hop™

YSEO™ PROCESS
Research in collaboration with Washington State University

It becomes child's play

Selected in collaboration with INRA SCIENCE & IMPACT

Natural Solutions that add value to the world of winemaking / www.lallemandwine.com

LALLEMAND

LALLEMAND OENOLOGY

HOP™, for successful alcoholic fermentation

HOP™ is an innovative yeast developed to ensure a successful alcoholic fermentation (AF) under the most difficult conditions.

This yeast was specially developed to withstand the stressful and delicate step at the beginning of fermentation while having a facilitated utilisation procedure. All this combined with a superior fermentative performance.

HOP™ is the result of an evolutionary process that culminated in the selection of a unique genetic background that allows a faster multiplication and a higher stress resistance associated with an impressive performance even under the most difficult conditions.

HOP™, definitely different

Efficiency and robustness are what characterize HOP™. Especially adapted to wineries managing important fermentation volume, HOP™ was selected to resist the stressful conditions often present in red winemaking (high sugar, high SO_2 level, Low vitamins...).

HOP™ properties

- **Strong fermentative capacity**
- **Short lag phase**
- **High resistance to SO_2**
- **Alcohol tolerance 16%**
- **Wide temperature range: 14°C/57°F to 30°C/86°F**
- **Low VA production**
- **Low nitrogen demand**
- **Fructophilic character**

HOP™, and everything becomes easier

The intrinsic characteristics of HOP™ make it able to overcome and resist to multi stress environmental conditions and a very wide range of usage.

Winemakers can choose usage conditions that fit the best with their needs:

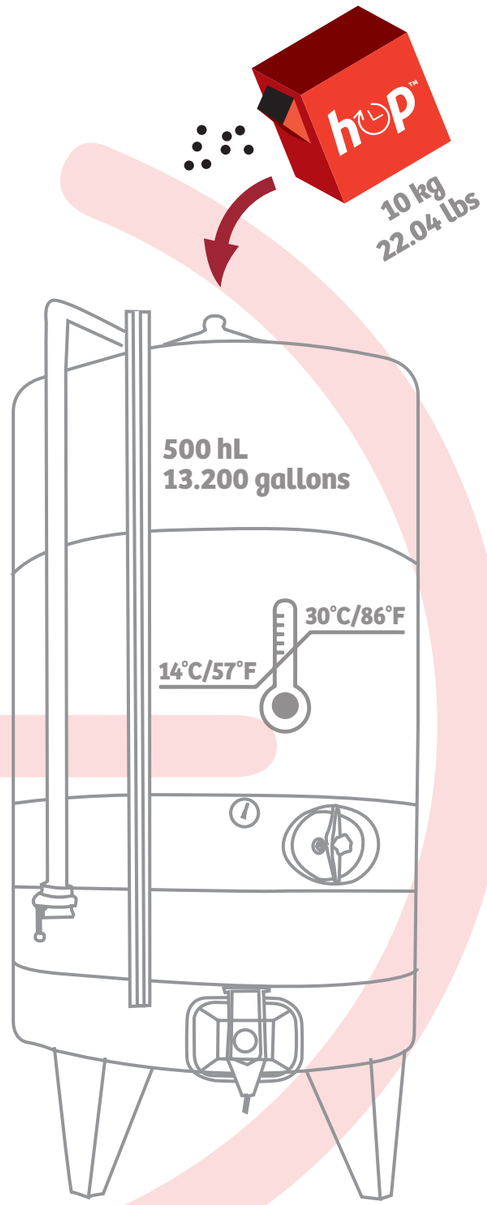
Without prior rehydration*:

1. Add the total content of the yeast pack directly on the top of the tank or preferably during tank filling.
2. Homogenize the entire tank with a pump over assuring a good yeast distribution.

With prior rehydration*:

1. Rehydrate the HOP™ unit pack in 100 liters of tap water.
2. Suspend carefully by gentle stirring and wait for 20 to 30 minutes.
3. Add to the must.

** Recommendation of usage (dosage for 500 hL/13,200 gallons)*



HOP™, proof of effectiveness

Compare to other selected wine yeast, HOP™ reaches its superior performance by having a higher stress resistance (such as high molecular SO_2 level), and a faster cell multiplication rate right from the beginning of the fermentation.

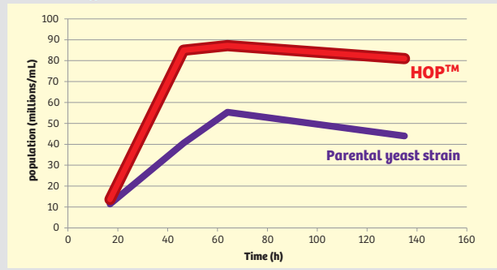
Across the whole fermentation, HOP™ is capable of keeping a high cell number as well a higher viability leading to a safer and quicker fermentation.

