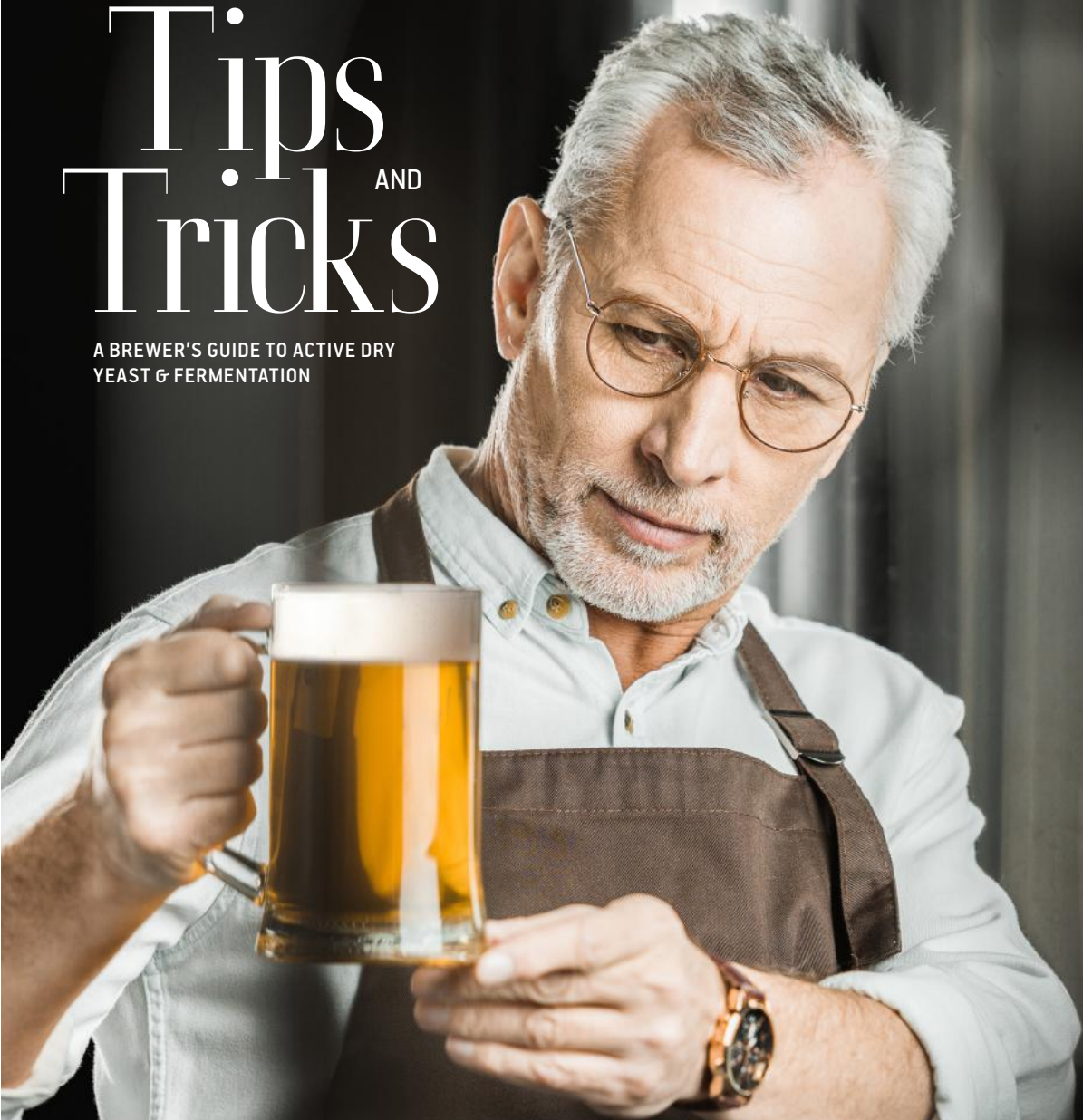


# Tips AND Tricks

A BREWER'S GUIDE TO ACTIVE DRY  
YEAST & FERMENTATION



ADY\*: An **essential tool** for brewers

What **IS** Yeast?

How is ADY **manufactured**?

How to **use** active dry yeast

What to **be careful about**

Yeast characteristics

Aromas, flavors & **beer styles**

Make your choice!

Major **notes & flavor** descriptors

Glossary

(\*) Active Dry Yeast

# WE'RE HERE TO HELP

Great things are happening in the world of fermented beverages. We are seeing young designers, small distilleries, craft breweries, and new wine estates emerging everywhere. There is risk, there is daring, and maybe a few disappointments, but we are truly excited by the bounty of wonderful results. This is a virtuous model, even for the market's biggest players, who are also inspired to be more inventive. We enthusiastically support the efforts of those who get creative, because we share this taste for innovation and initiative.

We created this guide for you, the brewers, to help you understand how high quality dry yeast is produced, what essential parameters will influence your fermentations, and how our yeast strains are characterized. And throughout these pages, we present useful, technical tips to help you better manage yeast in your brewery. We hope it will be an everyday resource to help you create the beers of your dreams.

You can download *Tips and Tricks* from our website, along with many other practical tips and tools.

 **Fermentis**  
by Lesaffre

# ADY: An essential

# tool for brewers

Constant innovation and creativity in craft brewing have made the industry a great success. But brewing a large number of beers in a single location can make yeast management very difficult – and maintaining the quality and consistency of beer between batches is essential to meeting and exceeding customer expectations.

Many craft brewers around the world choose dry yeast is a reliable way to achieve consistent fermentations from batch to batch. Fermentis Active Dry Yeast is a ready-to-pitch yeast, either directly into the wort or after a simple rehydration, and is very easy to use (E2U™!).

Correct yeast population is achieved simply by pitching a known weight of dry yeast. No propagation or in-house laboratory input is needed. Fermentation consistency also adds the advantage of predictable fermentation output, which is essential for good planning in a busy brewery.

Fermentis is the supplier of choice for true dried lager yeasts (*Saccharomyces pastorianus*). Our different strains are available from recognized sources, and enable high quality lager production.

A range of ale yeasts has also been developed to produce ales with authentic flavor profiles, as well as a variety of specialty beers.

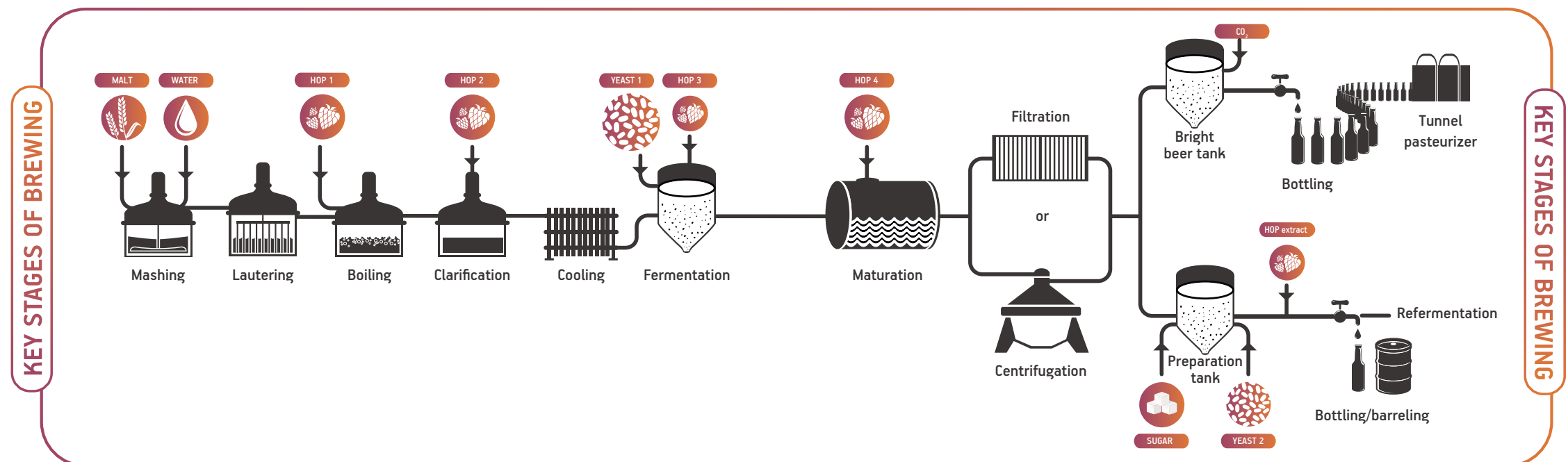
Each Fermentis yeast has its own characteristics, including fermentation kinetics and profile, attenuation rate, alcohol tolerance, sedimentation, organoleptic expression.

Knowing our yeasts better and understanding their characteristics will allow you to get the best results from them and adapt your brewing and fermentation conditions to create the beer you want.

The diagram below shows the most important steps in beer production, and at which stage each ingredient enters the process. Yeast affects fermentation and the subsequent steps of beer production.

Yeast plays a key role in the release of aromas, flavors and mouthfeel compounds in the finished beer. A number of compounds are released during fermentation and the yeast strain and fermentation conditions chosen by the brewer significantly impact the final beer profile. All the elements in the brewing recipe influence the final character and aromas of the beer: water, minerals, malts, hops and hopping regime.

Keep in mind that the choices made before fermentation can also influence how the yeast reacts.

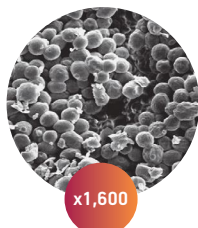


# What IS Yeast?

— YEAST IS THE GENERIC NAME GIVEN TO A GROUP OF EUKARYOTIC UNICELLULAR MICROORGANISMS, classified within Fungi Kingdom. They grow predominantly as single cells, and they include the genus *Saccharomyces* (from Latin origin 'sugar fungus'). The yeast is responsible for transforming wort into beer and is also involved in a number of other fermentations. The taxonomy of yeasts can be confusing, but all classic beer yeasts are members of the genus *Saccharomyces*. Two species commonly used in breweries are *S. cerevisiae* (top fermenting yeast) and *S. pastorianus* (bottom fermenting yeast), although a variety of strains and other microorganisms may be used in brewing for different applications (see below).

