Winemaking:
The Secret of Good Taste and High Quality

A millennia-old tradition meets state-of-the-art technology: wine production has experienced many trends and developments throughout its history. Herein, you can learn more about the prerequisites for a safe and flavorful product. We talked to experts in the field of modern, sustainable viticulture and wine analysis and found out that attention to details and care for the product are the keys to wines of the highest quality. In the second part of this article, you can find an overview of common microbiological spoilages, a collection of recent studies on how to monitor and control them, and what needs to be considered during the filtration process of wine.
There are always new trends in a wide variety of subject areas – and the wine industry is no exception. Customers are demanding sustainably produced wines, non-alcoholic alternatives, and special flavors. Small as well as large vineyards worldwide are challenged to adapt and stand out as something special. Especially due to guidelines and requirements regarding the monitoring process, wine analysis is inevitable to ensure its quality and taste. In the following, you can read about special features and emerging trends of wine production explained by the operator of a wine analysis laboratory and the managing director of a winery that is specialized on organic wines.

“Optimizing the ideal data streams and exploiting synergy effects is the future.”

Jörg L. Neumann, owner of Weinlabor Neumann
is the stability of the beverage. Negative turbidity – caused by protein, tannins, or crystalline tartrates – should not affect the appearance of the product. (See section on filtration.) Here, special test procedures can provide certainty and lead to clear stable products after filtration. FTIR analysis can be used to determine the health of the production goods quickly and easily. However, the interpretation of the determined data should be carried out by an experienced specialist since matrix effects can lead to irritations, explains the wine analyst. Classical microscopy is used to monitor the fermentation process. He believes that soon, smartphone application technology will bring progress for practical applications. By means of NMR analysis or GC-MS, a very precise analysis is possible. The detection limits are also shifting into a tiny range thanks to statistical calculation models, which is finding its way into food monitoring.

Wine production and process monitoring

In wine production, there are several parameters and ingredients to look out for. One example is *Brettanomyces bruxellensis* (also known as Brett). (See section on microbiological spoilage.) It is a yeast commonly found in red wine, which causes spoilage of the product. This yeast has also been isolated in other ecological niches. The deficient attributes in wine sensory are described as leather, medicinal clay, cold horse sweat and mouse urine. *B. bruxellensis* adapts well to harsh environments not often inhabited by other wine yeasts. High pH values, oxidative conditions, and a lack of hygiene in the production steps favor its development.

Progress in monitoring the manufacturing process is important. Thus, it is above all digitalization that is advancing and facilitating cooperation between the individual market and production participants. Whether data exchange during fermentation between laboratory and cellar management, demand reporting from management to the production site, or data reconciliation between crop protection and cadastre, data is determined and processed everywhere. Optimizing the ideal data streams and exploiting synergy effects is the future. In the specific case of fermentation, for example, the recording of the temperature with the sugar decrease in combination with an optical control of the active yeast cells brings a fermentation security and prevents a fermentation disturbance. Thus, the fruitiness of the wines can be improved, and a loss of quality can be avoided. The more closely the monitoring steps, the more quickly an undesirable development can be detected, explains Jörg Neumann.

Recent wine trends

Many trends are recognizable, so the wine production has changed in the last 50 years accordingly. The producers consider the taste of the consumer by offering modern, fresh wines with „drinking fun“. To ensure that the desired, upbeat, stimulating product is available in the bottle at the end, a process line with individual work steps must be followed. The product is vinified specifically for the individual customer group. “We are seeing that young consumers currently like rosé wines and that fruity white wines with effervescence are the order of the day. Wines must no longer be too heavy and overloaded. The ‘winemakers’ also like to experiment with traditional methods of preparation and the customers follow with interest. It is nice that there is something for everyone – the customer just has to make the effort to find their ideal pearl” according to the wine analyst.

Jörg Neumann adds: “Many winemakers pay special attention to the awareness towards nature. Soil and fertility are closely intertwined and protecting nature is automatically part of it.”

“Soil and fertility are closely intertwined and protecting nature is automatically part of it.”

Jörg L. Neumann, owner of Weinlabor Neumann

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Jörg L. Neumann, owner of Weinlabor Neumann
wine remains a luxury food and a cultural asset that is supported by alcohol in its flavorful totality.

