Tips AND Tricks

ACTIVE DRY YEAST AND FERMENTATION EXPLAINED TO BREWERS

THE OBVIOUS CHOICE FOR BEVERAGE FERMENTATION

Fermentis
LESAFFRE FOR BEVERAGES

(*) Active Dry Yeast

We're here to help

There are some great things happening in the world of fermented beverages. We are seeing young designers, small distilleries, craft breweries, new wine estates... There are risks; there is daring and some wonderful results. And as with any kind of creative endeavor, there are also disappointments.
This is a virtuous model, even for the market's biggest players who are pushed to be even more inventive. This is why we want to support the efforts of those who give it a try, maybe because we share this taste for innovation and initiative.
This document, we designed it for you, brewers; to offer you a tool to learn how dry yeast is produced, what essential parameters will influence your fermentations, how the Fermentis yeast strains are characterized and give useful technical tips to better manage yeast in your brewery.
We sincerely hope that it will be useful to you and will help you create the beers you dream of.

Tips and Tricks can be downloaded from our website, as well as other practical tips and tools.

Fermentis
LESAFFRE FOR BEVERAGES

ADY: a precious tool for you

Constant innovation and creativity in brewing have made the success of the craft brewing industry. Brewing a large number of beers in the same premises adds to the difficulty of yeast management, while beer quality and consistency between batches are key factors to exceed customers' expectations.

Dry yeast is a reliable answer and the choice of numerous craft brewers around the world to achieve consistent fermentations from batch to batch. Ready to pitch, directly into the wort or after rehydration through a simple procedure, Fermentis Active Dry Yeast is easy to use (E2U™)! Correct yeast counts are achieved simply by pitching a known weight of dry yeast. No propagation or in-house laboratory input is needed. The consistency of fermentations 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 enabling high quality lager production. A range of specialty ale yeasts has also been developed to produce ales with authentic flavor profiles and a variety of specialty beers.

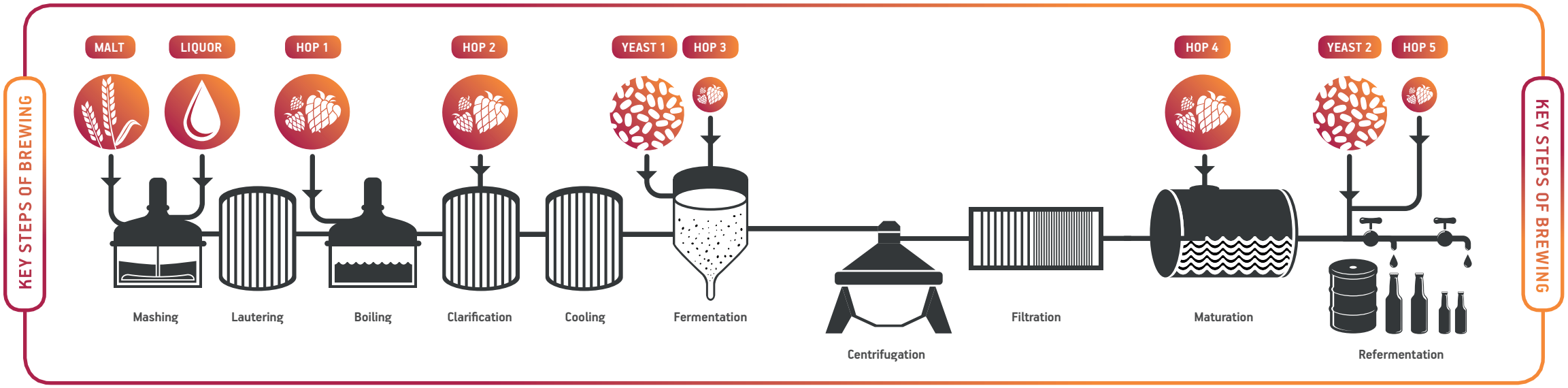
Each Fermentis yeast has its own characteristics; fermentation kinetics and profile, attenuation rate, alcohol tolerance, flocculation, sedimentation, organoleptic expression…

Better knowing our yeasts and better understanding their characteristics will allow you to get the best out of them and to adapt your brewing and fermentation conditions to brew the beer you want.

This diagram shows the most important steps in beer production and at which stage each ingredient enters the process. Yeast affects fermentation and 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 will be released during fermentation and as such the yeast strain and fermentation conditions chosen by the brewer will impact the final beer. All the elements in the brewing recipe will influence the final character and the final aromas of the beer: the water composition, the minerals, the malt bill, the choice of hops and the hopping process.

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

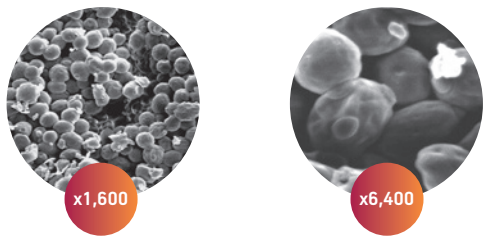


Yeast, what is it?

YEAST IS THE GENERIC NAME GIVEN TO A GROUP OF EUKARYOTIC MICROORGANISMS, classified within Fungi. They grow predominantly as single cells, and they include the gendre *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 classical beer yeasts are members of the genus *Saccharomyces;* 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 to allow them to be classified into the same genus or species (either *S. cerevisiae,* which include ale strains, or *Saccharomyces pastorianus,* which include lager strains). The taxonomy of yeasts has been and is still under a continual revision, often accompanied by changes in nomenclature.

MICROSCOPIC PICTURE OF A YEAST CELL



Yeast, *Saccharomyces cerevisiae*, is a unicellular fungi.
A *Saccharomyces cerevisiae* yeast cell measures between 5 and 50 µm.

FLASH BACK

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 an extensive and meticulous work, he elucidated that beer was fermented not by chemicals but by microorganisms. He noticed that in the midst of another population of microorganisms ('wild yeast', bacterias and molds), there were the 'brewers yeasts' and just these microorganisms were the greatest responsible for a proper beer fermentation. With this new understanding, he and other scientists began to refine microbiological techniques and thus major understandings regarding principles and quality control for beer could be effectively implemented.

Important microorganism in beer

WITH RESPECT TO BEER PRODUCTION RELATED PROPERTIES; THE YEASTS USED FOR FERMENTATION OF WORT INTO BEER ARE TRADITIONALLY CLASSIFIED AS ALE, LAGER OR 'WILD' TYPES, whereas *Saccharomyces cerevisiae* are referred as ale yeasts or top-fermenting yeasts and *Saccharomyces pastorianus* as lager yeast or bottom-fermenting yeast. *S. cerevisiae* include a very diverse group – considered domesticated – of ale yeasts used for producing beer, bread, wine and in a number of other applications. They are distinct from lager beer strains – a cryotolerant hybrid – called *Saccharomyces pastorianus* (over the time, these yeasts were also called *S. carlsbergensis*).

NOT JUST THE LAGER YEAST *S. PASTORIANUS* IS A NATURAL HYBRID USED IN BEER PRODUCTION, but an important fraction of brewing strains classified as *S. cerevisiae* may correspond to hybrids.

REGARDLESS OF NOMENCLATURE ISSUES, IN THE BREWING INDUSTRY THERE IS A FUNDAMENTAL 'RULE' THAT LAGER YEASTS PERFORM IDEALLY AT LOW TEMPERATURES (8-15°C), whereas ale yeasts operate best at higher temperatures (approximately at or above 20°C). The enormous range of beer styles, and its flavors and aromas are not only resulting of different processing parameters and raw materials, but also due to the use of specific yeast strains with their typical sensory expression. The yeast plays an important role in the primary fermentation (the main alcoholic fermentation) as well in the secondary bottle re-fermentation.

LASTLY, WILD YEASTS ARE BY CONVENTION DIVIDED INTO *SACCHAROMYCES* AND NON-*SACCHAROMYCES* TYPES. Some specific strains of *S. cerevisiae* can be seen as non-wanted wild yeasts. While some strains can behave as contaminants and they can affect the expected flavor profile of certain types of beer – some of these specific attributes may be wanted in specific beer styles (for example the POF character, see right page).

