MARTIN VIALATTE

www.martinvialatte.com

PLANT-BASED FINING

TECHNOLOGICAL GUIDE

Background

The first mention of the practice of fining wines can be found in books from the seventeenth century, when milk, blood, egg white and isinglass were used as fining aids. The use of fining became widespread on quality wines, becoming almost systematic in the nineteenth century. At the time, fining was used as a fast, effective curative treatment.
At the end of the twentieth century, the development of oenology consultancy and progress in winemaking knowledge led to **preventive** rather than **curative** fining.
The objective of fining became preservation and stabilisation, with regard to both organoleptic and visual criteria.

Current context

Ever since the mad cow disease crisis at the end of the 1990s, the demand for wines free of products of animal origin and allergens had been steadily growing.

At that moment, Martin Vialatte® launched a pioneering project to identify and develop alternatives to fining agents of animal origin.
A selection of novel plant-based raw materials was undertaken and then tested, enabling Martin Vialatte® to become an OIV project leader in 1999. Industrial-scale trials were launched from 2001 to 2003 to validate the benefits of the novel raw materials selected. They were tested not only for their technical capability but also for their allergenic potential (350 wines were treated at a dose of 50 g/hL (Professor Restani, Milan)).
For these next-generation fining products, the plant proteins selected by the OIV were derived from peas and wheat. Fining agents derived from wheat were subject to labelling in accordance with Directive 2003/89 since they contained gluten. Patatin was added to the list of plant-derived proteins in December 2013.
Thanks to this experience, Martin Vialatte® could guarantee GMO-free plant-based fining agents derived exclusively from pea proteins.
The use of these fining agents was validated in October 2004 by the OIV, and the maximum dose was set at 50 g/hL by Regulation 2019/934.

FINING

1 Objectives of fining

Fining, whether carried out on must or on wine, has multiple effects: clarity, settling of solid particles, management of colour parameters, prevention and treatment of **oxidation processes**, and **organoleptic enhancement**. There is no perfect or ideal fining agent. They all act with varying effectiveness on each of the aforementioned parameters. It is therefore essential to determine the primary objective of fining before selecting a product and then its dosage.

2 Principles of fining

The general principle of fining is based on the reaction between proteins in the fining agent, considered to be **positively charged electrolytes at the pH of wine**, and compounds in the wine with an excess of **negative surface charges**. This causes **neutralisation of the charges**, leading to the formation of agglomerates. These complexes are unstable in the presence of metal cations, resulting in **flocculation.** Since the agglomerates are more voluminous they settle more rapidly, leading to **clarification** of the wine or must (Figure 1).

