Reducing Dissolved Oxygen:
Acid and Detergent Cleaning of Brite Tanks

your partner in food safety

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After fermentation is completed and yeast is removed from beer, oxidative staling can be the single biggest enemy of fresh tasting beer. When beer tastes wet, papery or like cardboard it is said to be “oxidized.” Reducing these off flavors due to oxidation is the main reason brewers work so diligently to ensure that the dissolved oxygen (DO) level in finished beer is kept extremely low. This is especially true in the brite tank and in packaging, the final “pit stops” the beer makes before making its way to the distributor and to the ultimate end user, the consumer.

This article will focus on cleaning the brite tank (or serving tank in brewpubs) with acid and detergent only, rather than using caustic or other alkaline cleaner, and discuss the advantages and disadvantages of cleaning with acid and detergent only, and provide some data from breweries that have utilized the approach successfully.

Cleaning brite tanks with caustic (sodium and or potassium hydroxide) can create efficiency problems and increase oxygen levels in the subsequent finished beer processed through the tank. Carbon dioxide has to be removed from the tank to keep it from neutralizing the caustic and more importantly, not implode the tank from the vacuum created when the carbon dioxide inside the tank is drawn into the caustic solution too quickly. The tank also needs to be cleaned warm, increasing the demand for hot water. Once cleaned and sanitized, the tank needs to be re-cooled and then re-carbonated before it can be filled with beer again. In addition to requiring a lot of C02, it takes time and not all of the oxygen with be removed from the tank, so the subsequent beer put through the tank can have a higher-than-normal level of DO.

Acid Cleaning Pros

- When cleaning with acid and detergent, the tank can remain under pressure, without worrying about CO2 being drawn into the solution. (However, if you clean under pressure and maintain the pressure head throughout, you can’t open the manway to inspect visually. See the section on “the Process” for testing suggestions).
- The acid is not neutralized by C02.
- Cleaning can be done with ambient (not hot) water, thereby taking less energy required to make hot water.
- Since the tank does not have to be depressurized, it is a time saver over cleaning with caustic.

Acid Cleaning Cons

- Rotating (spinning) spray nozzles are a must to make sure the tank gets cleaned properly with acid. Typically, beer is not in brite tanks very long so they are not difficult to clean, but the coverage from the spray nozzles must adequate reach the exposed area of the tank. Beer skins at the top of the tank tend to be the hardest to remove using acid without a detergent additive to increase the wetting and protein dispersion.
- For breweries using their hoses and brite tanks for wild yeast such as Brettanomyces, or bacteria to make sour beers, it is best to use the traditional caustic-followed-by-acid

method to make sure that the bacteria and wild yeast are destroyed in the cleaning process.
- The acid and detergent method may not be adequate to clean unfiltered beers that have a lot of protein. For best results, filtered beers work best.
- On a pound-for-pound basis, acid tends to cost more than caustic, so having a way to recycle the acid is key.

The Process

Making a change in cleaning protocol change in the brewery often takes a big leap of faith, especially something so late in the process that can affect the taste if not done properly. “If it isn’t broke, don’t fix it” seems to be the philosophy in many breweries. But what if there is a better way to do something – one that will actually improve the shelf life of the beer and keep it tasting better at the same time?

Here’s the step-by-step procedure to clean the brite tank with acid and detergent:

1. Purge beer from the tank.
2. Rinse well with ambient temperature water.
3. Clean with 1-2 oz. of nitric/phosphoric blend along with a suitable detergent additive (consult your chemical vendor). The pH of the cleaning solution should be in the 1.0-1.5 range and contain 0.25%-0.5% as phosphoric when titrated with an acidity test kit.
4. Rinse well.
5. Sanitize (peracetic acid or chlorine dioxide, preferred).
6. Purge sanitizer out of the tank with CO2 (Breweries may also consider adding a source of sterilized de-aerated water for rinsing sanitizer before refilling with beer).
7. Tank is ready for beer!

Testing the final rinse water for soil and/or microbial growth is recommended to make sure they are being adequately removed in the cleaning process. Plating final rinse water for beer spoiling organisms such as Lactobacillus is helpful, as is adding some sterile wort to the final rinse water to see it turns turbid (cloudy) when incubated. Subjecting the beer to warmer temperatures will also give you an idea of how well it is going to hold up in the market down the road. Compare beer from the acid-cleaned tank to a caustic cleaned tank. How do they compare in terms of taste and appearance?

Case Study: Avery Brewing Co.

In September 2007, Avery Brewing Co. in Boulder, Colo., switched from using a chlorinated liquid caustic to cleaning its kegs with the acid and detergent approach (“Keg Cleaning with Acid and Detergent Only,” The New Brewer, July/August 2008). The result was very successful (still in use today) and subsequently the regime was used for cleaning the brite tanks as well.

Matt “Hand Truck” Thrall, Avery’s head brewer, explains. “Basically, our DO levels are about half what they are in a AUP (acid under pressure cycle) versus when we have to open a tank. Keep in mind they are still very low as we purge with CO2 before they are used after opening.

For example, an IPA will be around a 20 PPB out of an AUP tank, whereas the first round out of an opened brite will be in the 35-40 PPB range. While this isn't necessarily a huge jump in DO, it is if you consider the amount of CO2, and labor to monitor the tank that was opened. We can then expect subsequent batches out of the opened tank to lose about 5-10 PPB per filling/emptying.

"I cannot imagine going back to opening all of our brites after each beer," Thrall continued. "While we will continue to open brites that held very yeasty beer (White Rascal) or barrel-aged beers (Brett, lacto, and pedio) we see this as a necessary evil. A sour batch of IPA is a lot more harmful to our market presence than an IPA at 40 PPB!!"

Oskar Blues in Longmont, Colo., has also recently switched to cleaning its brite tanks cold and under pressure with acid and detergent. Oskar Blues' Eric Baumann reports that they have witnessed a significant reduction in DO in the beer going to packaging.

Conclusion

As the craft brewing industry grows and requires larger and larger brite tanks, not purging the brite tank for each and every cleaning becomes more important to save time, energy, and CO2. Acid cleaning of brite tanks under pressure can significantly reduce the amount of CO2 needed to replenish the brite tank and can significantly reduce the DO level in the subsequent beer run through the tank.

DO is the enemy of packaged beer, and brewers take great care to make sure that the DO level from packaging is kept as low as possible. Guinness has concluded, however, that in their breweries the overall exposure to DO during process is more significant than package DO alone.[1] Lower DO increases shelf life and flavor stability. Decreased DO levels in finished beer along with reduced energy and C02 usage is much better for the brewery's bottom line as well as reducing the carbon footprint.

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[1] Presentation by Greg Casey, Ph.D., Miller Coors, at Joint Technical Meeting of MBAA-Rocky Mountain District and ASBC Wild West Chapter, Golden, Colo., November 2010.