— THE TERM STRAIN IS USED TO DENOTE THE SMALLEST TAXONOMIC UNIT - a subdivision of the species. In the brewing industry, many thousands of yeast strains are used, although all have similar genetic material that allows them to be classified into the same genus or species. The taxonomy of yeasts has been, and still is, under continual revision, often accompanied by changes in nomenclature.

## DRY YEAST MICROSCOPE IMAGE



x1,600



x6,400

Yeast, *Saccharomyces cerevisiae*, is a unicellular fungi.  
A *Saccharomyces cerevisiae* yeast cell measures between 5 and 50  $\mu\text{m}$ .

### FLASHBACK:

#### PASTEUR DID A LOT FOR BREWERS

In 1876, Pasteur published his study *Études sur la Bière* and brought beer forward by describing the basis for fermentation. With extensive and meticulous work, he showed that beer was fermented not by chemicals, but by microorganisms. He noticed that in the midst of another population of microorganisms ('wild yeast', bacteria and molds), there were the 'brewers yeasts' and that these microorganisms were most responsible for a proper beer fermentation. With this new understanding, he and other scientists began to refine microbiological techniques, resulting in major improvements regarding the principles and quality control of brewing beer.

## Important microorganisms in beer

— THE TYPES OF YEASTS USED FOR FERMENTATION OF WORT INTO BEER ARE TRADITIONALLY CLASSIFIED AS ALE, LAGER OR 'WILD.' With respect to beer production-related properties, *Saccharomyces cerevisiae* are referred to as ale yeasts or top-fermenting yeasts, and *Saccharomyces pastorianus* are referred to as lager yeast or bottom-fermenting yeast. *S. cerevisiae* include a very diverse group of ale yeasts, considered domesticated, used for producing beer, wine, cider, spirits and other fermented beverages. They are distinct from lager beer strains called *Saccharomyces pastorianus* (a cryotolerant hybrid between *Saccharomyces cerevisiae* and *Saccharomyces eubayanus*). At times, lager yeasts were also called *Saccharomyces carlsbergensis*.

— NOT ONLY IS *SACCHAROMYCES PASTORIANUS* A NATURAL HYBRID USED IN BEER PRODUCTION, there is actually a large number of *Saccharomyces cerevisiae* strains which are hybrids.

— REGARDLESS OF NOMENCLATURE, THE BREWING INDUSTRY HAS A FUNDAMENTAL 'RULE' THAT LAGER YEASTS PERFORM IDEALLY AT LOW TEMPERATURES (8-15°C / 46-59°F), while ale yeasts operate best at higher temperatures (approximately at or above 20°C / 68°F). The enormous range of beer styles, and their flavors and aromas, are not only the results of different processing parameters and raw materials, but also of the use of specific yeast strains with their typical sensory expression. Yeast plays an important role in the primary fermentation (the main alcoholic fermentation) as well as bottle conditioning.

— WILD YEASTS ARE *NON-SACCHAROMYCES SPP. YEASTS*, identified by EBC Analytica 4.2.6 or ASBC Microbiological Control-5D. A specific media with lysin is used. Most brewers yeasts are *Saccharomyces* and cannot grow with lysin as the sole source of nitrogen (lysin-negative). On the other hand, *non-Saccharomyces spp.* are lysin-positive and grow on lysin media.

— SOME YEASTS MAY INCLUDE VARIATIONS OF *SACCHAROMYCES CEREVISIAE* - for example, *S. cerevisiae var diastaticus*, which release glucoamylase in the media to degrade dextrins, leading to potential hyper-attenuation. Additionally, other species, like those of the genus *Brettanomyces (Dekkera)*, are known to give a typic animal and funky flavor to beers. Because they vary in the production of flavor-active metabolites, there is a big biodiversity that can be exploited as single or mixed cultures in beer brewing.

### FLAVOR

#### POF+ OR POF-?

Some yeast strains may be from the same species, but they differentiate themselves by producing very diversified flavors. An example in beer is yeasts that differ in their 'POF' – or phenolic off flavor – gene expression.

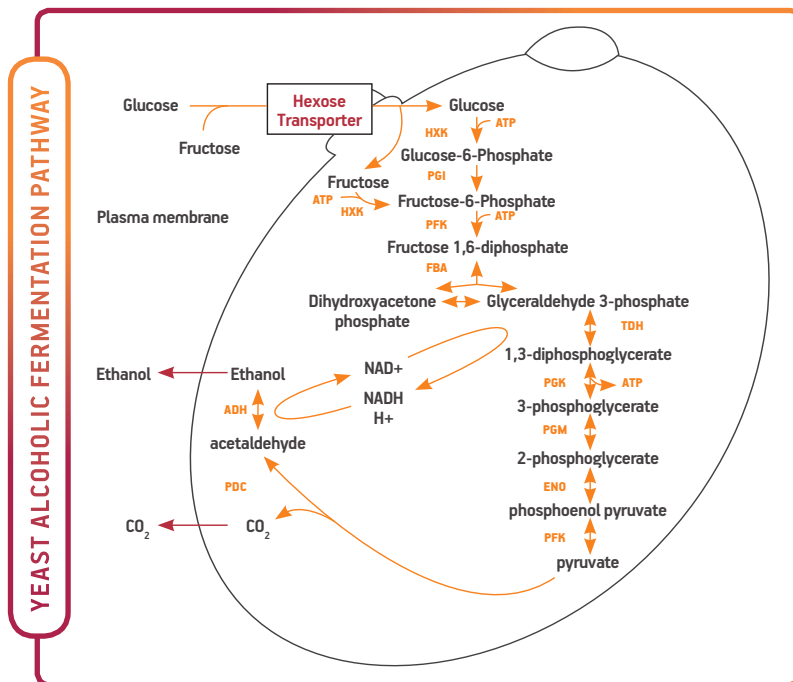
In other words, these yeasts have a specific enzyme that decarboxylates phenolic acids, like ferulic acid, present in wort and producing the flavor-active compound 4VG. This compound contributes to spicy, clove-like flavors which, depending on the concentration, may produce a spicy and complex character in some Belgian ales and wheat-based beers, but can be extremely undesirable in other beer types, like Pilsen or Stout Beers.



## Yeast in fermentation and maturation

— TYPICAL BOTTOM FERMENTATION CAN TAKE ABOUT ONE OR TWO WEEKS, whereas top fermentation tends to be faster, taking about three to six days, depending on the conditions and more specifically, the temperature. During main fermentation and depending on yeast strain and process parameters, specific flavors are produced. During maturation at low temperatures, there is minimal yeast activity, also contributing to some extent to the final beer flavor.

— TRADITIONALLY BOTTOM-FERMENTED BEERS AND TOP-FERMENTED BEERS ARE DISTINGUISHED BY THE TYPE OF YEAST used and the applied fermentation temperature. The choice of the fermentation temperatures in beer production processes is a critical factor: it can typically vary within a range of 8 to 28°C (46-82°F). The higher the temperature, the faster the process, and sometimes the higher the concentration of co-products (like flavor-active components).



## Sugars Involved

— BEER YEAST STRAINS CAN UTILIZE VARIOUS CARBOHYDRATES, with some differences between ale, lager and diastaticus. The wort supplies the yeasts with sugars, such as glucose, fructose, maltose, maltotriose and dextrins.

### ⊕ GLUCOSE

Glucose is a monosaccharide. It is a single hexose and is the first sugar to be assimilated by the yeast. Glucose is a basic building block of the starch, which is a long-ramified glucose chain.

### ⊕ MALTOSE

Maltose is a disaccharide (2 glucose units). All Fermentis beer yeasts were selected for their high maltopermease activity. Maltopermease carries the maltose from the wort to the cytosol through the cell's membrane. Maltose is then hydrolyzed into two glucoses by intracellular maltase.

### ⊕ MALTOTRIOSE

Maltotriose is a trisaccharide sugar (3 glucose units). Not all yeasts are able to metabolize it. In theory, all bottom fermenting yeasts can partially assimilate maltotriose. There are some top fermenting yeasts that have this capacity too, like SafAle™ BE-256, for example.

### ⊕ DEXTRINS

Dextrins are polymers (multiple units) of glucose in a linear or branched chain. They are formed in the wort during the mashing process. They are not fermented by beer yeast unless *Saccharomyces cerevisiae var. diastaticus* releases enzymes to convert them into fermentable sugars. Those non-fermentable sugars (residual extract) contribute to the body and mouthfeel of the beer.

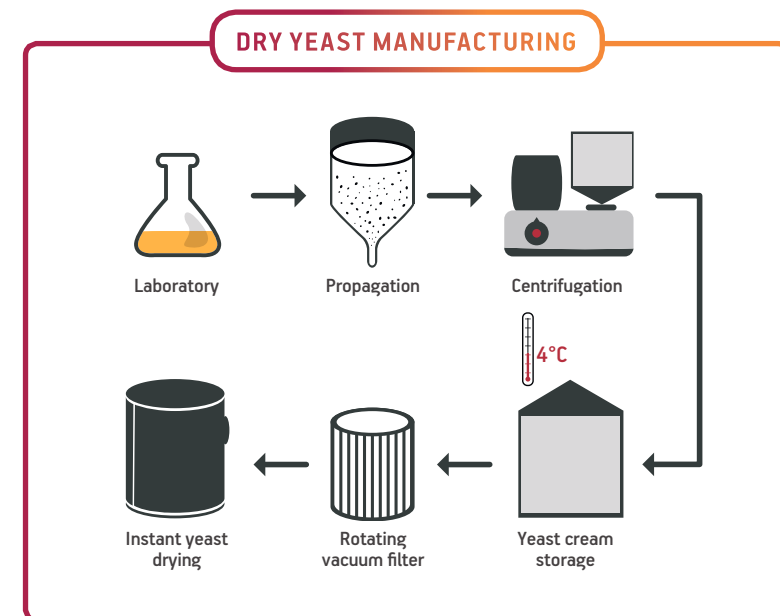
Wort also contains several other nutrients for the yeast metabolism, such as minerals, ions and assimilable sources of nitrogen (amino acids, ammonium ion and some peptides) which are utilized by yeast for growth, protein formation (structural and enzymic) and flavor precursors.



