



TIPS AND TRICKS

FERMENTIS GUIDE ON YEAST AND FERMENTATION FOR CRAFT BREWERS

TIPS AND TRICKS

is the Fermentis booklet on yeast and fermentation for craft brewers. With Tips & Tricks our purpose is to offer brewers 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.**

Tips & Tricks is downloadable from the craft brewers section of our website where you will also find downloadable recipes. For the list of available recipes, refer to the inside back cover of this booklet.

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BEER YEAST FOR CRAFT BREWING



Constant innovation and creativity in brewing have made the success of the craft brewing industry.

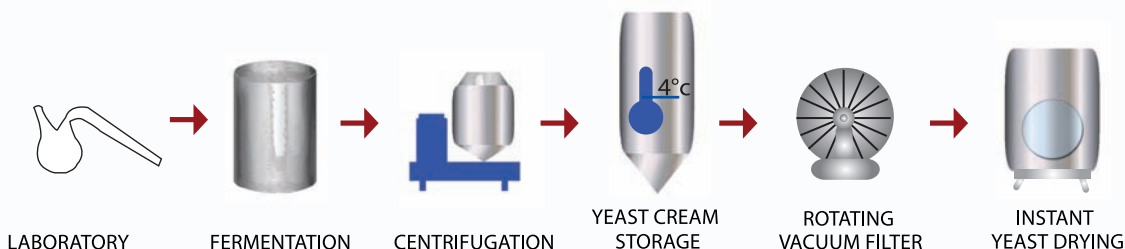
Brewing a large number of beers in the same premises adds to the difficulty of yeast management, while beer quality and consistency between batches are key factors to exceed customers' expectations.

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, their rehydration is a simple procedure and 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 sole producer of true dried lager yeasts. Our different strains are available from recognised sources enabling high quality lager production. A range of speciality ale yeasts has also been developed to produce ales with authentic flavour profiles and a variety of specialty beers.

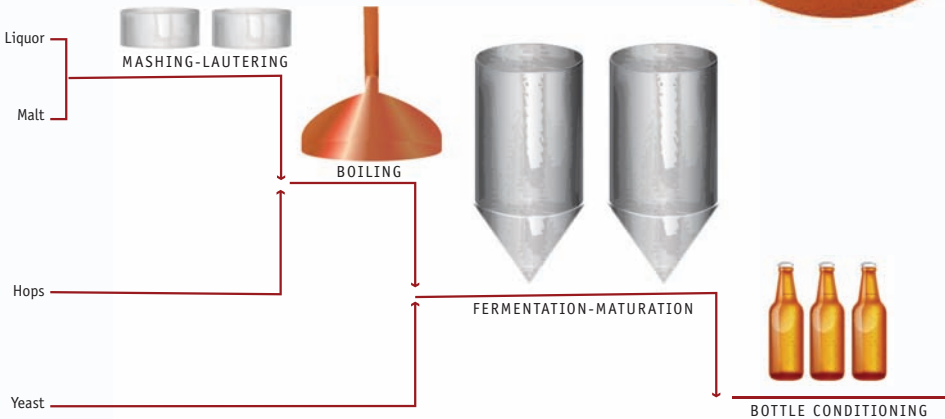
Each Fermentis yeast has its own characteristics, some ferment faster than others, some develop specific aromas or on the contrary are more neutral in flavors.

Better knowing our yeast range 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.



Dry yeast manufacturing

YEAST AND BREWING



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 and mouthfeel compounds in the finished beer. A number of compounds will be released during fermentation and as such the 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 basics

Yeast, *Saccharomyces cerevisiae*, is a unicellular fungi. They are eukaryotes with a similar cell structure to plants and animals including humans. A *Saccharomyces cerevisiae* yeast cell measures between 5 and 50 μm . During the brewing fermentation it reproduces asexually through budding.

Don't Mix-up

Eukaryotes & Prokaryotes

Prokaryotes are organisms that multiply by division and are constituted by a circular chromosome which is diffused in the cytoplasm.

