Master Brewers Association of the Americas
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MBAA Annual Conference

Astringent: A case study in product development

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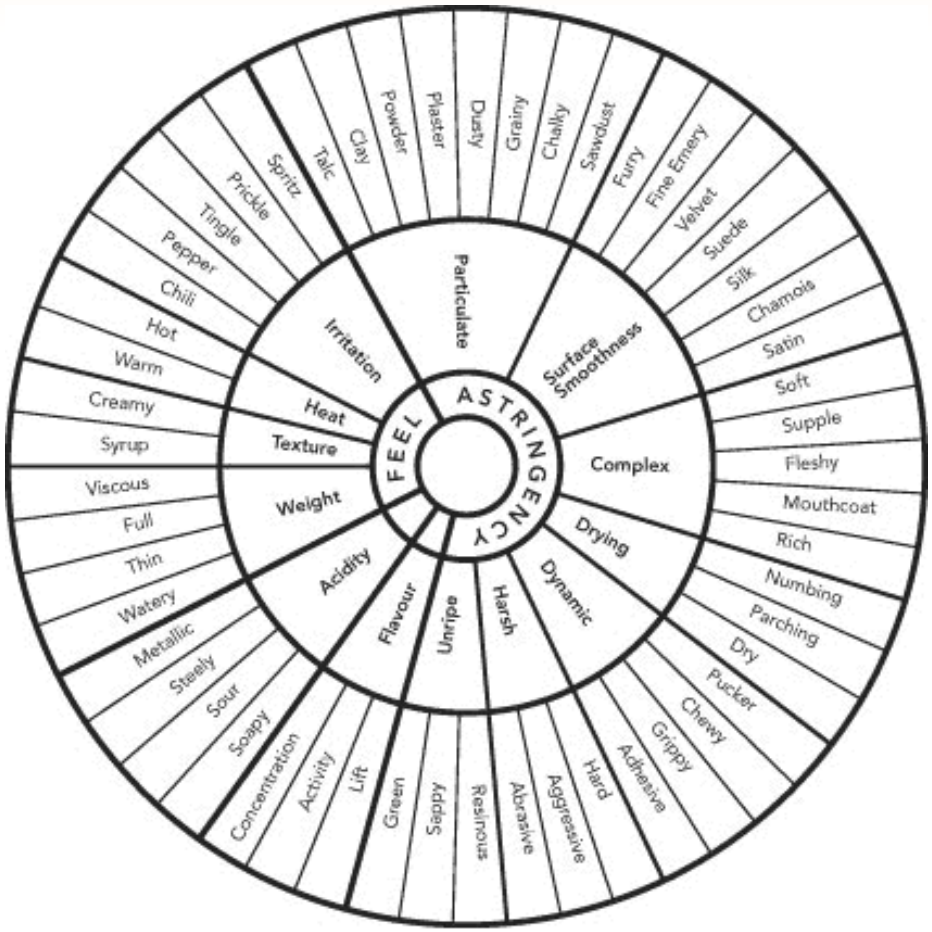
- Definition of astringency
- Mechanisms of formation / detection
- “true” astringent compounds
- Astringency and bitterness
- Origins of astringent compounds
- Palatability and preference
- Development of astringent standard
- Field tests with sensory panels

What is astringency

- "A feeling not a taste", Bate-Smith (1954)
- "The precipitation of tissue proteins is accompanied by the shrinkage of tissue due to a loss of water and a decrease in the permeability of this tissue to water and solutes." Joslyn and Goldstein (1964)
- "The complex of sensations due to shrinking, drawing or puckering of the epithelium as a result of exposure to substances such as alums or tannins" (ASTM, 2004).
- "A drug that causes cells to shrink by precipitating proteins from their surfaces" (CDM 2007)