SOME WILD YEASTS MAY INCLUDE VARIATIONS OF *S. CEREVISIAE* - for example *S. cerevisiae var diastaticus* which have abilities to ferment comparatively a higher portion of complex sugars – as well other species, like the ones of the genus *Brettanomyces (Dekkera)* 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-?

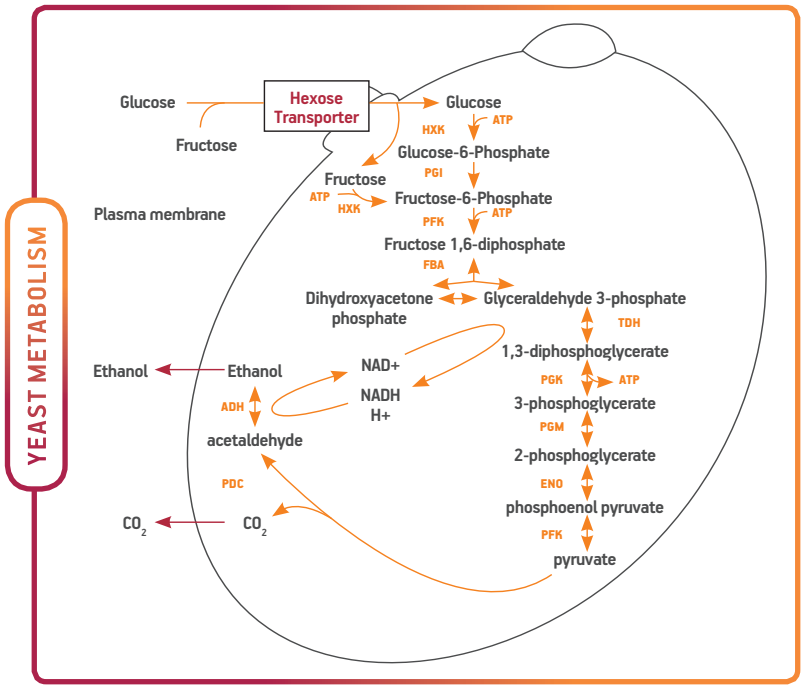
Some yeast strains may be from the same species, although then can carry important genes that impact the beer flavor. A very important example in beer is yeasts that differ in its 'POF' – *or phenolic off flavor* – gene expression.

In other words, those yeasts have a specific enzyme that decarboxylates phenolic acids from the beer wort such as ferulic acid and cinnamic acid - producing the flavor active compounds 4-vinyl-guaiacol and styrene, respectively. Those components have a clove, spicy or medicinal flavors which, depending on the concentration, may give spicy and complexity character in some Belgian Ales and wheat beers but, can be extremely undesirable in other beer types, such as Pilsen or Stout Beers.

Yeast in fermentation and maturation

TYPICAL BOTTOM FERMENTATION CAN TAKE ABOUT ONE OR A COUPLE OF WEEKS whereas a top fermentation tend to be faster and takes about three to six days – depending on the conditions and more specifically the temperature applied. During maturation at low temperatures, there is minimal yeast activity, but the fermentation by-products produced during the fermentation phase will deliver the flavor characteristics depending on the identity of the yeast(s) strain(s) used along with the specific fermentation conditions.

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



Sugars Involved

BREWING YEAST STRAINS CAN UTILIZE VARIOUS CARBOHYDRATES (glucose, sucrose, fructose, maltose, etc.) with some distinguishing difference between ale, lager and wild types. The beer wort supplies the yeasts with simple and complex sugars such as glucose, 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 brewing 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 assimilate maltotriose. There are some top fermenting yeasts that have this capacity too, like SafAle™ WB-06, for example.

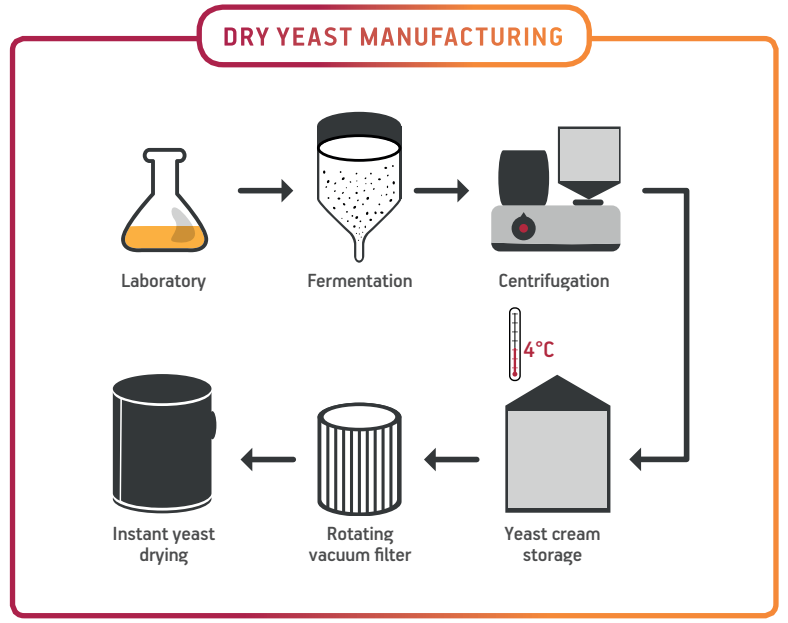
DEXTRINS

Dextrins are polymers (multiple unites) of glucose in a linear or branched chain. It is formed in the beer wort during the mashing process but its relevance to brewing is due to fact they are not fermentable by brewing yeast (with some exceptions). Fixed final attenuation values indicates the end of fermentation and it describes the amount of fermentable sugars in wort - though residual extract (no fermentable sugars) left in final beer. Therefore, its concentration is mainly associated with the body and mouthfeel of the beer.

Not only sugars but the beer wort provide several other nutrients for the yeast metabolism, such as minerals, ions and remarkably sources of nitrogen (amino acids, ammonium ion and some peptides) which will be utilized by yeast for growth, protein formation (structural and enzymic) as well flavor precursors.

How is ADY manufactured?

SOME STILL THINK THAT AN ACTIVE DRY YEAST HAS PARTLY LOST ITS PROPERTIES and that it is more convenient, for example, to use a liquid yeast. It is a common belief and a false perception because dry yeast is the freshest yeast format. This is definitively the reliable answer to achieve consistent fermentations from batch to batch and to meet brewers needs. At Fermentis, we select yeasts that can support drying and are able to recover all their properties once rehydrated. Let's see how we produce them.



Yeast cycling

1. FROM THE LABORATORY TO CENTRIFUGATION

THE ACTIVE DRY YEAST IS GROWN BY A SEXUAL REPRODUCTION, BY BUDDING. The mother cell forms a bud. This bud receives progressively a duplicate of all mother yeast content (cytosol, organites, nucleus, ...). The bud continues to grow until it separates from the parent cell. It forms a daughter cell. If the two yeast cells daughter and mother are in a good medium, they start again to make a bud.

