



The Role of Wine Polysaccharides on Salivary Protein-Tannin Interaction: A Molecular Approach

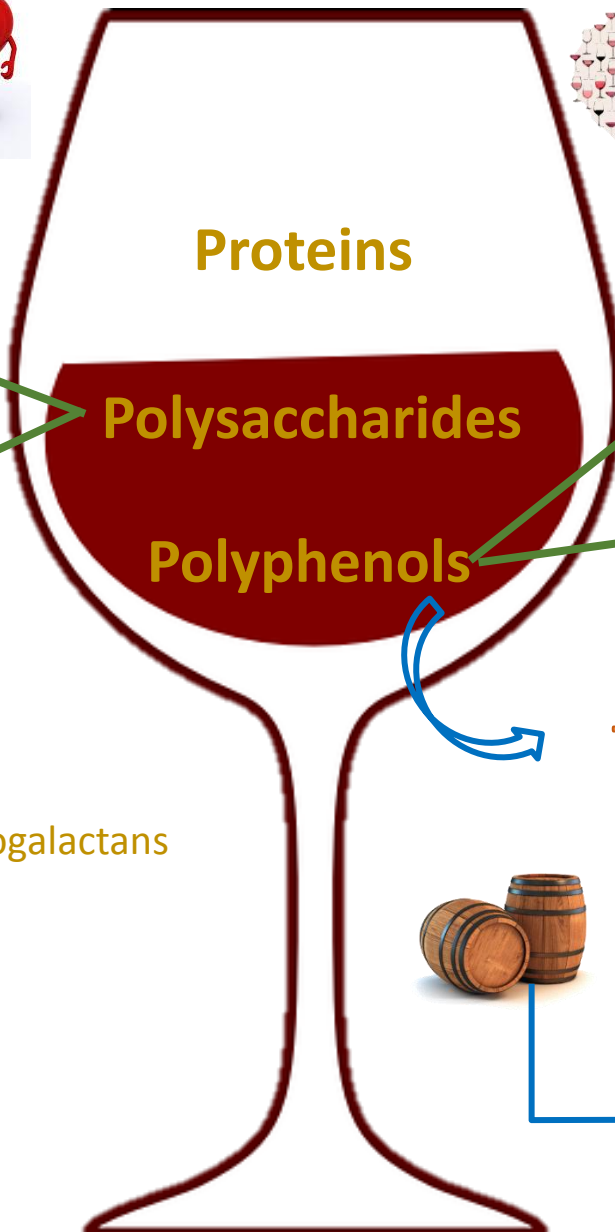


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Universidade do Porto



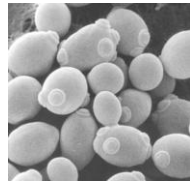
Moderate Intake = Health promotion



Color



Mannoproteins



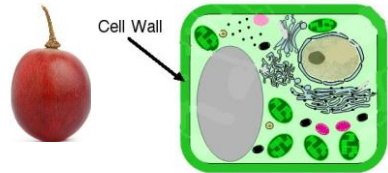
Proteins

Flavor

Bitterness

Astringency

Rhamnogalacturonan type II (RGII)



Polysaccharides

Polyphenols

Tannins

Condensed tannins

Polysaccharides rich in Arabinose and Galactose (PRAGs)

Arabinogalactans



Hydrolyzable

Ellagitannins

Arabinogalactan proteins (AGPs)

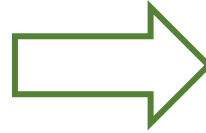
Arabinans



Dryness

Puckering

Tightening



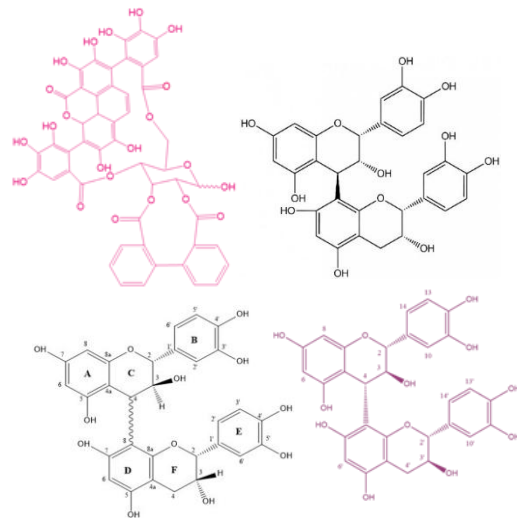
Mechanisms of Astringency

- Mechanoreceptors
- Interaction with oral cells

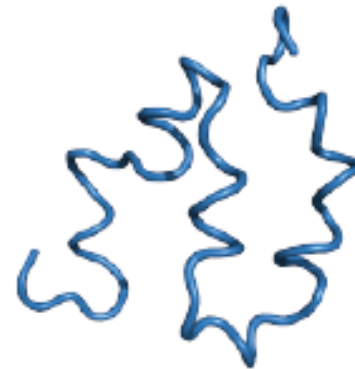
- Salivary proteins/Tannins interaction



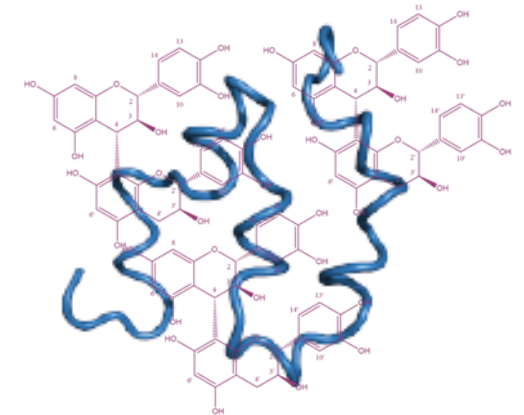
Negative  tribute
Balanced level
Quality



