Cross-flow microfiltration and its applications
This technical guide is meant to contribute to enhance the value of your productions. You will find useful information about the implementation of cross-flow microfiltration solutions. On no account, it is meant to replace your know-how and the one of your wine consultant.
Cross-flow microfiltration and its applications

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A continuous improvement

The cross-flow microfiltration (CFF) technology is widely used within the pharmaceutical, chemical and food industries as much as for water treatment.

In the early eighties, the first machines tested in oenology were not adapted to wine. However, right after the first trials, the technology appears to be very encouraging. Indeed, one single filtration is needed to treat cloudy wines, no consumables are necessary, automation is made possible... And this type of filtration offers other interesting applications such as the elimination of wine microorganisms, and wine mutage without $SO_2$.

In the nineties, research involved in understanding the phenomena of membrane clogging together with the development of components, gave way to a great expansion of the cross-flow microfiltration, thus penetrating the wine market first with mineral membranes, then organic membranes adapted to the wine industry.

In the last decade, the machines were made easier to use and today are fully respectful of the wine quality.
CFF general principle

The CFF uses micro-porous membranes (average pores diameter superior to 0.1 µm). The liquid to be treated is moving along the membrane in a closed-loop. Part of the liquid passes through the membrane under the effect of a pressure gradient (permeate), whereas particles that are retained upstream concentrate in the liquid that hasn’t passed through the membrane (retentate). A shear stress, created by the fluid circulation, prevents particles from settling on the surface.

In practice, the build-up of particles on the surface of the filtering medium is far less substantial than for a dead end filtration. Thus, flow resistance and membranes clogging are minor compared to dead end filtration.

The CFF thus enables, with a rather low cut-off threshold, the filtration of rather heavily loaded liquids in one single operation. This technique also enables a steady level of filtration quality throughout the operation.
Bucher Vaslin Flavy FX and Flavy Leestar ranges

Since 2005, the Bucher Vaslin Flavy FX range has been equipped with organic membranes for enhanced performances and outputs, the filtration process has been optimized and its applications have widened up and are no more focused on wine only.

Since 2010, thanks to its expertise of more than 15 years, Bucher Vaslin has become the leader in the CFF field with innovations that have changed radically the organization in wineries and are now preventing them from using diatomaceous earth filtration (DE). From now on, the CFF enables the filtration of: wine (Sitevi citation Award 2007 - Flavy Tandem), wine and juice lees (Vinitech citation Award 2008 - “2 in 1” Flavy FX), and tank bottoms (Vinitech Bronze Trophy 2010 - Flavy Leestar). Today, the Bucher Vaslin CFF offers solutions that can be used all year round, economically profitable and thus with a fast return on investment.

Further to a European program (Eureka vinofiltre EU 964 F) in which Bucher Vaslin participated, an organic, hydrophilic, polyethersulfone (PES) membrane with its asymmetrical structure and a nominal pores diameter of 0.2 µm – specifically adapted to wine filtration – has been developed. The pores dimension guarantees a perfect limpidity and a “low in germs” filtered wine, while reducing in-depth clogging to its lowest level and limiting the retention of polyphenols (thanks to the hydrophilic characteristic of the membrane).

Bucher Vaslin membrane
- Back-flush is more efficient (automatic, frequent, fast (1 second)).
- Surface clogging is controlled.

Asymmetrical membrane (Flavy FX)

Other membrane
- Back-flush lack of efficiency.
- Risks of in-depth clogging.

Symmetrical membrane

(Bucher Vaslin) asymmetrical membrane vs other membrane.
The Flavy FX range for wine and juice lees

The Flavy FX filter is meant to treat juice lees during grape harvesting and wine the rest of the year.

- No pre-filtration or centrifugation is necessary for the wine. The filtered wine is perfectly brilliant, limpid (turbidity < 1NTU) and stable (low in germs: yeasts are eliminated and < 1 CFU/100 ml).*
- There are 3 steps for the treatment of juice lees:
  - juice sedimentation with pectolytic enzymes (in order to facilitate the juice lees settling),
  - removal of rough elements (pips, skins…) with a Flavy D3 or D10 pre-filter,
  - the filtration itself with the Flavy FX filter equipped with specific membranes.

