



Rapid Clarification: Tips and Tools for Clarifying Juice and Wine During Harvest

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Overview

- Fining and Clarification
- Flotation vs. static settling
- Stokes Law
- Decreasing juice viscosity
- Filterability improvement
- Colloids
- Increasing flocculation efficiency



Objectives of juice fining?

- Clarification improvement
- Removal of bitter compounds
- Removal of astringency
- More oxidative stability – less browning potential
- Remediation of off flavors
- Stabilization of proteins
- Removal of bacteria and wild yeast



Why do we decrease turbidity in rose and white juices?

- Avoid reduction – elemental sulfur in solids
- Esterase activity in solids, less aromas
- Polyphenol oxidase activity higher in solids
- Reduces herbaceous alcohols and aldehydes
- Results in more delicate, fruity wines

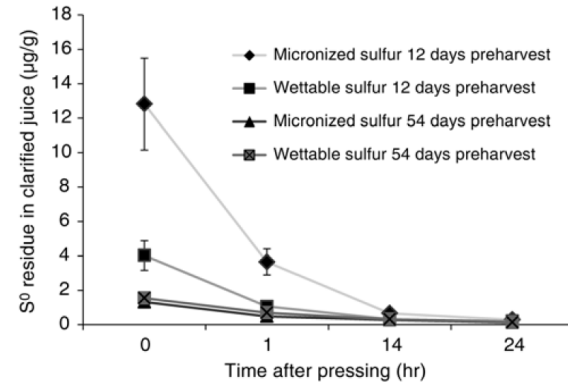


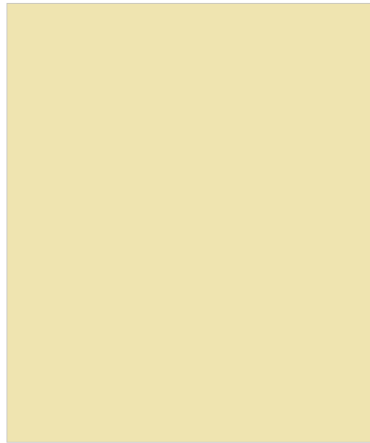
Figure 6 Elemental sulfur (S^0) residue present in juice pressed from fruit that received sequential applications of two commercial formulations (4.48 kg/ha S^0) during 2011, ceasing either 54 or 12 days preharvest. Samples were obtained from 30 cm below the juice surface in a 20-L carboy, at the postpressing time intervals indicated. Data points represent the means for three replicate fermentations per treatment, with error bars indicating standard deviation. All means for 38- and 25-day PHI treatments were intermediate between those for the 12- and 54-day extremes but are omitted from the graph for clarity.

Misha T. Kwasniewski,^{1,3*} Gavin L. Sacks,¹ and Wayne F. Wilcox²
Am. J. Enol. Vitic. 65:4 (2014)

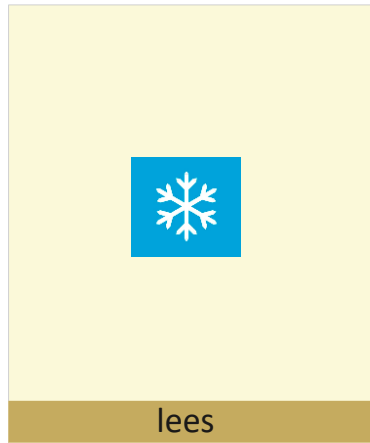


FLOTATION VS. STATIC CLARIFICATION

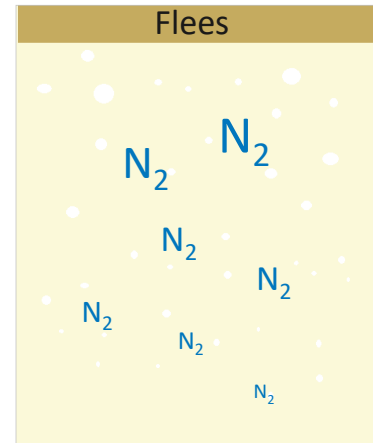
Flotation vs. Static Clarification



Turbid juice



Static clarification



Flotation

How do we use these principles to make clarification more efficient?

