The Effect of Pitch Rate on Fermentation and Isoamyl Acetate Production
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Results

- Yeast strain supplies and brewers claim that underpitching yeast for Hefeweizen strains increases isoamyl acetate production, a desirable aromatic compound for this beer style.

There are four main ingredients in beer: grain, hops, water, & yeast.
Yeast is critical for beer fermentation. The yeast convert glucose into alcohol and CO₂, as well as many desirable esters.
The amount of yeast added (pitch rate) is crucial for efficient fermentation and production of desirable flavors and aromas in the final product.

Yeast strain supplies and brewers claim that underpitching yeast for Hefeweizen strains increases isoamyl acetate production, a desirable aromatic compound for this beer style.

“Traditional brewing techniques suggest underpitching to produce more classic characteristics of the style” (White Labs).

Hypothesis

Yeast pitch rate will affect fermentation rates and isoamyl acetate production in a Hefeweizen brewing strain.

Materials & Methods

- Every sample was blindly typed, set to incubate at 21°C.
- Cell counts in all pitch rate conditions were significantly different by day 1.
- Overpitching was found to lead to higher detectable levels than underpitching.

Discussion

- Fermentation rates, as expected, were higher in over pitched conditions at the start, but by the five day mark attenuation in all pitch rate conditions was equal.
- Cell counts in all pitch rate conditions equilibrated by day 2 regardless of pitch rate.
- Control contamination is evident indicated by visual identification of cells on the refractometer and decreased specific gravity which signifies increased fermentation.
- The sensory analysis of control B revealed a diacetyl aroma, which could be indicative of contamination with lactic acid fermenting bacteria. Controls A & C had aromatics of other fruity esters, but the strong presence of isoamyl acetate was not observed.
- While pitch rate affected the initiation of fermentation, it did not have a significant impact on fermentation length or attenuation.
- While there was no significant difference in cell count or viability by day 2 of the experiment.
- This experiment aimed to find the specific underpitch condition that will produce significant amounts of isoamyl acetate.

Conclusion

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Further Directions

- Scale the experiment up to better imitate brewery conditions to account for the control of oxygen levels seen in brewery fermentation tanks.
- Incrementally underpitch the beer to see if there is a condition that is statistically different that was not tested in this experiment.
- Work with a trained oenocore for sensory analysis who can better quantify the data.
- Perform GC-MS on samples to quantify isoamyl acetate levels.
- Examine gene expression in all conditions and determine correlation with isoamyl acetate production.

Citations

- Dewangan, N., & Mahiru, A. (2023, August 3). Beer production in a Hefeweizen brewing strain. Ramapo College of New Jersey, Mahwah, NJ, 07430
- Sensory Analysis Data. The Effect of Pitch Rate on Fermentation and Isoamyl Acetate Production. (2023). Ramapo College of New Jersey, Mahwah, NJ, 07430

Introduction

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- Yeast is critical for beer fermentation. The yeast convert glucose into alcohol and CO₂, as well as many desirable esters.
- The amount of yeast added (pitch rate) is crucial for efficient fermentation and production of desirable flavors and aromas in the final product.

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