PINNACLE™

ACTIVE DRY BREWING YEAST

Low Alcohol

product information

for **Craft Brewers**
from craft beer lovers

Introduction

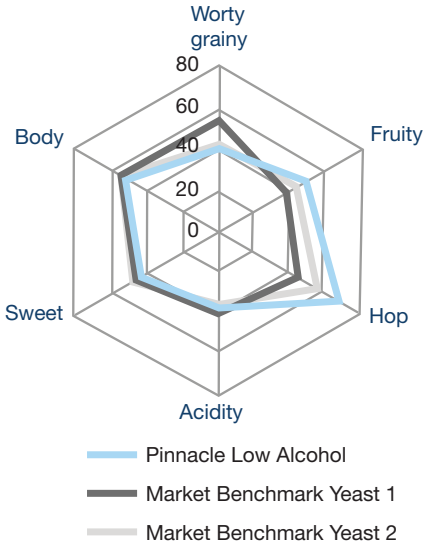
Besides health awareness and lifestyle choices, the recent success of low alcohol beers can be subscribed to a significant rise in quality and the fact they can be considered as some of the most innovative products that hit the market nowadays.

The development of new industrial technologies to produce low alcohol beers certainly plays a huge part in this success. While dealcoholisation methods are expensive and older methods like cold contact or arrested fermentation result in mediocre quality beer, the idea of producing low alcohol beers through yeasts that have a limited uptake of fermentable sugars, i.e. maltose negative strains, has revolutionized low alcohol beer production and provides good quality beer for an affordable price.

Pinnacle Low Alcohol offers an elegant solution for craft brewers to make good quality low alcohol beer without investment in expensive dealcoholisation equipment.

It also offers solutions for larger brewers who use distillation or membranes to produce 0.0% ABV beer with significant malt and energy savings, compared to regular yeast strains.

Furthermore, **Pinnacle Low Alcohol** is a unique low alcohol strain, with a fast onset of fermentation, good sedimentation behaviour, absence of off-notes like 4-vinyl guaiacol (spicy-clove) and good ester and hop aroma expression.

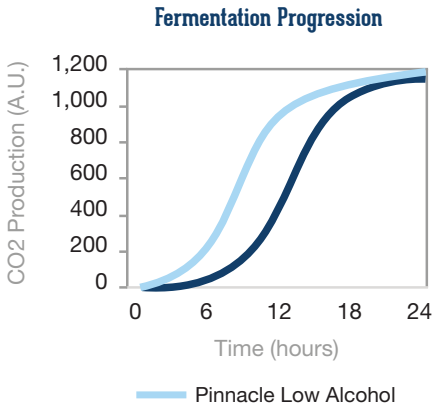


Fermentation Kinetics

Pinnacle Low Alcohol has been selected for a fast onset of fermentation that leaves less chances for microbes to develop. In comparison with other maltose negative strains, we have seen that **Pinnacle Low Alcohol** ferments faster in optimal lab conditions (5.2°P full malt wort, see figure) and this has also been reported in industrial trials.

Attenuation levels range between 12 and 18% (ADF) depending on wort composition and starting gravity and fermentation can be completed in 1-4 days, with a pitching rate of 50 g/hl.

From microbiological safety standpoint, it is better to stop the fermentation when the fermentation has reached the plateau. This typically happens after 1-2 days. However, we have seen that longer fermentation time can clear more of the aldehydes that impart worty flavour.



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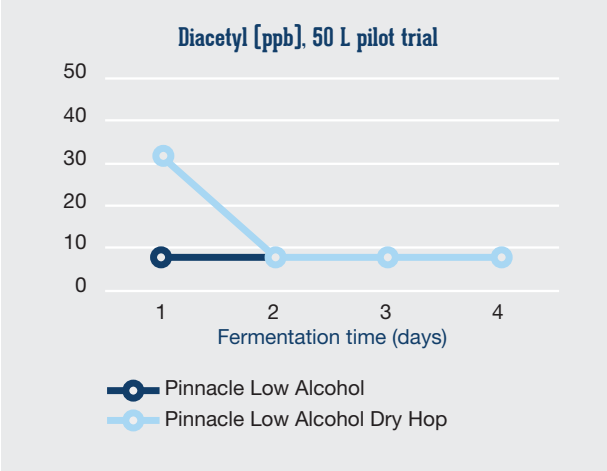
There is little to no formation of diacetyl, acetaldehyde or H_2S. The measured diacetyl concentration mostly stays below the sensory threshold of 50ppb. Warm dry-hopping can slightly increase diacetyl, however, it is quickly reduced to very low levels during fermentation, typically as from day 2.