$$v = \frac{D^2 * g}{18 \eta} \Delta \rho$$

V = speed of the floccule moving through the juice

$\Delta\rho$ = density difference between particle and liquid

n = viscosity of the juice

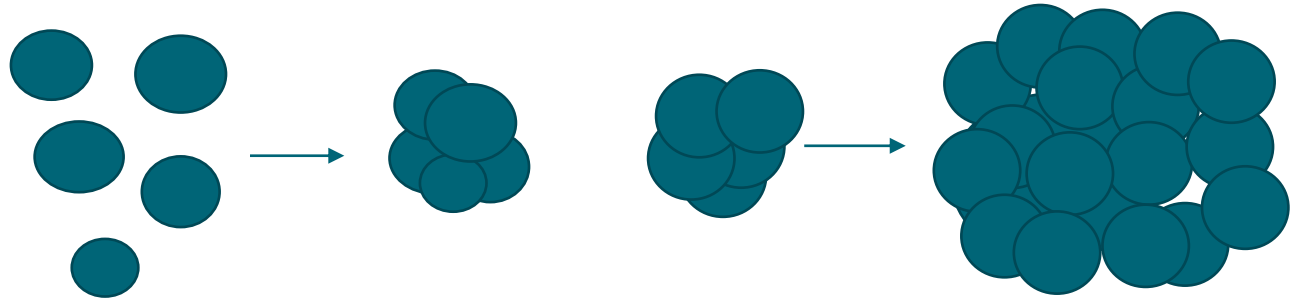
D = diameter of particulates or floccules

*Stokes' law states that decreasing juice viscosity, increasing diameter, and increasing density of particulates (or floccules) increases the speed at which said particulates can move through the juice.



How do we improve it?

- Decreasing juice viscosity
- Increase particle /floccule density
- Increasing particle/floccule diameter



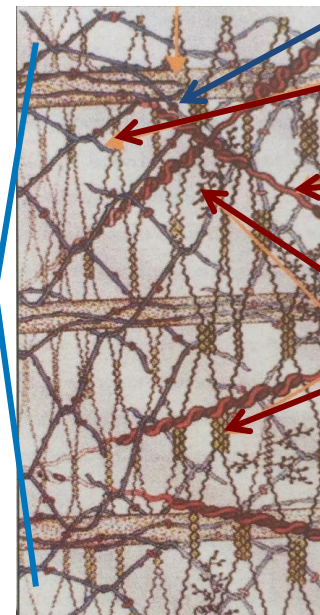
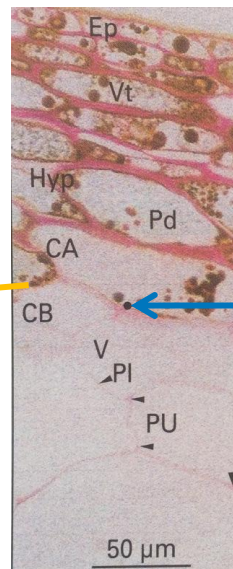
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- ☞ Increasing particle/floccule diameter
- ☞ Increase particle /floccule density



What is pectin?

Polysaccharide which acts like a cement or glue for plant cell wall structures



Cellulose microfibrils

Xyloglucans (hemicellulose)

Extensins (proteins)

