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Oak chip maceration of wine under high pressure

Because of the disadvantages of barrel aging technology, such as the high cost of oak barrels, the long aging time required and the large space taken up by barrels, an alternative method, namely the addition of oak chips into the wine container has occasionally been adopted in winemaking. Now the influence of high hydrostatic pressure (HHP) together with oak chip maceration on the physicochemical and sensory properties of a young red wine has been investigated. French oak chips (5 gm/L) were added and wines were treated by HHP at 250, 450 and 650 MPa for up to 45 minutes. The phenolic contents and antioxidant activity of the wine increased after HHP processing in the presence of oak chips. The anthocyanin content and wine colour intensity decreased in the first 5 minutes of pressure treatment and then increased gradually. It was found that the pressure holding time played a more important role than pressure in affecting wine physicochemical characteristics. Regarding wine sensory profiles, HHP together with oak chip maceration for 30 minutes weakened the intensities of fruity and sweet aromas, as well as the intensities of acid, astringent and fruity tastes. Furthermore, an artificial taste arose after HHP processing in the presence of oak chips. Wine macerated with oak chips alone for 45 minutes showed similar sensory properties. http://dx.doi.org/10.1016/j.foodchem.2015.07.041

Application of nitrogen to grapevines at veraison

Veraison-time application of nitrogen to grapevines has been shown to improve grape juice yeast assimilable nitrogen (YAN) concentrations and may also prevent the excessive vine growth, delayed maturity, and adverse changes in fruit properties sometimes associated with high applications of nitrogen earlier in the growing season. However, the consequences of late-season foliar- and soil-applied nitrogen (N) for grape juice YAN and the resulting grape juice amino acid profiles have rarely been compared. To make this comparison, grape juice amino acids were measured over a two year period from drip-irrigated Merlot and Pinot gris vines to which urea had been applied three times around veraison at a rate of 3.8 grams/vine to either the foliage or the soil surface. It was found that foliar-applied urea (applied as a 2% w/v solution) was usually more effective at boosting grape juice ammonium and amino acid concentrations, although soil-applied urea improved some grape juice amino acids at the Pinot gris site. Applications of isotopically-labelled urea at the Pinot gris site demonstrated that a greater quantity of fertilizer N was incorporated into grape juice amino acids when urea was applied to the foliage than when it was applied to the soil surface. Thus late-season foliar applications of urea is a reliable, efficient and effective method of improving grape juice YAN. Changes in the amino acid profiles of grape juice, observed in response to foliar N applications but not soil N applications may have implications for wine quality. http://dx.doi.org/10.5344/ajev.2015.15015

Determination of energy savings in the alcoholic wine fermentation process

The equipment that consumes most energy in wineries is the cooling system, which can account for between 50% and 70% of the total. Temperature is a key parameter throughout the fermentation process that must be controlled to avoid quality problems or even interruptions in fermentation. Temperature is usually controlled by means of low-temperature fluids, however, information is not generally available on the energy requirements of this control. A study has established a method for conducting energy analyses of the must fermentation process, so as to learn how much energy is actually required by the process and what its cooling needs are. Based on the methods developed, the performance of various fermentation tank cooling strategies were studied in terms of energy requirements and products. It was found that the maximum energy demand varies widely depending on the cooling strategy chosen, and that total energy demand in the fermentation process can be reduced by more than 13%. http://dx.doi.org/10.5344/ajev.2015.14131

Comparison of two tunable diode laser absorption spectroscopy-based carbon dioxide sensors for bottled wine

Carbon dioxide is responsible for effervescence in champagne and sparkling wines but its influence on the organoleptic properties of other wines is important, even when the concentration is below the perception threshold (500mg/L). Dissolved carbon dioxide concentrations range from 300mg/L for red still wines up to 800 - 1800 mg/L for white and rosé wines and over 10 gm/L for Champagne. Two different carbon dioxide sensors (one of which is shown right) have been evaluated for their applicability to bottled wine measurements. The instruments considered shared the same technique, which is gas-phase carbon dioxide headspace detection through absorption spectroscopy. Wine bottles are perfect from this point of view, as they can be measured non-invasively with this technique after shaking and the process can be repeated as many times as desired to make sure that equilibrium is reached. The tests were run on a range of concentrations and pressures encountered in the bottling of wine, beer and soft drinks. One of the instruments gave good results, while the other had serious limitations in its ability to measure carbon dioxide concentrations in the headspace. http://dx.doi.org/10.5344/ajev.2015.15027