Nicola Libelli, Cellarer, Dr. Bürklin-Wolf winery

personal purchase. Alcohol-reduced products are increasingly in demand and are now present on the market without any loss of quality. Mixed wine beverages are also an important trend and reflect consumer passion for local products."

Dr. Bürklin-Wolf winery, Wachenheim, Germany

The Dr. Bürklin-Wolf winery from Wachenheim manages the entire vineyard biodynamically. The self-understanding for the ecosystem vineyard is the top priority. In 2001 they started to cultivate the first vineyards biodynamically, since 2005 they practice this on the whole farm. "The most important analysis before harvest is sensory: How do the grapes taste? Is the origin recognizable? How do the seeds separate from the pulp? How does the grape skin taste? Only when this is satisfactory, the analysis in the laboratory begins by determining the pH values, the composition of the acids, etc.", explains Steffen Brahner, Managing Director of the winery Dr. Bürklin Wolf. "In wine analysis, especially in the analysis of organic wine, the main thing is to consider the tight limits in terms of sulfur. However, the winemaking process we use leads to minimal amounts of sulfur anyway and only harvests without rot are processed, the wines are already well below these by default. For us, the analysis of our soils has gained much more importance in recent years than the analysis in the wine", he added. "In our opinion, this is a key to the best qualities. Only from a healthy and optimally supplied soil can grapes for top qualities arise."

The cellarer Nicola Libelli adds: "It is observed that the demand for terroir-typical wines, especially Riesling, is increasing enormously. Customers are looking for wines capable of maturing or mature
wines that still offer drinking pleasure years later and are very much characterized by minerality rather than high alcohol levels. An increasing demand for non-alcoholic wines is also being observed. For consumers who do not want to or cannot consume alcohol, this is an alternative to fruit juice. Ultimately, however, wine remains a luxury food and a cultural asset that is supported by alcohol in its flavorful totality."

The key to sustainable winemaking

Biodynamics considers winemaking in its entirety and is essentially characterized by respect for natural cycles and understands in particular the soil as a central element of quality. By avoiding the use of synthetic pesticides and mineral fertilizers, the main objective is to strengthen the plants and make them resistant.

“We succeed in this by using various teas and preparations as well as structured work with compost and seeding to provide the soil and thus the vines with optimal care”, says Steffen Brahner. “Crucial to winemaking is that we get healthy grapes for further processing in the cellar.”

The Cellarer explains: “The peculiarity of monitoring the production process is best described as controlled idleness. Every intervention takes away something of the uniqueness of the individual wine. We have been observing this trend for many years among all top producers. Of course, improved analytical methods help us, and we also work together with regional laboratories here. However, the decisive factor is and remains sensory analysis.”

Recognizing the origins

Regarding the trend especially in taste, authentic wines with a gustatory clearly recognizable origin are in demand. Even if the winery produces almost exclusively dry Rieslings on about 90% of its area, this is ultimately the tool to bring the uniqueness of a Forster Kirchenstück or a Forster Pechstein into the bottle. Even with the basic wines, it is quite decisive that the signature or, more generally speaking, the typicality of the respective origins can be recognized.

In conclusion, the vineyard Dr. Bürklin-Wolf does not consider biodynamics to be in contradiction to doctrine, but rather as an elementary component of producing highest quality wines, ensuring the health of the soil, as well as preserving the ecosystem.

“Crucial to winemaking is that we get healthy grapes for further processing in the cellar.”

Steffen Brahner, Managing Director, Dr. Bürklin-Wolf winery
Remove the Contaminants. Preserve the taste.

The quality, taste and aroma of wine are influenced by the participation of yeasts and bacteria, which are naturally present on the grapes. Environmental factors play an important role: not only does the vineyard contain a range of yeast, bacteria and fungi, but so do the wineries in which the grapes are fermented. Therefore, the taste and quality of the wine depend on the location and the ecosystem in the vineyard. In addition, hygiene in the wine cellar and during production plays an important role. Lastly, separations are involved at numerous stages of wine preparation in order to clarify and stabilize the wine.¹

This section is designed to give you an overview of common microbiological contaminants, recent studies on how to monitor and control them, and what needs to be considered during the filtration process of wine.
Overview: Microbiological ingredients and spoilages

During the production process, various microorganisms produce different metabolic products that contribute significantly to the taste of the wine. During this fermentation process, undesirable products may be produced, and undesirable yeasts and bacteria can contribute to a bad taste; therefore, the monitoring of the microorganisms and the metabolic products is of central importance.