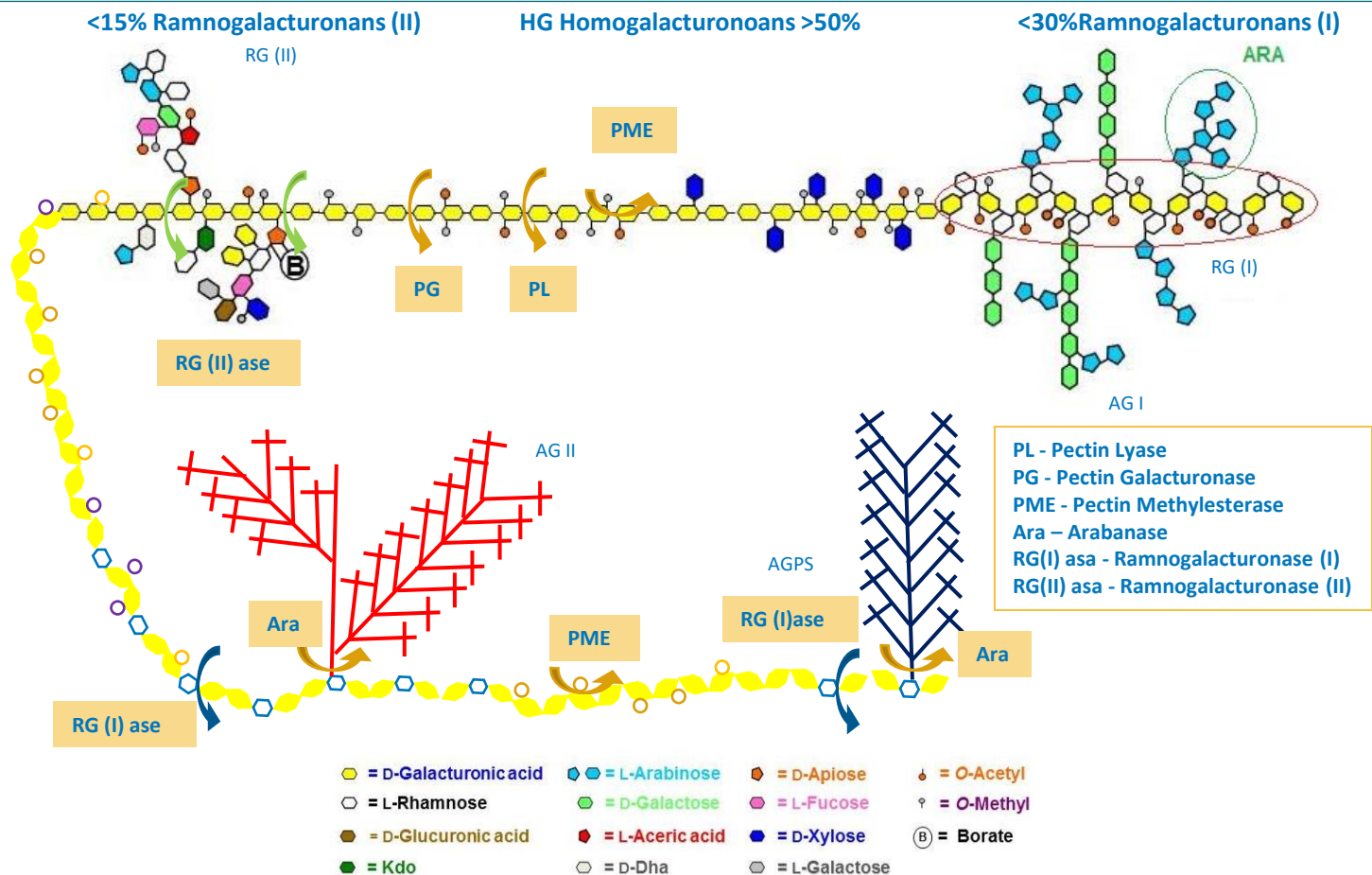
Pectins
HG
RGI
RGII

HG Homogalacturonans
RG Ramnogalacturonans

*Pectin is broken down naturally as fruit ripens. Less ripe fruit has more pectin



DECREASING JUICE VISCOSITY– PECTIN STRUCTURE



The **viscosity** of a juice can be altered by changing the concentration, molecular weight, and shape of pectin

- Decrease molecular weight and change the shape with broad ranged pectic enzyme
- Not all pectic enzymes work the same! Use appropriate enzyme for your application



Fastest and most efficient broad range pectinase



Flotation specific pectinase



Pectinase + glucanase activity



2.5 hour time lapse of addition of fining agents

Left to right: Control, 3 mL/hL RS, 3 mL/hL EZ filter



Control

ZYM RS

EZ FILTER

For Botrytis affected fruit



Glucans are polysaccharides excreted by *Botrytis Cinerea* which increase juice viscosity, decrease clarification, and decrease filterability