Mouthfeel Wheel

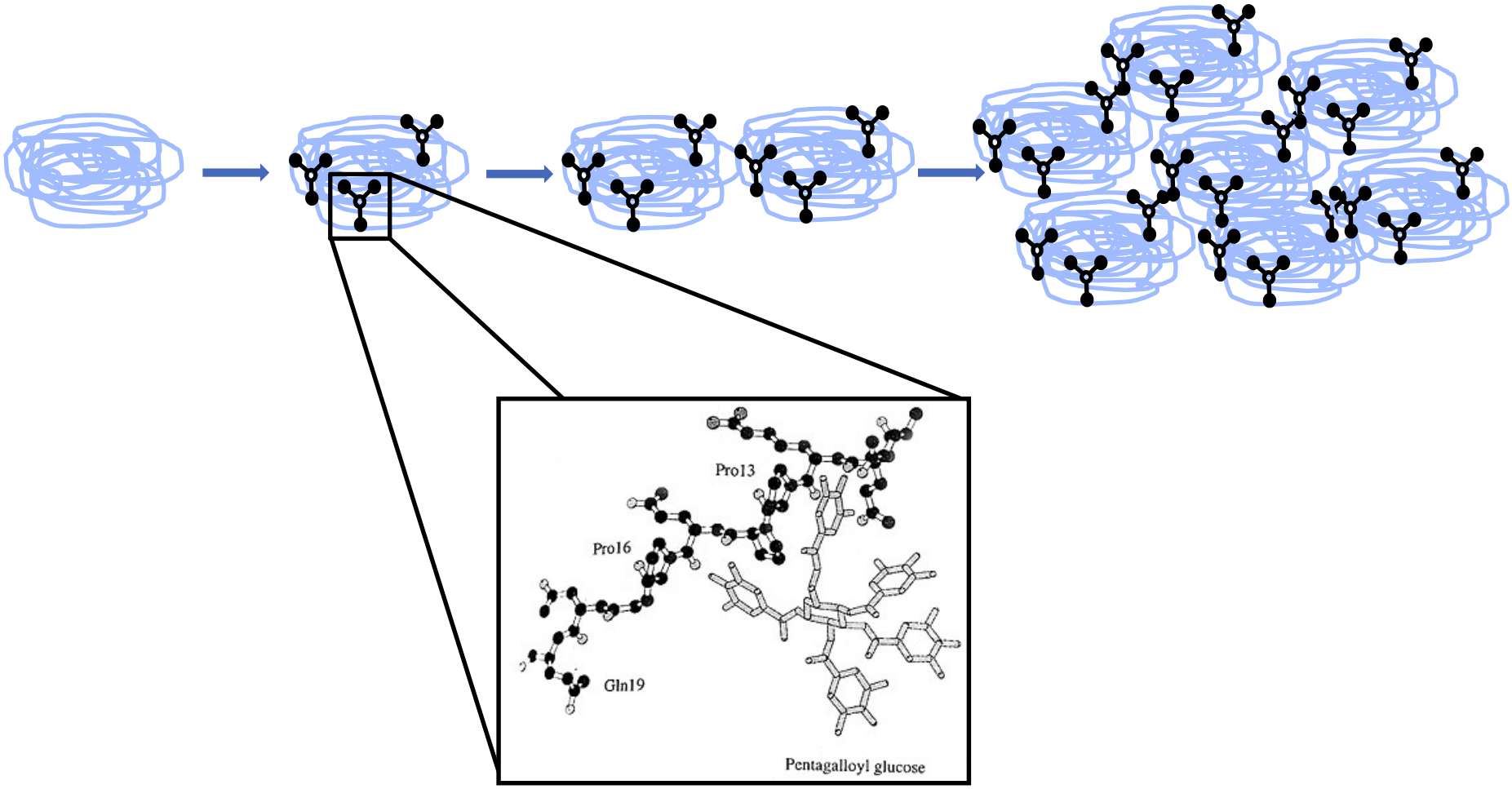


Mouth-feel Wheel

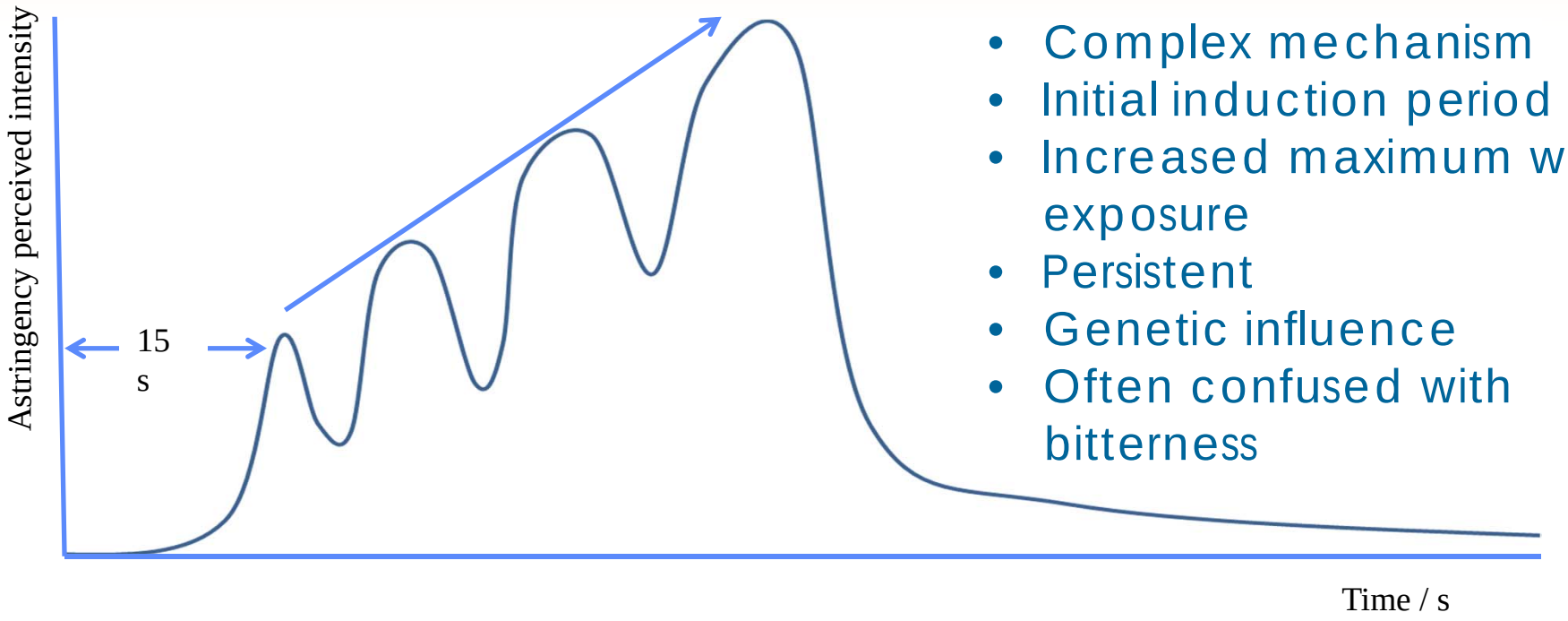
Terminology for Communicating the Mouth-feel of Red Wine

Source: Gawel, R., Oberholster, A. and Francis, I.L. (2000)
Australian Journal of Grape and Wine Research, 6(3), 203-207

Polyphenol PRP interaction



Detecting astringency



- Complex mechanism
- Initial induction period
- Increased maximum with exposure
- Persistent
- Genetic influence
- Often confused with bitterness

- Astringency cannot be evaluated by 2 or 3 AFC, triangular tests
- Difficult to asses maximum intensity (QDA, Spectrum Analysis®)
- Time Intensity analysis can provide insights

