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Anchor
OENOLOGY
Supporting you from grape to glass

FLOTATION USER'S GUIDE

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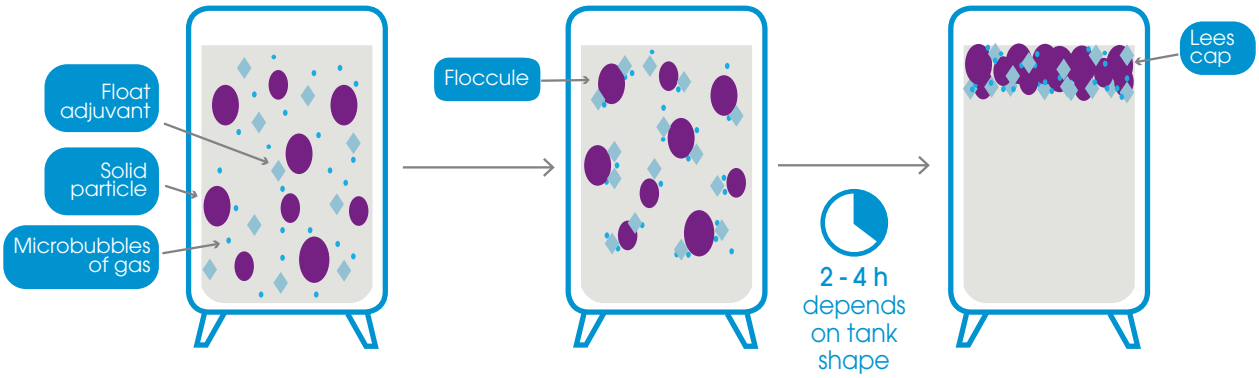
TECHNICAL KEY POINTS FOR FLOTATION

Flotation is based on the formation of hydrophobic floccules formed through the interaction of solid particles in the juice and flotation key adjuvants. These floccules are able to form an adhesive relationship to micro-bubbles of gas (nitrogen or air but not C02). This gas-floccule relationship is produced under a 5-6 bar pressure over a short period of time in conditions that permit saturation of the floccules with the flotation gas.

The floccules with attached and embedded carrier gas micro-bubbles have a lower density than juice and consequently float.



The key physical principles at work are also described by Stokes Law which states $V = \frac{D^2 \boldsymbol{g} \Delta(\rho)}{18\mu}$

V = Velocity in m/s (the speed of particle)
D = Diameter of particle m
$\boldsymbol{g}$ = gravity, here 9,81m/s2
$\Delta(\rho)$ = Difference in specific mass between the solid particle and liquid (kg/m3) which in flotation is a negative value
μ = viscosity of the grape juice

To take in consideration

- The temperature influence the viscosity. A low temperature will increase the viscosity and lower the speed of migration of the particles to the top of the tank.
- Flotation seeks to enhance the value of the specific mass between the solid particles and juice while simultaneously limiting the value of the viscosity to increase the speed of separation.

Physical aspects of the process

The mode of gas dissolution and adherence to the solid particle is fundamental to the process of flotation. Gas bubbles must have a D value < 120 microns for effective flotation to occur. This flotation bubble it termed a micro-bubble.