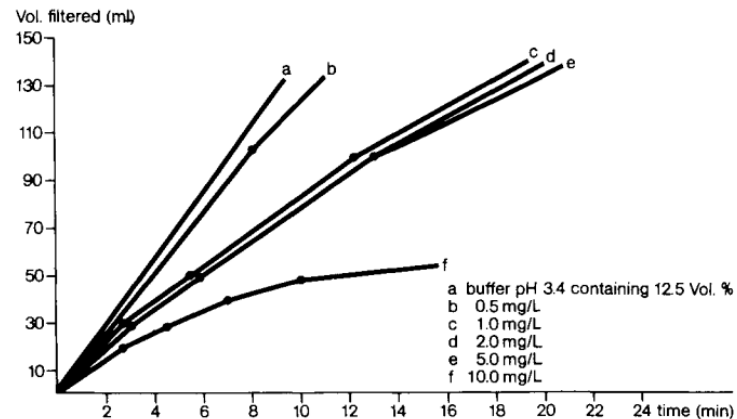
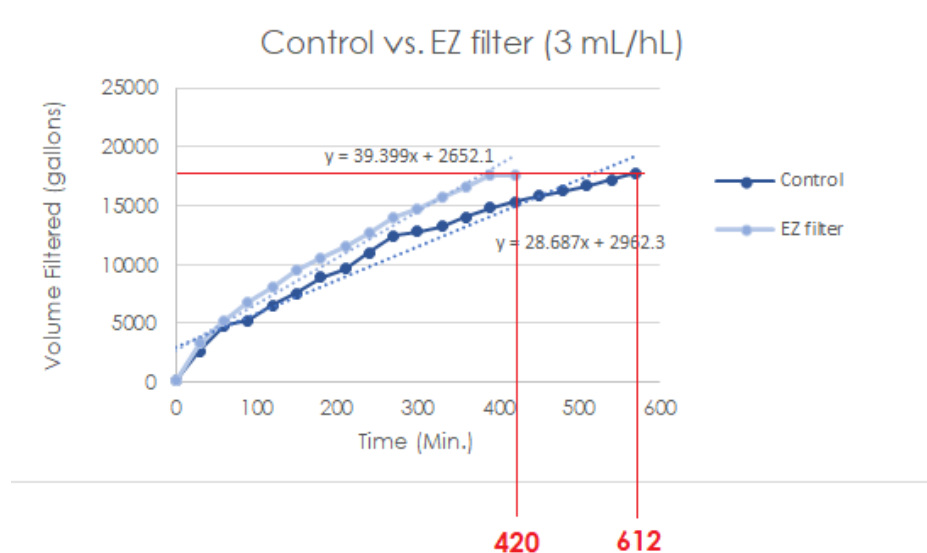


Fig. 1. Influence of the glucan concentration on the filterability of an alcoholic solution over membranes (0.45 μm).

J.-C. VILLETAZ¹, D. STEINER², and H. TROGUS³
Am. J. Enol. Vitic., Vol. 35, No. 4, 1984



EZ filter applied for 3 weeks contact, crossflowed

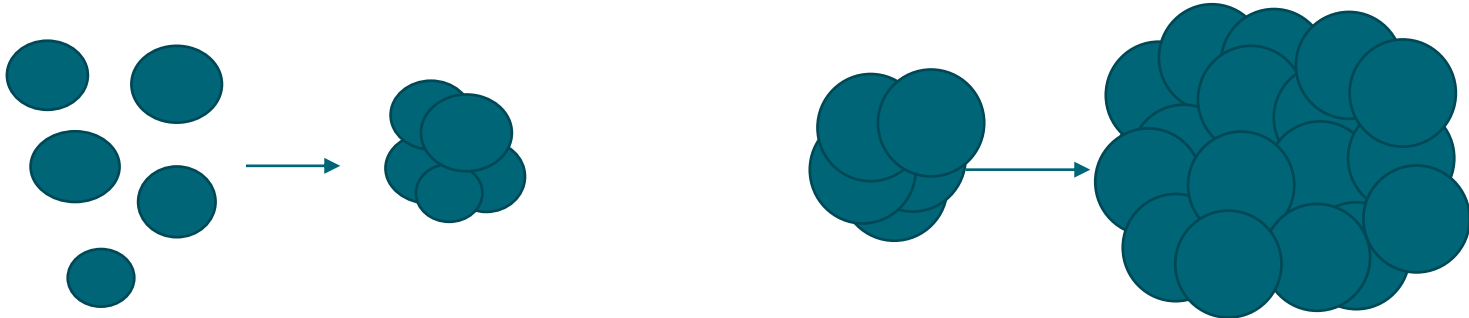


Avg. Rate of Filtration (GPM)	
Control	28.6
EZ Filter	39.4



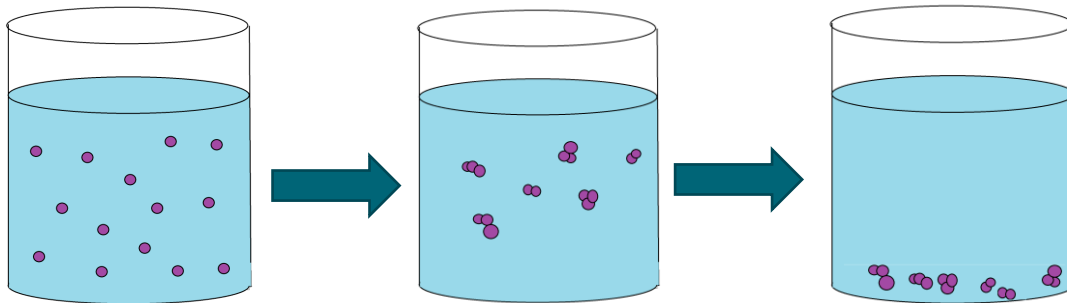
How do we improve it?