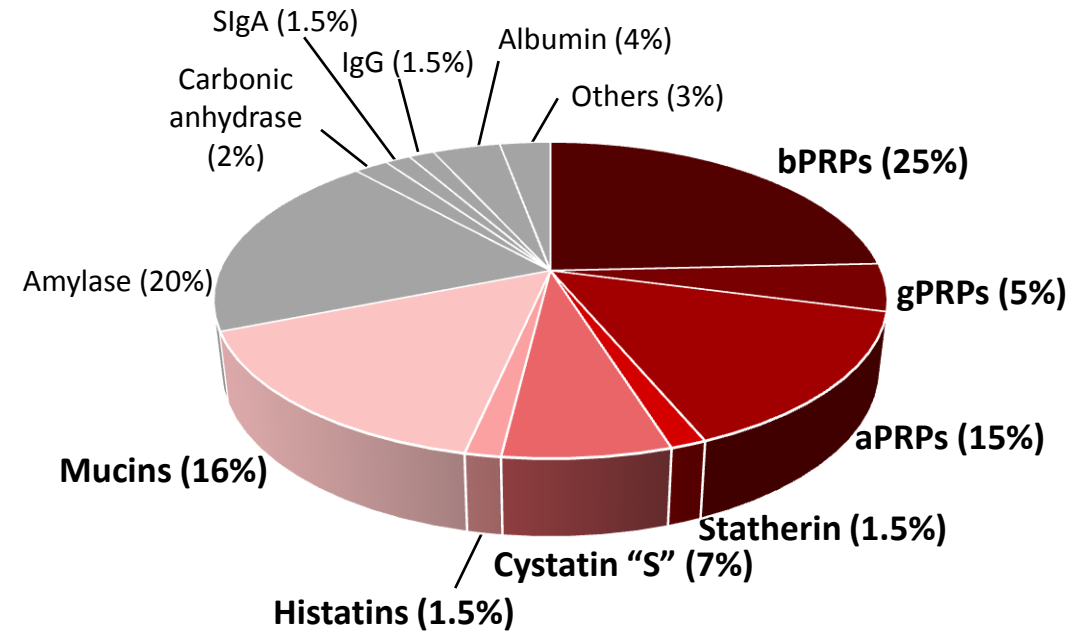
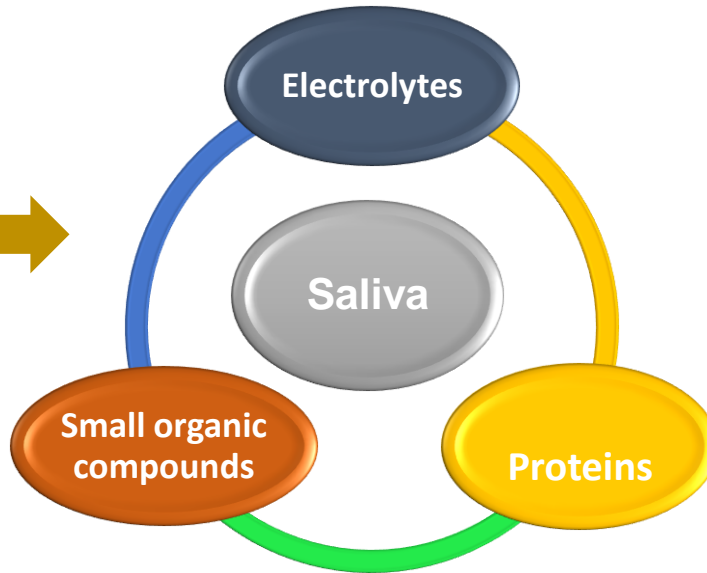
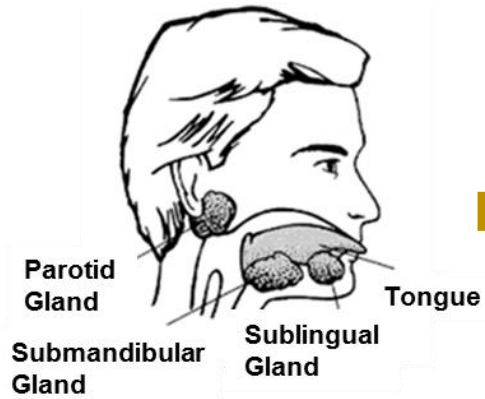
Tannins