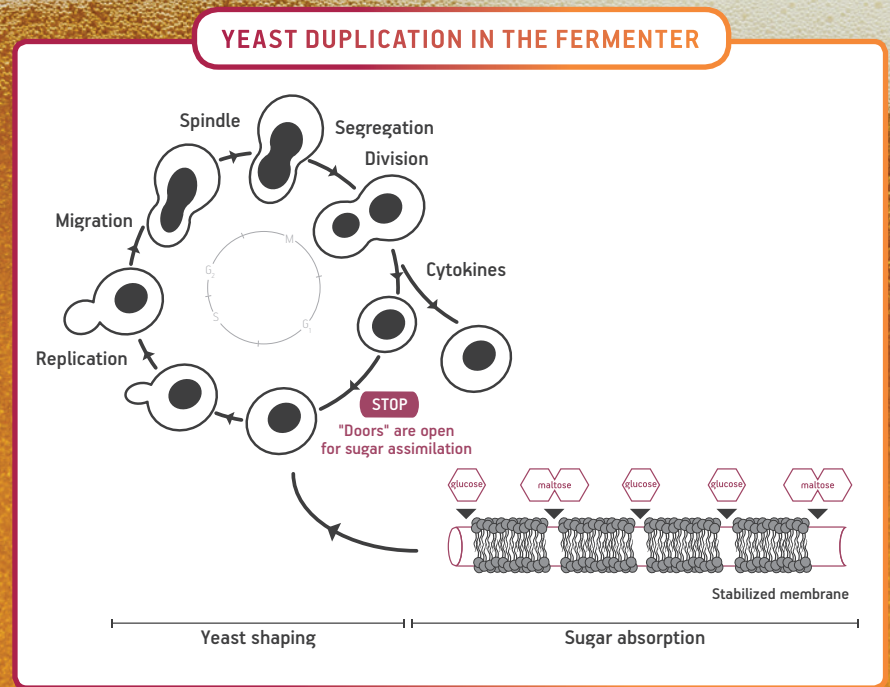
IF THE YEAST ENVIRONMENT IS ADVERSE TO THE GROWTH, the yeast may start to metabolize resisting compounds like glycerol, trehalose, glycogen,... Glycerol synthesised help the yeast resist to osmotic pressure. Trehalose is a key contributor to the membranes drying resistance. Trehalose and Glycogen are reserved carbon hydrate (energy to restart). Glycogen could act in lager yeast as membrane skeleton.

IN NATURE, DURING THE RAINING SEASON, ENVIRONMENT IS GOOD FOR THE GROWTH. When the dry season starts, environment begins to be adverse to growth. Microorganisms do exhibit specific metabolisms to be naturally dried.

FERMENTIS YEASTS ARE GROWTH 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 FERMENTATION, THE YEAST IS CENTRIFUGED. The resulting fresh cream yeast is stored to be dried quickly. The cream yeast is filtered to obtain crumble yeast which is extruded and dried.



experience!

Is ADY ready to "work"?

You want to be sure by yourself that your Fermentis active dry yeast is ready to work? Do the test by your own!

What you need: two plastic bottles, two balloons or rubber gloves, 20cl of water (twice), 15g of sugar (twice) and 15g of yeast.

1. Put the water and the sugar in each of the bottles* and in one add the yeast.
2. Immediately fix a ballon or rubber glove tightly on each bottle (and place them in a warm environment: 40°C).
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 which starts to produce CO_2 (carbon dioxide), the same CO_2 which is able to inflate the balloon.

Your experience is a success? Great, it is the sign that your Fermentis yeast is active, you could now pitch it in your wort!

* Make sure that the balloon or rubber glove is hermetically fixed on the neck of the bottle.

Quality control

FERMENTIS EXECUTES A POSITIVE RELEASE: after production, the batches are blocked up until all quality control results are obtained. 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 (*)/ ml (**).

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

UP TO NOW, NO CONTAMINATING BACTERIA GROWTH WERE OBSERVED IN HOPPED WORTS OR BEERS. The level of non-*Saccharomyces* yeast contamination is so low that it does not impact the flavor with up to several recyclings.

Shelf life

THE STABILITY OF EACH FERMENTIS ADY IN TERMS OF FRESHNESS AND ACTIVITY has been monitored during more than three years. The yeasts were stored at different temperatures.

FIVE BATCHES OF EACH FERMENTIS YEAST were also submitted to forced ageing tests.

NO SIGNIFICANT FRESHNESS VARIATIONS WERE OBSERVED. Therefore, beer yeast shelf life is three years, when store under recommended conditions (see sachets).

BATCH CLEARANCE is related to forced ageing tests results..

Batch number and traceability

ALL FERMENTIS SACHETS OR BOXES ARE IDENTIFIED BY AN ALPHANUMERIC CODE. It permits to find all data related to the batch produced, from raw material used to recorded process parameters and quality results.

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

CERTIFICATION

YOU NEED A STATEMENT?

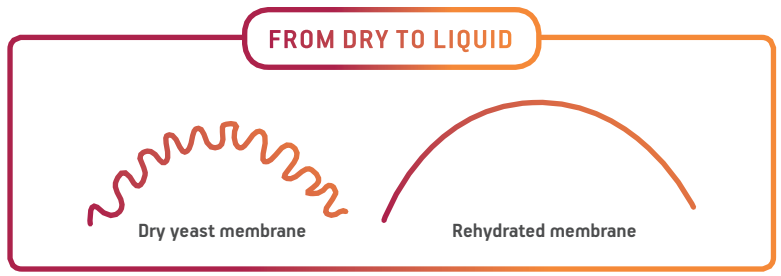
All our products are certified for your benefit. We remain at your disposal to provide any certificate or statement you may need. Simply send us an e-mail at fermentis@lesaffre.com

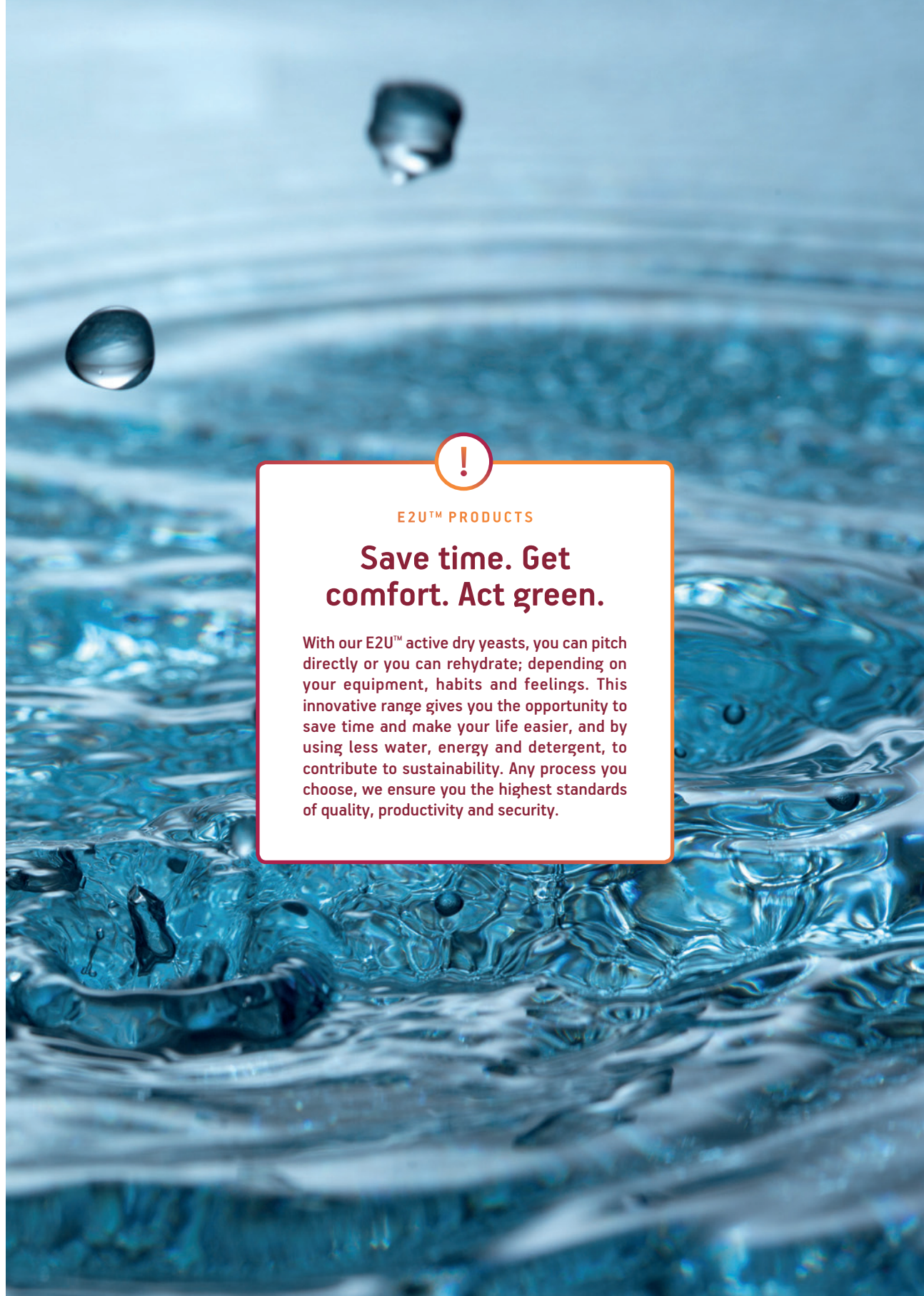
How to use active dry yeasts?