Up to 90% of the juice lees volume is thus recovered (that is 99% of the juice volume in the original tank). Clear juices can be re-incorporated into the tank where the juice has already been stored. It will then contribute to the wine sensory qualities of fat, subtlety and aromatic freshness.

Flavy Leestar for tank bottoms

Flavy Leestar enables the filtration of “tank bottoms”: fining lees (any type of fining), retentates from cross-flow filters, centrifuge sludges… This unique solution can usefully replace rotary vacuum filters.

The Flavy Leestar cross-flow filter is equipped with:
- a specific stainless steel membrane,
- a unique process.

The rate of wine recovery reaches its top level (up to 96% for “tank bottoms” with increasing stream at 45% of volumetric suspended solids content (VSS)), and the quality is even better without any loss of alcoholic degree. The filtered wine is perfectly brilliant, limpid (< 1 NTU) and can be re-incorporated directly into the filtered batch without previous treatment (fining and filtration).

* CFU: Colony Forming Unit
The numerous advantages of the CFF

A cutting-edge, reliable technology respectful of wines quality

Experts acknowledge the fact that the organoleptic, physical and chemical qualities of the wine are preserved.

Extract from the publications “Rencontres Œnologiques - Janvier 2011”, Aude Vernhet, expert in CFF at SupAgro University in Montpellier.

“It is important to note that taste and sensory analysis trials achieved for the past ten years in this particular field do not show any negative impact of the cross-flow microfiltration on the global organoleptic quality of filtered wines.”


“The trials achieved by the ICV (2009) also show that, despite a nominal pores diameter of 0.2 µm (low in germs filtration), the cross-flow filter has no negative impact on wines. Furthermore, this filtration does not create any oxygen pick up.”

Extract from the publication “La filtration tangentielle fait ses preuves” - La Vigne, Octobre 2007, Cécile Vuchot.

“The 2007 Inter Rhône survey compared three principles of filtration: the CFF, the DE filtration and sheet filtration. The CFF is the best process to improve the filterability of wines. This Inter Rhône survey shows indeed that the cross-flow filtration is respectful of wine, including “Grands Crus”. One year after their treatment, no significant difference appears between rough wine and wine coming from cross-flow filtration in regards to the majority of oenological parameters. During those trials, neither the polysaccharides nor the polyphenols or SO₂ were affected by the CFF. One year after, it only generates a slight colour fading (-2.8%), whereas the loss is doubled with sheet filtration. The free SO₂ loss is subsequent in batches filtered with DE filtration (-23% after one month) whereas it remains stable with cross-flow filtered batches, even one year later. Now, the SO₂ coverage contributes to the aromatic quality of wines. As a matter of fact, the Inter Rhône sensory analysis, during a blind test one year after the filtration, reveals that the sensory quality of red wines is preserved with the CFF, keeping their fruity taste and reducing their barnyard notes.”
Bucher Vaslin exclusive solutions

Bucher Vaslin has designed a unique process that regulates the flow of filtered wine which, in association with the new polyethersulfone (PES) membrane, offers enhanced performances and yields compared to those obtained so far.

The hydrophilic characteristic of the organic PES membrane plays a positive role in controlling the phenomena of polyphenols and polysaccharides adsorption. In order to get the most out of it, Bucher Vaslin has designed simultaneously a volumetric feed pump with variable speed. It enables the trans-membrane pressure (TMP) to be controlled and regulated throughout the filtration process, depending on the type of wine to be filtered. It also enables the incoming stream flow rate of the filter to be maintained to the level of the permeate flowrate (limited time of the wine inside the loop). This association allows to improve significantly the permeate flow rate and steadiness of the filtration, compared to other CFF technologies.

This process of Bucher Flavy FX filter guarantees:
- a steady, optimal wine or juice quality,
- steady filtration flow rates,
- and low fouling index.

