



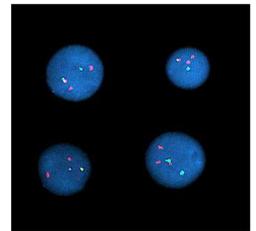
Winetech Scan

Wine Industry Network of Expertise and Technology
Netwerk van Kundigheid en Technologie vir die Wynbedryf

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Research News

- The theme of the Autumn Meeting of the Society for General Microbiology held in Edinburgh was 'Putting Microbes To Work'. Two papers dealt with wine fermentation. The first investigated the genomic adaptation of the lactic acid bacterium *Oenococcus oeni* to the wine environment. *O. oeni* is a minor species among the lactic acid bacteria that occur naturally on grapes, but it rapidly becomes predominant in wine and is generally the only detectable species during malolactic fermentation. To identify traits responsible for this very efficient adaptation to the wine environment, a number of genomic approaches were used. The results supported the idea that *O. oeni* is a fast-evolving species and provided clues about how some strains can better survive in wine, making it possible for the first time to select the best adapted strains for industrial applications on the basis of genetic traits, rather than phenotypic criteria. The second paper looked at the stress response of wine yeast, in particular the role of the deacetylases (enzymes that remove acetyl groups from proteins) called sirtuins in stress response and longevity in wine yeast. Strategies were developed to overexpress stress response genes under the control of regulatable promoters, which resulted in improved aspects of yeast growth and viability on wine fermentation, and better performance during wine-making. www.sgm.ac.uk/meetings/pdfabstracts/hw2009abs.pdf (abstracts only)
- A study for rapidly and accurately identifying detrimental lactic acid bacteria and acetic acid bacteria during the earliest stages of the wine fermentation process applied FISH (fluorescence in situ hybridization), PCR (polymerase chain reaction) and 16S-ARDRA (Amplified rDNA Restriction Analysis) techniques and compared how effectively bacteria marked with probes, or their DNA, can be identified using these methods. FISH is a cytogenetic technique used to detect and localize the presence or absence of specific DNA sequences on chromosomes, using fluorescent probes (right). The FISH technique, which can be used to directly identify individual bacterial cells in grape juice or wine, proved the most effective. The identification method developed is suitable for industrial-scale wine fermentation. https://portal.mtt.fi/portal/page/portal/mtt_en/mtt/news/pressreleases/Winemaking%20enhanced%20by%20DNA%20technology
- The non-enzymatic oxidation of wine has profound effects on its sensory attributes and thus perceived quality. However, it is only recently that the role of free radical intermediates in wine aging has been addressed. A recent study investigated the effect of various wine components on the formation or suppression of free radicals. Electron paramagnetic resonance (EPR) spin trapping was used to detect, quantify, and identify factors that alter the major radical species formed in actual wine systems. In all cases, the 1-hydroxyethyl radical was the sole spin adduct detected, suggesting that the Fenton reaction (the formation of the hydroxyl radical and its subsequent oxidation of ethanol in the presence of iron) is the major route for oxidation in wine. The addition of either iron, copper, or iron and copper in combination to a red wine resulted in a marked increase in observed spin adducts, demonstrating that trace levels of metals are essential catalysts in the oxidation of wine. The following wine oxidation scheme was proposed: reduced transition metals (e.g., iron, copper, and potentially manganese) are essential for catalyzing the thermodynamically favourable, yet kinetically unfavourable, reaction between oxygen and polyphenols to yield hydrogen peroxide. Furthermore, metals are required in order to reduce hydrogen peroxide to the reactive hydroxyl radical via the Fenton reaction. It is hypothesized that this radical species is responsible for the oxidation of ethanol to acetaldehyde. Also investigated was the addition of catechin (a polyphenol) to a white wine containing excess sulphur dioxide. This had had no effect on the initial rate of radical formation, but was pro-oxidative in the latter stages of the experiment. Sulphur dioxide was shown to inhibit radical formation in a concentration-dependent manner. www.ajevonline.org/cgi/content/abstract/60/4/471



Local research results

- The ability to detect fraudulent addition of aroma constituents to wine can only be based on an extensive knowledge of what naturally occurs in wine, hence the need for a database of aroma profiles of wines. Comprehensive databases of the aroma components of the six of the most important South African cultivars, Sauvignon Blanc, Chardonnay, Pinotage, Shiraz, Cabernet Sauvignon and Merlot for the 2005, 2006 and 2007 vintages for 15 geographical regions have been prepared. The project collected and analysed 1005 wines in the above categories. The analytical methods of headspace extraction of volatiles and liquid/liquid extraction of volatiles were used to detect as many components as possible in all 1005 wines. Headspace extraction of methoxypyrazines and liquid/liquid extraction of mercaptans were applied only to 555 Sauvignon Blanc, Cabernet Sauvignon and Merlot wines. A new method for the analysis of volatiles (Stir Bar Sorptive Extraction) was

developed for future use by the wine industry. The method utilises a magnetic stirring rod coated with polydimethylsiloxane which absorbs organics which can then be directly analysed by gas chromatography-mass spectrometric analysis. www.sawislibrary.co.za/dbtextimages/MaraisJ31.pdf