TODAY A STUDY DEMONSTRATES THAT THE USE OF ACTIVE DRY YEASTS (ADY) is very easy and does not necessarily include a rehydration step. To the contrary, the ADY can advantageously be immediately put in contact with the wort into the fermentation vessel (direct pitch). Several rehydration and direct pitch conditions do not show any significant differences in terms of the viability and the vitality of the ADY. This concept is protected under the E2U™ umbrella.

E2U EASY USE by Fermentis

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





E2U™ PRODUCTS

Save time. Get comfort. Act green.

With our E2U™ active dry yeasts, you can pitch directly or you can rehydrate; depending on your equipment, habits and feelings. This innovative range gives you the opportunity to save time and make your life easier, and by using less water, energy and detergent, to contribute to sustainability. Any process you choose, we ensure you the highest standards of quality, productivity and security.

Temperature Monitoring

If you are used to rehydrate dry yeast, no worry you still can! Just follow our recommended process.

- Rehydrate the dry yeast into yeast cream by sprinkling it on 10 times its own weight of sterile water or hopped wort.
- Leave to rest; eventually agitate gently (no violent agitation) for about 15 minutes.
- Finally, pitch the resultant cream into the fermentation vessel.

ALE YEASTS
Recommended temperature range
15-30°C
(59-86°F)

LAGER YEASTS
Recommended temperature range
15-25°C
(59-77°F)

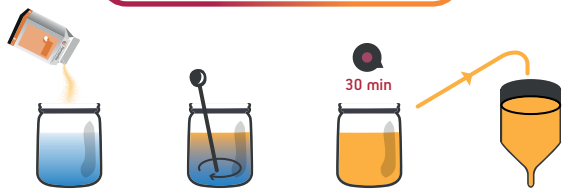
AFTER REHYDRATION, BACTERIAL CONTAMINATION CAN DEVELOP IN THE SLURRY. For that reason, we recommend a rehydration in sterile hopped wort compared to sterile unhopped wort or sterile water. The iso-alpha acids present in the media will protect the slurry from bacterial contaminations and will not affect the rehydration process of the ADY.

Stored at 4°C (39°F)
pitch within 18H

Stored at 20°C (68°F)
pitch within 6H

Stored at 25°C (77°F)
pitch within 4H

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.

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, but in any case, sterility is mandatory.

IF THE REHYDRATION PROCESS OCCURS IN HOPPED WORT, it should be after a first hop addition and a wort boiling for at least 20 minutes, Therefore, collect the volume required for rehydration and leave to cool to the required temperature. In both cases, rehydrate the yeast for 15 minutes. Pitch immediately into the tank, during the first part of the cooling.

DON'T FORGET YOUR REHYDRATION ESSENTIALS

- 1 -
Respect recommended rehydration temperatures to ensure good start of the fermentation

- 2 -
Water or hopped wort, whatever you choose make it sterile

GOOD TO KNOW

Direct pitch

If the 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 the cooling will be the same as the temperature used to start the fermentation. There is no need for aeration during this process.

What to be careful about?

Pitching rate

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

ADY ADDS THE ADVANTAGE OF CONVERTING A DRY YEAST WEIGHT to accurately know the number of viable cells pitched in the wort.

IF THE FERMENTATION VESSEL WILL CONTAIN MORE THAN ONE BREW, we also recommend adding the total quantity of ADY of 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 10^6 cells/ml
LAGER YEASTS*	80-120 g/hl (0.10-0.16 oz/gal)	8-12 10^6 cells/ml

*Values given are for fermentation between 12-15°C (53-59°F).
The 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).

Temperatures

THE RECOMMENDED FERMENTATION TEMPERATURE RANGE (refer to product packaging or specification sheets) of each strain must be respected.

THE HIGHER THE TEMPERATURE IS AT THE BEGINNING OF THE FERMENTATION, the faster the fermentation will start. Using higher temperatures will increase the aromatic profile and the diacetyl formation during the fermentation. Specifically, for the reduction of diacetyl, it may be necessary to increase the temperature at the end of fermentation (diacetyl rest).

LOW TEMPERATURE (0-5°C) 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 the appearance of CO_2 bubbles and smell 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 THE WORT COOLING AND TRANSFER TO THE FERMENTER. Indeed, the 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, addition of air or oxygen is mandatory.

Yeast recycling

REUSING YEAST FROM A PREVIOUS BATCH REQUIRES DEDICATED TANKS, 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 final population required at the beginning of the fermentation.

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

Bottle and cask conditioning

YEAST IS USED FOR REFERMENTATION IN BOTTLES OR IN CASKS. If the primary objective of the method is to saturate the beer in CO_2, doing a refermentation brings other benefits to the beer. First, the presence of living yeast in the bottles/casks will prevent the beer from oxidation and increase its shelf life. It will also bring mouthfeel and roundness to the beer.

WHEN SELECTING A YEAST for refermentation some aspects need to be considered:

- ☑ Its tolerance to higher alcohol levels
- ☑ Its aroma development capabilities
- ☑ Its sugar assimilation profiles
- ☑ Its ability to flocculate, settle and stick well to the bottom of the bottle/cask

AFTER PRIMARY FERMENTATION, yeast is often exhausted and as such we do not recommend to use cropped yeast to make a refermentation.

THE SUGAR ADDITION NEEDS TO BE CALCULATED depending on the desired carbonation of the finished beer. Knowing that 2g of sugar give 1g of CO_2 and assuming there is no CO_2 in the green beer, 10g of sugar per liter will need to be added to saturate the beer at 5g of CO_2/l. If the green beer already contains 2g of CO_2/l, then 6g of sugar per liter have to be added.

ACCORDING TO THE LEVEL OF ALCOHOL AND THE CARBONATION of the beer before refermentation the quantity of yeast to be added is indicated in our technical data sheet (available on our app').

SMART CHOICE. SAFALE™ F-2.

