



ALCOHOLIC BEVERAGES

Yeast is an invisible but essential partner of all alcoholic beverages, including wines, beers, and spirits.



ROLE OF YEAST

CONVERTING SUGARS INTO ALCOHOL

Ubiquitous in nature, yeast has been used for centuries by humans in fermentation processes, particularly in winemaking and brewing.

In the absence of oxygen (anaerobic), yeast acts as a catalyst in a reaction transforming sugars from fruit (grapes, for wine production) or cereals (malt, for beer production) into alcohol (ethanol). This reaction releases carbon dioxide, flavours (volatile aromatic compounds) and energy.

Fermentation should not be confused with distillation, a complementary process which, by heating in an alembic, concentrates the alcoholic content of the previously fermented liquid.

EXPRESSING THE AROMATIC POTENTIAL OF ALCOHOLIC BEVERAGES

Wine yeasts, unveiling the wine sensory

There are over 300 selected wine yeasts strains available to winemakers, *Saccharomyces cerevisiae* being the main specie. Each strain can reveal different aromatic compounds during fermentation:

- **Varietal aromas**, naturally present in grapes in the form of odourless "aromatic precursors". Revealed by the action of yeast, they are characterized by aromas such as citrus, floral and fruity notes.
- **Aromas derived from the fermentation process**, such as certain fruity aromas, are associated to the yeast metabolism in parallel of the fermentation reaction. The aromatic profile of each wine combines these aromas to give it a complex and fascinating style! Moreover, yeast can also have an impact on sensations of volume in the mouth, freshness, or more generally on the taste profile.

Two main types of brewer's yeast

Both types of fermentation are crucial for creating the large range of beer styles enjoyed worldwide:

- **Ale fermentation with top-fermenting yeast** that rise to the surface of the tank towards the end of fermentation (*Saccharomyces cerevisiae*). They operate at warmer temperatures, between 15-20°C. This fermentation is relatively quick, lasting from a few days to a couple of weeks, and produces beers with robust, fruity, and complex flavors. These beers have a higher alcoholic content and a more fruity, estery and malty character.
- **Lager fermentation with bottom-fermenting yeast** that settle to the bottom of the tank towards the end of fermentation (*Saccharomyces uvarum* and *pastorianus* or *carlsbergiensis*). They ferment at cooler temperatures, usually between 7-15°C. This process is slower, often taking up to several weeks, and results in cleaner, crispier, and more mellow flavours. These beers have a lower alcoholic and higher CO₂ content, making them more sparkling, potentially exhibiting hints of sulphur.



FORMAT OF YEAST USED

Alcoholic fermentation is performed by either liquid yeast (mainly beer and spirits) or active dry yeast (mainly wine). Active dry yeast is one format of yeast used since the 1970's for alcoholic fermentation:

- Active dry yeast enables sugars to be fermented efficiently, either after rehydration or directly in the must or wort, in the case of certain yeast strains.
- Active dry yeast offers excellent stability and longer shelf life. It gives winemakers and brewers greater flexibility and control over the fermentation process.



A SHORT HISTORY

5400 BC: Large-scale wine production in the northern Zagros mountains (current-day Iran).

3140 BC: Estimated date of the first wine yeast residues found in ancient Egyptian wine jars.

1860: Louis Pasteur establishes a link between microscopic yeast cells and the fermentation process.

1888: Emil Hansen perfects Pasteur's method for isolating pure yeast cultures.

1890: Hermann Müller-Thurgau creates the concept of must inoculation with selected yeast cultures.

1965: First active dry yeast industrially produced in California.



KEY DATA

European wine market

- Europe is the largest wine-producing and consuming area in the world.
- The European wine market was valued at around US\$155 billion in 2022.
- The top wine-producing countries in Europe include Italy, France, and Spain. They account for about half of the world's wine production.

European beer market

- Europe is one of the largest beer markets in the world, valued at approximately US\$ 144 billion in 2022, with steady growth projected in the coming years.
- The top beer-producing countries in Europe include Germany, the United Kingdom, Poland, and Spain. Germany is the largest producer, brewing over 90 million hectolitres annually.



PROSPECTS AND INNOVATIONS

- **Research into new natural yeast strains**, including non-*Saccharomyces* species, to diversify wine and beer sensory styles and provide certain technological advantages.
- **Reducing chemical inputs:** yeast can reduce the use of chemical inputs in the winemaking process, as they prevent the development of faults or spoilage microbes.
- **Non-GMO yeast improvement:** for the needs of GMO-averse consumers, to develop new yeast strains that offer improved performance and fermentation capabilities (e.g. higher alcohol tolerance, faster fermentation rates, increased resistance to stress conditions).
- **Fermentation efficiency and optimal product quality:** better real-time monitoring and control of fermentation parameters, via advanced sensors and automation technologies.
- **Sustainability and environmental impact:** develop new, less carbon- and energy-intensive yeast strains capable of efficiently fermenting alternative substrates, such as agricultural waste or non-traditional raw materials, and contribute to circular economy practices.
- **Bioinformatics and data analysis:** used to better understand yeast genetics, metabolism and fermentation dynamics, and better target strain development and process optimization.
- **Artificial intelligence:** to predict fermentation outcomes and optimize yeast performance.
- **Hybrid yeasts:** to combine the properties of different yeast strains to create hybrid yeasts, offering brewers and winemakers new options for product differentiation.