Salivary Proteins



(In)Soluble Complexes



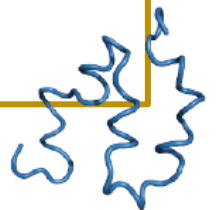
Salivary Proteins (SP)

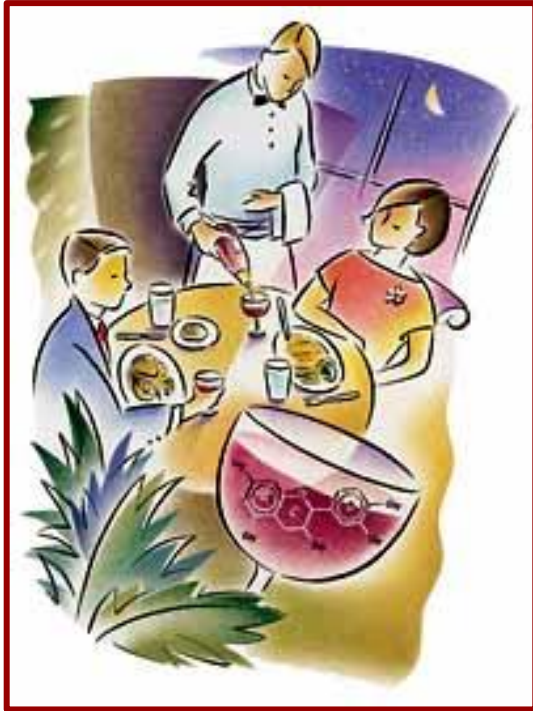
Proline-rich proteins (PRPs)

- Cystatins
- Statherin
- Mucins
- P-B peptide
- Histatins

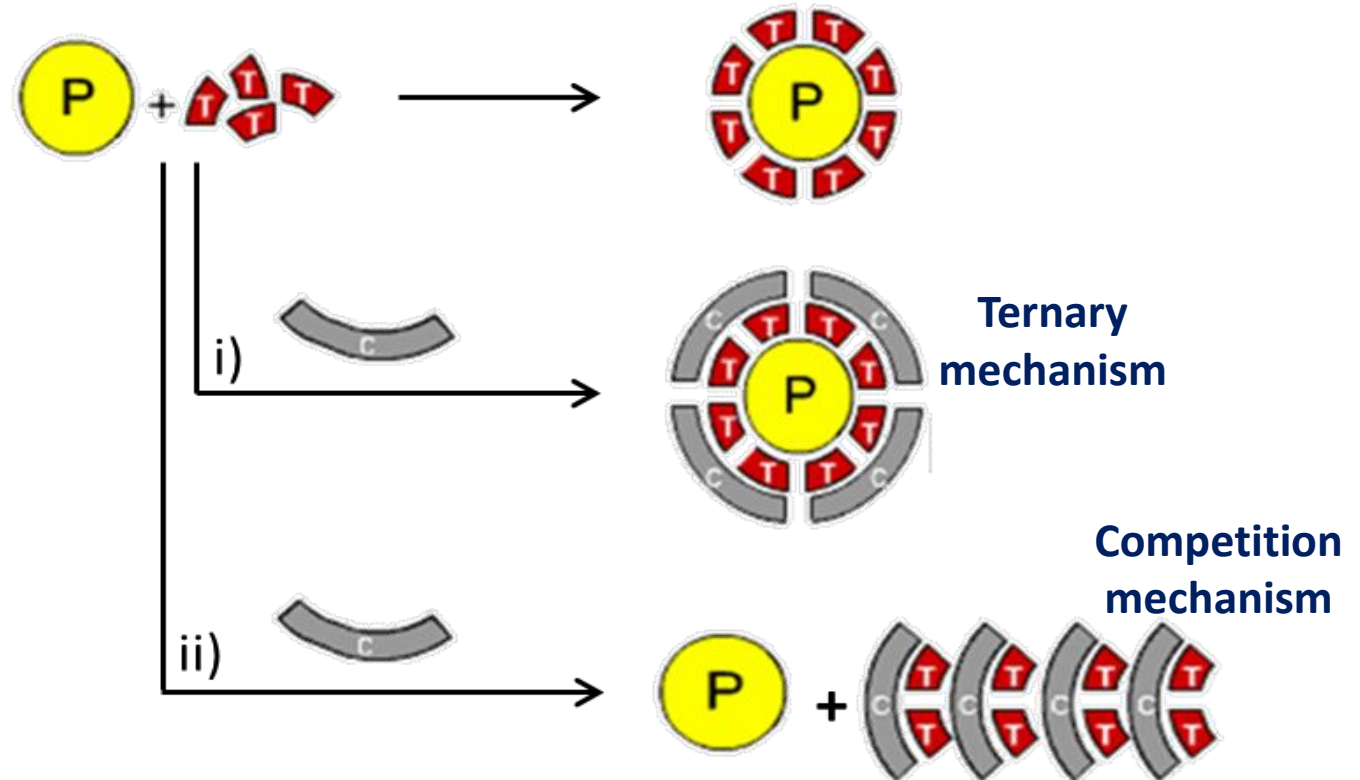
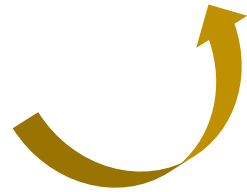
Relevant biological functions