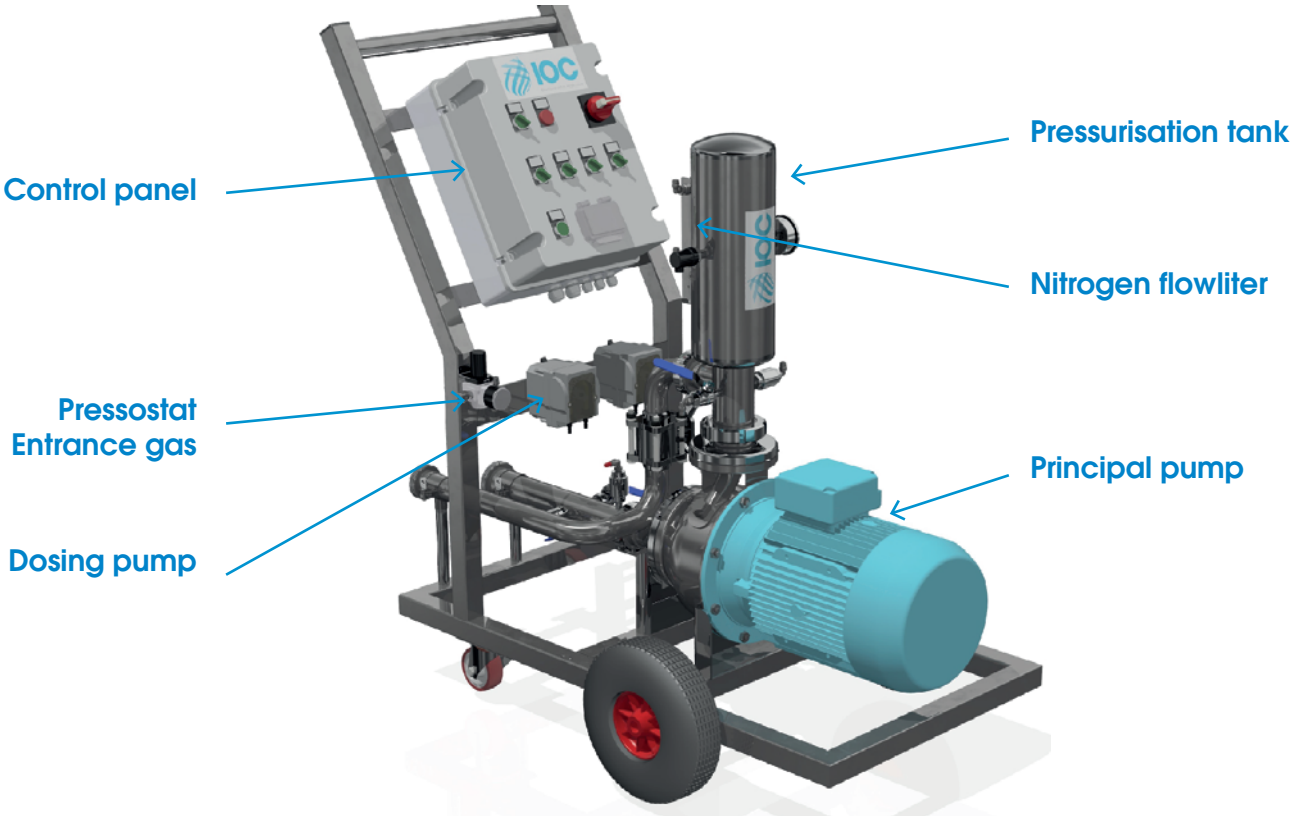
A gas bubble in the process of flotation will adhere to a solid particle via 2 modes:

1. Superficial adhesion to the suspended solid which in turn leads to small particles agglomerating
2. Entrapment of gas within the agglomerated floccule

The theoretical forces involved in solid-gas adhesion are

1. Steric aggregation of the bubble and solid
2. Microbubble attraction based on Zeta potential
3. Surface tension whereby the microbubble adheres when the tension of gas-solid is > tension of water – solid. Therefore we can see that gas will adhere to a particle with a more hydrophobic character. This hydrophobicity is an important factor to note!

MOBILE FLOTATION SYSTEM (MOBILE UNIT)



This is a method of flotation based on continuous circulation of juice volume in one tank, addition of adjuvant to aid floccule formation and oversaturation of the juice with the flotation gas. Typically this form utilizes one adjuvant which is progressively introduced during the circulation by small '"on Board" peristaltic dosing pumps. The process is effective and produces very high quality juices. However, it is not suited for flotation in continuous mode.

PRACTICAL ASPECTS FOR A GOOD FLOTATION

- The shape of the tank is important:
  - A "cigar shape" tank (small diameter and high length) will produce a thick and heavy foam which might collapse.
  - A tank with a too big diameter, it will be difficult to make all the juice moving.
- The minimal height of liquid in the tank is 1 m to allow to generate the flotation foam, and for the flotation foam to not break by the flow of circulation.
- The maximum height is about 7 m. Higher than this, the flotation foam will be too heavy and can collapse.

PRACTICAL ASPECTS FOR A GOOD FLOTATION

- In the case of a flotation from one tank to another:
  - The reception tank must be as close as possible from the initial tank to not loose pressure in the pipes. If more than 10 m, we can partially close the reception valve to keep a pressure of at least 4 bar in the pipes.
  - Racking to be done from the bottom valve.
  - Reduce the dosing speed of gas and liquid at the beginning of the operation to give time for the foam cap to be properly formed.

- In the case of a flotation in one tank only (recommended)
  - pump the juice from the bottom valve
  - return the juice into the racking valve
  - if the racking valve is equipped with a racking arm, point it at 30° and direct the liquid in the opposite flow from the bottom valve

- Supply a nitrogen bottle (or oxygen or food grade compressed air)
  - Get a pressure regulator

- Generally:
  - Pumping time should be 1.5 times the juice volume
    Eg: To float 8,000 L with a Quick-up 10 KL/h : you will need to pump for 72 min.