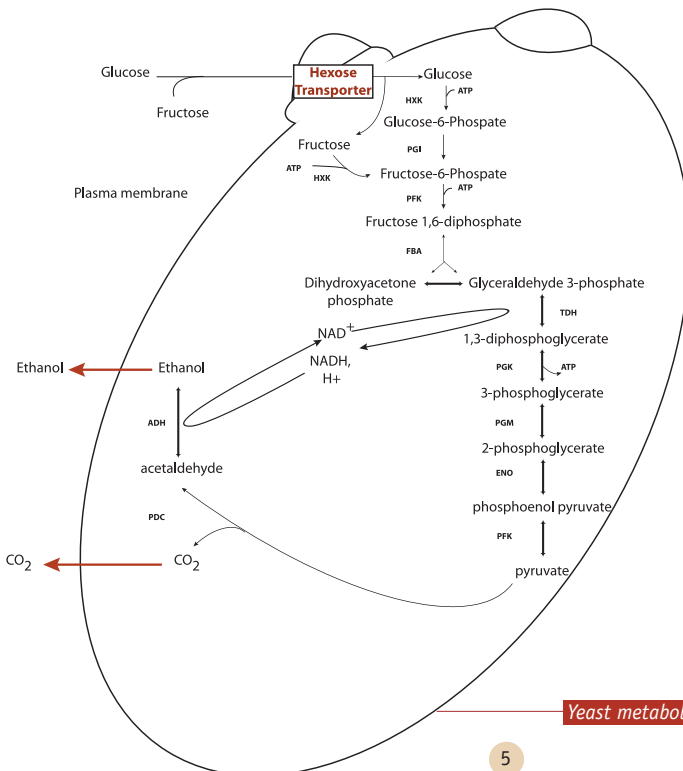
Example: bacteria

Eukaryotes are microorganisms that genetic material is situated in a specific organ called the nucleus.

Example: yeast cells, animal cells...

A yeast cell could be compared to a production facility on its own. To ferment correctly it needs to be supplied with the correct raw materials to be able to produce the right compounds. When a beer recipe contains 80 to 100% of malt its nutritional quality is sufficient for the yeast's health.

The yeast will metabolize sugars, amino acids and nutrients from the wort to produce **ethanol, CO_2 , aromas and other compounds** that will bring the final taste to the beer.



Sugars are supplied by the wort. Depending on the recipe chosen for the malt bill, the quantity of sugars that can be metabolized by the yeast will vary. The three main sugars of interest for the yeast are glucose, maltose and maltotriose.

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 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 Safbrew WB-06, for example.

The result of a brew with high residual maltotriose levels will give beers with more roundness and mouthfeel, while beers with a high drinkability are those that contain no or very little residual maltotriose.

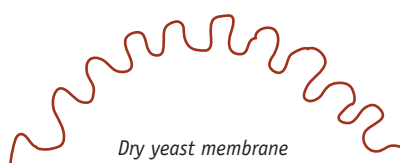
Rehydration



Microscopic picture of a yeast cell

Fermentis dry yeasts look like a compact sponge composed of microballs tightened close together. This sponge is ready to absorb the water. The yeast cells need to recover the water they lost during the drying to start fermenting. The membrane of the yeast cell after drying contains circumvolutions, after its rehydration it becomes perfectly smooth.

The picture below illustrates how the yeast membrane will act to recover their shape as they replenish with water.

