Overview of Phenolics in Wine: Bitterness vs Astringency and Mouthfeel

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Wine Flavor 191C: The Impact of Phenolic Management on Wine Style Options
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• Bitter Compounds:
  • Structurally diverse
    • Phenols, Amino acids, peptides, salts, ions, alkaloids, acylated sugars, glycosides, nitrogenous compounds, and thiocarbamates

• Astringents:
  • Compounds which precipitate proteins.
    • Salts, Acids, water soluble phenols with MW 500-3000

Factors affecting perception of bitterness

System
- Temperature
- Concentration
- Taste Interactions
- Matrix
- Viscosity
- Ethanol

Sensitivity
- *PROP Status
- Gender
- Specific Compound
- Age
- Disease
- Race
- *PROP propylthiouracil

Factors influencing astringency

- Stereochemistry
- Molecular weight
- Functional groups
- Composition
- pH
- Temperature
- Viscosity
- Carry-over effect
- Flavor/taste
- Salivary Flow rate
**FLAVAN-3-OLS**

Monomeric units of flavonoid phenolic compounds (tannins)

![Chemical structures](image)

- **Epicatechin**
- **Catechin**

**Effect of one chiral site**

Thorngate Noble 1990

**Effect of degree of polymerization (dp)**

As DP increases,
- Bitterness Decreases
- Astringency Increases

![Graph](image)

Gacon et al 1999

**Why do DP3 Fractions differ in Astringency?**

- **New DP 3**
  - MW = 893
- **Old DP3**
  - MW = 862

![Mass spectra](image)

Fischer Noble 1994

**Effect of pH on bitterness and astringency of tannic acid in wine**

![Graphs](image)

Fischer Noble 1994
**Effect of ethanol on bitterness and astringency of tannic acid in wine**

<table>
<thead>
<tr>
<th>Bitterness</th>
<th>Astringency</th>
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<tbody>
<tr>
<td>% Ethanol</td>
<td>% Ethanol</td>
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<tr>
<td>8</td>
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Fischer Noble 1994

**Effect of Viscosity on Astringency of grape seed tannin**

- No CMC
- 1% CMC
- 2% CMC

Smith Noble 1996

**Effect of Sweetness, Fruit flavor, VEGY flavor on astringency of red wine**

- Base
- Fruity
- Sweet
- Veg

Speegle Noble 2002

**Effect of Saliva flow rate on astringency intensity**

- RED WINE
- WHITE WINE with tannic acid

- Low
- High

LeDrean Noble 1998

**Astringency:**

Tactile sensation of roughness which has carryover effects.

Each sip or product affects the astringency of the next AND Consumers drink many sips of a beverage…not just one.
Astringency of tea

8 Sips at 25 intervals  Sturzenegger Noble 1998

How can carry-over be eliminated or minimized?

Effect of serving order

Carry over reduced with longer time between sips
The dry, rough sensation which is the friction perceived when lubrication of saliva is decreased by tannins binding with saliva proteins.

What is effect of varying flow-rate on perception of astringency WITHIN an individual?

Artificial saliva or Artificial Saliva plus gelatin introduced at 0.5, 5.0 or 8.5 ml/min while judges sipped alum, tannic acid or wine.

Artificial saliva (control) 0.234g NaCl, 0.746g KCl, 0.504g NaHCO₃, 0.601g KHCO₃, 0.0685g CaCl₂, 0.102g MgCl₂, 0.0327g KH₂PO₄, and 0.0418g K₂HPO₄ per liter DI water.

Effect of saliva flow rate on wine astringency

4 SIPS OF TANNIC ACID
Saliva flow : Low = 0.5 ml/min
Very High = 8.5 ml/min

Mouthfeel Wheel
Gawel et al
Aust. J. Grape Wine 2000