- Decreasing juice viscosity
- Increasing particle/floccule diameter
- Increase particle /floccule density

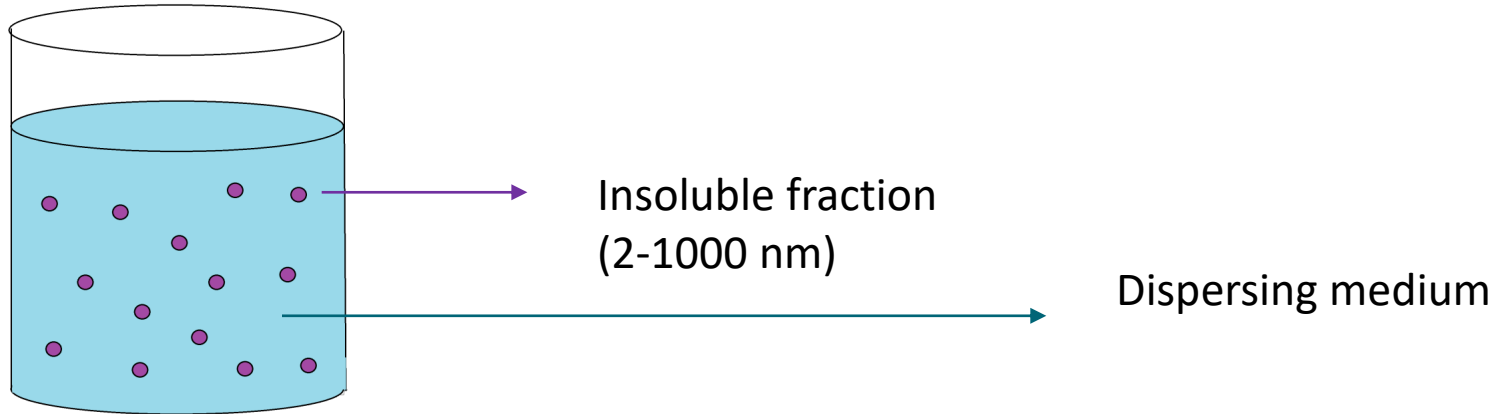


Basics of juice fining

- Desired outcome to remove something from the juice
- Addition of charged compounds
- Neutralize, flocculate, sediment
- Rack off

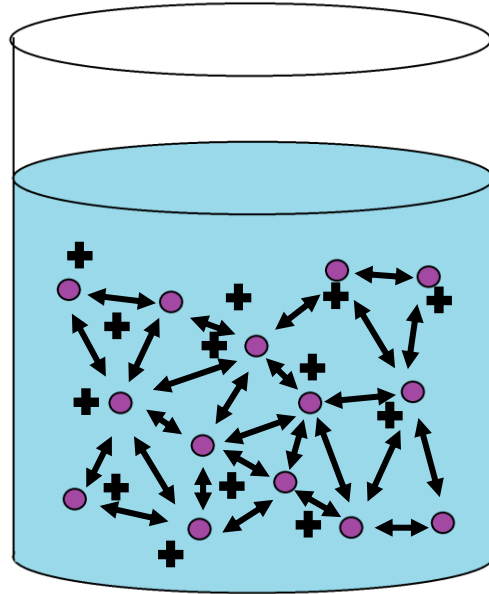


- A colloidal system is one in which one substance of microscopically dispersed insoluble particles is suspended in another dispersing or continuous substance