# How is ADY manufactured?



— ACTIVE DRY YEAST IS THE FRESHEST YEAST FORMAT USED IN THE BREWING INDUSTRY. At Fermentis, we select and manufacture yeast to produce a large amount of beer styles. With experience and expertise, we produce yeast that preserves all its native properties during the entire production process. In addition, as soon as it is in contact with wort, the yeast is ready to ferment. This is the definitive and reliable way to achieve consistent fermentations from batch to batch and achieve each brewer's goals.



## Yeast cycling

### 1. FROM THE LABORATORY TO CENTRIFUGATION

AT FIRST, THE YEAST IS MULTIPLIED BY BUDDING, AN ASEXUAL REPRODUCTION. The mother cell forms a bud. This bud progressively receives a duplicate of all mother yeast content (cytosol, organites, nucleus, etc.). The bud continues to grow until it separates from the parent cell, forming a daughter cell. If the mother and daughter cells are in a good medium, they both start budding.

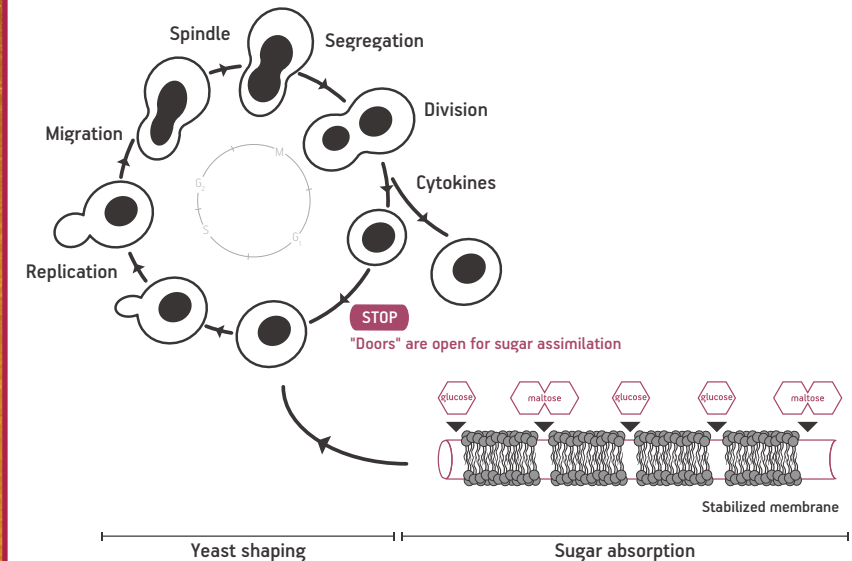
IF THE YEAST ENVIRONMENT IS ADVERSE TO THE GROWTH, the yeast may start to produce protective compounds like glycerol, trehalose, and glycogen, for example. Glycerol helps the yeast resist the osmotic pressure. Trehalose is a key contributor to membrane stability during drying. Trehalose and Glycogen are reserve carbohydrates – these compounds allow the yeast to be naturally resistant to drying.

FERMENTIS YEASTS ARE GROWN IN OPTIMUM MEDIA. By the end of duplication, the yeasts are shaped, and the recipes are tuned to express resistance to drying. The yeasts contain all ingredients to start the fermentation.

### 2. FROM THE CREAM YEAST TO THE FRESH ACTIVE DRIED YEAST

BY THE END OF BIOMASS PRODUCTION, THE YEAST IS CENTRIFUGED. The resulting fresh cream yeast is stored cold. Afterwards, it is filtered to obtain compressed yeast, which is extruded and dried.

### YEAST MULTIPLICATION IN THE PROPAGATOR



*experience!*

#### Is your ADY ready to "work"?

To be sure your Fermentis yeast is ready to work, do this test on your own!

What you need: two plastic bottles, two balloons, 20cl of water at room temperature (twice), 15g of sugar (twice) and 11.5g of yeast.

1. Put the water and sugar in each of the bottles and add the yeast to one of them.
2. Immediately fix a balloon tightly on each bottle\* and place them in a warm environment: 40°C / 104°F).
3. Observe.

After a few minutes (which corresponds to what we call "lag phase"), you should see the balloon inflate only in the bottle containing the yeast. This is due to the yeast metabolism producing CO<sub>2</sub> (carbon dioxide), which expands to inflate the balloon.

Was your experience a success? Great! That is the sign that your Fermentis yeast is active.

\* Make sure that the balloon is hermetically fixed on the neck of the bottle.





## Quality control

— **FERMENTIS EXECUTES A POSITIVE RELEASE:** after production, the batches are retained until all quality control results are achieved. If all results are good, the batch is released.

— **WHEN PITCHING AT 50 G/HL FOR ALE OR AT 100 G/HL FOR LAGER,** contaminations are lower than 1 contaminating cell\* per ml\*\*.

— **THEREFORE, A SEMI-QUANTITATIVE PCR TEST MAY GIVE POSITIVE RESULTS.** It is recommended to cross-check PCR results with plating methods.

— **UP UNTIL NOW, NO CONTAMINATING BACTERIA GROWTH WAS OBSERVED IN HOPPED WORTS OR BEERS.** The level of non-*Saccharomyces* yeast contamination is so low, it does not impact the flavor, even when recycled several times.

## Shelf life

— **THE SHELF LIFE OF FERMENTIS YEAST IS 3 YEARS FROM THE PACKAGING DATE,** when stored below 15°C (59°F) for an extended period of time (more than 6 months). For shorter periods of time (up to 6 months), it is acceptable to store yeast at temperatures up to 24°C (75°F).

## Batch number and traceability

— **ALL FERMENTIS SACHETS, PACKS AND BOXES ARE IDENTIFIED BY AN ALPHANUMERIC CODE.** This permits us to find all data related to the batch produced, from the raw material used, to the recorded process parameters and quality results.

(\*) contaminating cell: *Lactobacillus spp.*, *Acetobacter spp.*, *Pediococcus spp.*, non-*Saccharomyces* yeast.  
(\*\*) meaning that contaminating cell concentration is lower than 103 cfu/g.



### CERTIFICATION

#### DO YOU NEED A STATEMENT?

All of our products are certified for your benefit. We remain at your disposal to provide any certificate or statement you may need. Simply send us an e-mail at [fermentis@lesaffre.com](mailto:fermentis@lesaffre.com)

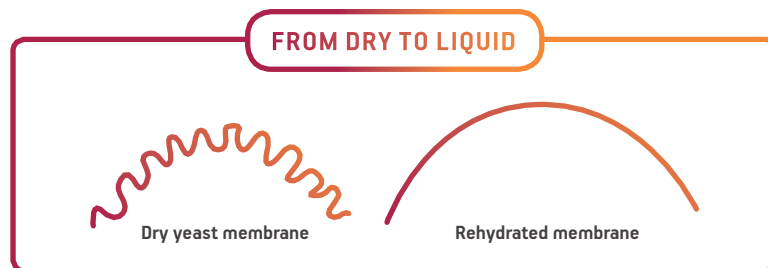


# How to use active dry yeast

A RECENT STUDY DEMONSTRATES THAT THE USE OF ACTIVE DRY YEASTS (ADY) is a simple, effective process that does not necessarily include a rehydration step. To the contrary, one great advantage of using ADY is that it can be immediately put in contact with the wort in a fermentation vessel (direct pitch). Several rehydration and direct pitch conditions do not show any significant differences in terms of viability and vitality of the ADY. This concept is protected under the E2U™ umbrella.



FERMENTIS ADY LOOKS LIKE A COMPACT SPONGE COMPOSED OF MICROSCOPIC BALLS TIGHTENED CLOSELY TOGETHER (CF. P6). This “sponge” is ready to absorb water or wort. The yeast cells need to recover the liquid they lost during drying to start fermenting. The membrane of the yeast cell after drying contains circumvolutions – after contact with water or wort, it becomes perfectly smooth again.



E2U™ PRODUCTS

**Save time. Save effort. Think green.**

With E2U™ active dry yeast, you can pitch directly, or you can rehydrate first, depending on your equipment, habits and preferences. This innovation and flexibility gives you the opportunity to save time and make your life easier – and by using less water, energy and detergent, your process is more sustainable. Whichever option you choose, we ensure the highest standards of quality, productivity and security.

## Rehydration process

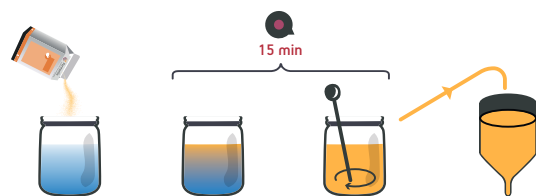
### 1. TEMPERATURE MONITORING

— IF YOU ARE USED TO REHYDRATING DRY YEAST, NO PROBLEM. You still can! Just follow our recommended process:

- Rehydrate the dry yeast into yeast cream by sprinkling it on with 10 times its weight of sterile water or hopped wort.
- The temperature of the hydration media is between 10 and 28°C (50-82,4°F); and should ideally be close to fermentation temperature.
- Leave it to rest, and optionally agitate gently (no violent agitation), for about 15 minutes.
- Finally, pitch the resultant cream into the fermentation vessel.



#### DRY YEAST REHYDRATION



THE REHYDRATION STEP IS DONE IN A VESSEL OUTSIDE THE FERMENTER. The objective is to allow the yeast to recover all its functionalities before pitching.

