

ASK THE EXPERTS

Managing Mixed Culture Fermentations

Brewers readily acknowledge that they're janitors first and brewers second. Maintaining clean, sanitary equipment is job number one for those who want to make great beer every time, but brewers who work with bugs such as *Brettanomyces*, *Lactobacillus*, and *Pediococcus* have to be even more careful to avoid contaminating those clean *Saccharomyces* brews.

WE ALL KNOW WE need to sanitize, but what's the best approach in a mixed culture environment? How much contact time is needed? How much vigilance is good enough, and where do we draw the line between responsibility and paranoia? We turned to an accomplished brewer and a sanitation microbiologist for answers.

A Brewer's Perspective

Crooked Stave Artisan Beer Project in Denver, Colorado, is famous for its funky, sour, Belgian-inspired ales. Founder and Brewer Chad Yakobson, an expert in 100 percent *Brettanomyces* fermentations, could easily include the title "yeast whisperer" on his résumé. His Master of Science dissertation, *Pure Culture Fermentation Characteristics of Brettanomyces Yeast Species and Their Use in the Brewing Industry*, analyzed *Brett* in depth and is available online at brettanomycesproject.com.

We asked Chad how brewers can best manage mixed culture fermentations in a sanitary way. "The most sound advice is to have two sets of equipment!" he says. "That way you can concentrate on brewing clean beers on clean equipment and wild beers on [their own] equipment."

Yakobson emphasizes that even if you do have two sets, the equipment you use for wild culture fermentations needs to be properly sanitized. Ideally, you start every beer with a clean slate. "But if it's got a good bug or two hiding away, then you are just helping your inoculation with wild organisms you already use throughout your setup," he notes.

Chad also asks brewers to remember that sanitation and safety go hand in hand. "The easiest way to sanitize is to use boiling hot water. PLEASE BE SAFE, and wear protective brewers gloves and eyewear as well as taking any other safety measures you can. Glass is inherently dangerous: Use caution with hot water and glass. For this reason, I recommend stainless steel, which still gets hot. Brewing is dangerous, and the most dangerous part is cleaning and sanitation. Use chemicals wisely, and work diligently. No one wants to get hurt during a fun hobby!"

A Sanitation Professional's Perspective

Zep, Inc., offers safety and sanitation solutions to the craft-brewing industry, and more than 400 craft brewers rely on Zep's products, services, and support to ensure that they turn out great beer every time. Adel Makdesi is Zep's corporate senior microbiologist. We asked him how brewers can best evaluate sanitizers when selecting the best options for their breweries.

"Sanitizers used by breweries do not kill or destroy all pathogenic microorganisms on treated surfaces, but they will reduce their number to a safe level. Beer that is processed on [sanitized] surfaces should not cause illness or death because of the body's immune system. With that in mind, a sanitizer may or may not destroy all pathogenic bacteria. Sanitizers must be able to reduce 99.999 percent (5 log reduction) of a specific bacterial population on the surfaces within 30 seconds. So, in other words, as long as the sanitizer stays in contact with the surface for 30 seconds, it should do its job."

PHOTOS: MATT GRAVES



A “log reduction” knocks a zero off of the initial microbe population count (i.e., divides it by ten). So a 5 log reduction, which is typical for food pasteurization, means that for every 100,000 microorganisms present before sanitation, at most one remains after the treatment.

All food-approved sanitizers have to accomplish this within 30 seconds, but some sanitizers kill microorganisms more readily than others.

Adel says that iodine-based sanitizers, such as Iodophor, for example, destroy microbial cells by “penetrating the cell wall of the microorganisms and forming complexes with amino acids and unsaturated fatty acids, resulting in impaired protein synthesis and alteration of cell membranes.” Oxidizing sanitizers, on the other hand, work a little differently.

“Chlorine dioxide, peracetic acid, and bleach [sodium hypochlorite] are oxidizing sanitizers that kill microorganisms—including bacteria, mold, yeast, and mold spores—instantly by oxidizing their protein, an essential part of their cellular structure, resulting in quick destruction of the microbial cell membrane where the cell components leak out of the cell. As a result, oxidizing sanitizers are more effective against yeast, mold, and mold spores than Quaternary or ‘quat’ sanitizers.”

The quat sanitizers that Adel refers to are Quaternary ammonium salts. They inhibit a microbe’s ability to take in food and excrete waste, functions that are both controlled by the cell membrane. “Since a quat sanitizer has a positive electric charge, when applied on the surface, it attaches itself to the negative sites on the microbial cell’s membrane and interferes with its metabolic function, resulting in microbial death,” he elaborates. All sanitizers require time to inactivate microbial cells, but iodine and quat sanitizers may require more contact time than oxidizing sanitizers.

“Contact time is essential to achieve the desired level of sanitizing or microbial reduction,” Adel emphasizes. “In some cases, when a specific microorganism develops resistance to a particular type of sanitizer over time, extending the exposure time of the sanitizer with the surface may improve its performance against the resistant microorganisms. Additionally, higher concentrations of the sanitizer might be required. If those options don’t

work, switching to a different type of sanitizer should do the trick.”

Adel recommends that brewers consider the following factors when selecting the best sanitizer for their equipment and processes:

- **Cost**—Iodine-based sanitizers such as Iodophor tend to be the most expensive of the three types of sanitizers, costing up to four times as much as a chlorine-based oxidizing sanitizer such as household bleach. However, bleach leaves a residue that must be rinsed and is corrosive to stainless steel, which may outweigh the cost savings. Quat sanitizers are readily available and affordable.
- **Contact time**—Oxidizing sanitizers work more quickly than quat sanitizers and iodine-based solutions. In fact, some oxidizing solutions need only about 20 percent as much time as iodine-based ones to achieve the same level of sanitation.
- **Water quality and hardness**—Hard water reduces the effectiveness of quats and iodine sanitizers, while oxidizing sanitizers have a greater tolerance for hard water. If your water is hard enough that you use treated water for brewing, an oxidizing sanitizer may be the best choice for your sanitation needs.
- **Target microorganisms**—All sanitizers are effective against bacteria, although oxidizing sanitizers have the edge against mold and yeast spores. Quat sanitizers are more effective against gram-positive bacteria such as *Lactobacillus* and *Pediococcus* than they are against gram-negative bacteria such as *E. coli*.

Choose Your Own Adventure

Every brewery is different, and your individual needs will dictate what works best for you. A homebrewer who works with only regular ale and lager strains for his or her weekend hobby may be willing to accept more risk than a professional like Chad Jakobson who relies on blends of bugs for the livelihood of his operation.

Take the time to assess your sanitation needs, research the products available to you, and choose the sanitation solution that best meets them. 

If you have a question for the experts, email us at info@beerandbrewing.com or visit our website at www.beerandbrewing.com.