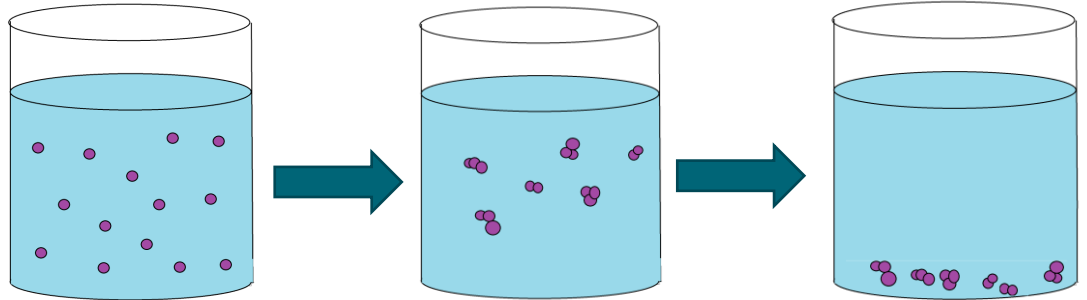
More on colloids..

- Charged either +/-
- Dispersion forces
- Too small to fall out of suspension



More on colloids..

- Loss of charge/dispersion forces
- Agglomeration
- Settling or floating out of suspension





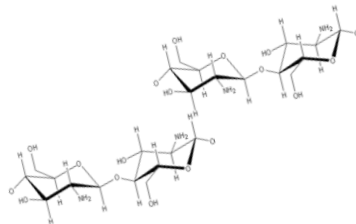
Examples of juice colloids

- ☞ Polysaccharides – pectin, cellulose, hemicellulose, glucans
- ☞ Proteins - grape derived
- ☞ Polyphenols – monomeric, polymeric
- ☞ Tartrates
- ☞ Colored matter



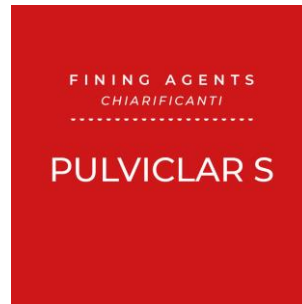
What are some options

- Animal protein – gelatin, casein, isinglass
- Vegan protein – pea protein (Request use), potato protein, chitosan
- Silica sol
- Bentonite



What are the options

- Hydroclar 30 – Works well on many different types of juices for clarification. Liquid form
- Pulviclar S – high molecular weight for excellent clarification capacity, especially with flotation. Granulated form
- Clargel – Medium hydrolysis for high quality musts. Liquid form





FINING AGENTS
CHIARIFICANTI

PLANTIS AF

Pea protein fining agent

- Oxidative removal
- Increases flocculation
- Decreases bitterness
- Request use from TTB

FINING AGENTS
CHIARIFICANTI

PLANTIS AF-P

Potato protein fining agent

- Oxidative removal
- Increases flocculation
- Decreases bitterness

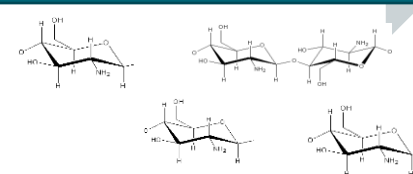
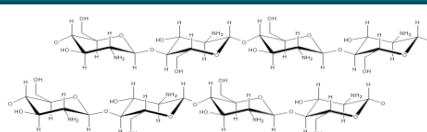
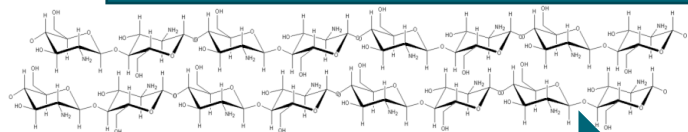


