



## CROSS-FLOW MICROFILTRATION IN WINEMAKING

Cross-flow microfiltration (CFMF) (also known as tangential flow filtration) is a method of clarification and microbial stabilization of different beverages utilizing the tangential flow principle. Since its application in the winemaking industry began, it became widely extended thanks to the availability of suitable membranes and continuous improvements to the equipment design.

### Principle of Process

Unlike the clarification techniques with frontal flow, the wine to be filtered flows parallel to the filter surface. This is an important feature for minimizing the clogging of the filtration surface. The wine circulates in a closed-loop. While the liquid portion can pass through the membrane, the material larger than the membrane pore size is retained on the feed side of the membrane due to the driving force of a pressure gradient.

### Application in Winemaking

In the winemaking industry, CFMF is used for clarification and microbial stabilization purposes. It can be used for different stages of wine production and sparkling wine. Its application areas are as follows and not limited to: elimination of yeast and bacteria after fermentation, elimination of suspended materials in wine after the fining, filtration of untreated or high turbidity wine, such as press wine and preparation of the wine prior to bottling. Although different pore sizes are available, micro-porous membranes with a diameter of 0.2  $\mu\text{m}$  are widely used in CFMF for the wine industry.

The main goal of CFMF is to process wines with high turbidity to obtain bright and microbiologically stable wines with one unit operation. The following points can be listed to outline the aspects of CFMF in terms of winemaking applications:

- **One-step treatment:** It generally takes more than one step of filtration to clarify untreated wines. This is the case in the conventional filtration processes, which can take several steps, starting from diatomaceous earth filtration until final microbial stabilization. However, CFMF, using the tangential filtration principle, can achieve the same clarification goal in a one-step procedure. This allows saving time and labour at the cellar and reduces wine loss during filtration processes.



- **Environmental friendly and safe compared to conventional methods:** By using CFMF, which doesn't require any consumables, it's possible to eliminate the usage of diatomaceous earth. Although traditionally used for filtration in winemaking, diatomaceous earth is considered a hazardous waste that implies disposal costs. Safety measurements are needed to be taken during the application of diatomaceous earth to avoid its harmful health effects. Moreover, if the earth is not stored properly, possible moisture retention can lead to biological growth. Finally, under compromised storage conditions, aromas absorbed by the earth can develop undesirable aromas in wine. Therefore, one of the advantages of CFMF is eliminating the usage of this earth and corresponding waste.
- **No air contact, ingress or escape for gases:** The filtration process with CFMF takes place in the enclosed filtering system, which prevents undesirable oxygen intake and carbon dioxide losses.
- **Possibility to decrease sulphur dioxide usage:** It's a common practice to use SO<sub>2</sub> to protect the wines from microbial risks and oxidation during post-fermentation operations, including racking, filtration and others. As CFMF provides a one-step treatment, SO<sub>2</sub> adjustments associated with these several filtration steps can be decreased.
- **Effects on wine quality:** Although some specific types and styles of wines are sold with a certain level of turbidity, the limpidity and brightness of wine give the first visual impression to the consumers, which highly impacts the perception of wine quality. With CFMF, it's possible to reach the required turbidity levels to obtain brilliant red, white or rosé wines.