Why use **commercial yeast** for **biological acidification**?

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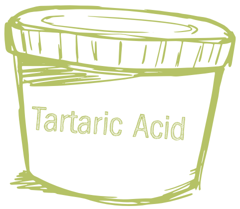
Acidification of wine



Acid management of wine has become problematic over the last few years because of climate change. Some wine regions located in warmer viticulture areas traditionally showed low acidity, while other viticulture regions previously considered more moderate climates are now starting to suffer from a lack of acidity.

This lack of acidity can significantly impact several important factors, as both the acidity and pH of wine play crucial roles in various equilibriums. Indeed, lower acidity and higher pH levels alter key wine parameters, **such as**:

- Free and molecular sulphur dioxide availability
- Colour
- Sensory aspects

Different acidification methods are allowed by the OIV:

- **Chemical acidification** being one of the most common.
- **Physical acidification** (ion exchange resins and electrodialysis treatments)
- **Microbiological acidification**.

Adding organic acids to wine to reduce its pH has become a common practice. However, controlling this pH reduction can be challenging, and there are several adverse effects and difficulties associated with using organic acids.

These include:

- Tartaric acid precipitation
- Risk of secondary malolactic fermentation if malic acid is used
- Limited availability and increased cost of tartaric acid in reduced global vintages

Environmental Considerations

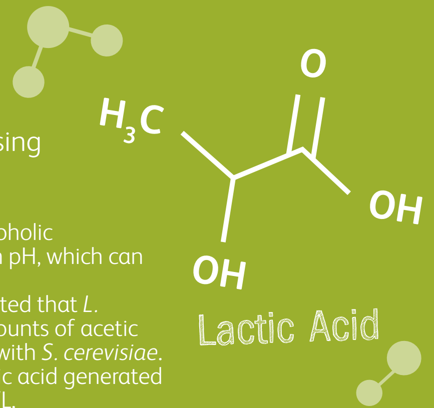
Furthermore, the use of ion exchange resins requires a significant amount of water, and the resulting effluents must be treated and recycled as special waste. This makes the technology costly and environmentally unsustainable. Electrodialysis is also associated with significant water consumption.

Biological acidification

Recently, winemakers have started to experiment with biological acidification by using commercial yeast products such as *Lachancea thermotolerans* yeast strains.

Examples of trials on white wines from warm areas show that the use of *L. thermotolerans* can effectively reduce pH while also **improving the freshness and aromatic** profiles of the wines. This is due to its ability to raise the final concentration of lactic acid in wine by several grams per litre, **significantly influencing its acidity and pH**. *L. thermotolerans* has an acidifying capacity on average of 1 to 9 g/L in lactic acid and 1 to 6 g/L in total acidity.

The lactic acid produced during alcoholic fermentation induces a reduction in pH, which can vary from 0.1 to 0.5 units.
Various scientific studies have reported that *L. thermotolerans* produces lower amounts of acetic acid than control wines fermented with *S. cerevisiae*. Typically, the concentration of acetic acid generated by *L. thermotolerans* is below 0.2 g/L.



Lactic Acid

Additional Benefits:

L. thermotolerans Benefits for Wine Production

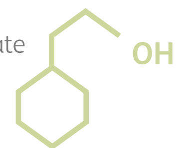
1 Enhanced Sensory Experience:

- Improved mouthfeel
- Enhanced floral notes, fruitiness, and freshness

2 Aroma and Flavour Contributions:

Fermentation-derived metabolites such as:

- 2-Phenylethanol
- 2-Phenylethyl acetate
- Ethyl lactate



3 Varietal Aroma Enhancement:

- Production of enzymes like β-glucosidases and β-lyases
- Modulation of monoterpenes and thiols release

4 Lower Alcohol Content:

- Channelling carbon into lactic acid production
- Potential to reduce alcohol by up to 0.8 % v/v

Current and **Previous Names**:

Lachancea thermotolerans is the type species of the genus *Lachancea*, which was proposed and validated in 2003. Prior to that, this species had carried various designations including *Zygosaccharomyces thermotolerans*, *Saccharomyces thermotolerans* and *Kluyveromyces thermotolerans*.

