable Winemaking

Peptidomics in the Wine Industry: Literature Perspectives on Functional Importance and Analytical Methods

Pol Gimenez-Gil[1], Alexandra Evangelou[1], Maria Dimopoulou[1], Danai Gkizi[1], Aikaterini Tzamourani[1], Artemis Tsioka[1], George Ntourtoglou[1], Aggeliki Kassioura[1], Urska Vrhovsek[2], Panagiotis Arapitsas[1,2]

[1]Department of Wine, Vine and Beverage Sciences, School of Food Science, University of West Attica, 12243 Athens, Greece; [2]Research and Innovation Centre, Fondazione Edmund Mach, 38010 Trento, Italy; fst24684137@uniwa.gr

Winemaking is a globally significant industry in the field of food technology (218 mhL of wine estimated for 2024 harvest) [1], which activity produces tons of by-products annually, including pomace (pulp, stems, seeds, skins), lees, organic acids, CO2 and water [2]. Wine lees, represent between 2 and 6% of the produced wine volume and between 14 and 25% of all winery by-products and, if utilized, could contribute to improve the economic and environmental sustainability of winemaking activities [3]. Therefore, there is a great need and interest in the management and further utilization of these by-products, towards pollution reduction and design of novel bioresources. At the same time, these by-products are mainly composed of value-added compounds, such as vitamins, complex polysaccharides, polyphenolic compounds, proteins, and peptides.

Peptides are the least known nitrogen-containing compounds of wine despite their diverse properties, such as their sensorial ability (responsible for sweet and bitter tastes), and antihypertensive activity, as well as being the nutrients for yeasts and bacteria [4]. The main reason for the dearth of studies on peptidic fraction is due to the multiple biochemical processes at different maturing stages, and the complexity and lack of specificity of the techniques used for its analysis. To characterize this fraction, the sample must be treated in successive fractionation steps to eliminate compounds that may interfere with the analysis. Employing peptidomics, a branch of proteomics, includes the identification and verification of all endogenous peptides in biological samples, as well as the comparison of the expression levels of target peptides in specific biochemical processes to provide sufficient data to study the structure and function of peptides.

Peptidomics is a promising discipline that draws inspiration from proteomics and exploits separation, analytical, and computational technological advances. It involves a comprehensive, qualitative and quantitative examination of all peptides present in a given biological sample. Peptidomics enables a comprehensive analysis of endogenous peptides, representing a relatively novel area of research distinct from its predecessor, proteomics, to progress our comprehension of signaling pathways and introduce a fresh layer of analysis in the realm of systems biology.

This work aimed to study the strategies to analyze different grape-derived and yeast-derived peptides to have a better understanding of their different functionalities.

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ID: 300 / Poster session 1: 104

Abstract Submission

Topics: Analysis and composition of grapes, wines, wine spirits

Keywords: Gas chromatography, carbonyl compounds, green character, ripeness

Development of an analytical method for the quantification of compounds responsible for the green character of wines: influence of ripeness on their levels.

Ignacio Ontañón, Maria Buñuel, Vicente Ferreira, Mónica Bueno

Laboratorio de Análisis del Aroma y Enología. Departamento de Química Analítica. Facultad de Ciencias. Instituto Agroalimentario de Aragón –IA2- (Universidad de Zaragoza-CITA). C/ Pedro Cerbuna, 12. 50009. Zaragoza, Spain.; ionta@unizar.es