The proof:

Must characteristics - Grape variety: Carignan

Initial Sugar	267 g/L
pH	3.46
Total acidity	6.7 tartaric Acid
Assimilable nitrogen	110 mg/L
Active SO_2	**1.61 mg/L**
Temperature	23 °C

Viable yeast cell evolution during fermentation

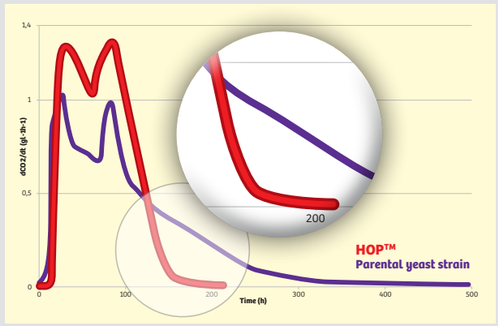


Even in harsh conditions, across the whole fermentation **HOP™** is capable of keeping a high cell number as well as a higher viability leading to a safer and quicker fermentation.

The results:

Prior rehydration in cold water or no rehydration of the active dry yeast **HOP™** will not have any impact on **viable cells, fermentation Kinetics and/or final wine analytical profile.**

Fermentation Kinetics



While most of wine yeast metabolism is affected by level of molecular SO_2 superior to 0.8 mg/L,(Ribéreau-Gayon P, Glories Y, Maujean A *et al. Handbook of Enology: The Microbiology of Wine and Vinifications.*, 2006.) **HOP™** was able to overcome and achieved alcoholic fermentation within 10 days.

Final wine analytical profile

End of alcoholic fermentation	Parental yeast strain	HOP™ Inoculated without prior rehydration
TAV (% vol.)	–	15,76
Sugar (g/L)	**18,34**	**0,36**
Volatile acidity (g/L H_2SO_4)	0,73	0,43
pH		3,58
Free SO_2 (mg/L)		16
Total SO_2 (mg/L)	–	70
Malic acid (g/L)	–	1,86
Lactic acid (g/L)	–	0,05

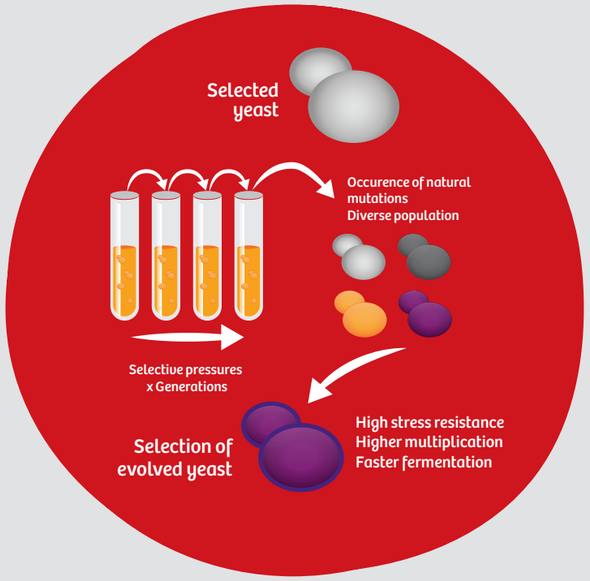
STUCK FERMENTATION

Stuck ferment was observed using the Winery yeast ref.
Even without prior rehydration, while the Winery ref. yeast rehydrated was not able to overcome and finish alcoholic fermentation, **HOP™** has consumed to dryness most of the sugar. The stressful impact of high sugar concentration did not affect **HOP™** in producing high VA level.

HOP™, story of a birth

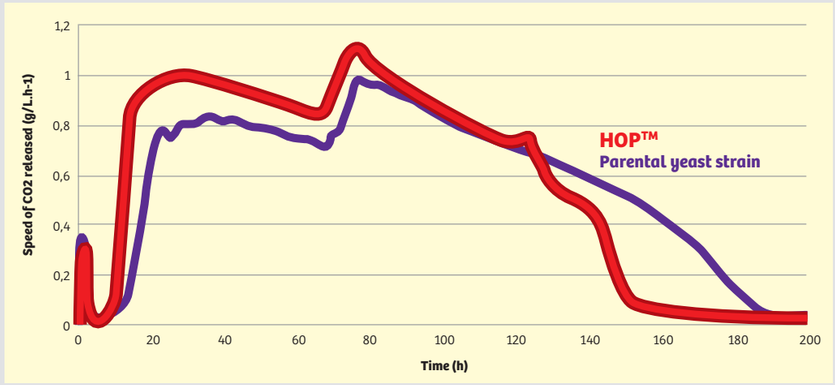
HOP™ is the result of a Lallemand collaboration with INRA *(Institut National de la Recherche Agronomique, Montpellier, France)* established during an European Marie-Curie ITN project called "YEASTCELL". The aim of that collaboration was to study and improve yeast stress resistance at the moment of inoculation using evolutionary adaptation technics during a PhD thesis.