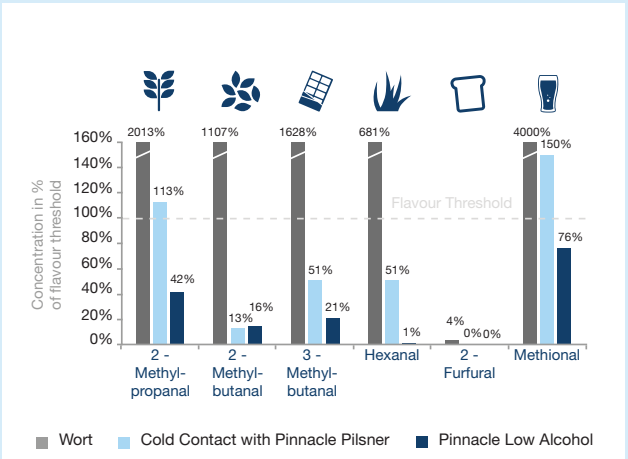


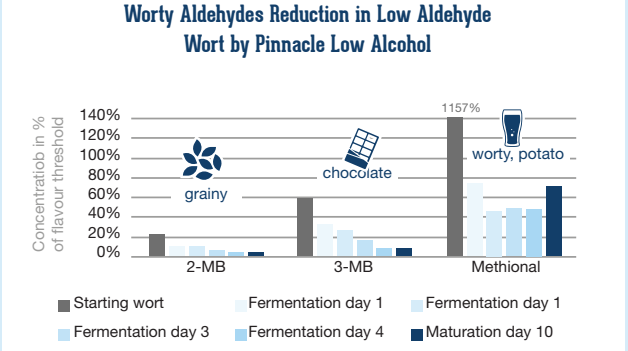
Aldehydes Removal

Since there is little masking effect coming from alcohol and esters and higher alcohols to counterbalance possible synergistic effects of the various Strecker aldehydes that cause worty aromas in low alcohol beer, reducing them is key to produce a high-quality product[5].

The concentration of aldehydes highly depends on the wort recipe and production process. **Pinnacle Low Alcohol** succeeds in lowering the concentrations of the indicator compounds to a value below their respective flavour thresholds in both worts, resulting in a beer that is free from overpowering worty notes.

Because of its abundancy and low sensory threshold, methional can be considered as the most important contributor of worty flavour and the data shows that this potato-like aroma is sufficiently removed after fermentation with **Pinnacle Low Alcohol**.





Pitching Rate

A pilot test (50 L) has shown that pitching rates lower than **50 g/hl** can further reduce worty aldehydes, however with a slightly slower fermentation rate. Given the high sensitivity of low alcohol beer to spoilage, we still recommend to pitch **50 g/hl** to enable a fast fermentation startup with the aim to avoid potential contamination to grow on the glucose.

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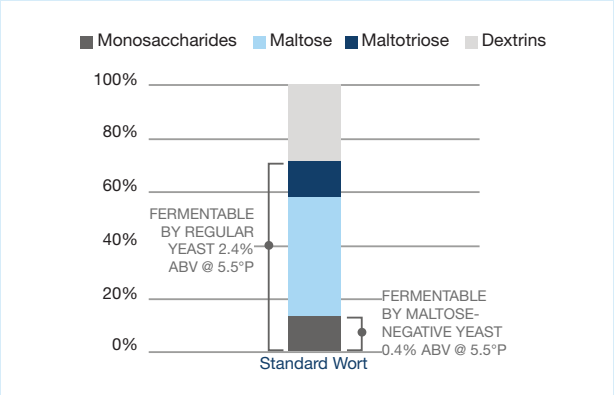
Recipe Design Strategies

