



Title: “Analysis of tannins in red wine using multiple methods: Correlation with perceived astringency”

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The authors study the relationship between astringency and tannin concentration in red wine using different analytical methods.

- One of the current challenges for many winemakers is to have an analytical method of measuring tannins that correlates well with perceived astringency. The successful analytical method would, ideally, be reproducible in the winery, be inexpensive, and require minimal analytical skills and equipment.
- Using a variety of analytical methods, the authors measured the tannins of 40 production-scale varietal wines (32 of 2003 vintage, 8 of 2002 vintage, including Cabernet Sauvignon, Merlot, and Syrah). Then they assessed astringency of those same wines with a sensory panel. Finally, they examined which analytical method provided the results that correlated best with the astringency score. The tannin concentration in the wines studied ranged from 387 to 1655 mg/l (by protein precipitation).
- Among the analytical methods compared, the authors used two well-known ones: 1) **absorption at 280 nm**, and 2) **protein precipitation** (See Summary 3). Additionally, they also included other less familiar methods, to see whether they might provide useful correlations to the astringency sensation. These less common methods have complicated names, and we will just call them: 3) **method A**, 4) **method B**, and 5) **method C**.
- Briefly, **method A** (dimethyl-amino-cinnamaldehyde method) consists of letting the tannin subunits react with a compound that enables them to develop color, which is then measured. This method reads the phenolic fraction called *flavanols*. **Method B** (phloroglucinolysis) consists of degrading tannins first into smaller pieces, and then measuring the subunits with HPLC (high pressure liquid chromatography). This method reads the fraction called *proanthocyanidins*. Finally, **method C** (gel permeation chromatography) consists on further separating the proanthocyanidins in a gel column based on molecular weight. The different fractions (monomers, dimers, trimers, tetramers, etc) come out at different times, smaller first, and are quantified by HPLC as before. (You must be panicking a little bit by now, and that’s understandable, but we are done with methods!)
- Astringency was assessed by a panel of five members (3 winemakers, 2 enologists), after performing three training sessions to unify criteria. Judges evaluated 6 pre-randomized wines at each sitting, scoring astringency intensity from 0 (no astringency) to 10 (extremely astringent). A commercial red wine produced by the winery was presented at each flight as an anchor standard (the authors do not mention which astringency score this standard represented). Because of the large amount of wines, it took the panel 20 flights to evaluate all the wines. And here is what they found.

- **Absorption of light at 280 nm and reaction with DMCA were not acceptable** methods to predict astringency as they had no correlation with perceived astringency. Given the non-specific nature of both assays, this was somewhat predictable.
- The remaining 3 methods had a good correlation with perceived astringency in each case. Of the three, **the protein precipitation method had the highest correlation** ($r^2=0.82$). This is also not entirely surprising, as the underlying mechanism of this method mimics the human response in the mouth to astringency (precipitation of the tannins in wine by proteins in human saliva).
- Can we learn about the chemical composition of a wine by evaluating astringency using protein precipitation? Can we link the chemistry lab and the sensory lab? To explore this possibility, the authors compared the results of the protein precipitation method with those of the two chromatographic methods (phloroglucinolysis and gel permeation chromatography). They found that correlations were excellent in both cases ($r^2=0.91$ and $r^2=0.89$, respectively). What this means is that the relationship between protein precipitation and the two chromatographic methods is stronger than the relationship between protein precipitation and sensory scores. This, again, is not unexpected as 1) human perception of astringency using a small panel is more subject to error than an instrument, and 2) as the authors discuss, sensory scores can be influenced by compounds in the wine that modify the sensation of astringency (color, acidity, polysaccharides), but do not influence quantitative tannin analysis.

In conclusion, the protein precipitation method of tannin analysis correlated well with the perception of astringency in wines with a wide range of tannin content. Because of the simple equipment necessary, this method seems the most adequate for wineries to adopt as a tool to establish a relationship between tannin concentration and astringency. The next summary goes one step further to address how some wineries have adopted the protein precipitation assay as a standard analytical tool to aid them in making decisions on wine style.

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