- Maintenance of ionic calcium concentration ↔ enamel
- Antimicrobial action
- Protection of oral surface
- Lubrication
- Digestion start



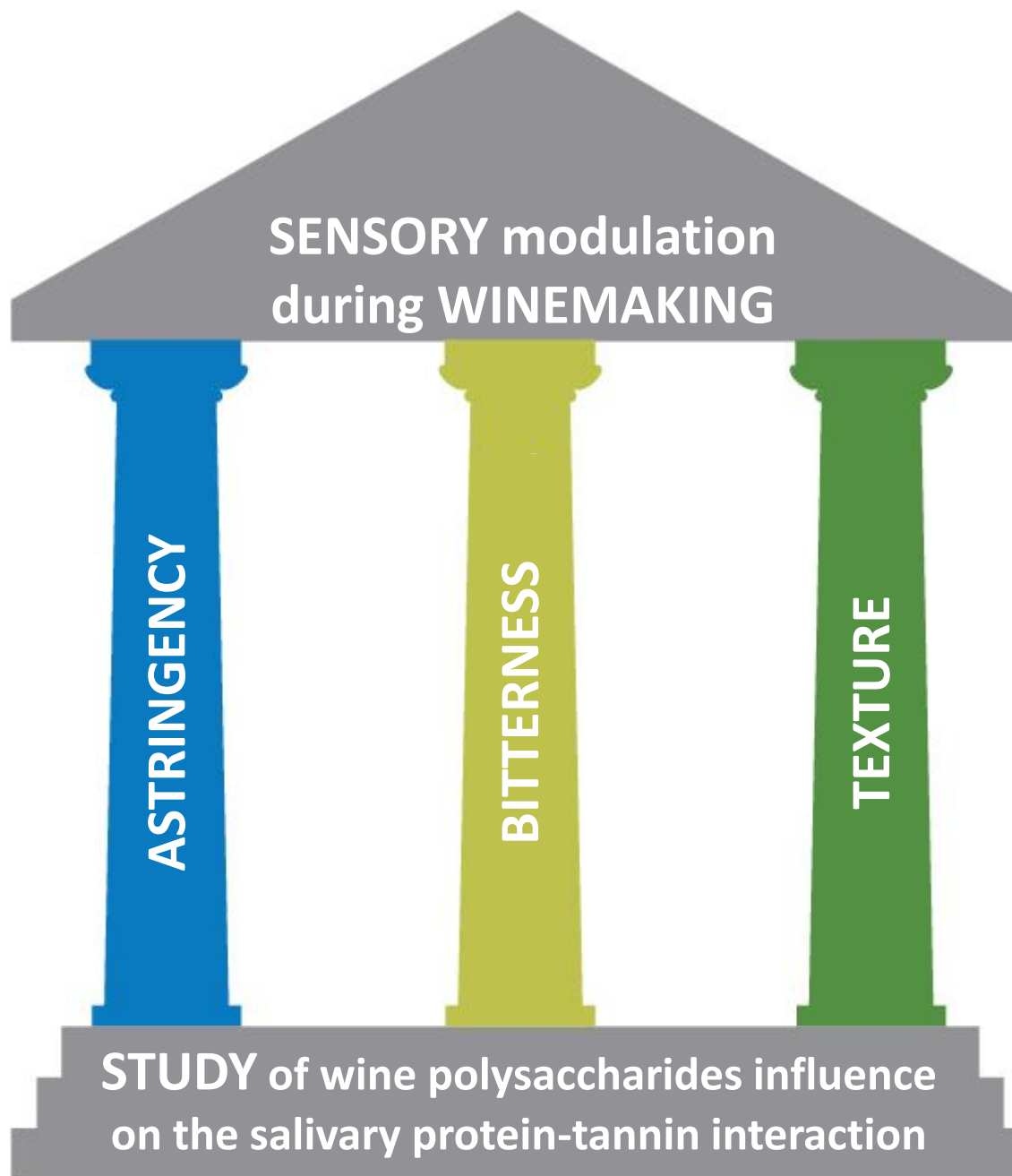


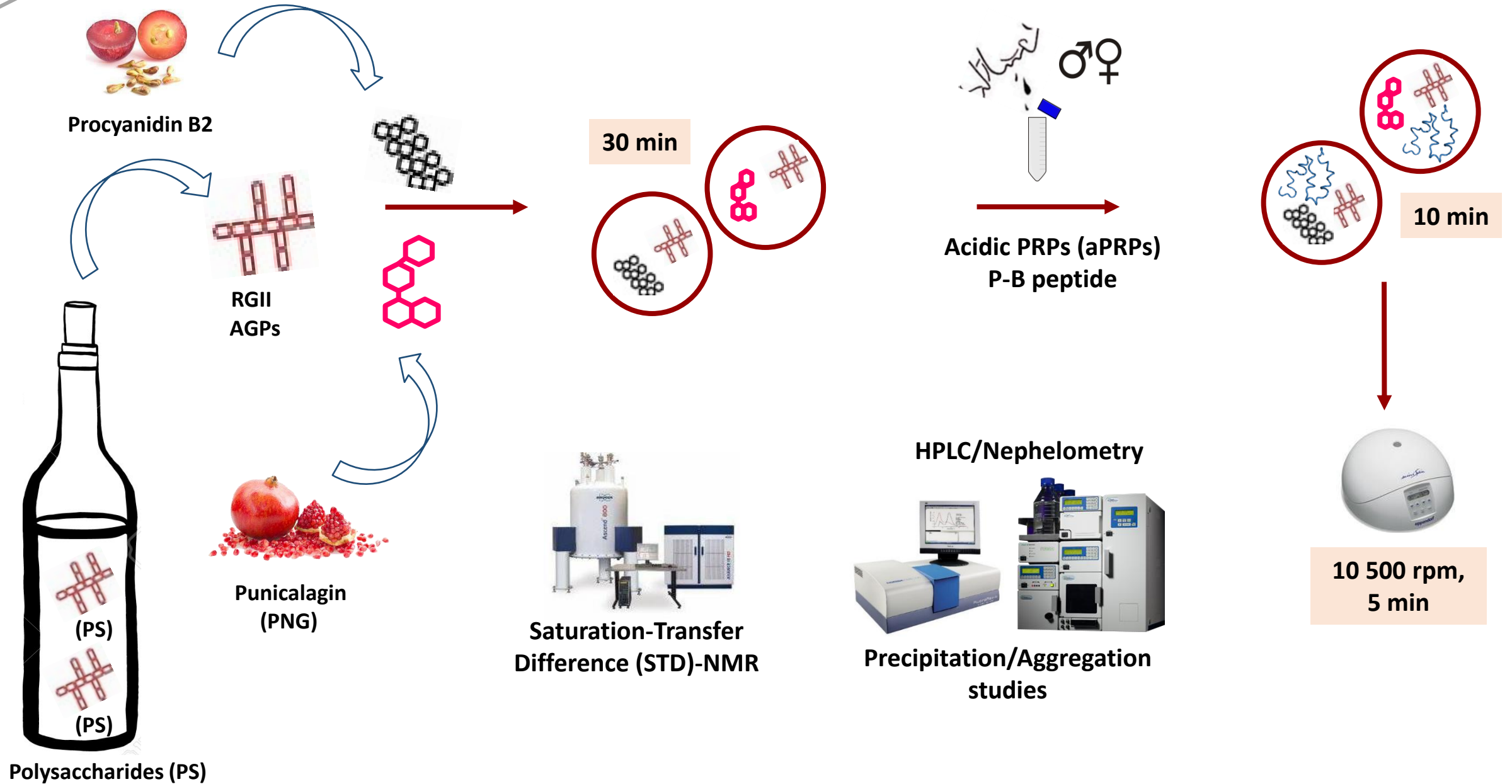
Astringency Modulation