Ferreira D. (2017) Stress resistance during the lag phase of wine fermentation and development of optimized yeasts. Thèse Montpellier Agro.



The use of **selective pressures** simulates stressful conditions that occur during wine-making.
Their presence lead to the selection of yeasts with **natural and positive mutations** to overcome those stressful conditions.
Evolved yeasts selected have an **improved** fermentative profile.

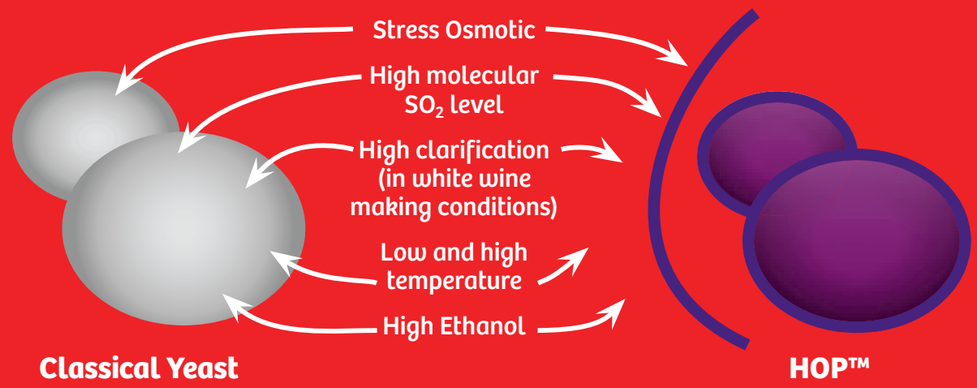
Merlot - 28°C - Sugar 240 g/L - YAN 90 mg/L - pH 3.4 - Fermaid E nutrition 30 g/hL added at 1/3 AF



After 200 generations of evolutionary adapation it was observed that **HOP™** had an improved kinetics in contrast with the parental strain in optimal inoculation conditions (rehydrated + additional nutrients).

HOP™, the sciences behind

The stressful conditions frequently present in grape must weaken yeast metabolism.
By having a higher stress resistance, HOP™ has an improved endurance when dividing and can grow at a faster rate. The more robust yeast cell also allows a higher resistance to stresses present at the beginning of the fermentation as well as to those that develop during fermentation such as ethanol.
Ultimately, this evolved profile ensures a higher fermentation reliability.



To summarize, HOP™ is an innovative yeast selection with an intrinsic genetic background, delivering superior performance and reliable fermentation under the most winemaking stressful conditions. Moreover, these specifics properties allow more flexibility of usage which fits with alcoholic fermentation management in large volume.

F.A.Q.

Since HOP™ has a genetically improved background, does it mean it is a GMO?
No, it's a yeast selected through evolutionary adaptation that simulates realistic winemaking conditions.

What is the compatibility of HOP™ with ML bacteria?
Still compatible.

Could I use HOP™ on White and Rosé?
Yes, HOP™ has been selected to ferment in a large range of winemaking conditions.

Do I need to use a protector with HOP™?
No, HOP™ is sufficient by itself to achieve alcoholic fermentation under a large range of conditions. However, it is important to respect the inoculation rate and to follow up good nutrition practices.

Is HOP™ able to dominate among wild yeasts?
The specific characteristic of HOP™ make it more competitive to dominate grape juice in fermentation to obtain clean wine.
Even when inoculated without prior rehydration, HOP™ shows strong fermentative properties allowing a quick onset of fermentation, with a good multiplication during the exponential phase, avoiding the development of the indigenous flora.

Can I always use HOP™ without prior rehydration step? What makes it different from the other wine active dry yeast?
For more than 15 years it has constantly been shown that optimal inoculation conditions (rehydration + protector) greatly improve fermentation process. HOP™ was specially developed to better resist the stressful fermentation conditions. It has a unique genetic background which makes it different from the others available selected wine active dry yeast.
HOP™ resistance to stress described above, offset the effects of non-rehydration.

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