- It is difficult to give precise indication of the amount of gas to use because it depend of the viscosity of the juice which will itself depend of:
  - Colloidal charge
  - Quantity of solids
  - Temperature

  Amount of gas normally use
  - For Quick-up 10 KL/h: 8 to 12 L/min
  - For Quick-up 30 KL/h: 20 to 25 L/min

- Adjuvants: IOC and Anchor Oenology offer a complete range of flotation adjuvant.

  RAPIDASE FLOTATION: liquid pectolytic enzyme, its use enables viscosity decrease, allowing for faster migration of solid particles. Vegan friendly and suitable for organic production

  Flotation require adjuvants with important charges as the juices itself will be charged.
  - Qi'Up XC: Chitosan based, vegan friendly and suitable for organic production
  - INOFINE V : pea-protein, vegan friendly and suitable for organic production

- Co-adjuvants to help clarification and formation of a compact foam:
  - BENT'UP : Sodium bentonite specially made for floatation, vegan friendly and suitable for organic production
  - ACTICARBONE ENO : active vegetal charcoal adapted for discolouration of juices. To be added 1h before beginning the flotation. You have to use BENT'UP to eliminate the particles of charcoal. Vegan friendly and suitable for organic production

PREPARATION OF THE JUICE FOR FLOTATION

- Temperature should not be below 13°C. Recommended temperature between 15°C and 20°C
- Idyllically juice should be clear of seeds, skin, other solids.
- Mix your tank with the principal pump (without gas and adjuvants). Pump the juice out from the racking valve and back in by the bottom valve of the tank, to put all the particles in suspension for 15 to 20 min depending of the size of the tank.

VERY IMPORTANT : The juice has to be in a pectin negative status

Use a pectolytic enzyme in the juice (at least 2 hours before flotation). We recommend RAPIDASE Floatation specially formulated for this application (dosage 2 to 4 ml/100 L).

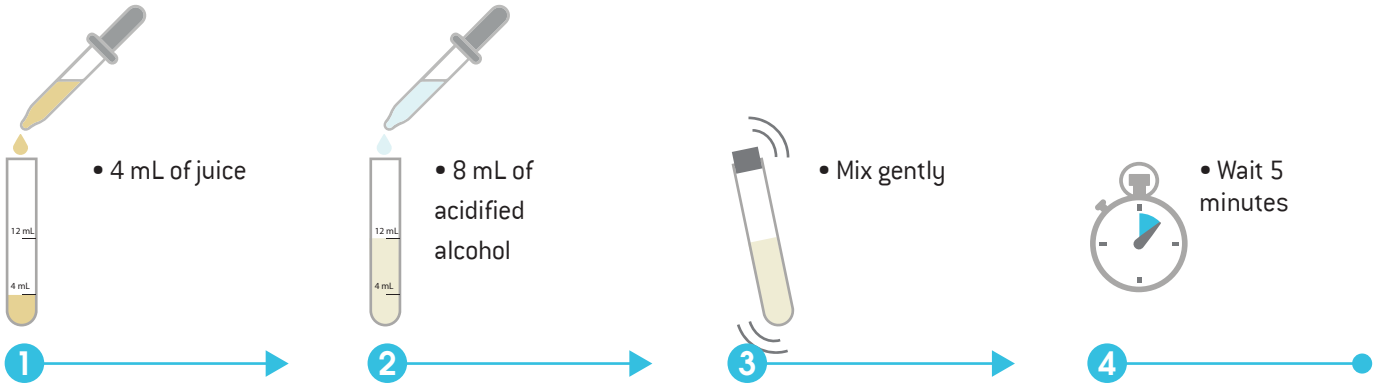
The confirmation of pectine status is by a simple and rapid test based on low cost reagents. It must be made prior every floatation.

PREPARATION OF THE TEST

- Preparation of the acidified alcohol
  - Take 250 mL ethanol @96% into a container
  - Add 2.5mL of hydrochloric acid (HCl) @ 37%
  - Stir

  The solution is stable and you will be able to make about 25 tests.
- Collect a sample of the juice to be test, and wait for 5 min

PROTOCOL



RESULTS

- In contact with alcohol pectin form floccules

  The pectines are hydrolysed by enzymes and the liquid stay clear.

  If the liquid show flakes, we suggest to add pectolytic enzyme in the tank.