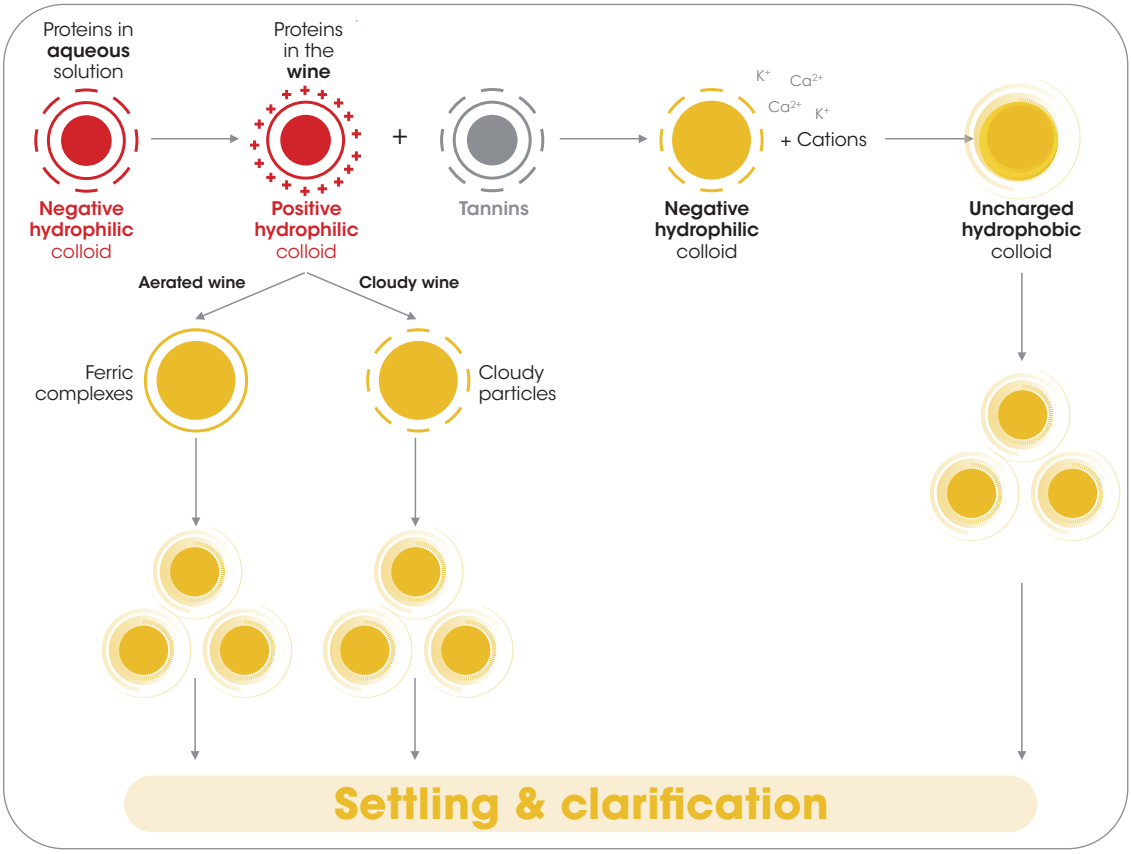


Figure 1: Diagram of the fining principle, according to Ribéreau-Gayon et al., 2012

Independently from the choice of fining agent, several factors can have a significant impact on the fining of musts and wines. These include the temperature of the must or wine (which affects the viscosity of the solutions), the presence of sugar, the sanitary state of the harvest (which can increase the presence of macromolecules affecting settling), and the presence of protective colloids. That is why it is important to carry out yearly fining trials on small volumes of wine after blending, in order to assess the suitability and effectiveness of potentially usable fining agents.

DECIDING WHICH FINING AGENT TO USE

PLANT-

1 Assessing impact on **clarification**

When comparing different fining agents, a number of analytical parameters can be assessed, such as the measurement of the total polyphenol index, the colour, and the turbidity. Today, the latter can be readily assessed at the winery using a portable turbidimeter.

2 Assessing impact on **colour**

On the other hand, both **colour** and the total **polyphenol index** are commonly assessed using a spectrophotometer to measure various optical densities (OD).

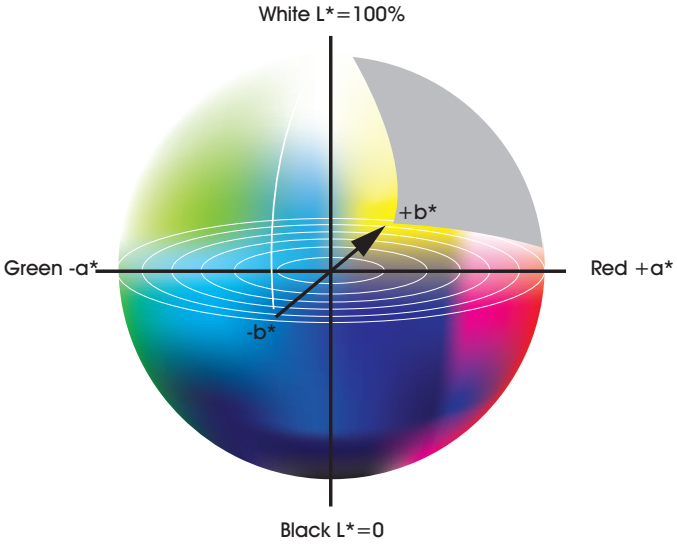
Colour is thus estimated from the ODs OD_{420nm}, OD_{520nm} and OD_{620nm}, from which the shade (OD_{420nm} / OD_{520nm}) and colour intensity (OD_{420nm} + OD_{520nm} + OD_{620nm}) can be calculated.