Thus, Bucher Vaslin offers an efficient solution for wines that are known to be “hard to filter”, heavily loaded with colloids: young red wines, cloudy wines (800-1000 NTU), red wines coming from thermovinification, sweet wines (up to 450 g/l of sugar)...

The Bucher Vaslin CFF does not generate any colour loss in wine. In order to prevent from any wine oxidation, Bucher Vaslin further offers the possibility to get the filter inerted with gas.
Environmentally friendly and health protective

The CFF is an environmentally friendlier filtration process and is also more respectful of the operators’ health than DE filtration.

- Effluents volumes are reduced (no earth to get rid off).
- No risk for the operators’ health:
  - no earth use, which is a controversial issue at the moment as its content of tiny particles of crystalline silica can generate “alveolar” dusts that can possibly migrate up to the lungs,
  - the CFF is the most efficient physical technique to reduce significantly the use of SO₂ while preserving the aromatic wine qualities (IFV-Orwine survey 2009).
- Decrease of the biodegradable wastes: the filtration retentate contains lees that can still be distilled.
- Low effluents level: it needs a small amount of water for washing cycles.

Bucher Vaslin exclusive solutions

When applied to wine, juice lees and tank bottoms, the CFF enables the volume of filtration earth handled by the operators to be considerably reduced.

The advantages of the Flavy FX filter equipped with organic membranes compared to a filter of same size equipped with mineral membranes: the volume of water for washing cycles is reduced by a factor of 2 and the consumption of chemical washing products by a factor of 5.
A simplified organization within the winery

One single operation is necessary (no pre-filtration, no centrifugation) to obtain a perfectly limpid and brilliant wine. The incoming stream, once filtered, is ready for bottling.

Operating comfort thanks to automation:
• Safe operating: once the machine is plugged in and programmed, the filter is fully automated. Only a simple attention is necessary.
• The operator can peacefully achieve other tasks and doesn’t have to worry about inputs or wasted DE treatment.

Bucher Vaslin exclusive solutions
• A user-friendly, easy-to-use, intuitive programming.
• Only one machine to filter both wines and juice lees.

The filtration of juice lees is processed per batch: the operator can process one tank after the other, avoid juice mixing and then valorize juice lees while keeping traceability of filtered batches.

“Naturally each client wanted to keep their juices separate from others but the minimum requirements of the RDV meant that bottoms needed to be bulked for processing and the resultant juice distributed pro rata.”

Filtration of juice lees - Testimonial from Winemaking Tasmania - WBM magazine - November 2010.

• The “tank management” option on the Flavy FX range allows sequences of wine filtration to be moved on from one tank to the other automatically and gives the filter a better autonomy.
A fast return on investment

• In general, the capital investment amount depends on the surface of filtration and the level of automation.
• In terms of return on investment, the CFF allows great savings regarding annual operating costs (from 50 to 60% according to Inter Rhône, 2007):
  - no consumables such as DE filtration,
  - reduced labour (automation, one single operation needed),
  - low wine losses (0.5% to 2% depending on the type of wines) and juice losses (approximately 1%).

**Operating cost** is evaluated between 10 and 80 cents of Euros per hectolitre (IFV, Itinéraires n° 19).

Apart from the operating costs, the CFF also allows savings on “hidden costs”:
• Saving on consumables: DE filtration and sheets.
• Saving on final filtration cartridges at the bottling line (approximately of 30%): better fouling index than DE filtered wine.
• Cost reduction on effluents treatment.
• Low wine losses.
• No need for the operator to stay all the way around (simple attention only).
• Saving on the vacuum hood imposed by the Health and safety regulations to eliminate all the tiny particles on each DE filter: 10 to 15 000 € per filter.

**Bucher Vaslin exclusive solutions**

With the “2 in 1” Flavy FX solution, that makes the filtration of both wines and juice lees possible, return on investment is very fast. Wine losses are almost insignificant: from 0.1 to 0.5% of filtered volumes. Return on investment is even faster when wines selling prices and filtered volumes are high.