i) Polysaccharides could form **ternary complexes** with the protein-tannin aggregates, **enhancing its solubility** in aqueous medium.

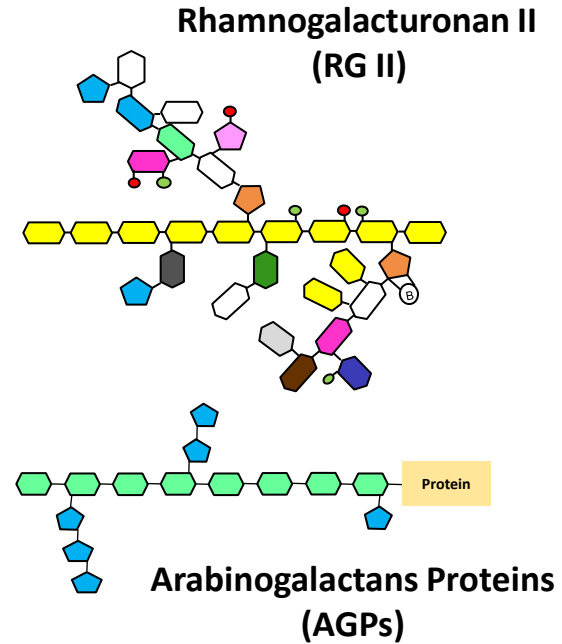
ii) Polysaccharides have the **ability to inhibit protein-tannin interaction** by competing with SP to bind tannins.