Red wines can sometimes exhibit undesirable green, herbaceous, and vegetative aromas, negatively impacting their sensory profile and consumer acceptance. While certain grape varieties, such as Cabernet Sauvignon, are known for their green pepper notes due to the presence of pyrazines, these aromas are increasingly appearing in non-pyrazinic grape varieties with each vintage. This phenomenon may be linked to climate change and winemaking decisions aimed at avoiding excessively high alcohol levels. Beyond pyrazines, some studies have associated these green notes with the presence of specific carbonyl compounds [1, 2]. Traditionally, due to their poor chromatographic and spectrometric properties, these compounds have been analyzed using derivatizing agents [3], which require tedious analytical procedures. Furthermore, these methods shorten the operational lifetime of chromatographic

columns. To address this, the objective of this work was to develop an analytical method to quantify carbonyl compounds while avoiding any derivatization steps. The proposed method includes a first extraction step using solid-phase extraction (SPE) prior to injection into a two-dimensional gas chromatographic system coupled with a mass spectrometer. Two different strategies for extracting the compounds were studied: deposition of 100 µL into Tenax tubes or the use of stir bar sorptive extraction (SBSE). Several parameters have been optimized, including breakthrough volume, elution conditions, solvent purge with Tenax tubes, and extraction conditions with SBSE. Good repeatability values, around 10% relative standard deviation, were found with both strategies. However, the repeatability worsened with the repeated use of the same Tenax tubes. This issue, along with the fact that better detection limits were achieved with SBSE, led to the decision to analyze real wine samples exclusively with this last strategy. Several wines made from the same grapes harvested at different ripeness levels were analyzed to study the evolution of carbonyl compounds with ripeness.

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ID: 301 / Poster session 1: 105

Abstract Submission

Topics: Winemaking processes and oenological practices

Keywords: Wine, Tartaric instability, Calcium tartrate instability, Alginic acid

Evaluating the Effectiveness of Alginic Acid, Sodium Carboxymethylcellulose, and Potassium Polyaspartate in Preventing Calcium Tartrate Instability in Wines

Fernanda Cosme[1], Luís Filipe-Ribeiro[2], Ana Coixão[3], Mario Bezerra[4], Fernando M. Nunes[5]

[1]Biology and Environment Department, School of Life Sciences and Environment, University of Trás-os-Montes and Alto Douro, 5000-801 Vila Real, Portugal; [2]Chemistry Research Centre-Vila Real (CQ-VR), Food and Wine Chemistry Laboratory, University of Trás-os-Montes and Alto Douro,5000-801 Vila Real, Portugal; [3]Chemistry Research Centre-Vila Real (CQ-VR), Food and Wine Chemistry Laboratory, University of Trás-os-Montes and Alto Douro,5000-801 Vila Real, Portugal; [4]Chemistry Research Centre-Vila Real (CQ-VR), Food and Wine Chemistry Laboratory, University of Trás-os-Montes and Alto Douro,5000-801 Vila Real, Portugal; [5]Chemistry Department, School of Life Sciences and Environment, University of Trás-os-Montes and Alto Douro, 5000-801 Vila Real, Portugal; fcosme@utad.pt

Calcium-induced instabilities are a major challenge in bottled wines, with calcium tartrate (CaT) precipitation becoming increasingly common due to rising calcium levels in grape must, largely driven by climate change. Although CaT is an insoluble salt, its instability—although less common than potassium hydrogen tartrate (KHT) precipitation—is more difficult to predict and control, as it develops gradually over time [1]. Spontaneous nucleation of CaT takes significantly longer than that of KHT, resulting in delayed precipitation, often occurring years after aging and typically post-bottling [2,3]. CaT instability occurs when ion concentrations exceed the solubility threshold, leading to crystal formation. Unlike KHT, CaT precipitation is minimally affected by temperature, making cold stabilization ineffective [4]. Various additives, such as metatartaric acid and carboxymethylcellulose (CMC), have been used to mitigate this problem, however, metatartaric acid has limited long-term effectiveness due to hydrolysis [5]. In addition, potassium polyaspartate (KPA), commonly used as a KHT stabilizer, has been suggested to potentially reduce CaT stability in some cases. Given the need for effective and sustainable stabilization methods, research into alternative tartrate stabilizers is essential. Alginic acid, an approved processing aid in winemaking, represents a promising alternative to CMC and metatartaric acid due to its strong negative charge and ability to bind calcium ions. Alginic acid is already approved by the OIV [5], for wine clarification with no restrictions on use and represents a clean-label solution for CaT stabilization. The aim of this study was to evaluate the efficacy of alginic acid as a CaT stabilizer compared to CMC and to assess the effect of KPA on CaT instability. The results showed that KPA did not increase CaT instability and, in some cases, even enhanced stability. Alginic acid demonstrated superior performance over both CMC and KPA, likely due to its higher zeta potential and stronger calcium ion complexation capacity. While these findings are highly promising, they primarily reflect short-term stabilization effects, highlighting the need for further long-term studies.