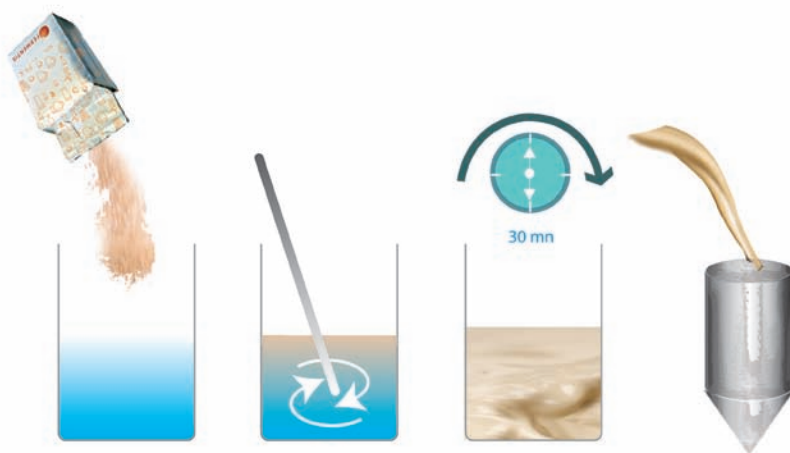


Dry yeast membrane



Rehydrated membrane

From dry to liquid



Dry yeast rehydration

Rehydrate the dry yeast into yeast cream by sprinkling it in 10 times its own weight of sterile water or wort. Gently stir and leave for 30 minutes. Finally, pitch the resultant cream into the fermentation vessel.

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.

Ale yeasts

Optimum
rehydration temperature

25-29°C (77-84°F)

Lager yeasts

Optimum
rehydration temperature

21-25°C (69-77°F)

After rehydration bacterial contamination can develop in the slurry. Follow our recommendations of maximum time between rehydration in sterile water and pitching depending on the storage temperature of the rehydrated yeast.

**Stored
at 4°C
pitch within
18H**

**Stored
at 20°C
pitch within
6H**

**Stored
at 25°C
pitch within
4H**

Water or wort?

Fermentis yeast can be rehydrated with sterile water or sterile wort.

After the wort has been boiled for at least 15 minutes collect the volume required for rehydration and leave to cool to the required temperature. Rehydrate the yeast for 30 minutes. Pitch immediately into the tank after checking the temperature of wort, in order to avoid foam.

DON'T FORGET YOUR REHYDRATION ESSENTIALS:

- 1 Respect recommended rehydration temperatures to assure the yeast membrane fluidity
- 2 Water or wort, whatever you choose make it sterile
- 3 Do not use chlorinated water it will kill the yeast
- 4 Do not use demineralized water

Effects of pitching rate

Dry yeast adds the advantage of converting a dry yeast weight to accurately know the number of viable cells pitched in the wort.

	<i>Fermentis yeast dosage</i>	<i>Minimum equivalent cell count at pitching</i>
Ale yeast	50-80g/hl (0.06-0.10 oz/gal)	4-6E06 cells/ml
Lager yeast*	80-120 g/hl (0.10 – 0.16 oz/gal)	8-12E06 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).*

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.

Activity

Fermentation starts immediately, but the apparition of CO₂ bubbles and smell will only be perceptible **after 12 to 24 hours for ale yeasts and 16 to 32 hours for lager yeasts.**

Temperature during fermentation

The recommended fermentation temperature range (refer to product packaging or specification sheets) of each strain has to be respected. The higher the temperature is at the beginning of the fermentation, the faster the fermentation will start. Using higher temperatures for your brew will increase the ester and diacetyl formation. Also for the reduction of diacetyl it may be necessary at the end of fermentation to allow the temperature to rise. Low temperature is required at the end of the fermentation to achieve good yeast flocculation.

Effect of oxygen

Oxygen is required to assure a healthy cell multiplication. Oxygen should only be added in the first eighteen hours of fermentation. Adding oxygen later will increase aldehyde and diacetyl levels.

Yeast recycling

Reusing yeast from a previous batch requires dedicated tanks, specific know-how and needs to be done in good hygienic conditions. Laboratory equipment and staff is required to validate the quality of the cropped yeast before pitching. As far as lager yeasts are concerned, we recommend to limit their recycling to no more than 4 to 6 times.



Bottle and cask conditioning

Yeast is used for refermentation in bottle or in cask. 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 bottle/cask 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 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, 10 g 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 6 g of sugar per liter have to be added.