1- Strong positive, high level of pectin, heavy flock formation

2- lear positive, medium level of pectin

3- Negative test, pectin totally hydrolysed

PREPARATION OF ADJUVANTS FOR FLOTATION

- Use dosage according to the technical sheet and your consultant.

- INOFINE V: dissolve the powder in 10 times its weight of water

  Example: for 20,000 l of juice, dosage 100 ppm : 2 kg INOFINE V in 20L of water

- Qi'UP XC : dissolve the powder mixing well (with an electric mixer if possible) in 10 times its weight in luke warm water (30°C to 40°C), lumps will form but wait 30 to 45 min and they will dissolve

  Example: batch of 20,000 l of juice, dosage 50 ppm -> 1 kg Qi'UP XC in 10 L of water.

- BENT'UP : Sodium bentonite in powder which clarify heavily charged juices, and make a compact foam, which improve the racking. Use this adjuvant in combination with a flocculation adjuvant (INOFINE V, QI'UP XC)

  The dosage is double from the principal adjuvant.

  Important: BENT'UP need at least 2 h of rehydration before use.

  Example: batch of 20,000 L of juice, dosage 100 ppm of INOFINE V + 2kg INOFINE V in a volume of 20 L water.

  BENT'UP *200 ppm + 4kg to dissolve in 40 L luke warm water (30 to 40°C) let it swell out for at last 2 h before use.*

- ACTICARBONE ENO : active vegetal charcoal adapted for discolouration of juices. To be added 1h before beginning the flotation. You have to use Bent'Up to eliminate the particles of charcoal.

  Dosage to be determined in function of the colour of the juice.

FLOTATION USING QUICK-UP 100
(Speed of about 10 KL/h at 5 bar)

Quick-Up 100 work only on manual mode.

Start:

- Connect the vacuum of the pump to the bottom valve of the tank
- Connect the return / delivery to the racking valve
    - f the racking valve is equipped with a racking arm, point it at 30° and direct the liquid in the opposite flow from the bottom valve
- Start the pump
- Adjust the pressure to 4.5 bar, partially close the ball valve
- Open the gas valve
- Adjust the pressure of entrance of gas to 1 -2 bar
- Adjust the speed of gas to the required value: between 8 and 12 L/min
- Check and adjust if necessary the exit pressure to stay at 4.5 bar.
- Open the addition valve
- Put the vacuum pipe of the dosage pump into the bucket with adjuvant.
- Start the dosage pump.

During flotation:

- Remember, pumping time will be determined by 1.5 times volume to be floated.
- When 50% of the adjuvant have been added, take a sample in a 250 ml sample cylinder, using the sample tap on the pump.
- Check the speed and the quality of the clarification and adjust adjuvants dosages and gas if necessary.
- When all adjuvants have been use, clean the dosage pump very well with water.

At the end:

- When the determined floating time is finished check that the foam on top of the tank is white: it means all the solids have been eliminated from the bottom of the tank.
- Rack the tank when the required turbidity is achieved
    - We estimate 1 h per meter of height of liquid to obtain a good clarification.

FLOTATION USING QUICK-UP 300
(Speed of about 30 KL/h at 5 bar)

For manual use, see instruction of the QUICK-UP 100

Start the flotation devise on automatic mode

- Connect the vacuum of the pump to the bottom valve of the tank
- Connect the return / delivery to the racking valve
    - if the racking valve is equipped with a racking arm, point it at 30° and direct the liquid in the.
- Position the button Manuel / Auto on Auto
- Position the button of the principal pump on Auto
- Position the button of gas control on auto
- Adjust the timer on the adequate setting
- Adjust pressure at 4.5 bar closing partially the ball valve at the exit
- Adjust pressure of entrance of gas at 1 – 2 bar
- Adjust the speed of gas to the required value: between 8 and 12 L/min
- Open the valve of injection
- Start the dosing pump

While using:

- The automatic mode will stop the main pump and the injection of the gas when the selected time has run out. Remember, pumping time will be determined by 1.5 times its volume to be floated.
- When 50% of the adjuvant have been added, take a sample in a 250 ml sample cylinder, using the sample tap on the pump.
- Check the speed and the quality of the clarification and adjust adjuvants dosages and gas if necessary.
- When all adjuvants have been used, clean the dosage pump very well with water.

At the end:

- When the determined floating time is finished check that the foam on top of the tank is white: it means all the solids have been eliminated from the bottom of the tank.
- Rack the tank when the required turbidity is achieved

    - We estimate 1 h per meter of length of liquid to obtain a good clarification

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