Analysis of phenolics in Cabernet Sauvignon and Syrah

So as to investigate the rapid and simple quantification of key phenolics during different stages of red wine production, reference measures of phenolics and UV/Visible spectra were gathered from 100 Cabernet Sauvignon and Syrah red wine samples throughout fermentation in order to create a model that could rapidly predict several key phenolics in red wine must. The reference method, UV/Visible spectra sample dilution, and multivariate regression method were all varied in order to determine which combination gave the greatest predictive power. Ridge regression significantly outperformed other regression methods when calibrated with the modified assay at pH 7 and UV-visible sample dilution at 10-fold for only the Cabernet Sauvignon samples. Correlation coefficients obtained for anthocyanins, small and large polymeric pigments, tannins and total iron reactive phenolics were 0.83, 0.78, 0.76, 0.92 and 0.90 respectively. None of the methods tested for Syrah gave accurate predictions, suggesting some cultivar specificity. A Microsoft Excel macro for estimating concentrations of various phenolics by inserting UV/Visible spectral readings into a spreadsheet is available upon request. http://dx.doi.org/10.5344/ajev.2015.15063

High pressure treatments of sulphur dioxide-free wine

During the last decade, the use of high hydrostatic pressure (HHP) as a non-thermal technology for food preservation and modification has increased substantially. Foods can be submitted to high pressures, ranging from 400 MPa to 600 MPa, in order to destroy microorganisms and inactivate enzymes with minimal effects on their sensorial and nutritional properties. As aroma is one of the most important quality parameters of wine, the effect of HHP treatments on the volatile composition of sulphur dioxide-free red and white wines during bottle storage was studied. White and red wines were produced without sulphur dioxide and, at the end of the alcoholic fermentation, the wines were pressurised at 500 MPa and 425 MPa for 5 minutes. Wine with 40 ppm of sulphur dioxide and a wine without a preservation treatment were used as controls. More than 160 volatile compounds, distributed over 12 chemical groups, were identified in the wines. The pressurised wines contained a higher content of furans, aldehydes, ketones, and acetals, compared with unpressurised wines after 9 months of storage. The changes in the volatile composition indicate that HHP treatments accelerated the Maillard reaction, and alcohol and fatty acid oxidation, leading to wines with a volatile composition similar to those of more rapidly aged and/or thermally treated wines. The Maillard reaction involves amino acids and reducing sugars resulting in a complex mixture of poorly characterized molecules which are responsible for a range of odours and flavours. http://dx.doi.org/10.1016/j.foodchem.2015.05.002

The impact of higher alcohols on the perception of fruity aroma in red wines

Research has suggested that higher alcohols (HA) may contribute to the aromatic complexity of wine or, in other cases, mask certain flavours, depending on their concentrations. Below 300 mg/L, HA are usually considered to contribute to the desirable complexity of wine, whereas at concentrations exceeding 400 mg/L, they are regarded as having a negative impact on wine quality. This study focused on the impact of five higher alcohols on the perception of fruity aroma in red wines. Various aromatic reconstitutions were prepared, consisting of 13 ethyl esters and acetates and 5 higher alcohols, all at the average concentrations found in red wine, corresponding to the red wine fruity aroma pool. The ‘olfactory threshold’ of the fruity pool was evaluated in dilute alcohol solution, dilute alcohol solution containing 3-methylbutan-1-ol or butan-1-ol individually, and dilute alcohol solution containing the mixture of five higher alcohols, blended together at various concentrations. The presence of 3-methylbutan-1-ol or butan-1-ol alone led to a significant decrease in the ‘olfactory threshold’ of the fruity reconstitution, whereas the mixture of alcohols raised the olfactory threshold. There was a masking effect on fresh- and jammy-fruit notes of the fruity mixture in both dilute alcohol solution and dearomatized red wine. When either 3-methylbutan-1-ol or butan-1-ol was added to the fruity reconstitution in dilute alcohol solution, an enhancement of butyric notes was reported with 3-methylbutan-1-ol and fresh and jammy-fruit with butan-1-ol. The study showed that these compounds participate, both quantitatively and qualitatively, in masking fruity aroma perception in a model fruity wine mixture. http://dx.doi.org/10.1021/acs.jafc.5b03489

A review: characterization and role of grape solids during alcoholic fermentation

During wine production, grape solids have a large impact on fermentation characteristics and the organoleptic qualities of the resulting wine. A review highlights the key role of solid particles during alcoholic fermentations in producing wine. Solid particles provide the yeast with essential nutrients and are therefore a determinant factor in alcoholic fermentation. The review begins by focusing on the origin, physical characteristics and composition of these solids, and the changes in these aspects occurring during fermentation. It then considers the effect of solids on fermentation, the role of sterols, the control of solids and interactions between solids and other nutrients. Solids exert their effects on alcoholic fermentation mainly by modulating lipid supply. The main mechanisms underlying the impact of solids on fermentation kinetics have been deciphered. Nevertheless, further knowledge about grape solids is required to address several unresolved issues. These are: solid composition and structure and their changes during fermentation; the bioavailability of nutrients including nature and properties of sludge; how yeasts take up sterols from solids for the maintenance of membrane structure and metabolism; and the impact of solids on aroma synthesis during fermentation. Knowledge of the composition of these solids, and of sterol uptake mechanisms by yeast should facilitate improvements in fermentation control. From a practical point of view, the main challenge will be optimizing control strategies by taking solid management into account, together with other key control components, such as the addition of oxygen and nitrogen. http://dx.doi.org/10.5344/ajev.2015.15060

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