Yeast

Yeasts constitute a vast group of single-celled fungi that are taxonomically heterogeneous and very complex. Taking into account synonymy and physiological races (varieties of the same species), at least 4,000 names for yeasts have been used since the 19th century. However, the species of yeasts likely to be highly present in the grape and in wine, intervening as an agent of alcoholic fermentation or responsible for wine spoilage, are more limited. The main order is Saccharomycetales, to which grape and wine yeasts belong.

Due to many changes in yeast classification and nomenclature since the beginning of taxonomic studies, wine-related yeast names and their positions in the classification have often changed. This has inevitably resulted in some confusion for winemakers.

The principal yeast species involved in grape must fermentation, particularly S. cerevisiae and S. uvarum, comprise a very large number of strains with extremely varied technological properties. The yeast strains involved during winemaking influence fermentation speed, the nature and quantity of secondary products formed during alcoholic fermentation, and the aroma characteristics of the wine. The ability to differentiate between the different strains of S. cerevisiae is required for the following fields: the ecological study of wild yeasts responsible for the spontaneous fermentation of grape must, the selection of strains presenting the best enological qualities, production and marketing controls, the verification of the implantation of selected yeasts used as yeast starter, and the constitution and maintenance of wild or selected yeast collections.

In the weeks that follow the completion of alcoholic fermentation, the viable populations of S. cerevisiae drop rapidly, falling below a few hundred cells/ml. In many cases, other yeast species (spoilage yeasts) can develop in wines during bulk or bottle aging. One of the most frequent and most dangerous contaminations is due to the development of B. bruxellensis, which is responsible for serious off-odors.

Brettanomyces

Brettanomyces bruxellensis is a significant wine spoilage yeast encountered during winemaking and it can cause significant financial losses. Wine spoilage by B. bruxellensis is primarily caused by production of ethylphenols that impart medicinal [4-ethylphenol (4-EP)] or smoky/clove [4-ethylguaiacol (4-EG)] characters.

The yeast may grow in wine during production, maturation, and/or storage, and off-odours may emerge years after the wine has been bottled. Growth often occurs during the barrel maturation of wines. Prevention may be effected by the formulation of a control strategy and implementation of appropriate winemaking procedures. Treatment of affected wine prior to bottling is a two-stage process, involving removal of viable yeast cells, and reduction in the level of volatile phenols.

Lactic acid bacteria

Lactic acid bacteria are present in all grape musts, in almost all wines during the winemaking process, and sometimes in wines after several years of bottle aging. Depending on the wine’s characteristics and on the stage of the
WINEMAKING: THE SECRET OF GOOD TASTE AND HIGH QUALITY

Winemaking process, the species and strains encountered are variable and more or less abundant. Environmental conditions determine their ability to multiply. When they develop, they metabolize numerous substrates. Lactic acid bacteria therefore play an important role in the transformation of grape must into wine. Their impact on wine quality thus depends on the species and strains present, on the substrates they transform, and on the stage at which they conduct these transformations.

The lactic acid bacteria isolated from grape must and wine belong to the Lactobacillaceae family for the Lactobacillus and Pediococcus genera, and Leuconostocaceae for Leuconostoc and Oenococcus. Four parameters very distinctly determine the growth rate of lactic acid bacteria in wine: pH, temperature, alcohol content, and SO$_2$ concentration.

**Oenococcus**

*Oenococcus oeni* is the main lactic acid bacterium of interest to enology because it conducts malolactic fermentation in the great majority of spontaneous fermentations.

After inoculation in wine, various strains not only perform fermentation more or less quickly and completely but also create differences between wines at the organoleptic level. Phenotypic analyses confirm that strains differ in their ability to metabolize sugars, citric acid, and many other compounds, which have an impact on quality.

**Acetic Acid Bacteria**

Acetic acid bacteria are present on ripe grapes. The populations vary greatly, in number and species, according to grape soundness. Acetic acid bacteria are well adapted to growth in sugar-rich and alcohol-rich environments. The bacteria of this family are separated into two genera: *Acetobacter* and *Gluconobacter*. The species *G. oxydans*, *A. aceti*, and *Acetobacter pasteurianus* are the ones that are most frequently found in the course of winemaking. The three species succeed each other during winemaking.

