

Yeast

Yeast are single-celled microorganisms that reproduce by budding. They are biologically classified as fungi and are responsible for converting fermentable sugars into alcohol and other byproducts. There are literally hundreds of varieties and strains of yeast. In the past, there were two types of beer yeast: ale yeast (the "top-fermenting" type, *Saccharomyces cerevisiae*) and lager yeast (the "bottom-fermenting" type, *Saccharomyces uvarum*, formerly known as *Saccharomyces carlsbergensis*). Today, as a result of recent reclassification of *Saccharomyces* species, both ale and lager yeast strains are considered to be members of *S. cerevisiae*.

Top-Fermenting Yeast

Ale yeast strains are best used at temperatures ranging from 10 to 25°C, though some strains will not actively ferment below 12°C (33). Ale yeasts are generally regarded as top-fermenting yeasts since they rise to the surface during fermentation, creating a very thick, rich yeast head. That is why the term "top-fermenting" is associated with ale yeasts. Fermentation by ale yeasts at these relatively warmer temperatures produces a beer high in esters, which many regard as a distinctive character of ale beers.

Top-fermenting yeasts are used for brewing ales, porters, stouts, Altbier, Kölsch, and wheat beers.

Bottom-Fermenting Yeast

Lager yeast strains are best used at temperatures ranging from 7 to 15°C. At these temperatures, lager yeasts grow less rapidly than ale yeasts, and with less surface foam they tend to settle out to the bottom of the fermenter as fermentation nears completion. This is why they are often referred to as "bottom" yeasts. The final flavour of the beer will depend a great deal on the strain of lager yeast and the temperatures at which it was fermented.

Some of the lager styles made from bottom-fermenting yeasts are Pilsners, Dortmunders, Märzen, Bocks, and American malt liquors.

Spontaneous Fermentation

Beer that is exposed to the surrounding open air to allow natural/wild yeast and bacteria to literally infect the beer, are spontaneous fermented beers. One of the typical yeasts is the *Brettanomyces Lambicus* strain. Beers produced in this fashion are sour, non-filtered and inspired by the traditional lambics of the Zenne-region. This brewing method has been practised for decades in the West Flanders region of Belgium.

Byproducts of Yeast

Yeast impact the flavour and aroma of beer more than you might think. The flavour and aroma of beer is very complex, being derived from a vast array of components that arise from a number of sources. Not only do malt, hops, and water have an impact on flavour, so does the synthesis of yeast, which forms byproducts during fermentation and maturation. The most notable of these byproducts are, of course, ethanol (alcohol) and carbon dioxide (CO₂); but in addition, a large number of other flavour compounds are produced such as:

- acetaldehyde (green apple aroma)
- diacetyl (taste or aroma of buttery, butterscotch)
- dimethyl sulfide (DMS) (taste or aroma of sweet corn, cooked veggies)
- clove (spicy character reminiscent of cloves)
- fruity / estery (flavour and aroma of bananas, strawberries, apples, or other fruit)
- medicinal (chemical or phenolic character)
- phenolic (flavour and aroma of medicine, plastic, Band-Aids, smoke, or cloves)
- solvent (reminiscent of acetone or lacquer thinner)
- sulfur (reminiscent of rotten eggs or burnt matches)

There are other yeast byproducts, and some of the listed can be both desired byproducts and/or undesired depending on the beer style or what the brewer was trying to achieve.