COMPARING FERMENTIS YEASTS

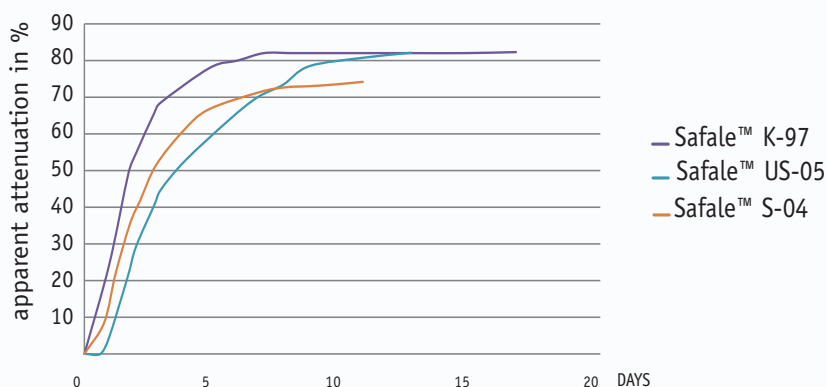


Fermentis led a yeast characterization study in collaboration with a technical center* to compare the strains between themselves in standard conditions. This study was done in EBC columns. Its purpose is to characterize each strain regarding its fermentation kinetics and attenuation, its maltotriose assimilation, its alcohol tolerance, its flocculation and its aromatic profile.

Fermentation kinetics and attenuation

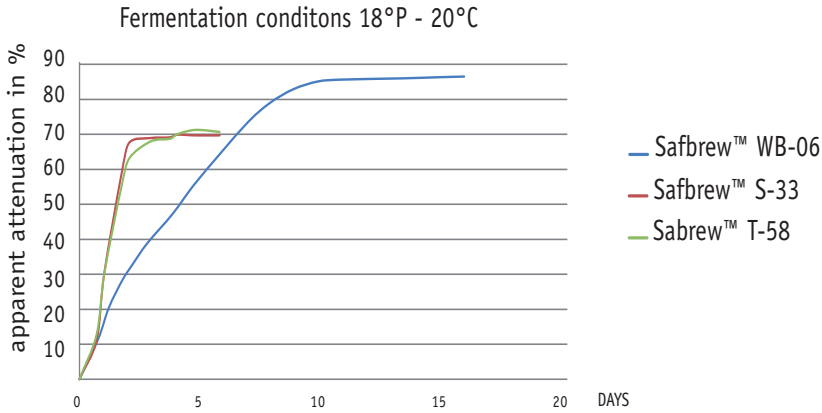
Safale range

Fermentation conditions 18°P - 20°C

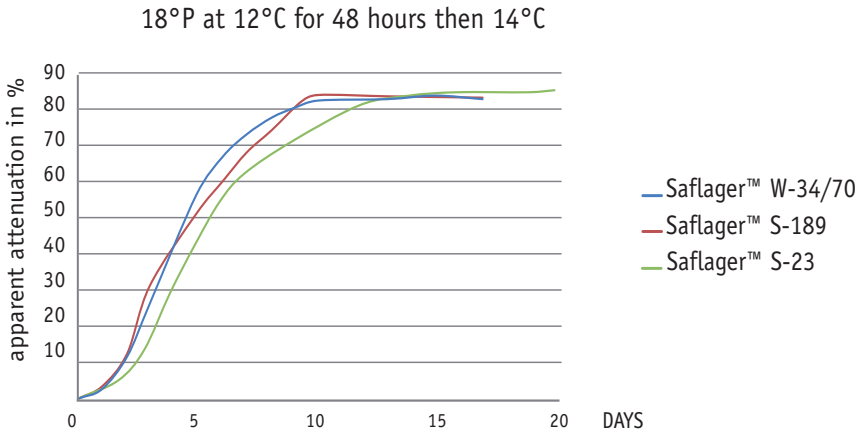


**Study conducted in collaboration with Institut Meurice - Department of Brewing Sciences and Fermentation Technology - Haute Ecole Lucia de Brouckère - Brussels, Belgium at 18°P and 20°C for Safale™ and Safbrew™ and at 18°P at 12°C for 48 hours then 14°C for Saflager™.*

