Sparkling Wines

Effervescence, a winning strategy

IOC

Révélons votre différence

Before secondary fermentation

What is secondary fermentation (*prise de mousse*) ?

The main aim of secondary fermentation is to obtain a sparkling wine with about 6 bar of pressure at 10°C.

At the start of secondary fermentation, an initial concentration of 1-2 million live yeast cells per millilitre of wine must break down some 24 g/L of sugar. This consumption of sugar is accompanied by an increase in alcohol level of 1.2 to 1.4% by volume, with a final concentration of carbon dioxide of 10 to 12 g/L.

The art of effervescence lies entirely in preparation. Every step towards the desired nature of the finished product must be thought out and planned. The preceding steps, i.e., the making of the base wine and the preparation of the yeast culture, are thus just as important as the secondary fermentation itself and the thereafter procedures.

The base wine

Base wines are usually made from dry white wines but also with rosé or even red wines. For a successful secondary fermentation, various conditions must be met :
- pH > 2.9
- Free SO_2 < 15 mg/L
- Temperature > 10°C.

The initial quantity of CO_2 in the wine may also cause greater or lesser problems with secondary fermentation.

A malolactic fermentation stage may also be used in order to de-acidify the wine and stabilise it in terms of micro-biological contamination. This step is not obligatory but, in the absence of malolactic fermentation, careful work in the winery and impeccable filtration will be necessary to guarantee the absence of any spontaneous initiation of any such fermentation within the bottles.

In the case of potentially unstable wines, suitable finings must be used, followed by tartrate stabilisation in order to prevent the crystallisation of potassium bitartrate or calcium tartrate, as these may cause serious problems later during disgorgement.

In the great majority of cases, careful filtration may be carried out after stabilisation in order to ensure the wine's perfect clarity. During the stabilisation-filtration stages, one must take care to minimise oxygen exposure since this would potentially have an invasive and sometimes negative effect.

We can provide a yeast culture plan.

Ask your oenology adviser for details.

The yeast culture

The aim of this step is to acclimatise the yeasts gradually to the actual conditions they will meet during bottling.
As a guide, here are some values for a base wine compared to the ideal conditions for yeast growth.

Parameter	Wine	Ideal situation
temperature °C	11 - 15	25 - 30
Free SO_2	5 - 15	0
alcohol % vol	11 - 11,5	0
pH	3,0 - 3,2	5 - 6

From B. Duteurtre (2011)

The preparation of the yeast culture (also just called the culture) is therefore considered to be a critical step in the success of the secondary fermentation. The selection of a yeast strain intended for secondary fermentation is fundamental.

IOC offers a selection of special secondary fermentation yeasts to match the chosen method and wine desired.
The yeast culture is prepared in several phases:
Phase 1 is the rehydration and protection of the yeasts (with HYDRA PC). Next, the 'yeast starter' phase, lasting 12 to 24 hours helps acclimatise the yeasts to the alcohol.
Lastly, the so-called 'multiplication' phase, lasting around 3 days, helps the culture to propagate in order to obtain an active fermentation, sufficiently concentrated, at the time of bottling. For example, the use at 3% of a yeast culture containing 50 million live yeasts per millilitre of yeast culture at the end of the multiplication phase will help to achieve 1.5 million live yeasts per millilitre of wine after bottling.

A few key steps towards success with sparkling wines

The liqueurs

Bottling liqueur (liqueur de tirage)

This liqueur may be made from a base wine with added cane sugar, beet sugar or MCR (rectified must concentrate = SUCRAISIN MCR LIQUEUR).

When preparing the liqueur, its exact concentration must be known in order to calculate precisely the quantity to be added during racking. The alcoholic fermentation of 4g of sugar liberates a quantity of CO_2 yielding a pressure of 1 bar at 10°C. With the Traditional Method, a few centilitres of liqueur are needed for every bottle, hence the importance of measuring the liqueur's concentration as well as being accurate in its introduction.

IOC's wine consultants are available to advise on the preparation of liqueurs de tirage and d'expedition.

Dosage liqueur (liqueur d'expedition)

Besides the physical conditions, the quality of the product depends heavily on the attention paid to the preparation of the dosage liqueur.

This liqueur may be made with cane or beet sugar dissolved in the base wine or, perhaps, in reserve wines. As with the racking liqueur, SUCRAISIN MCR LIQUEUR may be used on its own. The addition of winemaking products helps to refine a sparkling wine and increase its harmonies (TANIN CAS, VOLUTAN etc) or perhaps correct some defect (SULFITAMINE, SOLUTION 700, etc).

It is essential to remember that this stage is the last one in which the wine-maker can intervene in order to adjust the wine to meet customer requirements. After this stage, any defects can no longer be compensated for.

With its specific expertise and custom-made audits, IOC can help customers take steps to control oxygen levels, from the grape harvest through to bottling.

Please contact your expert wine adviser for further information.

