Why use **commercial Malolactic starter cultures?**

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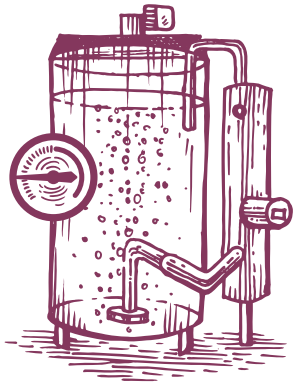
There are 2 main stages of **fermentation** during the winemaking process.



1. The first is **Alcoholic fermentation**
   This is where the yeast cultures convert the natural grape sugars into alcohol and CO_2.

2. The second is **Malolactic fermentation** (MLF).
   MLF is the process by which bacteria convert malic acid into lactic acid and CO_2. These lactic acid-producing bacteria (LAB) can include *Oenococcus oeni* and other species of *Pediococcus* and *Lactobacillus*. Malolactic conversion happens after OR during yeast fermentation (primary fermentation), which is why it's sometimes called secondary fermentation.

Why do **Malolactic** fermentation?
The **3 main purposes** of MLF:

1 **DEACIDIFICATION**
(acid reduction)
The conversion of malic acid into lactic acid and CO_2.

2 **FLAVOUR**
(modification/improvement of the aroma profile)

For a **richer bouquet**.

- This includes attributes such as buttery and nutty.
- Traits of honey, vanilla, leather, spice and smoother tannins.
- Malolactic fermentation tends to create a rounder, fuller mouthfeel. (*Malic acid is typically associated with the taste of green apples, while lactic acid gives a richer, more buttery taste.)*

3 **MICROBIAL STABILITY**
(for microbial stabilisation and sensory improvement)

This is due to the conversion of L-malic acid into L-Lactic acid and nutrient depletion (remove carbon source).

Timing of the **inoculation:**
sequential inoculation vs co-inoculation

SEQUENTIAL INOCULATION

- **Yeast produces nutrients for LAB** - due to lysis of dead yeast cells.
- Avoids possible production of acetic and lactic acid.
- Prevents interactions between yeast and LAB.
- More traditional **buttery flavour** due to higher diacetyl production, which may be favourable in certain wine styles such as Californian Chardonnay.

CO-INOCULATION

- **More favourable conditions** - lower SO_2 and ethanol levels and higher temperature due to yeast fermentation.
- **Improves the efficiency of MLF** allowing the wine to be packaged much sooner.
- **Enhance aroma** complexity - more fruity wines.
- Reduce chances of biogenic amine production.
- **Reduce colour loss** and bitterness and astringency perception in wine.
- Some metabolites produced by yeast can promote LAB growth and performance.
- *Non-Saccharomyces* yeasts have recently been found to produce secondary metabolites during the MLF process which improved wine quality and **increased the final flavour and texture** of the wine.
- **Early completion**, less oxidised wines - wine more protected due to earlier addition of SO_2.

Why use **selected cultures** of Malolactic Fermentation?

Winemakers are starting to recognise the **benefits of inoculating grape must or wine with commercial starter cultures** of LAB to ensure the successful completion of MLF and to reduce the risks associated with spontaneous MLF.

- It improves the malolactic fermentation process.
- It enhances the quality and safety of the wine.
- Wines that have completed a controlled MLF are described as: buttery, nutty, yeasty, honey, vanilla, spicy, toasty and fruity.
- The winemaker can determine the precise timing of the inoculation.
- The winemaker has more control and can time the MLF to be early in the market which can often be a great advantage.
- They can be co-inoculated (24 hrs after the initiation of alcoholic fermentation) OR do sequential inoculation (after alcoholic fermentation). The co-inoculated starter culture will complete MLF during alcoholic fermentation.

Why not just do spontaneous MLF during winemaking?

It can delay MLF and put the wine at risk:

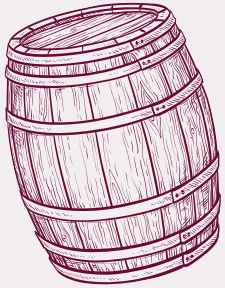
- Produce unpleasant odours.
- Produce biogenic amines.
- And too much volatile acidity.

It is frequently **unpredictable** and **can take a long time to complete.**

Wines that have undergone uncontrolled MLF are described as: **intense lactic aroma, acid yogurt, rancid, sweaty, acetic, intense bitterness and animal notes.**

Spontaneous malolactic ferments (sometimes called 'wild') have the potential to **produce more diacetyl** than inoculated ferments, due to the lower initial populations during the lag phase, with inoculated ferments usually having high numbers.

Wine stored in barrels in the cellar during the winter will often have a very prolonged MLF due to the cool cellar temperatures, this can cause **wines to be released much later to the market.**



Examples of other "problems" due to wild MLF:

- Acrolein (produced by degrading glycerol) and mannitol (due to metabolising fructose) taint.
- Ropiness (cottony mycelium-like growth).
- Mousiness (aroma like rodent droppings) and geranium (synthesize from sorbate) taint.
- Tourne (degradation of tartaric acid).
- Ethyl carbamate precursors and biogenic amines.

These are reasons why we recommend greater control of the process by using a commercial malolactic starter culture.

Recent research has revealed that some **Pediococcus and Lactobacillus do not taint wine** and **may even enhance its quality**.

As a result, using these strains to induce MLF increased the variety of MLF starter cultures and led to the production of more distinctive wines.

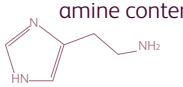
Therefore, some of these strains are extremely suitable to work in these 'Global Warming' conditions.

The Global Warming challenges

How does Global Warming change/affect wine?

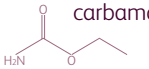
Global Warming is causing increases in pH and ethanol levels, but this can lead to many other issues such as:

- Proliferation of spoilage microorganisms
- Increased biogenic amine content



- Inhibition to native favourable organisms eg. MLF bacteria
- Sluggish or stagnant MLF

- Loss of colour in wine
- Changes in taste and aroma
- Adds astringency, masks ester aroma
- Increased ethyl carbamate content



In summary: Why use commercial Malolactic starter cultures?

Using starter cultures of LAB to ensure successful completion of MLF has many benefits to the wine but also to the winemaker. The main benefits are:

- It improves the overall MLF process.
- Improves flavour and stability of wine.
- Winemakers have more control over timings of inoculation and release to market.
- Much more reliable and effective than wild MLF.
- Many selected malolactic starter cultures work well in the challenging conditions presented by Global Warming.

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