Safbrew range



Saflager range

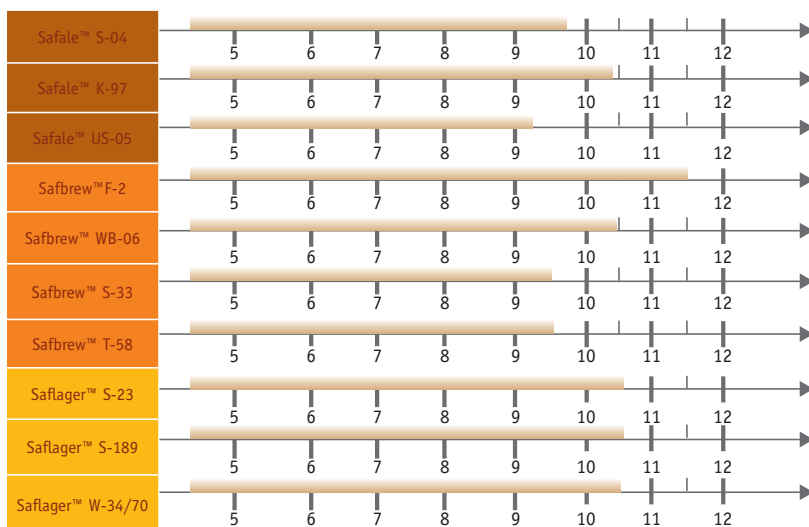


Maltotriose

The table below shows for each strain the amount of remaining maltotriose in g/l after fermentation.

	Maltotriose in g/l
Safale™ S-04	10
Safale™ K-97	2
Safale™ US-05	3
Safbrew™ WB-06	0
Safbrew™ S-33	12
Safbrew™ T-58	11
Saflager™ S-23	4
Saflager™ S-189	2
Saflager™ W-34/70	2

Alcohol tolerance in % v/v



Flocculation

Flocculation is the ability of yeast cells to form aggregates.

A high flocculent yeast will 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 give hazy beers.