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 **(see more page 38).**

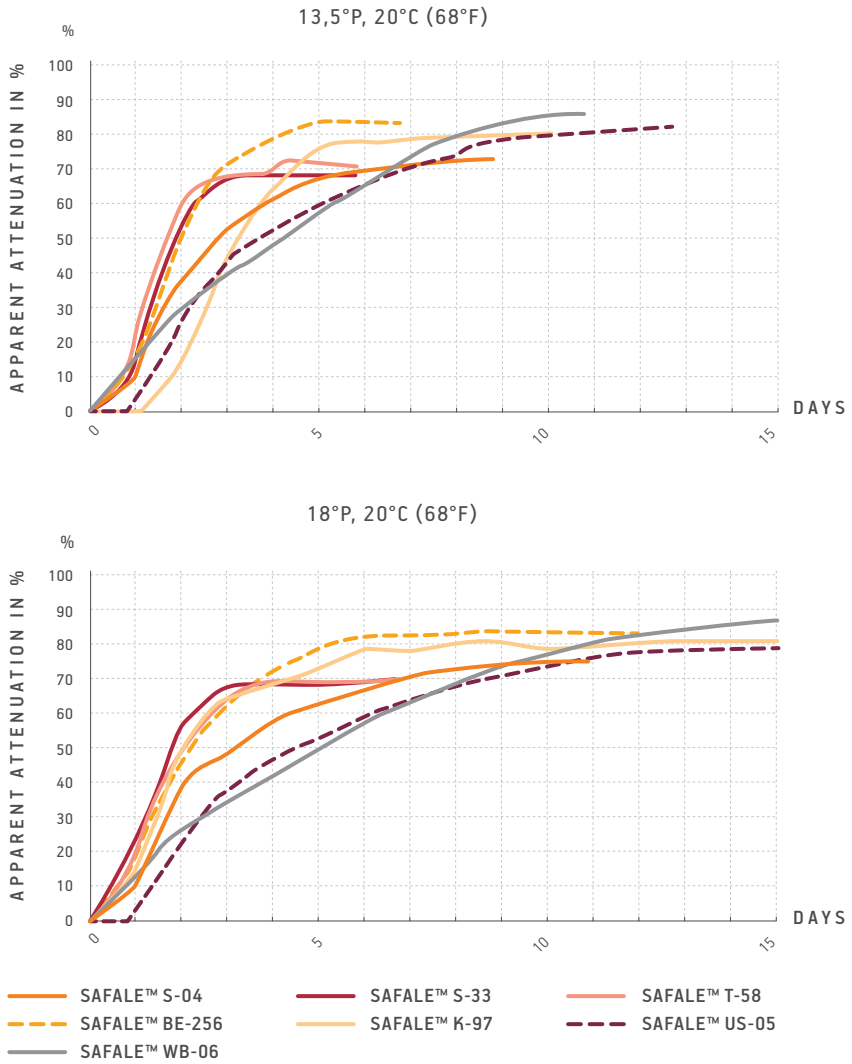
Yeasts characteristics

FERMENTIS LED A YEAST CHARACTERIZATION STUDY IN COLLABORATION with a technical center* to compare the strains between themselves in standard conditions. This study was done in EBC columns. Its purpose is to characterize each strain regarding its fermentation kinetics and attenuation, its maltotriose assimilation, its alcohol tolerance, its flocculation, its sedimentation and its aromatic profile.

*Study conducted in collaboration with Institut Meurice - Department of Brewing Sciences and Fermentation Technology - Haute Ecole Lucia de Brouckère - Brussels, Belgium.

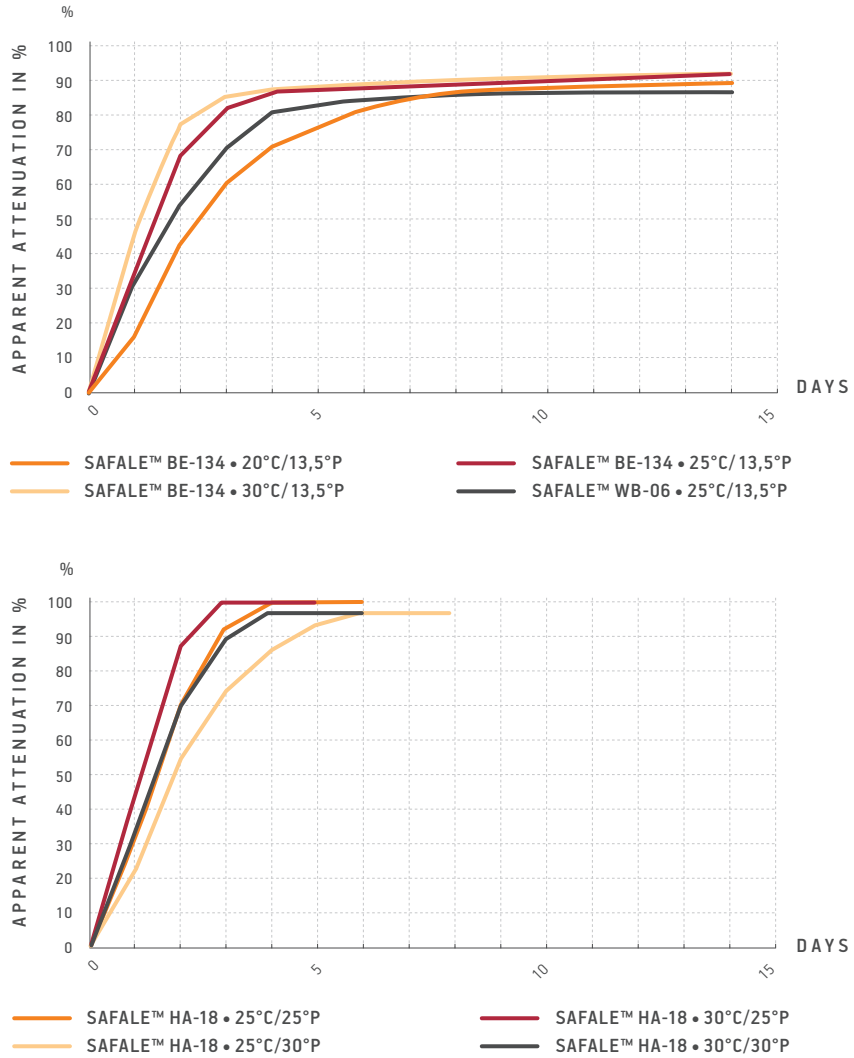
Fermentation kinetics and attenuation

SafAle™ range



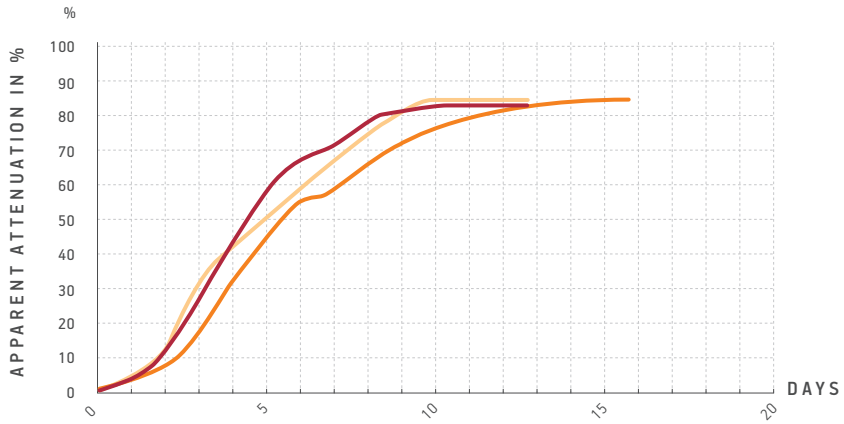
Other SafAle™ yeast strains

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

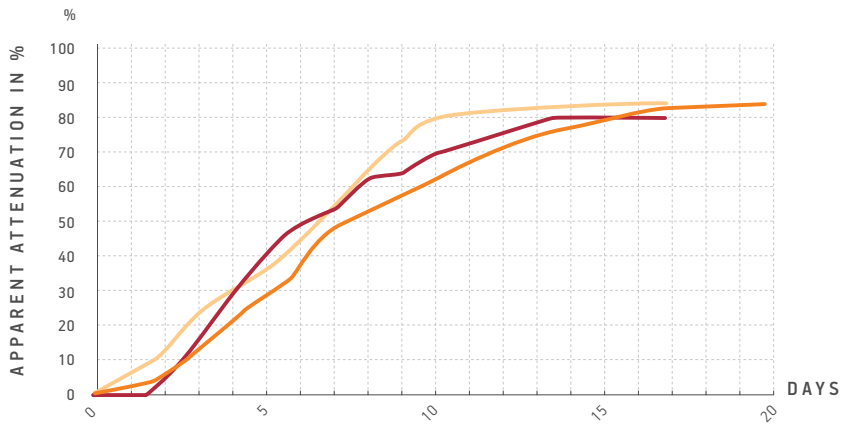


SafLager™ range

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

Maltotriose

THE TABLE BELOW SHOWS THE AMOUNT OF REMAINING maltotriose in g/l after fermentation for each strain.