Although possible in all genera, the characteristic metabolism of *Acetobacter* is the oxidation of ethanol into acetic acid with the highest transformation yield.

Finished wines contain around 0.3–0.5 g of volatile acidity (expressed as H$_2$SO$_4$) per liter, resulting from yeast and lactic acid bacteria metabolisms. Above this concentration, acetic acid accumulation most often comes from acetic acid bacteria; this problem is called vinegar taint. This contamination must be avoided not only because of its negative effect on wine quality but also because of the legal limits on the concentration of volatile acidity permitted in wine.

The increase of volatile acidity also depends on the wine storage method. In large-capacity tanks, the increase in volatile acidity is lower than in barrels. To avoid spoilage from acetic acid bacteria, the winemaker should first of all concentrate on winery hygiene in order to eliminate potential contamination sources for microorganisms. The population decreases slowly but inexorably during bottle aging. The total absence of subsequent oxygenation leads to the elimination of these bacteria.

Spoilage detection for winemakers

The art of winemaking is a challenging business. It can take generations to create an exceptional wine but you only have a few weeks to produce it. No errors should occur in this short phase so the wine can mature without any complications.

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Case studies: Microbiological detection methods

As was clear from the statements of wine experts in the first part of our article, precise monitoring of the wine production process plays a major role in ensuring the quality of the product. Accordingly, the development of new methods of wine analysis is a growing field of research. Here, you can find recent studies that highlight the importance of the precise determination of certain ingredients and contaminants in wine.

Volatile aroma composition and sensory profile of Shiraz and Cabernet Sauvignon wines produced with novel Metschnikowia pulcherrima yeast starter cultures

The use of non-Saccharomyces yeast strains as starter cultures for wine production has become increasingly popular, particularly due to their positive effect on wine composition, color, aroma and flavor. This article describes the characterization of the volatile aroma composition and the sensory profile of Shiraz and Cabernet Sauvignon wines produced with novel active dry yeast preparations of Metschnikowia pulcherrima compared to that of reference strains.

Winemaking treatments included an uninoculated fermentation, two reference Saccharomyces cerevisiae fermentations, and sequential fermentations inoculated with either M. pulcherrima AWRI1149 or M. pulcherrima AWRI3050 and S. cerevisiae. Amplicon-based internal transcribed spacer phylotyping was used to determine microbial population dynamics during fermentation. Wines were analyzed for volatile composition and subjected to sensory analysis. The M. pulcherrima strains survived and dominated in both grape cultivars, and produced distinctive wine volatile profiles depending on the inoculation treatment. These differences in volatiles resulted in significant differences for several sensory attributes.

Wines made with active dry yeast preparations of M. pulcherrima AWRI1149 and M. pulcherrima AWRI3050 were characterized by increased intensity of desirable sensory attributes and by low scores for negative descriptors. This work provides winemakers with additional yeast preparations that can shape sensory profile and wine style.


Effect of malolactic fermentation and ageing on the concentration of ρ-coumaric acid of Pinot Noir wine and the consequence for volatile phenol production by Brettanomyces

This study compared changes in the concentration of ρ-coumaric acid in wine because of enzymatic hydrolysis of ρ-coutaric acid by Oenococcus oeni with that of chemical hydrolysis during ageing.

Malolactic fermentation of a Pinot Noir wine with a cinnamoyl esterase-positive (CE+) O. oeni strain resulted in a significant increase in ρ-coumaric acid concentration. No significant change in ρ-coumaric acid concentration occurred during ageing regardless of wine pH, ethanol concentration or storage temperature. Brettanomyces bruxellensis produced a significantly higher concentration of volatile phenols in wines that underwent malolactic fermentation with the CE (+) O. oeni strain than with the CE (−) strain.

The O. oeni strain had significantly more impact on wine ρ-coumaric acid concentration than chemical hydrolysis during ageing. The use of CE (+) O. oeni strains should be avoided in wines at risk of Brettanomyces spoilage because of an increase in the concentration of the volatile phenol precursor, ρ-coumaric acid.