Ca++

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

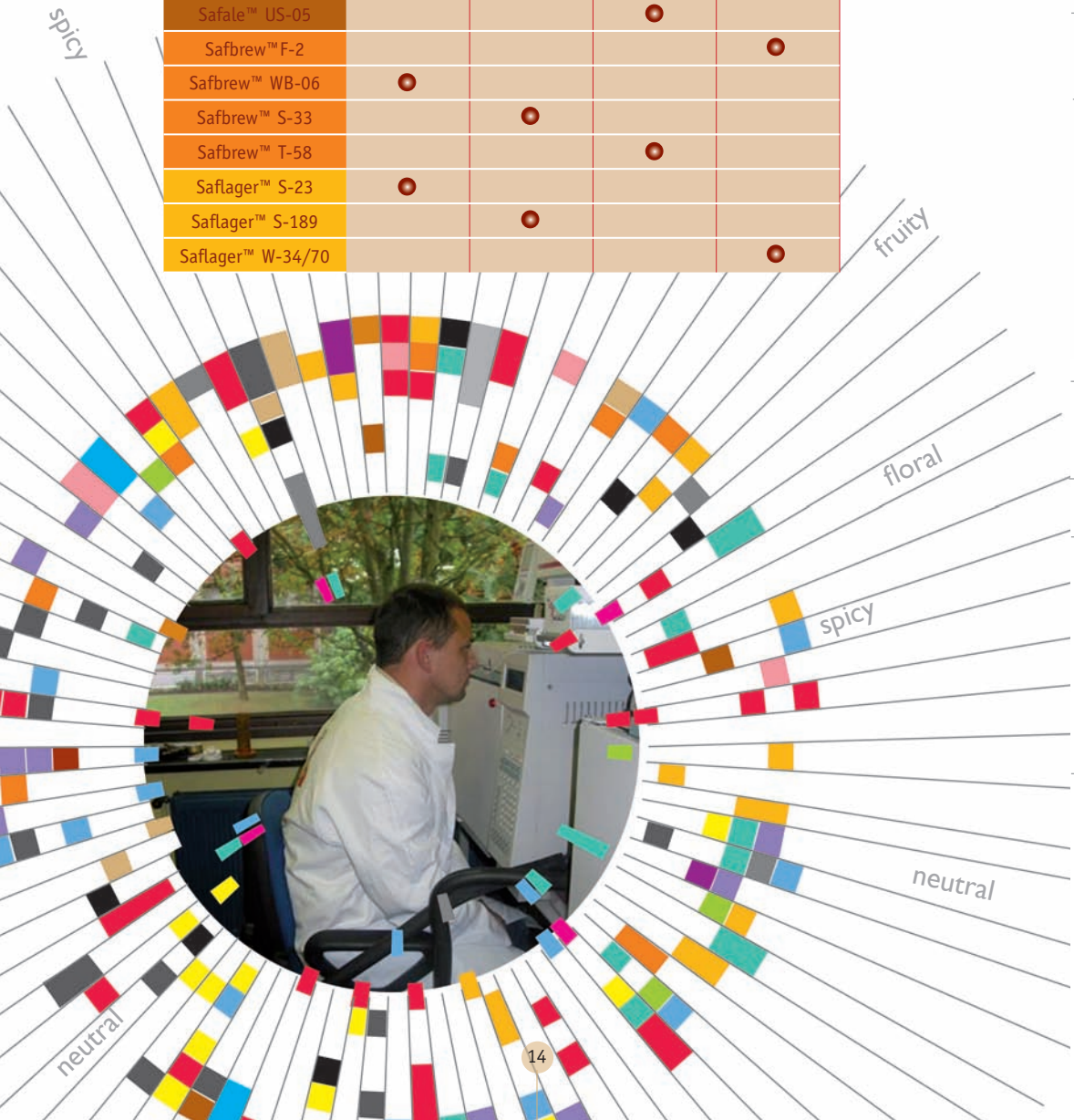
	Flocculation in primary fermentation		
	High	Medium	Low
Safale™ S-04	●		
Safale™ K-97	●		
Safale™ US-05		●	
Safbrew™ WB-06	●		
Safbrew™ S-33			●
Safbrew™ T-58			●
Saflager™ S-23	●		
Saflager™ S-189	●		
Saflager™ W-34/70	●		

Aromas

A beer yeast is able to produce many aromas that we have chosen to group into four categories : **fruity**, **spicy**, **floral**, **neutral**.

The table shows the predominant category of aromas produced by each strain in our fermentation trials.

	fruity	floral	spicy	neutral
Safale™ S-04				●
Safale™ K-97	●			
Safale™ US-05			●	
Safbrew™ F-2				●
Safbrew™ WB-06	●			
Safbrew™ S-33		●		
Safbrew™ T-58			●	
Saflager™ S-23	●			
Saflager™ S-189		●		
Saflager™ W-34/70				●





GLOSSARY

A **Alcohol By Volume (v/v):** The percentage of volume of alcohol per volume of beer. To calculate the approximate volume content apply the following method:

$$\frac{\text{Original Gravity} - \text{Final Gravity}}{X} = \% \text{ v/v}$$

Alpha-Acid Unit (AAU): Measurement of the potential bitterness of hops, expressed by their percentage of alpha acid. Low: 2-4%; medium: 5-7%; high 8-12%.

Attenuation: Measurement of the quantity of sugar in the wort that has been fermented by the yeast into alcohol and carbon-dioxide gas.

C **Colour:** There are two different analytical methods SRM (Standard Reference Method) and EBC (European Brewery Convention) to measure the colour of wort and beer. SRM units are equivalent to Lovibond degrees and are used by ASBC (Association of Brewing Chemists). EBC are European units.

$$\text{EBC} / 1.97 = \text{SRM}$$

D **Density:** Measurement of the weight of a solution compared with the weight of an equal volume of pure water.

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 flavours.

E **Esters:** Aromatic compounds from fermentation composed of an acid and an alcohol. Major esters are: **Ethyl Acetate** - fruity odour and taste - **Isoamyl Acetate** - banana ester - and **Ethyl Hexanoate**. Top fermenting yeast strains are preferred for their ability to produce particular mixes of esters.