— AFTER REHYDRATION, BACTERIAL CONTAMINATION CAN DEVELOP IN THE SLURRY. For that reason, we recommend rehydration in sterile, hopped wort as opposed to sterile, unhopped wort or sterile water. The iso-alpha acids (ideally above 5ppm, the equivalent of 5 IBU) present in the media will protect it from Gram + bacterial development and will not affect the rehydration process of the ADY.

### 2. WATER OR HOPPED WORT?

Fermentis yeast can be rehydrated with sterile water or sterile hopped wort:

— IF THE REHYDRATION PROCESS OCCURS IN WATER, it can be tap water, mineral water or distilled water. In any case, sterility is mandatory.

— IF THE REHYDRATION PROCESS OCCURS IN HOPPED WORT (with first hop addition and minimum 20-minute boil), collect the required volume in a closed vessel. Leave it to cool down to pitching temperature before adding Fermentis yeast.

— IN BOTH CASES, rehydrate the yeast for 15 minutes. Pitch immediately into the tank during the first part of cooling.

#### DON'T FORGET YOUR REHYDRATION ESSENTIALS

- 1 -

**Respect recommended rehydration temperatures to ensure a good start of the fermentation.**

- 2 -

**Whether you choose water or hopped wort, you must make it sterile.**





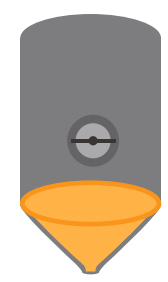
**GOOD TO KNOW**

### Direct pitch

If a brewery is not equipped with a system designed for the rehydration step, we highly recommend a direct pitch.

To do so, we recommend using the necessary quantity in weight of ADY and to put it into the fermentation vessel during the first part of the wort cooling step. The temperature of cooling will be the same as the temperature used to start fermentation. There is no need for aeration during this process.

#### DRY YEAST DIRECT PITCH



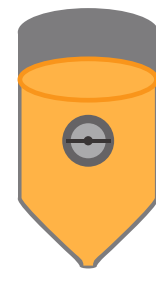
Step 1

Start to fill your fermenter with hopped wort until the cone is filled



Step 2

Sprinkle dry yeast directly in the hopped wort



Step 3

Finish to fill the fermenter

# What to be careful about



## Pitching rate

**PITCHING AT THE CORRECT LEVEL WILL GUARANTEE A RAPID START** of fermentation. Using a low pitching rate will delay the start of fermentation and increase contamination risk.

**ACTIVE DRY YEAST HAS THE ADVANTAGE OF CONVERTING A DRY YEAST WEIGHT** to an accurate number of viable cells pitched in the wort.

**IF THE FERMENTATION VESSEL CONTAINS MORE THAN ONE BREW**, we also recommend adding the total quantity of ADY to the fermentation vessel during the cooling of the first brew.

	FERMENTIS YEAST DOSAGE	
ALE YEASTS	50-80 g/hl (0.06-0.10 oz/gal)	4-6 10 <sup>6</sup> cells/ml
LAGER YEASTS*	80-120 g/hl (0.10-0.16 oz/gal)	8-12 10 <sup>6</sup> cells/ml

\*Values given are for fermentation between 12-15°C (53-59°F). Lager yeast dosage should be increased at temperatures below 12°C (53°F), up to 200 to 300g/hl (0.26-0.40 oz/gal.) at 9°C (48°F).

## Fermentation temperatures

— THE RECOMMENDED FERMENTATION TEMPERATURE RANGE (refer to technical data sheets) of each strain must be respected.

— THE HIGHER THE TEMPERATURE IS AT THE BEGINNING OF FERMENTATION, the faster the fermentation will start.

— DIACETYL REDUCTION WILL ALSO BE FASTER AT HIGHER TEMPERATURES towards the end of fermentation. For ale, a 24h diacetyl reduction rest at 23°C (73°F) minimum should be applied before cooling. For lager, temperature may be raised (during the second part of fermentation) to 16°C to 18°C (61-64°F) and left for 48h to reduce diacetyl.

— LOW TEMPERATURE (0-5°C / 32-41°F) IS REQUIRED 24h after the end of the fermentation to achieve good yeast sedimentation.



### GOOD TO KNOW

#### Be careful, it starts right away!

Fermentation starts immediately, but significant CO<sub>2</sub> release and aroma formation will only be perceptible after 12 to 24 hours for ale yeasts and 16 to 32 hours for lager yeasts.

## Effect of oxygen

— WHEN USING ADY THERE IS NO SPECIFIC REQUIREMENT OF AIR OR OXYGEN DURING WORT COOLING AND TRANSFER TO THE FERMENTER. Indeed, ADY is rich enough in sterols (lipids) and minerals for its own multiplication process.

— IN CASE THE YEAST IS CROPPED AND REPITCHED FOR A NUMBER OF GENERATIONS, supply of air or oxygen is mandatory.

## Yeast recycling

— REUSING YEAST FROM A PREVIOUS BATCH REQUIRES DEDICATED TANKS and specific know-how; and needs to be done in good, hygienic conditions. A viability test should be performed on the slurry, and the dosage rate should be calculated based on the living cells and according to the population required at fermentation start.

— THERE IS A RISK OF GENERATING VARIANTS AFTER A FEW GENERATIONS, which could result in a change of the aromatic profile of the beer. The maximum number of generations is highly dependent on the brewery and the process, and should be evaluated based on experiences with, and the consistency of, the product.



## Bottle and cask conditioning

— YEAST IS USED FOR REFERMENTATION IN BOTTLES OR IN CASKS. If the primary objective is to saturate the beer with CO<sub>2</sub>, refermentation brings other benefits to the beer. First, the presence of living yeast in the bottles/casks will prevent beer oxidation and increase its shelf life. It will also provide mouthfeel and roundness to the beer.

— WHEN SELECTING A YEAST for refermentation, you have to consider:

- ☑ Its tolerance to high alcohol and CO<sub>2</sub> levels
- ☑ Its aroma development capabilities
- ☑ Its sugar assimilation profile (maltotriose negative)
- ☑ Its ability to settle and stick well to the bottom of the bottle/cask at the end of refermentation

— AFTER PRIMARY FERMENTATION, yeast is often inhibited by alcohol, so we do not recommend using cropped yeast to make the refermentation.

— THE SUGAR ADDITION NEEDS TO BE CAREFULLY CALCULATED considering the desired carbonation of the finished beer. Knowing that 2g of sugar gives 1g of CO<sub>2</sub>, assuming there is no CO<sub>2</sub> in the green beer, 10g of sugar per liter would need to be added to saturate the beer at 5g of CO<sub>2</sub>/l. If the green beer already contains 2g of CO<sub>2</sub>/l, then 6g of sugar per liter would have to be added.

### SMART CHOICE. SAFALE™ F-2.

SafAle™ F-2 has been selected specifically for secondary fermentation. It guaranties a neutral aroma profile, respecting the base beer character (see more page 38).

— The table below indicates the quantity of SafAle™ F-2 to be added in relation to the alcohol content and the carbonation level before refermentation (You can also calculate this with the Fermentis App).

		CO <sub>2</sub> (g/l)			
		0,5	1,5	3	6
ABV (%)	5	2	7	7	14
	8	2	7	7	14
	12	2	7	7	35

# Yeast characteristics

— ONE OF THE MAJOR PILLARS OF THE FERMENTIS TECHNICAL PROGRAM is to constantly improve the understanding of the yeast promise. To this end, the Fermentis Academy is rolling out a strategy to explore both technical and sensory characteristics linked to fermentation. Here we will reveal some of our findings, which include discoveries about kinetics, attenuation, sugar assimilation, alcohol tolerance, flocculation, sedimentation, aromas, etc.



## Learn, Share, Exchange

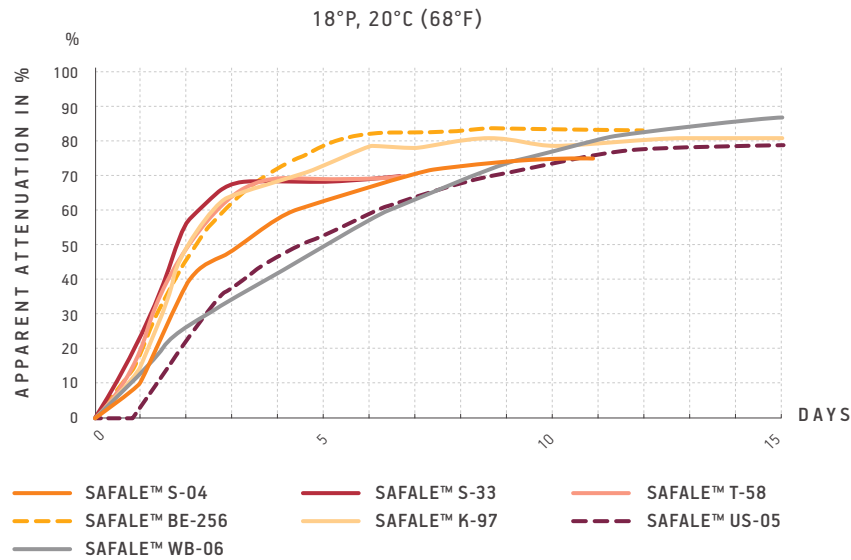
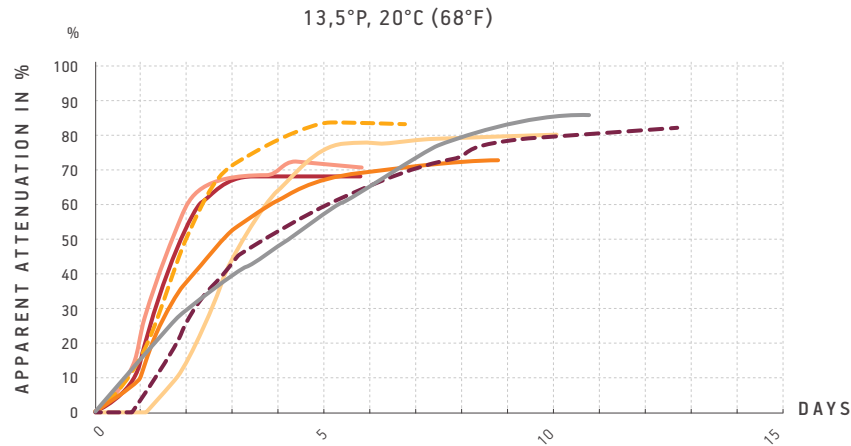
The Fermentis Academy is a place of unique inspiration, a crossroads of research and creation. In this open, eclectic forum, you will be welcomed by our researchers and tasting experts. You will also meet with other professionals who, like you, are seeking to innovate and advance their craft. Here, you will be able to test our products, taste the latest creations from our cellars, learn about the aromatic variations created by our yeasts, and train your team in the art of fermentation.