Colour can also be estimated by means of colorimetry, a technique based on reflectance, using the CIELAB space, or L*a*b*C*h°, as a frame of reference. This also goes under the name of tristimulus coordinates.

Wine Quality Solution by Vinventions has developed a portable analyser, the NomaSense Color, which can measure the colour of a sample instantaneously using this technique.

Although this frame of reference is not as well known and is harder to interpret than optical densities for those unaccustomed to it, it provides a means of obtaining an instant and much more accurate assessment of colour. In fact, this technique has always been used in oenology. Spectrophotometry was preferred to it simply because spectrophotometers are found much more commonly in oenology laboratories.

Figure 2:
*Model of the L*a*b*C*h° space*



Today, thanks to the NomaSense Color, Martin Vialatte®'s R&D department has decided to supplement the characterisation of its fining agents by assessing tristimulus coordinates. This tool makes it possible to dispense with the time required for analysis in the laboratory and obtain far more accurate results.

How to interpret tristimulus coordinates:
L*: related to intensity: L = 100, very bright (white)
a*: green-red axis
b*: blue-yellow axis
a^*_{max} and b^*_{max} differ depending on L. So if L is different, a* and b* cannot be compared.
C*: saturation, which indicates whether the subject is deeply coloured or if it is closer to grey/black.
h°: indicates if the subject is yellowish.

3 Assessing impact on **phenols**

The total polyphenol index is based on measuring absorbance at **280 nm**.

In the past few years, Wine Quality Solution by Vinventions has developed an innovative, easy-to-use sensor that can assess the oxidisable phenols contained in musts and wines simply and instantaneously: the PolyScan.

WINE QUALITY SOLUTIONS
by VINVENTIONS

NOMA*Sense* PolyScan P200

Figure 3: Image of the NomaSense PolyScan

The technology used is based on linear sweep voltammetry. The raw result is an electrochemical fingerprint (current density-voltage curve). This is matrix-dependent. Two indices are determined from the fingerprint.

- **PhenOx** indicates total oxidisable polyphenol levels. It is similar to the Folin-Ciocalteu index which measures the total quantity of polyphenols. The PhenOx index is easier to measure than the Folin-Ciocalteu index, which has to be measured in a laboratory.
- **EasyOx** is an indicator of easily oxidisable polyphenols.

The sensor enables decisions to be taken based on the value of these indices and of their evolution during the various stages of vinification.

Using this new sensor, Martin Vialatte®'s R&D department, in collaboration with Wine Quality Solution by Vinventions, is undertaking innovatory research into the characterisation of fining agents. Several campaigns of trials on musts and wines have been launched in order to assess the effect of fining agents of different origins on musts and wines, on the basis of these indices.

Generation 1.0: pea protein

2005

PROVGREEN® RANGE

Plant-based fining agents made from pea proteins were the first fining agents to provide an alternative to fining agents of animal origin. These fining agents are must- and wine-friendly, and are solely made from pea proteins. Although such proteins are different from animal proteins, their mode of action and properties are more or less the same. Compared to animal-based fining agents, plant-based fining agents bring about improved settling of particles in suspension.

Generation 2.0: synergy between pea proteins and other specific raw materials

2008

POLYGREEN®

, a blend of pea-based plant proteins, PVPP, bentonites and cellulose. It removes oxidised and oxidisable phenolic compounds from must, as well as the brown colour and unpleasant tastes related to oxidation.