Example of a fast return on investment:
“The winery has reported significant savings in the cost of refrigeration as juices have been settled at higher temperatures and for shorter periods than in the past. The savings made from better yields of premium quality juice, the removal of DE and the time saved in the set-up and clean-up of the RDV were also significant”.

*Juice lees filtration – Testimonial from Winemaking Tasmania, WBM magazine- November 2010.*

The reports indicate that the Bucher Vaslin CFF is a costs-reducing solution.
The Bucher Vaslin exclusive solutions offer a wide range of applications

Thanks to all those applications available nowadays with the Flavy FX and Flavy Leestar filters (for tank bottoms), gradually wine cellars free themselves from using DE filtration all year round.

**Juice lees filtration**

The objective is to recover the maximum of qualitative juice rich in fatty acid and aromatic potentials.

Performances: flow rate of approximately 35 l/h.m² for cold settled juice lees and of approximately 26 l/h.m² for floted juice lees. Reduction of the oxidation rate compared to traditional techniques. Filtration of one batch after the other – Reduced labour. Operators’ safety (no need to manipulate DE filtration) - Juice losses from juice lees are limited.
Operational comparison

Example of application: a winery in Chile filters 9200 hl/year of juice lees and 220 000 hl/year of wines. The tables show the savings and how the winery managed to valorize their juice by filtering the juice lees with a Flavy FX filter.

Savings with the Flavy FX filter

<table>
<thead>
<tr>
<th>Juice lees</th>
<th>Rotary vacuum filter - 10 m²</th>
<th>FX 10 - 60 m²</th>
</tr>
</thead>
<tbody>
<tr>
<td>Washing products</td>
<td>0,037</td>
<td>0,057</td>
</tr>
<tr>
<td>Power</td>
<td>0,075</td>
<td>0,296</td>
</tr>
<tr>
<td>Water (hot)</td>
<td>0,005</td>
<td>0,025</td>
</tr>
<tr>
<td>Labour</td>
<td>0,137</td>
<td>0,036</td>
</tr>
<tr>
<td>DE Filtration</td>
<td>2,138</td>
<td>0,000</td>
</tr>
<tr>
<td>Wastes/Treatments</td>
<td>0,535</td>
<td>0,136</td>
</tr>
<tr>
<td><strong>TOTAL in €/hl</strong></td>
<td><strong>2,927</strong></td>
<td><strong>0,550</strong></td>
</tr>
</tbody>
</table>

For 9200 hl/year, savings on juice lees filtration with a FX 10 filter is worth 21 870 €/year.

How to valorize the juice

With the rotary vacuum filter (RDV), 55% of the total juice lees volume is recovered, that is 5060 hl made into standard-quality wine worth 60 €/hl

<table>
<thead>
<tr>
<th>With the Flavy FX 10 cross-flow filter, 88% of the total juice lees volume is recovered, that is 8096 hl made into upper-quality wine worth 75 €/hl</th>
</tr>
</thead>
<tbody>
<tr>
<td>303 600 €</td>
</tr>
<tr>
<td>607 200 €</td>
</tr>
</tbody>
</table>

Extracted quantity and quality allowed a saving of: 303 600 €.

The cross-flow filter can filter one batch after the other, which valorizes the juice. For the winery, this solution allowed a saving worth 325 470 € compared to the RDV.

Example of implementation of a juice lees filtration unit.
How to stop the fermentation process

The cross-flow microfiltration enables the filtration of a wine loaded with microorganisms during its fermentation. As the nominal pores diameter is 0.2 µm, it enables the elimination of the microbial biomass in order to obtain a low in germs wine.

The advantage: the CFF has a lower consumption of SO₂ than a traditional mutage (cold + racking).

“The microbiological stability is obtained at an earlier stage than with a traditional mutage. For a same required content in free SO₂, the elimination of the complete biomass generates a lower combination of SO₂ by wines. Micro-filtered wines need less re-adjustment during their ageing process. Compared to the traditional mutage, the total SO₂ saving at the end of the breeding can be from 6 to 30%.”