Every year, we organize Fermentis Academy events all around the world, so you can be sure we'll be at a location near you. Follow us on our social networks to connect with our events – and to learn more about yeast and fermentation.



## Indicative fermentation kinetics and attenuation

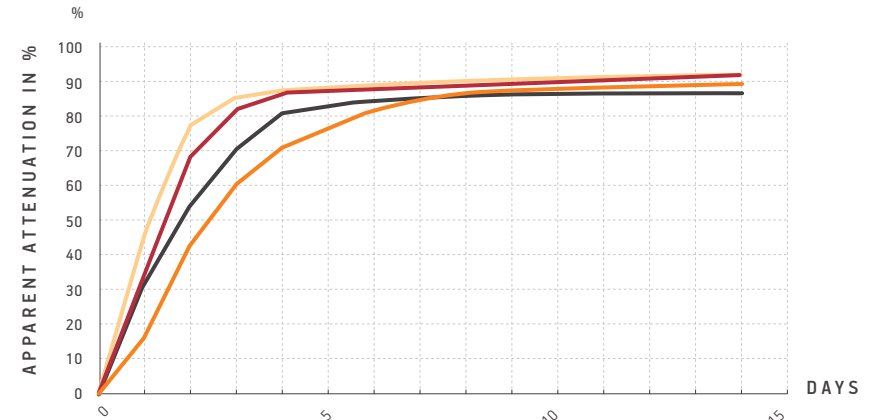
### SafAle™ range



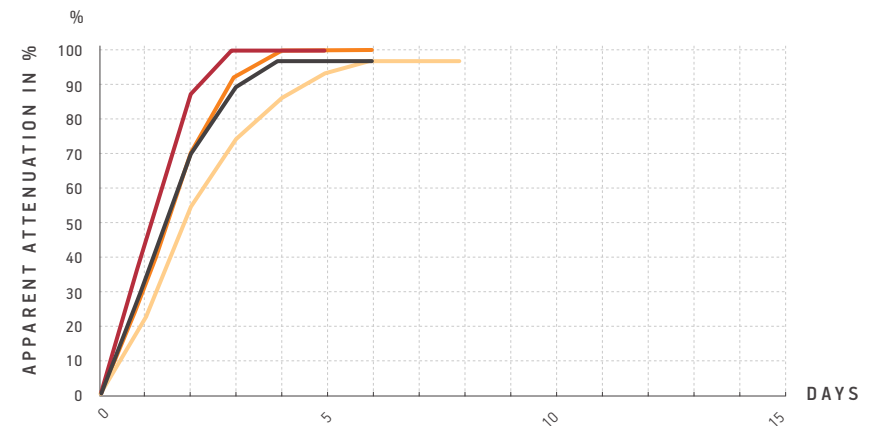
Apparent attenuation is indicative and may vary under different conditions.

### Other SafAle™ yeast strains

THIS IS OUR SELECTION OF HYPER ATTENUATING YEASTS. They present a high attenuation with low residual sugar content and allow production of different beer styles and flavors.



SAFALE™ BE-134 @ 20°C/13,5°P	SAFALE™ BE-134 @ 25°C/13,5°P
SAFALE™ BE-134 @ 30°C/13,5°P	SAFALE™ WB-06 @ 25°C/13,5°P

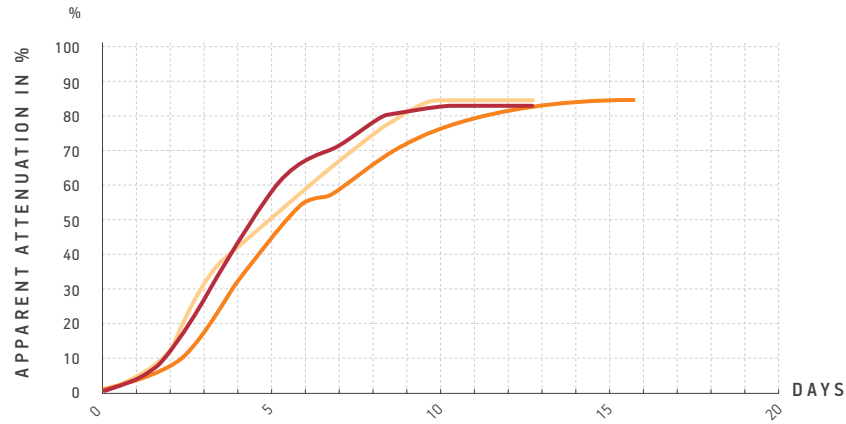


SAFALE™ HA-18 @ 25°C/25°P	SAFALE™ HA-18 @ 30°C/25°P
SAFALE™ HA-18 @ 25°C/30°P	SAFALE™ HA-18 @ 30°C/30°P

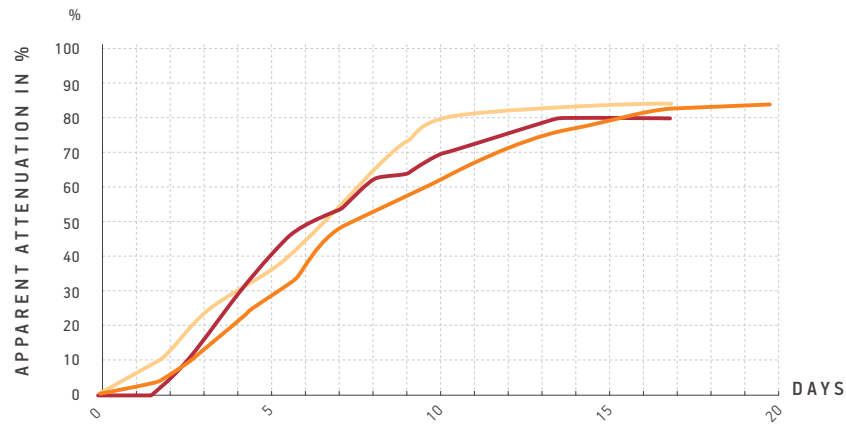
Apparent attenuation is indicative and may vary under different conditions.

SafLager™ range

13,5°P AT 12°C (53.6°F) FOR 48H THEN 14°C (57.2°F)



18°P AT 12°C (53.6°F) FOR 48H THEN 14°C (57.2°F)



SAFLAGER™ W-34/70    SAFLAGER™ S-189    SAFLAGER™ S-23

Apparent attenuation is indicative and may vary under different conditions.





## Apparent Degree of Fermentation (ADF)

THE TABLE BELOW SHOWS THE APPARENT DEGREE OF FERMENTATION (ADF) in % after fermentation for each strain.

### SafAle™ range

	ADF
SafAle™ S-04	74-82%
SafAle™ K-97	80-84%
SafAle™ US-05	78-82%
SafAle™ WB-06	86-90%
SafAle™ S-33	68-72%
SafAle™ T-58	72-78%
SafAle™ BE-256	82-86%
SafAle™ BE-134	89-93%
SafAle™ HA-18	98-102%

### SafLager™ range

	ADF
SafLager™ S-23	80-84%
SafLager™ S-189	80-84%
SafLager™ W-34/70	80-84%

## Flocculation

FLOCCULATION IS THE ABILITY OF YEAST CELLS TO FORM AGGREGATES. It is the ability of yeast to raise in the foam at the end of fermentation. If the yeast is not remaining in the foam at the end of fermentation, a highly flocculent yeast will sediment fast and create a clear beer with little cells in suspension. On the contrary, a low flocculent yeast will sediment slowly and leave the beer hazy for a longer period of time.

### SafAle™ range

	FLOCCULATION	SEDIMENTATION	FLOTTATION
SafAle™ S-04	+	Fast	-
SafAle™ K-97	+	Slow	+
SafAle™ US-05	+	Medium	+
SafAle™ WB-06	-	Slow	+
SafAle™ S-33	-	Medium	-
SafAle™ T-58	-	Medium	-
SafAle™ BE-256	+	Fast	-
SafAle™ BE-134	-	Slow	-
SafAle™ HA-18	-	Medium	-

### SafLager™ range

	FLOCCULATION	SEDIMENTATION	FLOTTATION
SafLager™ S-23	+	Fast	-
SafLager™ S-189	+	Fast	-
SafLager™ W-34/70	+	Fast	-