“true” astringent compounds

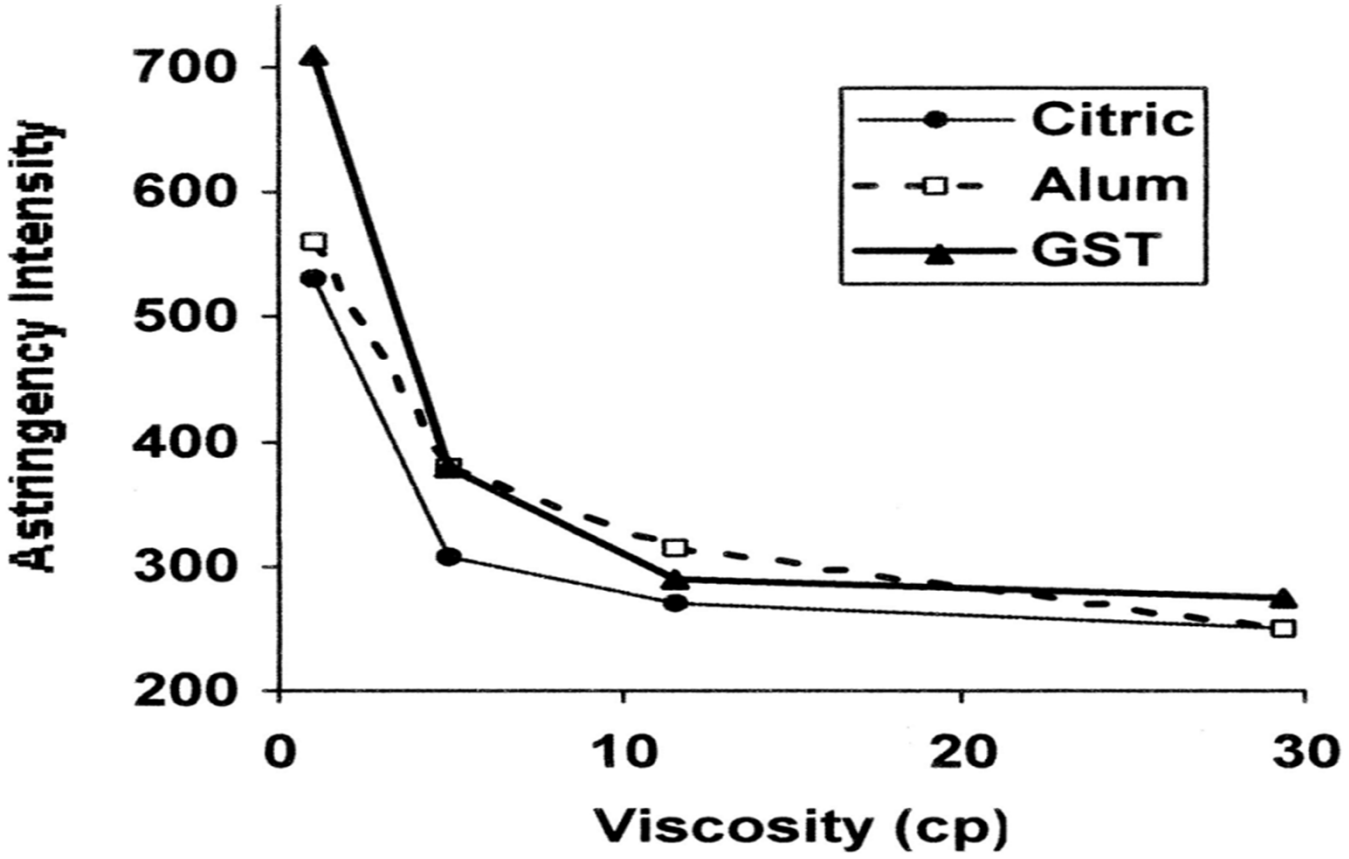
- Salts of multivalent metallic cations
- Dehydrating agents (ethanol and acetone)
- Mineral and organic acids
- Polyphenols

Relation between bitterness and astringency

- Many compounds are both bitter and astringent
  - Molecular weight
  - Degree of polymerization
  - Hydrosolubility
- Interactions with liquid matrix
  - Alcohol content increases bitterness
  - Low pH increases astringency
  - Sweetness decreases bitterness but no effect on astringency
  - Viscosity (body) significantly reduces astringency
- Interactions with food

Effect of matrix viscosity and astringency

Effects of increased viscosity on maximal astringency intensity of citric acid (1.2 g/L), alum (1 g/L), and grape seed tannin (GST) (2.5 g/L).



Origins in beer

Malt related

- Grain husks boiled with the wort
- Overagitation of the mash
- High pH sparge water
- Overly hot sparge water
- Poor quality malt

Release of tannins
from malt husk

Origins in beer

Hop related

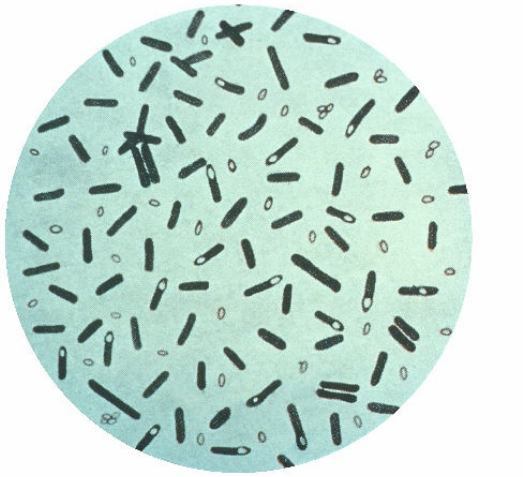
- Over boiling hops
- Over hopping
  (especially with whole hops)
- Wort trub not separated out properly