Nutrient Pad Sets

Total colony count

- **Caso**: Mixed culture from river water
- **R2A**: Mixed culture from river water
- **Standard TTC**: Mixed culture from well water
- **MRS**: Mixed culture from river water
- **TGE**: Mixed culture from natural water
- **Yeast Extract**: Yeasts and molds from cough syrup

E. coli and coliforms, Enterobacteria

- **Escherichia coli**: Mixed culture from river water
- **Enterococci**: Enterococcus faecalis

Non-faecal, pathogenic bacteria

- **Pseudomonas aeruginosa**: Mixed culture from sewage
- **Staphylococcus aureus**: Chapman

Other faecal bacteria

- **Bismuth Sulfite**: Salmonella typhi, shigella
- **MacConkey**: Escherichia coli

Product Spoiling Microorganisms

- **Glucose Trypsone**: Bacillus subtilis
- **Jus de Tomate**: Yeasts and molds from sewage

Yeasts and molds

- **Malt Extract**: Mixed culture from sewage
- **Sabouraud**: Mixed culture from sewage
- **m Green yeast and mold**: Yeasts and molds from sewage
- **Wort**: Yeasts and molds from sewage

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*These NPS types are suitable for the determination of the mentioned microorganisms, although the media are not explicitly declared in references.

In particular cases, color and shape of the colonies could vary from the expected habitus. Further tests may be necessary to validate the results.

The description of the typical results or any pictures show typical appearance of the mentioned microorganisms.
### Typical Application Examples

