



MASTER BREWERS ASSOCIATION OF THE AMERICAS

Effect of the Early Pitching Method on Beer Composition during the Brewing Process

Joseph Spearot, Arcadia University

Abstract

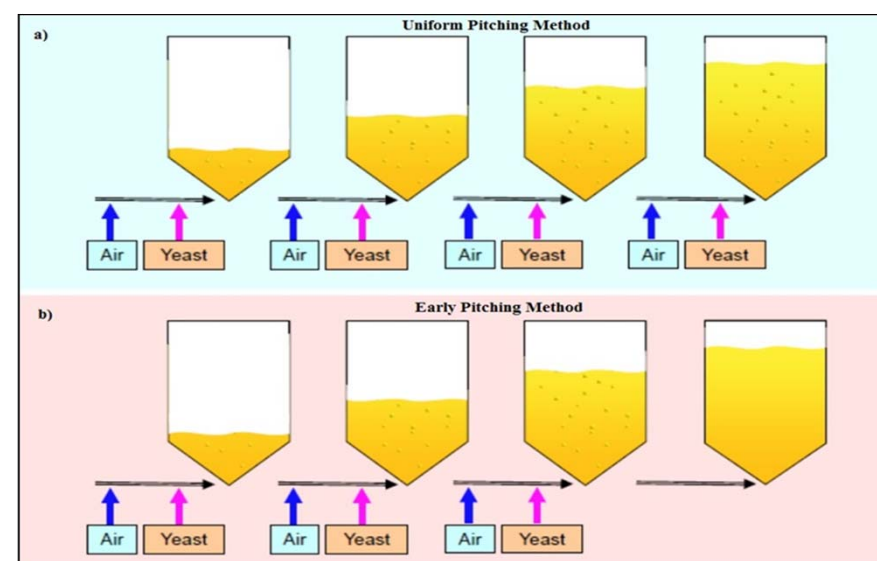
Beer is one of the oldest and arguably most important handcrafted beverages in the history of civilization. This is largely due to the fact that it was safer to drink than most of the water supplies of the time. Today is the time of microbreweries with a large push toward innovation and increasing product quality. At the 2012 World Brewing Congress Koizumi and Nakamura of Asahi Breweries presented on a method of brewing, the early pitching of yeast, which should increase the overall quality of the beer. It was proposed that the early pitching method of brewing would produce a final beer product with detectable differences and a decrease in the level of fusel alcohols coupled with an increase in ester levels. Pale ale was brewed on a modified home brewing system using both the control and experimental pitching methods. During fermentation general conditions were monitored in each section of the modified fermentor. After bottling, fusel alcohol and ester levels were quantified using distillation and gas chromatography respectively. A taste test was completed for samples from the third trial to determine if differences were within range of the of taste perception. The uniform pitching method behaved homogeneously, while the early pitching method saw spikes in testing, indicating different conditions during fermentation. Analysis also showed higher levels of esters in the early pitched beer but lower levels of isoamyl alcohol, a fusel alcohol. The taste test indicated a statistically significant difference between the two pitching styles with the early pitched method ranking higher in ester levels. In the future, a study should be completed on a larger scale and with different beer styles. It is anticipated that this research will form a basis for other research into the quality of our food and beverages, will result in improved products with superior composition.

Introduction

- Evidence suggests that beer may date back to the Neolithic Era it is first described on clay tablets from Ancient Mesopotamia around the 5th millennium BC
- The Reinheitsgebot, or German Purity Law of 1515, greatly limited beer composition
- Anton van Leeuwenhoek (1680), Antonie-Laurent Lavoisier (1789), and Louis Pasteur (1879) made huge contributions to the scientific world and brewing
- Beer shifted to a luxury beverage over time as contamination sources of water were identified and dealt with in a proper fashion
- Many small breweries do not have the resources or finances to devote to research
 - revenue goes toward maintaining the facilities, purchase of raw materials, and advertising
- At the 2012 World Brewing Congress, Yuichi Nakamura and Hisao Koizumi of Asahi Breweries Ltd discussed the benefits of a heterogeneous fermentation method during brewing

Hypothesis: The early pitching method should produce a final beer product with detectable differences including a decrease in the level of fusel alcohols coupled with an increase in ester levels. The beer will taste better and be produced more efficiently!

Figure 1. Differences between the a), uniform and b), early yeast pitching method. This image was reproduced from Nakamura and Koizumi's presentation at the 2012 World Brewing Congress.