Release of tannins from
hop plant matter

Origins in beer

Other

- Bacterial contamination and infection
- Fruit skins boiled with the wort
- Chemicals used in tank cleaning



Astringency and preference

- Astringency usually considered undesirable
- Rejected by infants (along with bitterness)
- Preference changes with time / exposure
  - Affected by extrinsic properties
  - Consumer's expectations
  - Social factors
- Some products are “expected” to be astringent

From concept to product

- Define possible candidates
- Sourcing and test candidates
  - Water
  - Beer
- Shortlist compounds and initial concentration
- Manufacture ‘proof of concept’ capsules
- Test with external panel
- Correct concentration (if required)
- Approve for production

Astringent candidates

- Aluminium Sulphate dodecahydrate
- Polyphenols from grapeseed (molecular weights between 500 and 3000 were reported to be required)
- Malic acid
- Tannic Acid
- Glycosides from green plant extract (alkaloid)

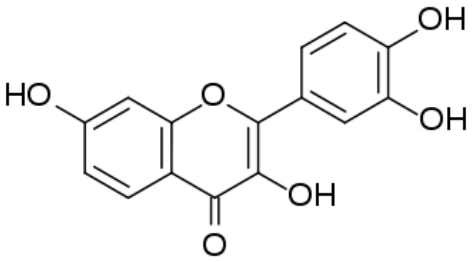
Aluminium Potassium Sulphate

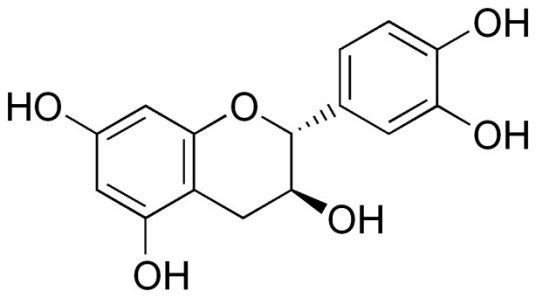
- Traditionally used in astringency training
  4 – 6 g/l + 0.01 M alkaline solution
- Provides an intense ‘harsh’ astringent mouthfeel
- Heavy visual alteration of beer (cloudiness)

$$AlK(SO_4)_2 \cdot 12H_2O$$

Polyphenols from grapeseed

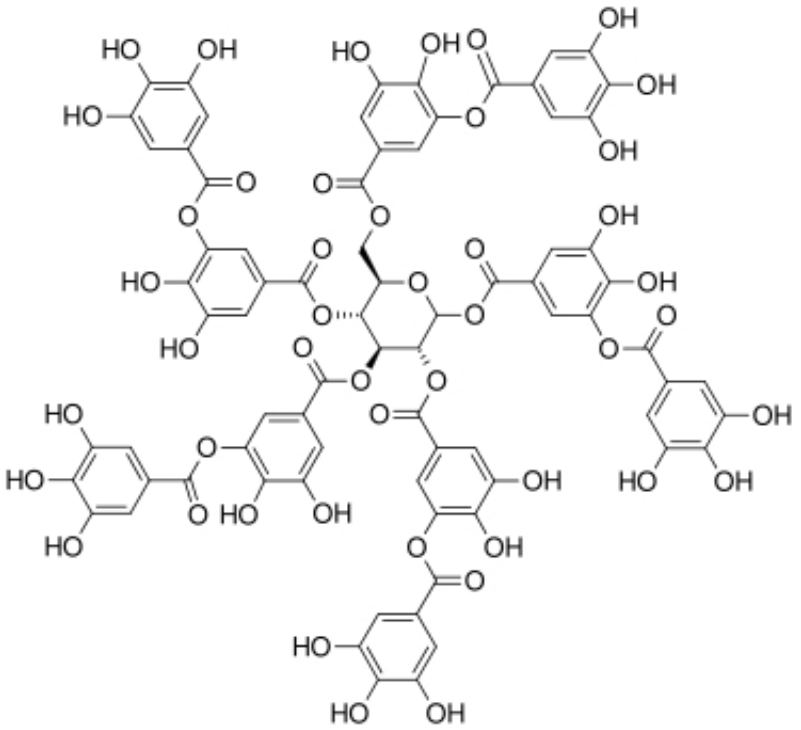
- Easy availability
- Good astringent effect but influenced by type and molecular weight
- Difficult to match polyphenol from grape to the polyphenols found in beer
  - ➢ catechins, proanthocyanidins and flavonols
- Sensory difference found in test trials
- Polyphenols (tannins) darken the beer