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Abstract Submission
Topics: Chemical and biochemical reactions, including grape and wine microorganism's impact, Winemaking processes and oenological practices
Keywords: UHPH, Brettanomyces, lactic acid bacteria, wine, inactivation

Eliminating Brettanomyces and lactic acid bacteria in wine: the potential of Ultra-High Pressure Homogenization (UHPH)

Anna Puig-Pujol[1], Gemma Roca-Domènech[1], Joan-Miquel Quevedo[2], Antonio-José Trujillo[2]
[1]IRTA-INCAVI. Institute of Agrifood Research and Technology - Catalan Institute of Vine and Wine. Plaça Àgora, 2. 08720 Vilafranca del Penedès, Barcelona, Spain; [2]Servei Planta Pilot de Tecnologia dels Aliments and Centre d'Innovació, Recerca i Transferència en Tecnologia dels Aliments (CIRTTA), CERTA-TECNIO, MALTA-Consolider, Departament de Ciència Animal i dels Aliments, Facultat de Veterinària, Universitat Autònoma de Barcelona, 08193 Bellaterra, Barcelona, Spain; anna.puig@irta.cat

Ultra-High Pressure Homogenization (UHPH) is an innovative technology that can be seamlessly integrated at various stages of winemaking. Its application helps minimize or even eliminate the need for sulphites and other antimicrobial or antioxidant treatments, offering a faster and more sustainable alternative. Recently, the OIV has approved UHPH among the recommended practices in the international oenological code [1]. UHPH is a continuous, high-pressure process applied directly to the wine, which is pumped into the equipment at a pressure of 200 MPa or higher and then rapidly depressurized through a high-resistance valve. As wine passes through the valve, it undergoes intense mechanical forces, primarily impact and shear, along with cavitation and friction. These forces generate a potent antimicrobial effect by effectively eliminating microorganisms such as yeasts and bacteria [2, 3, 4]. This study explores the potential of UHPH as an effective technique for the inactivation of *Brettanomyces sp.*, a spoilage yeast in winemaking. Additionally, in base wine intended for sparkling wine production, UHPH is evaluated as a preventive solution against a common challenge faced by some producers: the occurrence of malolactic fermentation (MLF) in the bottle, which compromises the sensory quality of the final product. So, the study also aims to assess the effectiveness of UHPH in eliminating lactic acid bacteria (LAB). Red wines naturally contaminated with *Brettanomyces* were treated with UHPH at 300 MPa and compared to untreated control wines and treated with chitosan. The evolution of this yeast population, volatile phenols, and acetic acid in bottled wines was monitored over time. The UHPH treatment effectively inactivated *Brettanomyces*, resulting in a >5 log reduction in the population of this spoilage yeast after 6 months of aging. To study the inhibitory effect of UHPH on lactic acid bacteria in base wines, MLF was induced, and three conditions were analysed: a control condition (C -), where MLF was not induced in the base wine; a second control condition (C +), where MLF in the bottle was not stopped by any method; and a third condition with UHPH treatment at 300 MPa and an inlet tª of 30ºC (UHPH), aimed at eliminating LAB present in the base wines to prevent MLF. The population of LAB, along with malic and lactic acid levels, was measured at 0 and 42 days, and after 5 months of sparkling wine aging. The UHPH treatment achieved >7 log reduction in LAB cells, effectively preventing MLF.