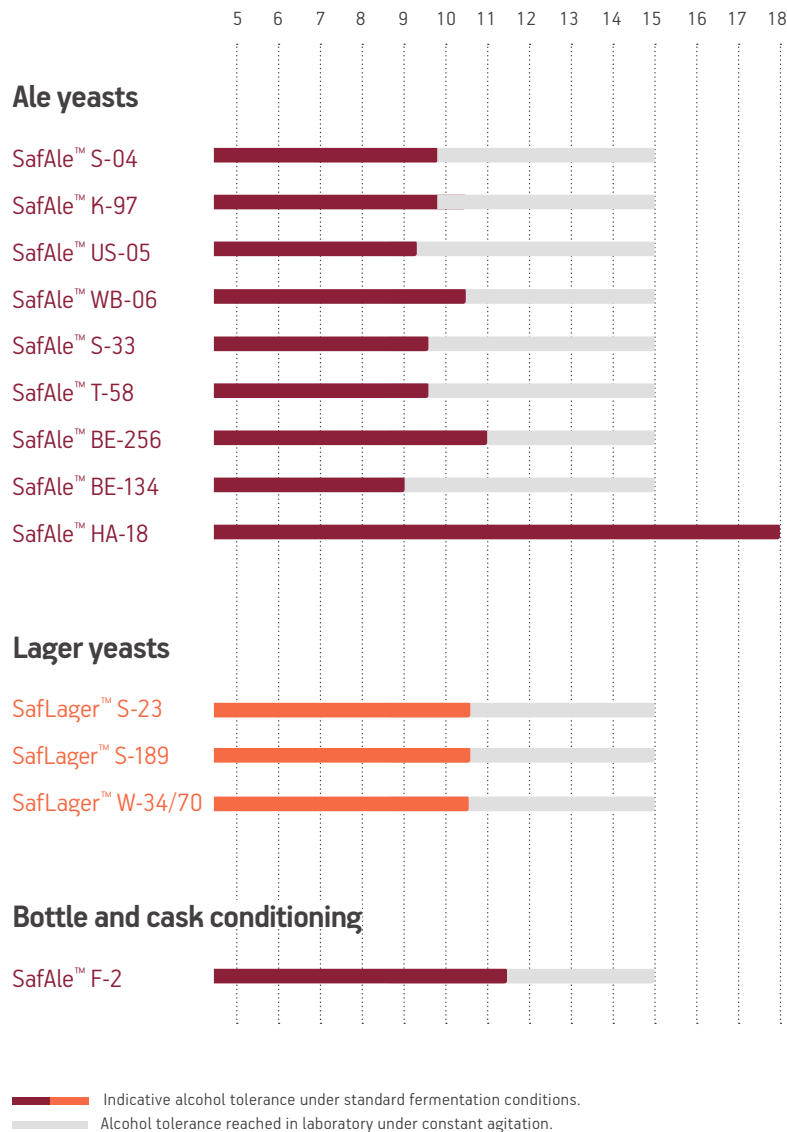


GOOD TO KNOW

**Ca<sup>++</sup>**

A minimum concentration of 100mg/l of Ca<sup>++</sup> is required to allow good flocculation.

Indicative alcohol tolerance in % v/v



# Aromas, flavors and beer styles

IT IS NOT ONLY ETHANOL AND CO<sub>2</sub> THAT PLAY AN IMPORTANT ROLE IN BEER. Its flavor components are chemically and sensorially diverse. The unique flavor profiles of beer can largely be attributed to the biochemical activities within the yeast cell during fermentation, along with the other raw materials and process parameters.

THE YEAST-DERIVED, FLAVOR-ACTIVE COMPOUNDS INCLUDE CARBONYLS (aldehydes/ketones), vicinal diketones, fatty and organic acids, sulphur compounds, higher/fusel alcohols, esters (acetate and ethyl esters). For example, the last ones correspond to a family of compounds closely linked to lipid metabolism and yeast growth, and there are dozens of different esters present in beer that often give fruity and floral notes.

THERE ARE TWO MAIN ESTERS GROUPS: first, the so-called acetate esters (in which the acid group is acetate and the alcohol group is ethanol or a complex alcohol derived from amino acid metabolism). Examples are ethyl acetate (solvent-like aroma), isoamyl acetate (banana aroma), and phenyl ethyl acetate (roses, honey). The second group, called ethyl esters (in which the alcohol group is ethanol and the acid group is a medium-chain fatty acid), includes ethyl hexanoate (aniseed, apple like aroma), ethyl octanoate (fruity, apple aroma), and ethyl decanoate (floral/fruity).

THE AMOUNT AND/OR VARIETY OF FLAVORING COMPOUNDS in beer is a consequence of the metabolism of a given yeast strain, with a particular wort composition and process parameters. The effect of some of these flavoring agents can be quite pleasant.



Representatives of Important Beer Styles	Organoleptic characteristics	Suggested yeast*
Pilsners and Special Lagers	Pronounced flavors from raw materials, specially from malts and hops (variable). Neutral fermentation character, high drinkability.	W-34/70, S-189, S-23
Blond / Pales, Ambers and Browns Ales - American and British Ales	Balanced fermentation flavors along with malt and hop notes.	S-04, US-05, S-33
Belgian Strong Ales (Dubbel, Tripel, Quadrupels, Abbey styles)	Intense Fermentation flavors, rich fruitiness and alcoholic notes, often spicy. Low to high attenuation.	BE-256, S-33, S-04, HA-18
Kolsch	Light and perfumed fruity-floral notes in balance. Delicaded, light with very high drinkability	K-97
Saison	Strong Fermentation flavors, specially intense in fruity notes and spicy character. High attenuation and very dry body, slight acidity, refreshing and sparkling.	BE-134, WB-06, T-58
Weizen beers	Strong Fermentation flavors, specially fruity, banana like and spicy-clove hints. Medium-High attenuation.	WB-06, T-58
Wit Beers (Blanche)	Balanced fruity, grainy and spicy flavors. Light and refreshing.	WB-06, T-58, K-97
India Pale Ales (IPAs)	Hoppy forward beer style, flavors depending on it's varieties. Low to mild fermentation flavors.	US-05, S-04
Hazy IPAs	Hoppy-fruity forward style. Juicy and Hazy.	S-33, K-97, S-04
Brut IPAs	Hoppy and bone-dry beer style (achieved by enzyme utilization). Refreshing and sparkling.	S-33, US-05
Imperial IPAs	Stronger version of India Pale Ale: strong hoppy flavors, high bitterness level and usually higher degrees of alcohol.	K-97, US-05, S-04
Session IPAs	Gentle and lighter IPA versions. High drinkability and lower alcohol and bitterness level.	US-05, K-97, S-04, S-33
Porters	Balanced fermentation flavors along with a complex and flavorfull dark malt character, with variable hop notes intensities.	S-04, US-05
Stouts	Mild and balanced fermentation flavors along with intense dark and roasted malt character, with variable and hop notes intensities and dryness.	S-04, S-33, US-05
Imperial Porters / Stouts	Supports higher fermentation fruity-flavors along with intense dark malt character, and variable hop notes. High alcohol levels, may present warmer mouthfeel.	BE-256, HA-18, US-05, S-04, T-58
Barley Wines	Rich maltiness, sustained fermentation flavors and hoppy notes. High alcohol levels including warm mouthfeel.	HA-18, BE-256, S-33, T-58
<b>OTHER SPECIALTIES</b>		
Acidic Beers	Represent a great variety of beers types, mainly characterized by its acidity often by mix fermentation with bacteria.	LP 652
Low and Non alcoholic beers	Every beer with low or no ethanol content.	LA-01

\*Recommendation of a single yeast strain accordingly with the major flavor expectations. Every strain will vary the flavor profile. For more information about every strain, see next table or, for more informations access: Fermentis App.

Strain	Taxonomy	Attenuation*	Pitching Rate	Phenolic Off-Flavor	E2U™	Usage Recommendation
SafAle™ S-04	<i>S. cerevisiae</i>	74-82%	50-80 g/hl	⊖	YES	English ale yeast selected for its fast fermentation character. Produces balanced fruity and floral notes. Due to its flocculation power, tends to produce beers with higher clarity. Ideal for a large range of American and English Ales - including highly hopped beers - and is specially adapted to cask-conditioned ones and fermented in cylindo-conical tanks.
SafAle™ BE-256	<i>S. cerevisiae</i>	82-86%	50-80 g/hl	⊖	YES	Active dry yeast recommended to brew a diversity of Belgian type beers such as abbey style known for its fruitiness and high alcohol content. It ferments very fast and reveals strong fermentation aromas. To maintain the aromatic profile at the end of the fermentation, we do recommend to crop this yeast as soon as possible after fermentation.
SafAle™ US-05	<i>S. cerevisiae</i>	78-82%	50-80 g/hl	⊖	YES	American ale yeast producing neutral and well balanced ales, clean and crispy. Forms a firm foam head and presents a very good ability to stay in suspension during fermentation. Ideal for American beer types and highly hopped beers.
SafAle™ S-33	<i>S. cerevisiae</i>	68-72%	50-80 g/hl	⊖	YES	Fruity driven strain, gives a high mouthfeel and body to the beer. Ideal for Belgian Ales (Blond, Dubbel, Tripel, Quadrupel Styles) and strong English ales (ex. Imperial Stouts). Is ideal also for New England IPA's. Yeast with a medium sedimentation: forms no clumps but a powdery haze when resuspended in the beer.
SafAle™ K-97	<i>S. cerevisiae</i>	80-84%	50-80 g/hl	⊖	YES	German ale yeast producing subtle fermentation character. Depending on the conditions tend to present floral and balanced fruity character. Ideal for delicate beers such as German Kolsch beers, Belgian Wits and some versions of Session Beers. Suitable for heavily hopped beers and has ability to form a large firm head when fermenting.
SafAle™ T-58	<i>S. cerevisiae</i>	72-78%	50-80 g/hl	⊕	YES	Specialty yeast selected for its strong fermentation character, intense fruity and phenolic flavors - specially banana, clove and peppery notes. Suitable for a great variety of wheat-base beers and fruity-spicy oriented styles. Yeast with a medium sedimentation: forms no clumps but a powdery haze when resuspended in the beer.
SafAle™ WB-06	<i>S. cerevisiae</i> var. <i>diastaticus</i>	86-90%	50-80 g/hl	⊕	YES	Fruity and phenolic character, varying with the fermentation conditions. Produce well-attenuated beers and its ideal for wheat base beers, such as Belgian and German Styles (Ex. Wit Beers and Weizen Beers). Produces typical phenolic notes of wheat beers. Allows to brew beer with a high drinkability profile and presents a very good ability to suspend during fermentation.
SafAle™ BE-134	<i>S. cerevisiae</i> var. <i>diastaticus</i>	89-93%	50-80 g/hl	⊕	YES	This typical yeast strain is recommended for well-attenuated beers, produces fruity, floral and phenolic notes and a dry character. Produces highly refreshing beers, it is ideal for Belgian-Saison style.
SafAle™ HA-18	<i>S. cerevisiae</i> + enzyme (glucoamylase)	98-102%	100-160 g/hl	⊕	NO	SafAle™ HA-18 is a powerful solution (consisting of Active Dry Yeast and enzymes) for the production of high-gravity and particularly high alcoholic beers - such as strong ales, barley wines and barrel aged beers with very high density. It has a very good resistance to osmotic pressure and high fermentation temperatures (thermotolerant yeast).
SafAle™ F-2	<i>S. cerevisiae</i>	NA	2-35 g/hl	⊖	NO	SafAle™ F-2 has been selected specifically for secondary fermentation in bottle and in cask. This yeast assimilates very little amount of maltotriose but assimilates basic sugars (glucose, fructose, saccharose, maltose). It is characterized by a neutral aroma profile respecting the base beer character and settles very homogeneously at the end of fermentation.
SafLager™ W-34/70	<i>S. pastorianus</i>	80-84%	80-120 g/hl	⊖	YES	This famous yeast strain from Weihenstephan in Germany is used world-wide within the brewing industry. Known by its neutral character, SafLager™ W-34/70 produces neutral fermentation character, giving clean and neutral profile. Depending on the conditions it may present slight fruity and floral notes.
SafLager™ S-23	<i>S. pastorianus</i>	80-84%	80-120 g/hl	⊖	YES	Bottom fermenting yeast originating from Berlin (Germany) recommended for the production of more fruity and estery lagers. Its profile gives beers with a good length on the palate.
SafLager™ S-189	<i>S. pastorianus</i>	80-84%	80-120 g/hl	⊖	YES	Originating from the Hürlimann brewery in Switzerland. This lager strain's profile allows to brew fairly neutral flavor beers with a high drinkability. Depending on the conditions, tend to present noticeable herbal and floral notes to lager beers.