<table>
<thead>
<tr>
<th>Product</th>
<th>Detection and enumeration of</th>
<th>Nutrient Pad type</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Beer</strong></td>
<td>Lactobacilli and Pediococci and other beer spoiling organisms</td>
<td>VLB-S-7-5, Raka Ray, Wallenstein Differential, NBB</td>
</tr>
<tr>
<td></td>
<td>Total colony count</td>
<td>Standard, Standard TTC,</td>
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<td></td>
<td>Wild yeasts</td>
<td>Yeast &amp; Mold (&gt; Copper)</td>
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<tr>
<td></td>
<td>Yeasts and molds</td>
<td>Malt Extract*, Wallenstein Nutrient, Wort</td>
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<tr>
<td><strong>Diary products</strong></td>
<td>Lactobacilli</td>
<td></td>
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<td></td>
<td></td>
<td>MRS</td>
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<tr>
<td><strong>Foods</strong></td>
<td>Acid-tolerant microorganisms</td>
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<td></td>
<td>Enterobacteria, E. coli and coliforms</td>
<td>CHROMOCULT**, Endo, (MacConkey), m FC, Tergitol TTC</td>
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<tr>
<td></td>
<td>Enterococci, Enterococcus faecalis</td>
<td>Azide</td>
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<tr>
<td></td>
<td>Lactobacilli</td>
<td></td>
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<td></td>
<td>Pseudomonas aeruginosa</td>
<td>Cebrimide</td>
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<td></td>
<td>Salmonellae</td>
<td>Bismuth Sulfite</td>
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<tr>
<td></td>
<td>Staphylococci, Staphylococcus aureus</td>
<td>Chapman</td>
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<td></td>
<td>Thermophilic spore formers and mesophilic bacteria</td>
<td></td>
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<tr>
<td></td>
<td>Total colony count</td>
<td>Caso, Standard, Standard TTC, TGE</td>
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<tr>
<td></td>
<td>Yeasts and molds</td>
<td>Malt Extract, Wort</td>
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<tr>
<td><strong>Food and Beverages</strong></td>
<td>Lactobacilli</td>
<td></td>
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<td></td>
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<td>MRS</td>
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<tr>
<td><strong>Fruit juice</strong></td>
<td>Enterobacteria, E. coli and coliforms</td>
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<td></td>
<td>Oenococcus and other product spoiling organisms</td>
<td>Jus de Tomate</td>
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<td></td>
<td>Lactobacilli</td>
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<td><strong>Milk</strong></td>
<td>E. coli and coliforms</td>
<td>Endo</td>
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<td></td>
<td>Enterococci, Enterococcus faecalis</td>
<td>Azide</td>
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<td></td>
<td>Salmonellae</td>
<td>Bismuth Sulfite</td>
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<tr>
<td><strong>Pharmaceuticals, WFI, raw materials, and cosmetics</strong></td>
<td>Enterobacteria, E. coli</td>
<td>MacConkey</td>
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<tr>
<td></td>
<td>Enterococci, Enterococcus faecalis</td>
<td>Azide</td>
</tr>
<tr>
<td></td>
<td>Pseudomonas aeruginosa</td>
<td>Cebrimide (cosmetics only)</td>
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<tr>
<td></td>
<td>Salmonellae</td>
<td>Bismuth Sulfite</td>
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<tr>
<td></td>
<td>Staphylococci, Staphylococcus aureus</td>
<td>Chapman</td>
</tr>
<tr>
<td></td>
<td>Total colony count</td>
<td>Caso, R2A</td>
</tr>
<tr>
<td></td>
<td>Yeasts and molds</td>
<td>Malt Extract, m Green yeast and mold</td>
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<td><strong>Soft drinks, concentrates</strong></td>
<td>Acid-tolerant microorganisms, Lactic-acid bacteria</td>
<td>Orange Serum, VLB-S-7-5</td>
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<td></td>
<td>Enterobacteria, E. coli and coliforms</td>
<td>Endo, MacConkey</td>
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<td>Lactobacilli</td>
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<td>MRS</td>
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<td>Thermophilic spore formers and mesophilic bacteria</td>
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<td></td>
<td>Yeasts and molds</td>
<td>Malt Extract, m Green yeast and mold</td>
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<td><strong>Sugar, sugar products</strong></td>
<td>E. coli and coliforms</td>
<td>Endo</td>
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<td></td>
<td>Thermophilic spore formers and mesophilic bacteria</td>
<td>Glucose Tryptone</td>
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<td></td>
<td>Yeasts and molds</td>
<td>Malt Extract*, Schaufus Pottinger</td>
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<td><strong>Water</strong></td>
<td>Acid-tolerant microorganisms, Lactic-acid bacteria</td>
<td>Orange Serum</td>
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<td>(general quality), mineral water, natural water, waste water</td>
<td>Enterobacteria, E. coli and coliforms</td>
<td>Chromogenic Coliform (DIN EN ISO 9308-1), CHROMOCULT**, Endo, (MacConkey), m FC, Tergitol TTC</td>
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<tr>
<td></td>
<td>Enterococci, Enterococcus faecalis</td>
<td>Azide</td>
</tr>
<tr>
<td></td>
<td>Pseudomonas aeruginosa</td>
<td>Cebrimide</td>
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<td>Total colony count</td>
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<td></td>
<td>Yeasts and molds</td>
<td>Malt Extract, m Green yeast and mold</td>
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<tr>
<td><strong>Wine</strong></td>
<td>Acetobacter</td>
<td>Orange Serum, Wort (both wetted with 5-8% ethanol)</td>
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<td>Acid-tolerant microorganisms, Lactic-acid bacteria</td>
<td>Orange Serum</td>
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<td>Lactobacilli</td>
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<td>MRS</td>
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<td>Oenococcus and other wine spoiling microorgan</td>
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In particular cases, colonies of the colonies could vary from the expected habitus. Further tests may be necessary to validate the result. Sartorius Steadim Biotech shall not be liable for consequential and / or incidental damage sustained by any customer from the use of its products. Nutrient Pad Sets (NPS) are subject to continuous product improvement as part of our product development program to align our products with changing application requirements.

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Wine filtration

Separations are involved at numerous stages of wine preparation: must clarification, barrel racking, and wine clarification and stabilization. To avoid any organoleptic impact on wine, proper filtration conditions must be achieved by knowing the product and thus choosing the right type of filtration, filter medium, and operating procedures. However, several studies show that filtration may reduce the concentration of certain compounds and may cause a temporary change of certain colloids. In fact, the wine should not be tasted right after filtration because the colloidal arrangement may be changed. Samples must be conserved for several days to several weeks in order to determine whether the filtration conducted has had a positive or negative effect on wine.