SafAle™ range

	MALTOTRIOSE IN G/L
SAFALE™ S-04	10
SAFALE™ K-97	2
SAFALE™ US-05	3
SAFALE™ WB-06	0
SAFALE™ S-33	12
SAFALE™ T-58	11
SAFALE™ BE-256	0
SAFALE™ BE-134	0
SAFALE™ HA-18	0

SafLager™ range

	MALTOTRIOSE IN G/L
SAFLAGER™ S-23	4
SAFLAGER™ S-189	2
SAFLAGER™ W-34/70	2

Flocculation

FLOCCULATION IS THE ABILITY OF YEAST CELLS TO FORM AGGREGATES. If the yeast is not remaining in the foam at the end of fermentation, a highly flocculent yeast could settle down fast and give a clear beer with little cells in suspension. On the opposite, a low flocculent yeast will settle down slowly and leave the beer hazy for a longer time.

SafAle™ range

	FLOCCULATION	CLARIFICATION*	SEDIMENTATION
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

*Yeast in the foam at the end of fermentation.

SafLager™ range

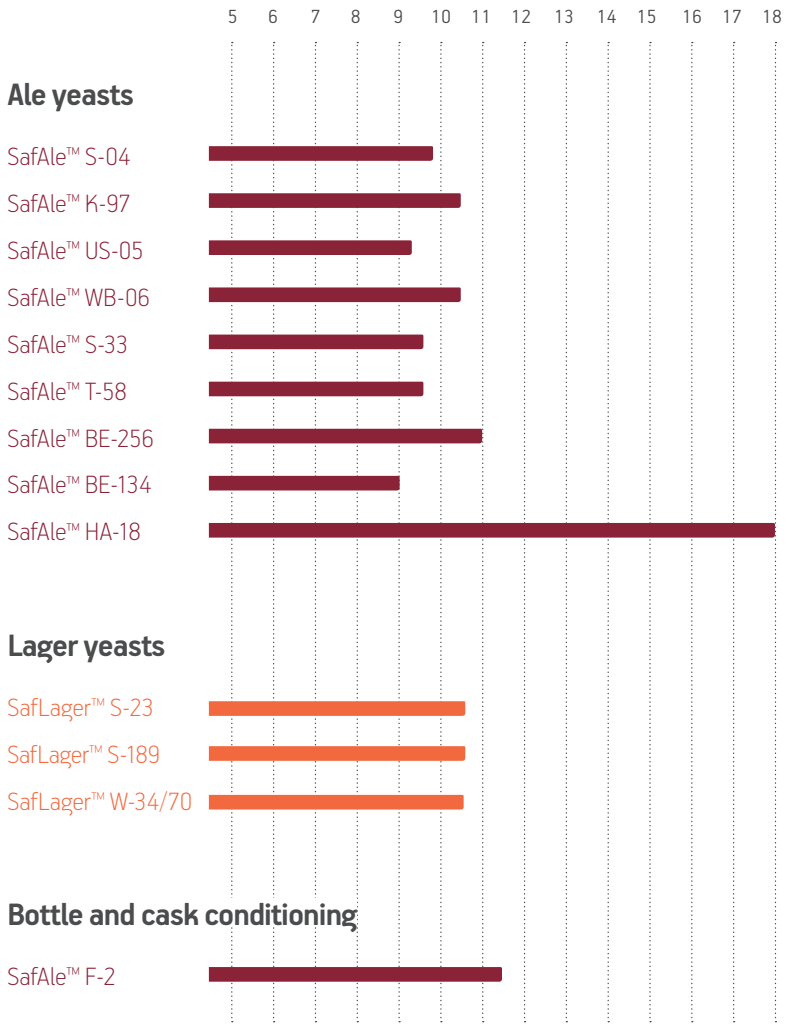
	FLOCCULATION	CLARIFICATION*	SEDIMENTATION
SAFLAGER™ S-23	+	-	Fast
SAFLAGER™ S-189	+	-	Fast
SAFLAGER™ W-34/70	+	-	Fast

GOOD TO KNOW

Ca++

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

Alcohol tolerance in % v/v



Aromas, flavors and beer styles

NOT ONLY THE ETHANOL AND CO_2 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 CAN BE LISTED AS CARBONYLS (aldehydes/ketones), vicinal diketones, fatty and organic acids, sulphur compounds, higher/fusel alcohols, esters (acetate and ethyl esters), etc. For example, the last ones correspond to a family of compounds closely linked to lipid metabolism and yeast growth and over dozens different esters are present in beer and often given 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), such as 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), ethyl decanoate (floral / fruity), etc.

THUS, THE AMOUNT AND / OR VARIETY OF FLAVORING COMPOUNDS in beer is a consequence of the metabolism of a given yeast strain, in a particular wort composition and processes parameters, whereas some of these flavoring agents may be pleasant.

Type of beer	Organoleptic characteristics	Suggested yeast
NE IPA	Juicy, hopy, hazy	S-33, K-97, S-04
Weissen	Hazy, wheat base, phenolic, citrussy	WB-06
Blanche	Hazy, wheat base, refreshing, spicy	WB-06,T-58, K-97
Pils	Lager beer, blond to golden, brilliant, refreshing, drinkable, slightly crispy, medium bitterness, highly digestable, neutral, malty or gently fruity	W-34/70, S-189, S-23
Session	Blond, light body, low alcohol, hoppy, high drinkability	BE-134, K-97, US-05
Kölsch	Blond, palatable, low alcohol, low bitterness, gently fruity	K-97, US-05, S-04
IPA	Blond to amber, dry and hoppy	S-04, US-05
Triple	Blond to amber, high alcohol, malty, fruity, full body, roundness	HA-18, US-05, BE-256, S-33, K-97
Saison	Blond to amber, refreshing, very dry, low alcohol, gently acidic and yeasty, hoppy, gently saturated	BE-134, WB-06, T-58
Bitter	Blond to amber, medium body and residual sweetness balanced with high bitterness, hop character	S-33, S-04, US-05
Ales (Pale/ Amber/Brown)	Blond to brown, medium alcohol content, fruity (estery), more or less malty tastes & notes, nutty, caramel	S-04, BE-256, US-05
Double	Amber - Brown/Dark, high alcohol, malty, fruity, caramel, roundness	HA-18, S-33, S-04, BE-256
Scotch	Amber to brown, full bodied, malty and lightly hopped	HA-18, S-33, S-04
Barley wine	Amber - Brown, woody, slightly saturated, maderized, stewed fruit	HA-18, S-33, T-58, BE-256, K-97
Porter	Mild to dark brown with red tint, roast malt flavor and aroma, sweet to bitter flavor, medium body, fruity esters	S-04, BE-256, US-05
Stout	Dark, creamy, smooth body, chocolate, coffee, roasted	S-33, S-04
Imperial Stout	Dark, high alcohol, hot mouthfeel, chocolat, coffee, roasted	HA-18, T-58, BE-256, US-05

Recommendations can be obtained from your distributor or from a Fermentis representative.

Strain	Taxonomy	Attenuation*	Pitching Rate	Phenolic Off-Flavor	E2U™	Usage Recommendation
SafAle™ S-04	*S. cerevisiae*	Medium	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 fermentated in cylindo-conical tanks.
SafAle™ BE-256	*S. cerevisiae*	High	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	*S. cerevisiae*	Medium	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	*S. cerevisiae*	Low	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	*S. cerevisiae*	Medium	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	*S. cerevisiae*	Medium	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	*S. cerevisiae var. diastaticus*	High	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	*S. cerevisiae var. diastaticus*	High	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	*S. cerevisiae + enzyme* (glucoamylase)	High	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	*S. cerevisiae*	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 ammount of maltotriose but assimilates basic sugars (glucose, fructose, saccharose, maltose). It is caracterized by a neutral aroma profile respecting the base beer character and settles very homogeneously at the end of fermentation.
SafLager™ W-34/70	*S. pastorianus*	Medium	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™ W34/70 produces neutral fermentation character, giving clean and neutral profile. Depending on the conditions may present slight fruity and floral notes.
SafLager™ S-23	*S. pastorianus*	Medium	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	*S. pastorianus*	Medium	80-120 g/hl	⊖	YES	Origininating 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.

*Low= less than 79%, Medium= 80-84%, High= 85%+

Make your choice!

