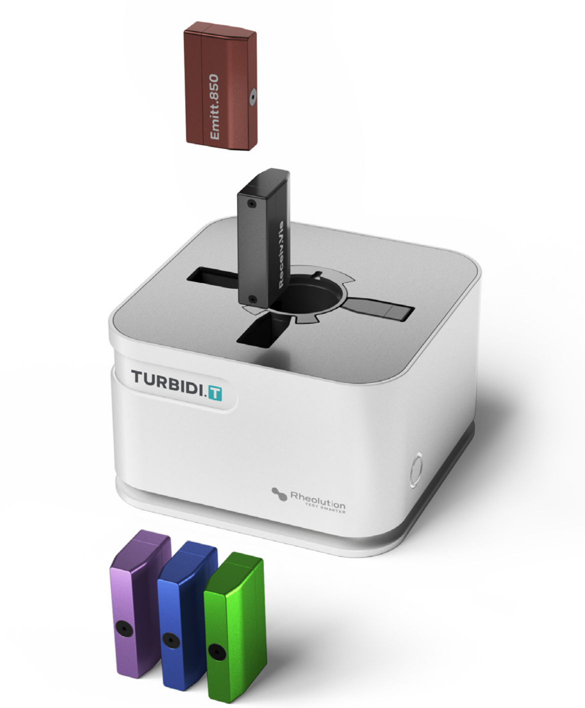

TIME MEASUREMENTS

TESTING CONFIGURATION

Application Notes | TURBIDI.T™

Monitoring the turbidity of beers during the brewing process with TURBIDI.T™

This study was performed in collaboration with the microbrewery EtOH (Montreal, QC) which brewed and provided the different tested beers.

SUMMARY

— Monitoring beer turbidity (or haze) is crucial in brewing to ensure quality and flavor.

— The TURBIDI.T™ was used to measure the turbidity of samples collected at various stages during the brewing process of an India Pale Ale (IPA).

— The turbidity increased along the first four steps of the brewing process and decreased in the latest stage, close to consumption.

INTRODUCTION

Beer brewing is a complex process that involves multiple phases and parameters to ensure consistent quality and flavor. From malting and milling the grains to fermenting and conditioning the beer, each step of the brewing process must be carefully monitored and controlled to achieve the desired result. One important parameter to be controlled throughout the process is the turbidity or haze of the beer [1].

Turbidity is a measure of the amount of suspended particles or solids in a liquid, and can indicate the quality at various stages during the beer production [2]. For example, after fermentation and before packing, it is crucial to monitor the turbidity of the beer to ensure that the yeast has properly settled out of the liquid and to prevent any remaining solids from affecting the flavor or appearance of the beer.

In order to monitor turbidity throughout the brewing process, breweries often use turbidimeters, which measure the amount of light that is scattered by the particles present in the liquid. In this work, the turbidity of samples collected from different stages of an India Pale Ale (IPA) brewing process was measured using the TURBIDI.T™.

MATERIALS AND METHODS

Samples from five consecutive stages of an India Pale Ale (IPA) brewing process (EtOH microbrewery, Montréal, QC) have been collected. The stages can be described as follows:

1) Wort phase: liquid extracted from the mashing process (mixture of infused grains and water)
2) Proliferation phase: proliferation of the yeast after 24h of yeast addition (a.k.a. lag phase)
3) One week fermentation and first addition of dry hop
4) Two weeks fermentation and second addition of dry hop

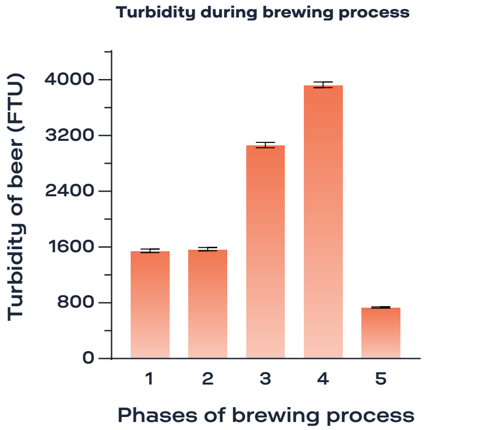

Figure 1. Turbidity levels in five different phases of beer brewing process: (1) Wort phase (pre-fermentation of beer); (2) Lag phase (after 24h of yeast addition); (3) 1 week fermentation and addition of hop; (4) 2 weeks fermentation and addition of hop; (5) Post-conditioning (in cold environment to facilitate particle sedimentation).

5) Post-conditioning phase (or crash phase): in cold environment to facilitate the sedimentation of suspended particles such as yeast and proteins.

Samples were frozen at -20°C until tests were performed. Previous to testing, the TURBIDI.T™ equipment was calibrated with formazin standards (FTU). Samples were thawed and incubated at 25°C and 3 vials were prepared for each step of the brewing process (n=3) to be tested in the TURBIDI.T™. Average results are expressed as mean ± standard deviation.

RESULTS AND DISCUSSION

Turbidity evolves through the beer brewing process. During the wort phase, the liquid extracted from the malted barley initially mixed with hot water (to extract the sugars needed for fermentation) has relatively low turbidity levels (stage 1: 1546 ± 25.90 FTU). The yeast is then added to begin the fermentation process. During the first 24h, the yeast starts proliferating (lag phase) and no significant increase was found in turbidity (stage 2: 1570 ± 23.10 FTU).

During the fermentation phase, the yeast begins to consume the sugars and produce carbon dioxide and fermentation byproducts, including proteins, amino acids, and polysaccharides. After one and two weeks of fermentation, the beer became more cloudy as the yeast continued to consume the sugars and produce more suspended particles. Additionally, dry hop additions further contributed to this increase in turbidity. Indeed the turbidity increased to 3062 ± 38.56 FTU and 3927 ± 40.37 FTU at stages 3 and 4, respectively.

Finally, after fermentation is complete, the beer is transferred to a cold-conditioning tank, where it is cooled to near-freezing temperatures for 4 days. During this stage (stage 5), the beer undergoes a natural clarifying process due to the sedimentation of the suspended particles resulting in the decrease of its turbidity, which was the lowest value among the analyzed stages (734.8 ± 8.89 FTU).

CONCLUSIONS

TURBIDI.T™ successfully measured the turbidity changes of beer throughout the brewing process, with the highest levels occurring after one and two weeks of fermentation with dry hop additions. After the beer is transferred to a cold-conditioning tank, it undergoes a natural clarifying process, resulting in the lowest turbidity levels of the overall process. Understanding the turbidity levels throughout the brewing process is essential for ensuring a consistent and high-quality beer product.

Therefore, this study showed that:

— Measuring the turbidity of beers is made easy with the user-friendly TURBIDI.T™ instrument.

— Turbidity measurements can be gathered and stored on a tablet and can be exported as needed.

— The TURBIDI.T™ can measure the turbidity changes in real time within the sample providing insights to the sedimentation kinetics when applicable.

— The TURBIDI.T™ instrument allows for a scalable testing platform, where multiple units can be connected to the same tablet for increased efficiency.

REFERENCES

[1] “A Healthy Shade”, Josh Weikert, 2017. Beer and brewing: https://beerandbrewing.com/a-hazy-shade/

[2] “The brewing process”, 2023. https://www.britannica.com/topic/beer/Types-of-beer#ref236418

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