(IFV Blanquefort 2001 - Itinéraires techniques N°19 - IFV)

Principle with the Flavy FX filter. When the required sugar / alcohol balance point is reached: cool down the tank to reduce the fermentation, then filter the tank with a Flavy FX filter, remove yeasts (concentrated in the retentate) and adjust SO₂ to preserve the product. With a flow rate of **40 to 55 l/h.m²** depending on the content in residual sugar, this treatment can reduce up to 30% of SO₂ doses for a same content in free SO₂.

Wines clarification and stabilization

Flavy FX performances

<table>
<thead>
<tr>
<th>Observed flow rates</th>
<th>l/h.m²</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dry, white fined wine</td>
<td>100</td>
</tr>
<tr>
<td>Dry, rough, rosé wine</td>
<td>70</td>
</tr>
<tr>
<td>Red press-wine (600 - 800 NTU)</td>
<td>25</td>
</tr>
<tr>
<td>Rough red wine coming from thermovinification*</td>
<td>35</td>
</tr>
<tr>
<td>Traditional rough red wine</td>
<td>40 - 55</td>
</tr>
</tbody>
</table>

- Steady flow rates even over long cycles (> 15-20 h).
- Average waste volumes < 1%.
- Low water consumption: from 0.7 litres to 1.4 litres per filtered hectolitre.
- Low consumption of washing products.

* Red wine coming from thermovinification: the asymmetrical structure of the membrane facilitates the efficiency of back flushing, which contributes to keep a steady filtering flow rate. The parameters of the process (feeding flow rate, TMP...) are adapted so as to control the filtration over long cycles.
In-line bentonite fining

The objective is to clarify and stabilize white and rosé wines in one single operation, in order to shorten times of wine preparation.

**Use of a very pure, non abrasive UF bentonite** (free of silica) whose particle size is adapted to the size of the membrane pores in order to prevent from any clogging.

The process controls automatically the in-line bentonite injection according to the filtration flow rate, which guarantees a very accurate dosage. The dosing pump is integrated in the filter. The operator gives details about the required dosage on the PLC of the filter and the concentration of bentonite solution.

Example of application: Wine negociant in the Bordeaux area, use of a Flavy Tandem FX 6/FX 2LWL filter since October 2011, filtration of 450 hl of white wine with 5NTU, UF bentonite dosage of: 40 g/hl.

Results: steady flow rate of 35 hl/h (90% of maximum flow rate), low waste volume of 90 litres (that is 0.2%).

Benefits:
- 2 in-line actions in one single operation (protein stabilization and filtration),
- duration of treatment is reduced,
- less wine transfer,
- less wine handling,
- tank management is simplified.

In-line bentonite fining process.
Wine filtration with Flavy FX Tandem

The Flavy FX Tandem filter is based on the association of two dedicated machines working simultaneously and in different ways: filtration of rough wines for one machine and concentration of retentates from the first filter for the other. Thus, each filter of the Flavy FX Tandem has its own application, has its own working parameters and uses specifically adapted membranes.

Its advantages are numerous:
• A concept specifically adapted to the filtration of large wine batches.
• Productivity is increased and wine losses are significantly reduced. As a matter of fact, the in-line treatment of retentates reduces the coggling on the main unit and wine losses are significantly reduced at the end of the batch (down to a level of 0.1% to 0.05% depending on the batch size).
• The organization is optimized: Flavy FX Tandem processes each batch as a whole and improves the organization of the winery.
• Operations are fully automated.
• Data records can be registered on a USB key.
Filtration of tank bottoms, fining lees, red wine racking lees and retentates with the Flavy Leestar

Tank bottoms represent 2 to 3% of the wine volume in a winery. Their filtration enables the recovery of three quarters of them.

Tubular, stainless steel membranes have been experimented for more than 20 years within the Bucher Industries Swiss division for fruit juices filtration. Resistant and long-lasting, they are adapted to rough components encountered in lees, to viscous, abrasive fluids such as bentonite or active carbon...

