097

WORLD BREWING CONGRESS 2016

TALES FROM THE BREWING ANALYTICS LAB

PAST PROBLEMS RISING AGAIN ALONG WITH NEW ISSUES TO INVESTIGATE

Darrin L. Smith[a], Gary Spedding[b], Tony Aiken[b], Amber Weygandt[b],

[a]Eastern Kentucky University: Fermentation Science Program, [b]Brewing & Distilling Analytical Services (BDAS)

World Brewing Congress
August 13-17, 2016
Sheraton Downtown Denver
Denver, CO 80202, U.S.A.

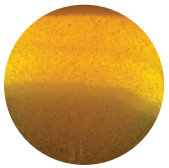
ABSTRACT

A number of quality issues have been raised recently that demand attention in the brewing community. This presentation will outline some original data as well as provide a review of methods and noted literature that has previously addressed problems but suggest where research and development is still needed. The purpose of these items will probably actually raise more questions and prompt discussions than provide answers but we are looking to survey individuals and how we can continue to work to provide more details.

HAZE ISSUES

Nasty globular chunks, which have been referred to as "snow globes", and mass gelatinous islands, sometimes referenced as "the blob" or "elephant snot", are floating pieces of unidentified matter cropping up in the craft beer segment. This has been noticed in highly hoppy beer styles and also noted in beers treated through centrifugation rather than filtration. Literature indicates the presence of active haze proteins (HA) hydrogen bonding and hydrophobic stacking of proline (in the available proteins) and polyphenol (PP) rings associated with π-(pi)-bonding.[1-3]

With highly hoppy beer, there is an increased amount of the PP that will be available to allow these stacks. The other option is the ability for 'slime' formation based on organism that are present in certain conditions.[4] However, future analysis with electrospray ionization mass spectrometry of these globular masses could yield more information about the particular structure and composition of the proteins and further microbiological investigations could determine if addition organisms are at play.



MALT ANALYSIS

A desperate need for malt testing facilities in the US and Canada is present right now. Since writing the original abstract, facilities available through the Hartwick College for Malt Quality Services (through the Center for Craft Food and Beverage) for this type of analysis have come available. These methods of analysis conform to the official methods of the American Society of Brewing Chemists. Therefore, work for further method development in this area has slowed.

[a]EKU Fermentation Science Program

[b]Brewing & Distilling Analytical Services

PROTEIN DETERMINATION

Utilizing the Kjeldahl method, the total nitrogen content for a sample is determined but not necessarily just from the protein content. A microwell ninhydrin assay that is suitable for determining protein as well as total usable nitrogen (free amino nitrogen – FAN) in beer has been previously developed.[5] However, additional requirements need to be considered as a replacement for the Kjeldahl method for the ASBC Methods of Analysis (MOA). The FAN assay is considered to be rapid, accurate, inexpensive, and applicable to large numbers of samples since sample absorbance measurements are made with a single reading. As an alternative, for use with cuvettes, reduced volume FAN assay can be employed using a sodium acetate buffered ninhydrin reagent.

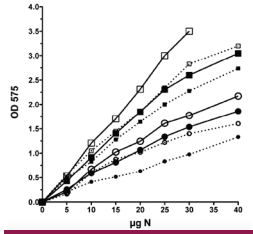


Figure 1. Plot shows the linearity of the FAN and microwell assays with increasing amounts of glycine standard and beer.[5] The solid line represents glycine for the standard FAN assay (•), the reduced FAN assay pH 6.8 (O), the reduced FAN assay pH 5.5 (■) and the microwell assay (□). Dotted lines represent increasing amounts of beer for the same assays to roughly match the increasing microgram amount of standard nitrogen and to confirm the linear assay response of beer (complex matrix) in comparison to glycine.[5]

FATS DETERMINATION

By May 2017, the Food & Drug Administration (FDA) mandate compliance to list calorie counts for alcoholic beverages will be in effect.[6] However, there is a voluntary push to provide information including calories, carbohydrates, protein, fat, alcohol by volume, and a freshness date for individual bottles and cans and/or secondary packaging. Current investigations suggest that fats are indeed present in beers that are heavily dry hopped or have adjuncts. However, more analysis is needed for a wide variety of beers to understand how this will influence labeling.

REFERENCES

1. Asano, K., Shinagawa, K. and Hashimoto, N., Characterization of haze forming proteins of beer and their roles in chill haze formation. *J. Am. Soc. Brew. Chem.*, 1982, **40**, 147-154.
2. Siebert, K. J. and Lynn, P. Y., Mechanisms of beer colloidal stabilization. *J. Am. Soc. Brew. Chem.*, 1997, **55(2)**, 73-78.
3. Aron, P. M. and Shellhammer, T. H. A Discussion of Polyphenols in Beer Physical and Flavour Stability. *J. Am. Soc. Brew. Chem.*, 2010, **116(4)**, 369-380.
4. Oevelen, D.V. and Verachtert, H. Slime Production by Brewery Strains of Pediococcus Cerevisiae. *J. Am. Soc. Brew. Chem.*, 1979, **37(1)**, 34-37.
5. Abernathy, D.G., Spedding, G., Starcher, B. Analysis of Protein and Total Usable Nitrogen in Beer and Wine Using a Microwell Ninhydrin Assay. *J. Inst. Brew.* 2009 **115(2)**, 122–127.
6. http://www.fda.gov/Food/IngredientsPackagingLabeling/LabelingNutrition/ucm217762.htm

UPCOMING ISSUES

In addition to the items presented, there are a number of other concerns and interesting studies that have recently begun or have manifested.

EXPLODING CANS

An issue with over-carbonation? Yeast or other organisms leading to can secondary fermentation? Can overfills? Poor quality cans or can sealers? Recent examples are shown to the right in Figure 2.

Figure 2.

WORT-MAILLARD EXPERIMENTS

Changes to the amino acid profile during wort generation could influence the chemical profile after fermentation. Figure on right shows the color variation based on a different type-amount of amino acids used to dose wort. A change at 275 nm (also used for IBU) is also observed based on the amino acids used, spectrum below.

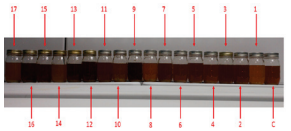
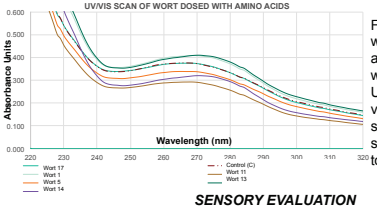


Figure 3.



For Figure 3, worts 1-8 were dosed with two amino acids, 9-16 had three, while wort 17 contained all. The UV spectrum shows the variation at 275 nm for selected worts. All wort samples were not included to simplify the scan.

SENSORY EVALUATION

As previously described, experiments are currently underway to change the wort profile through the Maillard reaction (via amino acid additions to wort). Sensory analysis post-fermentation will be necessary in addition to chemical analysis to better understand the overall changes to the product profile and their flavor impacts. The cross evaluation of chemical analysis with sensory is a useful tool to employ.