# Make your choice!



— THIS IS OUR PORTFOLIO COVERING BREWERS' SPECIFIC NEEDS. We offer efficient and qualitative strains which will help you design the beer of your dreams. Let's discover their main characteristics.

— PLEASE KEEP IN MIND THAT ALL OUR RESULTS ARE INDICATIVE and may vary according to raw materials, brewing processes, and fermentation conditions.

## Ale or Lager?

— FERMENTIS SUPPLIES TWO RANGES OF YEAST STRAINS. Do you want to make a Lager beer? You can select from our three dedicated yeasts. An Ale? Select from our 9 strains!

### SafAle™

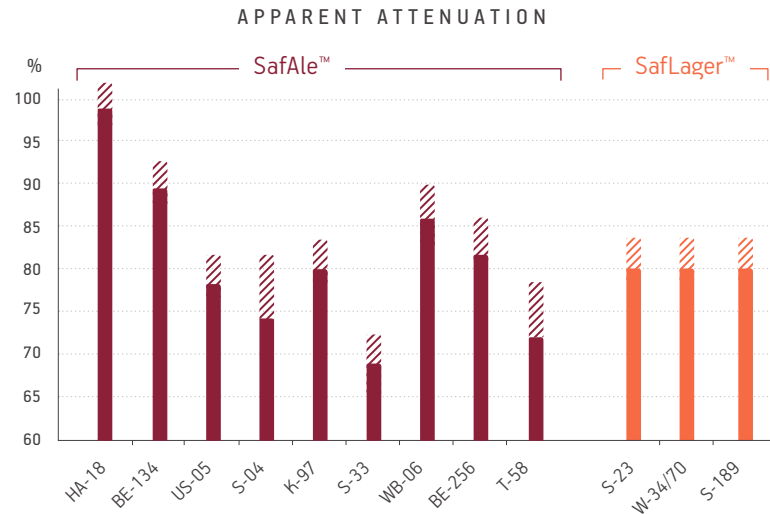
- BE-134
- HA-18
- US-05
- S-04
- K-97
- S-33
- WB-06
- BE-256
- T-58

### SafLager™

- S-23
- W-34/70
- S-189

## Dry or full-bodied beers?

**FIND THE RIGHT BALANCE BETWEEN RESIDUAL SUGARS AND FINAL ALCOHOL.** Almost all of our yeast strains guarantee a medium/high attenuation rate: around 78-84%. If you want to create a beer with a higher attenuation and a low level of residual sugars, SafAle™ BE-256 or SafAle™ BE-134 are the obvious choices. For high-density beers, SafAle™ HA-18 allows for a very high attenuation. However, if you want to create a medium level of residual sugars, SafAle™ S-33 will work perfectly.

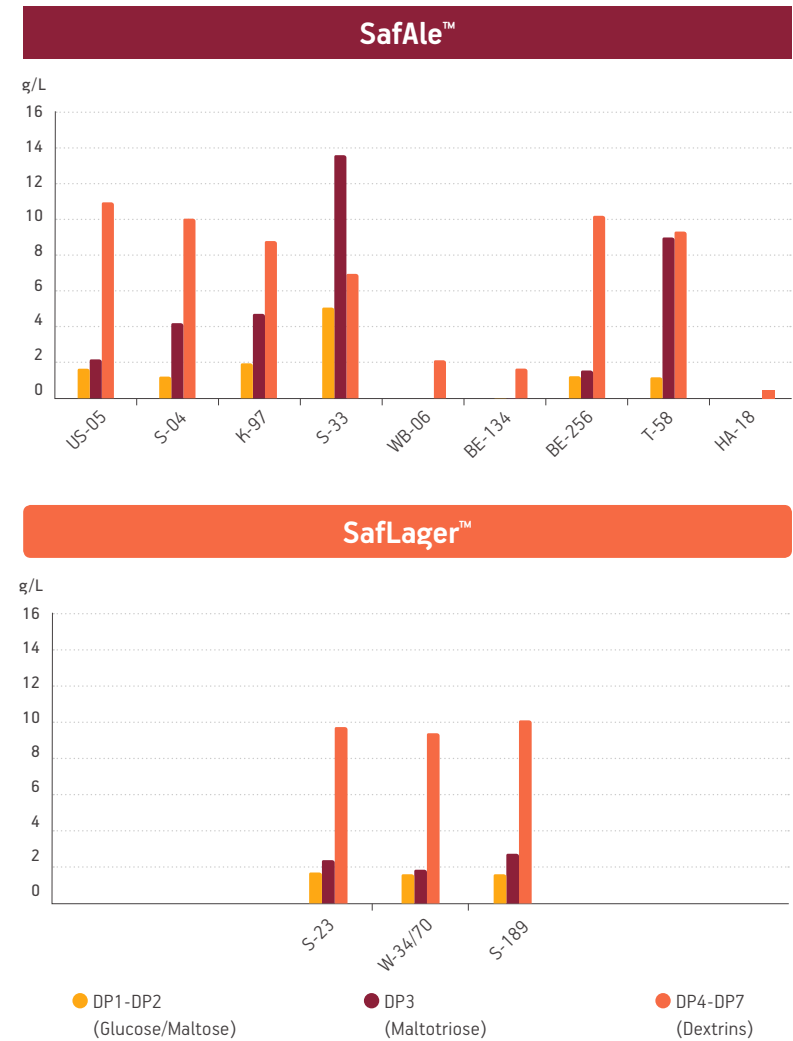


### GOOD TO KNOW

We have set up a study to demonstrate and compare the flavor and aroma characteristics of our main commercial yeast strains (see page 45). All have been tested in the same standard conditions, with the lowest possible impact of other ingredients, i.e. in the most neutral conditions. Wort: 100% 2 row spring barley pils malt, 15°P / Bitterness: 25 IBU with pure iso-alpha-acids (end of boiling) / Pitching rate: 50 g ADY/hl / Fermentation: 23°C, @Atm. P.

## Residual sugars

**LOOKING FOR YEASTS THAT LEAVE SOME SPECIFIC SUGARS BEHIND?** SafAle™ S-33 will leave most of the maltotriose. Conversely, SafAle™ BE-256 will consume almost all of it. Furthermore, SafAle™ WB-06 and SafAle™ BE-134 are *S. cerevisia* var. *diastaticus* and will convert dextrins into fermentable sugars.



## Esters

SOME SPECIFIC SAFALE™ STRAINS DEVELOP A NEUTRAL PROFILE, while other yeasts express more fruity flavor – mainly SafAle™ BE-256 and SafAle™ WB-06.