F
Final specific gravity: The specific gravity a beer has obtained when the fermentation is over.

I
International Bitterness Unit (IBU): Standard unit used to measure the concentration of iso-alpha-acids in milligrams per litre.

M
Malt: Barley steeped in water, germinated and dried in kilns. This process converts insoluble starches to soluble substances and sugars.

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.

O
Original Gravity: Specific gravity of wort prior to fermentation. Original gravity is the measure of the total amount of dissolved solids in the wort.

P
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).

S
Sparging: Spraying the spent grains in the mash with hot water to remove the remaining malt sugar.

W
Wort: Sweet wort is the mash extract. Bitter wort is the hopped sugar solution before pitching.



BREWING

LOG

SHEET



Beer name:

Beer style:

Batch size:

Target OG/°P:

Brew date:

Brewer:

Brew number:

Lb/Kg per hl

Ingredients

Colour (SRM/EBC)

Start time:

End time:

Sparging number

Volume(L/Gal)

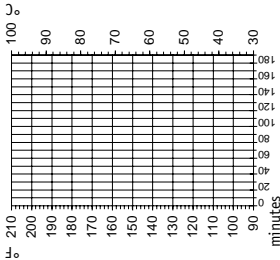
Temperature (°C/°F)

Time (minutes)

Lautering/sparging

Boiling and hopping

Mash time & temperature



Mash type:

Volume of water for washing (L/gal):

Volume of wort (hl):

Iodine Starch Test:

Start time:

End time:

% evaporation rate:

Oz/g/hl

Hop/seasoning

% Acid

IBU

Addition time

Gravity (°P):

Whirlpool time:



FERMENTATION

LOG

SHEET



Fermenter: _____

Wort volume: _____

Start date: _____

Type of yeasts: _____

Generation: _____

Fermentation temperature (°C/°F): _____

Pitching rate (g/hL): _____

Original gravity (°P): _____

Date/time Gravity (°P) Tank temperature (°C/°F) Pressure (bar) Comments

Sensory description

Green beer Finished beer

Date: _____

Colour: _____

Odour: _____

Flavour: _____

Taste: _____

Lagering

Start date: _____

Tank temperature (°C/°F): _____

End date: _____



LOG SHEET

Brew number:

Time (minutes)

Whirlpool time:



FERMENTATION

LOG

SHEET



Fermenter: _____

Wort volume: _____

Start date: _____

Type of yeasts: _____

Generation: _____

Fermentation temperature (°C/°F): _____

Pitching rate (g/hL): _____

Original gravity (°P): _____

Date/time	Gravity (°P)	Tank temperature (°C/°F)	Pressure (bar)	Comments
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____

Sensory description

Green beer	Finished beer
Date: _____	Date: _____
Colour: _____	Colour: _____
Odour: _____	Odour: _____
Flavour: _____	Flavour: _____
Taste: _____	Taste: _____

Layering

Start date: _____

Tank temperature (°C/°F): _____

End date: _____

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OUR RECIPES ONLINE


DOWNLOAD THEM HERE :

<http://www.fermentis.com/brewing/craftbrewing/tips-tricks/>

	Using	
Red Smoky Lager	➤	Saflager™ W-34/70
Weizen Beer	➤	Safbrew™ WB-06
Red ale	➤	Safale™ US-05
Light bock	➤	Saflager™ S-189
German Light Lager	➤	Saflager™ W-34/70
Dark bock	➤	Saflager™ S-189
Christmas Special	➤	Safale™ S-04
Amber	➤	Safale™ S-04
Stout	➤	Safbrew™ S-33
IPA	➤	Safale™ US-05
Belgian Red Pure Malt	➤	Safale™ US-05
Belgian Abbaye Dark Beer	➤	Safbrew™ T-58
Belgian Amber Beer	➤	Safbrew™ S-33
Belgian Wheat Beer	➤	Safbrew™ WB-06
Belgian Weizen	➤	Safbrew™ WB-06
Belgian Blond Beer	➤	Safbrew™ T-58

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