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ENARTIS NEWS

IMPROVING FLOTATION EFFICIENCY WITH ENOLOGICAL TOOLS

Flotation is a method used by wineries as a means of clarification of juice prior to fermentation. This method is faster and oftentimes more effective for clarification when compared to traditional cold settling. While this method has benefits with respect to quality and sustainability, it requires more extensive technical know-how to implement it correctly and efficiently, as well adequate equipment. This document will detail some of the important aspects of floatation from a technical perspective.

HOW DOES FLOTATION WORK?

Flotation relies on specialized equipment which disperses micronized gas bubbles into juice or must via flotation pump or tank. These micronized bubbles will slowly rise to the top of the tank which in turn brings grape solids and particulates up with them, forming a floating lees cake or "flees" at the top. The clarified juice is then racked from underneath the floating lees cake, leaving the flees behind in the tank.

THE GOAL OF FLOTATION

The main goal of flotation is to clarify juice and must, and a successful flotation will result in a dense flees cap at the top of the tank, and remaining juice which is clarified to the desired specifications of the winemaker. Achieving this successful flotation requires the winemaker effectively test and treat the juice properly before flotation commences.

FLOTATION PRINCIPLES

Effective and efficient flotation relies on increasing the speed of particulates or floccules moving through juice. Stokes' law defines the most important factors to consider:

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

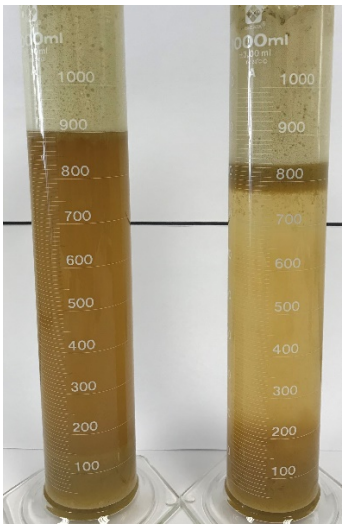
V = speed of the floccule moving through juice
Δρ = density difference between particle and liquid
n = viscosity of juice
D = diameter of particulates or floccules

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 juice.

DECREASING JUICE VISCOSITY (N)

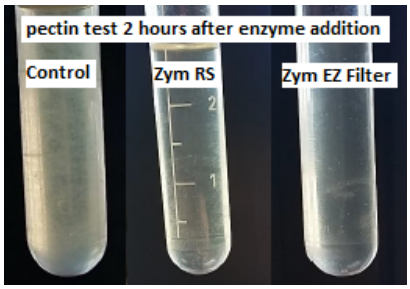
One major way to impact floatation efficiency is by decreasing juice viscosity. The best way to achieve this objective is by eliminating pectin in juice. Pectin is a polysaccharide naturally present in all grape juices. A negatively charged polysaccharide, pectin increases juice viscosity and interferes with the effective formation of floccules during flotation or fining.
Pectinase enzymes are an extremely effective tool readily used by winemakers to degrade pectin and decrease juice viscosity. EnartisZym RS, EnartisZym EZFilter, and EnartisZym Quick are all excellent enzyme choices to

achieve rapid de-pectinization of juice in as little as two hours after treatment. EnartisZym EZFilter is a new and innovative enzyme preparation which also has glucanase activity. The glucanase activity helps further improve clarification and improves filterability of subsequent wines made from those treated juices.



Untreated (left) and EnartisZym EZFilter treatment (right) after two hours of contact time. Note the differences in clarity and cap quantity between the two.

It is also recommended to do pectin testing after treating juice with enzymes to confirm that the enzymes have completed the degradation of pectin. This can be conducted at two-hour intervals after treatment to determine when the juice is ready for fining and floatation.



Floccules present after the pectin test indicate there is still pectin present in the juice.

In juices which have high solids content, it is recommended to rack the heavy lees from the bottom of a tank after juice de-pectinization. This will help floatation efficiency and will reduce the amount of flees produced.

INCREASING FLOCCULE DENSITY (ΔP) AND DIAMETER (D)

Increasing the diameter and density of floccules in juice allows for better flotation efficiency. Floccules form in juice when charged molecules interact and bind to one another, forming larger agglomerates. The larger the floccules are, the easier it is for them to float to the top of the tank during flotation. Winemakers can encourage flocculation by adding charged compounds or fining agents to juice, such as proteins (plant or animal origin), chitosan, silica or bentonite. Enartis specializes in producing fining agents as pure forms or blends which have synergistic effects to provide exceptional juice clarity and flees density.