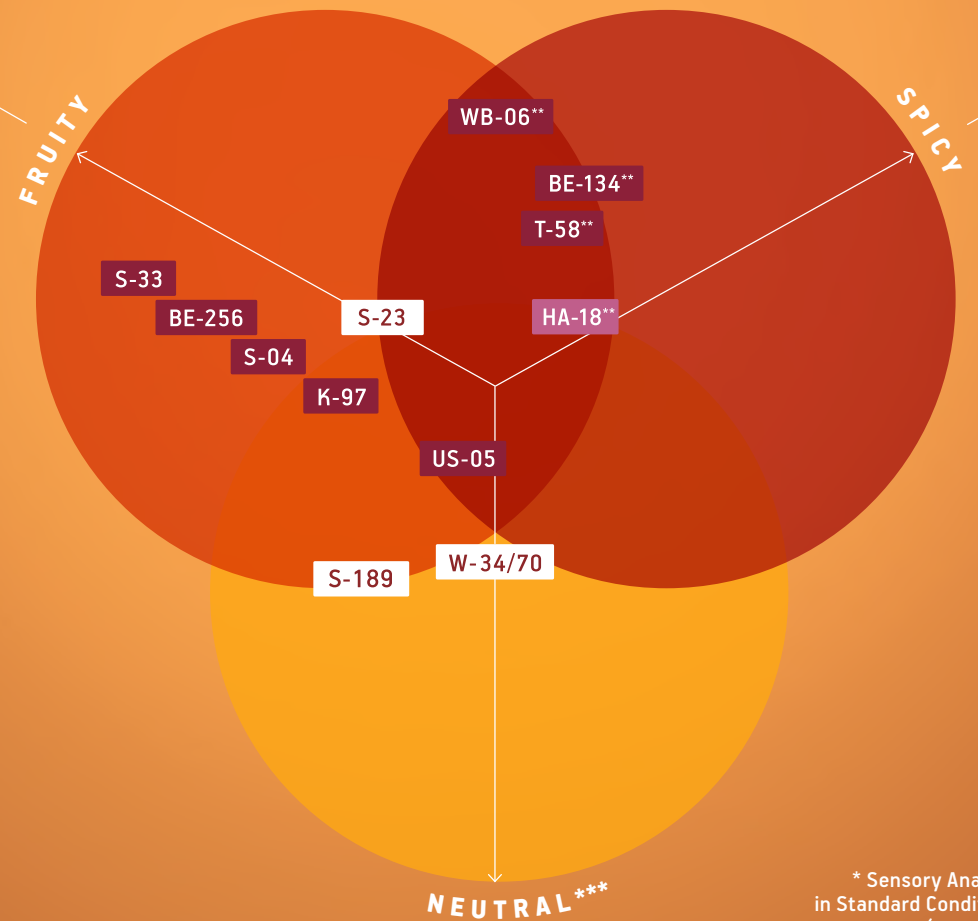


## Baseline Flavor & Aromas\*

SafLager™ Yeasts

SafAle™ Yeasts

Mix: Yeast + Enzyme



\* Sensory Analysis in Standard Conditions (see p.42).

\*\* Phenolic Flavors

\*\*\* Raw Material Expression Facilitated

# Major notes &

# flavors descriptors

🌾 Malt	
<b>Grainy</b>	Cereals, Bready
<b>Malty</b>	Biscuity
<b>Caramel</b>	Toffee, Molasses, Honey
<b>Nutty</b>	Almond, Nuts, Marzipan
<b>Roasty</b>	Coffee, Cocoa, Chocolate
<b>Smoky</b>	Smoked

🌿 Hop	
<b>Herbal</b>	Herbs, Tea-Like
<b>Menthol</b>	Mint, Camphor, Pine, Resinous
<b>Citrusy</b>	Grapefruit, Orange, Lime, Lemon, Mandarin, Etc.
<b>Fruity</b>	Berries, Melon, Peach, Apricot, Passion Fruit, Lychee, Pineapple
<b>Spicy</b>	Spices, Pepper, Chili, Curry, Juniper
<b>Floral</b>	Lily, Jasmine, Violet, Rose, Geranium
<b>Vegetal</b>	Celeriac, Onion, Garlic

🍄 Yeast	
<b>Fruity</b>	Banana, Apple, Pear, Apricot, Pineapple, Tropical Fruits, Sweety-Ripened Fruits, Tutti-Frutti
<b>Floral</b>	Roses, Geranium
<b>Phenolics</b>	Spicy, Clovy
<b>Alcoholic</b>	Vinous, Sherry
<b>Aromatic</b>	Perfumy, Estery

Off Notes	
<b>Sulfury</b>	Lightstruck, DMS, H <sub>2</sub> S, Sulfitic
<b>Stale/Oxidized</b>	Metallic, Papery, Cardboard
<b>Fatty/Dairy</b>	Diacetyl (Buttery), Isovaleric (Cheesy), Butyric (Rancid), Caprylic (Goaty, Waxy)
<b>Acetaldehyde</b>	Cidery, Green Apple-Like
<b>Infection</b>	Medicinal, Lactic, Acetic, Animal, Leathery, Musty, Earthy
<b>Autolysis</b>	Yeasty, Meaty, Mercaptans
<b>Phenols</b>	Plastics, Rubber, Smoky, Chlorophenol
<b>Solvent</b>	Chemical, Paint, Glue



# Glossary

## — Alcohol By Volume (v/v) —

THE PERCENTAGE OF VOLUME OF ALCOHOL per volume of beer.

## — Alpha-Acid Content —

MEASUREMENT OF THE POTENTIAL BITTERNESS OF HOPS, expressed by their percentage of alpha acids.

## — Apparent extract (AE) —

MEASUREMENT OF THE EXTRACT, EXPRESSED IN PLATO (°P), and without correcting the depressing effect due to ethanol presence.

## — Apparent Specific gravity (ASG) —

MEASUREMENT OF THE BEER-SPECIFIC GRAVITY without correcting the depressing effect due to ethanol presence (See Specific gravity).

## — Attenuation/Apparent Degree of Fermentation —

PERCENTAGE OF EXTRACT THAT HAS BEEN FERMENTED when comparing apparent extract to original extract. It is calculated by one the following formulas:  $100 \cdot (OE - AE) / OE$  or  $100 \cdot (OSG - ASG) / (OSG - 1)$

## — Diacetyl (Butane-2,3-dione) —

A FERMENTATION BY-PRODUCT GIVING "BUTTERY" OFF-FLAVOR.

It is formed and reduced during and at the end of fermentation by the yeast. It can also come from contamination.

## — Dimethyl sulphide (DMS) —

A SULFUR AROMA COMPOUND FROM MALT ORIGIN that brings corn or cabbage flavor to the beer. At high temperature, S-methylmethionine (SMM) is converted into DMS. During boiling, evaporation eliminates DMS, whereas DMS formed during whirlpool stays in the wort.

## — Esters —

AROMATIC COMPOUNDS GENERATED BY YEAST DURING FERMENTATION.

The main esters are: isoamylacetate - banana; ethylhexanoate - red apple and ethylacetate - fruity/solvent (in excess).

## — International Bitterness Unit (IBU) —

STANDARD UNIT TO MEASURE THE CONCENTRATION OF BITTER COMPOUND in beer. 1 IBU stands for 1 ppm (mg/l) of iso-alpha-acid.media.

## — Malt —

BARLEY OR OTHER CEREAL STEEPED IN WATER, GERMINATED AND KILNED (DRIED).

The malt provides the necessary enzymes to convert insoluble starch to soluble substances and sugars during mashing. It also provides color and flavor to the beer.

## — Mash - Mashing —

PROCESS OF MIXING THE CRUSHED CEREAL (mainly malted barley) with water and heating it to produce an aqueous extract. During this process, natural malt enzymes degrade starch into fermentable sugar and dextrins.

## — Original Extract (OE) —

MEASUREMENT OF THE WORT CONCENTRATION (total dissolved solid present in the wort), expressed in plato (°P), prior to fermentation. It includes fermentable and non-fermentable substances.

## — Original Specific Gravity (OSG) —

SPECIFIC GRAVITY OF THE WORT PRIOR TO FERMENTATION (see Specific Gravity).

## — Plato degree (°P) / Extract —

MEASURE OF DISSOLVED SUBSTANCES INTO THE WORT OR BEER.

Extract is expressed in plato degree (°P). 1°P equals 1g of extract per 100g of liquid. When measured into the beer, alcohol is mixed with water. As alcohol has a weight by volume lower than water, a measure of extract in beer is lowered due the alcohol presence. This is the depletion effect of the alcohol.

## — Specific gravity —

RATIO between the weight by volume of wort/beer to the weight by volume of pure water at 20°C / 78°F. Example: a specific gravity of 1.048 (or 1048).

## — Wild yeast —

WILD YEASTS ARE NON-SACCHAROMYCES SPP. YEAST identified by EBC Analytica 4.2.6 or ASBC Microbiological Control-5D.

# Get our app!

Fermentis has developed the art of fermentation with passion, always aiming to always improve taste and enjoyment in the beverage industry.

DRIVEN BY THIS SPIRIT, THE FERMENTIS TEAM HAS DESIGNED A NEW APPLICATION TO ADVISE AND ASSIST ALL BREWERS.

Find helpful and creative tools in our Fermentis app, available on Apple Store and Google Play.

## CONVERTERS

(volume, temperature, weight, density...)

## REFERMENTATION TOOL

(calculate the amount of sugars you need)

## YEAST ADVISOR

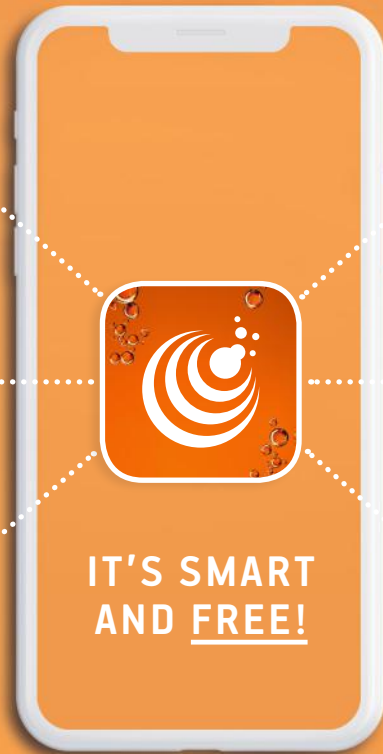
(advice according to the type of beer you need)

## MAKE YOUR CHOICE TOOL

(uncertain? This compares our yeasts and chooses the best one for you)

## ABV AND ATTENUATION CALCULATOR

## MANY OTHERS TO COME!



## Contact Us

For any question or project, feel free to email or call us. We'll be pleased to help you.

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   [www.fermentis.com](http://www.fermentis.com)

# An expert in the art of fermentation

Fermentis works with everyone in the world of beer, wine, spirits and other fermented beverages. Its range of products and services covers almost all professional requirements: from safeguarding production to expressing sensory characteristics. Business Unit of the Lesaffre Group, global key player in fermentation and yeast, Fermentis builds solutions and results upon its talented experts, visionary R&D program, industrial expertise which meets the highest international quality standards and a strong and coherent marketing and communication strategy. Its mission? Become the obvious choice for brewers, winemakers and all producers of fermented beverages, helping them express their inventiveness and creativity.