TiO₂ membrane on stainless steel, sintered 316 L support
Operational comparison

Example of application: a winery in Portugal produces 6000 hl of tank bottoms per year. The tables show the savings and how the winery managed to valorize the filtered product by filtering the tank bottoms with a Flavy Leestar filter.

Savings with a Flavy Leestar filter

<table>
<thead>
<tr>
<th>Tank bottoms</th>
<th>RDV filter - 6 m²</th>
<th>Flavy Leestar 3</th>
<th>Flavy Leestar 6</th>
</tr>
</thead>
<tbody>
<tr>
<td>DE</td>
<td>1.772</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Washing products</td>
<td>0</td>
<td>0.958</td>
<td>0.615</td>
</tr>
<tr>
<td>Power</td>
<td>0.206</td>
<td>1.046</td>
<td>0.523</td>
</tr>
<tr>
<td>Labour</td>
<td>1.953</td>
<td>0.129</td>
<td>0.064</td>
</tr>
<tr>
<td>Water</td>
<td>0.106</td>
<td>0.124</td>
<td>0.087</td>
</tr>
<tr>
<td><strong>TOTAL in €/hl</strong></td>
<td><strong>4,037</strong></td>
<td><strong>2,257</strong></td>
<td><strong>1,289</strong></td>
</tr>
</tbody>
</table>

For 6000 hl/year of tank bottoms filtered with a Flavy Leestar, savings are worth:
- 10 680 €/year for the Flavy Leestar 3,
- 16 488 €/year for the Flavy Leestar 6.

How to valorize the filtered product

<table>
<thead>
<tr>
<th></th>
<th>754 800 €</th>
</tr>
</thead>
<tbody>
<tr>
<td>With a rotary vacuum filter (RDV), 74% of the total tank bottoms volume is recovered, that is 4440 hl whose value is worth 170 €/hl (product to be re-filtered).</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>902 400 €</th>
</tr>
</thead>
<tbody>
<tr>
<td>With the cross-flow Flavy Leestar filter, 80% of the total tank bottoms volume is recovered, that is 4800 hl whose value is worth 188 €/hl (ready to be added to the finished product).</td>
<td></td>
</tr>
</tbody>
</table>

The extracted quantity and quality allowed savings worth 147 600 €.

The cross-flow filter enables the filtration one batch after the other, which valorizes the wine. For the wine cellar, this solution allows a total saving worth:
- 158 280 € with the Flavy Leestar 3, that is a return on investment approximately over 12 months,
or
- 164 088 € with the Flavy Leestar 6, that is a return on investment over less than 18 months.

After filtration: the colour intensity and alcoholic content are preserved. The filtered wine has the required qualities for bottling (added to the finished product).
“Does the size of my winery justify the purchase of a cross-flow filter? I have a small vineyard... Is cross-flow filtration only adapted to large wineries?”
No, the CFF is adapted to any type of wineries! Having a small footprint, it is easy to use, fast and user-friendly. You don’t have to be an expert to use it, the machines are fully automated on the whole Flavy FX range (filtration, unclogging, rinsing, washing), safety is fully respected thanks to permanent auto-checks. Besides, the “2 in 1” filtration, juice lees and wine, enables year-round filtration, which means you save money and improve your efficiency.

“My customers ask for more and more restricting specifications (level of turbidity, microbiological stability...)?”
If it is the case, it is recommended to invest in a cross-flow filter.

“Can the CFF be applied to my organic wines?”
As a matter of fact, there is no restriction. Indeed, this technique is very much respectful of wine quality.

“Is it possible to have a mobile filter in the case of a purchase by several users?”
Yes, Bucher Vaslin has many references of filters installed on a trailer in order to be able to share it between several users, including service companies.

“Can wine coming from thermovinification be treated?”
Yes. Wines coming from thermovinification have a high level of turbidity, especially now that filtration tends to be carried out even earlier than before. Due to their high concentration in polyphenols, those wines have a clogging profile that needs an appropriate type of filtration. Thanks to the organic, hydrophilic membrane with its asymmetrical structure, Flavy FX filters are the proper, efficient solution for the filtration of red wines coming from thermovinification.

