

Wine quality grading by near infrared spectroscopy.

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The ability to accurately assess wine quality is important during the wine making process, particularly when allocating batches of wines to styles determined by consumer requirements. Grape payments are often determined by the quality category of the wine that is produced from them.

Wine quality, in terms of sensory characteristics, is normally a subjective measure, performed by experienced winemakers, wine competition judges or winetasting panellists. By nature, such assessments can be biased by individual preferences and may be subject to day-to-day variation.

Taste and aroma compounds are often present in concentrations below the detection limit of near infrared (NIR) spectroscopy but the more abundant organic compounds offer potential for objective quality grading by this technique.

Samples were drawn from one of Australia's major wine shows and from BRL Hardy's post-vintage wine quality allocation tastings. The samples were scanned in transmission mode with a *FOSS NIRSystems6500*, over the wavelength range 400–2500 nm. Data analysis was performed with the *Vision* chemometrics package.

With samples from the allocation tastings, the best correlations between NIR spectra and tasting data were obtained with dry red wines. These calibrations used loadings in the wavelengths related to anthocyanins, ethanol and possibly tannins. Anthocyanins are a group of compounds responsible for colour in red wines - restricting the wavelengths to those relating to anthocyanins produced calibrations of similar accuracy to those using the full wavelength range. This was particularly marked with Merlot, a variety that tends to have relatively lower anthocyanin levels than Cabernet Sauvignon and Shiraz. For dry white wines, calibrations appeared to be more dependent on ethanol characteristics of the spectrum, implying that quality correlated with fruit maturity.

The correlations between NIR spectra and sensory data obtained using the wine show samples were less significant in general. This may be related to the fact that within most classes in the the show, the samples may span vintages, growing areas and winemaking styles, even though they may be made from only one grape variety. For dry red wines, the best calibrations were obtained with a class of Pinot Noir — a variety that tends to be produced in limited areas in Australia and would represent the least matrix variation. Good correlations were obtained with a tawny port class — these wines are sweet, fortified wines, that are aged for long periods in wooden barrels. During the ageing process Maillard browning compounds are formed and the water is lost through the barrels in preference to ethanol, producing “concentrated” darkly coloured wines with high alcohol content. These calibrations indicated heaviest loadings in the water regions of the spectrum, suggesting that “concentration” of the wines was important, whilst the visible and alcohol regions of the spectrum also featured as important factors.

NIR calibrations based on sensory scores will always be difficult to obtain due to variation between individual winetasters. Nevertheless, these results warrant further investigation and may provide valuable insight into the main parameters affecting wine quality.