How to retain the body

Arriagada-Carrazana et al. conducted a study on the effects of filtration (physicochemical and organoleptic characteristics) on Cabernet Sauvignon wines with 0.65-μm polyvinylidene fluoride (PVDF) membranes. Results show there is a significant effect on chemical compounds (4.8% tannin concentration decrease and 2.4% anthocyanin decrease). As for aroma compounds, there is a significant reduction of 12 out of the 120 compounds analyzed. These results show the importance of having full knowledge regarding filtration phenomena in order to avoid any harmful effects. The main criticism is that filtration takes the body out of wines. In reality, these criticisms are excessive and should be taken with a grain of salt. Proper filtration of a correctly prepared wine with well-prepared and well-sterilized equipment has positive qualitative effects and conserves the organoleptic qualities of wine. In such cases, the previously noted differences are not necessarily found in sensory analyses, and distinctions found via triangle tests are thus not always confirmed. Good filtration also depends on the winemaking techniques used, varieties, vintages, and filtration techniques.

Most common filtration methods

There are several types of filtration, using different filter media mounted on appropriate equipment. We can thus distinguish between direct- or perpendicular-flow (dead-end) filtration through a mass (precoat, sheets), direct-flow surface filtration (membrane cartridges), and tangential filtration on membranes. Filtration using filter aids (diatomaceous earth, perlite, cellulose) is done “in depth” through a porous layer. The filter medium retains solid particles. Filter aids (known as filter earth in wineries) and sheets must be disposed of as special industrial waste because these materials cannot be regenerated after use. Filtration without aids (direct-flow filtration on membranes or tangential filtration) is done by steric retention on the membrane surface. The filter material can thus be regenerated.

The following are used in winemaking:

1. Filtration through a diatomaceous earth (kieselguhr), perlite, and/or cellulose precoat formed by continuous accretion.
2. Filtration through cellulose sheets or lenticular modules. These are permeable plates consisting of cellulose fibers with incorporated granular components (diatomaceous earth, perlite, cation resins, polyethylene fibers, etc.).
3. Clarification: Tangential (or crossflow) filtration through inorganic or organic membranes, and/or with Jumbo Star Technology.

See also Vinosart® PS.2

Clear, bright, chemically and biologically stable – and tasty – wine

For this, all wines rely on filtration. Don’t let contaminants affect the quality of your wine. Contaminants that can significantly impact your wine’s quality include:

- Crystals
- Treatment residues
- Organic aggregates
- Bacteria and yeast

Cartridges designed so that filtration doesn’t affect the body, sealed systems that exclude any contact with oxygen:

find out more about the wine filtration solutions from Sartorius.

CLICK HERE for more information
4. Dead-end filtration through synthetic polymer membranes, with calibrated pores.

Unlike the standard clarification technique with direct flow, the liquid flows parallel to the filter surface in tangential filtration, thus minimizing clogging. An untreated wine is not usually perfectly clarified in a single operation—only tangential filtration is capable of achieving this result. Filtration through fine filter media leads to rapid clogging, whereas, if the medium is too coarse, all the particles are not removed. Each filtering operation fits into an overall clarification strategy, including the other techniques that contribute toward ensuring total clarity (spontaneous sedimentation, fining, centrifugation, etc.). Wines that are barrel aged for several months, or even years, have fairly low turbidity by the time they are bottled but are still often capable of causing significant clogging. A single-sheet filtration is generally sufficient. In the case of great red wines, some winemakers take the risk of not filtering at all. Their reservations about this technique, which is alleged to make wine taste thinner, are probably excessive.

Wines that are bottled relatively young are subjected to a greater number of clarification operations. Wine may be filtered through a diatomaceous earth precoat one or more times to prepare it for bottling. Sheet, lenticular module, or possibly membrane filtration is used, resulting in low microbe levels or even totally sterile wines. All these operations are not always necessary. Clarification techniques should be adapted to each wine and kept to a minimum.

Assessing clarification quality

The effectiveness of filtration processes may be assessed by measuring various parameters indicative of clarity, such as defining the quantity of particles, the turbidity, and microbiological contaminations. Turbidity is measured by evaluating the disturbance in the diffusion of light caused by contact with particles in a liquid. A turbidimeter measures the intensity of the diffused light. A turbidimeter that makes measurements at a 90° angle is also known as a nephelometer. These apparatuses are calibrated in nephelometric turbidity units.

Microbiological analyses are essential, not only as they provide a good assessment of the effectiveness of clarification but also due to the fact that residual yeast and bacteria are likely to affect biological stability. The total number of microorganisms was formerly counted under a microscope using a counting chamber (Malassez cell) either directly, if the population is sufficiently large, or after concentration by centrifugation. If centrifugation is used, the technique is rather long and imprecise.

Literature