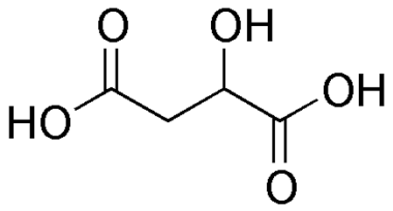




Tannic and malic acid

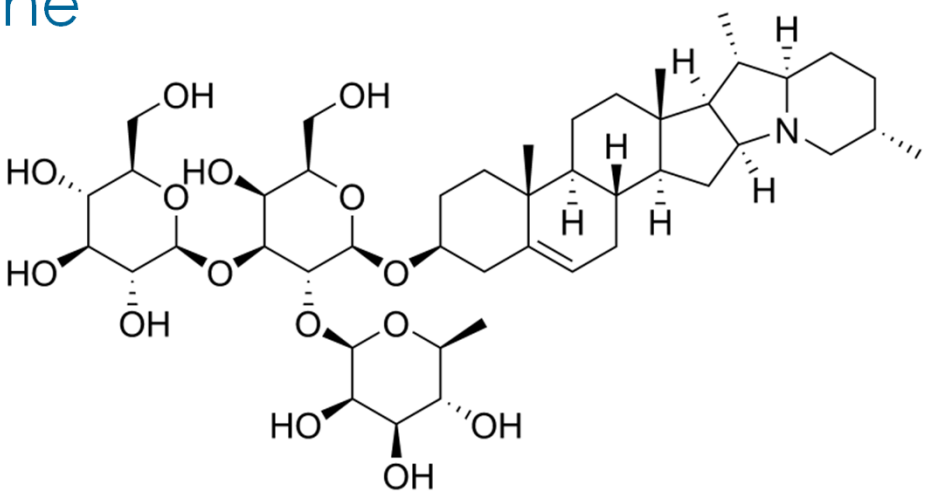
- Trialled as an attempt to ‘isolate’ the astringency found in Tannins
- Intense and long lasting astringency at low concentrations (4 – 50 mg/l)
- Malic acid described as “tart”
- Produce beer haze





Glycoside from green plant

- Produces a “generic” astringent mouthfeel
- Does not interact with the beer matrix
- Food safe
- Very intense at low concentrations (250 mg/l)