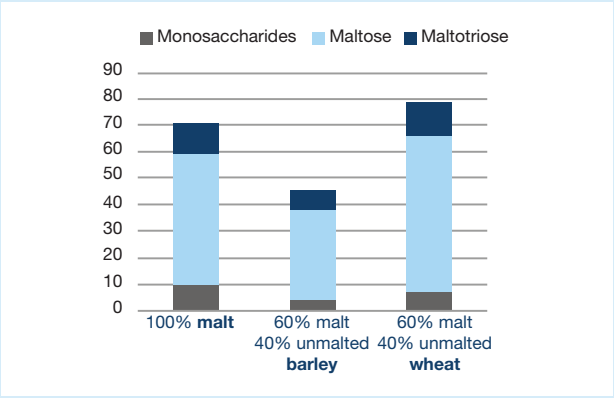
Pinnacle Low Alcohol yeast strain is a maltose negative strain which means it will only ferment simple sugars, i.e. glucose, fructose and sucrose. So controlling their amount is key to successfully produce a beer below the alcohol threshold you need to stay below the legal limit that is applicable in your region[2], while keeping a sufficiently high gravity to provide body and mouthfeel.

Based on a standard wort sugar profile, with simple sugars at around 15%, the original gravity should be kept below 5.5°P to reach a maximal value of 0,4% ABV. When you want to go higher in OG there are ways to alter the wort sugar composition in order to lower the fermentability.

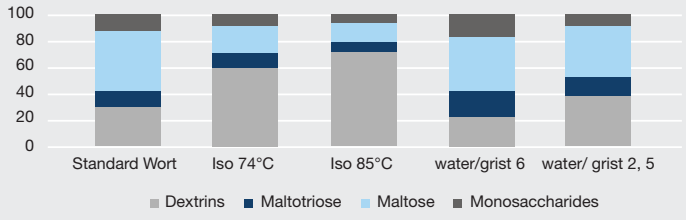
The most widely used and successful strategy is to use an elevated mashing temperature. This allows for a significant reduction in fermentable sugars and especially the monosaccharides due to the thermal inactivation of the barley amylases. Another relatively easy way is to mash with a low water to grist ratio to slow down the enzyme kinetics. Be aware of the increased viscosity and ratios lower than 2,5 often lead to difficulties for mash transfer to the wort separation step.

The graph shows the percentages of the different sugars in the resulting worts, but an elevated mashing temperature will also lead to lower absolute concentrations of sugars in the wort due to further inactivation of the starch degrading enzymes[3].





Wort Sugar Composition



In terms of raw material selection, it can also be useful to lower the fermentability by replacing a part of the malt with unmalted cereals and other adjuncts[4]. Selecting malt types with lower diastatic power like specialty malts will also provide you with some more possibilities to aim for a higher gravity wort and introduce different flavour notes.

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Dry Hopping

Dry hopping is a valuable technique to introduce flavour complexity to your low alcohol beer, but some considerations must be made.

Although the use of hops will provide some resistance to unwanted microbial growth; it is also a way to increase microbial instability since hops can be a potential source of contaminants.

Therefore, it is preferred to only dry hop during the cold stages of the process to avoid contamination and to eliminate hop creep which can lead to higher-than-expected alcohol levels and/or diacetyl formation, the excess fermentable extract created this way can be as high as 1° plato.

The lower ethanol content of Nablab beers has a variable impact on different hop fractions and compounds. There is no significant change in solubility of isomerized alpha acids and humulinones, but xanthohumol, alpha –and beta-acids will be present in lower concentrations, so the general bitterness impression of low alcohol beers tends to be reduced.

In terms of aroma compounds, the lack of ethanol has a higher effect on the presence of sesquiterpenes and esters as opposed to terpenes that have a comparable solubility in water and ethanol. This means that herbal and spicy notes can be in the lower spectrum for low alcohol beers but achieving sufficient floral and fruity notes should be no problem when applying a standard dry hopping dosage for the style of your choice.

Scan here

to discover more about our yeast development.

