Body Building: Tannin and Structure in Red Wines

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What are tannins?

Tannins are plant polyphenolics capable of cross-linking collagen fibers in animal hides. This categorization is purely functional, and is derived from traditional leather tanning practices. The important point is that tannins are capable of precipitating proteins. When wine tannins precipitate proteins in a consumer's saliva, the wine is perceived as astringent.

Types of Tannins in Wines

Type	CONDENSED	HYDROLYSABLE
Source	Grape skins and seeds; varies by cultivar, site, and viticultural practices	Oak barrels and products; commercial tannin products produced from oak galls, quebracho, or other woods
Size	larger	smaller
Astringency	higher	lower
Color stabilization	Yes, when present at the beginning of fermentation	No known potential for color stabilization

NOTE: Studies have shown that higher concentrations of condensed tannins correlate to higher perception of overall red wine quality.

Flavan-3-ols

- The building blocks, or monomers, that make up condensed tannins. The most important monomers are (+) catechin, (-) epicatechin, gallocatechin and gallocatechin gallate.
- Flavan-3-ol monomers group together in short chains (oligomers) or long chains (polymers) to form condensed tannins.

Condensed Tannins

- Vary in size, degree of polymerization, degree and type of branching, and in the type of flavan-3-ols they contain.
- Tannin chain length is discussed in terms of **mDP**, or **mean Degree of Polymerization**. The only way to currently measure large tannins is to chemically tag chain ends, break them into pieces, and then assess the average size of the pieces. This gives us an idea of mean size, but doesn't allow us to quantify the concentration of different size tannins.
- Tannins with mDP < 5 are perceived as bitter; those with mDP > 5 are perceived as astringent.

Tannin development and extraction

- During ripening, tannin length (mDP) increases, but extractability decreases.
- Grape seeds contain more tannin than grape skins, but seed tannin extracts much more slowly. Consequently, skin tannins are most prevalent in wines.

- Production practices that increase tannin extraction include warmer fermentation temperatures, saignée (bleeding out some of the juice to increase skin-to-juice ratio), punchdown, pumpover, extended maceration, and freezing/thawing grapes prior to fermentation.
- Cold soak and thermovinification improve anthocyanin (color) extraction, but not tannin extraction.

Tannin concentration and extractability
- The total concentration of tannin in a given grape cultivar does not correlate directly with the concentration of tannin in wines made from that cultivar.
- Tannin extractability is defined as [wine tannin/grape tannin] X 100.
- Tannin extractability is impacted by polysaccharides and (especially) proteins present in grape must.

Hybrid grapes and wines
- Many non-vinifera grape cultivars have relatively high tannin concentrations, but produce wines with relatively low tannin.
- Red hybrid wines are low in condensed tannin, and the tannins they have are small in size.
- Red hybrid grapes contain higher concentrations of the proteins that bind with tannins and remove them from solution, resulting in lower tannin concentrations in wine.

Tannin 'quality'
- "Hard" tannins generally reflect high tannin concentration and more seed, rather than skin, tannins.
- "Soft" tannins have not been correlated to specific chemical parameters.
- "Green" tannins have been linked to a taster's subconscious interpretation of wines with low color intensity, rather than actual tannin concentration.
- Other wine matrix effects, like alcohol, acid, and sugar content, will influence the perception of tannin quality and wine mouthfeel.
- Perception of wine texture is highly individual, as wide variations in the quantity and quality of saliva individuals produce results in variable reactions with tannins.

Tannin additions
- Commercial tannins are sourced from grapes, wood products, or a combination of the two.
- Commercial tannin products contain somewhere between 20-50% tannin; the remainder of the product consists of other polyphenols, processing aids, and plant artifacts. Pure tannin is difficult to create, and is prohibitively expensive for wine production.
- Because hybrid red grapes contain high concentrations of tannin-binding proteins, additions of exogenous tannins must be much higher than recommended for traditional wines.
- The later a tannin addition is made, the greater the concentration that remains in the wine.
- Don't rely on traditional methods- like extended maceration- to increase tannin concentrations in hybrid red wines. During maceration, proteins bind tannins and precipitate them from solution.