PROTEIN FINING AGENTS FOR FLOATATION

Hydroclar 30

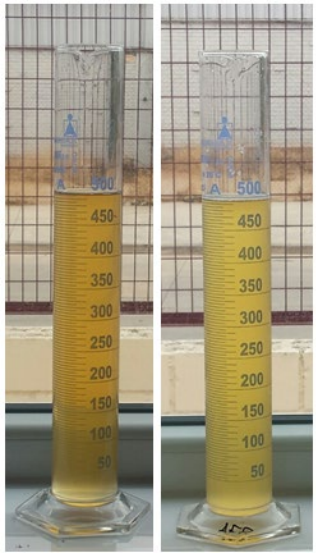
This gelatin has shown to be very versatile in its fining efficiency across different juice types for flotation.

Pulviclar S

An extremely effective gelatin for floatation which provides excellent clarification efficacy and floating lees density.

Plantis AF-P

This is an allergen free and vegan friendly fining agent which removes bitter phenolics and brown pigments while also increasing flocculation and flotation clarification.



Parameter	Hydroclar 30	Plantis AF-P
Dosage	30 mL/hL	5 g/hL
Solids produced	8%	4%
Post floatation turbidity	74.4 NTU	50.6 NTU
% reduction of color	29.4	36.6
% reduction catechins	23.3	22.4

Comparing the clarification efficacy of Hydroclar 30 (left) and Plantis AF-P (right) for flotation. Initial juice turbidity was over 1000 NTU.

NON-PROTEIN BASED FINING AGENTS FOR FLOTATION

Sil Floc

Sil Floc (silica sol), when used in combination with protein fining agents, can improve timing and degree of flocculation of juice.

Bentolit Super

Bentonite can also dramatically improve efficacy of flotation when used in low dosages and in combination with other fining agents. It can also help counter fine any residual protein which does not readily react with phenolic material in the juice.

Chitosan Based Fining Agents

While chitosan is typically known for its ability to inhibit microbial contaminations in wine, there are different forms of chitosan which can be useful for other purposes. Enartis has unique blends of fining agents containing chitosan which is processed to improve charge density and fining.

EnartisStab Micro M

While EnartisStab Micro M is most well known as an antimicrobial fining agent, it has also been shown to be an exceptional floatation agent. At dosages as low as 5 g/hL, floatation efficiency and microbial protection can be achieved. While it is not the most cost-effective floatation agent compared to regular protein fining agents, it adds the benefits of improved protein stability, reduced browning potential, and most importantly, improved microbial stability.

Plantis PQ

A new allergen free and vegan friendly potato protein fining agent which also contains a special type of chitosan that improves efficacy of formation of floccules by increasing charge density. This aids in forming a denser and more compact flees cake, with excellent clarification of juice.

Impact of Plantis PQ (10 g/hL) on the formation of flees compared to a control with no fining agent added. Note the compaction of the floating lees cake. This leads to improved yields and better clarification.

FLOTATION TRIALS

To ensure that the proper balance of fining agents is achieved, winemakers will often conduct flotation trials on juice before flotation on the full batch. This requires a smaller piece of equipment designed to replicate the flotation effect. These units are typically offered to wineries by floatation equipment providers. In the USA, Enartis collaborates with Della Toffola and uses the lab scale flotators developed by them.

EQUIPMENT/MATERIALS:

- Small lab-scale flotation unit
- Nitrogen or carbon dioxide gas source
- Nephelometer or turbidimeter (optional)
- 3 x 1000 mL graduated cylinders
- Samples of fining agents (see above)
- P1000/P200 pipettes or small glass pipettes
- Ruler or measuring tape
- 3 - 12 liters of de-pectinized grape juice

1. Juice is prepared ahead of trials by adding pectinase enzyme. Confirm that juice is pectin free prior to conducting these trials by performing a pectin test.
2. Once the juice is de-pectinized, using the appropriate pipette, deliver your desired dosage of fining agent for 800 mL of juice into one of the graduated cylinders which is marked with the added fining agents.
3. Fill the graduated cylinder with juice up to the 800 mL mark on the graduated cylinder.
4. Pour the juice from the cylinder into the flotation unit and seal the unit.
5. Charge the flotation unit up to 5 bars of pressure with nitrogen or carbon dioxide gas, and invert the unit five times to ensure homogeneity
6. Discharge the juice from the flotation unit back into the graduated cylinder.
7. Repeat this process for the two other graduated cylinders with varied amounts of desired fining agents.
8. Five minutes after the juice is distributed into the last graduated cylinder, visually compare the clarity of the three juices. You may also draw some sample of juice from the cylinders to measure turbidity for more accurate record of clarification effect. Finally, take note of the total volume of lees and clarified juice produced.
9. Depending on the goals of the winemaker, the juice with the most clarity or less percentage of flees volume may be chosen.
10. Repeat with the juice varying the combination fining agents or dosages of fining agents as necessary.

    Recommended fining agents to begin trials with:
    - 30 mL/hL Hydroclar 30 + 10 g/hL Bentolit Super + 50 g/hL Sil Floc
    - 5 g/hL Plantis PQ + 10 g/hL Bentolit Super
    - 20 g/hL Claril ZW

For more information, please call us at (707) 836-2451 or contact your technical sales representative.