HYDROLYSIS LEVEL

LOW

MEDIUM

HIGH



ANTIMICROBIAL EFFECT
HIGH

CLARIFICATION EFFECT
MEDIUM

ANTIMICROBIAL EFFECT
MEDIUM

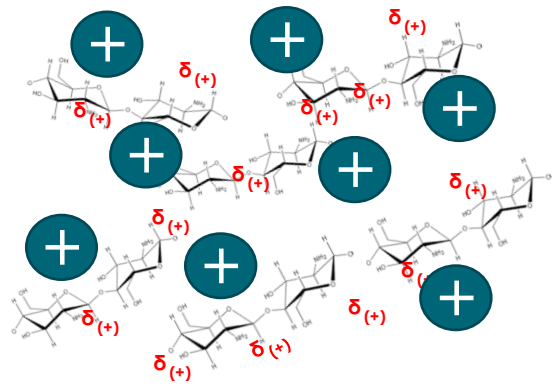
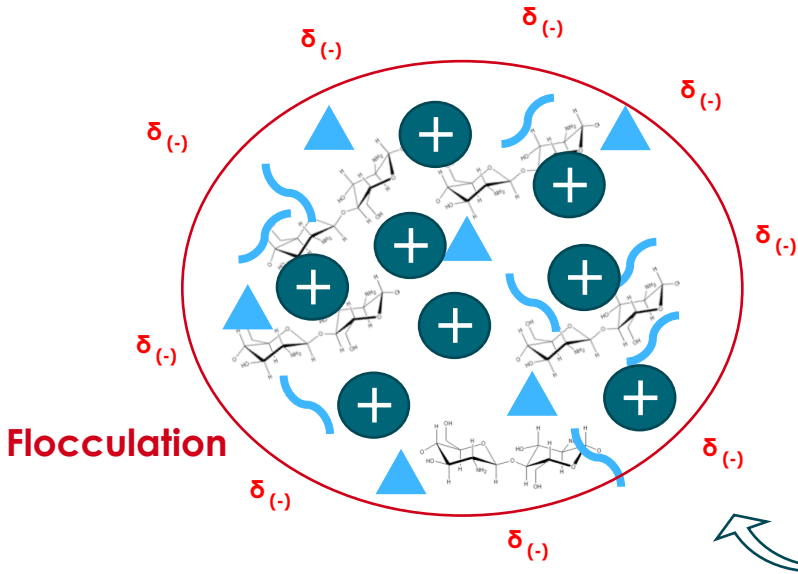
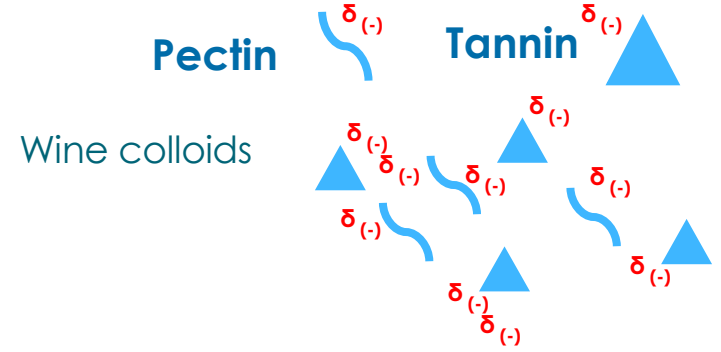
CLARIFICATION EFFECT
MEDIUM

NO ANTIMICROBIAL
EFFECT

FINING EFFECT
HIGH



- Colloids are negatively charged.
- Chitosan enhances plant protein positive charge.
- Fast formation of floccules



Fining with plant protein empowered by chitosan



- Blend of plant (potato) protein and pre-activated chitosan
- Improves oxidative stability
- Increases clarification
- Improves **density** of sediment or flees
- Removes bitterness