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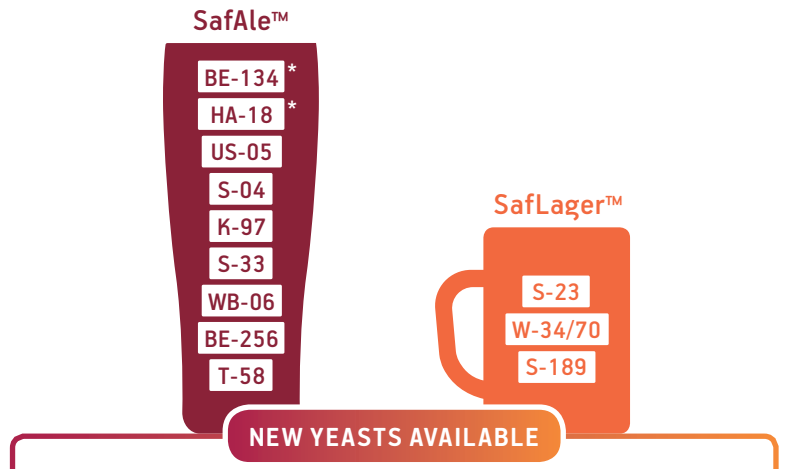
Ale or Lager?

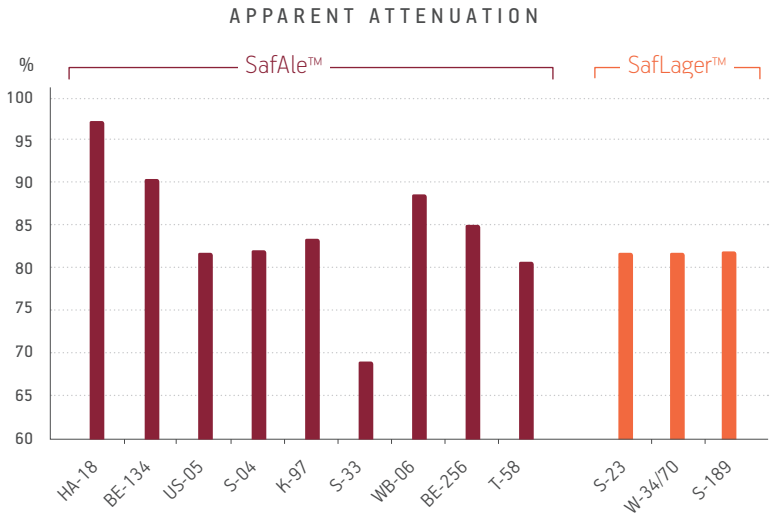
FERMENTIS SUPPLIES 2 RANGES OF YEAST STRAINS. You want to make a Lager beer? Ask for our 3 dedicated yeasts. An Ale? You can select amongst 9 strains.



***Newcomers in our range, two new yeast strains have been partially included in this study. The SafAle™ BE-134, ideal for Belgian-Saison-style beers and the SafAle™ HA-18, recommended for the production of particularly high attenuating beers even for very high gravity fermentation, such as "Barley Wine".**

Dry or full-bodied beers?

FIND THE RIGHT BALANCE BETWEEN RESIDUAL SUGARS AND FINAL ALCOHOL. Almost all of our yeast strains guarantee a fairly high attenuation rate: between 80% and 90%. If you want to obtain a beer with a high attenuation and a low level of residual sugars, SafAle™ BE-256 or SafAle™ BE-134 will be the obvious choices. Likewise for high-density beers, the SafAle™ HA-18 will allow a very high attenuation. However, if you want to obtain a high level of residual sugars, SafAle™ S-33 will fit perfectly.



CONDITIONS

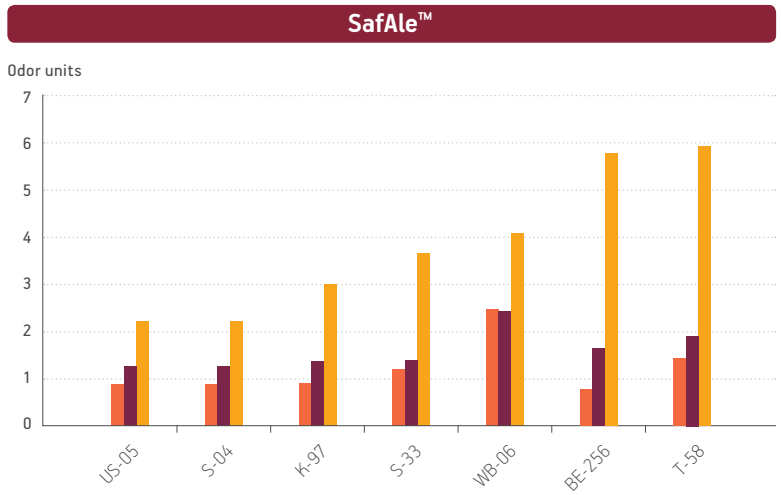
This study has been set up to picture and compare the flavor and aroma characteristics of our main commercial yeast strains. All have been tested in the same standard conditions, with the lowest possible impact of other ingredients, i.e. in the most neutral conditions. Wort: 100% 2 row spring barley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

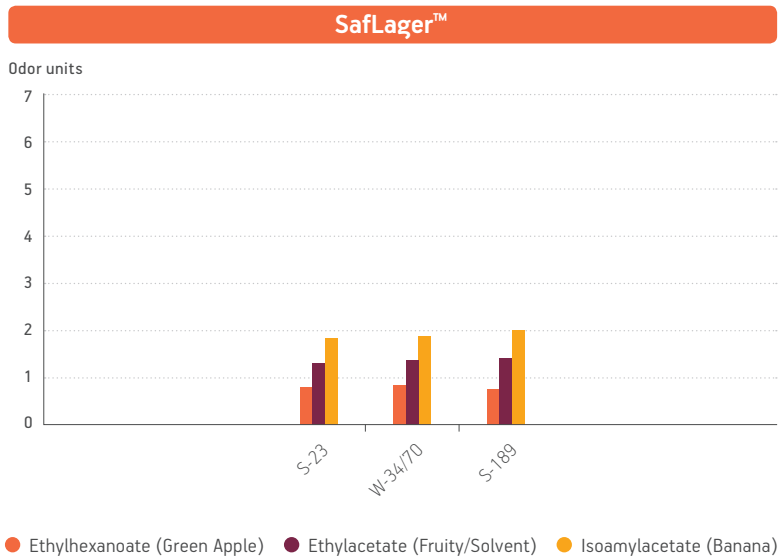
Residual sugars

LOOKING FOR YEASTS WHICH LEAVE SOME SPECIFIC SUGARS BEHIND? SafAle™ S-33 will leave most of the maltotriose. Conversely, SafAle™ WB-06 and SafAle™ BE-256 consume almost all of it.

