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HOP SCIENCE

KNOWLEDGE FOR YOUR SUCCESS

Searching the world of hops and brewing to bring you the latest news and research ... so you don't have to!

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NITROGEN – FROM FIELD INTO BEER

Nitrate is a naturally occurring ion in living organisms. Due to its high-water solubility nitrate is extracted out of hops during dry-hopping which may result in relatively high concentrations in beer depending on several factors. Concentrations of nitrates in hops have been reported to be in the range of ~300–10000 mg/ kg. While nitrate naturally occurs in humans drinking water guidelines and standards exist because of the potential sensitivity of infants. These US researchers investigated the transfer rates of nitrate from hops into beer during kettle, whirlpool and dry hopping. To quantify the dose-response relationship two contrasting nitrogen fertilizer rates, 90 and 269 kg/ha, were used to produce hops with low and high nitrate concentrations (852 and 2651 mg/kg of nitrate, respectively). Hop-forward beers (kettle hopped at 0.52 g/L, whirlpool hopped at 2 g/L, and dry-hopped at 4 g/L) were produced with these hops and nitrate accumulation was quantified after each hop technique to determine the overall contribution of each hop technique on the nitrate concentration in beer. They found that nitrate accumulates quantitatively with respect to the different hop techniques, with dry hopping resulting in the largest increase in nitrate, followed by whirlpool additions, and then kettle hop additions. This is probably a topic the brewers and hop producers should keep an eye on.

Nitrogen fertility practices in the field influence the accumulation of nitrate during the production of hop-forward beer. T. H. Shellhammer, S. R. Lafontaine, A. E. Iskra, J. Clawson, K. M. Trippe, C. L. Phillips and D. H. Gent. BrewingScience, 74 (July/August 2021), pp. 88–91. https://www.brewingscience.de/index.php?tpl=table_of_contents&year=2021&edition=0007%2F0008&article=92837

MEASURING CREEPINESS

Hop creep is an important phenomenon that brewers need to understand when they produce hop-forward intensive beers. What is hop creep? When hops are added during fermentation or maturation, hop diastatic enzymes can still be active and may convert beer dextrins in the young beer to fermentable carbohydrates. Yeast cells still present in the green beer can ferment these carbohydrates to carbon dioxide and ethanol.

Concurrently, fermentation by-products such as acetaldehyde, diacetyl, ethyl and acetate esters, and higher alcohols can be formed, thus compromising beer quality. Furthermore, the fermentative activity can lead to an increased alcohol content, decreased residual extract, and an increased risk of overflowing fermentation tanks or over-carbonated bottles due to the formation of CO_2. Also bursting of bottles or cans may occur in severe cases. These German researchers have now developed a method for quantification of the diastatic activity of hops. Hops were incubated with a potato starch substrate for 48 hours. Using response surface methodology, the independent factors: starch concentration (1 – 3 % w/v), hop concentration (5 – 15 g/L), and incubation temperature (25 – 35 °C) were varied and optimized. Fructose, glucose, maltose, and maltotriose were analyzed by HPLC after incubation. Because hops possess amyloglucosidase activity, which can degrade one maltose unit to two glucose units, measuring solely maltose or glucose cannot be recommended. Total mono hexoses, as the sum of glucose plus two times maltose, was found to produce more appropriate results and was followed for measuring the diastatic activity of hops. 14 different German hop varieties were tested with the optimized methodology and were correlated with the release of fermentable sugars from a lager beer by hop diastatic enzymes. The results are very promising in terms of reliability and reproducibility. Further investigations will aim at looking for even more suitable starch or dextrin substrates. To learn more about the Hop Creep Join us in our **Hop Creep Special on Nov 8th.**

A method for the determination of hop diastatic power – part 1. P. C. Wietstock, T. Luetzenberger, M. Biendl, B. Gibson. BrewingScience, 74 (July/August 2021), pp. 92–99. https://www.brewingscience.de/index.php?tpl=table_of_contents&year=2021&edition=0007%2F0008&article=92838

SOME (YEASTS) LIKE IT SOUR

Although these US researchers did not investigate hops their research work on fermentation performance in sour beer may be of importance for hop-forward sour beers. The presence of high concentrations of organic acids is known to adversely affect the efficiency and quality of ethanol fermentation. The growing popularity of sour beers warranted the exploration of strain-specific performance under optimal and suboptimal conditions similar to those found in sour beer production. The focus of this study was on the performance of select active dried yeast strains under artificially acidified conditions. Nine common brewing strains of active dried yeast were assessed based upon overall fermentation performance and their ability to metabolize maltotriose and maltose between 0.0% w/w – 1.0% w/w lactic acid and 0.0% w/w – 0.5% w/w acetic acid. A single strain of active dried yeast specifically selected and bred for bottle conditioning environments was assessed for its ability to metabolize glucose, and carbonate artificially acidified finished beer between 0.0%–1.6% w/w lactic acid and 0.0%–1.0% w/w acetic acid. This study confirmed the suitability of active dry brewing yeast for sour beer fermentations that meet or exceed the typical organic acid concentrations encountered in sour wort. The majority of the selected strains performed well in sour wort containing < 0.4% w/w lactic acid or < 0.1% w/w acetic acid. The importance of strain selection became apparent at concentrations exceeding these reported values, with two strains displaying almost no change in fermentation capabilities across the range of organic acid concentrations. Bottle conditioning remained unhindered by lactic acid up to 1.6% w/w, while acetic acid concentrations at and above 0.4% w/w significantly hindered bottle conditioning.

Avi Shayevitz, Eric Abbott, Sylvie Van Zandycke & Tobias Fischborn; The Impact of Lactic and Acetic Acid on Primary Beer Fermentation Performance and Secondary Re-Fermentation during Bottle-Conditioning with Active Dry Yeast, JASBC 2021 https://doi.org/10.1080/03610470.2021.1952508

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- October 27th, Hop Flavor Impact Day; Webinar
- November 8th, Hop Creep Halloween Special; Webinar
- November 17th, Hop Selection Harvest Special; Webinar

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