Control Plantis PQ



Allergen free



Organic compliant

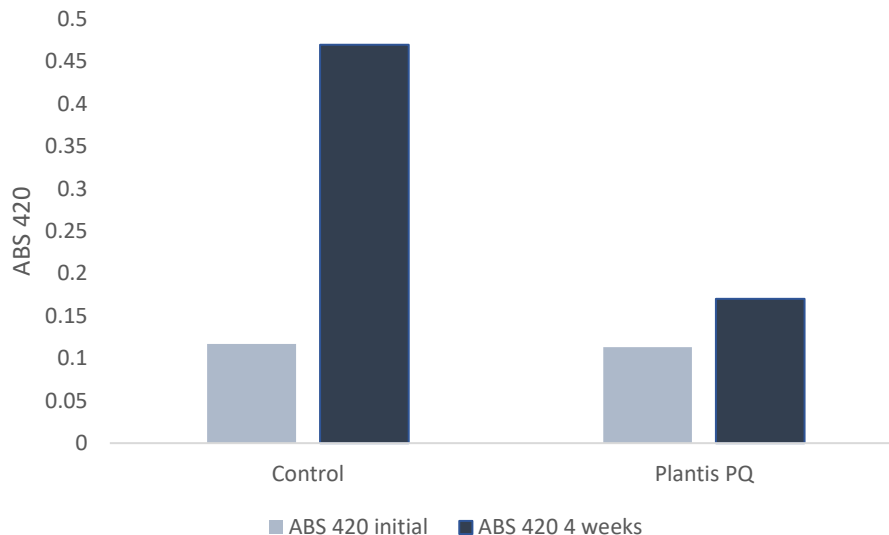


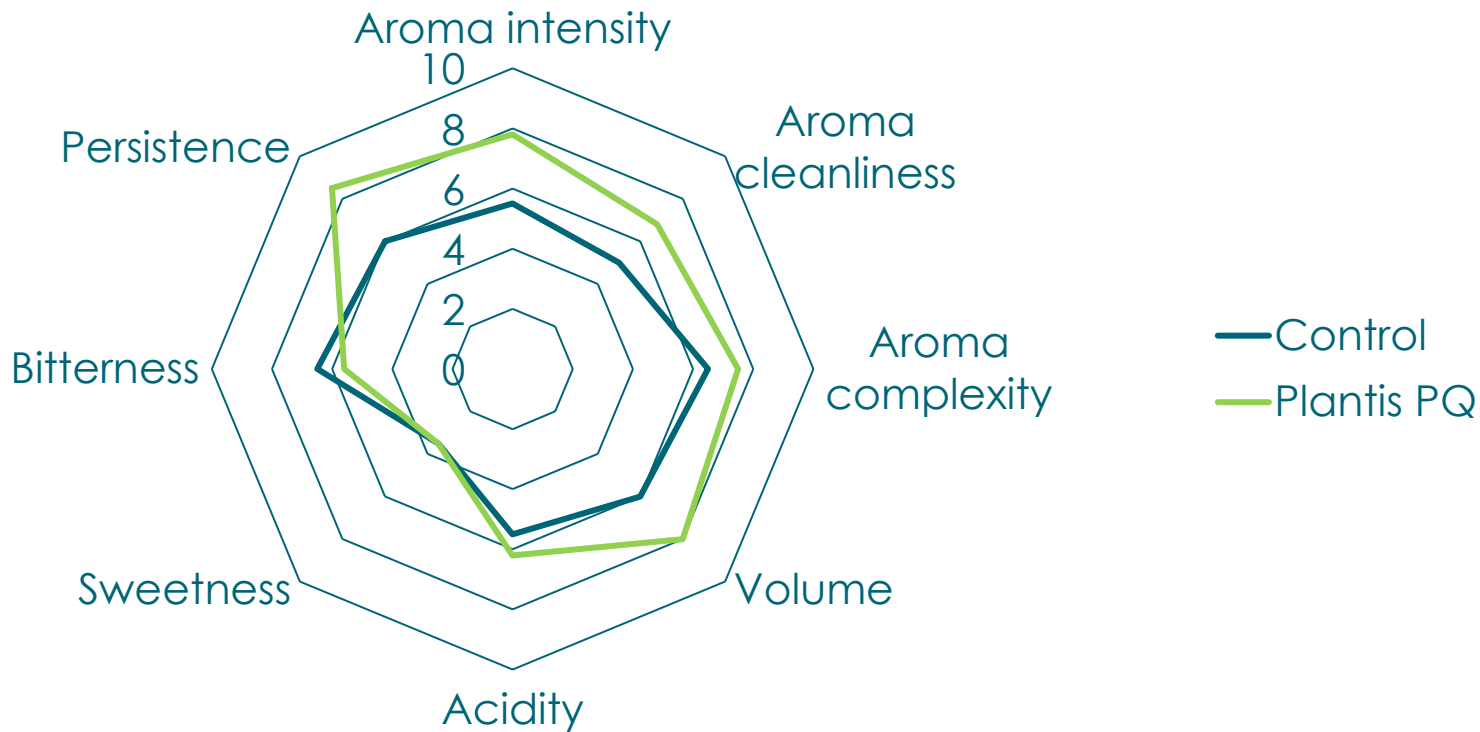
Vegan





Treatments measured at ABS 420 after treatment, subjected to a full saturation of oxygen, room temperature 4 weeks, 420 measured again





For Clarification

- Clarification of white and rose juices has dramatic effects on style and quality of subsequent wines
- We can dramatically decrease time for clarification by using a broad spectrum Pectic enzyme like Zym RS, Zym Quick or Zym EZ filter
- Winemakers can use fining agents like Hydroclar 30, Pulviclar S, or Clargel to increase flocculation and thereby settling or flotation efficiency
- New innovative vegan fining alternatives like Plantis PQ can be substituted for gelatin to improve juice clarification, oxidative stability, and aromatic qualities





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