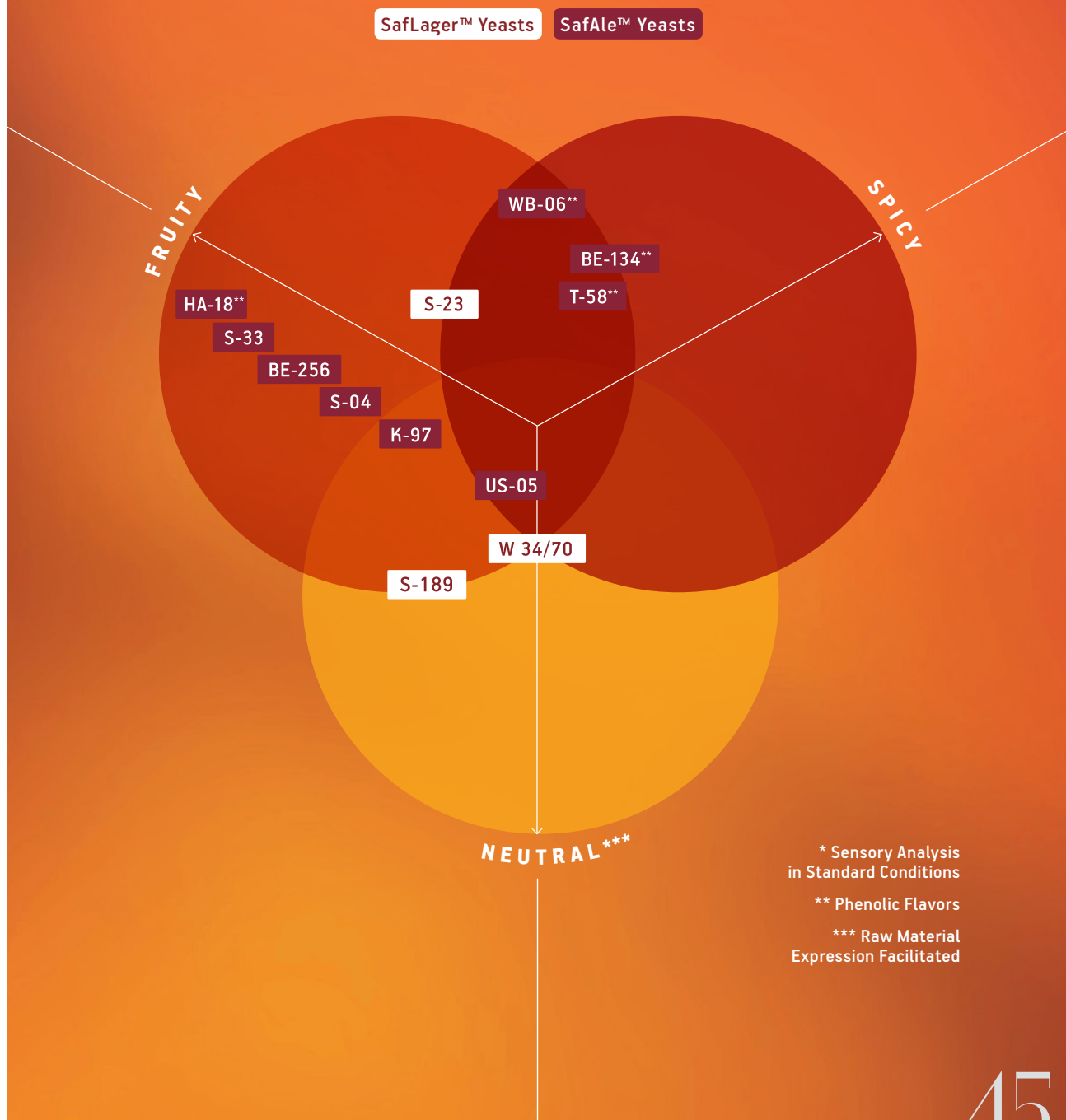
Esters

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*



Major notes & flavors descriptors

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

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

Yeast	
Fruity	Banana, Apple, Pear, Apricot, Pineapple, Tropical Fruits, Sweety-Riped Fruits, Tutti-Frutti
Floral	Roses, Geranium
Phenolics	Spicy, Clovy
Alcoholic	Vinous, Sherry
Aromatic	Perfumy, Estery

Off Notes	
Sulfury	Lightstruck, DMS, H_2S, Sulfitic
Stale/Oxidized	Metallic, Papery, Cardboard
Fatty/Dairy	Diacetyl (Buttery), Isovaleric (Cheesy), Butyric (Rancid), Caprylic (Goaty, Waxy)
Acetaldehyde	Cidery, Green Apple-Like
Infection	Medicinal, Lactic, Acetic, Animal, Leathery, Musty, Earthy
Autholysis	Yeasty, Meaty, Mercaptans
Phenols	Plastics, Rubber, Smoky, Clorophenol
Solvent	Chemical, Paint, Glue

Glossary

Alcohol By Volume (v/v)

THE PERCENTAGE OF VOLUME OF ALCOHOL PER VOLUME OF BEER. To calculate the approximate volume content, apply the following formula:
Initial Gravity (°P)/2,5 = % Vol

Alpha-Acid Content

MEASUREMENT OF THE POTENTIAL BITTERNESS OF HOPS, expressed by their percentage of alpha acids. Low: < 6%; medium: 6-12%; high 12-15%; super > 15%.

Attenuation

MEASUREMENT OF THE QUANTITY OF SUGAR in the wort that has been fermented by the yeast into alcohol and carbon-dioxide gas.

Color

THERE ARE TWO DIFFERENT ANALYTICAL METHODS (SRM Standard Reference Method) and EBC (European Brewery Convention) to measure the color of wort and beer. SRM units are equivalent to Lovibond degrees and are used by ASBC (American Society of Brewing Chemists).
EBC/1,97=SRM

Density

MEASUREMENT OF THE WEIGHT OF A SOLUTION compared with the weight of an equal volume of pure water.

Diacetyl

IS A FERMENTATION BY-PRODUCT GIVING "BUTTER" OFF FLAVOR. It is dismantled in the end of fermentation by the yeast. Its threshold is around 0.1 mg/l.

Dimethyl sulphide (DMS)

AN IMPORTANT SULPHUR-CARRYING COMPOUND ORIGINATING FROM MALT. At low levels, DMS adds a crisp character, at high levels it will add corn or cabbage flavors.

Esters

AROMATIC COMPOUNDS GENERATED BY FERMENTATION composed of an organic acid and an alcohol. The main esters are: Ethyl Acetate - aroma and fruit odor - Isoamyl Acetate - banana ester - and Ethyl Hexanoate. High fermentation yeasts are preferred for their ability to produce mixtures of particular esters.

Final specific gravity

THE SPECIFIC GRAVITY a beer has obtained when the fermentation is over.

International Bitterness Unit (IBU)

STANDARD UNIT USED TO MEASURE THE CONCENTRATION OF BITTER compounds in beer, i.e. isoalpha-acids and other related components in milligrams per liter.

Malt

BARLEY STEEPED IN WATER, GERMINATED AND DRIED IN KILNS. This process produces the enzymes necessary to convert insoluble starches to soluble substances and sugars and gives the colour to the grain transferable to beer.

Mash - Mashing

PROCESS OF ENZYMATICALLY EXTRACTING AND CONVERTING MALT solubles to wort, in an acid uric aqueous solution. In infusion mashing, the conversion goes through different phases: the acid rest, the protein rest, saccharification & the lauter rest.

Original Gravity

SPECIFIC GRAVITY OF WORT PRIOR TO FERMENTATION. Original gravity is the measure of the total amount of dissolved solids in the wort.

Plato degrees

EXPRESSES A SOLUTION'S DENSITY in grams of sucrose per 100 grams of solution. Plato degrees are measured at 20°C (68°F).

Sparging

SPRAYING THE FILTER CAKE with hot water to remove the remaining malt extract.

Wort

SWEET WORT IS THE MASH EXTRACT.
Bitter wort is the hopped sugar solution before pitching.

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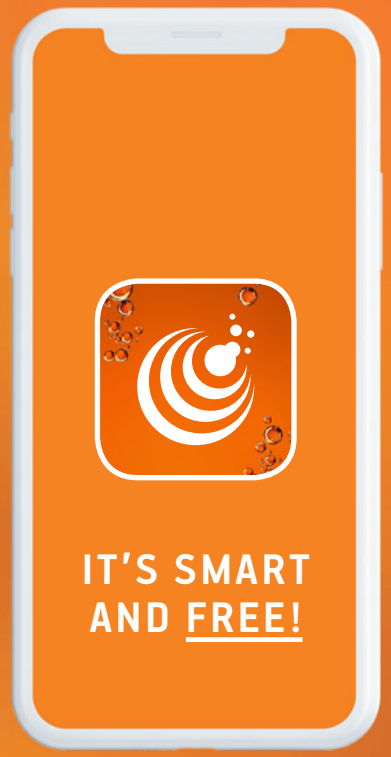
Converters
(volume, temperature, weight, density,...)

Refermentation tool
(to calculate the amount of sugars you need)



Yeast advisor
(according to the type of beer needed)

Make Your Choice tool
(if you hesitate, it compares our yeasts and chooses the best for you)

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ABV and attenuation calculator

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November 2018

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