



Characterisation of colour components and polymeric pigments of commercial red wines by using selected UV-Vis spectrophotometric methods

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In: South African Journal of Viticulture and Enology. 28(1):6-10. 2007

- The color of red wine is a complex mixture of several components, including 1) free monomeric anthocyanins, 2) the enhancement of their color due to non-colored cofactors (copigmentation), and 3) polymeric pigments. The color of wine changes throughout its life. As the wine ferments and ages, monomeric anthocyanins are gradually incorporated into polymeric pigments, which confer color stability to the wine.
- The purpose of this study was to characterize the color components of a large variety of Italian red wines (128 total samples including many varieties), with special emphasis on Sangiovese. The color components characterized included: 1) total color, 2) co-pigmentation, 3) SO₂-resistant pigments, 4) small and large polymeric pigments, and 5) tannins.
- Even though the color measurements were done using two methods: 1) the Boulton and 2) the Adams methods, in their introduction the authors mention briefly two other available methods. To put things in perspective, let's look quickly at all 4 methods:
 - _ *Ribereau-Gayon method*: measures the polymeric pigment after bisulfite bleaching of the anthocyanin monomers;
 - _ *Somers method*: measures total anthocyanins (the portion of total color that is bleached by SO₂), and polymeric pigments;
 - _ *UC Davis method (Harbertson and Adams method, or simply, Adams method)*: this spectrophotometric method is able to separate polymeric pigments into large-size (protein precipitable) and small-size fractions. Additionally, it measures tannins and anthocyanins.
 - _ *Boulton method*: this spectrophotometric method measures three different components: total color (A520), SO₂-resistant pigment (A520 after adding SO₂), and co-pigmented color (A520 after dilution), thereby incorporating the first two methods for a more complete profiling of pigmented molecules.
- **Results. 1)** In a first step, the authors analyzed all the wines for total color, co-pigmentation, and SO₂-resistant pigments (Boulton method). Of all the varieties studied, the Marzemino and Aglianico, followed by Cabernet Sauvignon, were the highest in total color. As for SO₂-resistant pigments, that category was highest in Cabernet Sauvignon. Overall, the authors believe that Marzemino and Aglianico would be well-suited for aging, as both showed high total color and high SO₂-resistant pigments.
- It is believed that wines from grapes high in copigmentation cofactors and/or acylated anthocyanins (anthocyanins bound to acetic, caffeic or coumaric acids) have a higher level of co-pigmentation. In this study, the authors noted that Sangiovese had poor co-pigmentation values. As the authors point out, this is in agreement with the lack of acylated pigments reported for this variety.

- 2) In a second step, and to obtain more insight into the composition of the wines studied, the SO₂-resistant pigments were further separated into small and large polymeric pigment fractions, SPP and LPP, respectively (Harbertson and Adams method). The authors' main finding was that the levels of LPP, SPP and tannin in Sangiovese increased as the age of the wine increased.
- When the authors examined the correlations between different phenolic parameters using the various methodologies, they found the highest correlation between the SO₂-resistant pigments as measured by Boulton's assay, and the sum of LPP and SPP as measured by the Adam's assay. This further confirms that the Adam's assay fractionates SO₂-resistant polymeric pigments into two classes, those that precipitate with protein (LPP) and those that do not (SPP).

In summary, in this study the authors explored the phenolic profile of several Italian varieties using the Boulton and Adams assays. The authors emphasize that these two methods, based on easy-to-get UV-visible spectrophotometric data, are two relatively new tools available to winemakers, making it possible for them to read the "color" of their wines with improved detail.

Author: Bibiana Guerra, Editor: Kay Bogart. This summary series funded by J. Lohr Vineyards & Wines.