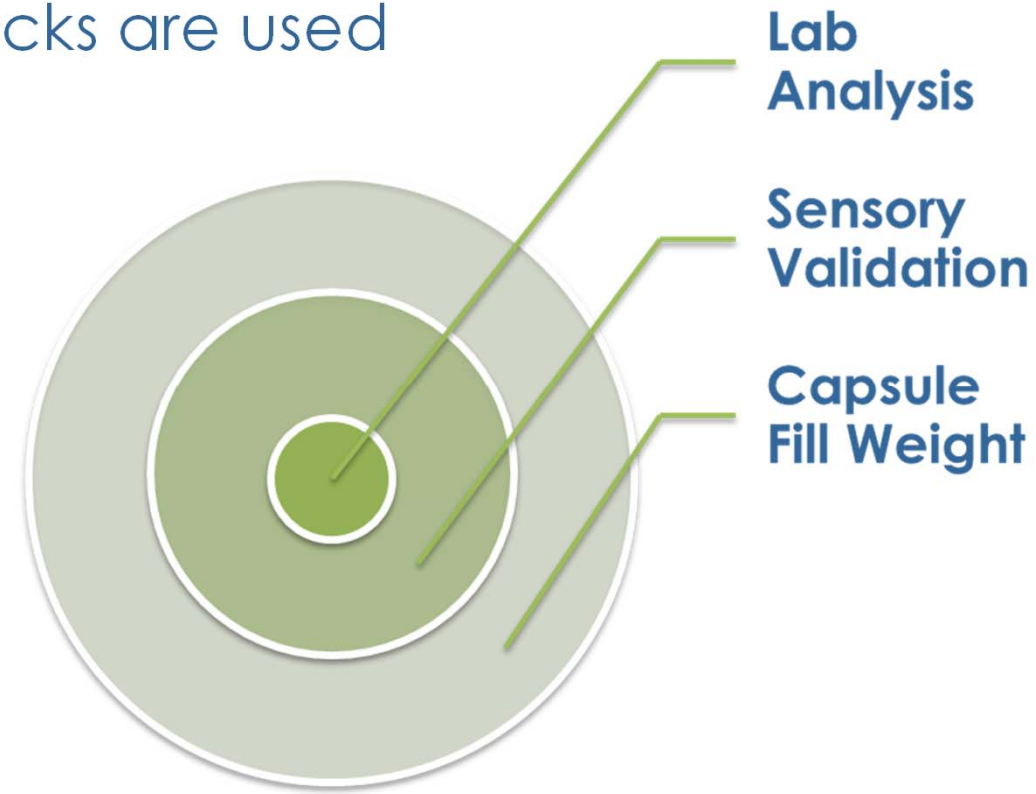


GMP Flavour Standard Production – Capsule filling

- Capsules are filled with the validated blend.
- Filling is volumetric, a full capsule is within the correct flavour loading due to the earlier blending.
- To eliminate contamination capsules are manually filled.
- A number of samples are selected at random for retain samples, volumetric weight comparison and for final sensory release.

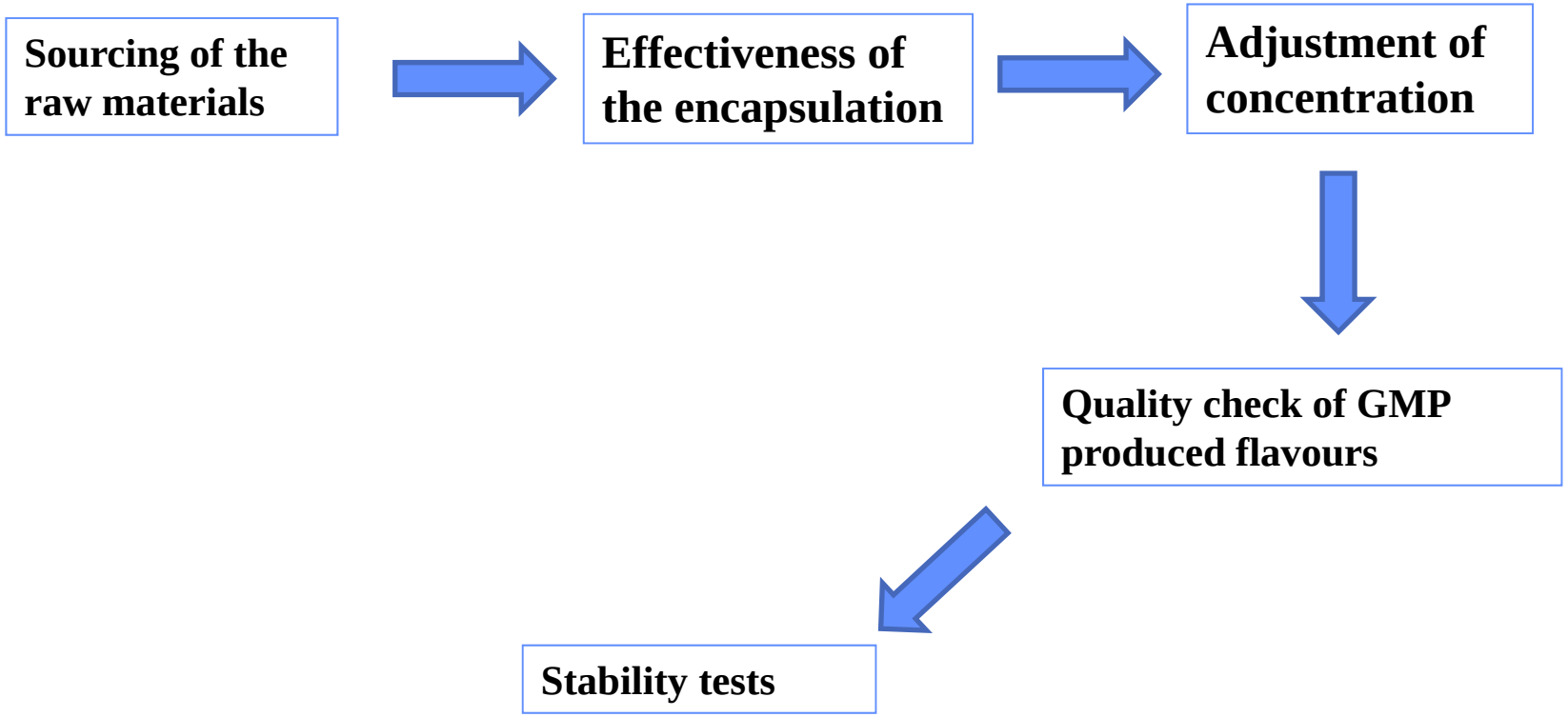
GMP Flavour Standard Production (release analysis)