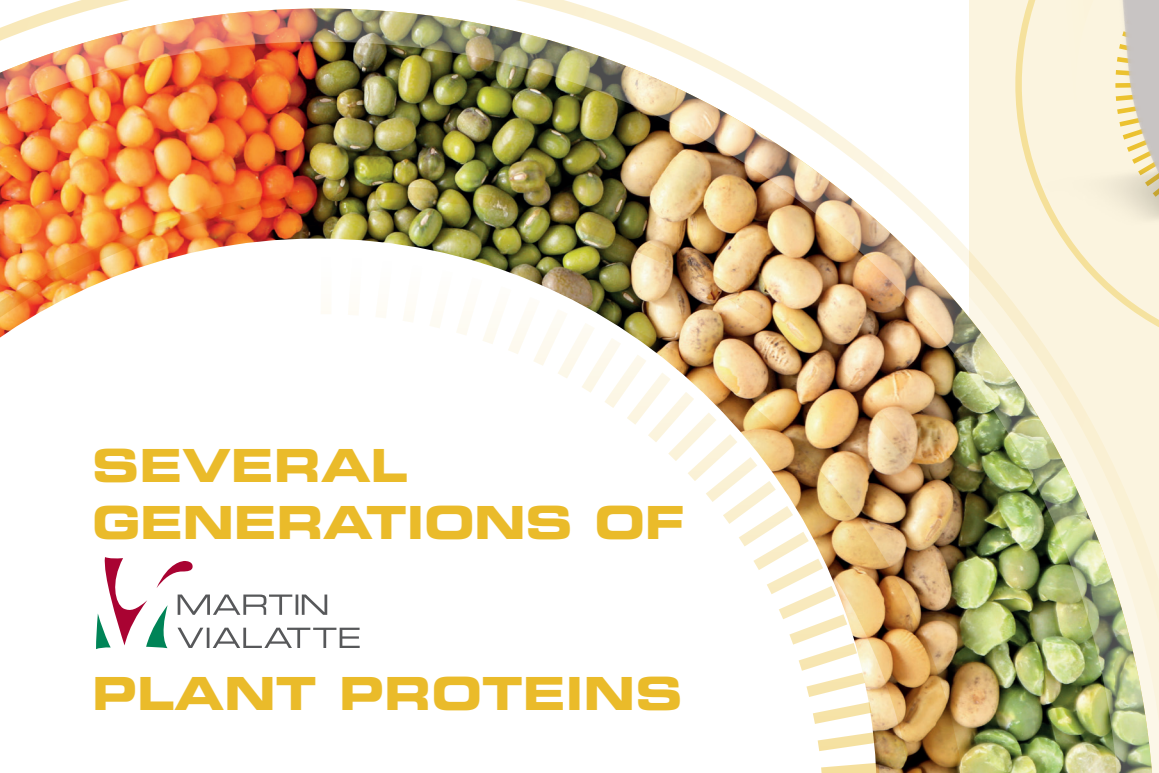
KTS® FLOT

2017 2020

Generation 3.0: the synergy of pea proteins with next-generation raw materials

KTS® FLOT

The validation by the EU in 2010 of the use of chitosan in winemaking opened up new prospects. Chitosan is a biopolymer belonging to the family of glycosaminoglycans. Its distinctive feature is that it is highly charged (positively charged) in an acid medium.



SEVERAL GENERATIONS OF

MARTIN VIALATTE

PLANT PROTEINS

Product authorized for the production of organic wines in accordance with European regulations EC 834/2007 and EU 2018/1584

KTS® FLOT results from the synergy between activated chitosan and selected pea proteins

Pea proteins bring about clarification, while chitosan acts as a flocculating agent.

Initially tested and validated in flotation for its rapid flocculation and good cap compaction, essential with this technique, **KTS® FLOT** can also be used for static clarification, with a significant impact on must browning mechanisms.