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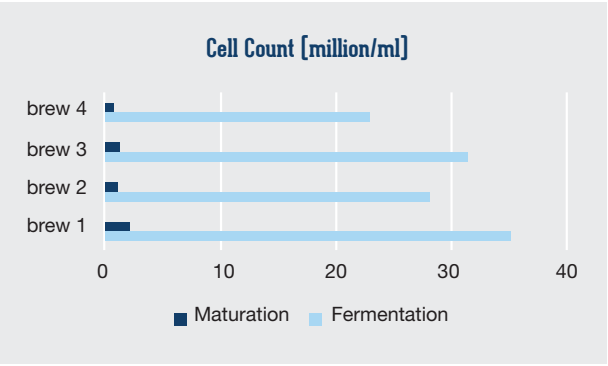
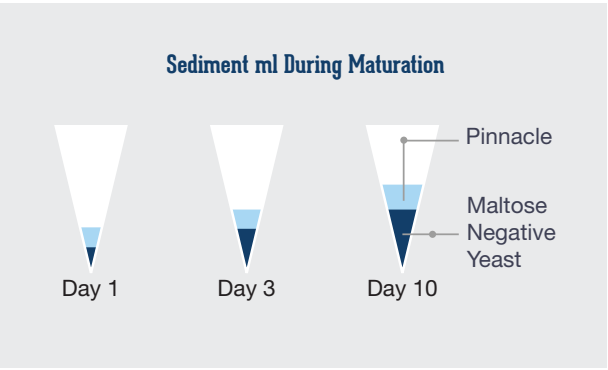
Colloidal Stability

Although there is less biomass formation compared to a regular beer fermentation with a higher starting gravity and increased attenuation level, this doesn't mean that there is a lesser need to ensure the beer has a sufficient maturation time.

Flocculation of maltose negative yeast strains is generally low; however, in industrial trials **Pinnacle Low Alcohol** does display a better sedimentation behaviour leading to a lower cell count in the beer prior to further clarification steps like filtration or centrifugation as could be seen from industrial brewing trials.

A beer with high biological stability can be achieved with standard maturation times of 10-14 days.





Microbial Stability

Taking additional measures to ensure product safety and avoid microbial spoilage when producing low alcohol beers with Pinnacle yeast is strongly advised. Pasteurisation is the most suitable way to achieve this, but this can only be successful when a number of factors are taken into account.

1. To prevent the growth of pathogenic bacteria, the wort must be acidified to pH 4.8-5.0 at the start of fermentation in order to reach the target pH by the end of fermentation. **Pinnacle Low Alcohol** will typically acidify the pH by 0.5-0.6 units. The industry best practices are to achieve a final product pH ≤ 4.2, but we recommend never to go above pH 4.5.
2. Adequate pasteurization in function of recipe and process is required to ensure microbial safety and stability of the final packaged product. (Industry best practices ≥ 50 PU on filtered beer and ≥ 80-120 PU for hazy or dry hopped beer.)
3. The matrix that will be subjected to the thermal processing has a big influence on the number of pasteurisation units needed. The amount of yeast and other particle load should be sufficiently reduced by centrifugation or filtration prior to pasteurisation. Higher levels of carbonation and bitterness help in lowering the required PU's.
4. Process monitoring and microbiological testing of the final product samples taken throughout the packaging run will ensure the effectivity of the pasteurization process.
5. Repitching or propagation is highly discouraged due to elevated contamination risks of low-alcohol and no-alcohol products.
6. Additional safety measures may apply to specific processes or product types. Please consult your local regulatory authorities.

References

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2. Michiels , P., Croonen , D., De Schepper , C., Debyser , W., Langenaeken, N., & Courtin , C. (2024). Effective strategies to maximise dextrin formation in brewing . Journal of the Institute of Brewing, 130(3), 182–198.
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4. Piornos, J. A., Koussissi, E., Balagiannis, D. P., Brouwer, E., & Parker, J. K. (2023). Alcohol-free and low-alcohol beers: Aroma chemistry and sensory characteristics. Comprehensive Reviews in Food Science and Food Safety, 22, 233–259.

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