Techniques for the traditional method

Tartrate stabilisation

Conventional tartrate stabilisation treatments, using electro-dialysis or refrigeration, are popular but expensive. Cellulose gum or CMC (carboxymethylcellulose) may be used as an alternative for tartrate stabilisation in wine. Its working properties are probably linked to its being deposited on some of the facets of the crystals as they form, effectively preventing further formation.

IOC recommends INOSTAB for tartrate stabilisation.

The stabilisation of calcium tartrate and potassium bitartrate can also be done in one step using DUOSTAB.

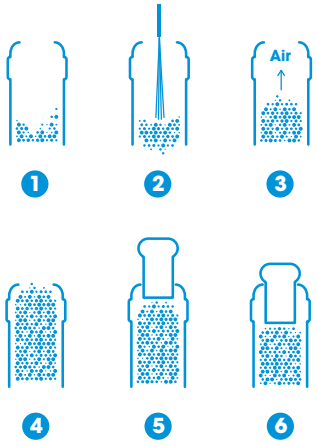
Jetting : MO_2D

Wines need oxygen but this can be harmful if not controlled. It has been shown, moreover, that disgorgement can bring about exposure to oxygen.

When disgorging, we recommend the use of our 'jetting' technique, 'MO_2D'. A very thin jet of sulphited water, or wine, is squirted into the neck of the bottle in order to make the wine foam. As it rises, the foam acts like a piston that forces out the air present in the bottle's neck.

When this is done just before final corking, we have measured levels of dissolved oxygen of around 0.2 ppm, although, for production line disgorgement working ideally, they are usually between 1 and more than 5 ppm.

Besides effective control over oxygen levels, this system provides excellent qualitative uniformity for the wine.



D'après M. Brévot et al. (2007)

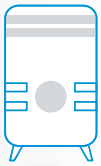
Traditional Method

RIDDLING AIDS

BASE WINE

Base wines intended for secondary fermentation must be high-quality and respect many physical, chemical and flavour criteria.

See § ' Base wine preparation '



CLARIFIANT S
+ PHOSPHATE MAZURE
or CLARIFIANT XL
or INOCLAIR 2

+ PH

BOTTLING

The wine is bottled together with the racking solution (liqueur de tirage) consisting of the yeast culture, sugar, riddling aids and fermentation starters. Secondary fermentation takes place at 12-15°C over 6 to 8 weeks.

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3 to 5% ye
See § ' Yea

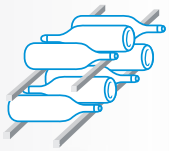
CHOICE OF CAP

The choice of cap used during ageing is important. By varying the cap's oxygen permeability, it is possible to adjust a wine's nature towards rapid maturation or one that keeps its freshness and fruitiness longer.

IOCAPS O or IOCAPS Y

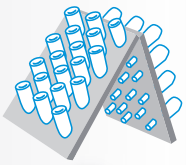
AGEING

During this stage, the lees consist mainly of yeasts in the form of a deposit. Autolysis of the yeast helps improve the wines sensorial features (aroma, volume, etc).



RIDDLING

Riddling helps to collect the sediments in the neck of the bottle. This stage affects the quality of the finished product by helping to obtain a brilliant clear wine, perfectly separated from its lees. Ideally, plan for testing before riddling.

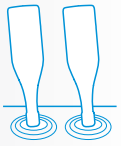


DOSAGE

+ other w

DISGORGING

The neck of the bottle is plunged into brine at -25°C, or mono-propylene glycol at -30°C, in order to form an ice plug. On opening, internal pressure helps eject this plug. As above, prior testing should be planned.



DOSAGE AND LABELLING

A dosage liqueur (liqueur d'expedition) is now added to the wine. The amount of liqueur depends on the desired wine type. It is essential to carry out tests for dosage. This stage plays a major part in the quality of the final product. The bottles are then corked, caged and labelled.

See § « liqueur d'expédition »

Expedition

Charmat method

ACTIVATOR

EXTRA PM

SOLUTION ST
OSPHATES TITRÉS

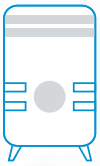
ee § « liqueur
de tirage »

ast culture prepared
st culture preparation '

MIXTION

See § « liqueur
d'expédition »

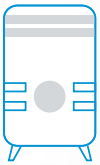
SUCRAISIN
ine-making products



Base wines intended for secondary fermentation must be high-quality and respect many physical, chemical and flavour criteria.

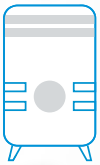
See § ' Base wine preparation '

BASE WINE



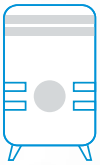
Secondary fermentation is achieved by adding yeast culture, sugar and a fermentation starter within a pressure resistant tank. It generally takes place at 12-25˚C over approximately 10 days.

RACKING



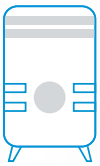
Ageing is not always practised. Where it is, it takes place in a tank fitted with an agitator and the duration depends on the character of the sparkling wine desired.