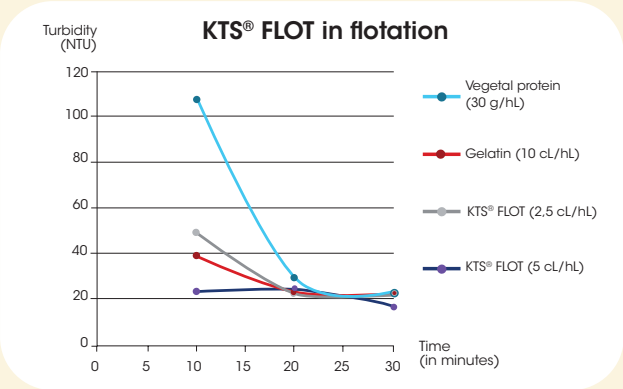


Figure 4:
Evolution of turbidity over time during a trial of fining by flotation

Tastings conducted on wines fined using **KTS® FLOT** show that this product is more respectful of wine than animal-based products. Wines treated with **KTS® FLOT** have more volume, more intense fruitiness and better balance in the mouth. **KTS® FLOT** is also more respectful of colour in red wines.

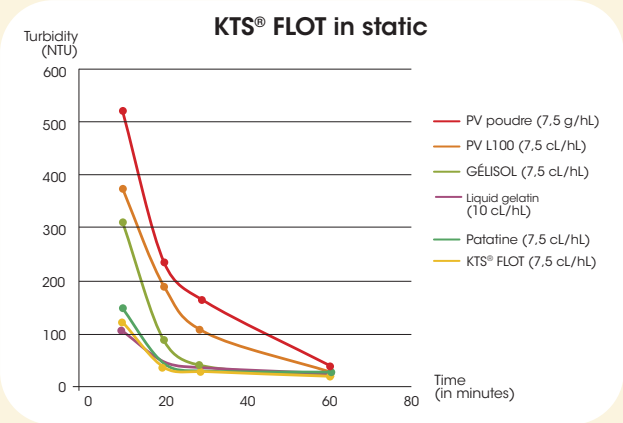
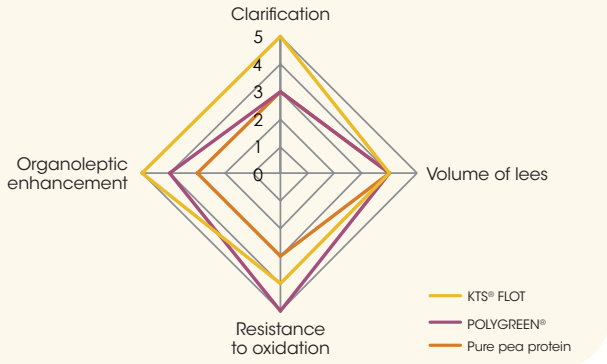


Figure 5:
Evolution of turbidity over time during a fining trial on port wine

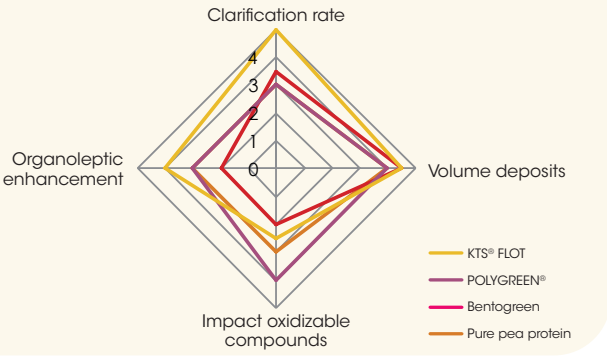
Alternatives to animal-based fining agents by Martin Vialatte®

DECISION SUPPORT

Decision support for wines



Decision support for musts (static)



Alternative to allergenic fining products

Oenological product	NTU	DO_{420nm}	DO_{320nm}	DO_{280nm}	Tasting
Casein					
POLYGREEN®					
ORIGIN® F-MAX					

Alternative to fining products of animal origin

Oenological product	NTU	DO_{420nm}	DO_{320nm}	DO_{280nm}	Tasting
Gelatin					
KTS® FLOT					
PROVGREEN® L100					
PROVGREEN® PURE MUST					

The larger the dot, the greater is the impact.

BIBLIOGRAPHY

Ribéreau-Gayon P., Glories Y., Maujean A., Dubourdieu D., Traité d'œnologie Volume 2, 403-446, 2012.

Caillet M.M., Revue Française d'œnologie, Technical article RFOE N°217, Historique du collage. Le collage des moûts et des vins : principes, résultats et perspectives.

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