Future Directions

- GC-MS analysis of Fusel Alcohols
- Triangle Test Methodology during Taste Test
- Complete for a variety of styles of beer (some with higher ABV) and yeast strains
- Track levels of mono-, di-, and trisaccharides in layers during fermentation
- Complete on a large cylindroconical system

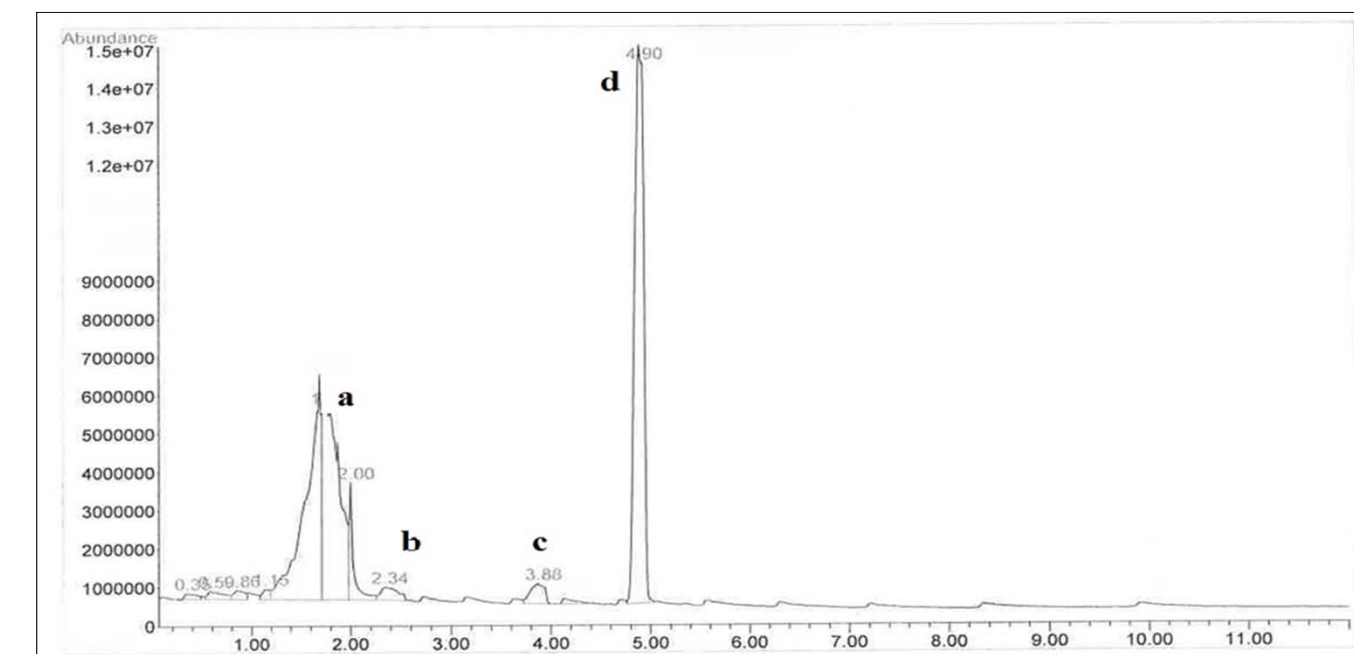


Figure 2. A sample spectrum of the compounds identified in beer headspace gas identified using GC-MS. Identified compounds include: a). Ethanol, b). Ethyl acetate (fruity/solvent flavor), c). Ethyl butyrate (pineapple flavor), and d). Isoamyl acetate (banana/pear flavor).

Conclusions

- Beer remains one of the most widely consumed beverages around the world
- During early pitching temperature remained fairly constant while uniform pitching had a huge spike
- pH remained similar between methods, with the range of 4.20-4.60
- Yeast cell counts remained homogenous in early pitching but heterogeneous in uniform pitching
- Amine consumption remained similar between methods
- Taste test confirmed subtle differences within human threshold
- Chemical testing (GC-MS) confirmed identity and levels of esters
- More testing is necessary to confirm these preliminary, yet significant, results

The early pitching method results in a final beer product with higher ester levels and lower fusel alcohol levels

It is anticipated that this research, and other research into the quality of our food and beverages, will result in improved products with superior composition

References

- Koizumi, H., & Nakamura, Y. (2012, July). *The Equipment to Sample the Fermenting Beer from Four Positions in the Cylindroconical Vessel and its Practical Application to Flavor Improvement in the Brewery*. 2012 World Brewing Congress, Portland, OR.
- Nakamura, Y., & Koizumi, H. (2012, July). *Heterogeneous Fermentation Method in Multi-filling Cylindroconical Vessels for High Quality Beer*. 2012 World Brewing Congress, Portland, OR.