“Can bentonite-treated wines be filtered?”
Yes, any type of UF bentonite-treated wine through in-line injection (in option on the Flavy FX range) can be filtered.

“Can the level of turbidity be decreased down to 1 NTU?”
Yes, after cross-flow filtration, wines turbidity is usually under 1 NTU, which corresponds to brilliant wines. Those levels of clarification are obtained whatever may be the wines preparation before filtration and in one single filtration step.
“Is there a risk to process my top-quality wines using a filtration with pores dimensions of 0.2 µm?”
No, the CFF has been proved to be respectful of the wine qualities through many separate trials (IFV, Inter Rhône...). The hydrophilic characteristic of the Bucher Vaslin organic, polyethersulfone (PES) membrane plays a positive role in controlling the phenomena of the polyphenols and polysaccharides adsorption.

“Is a high volume of water necessary to wash cross-flow filters?”
No, a Bucher Vaslin survey compared the washing of a Flavy FX 6 filter (organic PES membrane) and of a filter equipped with ceramic membranes of the same size: water consumption is divided by 2 with the Bucher Vaslin filter (950 l/washing), and the cost is worth 12000 €/year (5 times less of washing products).

“Is water consumption higher when using the cross-flow filtration compared to the DE filtration?”
No. Many testimonials from people using a Flavy FX filter show after 2 or 3 years of use that water consumption is divided by three.

“Is bottling possible after the CFF?”
Yes, if wine clarity is the objective. No, if wine sterility is wanted. In that particular case, a final filtration on cartridges is necessary before bottling.

“Are microbiological risks going to be reduced?”
Yes, the Bucher Vaslin CFF enables wines to be low in germs.

“Can rough, high solids content tank bottoms containing tartaric crystals or active carbon or fining agents be filtered?”
Yes, the new Flavy Leestar filter has been designed to be resistant to abrasion, clogging and any mechanical stress.

“Can the CFF treat volatile phenols?”
The CFF can remove from wine the Brettanomyces which are responsible for the production of volatile phenols (phenol tastes). With a size of about 1 to 2 µm, Brettanomyces yeasts are eliminated during the filtration process thanks to the nominal pores dimension of 0.2 µm of the Bucher Vaslin organic membranes. However, volatile phenols that may have been produced before the filtration are not eliminated by the CFF. To remove those phenol tastes, Bucher Vaslin has developed a new process (being examined by the OIV) based on the association of a nano filtration membrane and absorber.
Further information

Glossary

**Cross-flow microfiltration (CFF):** clarifying of a liquid passing through a porous barrier with pores diameter of about 0.1 to about 10 microns. The liquid to be clarified is flowing parallel to the filtering surface.

**Permeate:** juice or filtered wine having passed through the membrane (also called filtrate).

**Retentate:** fluid containing the particles or macro-molecules retained by the membrane (also called concentrate).

**Trans-membrane pressure (TMP):** differential between the pressure on the retentate side and the pressure on the permeate side of the membrane.

**NTU (Nephelometric Turbidity Unit):** optical measure to calculate the content of particles responsible for wine turbidity.

**Volumetric suspended solids content (VSS):** suspended humid matters in % Vol/Vol. This value is obtained after the centrifugation at 4000 rpm during 30 minutes. They correspond to the non soluble fraction (leaves, skins, pips, DE filtration ...).

**Clogging:** phenomena that produces a decrease of the permeation flow rate.

**Permeation flux density** (or permeation “flow rate”, or permeability): volume of liquid passing through the membrane per surface unit and time unit (generally expressed in l/h.m² that is in LMH).

**Rinsing:** membrane washing with water.

**Regeneration:** membranes cleaning in place (CIP) by using chemical products in order to recover the initial permeability.

**Back-flush, back-pulse, back-wash:** unclogging process of the membranes during the filtration by reversing the permeation flow.

**Volumetric Concentration Factor (VCF):** ratio of the initial volume to the retentate volume (retentate concentration).
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