

HOW TO OPTIMIZE FILTRATIONS

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In numerous countries, such as the United States, well-informed customers tend to request non-filtered but microbiologically stable wines. Other countries, such as Canada and Sweden, have stringent requirements concerning the microbial load of wines. Thus, preparation of wines for bottling has to meet certain demands: Quality preservation of filtered wines, valorization of filter residues, cost management and environmental sustainability represent today's professional concerns.

While the conditions and duration of wine ageing already allow to achieve a certain physical and microbiological stability, it is the final filtration before bottling, which prevents deposits and microbiological modifications through removal of particulate matter and microorganisms.

It is generally acknowledged that an overly tight filtration can retain some components, such as colloids, and affect the organoleptic and gustative qualities of the product. Therefore, it would be preferable to reduce these operations, which affect wine quality, while ensuring physical and microbiological stability: This is the declared purpose of the tangential filtration as rough, pre-membrane filtration.

Comparative trials

Fourteen comparative trials were conducted by Inter Rhône in 2001, three of them in collaboration with the Drôme Chamber of Commerce. The studies were carried out with six red wines from the 1999, 2000 and 2001 vintages, which were filtered either by diatomaceous earth or tangential flow filtration. In the latter case, three kinds of membranes were tested: organic hollow fibre membranes (spiral wound or not), and a ceramic hollow fibre membrane.

The microbiological results are clear: after a single tangential filtration, all yeast were retained (Figure 1) and a 3–4 log reduction of the bacterial population achieved (Figure 2). Using traditional filtration, several stages had to be carried out first with diatomaceous earth and then with a membrane in order to obtain similar results. Besides, microbial growth can sometimes be observed after filtrations with diatomaceous earth that is rather prone to contaminations.

Y-Axis: Yeast population (log cfu/ml)

X-Axis: Trial 1 / Trial 2

Legend:

Spiral wound

Hollow

DE

Control

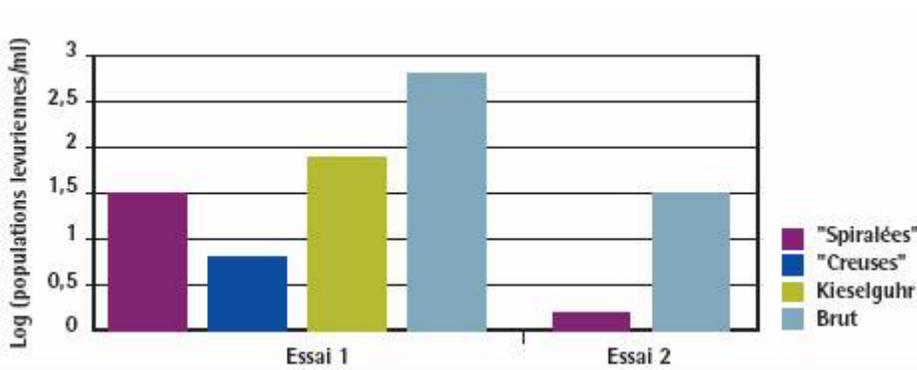


Figure 1
Yeast counts as a factor of filters used

Y-Axis: Bacterial population (log cfu/ml)

X-Axis: Trial 1 / Trial 2

Legend:

Spiral wound

Hollow

DE

Control

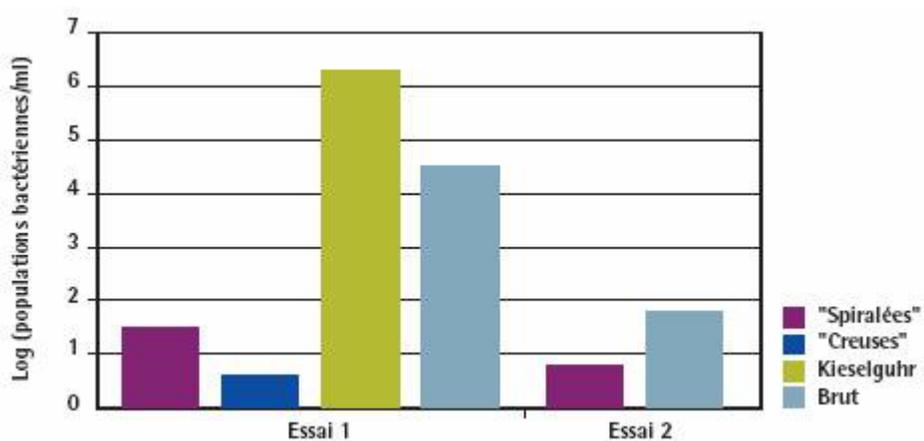


Figure 2
Bacterial counts as a factor of filters used

Regarding the physicochemical analysis, none of the traditional parameters were modified by tangential filtration, regardless of the membrane. Specifically, no significant loss of free SO₂ could be observed, nor a change in volatile acidity, the optical densities or the concentrations of anthocyanins and phenolic compounds. Moreover, these trials have confirmed the better filterability of wines after tangential filtration. After a single filtration, the turbidity and fouling index decreased significantly. In contrast to diatomaceous earth filtrations, this effect persisted for 2 to 4 weeks after filtration.

To assess the sensory effects, a discrimination (triangle) test was carried out the day of the filtration and one month later. No significant difference was detected by the tasting panel. This result indicates that no component essential for sensory perception was retained during tangential filtration.

Overall, all tested membranes provided similar results from a microbiological point of view. The ceramic membranes offered a small advantage in terms of filterability: compared with organic membranes, they allowed to limit the fouling index for longer periods.

A filtration technique, which respects wine quality

The trials conducted in collaboration with the Drôme Chamber of Agriculture showed that it was the membrane filtration, which led to stronger modifications of the parameters studied. The contents of anthocyanins, total polyphenols, total tannins and the dry extract were noticeably reduced after membrane filtration. Thus, it is essential to decrease the number of these filtrations. In contrast with diatomaceous earth filtrations, one final membrane filtration step is sufficient after tangential filtrations in order to obtain wines with low microbial loads. This makes tangential filtrations clearly advantageous.

While unable to solve all wine stabilisation concerns, tangential filtration appears to be well adapted to wines and respect their quality. On the one hand, no significant difference could be found compared with traditional filtrations. On the other hand, tangential filtration is part of a less depleting winemaking protocol, since it allows to avoid the other preparatory clarification steps before final filtration. Finally, tangential filtration offers other important benefits (see below) and thus, can be integrated easily into any production protocol. Its impact on waste water management and thus the environment, has been questioned. However, especially the discharge and water consumption are variable depending on the filter used and depend mainly on the fouling capacity of the wine.



Figure 3

Fourteen comparative trials were carried out in 2001 by Inter Rhône.

Advantages of tangential filtrations

- Oenology: allows to stabilize wines microbiologically in one filtration step while respecting product qualities. Constant filtrate quality.

- Logistics: facilitates the management of dry filter materials (diatomaceous earth, filter pads or membranes, which lose quality rapidly if stored inappropriately or after high throughput).
- Economy: time optimization (automation, 20/24 h operation). Optimization of cleaning products by system automation. Reduction of consumables, such as final filtration membranes. Eliminates discharge costs caused by traditional filtration media.

**Overview of tangential filtration
(filtration surface: 20 – 30 m²)**

Average flow rate (1): 12 – 13 hl/h for white or rosé wines; 8 hl/h for red wines (for very turbid wines the flow can fall to 4 hl/h).

Wine loss (2): 0.2 – 1%

Water consumption (1): 2 – 9.5 litres water/hl of filtered wine.

Power consumption (3): 1.2 – 4 kWh/hl of filtered wine.

Purchasing price: 45,000 – 55,000 €

(1): may vary according to wine filterability, and the requirement for and number of intermittent rinsing steps.

(2): 0.2% for the basal dead volume and independently usable modules, which are used according to the quantity of wine to be filtered.

(3): considering the power consumption of the filter, the loading pump and the hot water tank.