Don’t Lose Your Head!
A look at using antifoams in the brewery

your partner in food safety

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Brewers are facing ever-increasing economic obstacles and demands that impact the bottom line. Raw materials, energy, packaging, and chemical prices have all increased dramatically in recent years. Maintaining a comfortable profit margin has become a real struggle for brewers, regardless of size. Successful brewers these days are finding ways to reduce costs, cut down on waste, and improve efficiency. One of the ways brewers are accomplishing this and improving the quality of the beer at the same time is with the use of process aids. Process aids are usually either a piece of equipment or a chemical additive which performs a certain function to hopefully stabilize and improve the quality of the beer to give it better taste and a longer shelf-life at the same time. For the purpose of this article, I will focus on using antifoam in the brewery to reduce loss, improve head retention, and optimize efficiency.

Antifoam!?! Won’t That Kill The Head On My Beer?

Perhaps the most difficult impediment of using antifoam in the brewery is that it seems, at least at first glance, to be counter-intuitive. It would seem that putting something in wort or fermenting beer to control foam will also kill the head on the finished product. However, when antifoams are used properly, quite the opposite is true. Let’s take a look at where antifoams are appropriate in the brewery.

- **Yeast Propagation.** Because yeast require a lot of air an agitation to grow in starter cultures and in the propagator, antifoams are helpful to reduce the amount of foam that occurs here.
- **Kettle.** Many brewers like to have a cold water spray handy during the 60 minutes or so boil to knock down the foam that rises up at varying intervals during the boil.
- **Fermenter.** This is where the antifoam can offer the biggest savings in terms of lost product. How many times have you seen a “blow-off” bucket near a fermenter that is completely overwhelmed with foam and there is foam all over the floor. This is a common occurrence in many breweries.
- **Wastewater.** Because yeast, trub and waste beer contain a lot of protein, wastewater can have foaming problems, especially if it is being centrifuged or aerated. Antifoams can assist here as well.

Yeast Propagation

There are two places where antifoam can assist yeast propagation. The first place is in the laboratory in the Erlenmeyer Flask. Foaming can be an issue here as the flasks are typically agitated to increase the amount of oxygen to the yeast. The same is true in the larger propagation vessels. Foam can be an issue here as well but care has to be taken not to “cover” the yeast with antifoam and keep it from metabolizing the sugars in the wort. The amount of antifoam needed in propagators tends to be quite small.

Kettle Defoaming

Kettle defoaming with antifoam is a good idea for a couple of reasons.

1. Over-flowing the kettle with boiling wort foam is a worker safety hazard so it is best to avoid it if possible.
2. Hop utilization can be increased using antifoam in the kettle. It is no secret that hops have become a very expensive commodity in the last year or so.

When there is a lot of foam in the kettle, hops (especially the palletized variety) can be lifted out of the boiling wort with the foam and stick to the sides of the kettle above the liquid where they cannot be isomerized by the boiling wort. This can get expensive, especially on highly hopped beers. When antifoams are used, the hops stay in the boiling wort and do not get lifted out of the wort by the foam, thereby increasing the amount of hop utilization. Some brewers have had to re-adjust their recipes to make up for the increase of International Bittering Units (IBU) when switching to using antifoam in the kettle.

Fermenters

Fermenters require the largest amount of antifoam per barrel of beer produced because ale yeast in particular is so active that it causes a lot of foaming in the early part of fermentation. Excess foam here is detrimental to the beer in a several ways. The foaming can cause top-fermenting yeast to be expelled before it can do its job in the wort. This then requires the rest of the yeast to work harder to achieve the final terminal gravity. Many of the hydrophobic proteins can also be expelled which can decrease head retention in the finished beer. Hop bitterness, both measured and perceived (aroma) can be lost in foam that is pushed out of the fermenter, which leads to a decrease in IBU's in the finished beer. The foam that spills over blow-off buckets is food for undesirable microorganisms on the floor and in drains, which can create unsanitary conditions in the brewery.

One of the biggest reasons that brewers are using antifoams in the fermenter these days is to increase the throughput. Without the use of antifoam in the fermenter, more headspace is required in order to keep from losing too much beer from foam. With the proper use of antifoam, much more wort can be put in the fermenter. In some cases, this can be as much as 20-30% more beer can be put into and recovered from the fermenter. This added throughput can help offset the high dollar per gallon cost of the antifoam and can prolong the need for new fermenter(s). This can be a huge issue in breweries that are struggling with space issues and cannot put in new fermenters.

Care needs be taken when using antifoam in the fermenter to not over-use silicone antifoam to coat the yeast and inhibit metabolism. Interestingly enough, however, a unique food grade oil based antifoam actually exhibited an unexpected benefit. The yeast cell count actually increased after the brewery started using a canola oil based antifoam. Since the yeast was a top-fermenter, some of the yeast probably was being spilled out of the fermenter. That would account for some of the extra yeast count but not all of it. Something else was going on. Could the yeast be "feeding" on the antifoam? This indeed appears to be what is happening. Yeast can take-up lineolinic and linoleic (C-18) acids to strengthen the cell wall. Normally, this occurs through oxygenation of the wort but it can also occur with a diet of this kind of antifoam!

How do foam control agents work?

Foam control agents are divided into antifoams and defoamers. What is the difference, you ask? Antifoams prevent foam from being a problem and are added to pre-existing foam whereas defoamers knock down foam that has already occurred. Furthermore, defoamers are usually associated with a non-silicone control agent, whereas the antifoams are typically either silicone

or silicon emulsion based. Regardless of whether the foam control agent is classified as an antifoam or defoamer, it must be somewhat insoluble in the foaming media for it to be effective.

Antifoams and defoamers have three main components:

1. Liquid Vehicle
2. Emulsifier/Spreading Agent
3. Hydrophobic Particle

The liquid vehicle does the bulk of the work. For it to be effective, it must have a high spreading rate coefficient and have some degree of incompatibility with the foaming media. The liquid vehicle tends to be either silicon, organosilicone oil, vegetable oil, or derivative thereof, a synthetic polymer, or a mineral or white oil. The emulsifier tends to be comprised of silicone/organo surfactants, ethoxylates, fatty esters, and alcohols. The activator or hydrophobic particle is normally made up of some type of fatty amide, fatty ester, fatty alcohol, fatty acid, metal stearates, silica, or urea compound.

Is it Legal?

The German Purity Law, Reinheitsgebot, forbids the use of antifoams but they are allowed in other countries. In the United States, the Food and Drug Administration (FDA) controls the type and use of antifoams and process aids. For silicone antifoams, the FDA states that no more than 10 ppm of active silicone can be used and that the antifoam must either be filtered or centrifuged prior to packaging to remove the antifoam. When beer is filtered with diatomaceous earth (DE) or Perlite and then followed by a sheet filter, this is adequate to remove the silicone from the beer prior to packaging. If only a sheet filter is used to filter the beer, it is not recommended to use a silicone based antifoam as the molecule is too large and can blind the filter, making for a long transfer. In this case, it is better to use a vegetable oil type antifoam that will not blind a sheet or membrane filter. It takes a large amount of these antifoams to do the job but since they do not have to be filtered and can actually save or feed the yeast, there is a benefit.

Conclusion:

Using antifoams in the brewery is becoming more and more popular but probably not surprisingly, the author could not find a brewery that wanted to be quoted in this article due to potential negative publicity around adding something “unnatural” to the beer. Having said that, however, if your brewery is experiencing a great deal of lost beer due to foaming, contact your chemical supplier to see if antifoam is right for you. You might just be glad you did.

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