Isolation and characterization of wine polysaccharides

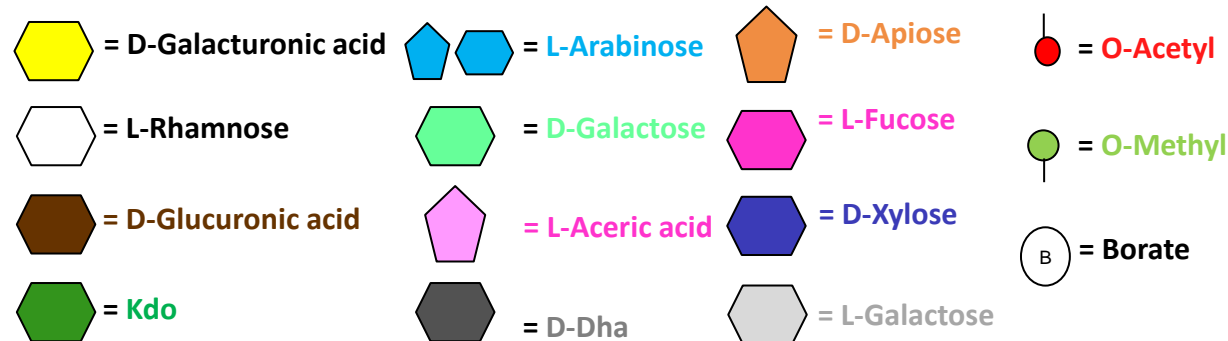


GC-MS analysis of the individual glycosyl residues



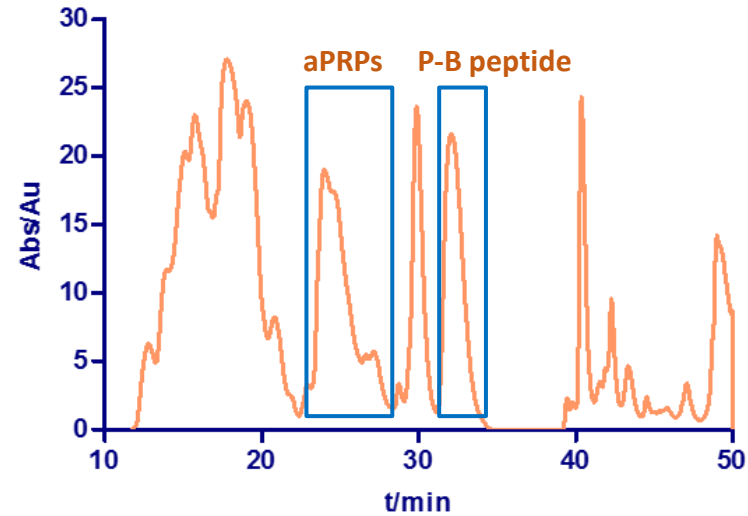
Neutral and acidic sugar determination

- Adsorption chromatography
- Anion-exchange chromatography
- Size exclusion high resolution column chromatography
- Affinity chromatography

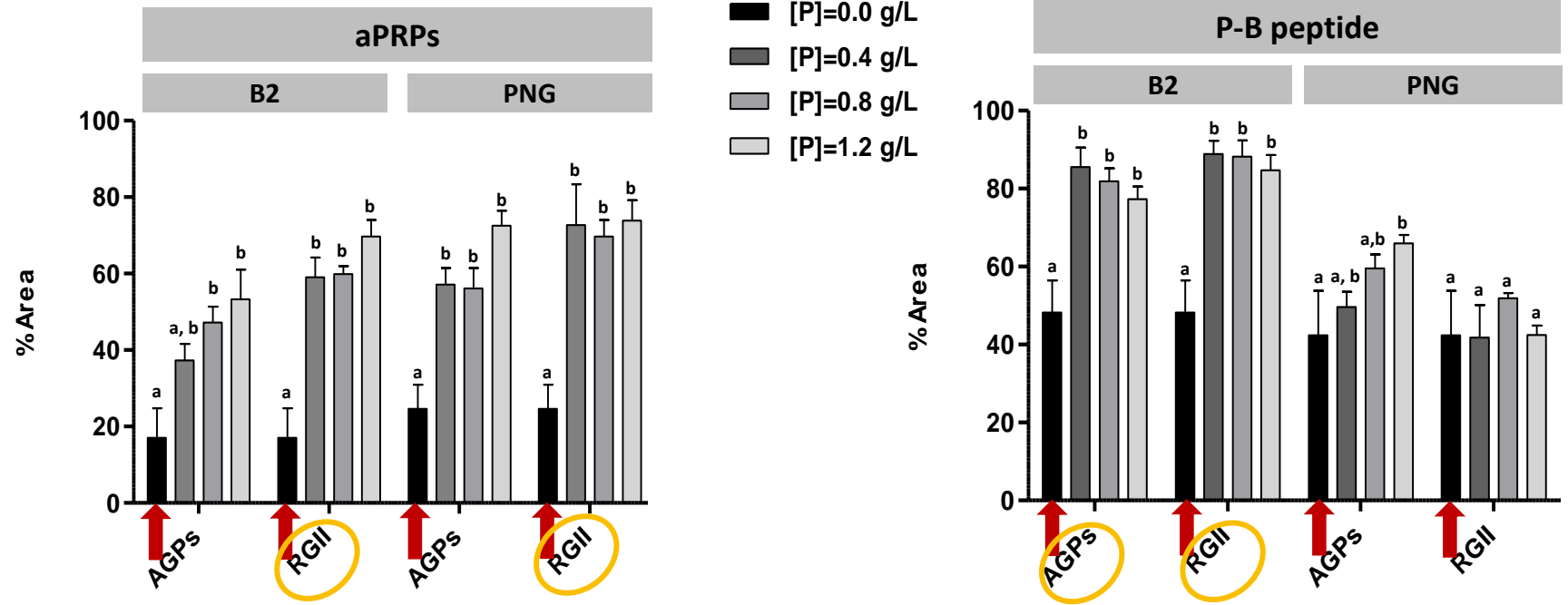




HPLC results



Influence of polysaccharides on SP-Tannin precipitation



CONTROL
SP-Tannin organic interaction

- ❖ All polysaccharides were able to produce a recovery of the SP-tannin organic interaction of SP families
- ❖ Recovery of SP was concomitantly with the increase of polysaccharides' concentration