Key Information

about *Lachancea thermotolerans* strains

Strains of L. thermotolerans have been widely described as moderate fermenters in terms of alcohol resistance, able to produce 5 – 10 % v/v ethanol, but mostly unable to entirely ferment grape must to dryness.

Most strains can tolerate up to 7 % v/v ethanol and standard SO_2 levels (25 – 50 mg/L) typically used in winemaking, while a few show tolerance to higher levels of 8 – 10 % v/v ethanol. The diversion of pyruvate to lactic acid can reduce the final ethanol levels in wine by 0.3 – 1 % v/v. **This may be useful for wines that need a decrease in ethanol to reduce both heat in the palate and the overall alcohol content of the final wine**.

Although *L. thermotolerans* can ferment both glucose and fructose, all strains display a glucophilic character and can produce lactic acid, which is derived from pyruvate in the yeast glycolytic pathway. The lactic acid is produced in the early stages of fermentation and can lead to reduction in pH by up to 0.5 units. **The pH reduction improves wine colour intensity and stability by increasing the molecular SO_2.**

In summary: Why use commercial yeast for biological acidification?

It is a **more natural, softer** method of acidification than physical acidification methods.

Lactic acid is a softer, more rounded and stable acid, generating a **more stable** wine with **greatly enhanced mouthfeel** and **sensory profile**.

Cellars experience **considerable savings** on tartaric acid cost, as well as **reducing warehouse space** required for pallets of tartaric acid.

It can **reduce energy costs** by not using electrodialysis or other engineering means to balance the pH and acidity levels.

It creates an extra tool for the winemakers toolbox!

Factors affecting Lactic Acid Production by *L. thermotolerans*

Nitrogen Assimilation:

- Competes with common wine yeasts for nutrients in grape must
- Requires a minimum YAN (Yeast Assimilable Nitrogen) of 200 mg N/L for maximum lactic acid production

Metabolic Characteristics:

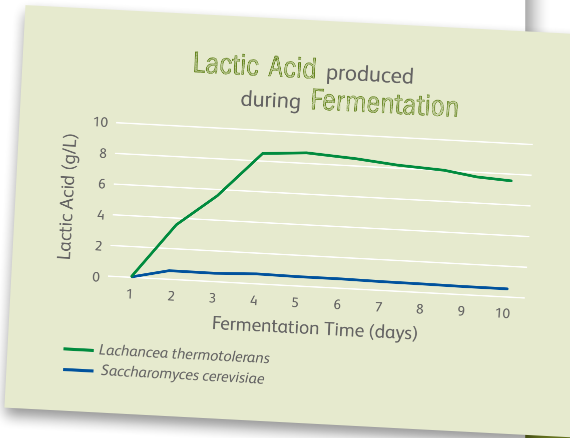
- **Crabtree positive yeas**t: Ferments sugars even in the presence of excess oxygen
- Sensitive to low dissolved oxygen: Increased aeration interventions (e.g., punch downs in red wines) can enhance persistence

Population Density:

- Efficient lactic acid production when cell numbers exceed 1 x 10^6 cfu/mL

Inoculation Strategy:

- Best practice: **Sequential inoculation** with *S. cerevisiae* 48 hours after *L thermotolerans*.
- **Co-inoculation** with stronger fermenters like *S. cerevisiae* is necessary to achieve complete fermentation since *L. thermotolerans* generally cannot tolerate ethanol levels above 10 % v/v



Temperature:

- Higher lactic acid production at and above 20°C
- Most lactic acid is produced in the first 4-6 days of fermentation, balancing lactic acid production with desired aroma and flavour profiles is crucial

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