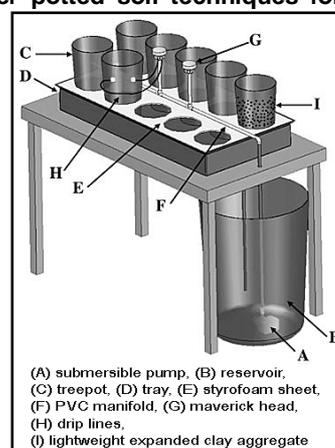
- The fermentation performance of wine yeast strains has major economic implications for the wine industry. The Fermentation Performance Programme has achieved a number of milestones its 5 years of funding. The occurrence of problem fermentations in the SA wine industry was assessed and a database for problem fermentations was initiated. Reproducible fermentation conditions to identify genes involved in the response to wine fermentation stresses were established. This included a standard synthetic must. Genes involved in nutrient-dependent gene regulation were characterised. Several of these genes are involved in cell wall regulation, and play roles in flocculation and flor formation, and have now been used to improve the control of flocculation. Genes that improve fructose utilisation genes have been identified and have been cloned for further analysis. Yeast strains with reduced nitrogen requirements and improved fructose utilisation were generated by hybridisation and mutagenesis. www.sawislibrary.co.za/dbtextimages/BauerFF5.pdf

Technological Developments

- Wine barrels in the United States are being cleaned for re-use by being blasted with dry ice under pressure. Dry ice is solid carbon dioxide (CO₂) and is colourless, odourless, non-flammable, and slightly acidic. It sublimates directly from a solid to a gas at -78.5°C. The blasting propels dry ice pellets at extremely high speeds. The pellets are quite soft, and much less dense than other media used in blasting-cleaning. Upon impact, the pellet sublimates almost immediately, transferring minimal kinetic energy to the surface and producing minimal abrasion. Sublimation absorbs a large amount of (latent) heat from the surface, producing shear stresses due to thermal shock and causing the top layer of dirt or contaminant to flake off more easily. The rapid change in state from solid to gas also causes microscopic shock waves, which are also thought to assist in removing the contaminant. In the wine-barrel cleaning process, the dry ice removes mould spores, bacteria and fungus, and importantly, about 0.1mm of old, wine-saturated wood without removing the 'toast' levels of the barrel, thus extending the life of the barrel and allowing the winemaker to use it again without further toasting. The developers of the process claim that blasting a barrel at three years is most cost-effective, with the last cleaning done when the barrels are 7 years old. For each barrel cleaned, which costs \$50, the winery saves about \$175 a year compared to buying new barrels. Approximately 65% of a barrel's flavour is extracted during the first season leaving about 30% of a barrel's flavour intact. The process opens the grain, doubling the surface area of the wood and reveals fresh, toasted oak and flavours, increasing the barrel's attributes to about 60% of the barrel's original flavour. In a test, 100 identical French oak barrels were divided randomly into two sets of 50. One set was used as the control and was prepared with a standard hot water, high pressure barrel washer, and ozone rinse. The other 50 were cleaned by the dry ice method. They were all filled with identical Cabernet Sauvignon. Throughout the 8 month aging process the wine from the dry ice-blasted barrels showed 'fresher, cleaner tastes and better oak aroma and flavour' than the non-blasted barrels. When the aging was complete, gas-chromatograph analysis showed that dry ice blasting allowed the barrels to impart significantly more oak volatiles into the wine. The only volatiles which showed lower readings were guaiacol and 4-methylguaiacol, which are responsible for 'smoke' and 'char' flavours, and their decrease is explained by the removal of the 0.1mm layer. www.barrelblasting.com/results.shtml http://en.wikipedia.org/wiki/Dry_ice_blasting



- Aerated solution culture (ASC), or hydroponics, provides several advantages over potted soil techniques for numerous plant research applications. It allows accurate control of nutrient and water supplies for plant physiological studies. In addition, roots can be harvested easily and cleanly without soil contamination. It has been found that grapevines grown for more than one month in aerated solution culture (ASC) can develop nutrient deficiency-like symptoms. This appears to be due the roots suffering from hypoxia because of oxygen diffusion limitations, which was confirmed by the steady-state transcript abundance of two hypoxia-induced transcripts, alcohol dehydrogenase II and α -amylase, increasing slowly after six days. These results indicated that mature vines with woody roots suffered slow and chronic hypoxic stress in ASC. A continuous recirculating drip system (RDS) (right) was designed to provide precise nutrient control, consistent water potentials, and to approximate a well-drained soil. Vines grown in the RDS did not suffer hypoxic symptoms and it was concluded that RDS was ideal for long-term greenhouse growth of grapevines, maintaining the advantages that solution culture provides for controlled abiotic-stress experimentation and ease of root harvest. www.ajevonline.org/cgi/content/abstract/60/4/542



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