AGEING



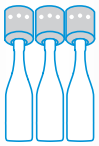
Stabilisation by refrigeration at – 2°C, where carried out, may either be on the base wine or at this stage. The wine is filtered at low temperatures …

STABILISATION
FILTRATION



… and then transferred, under pressure, to a buffer tank, thus preserving the dissolved carbon dioxide. The dosage liqueur is now added to the tank. Its nature and quantities need to be tested to match the type of wine desired.

DOSAGE



Bottling is carried out at the same pressure.

BOTTLING

The bottles are then corked, caged and labelled.

LABELLING

Expedition

FAQ

Why make up a yeast culture when simple rehydration is enough for alcoholic fermentation?

Secondary fermentation is very similar to alcoholic fermentation. There are, however, several points of difference :

Secondary fermentation is re-fermentation. The base wine, with its 11% alcohol by volume, its low pH and SO_2 content is more hostile to the yeasts than grape must.

Secondary fermentation happens in a closed bottle and not in an open tank like alcoholic fermentation. The presence of CO_2 and presure prevents yeast growth.

This is why it is important to acclimatise the yeasts by preparing a yeast culture in several stages.

How much yeast should I add for a successful secondary fermentation?

Yeast starting takes place on the basis of 1 to 2 millions of live cells per mL. The multiplication of yeasts is strongly limited by the various factors that typify the wine. Where these conditions are particularly difficult, we recommend increasing the quantity of starter culture up to 3 million live cells per mL in order to compensate for the absence of cellular multiplication and to prevent difficulties at the end of secondary fermentation. By following IOC's plan, a 3 to 5% yeast starter culture can result in a cellular concentration that is sufficient for complete secondary fermentation.

What are the factors that effect secondary fermentation?

In addition to alcohol levels and pH, one must allow for the quantity of SO_2 present in the wine or, more accurately, the free SO_2. Generally, wines are adequately protected at a level of 10 mg/L of free SO_2, with no significant inhibition of the yeasts' activity. Beyond this, there is possible risk of inhibition. Temperature also plays an important role. Secondary fermentation is hard to achieve below 10°C. Using the Traditional Method, above 20°C, the number of yeasts will be so large that the deposit will be hard to remove. Furthermore, initial CO_2 levels in the racked wine may upset secondary fermentation. An initial pressure of 0.2 bar, corresponding to a CO_2 concentration of 0.4 g/L, will reduce cellular growth by 40% when compared with a de-carbonated wine.

The wine's conditions were correct and I prepared a yeast culture but secondary fermentation was incomplete. Why?

Where the wine conditions are within acceptable limits but at the extremes, secondary fermentation can be difficult. This is due to the combined effect of various factors that will sometimes lead to an arrested secondary fermentation. To achieve full secondary fermentation, we need to avoid extreme conditions, both individually and, above all, simultaneously.

Other factors, e.g., pesticide residues, may adversely affect secondary fermentation.

Why should one add SOLUTION ST to the racking liquor?

When added before racking, SOLUTION ST provides greater structure for the wine. In addition, the presence of copper sulphates prevents the appearance of reduction taints, which are a recurrent problem in wine-making. The causes of such reduction are many and the reduction taints are generally described in terms of sulphur, rubber, rotten eggs, etc. Where reduction taints are found, they may be corrected with NETAROM or NETAROM EXTRA.

How can one achieve effective riddling?

Even where practically totally automated, this operation is no less fraught. Beyond the riddling itself, the finings added to the base wine are important. We strongly recommend the use of FISHANGEL, INOCOLLE or CRISTALLINE when adding finings to base wines intended to produce sparkling wines. The filtration stage must also be carried out with care. Depending on the wine concerned, IOC's wine experts can advise on the various riddling aids to introduce into the liqueur de tirage for successful riddling later.

Is it true that the smallness of the bubbles has a relationship to the quality of a sparkling wine?

Many people believe that the smallness of the bubbles is a gauge of quality. In fact, small bubbles are often found in the best wines because these have been selected for longer storage times. It can be shown that long storage increases the loss of CO_2 through the cap. The smallness of the bubbles is not therefore linked to the wine's intrinsic quality but to its length of storage.

Other factors may be involved, such as the height of the tasting glass. In essence, the bubbles form at the bottom of the glass and increase in size as they rise. Similarly, the amount of sugar has an effect on the bubbles' size, so some cellars use a lesser amount of sugar before bottling in order to achieve a smaller bubble size.

Institut Œnologique de Champagne

Adresse siège social :
ZI de Mardeuil - 1 rue du Pré Bréda
51530 MARDEUIL

Adresse postale :
ZI de Mardeuil - Allée de Cumières
BP 25 - 51201 EPERNAY Cedex France

Tél +33 (0)3 26 51 96 00
Fax +33 (0)3 26 51 02 20
ioc@ioc.eu.com

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