3 Analytical checks are used

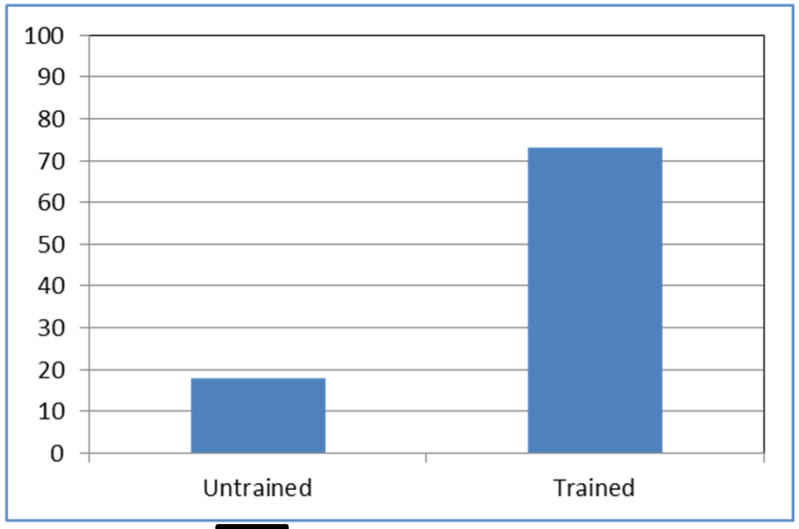


All these tests guarantee that the amount of the standard released is constant.

Sensory tests

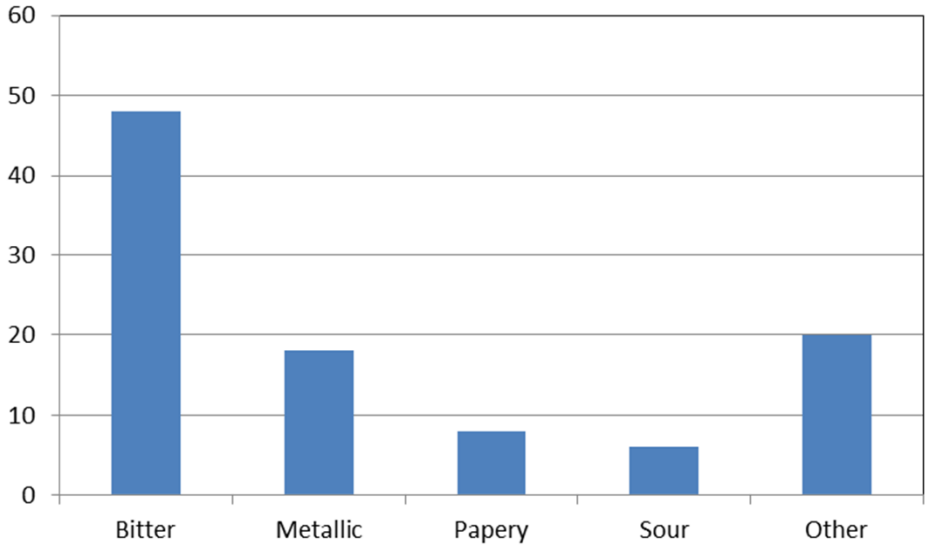


Sensory Panel test



Test

- 42 panellists in 3 different locations
- 250 mg/l light lager matrix
- Asked to describe most intense characteristic



Thank you for your attention

We would like to thank…

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