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Abstract Submission
Topics: Analysis and composition of grapes, wines, wine spirits, Winemaking processes and oenological practices
Keywords: Ozone, white wines, NIRs, E-nose, oeno-chemical attributes, polyphenols, VOCs

Effect of ozone treatments in wine production of young and short-term aged white wines: destructive and non-destructive evaluation of main quality attributes

Andrea Bellincontro, Gianmarco Alfieri
University of Tuscia, Italy; gian.alfieri@unitus.it

The main aim of WiSSaTech project (PRIN P2022LXY3A), supported by Italian Ministero dell'Università e della Ricerca and NextGenerationEU program, is to investigate eco-friendly and safe alternatives to sulphur dioxide (SO_2) in wine production. Three treatments were compared on two Italian white wines produced from grapes cv. Fiano and Vermentino as follow: by ozone treatment of grapes and cellar equipment either alone (O_3) [1], or used into the Purovino® method [2], (PV), and by conventional use of SO_2. All analyses were carried out on the obtained wines (T0), after accelerated aging at 35 °C for one week (T1), and after six months of conventional aging at 18 °C (T6). Non-destructive analyses were performed on the wine samples through NIR-AOTF [3] and E-nose [4] measurements together with destructive ones, FT-NIR detected and associated with the main oeno-chemical parameters, with detailed polyphenols analysed by HPLC-HRMS [5], and VOCs [6]. Results coming from both analytical approaches were subjected to chemometric analyses with the aim to appreciate combinate behaviours of wine samples with respect to the employed grape variety, the vinification process, and the timing of the wine aging. PLS-DA modelling performed on NIR data revealed that Vermentino wine samples exhibit a good classification performance (96%) based on the ageing time of sampling (T0, T1, and T6), otherwise observed as lower in Fiano wines (74%). Statistical performances were significantly reduced when single wine samples (O_3, PV, and SO_2) were considered as discriminative variables of classification (47% and 63% for Fiano and Vermentino wines, respectively). PLS-DA computed on E-nose data lead to similar results, showing a discrimination among T0, T1 and T6 (92%, and 76% for Vermentino and Fiano, respectively), regardless the single wine samples associated with the treatments. Conversely, the segregation among these last looked less evident (50%, and 41% for Vermentino e Fiano, respectively), being probably affected by an overlapping of the

samples at T6. PCA computation performed on destructive data revealed a clear sample segregation between T0 and T6 times, for both the variety and the treatments. A significant correlation was found about the stability of the wines between accelerated aging (T1) and T6, based on the DE. Wine samples with no added sulphites showed the lower stability, particularly in Fiano, due to the highest catechin index values and Cu^{++} concentrations.

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Abstract Submission
Topics: Vine science and link with grape and wine quality, Wine, environment, health and sustainability, Artificial Intelligence in the vine and wine sector
Keywords: Protection systems, sustainable viticulture, drones, sensors

SmartVitiNet: transforming viticulture through precision agriculture and advanced technologies

Emma Tsai
Future Needs, Cyprus; emma@futureneeds.eu

SmartVitiNet is an innovative project whose aim is to to scale up, pilot, and bring to the market a holistic phytosanitary and plant protection system based on the application of unmanned aerial vehicles, new observational platforms, and new ready-to-use sensors. This 36-months project involves participants from Greece, Portugal, Cyprus, and France. The research will enable synergies between members of the quadruple helix, utilizing their complementary knowledge, experiences, and infrastructure in the specific area to achieve innovative results. The sustainability of the undertaking will be ensured by the establishment of a Competence Centre for Precision Viticulture, whose aim is to upskill sector professionals, create expert networks, facilitate permanent flows of knowledge transfer between academia, innovative SMEs, viticulture professionals, and regional authorities, to increase sector competitiveness while enacting EU environmental policies, reducing sector health impact and risks of food pollution. SmartVitiNet addresses several S3 priorities of the regions involved and is expected to have significant impacts on regional and EU sectors of Agriculture, Health, Environment, and ICT. SmartVitiNet is co-Funded by the European Union (ERDF I3 programme) under Grant Agreement number 101083737.