Nephelometry

90° light scattering photometer
 $\lambda_{exc} = \lambda_{em} = 400 \text{ nm}$

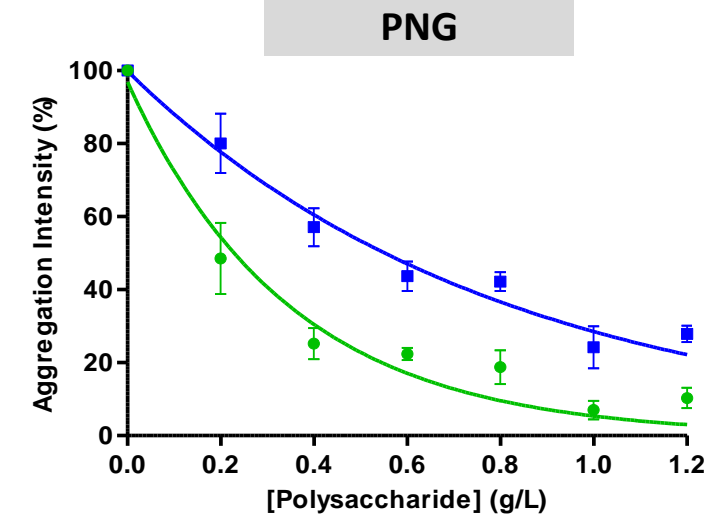
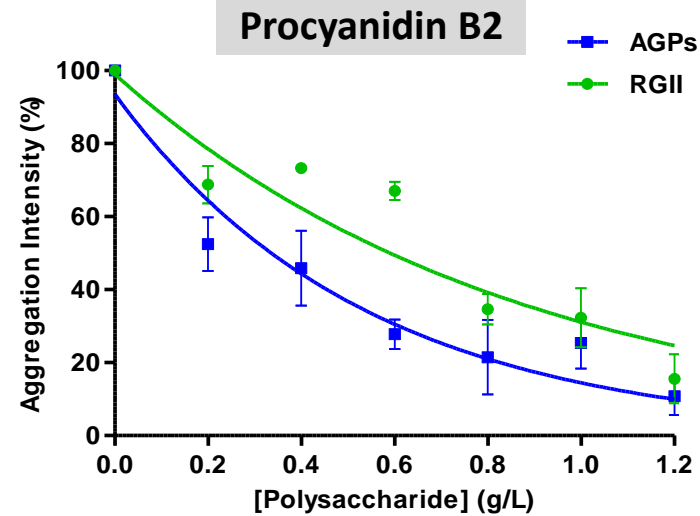
Decrease in light scattering



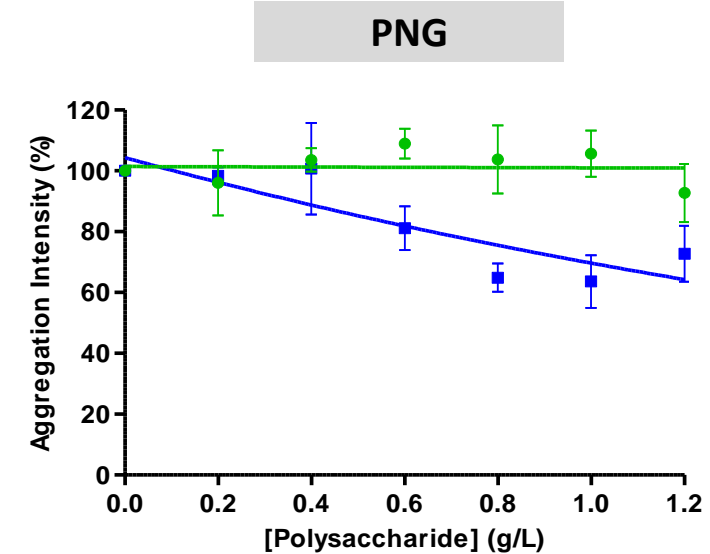
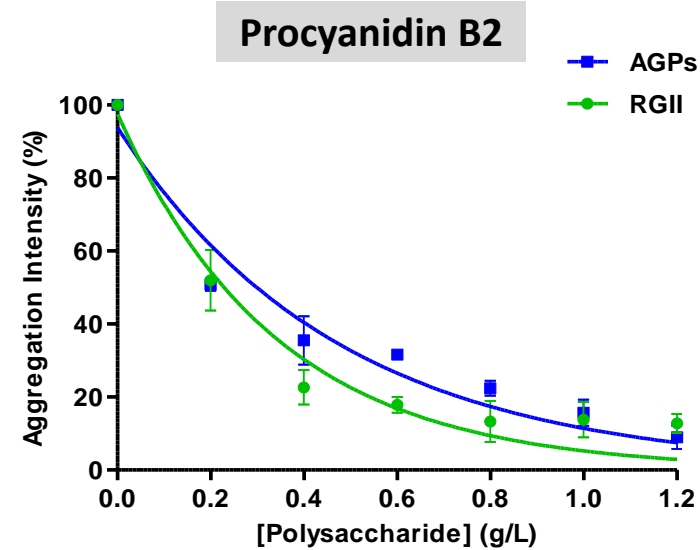
Tends to a stabilization

Influence of polysaccharides on SP-Tannin aggregation

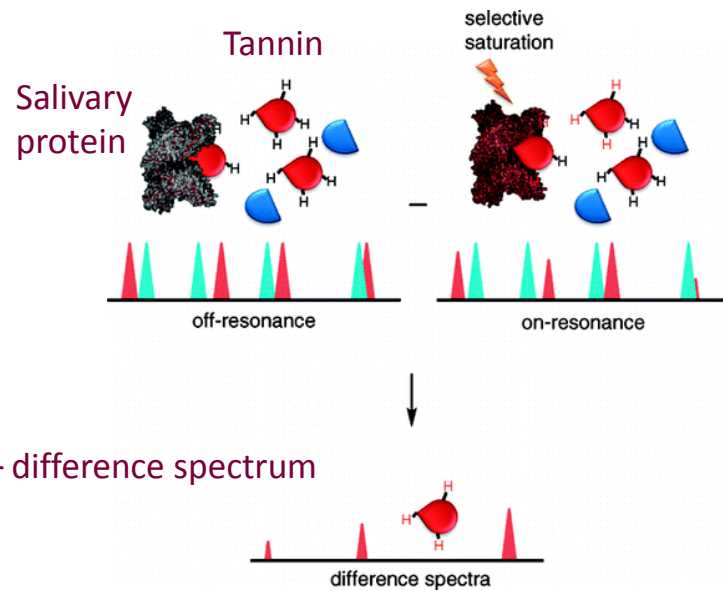
aPRPs



P-B peptide



STD-NMR results



| | B2 | | PNG | |
|-------------|------|------|------|------|
| | AGPs | RGII | AGPs | RGII |
| aPRPs | 65.4 | 42.9 | 57.7 | 89.1 |
| P-B peptide | 83.0 | 87.6 | 86.3 | 99.8 |

STD tannin signal

Polysaccharides bind tannins, competing with SP

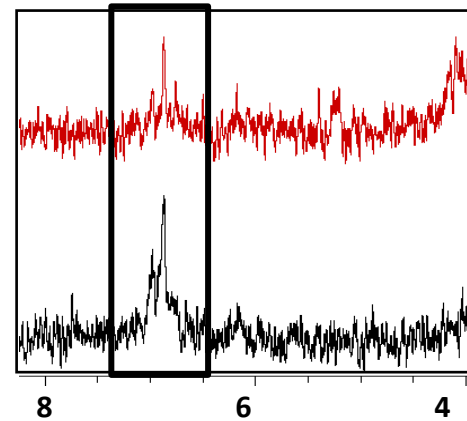
Competition mechanism

STD tannin signal

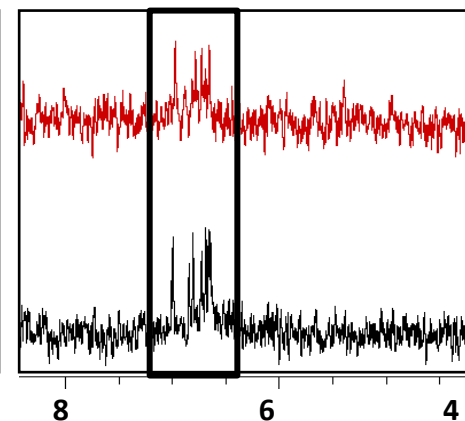
Formation of a ternary complex SP-Tannin-Polysaccharide

Ternary mechanism

aPRPs + Procyanidin B2 + AGPs 0.8 g/L



aPRPs + PNG + AGPs 0.8 g/L



aPRPs + Procyanidin B2 (Control)



aPRPs + PNG (Control)



ppm



- ❖ Wine polysaccharides are able to reduce or inhibit the interaction between SP and tannins
- ❖ HPLC and nephelometry results showed that there is non-association (**competition mechanism**) or (re)solubilization of SP-tannin aggregates (**ternary mechanism**)
- ❖ STD-NMR results – suggest which mechanism was responsible for each interaction

| | B2 | | PNG | |
|-------------|-------------|-------------|-------------|---------|
| | AGPs | RGII | AGPs | RGII |
| aPRPs | Competition | Competition | Competition | Ternary |
| P-B peptide | Ternary | Ternary | Ternary | - |



Differences of polarity of the molecules involved



Affect the main forces of these interactions

- Hydrophobic interactions
- Hydrogen bonds

THANK YOU FOR YOUR ATTENTION!



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