MBAA District New England
Autumn 2001 Meeting Technical Session Recap
Brewery Cleaning and Chemical Usage
Hosted by Redhook Ale Brewery in Portsmouth NH
Dana Johnson, Birko Chemical

Following are Dana's responses to highlighted questions on the topic of general brewery cleaning and chemical uses. Once again, District New England would like to thank Dana and Birko for responding to our questions on this interesting and (occasionally) controversial topic.

It should be noted that Bob Scott of Rochester-Midland Chemical put together an excellent presentation that made up the main portion of the technical session on this topic. Bob's discussion covered all of the basics of brewery chemical composition (including definitions of many of the terms chemical suppliers use to describe their products' characteristics) and the fundamentals of the brewery CIP process. Bob was then joined by several of his colleagues from the industry (including Dana, Dirk Loeffler of Loeffler Chemical, and several others) for a lively panel discussion on the relative merits of different philosophical approaches to brewery cleaning and chemical applications. The discussion was good natured and spirited at times.

Q. How effective as a biocide is phosphoric acid (H_3PO_4) at 2-4% as final rinse for fermenters and bright tanks? What is the difference between acid cleaners and acid sanitizers?

A. A pH below 2 tends to be fairly effective in destroying most organisms, however there are exceptions. Because there are some acid tolerant organisms that can survive in the brewery, I personally don't think that H_3PO_4 by itself is all that great as a sanitizer. It is better to use an EPA registered sanitizer for post-rinse sanitizing to be absolutely certain you have destroyed the unwanted organisms that can spoil wort or beer.

The difference between an acid cleaner and an acid sanitizer is that an acid cleaner is intended to remove hard water scale, soil, beerstone, etc., and does not typically make any bactericidal claims. An acid sanitizer is not normally designed to be a cleaner and is used to sanitize a previously cleaned surface. Two examples of acid sanitizers are Peracetic Acid (PAA) and Phosphoric/Anionic surfactant.

Q. Could you tell us more about new CIP regimens for CO_2 pressurized tanks? How effective are they? Are they "the future?"

A. Since cleaning with caustic can cause tanks to implode if the CO_2 is not properly purged prior to cleaning, acid cleaning bright tanks is becoming more popular. In bright tanks, soil loading isn't very severe and a light acid cleaning works well, even in cold water. A brief rinse with a phos/nitric or PAA solution, for example, is enough to remove soil and organisms that can contaminate beer and can even assist in preventing biofilm formations. It also helps reduce stress corrosion cracking if you can clean with cold water rather than using hot caustic. I think that acid cleaning will be more prevalent in the future for cleaning CO_2 pressurized tanks as surfactant technology improves and breweries have to reduce CO_2 emissions and speed things up.

Q. How tough are acetic acid/hydrogen peroxide (P_3) foams on stainless steel and other metals? Can you discuss the mechanism through which hydrogen peroxides work and how it is different from standard alkaline cleaners? Can high temperature (80^o C) hydrogen peroxide be harmful to standard production beer hose, or buna, epdm, or viton seals?

A. PAA is extremely tough on soft metals like copper and brass, but isn't so bad on properly passivated 304 or 316 grade stainless steel. Chlorines are reactive to proteins, creating byproduct chloramines, with their good and bad qualities, but are also reactive to many metals, including stainless, copper, and brass, as well as being reactive to many plastics as well. Hydrogen peroxides are moderate oxidizers and they assist cleaning by loosening and dispersing protein in an alternate mechanism to the way chlorine assists cleaners. Peroxides are unstable in high pH and temperatures, so it is better not to run them extremely hot. Your formulations need to be balanced for the application. Most hydrogen peroxide compounds used at proper concentrations, times, and temperatures will not have a deleterious effect on beer hose, buna, epdm, or viton seals.

Peracids are somewhat more effective as cleaners and sanitizers than Peroxides because the Peracids have more of a surfactant effect built in, and so attach to organics better than the simple hydrogen peroxide will.

Q. Is there one type of acid that is particularly effective on iron deposits?

A. There are several types of acid that are effective in removing iron (rust) deposits. Hydrochloric, oxalic, citric, and even phosphoric will usually work. If I had to pick one for quickly stripping rust, it would be hydrochloric, but then immediately clean with a gluconated and silicated alkaline cleaner afterwards in order to keep the corrosion to a minimum.

Q. For general purpose acid rinsing, which is preferable, hot or cold? Why? What solutions are considered acceptable for passivating stainless steel? How often should tanks/equipment be re-passivated?

A. I personally don't see a reason to run acids extremely hot, especially if it has an oxidizer in it like hydrogen peroxide or nitric. Running acids hot increases the chance corrosion to metal and the equipment mentioned in the previous question. Nitric acid is probably the best acid for passivating stainless. Mueller recommends a combination of ammonia hydroxide and citric. Birko uses a phosphoric/nitric solution followed by a non-caustic cleaner for a conversion coating that works well and doesn't need a lot of time to air dry like most passivation procedures require. Passivation should be done as needed, more often if harsh chemicals are used in the cleaning process or if beer is stored in the tank for an extended period of time.

Q. What is the difference between sanitary condition and bacteriostatic?

A. Sanitary means there are little or no bacteria present. Bacteriostatic means that if there are bacteria present, they are unable to reproduce and multiply, creating an unsanitary surface.

Q. What role does water hardness play in choosing chemical concentrations? What additives can tie up Ca^+ to allow proper cleaning? Can caustic react to Ca^+ and Mg^+ to form a precipitate? Are sequestrants and chelating agents the same thing? Comment on EDTA's performance. Any viable alternatives?

A. Water hardness can increase the amount of chemical needed to properly clean a surface or material. Chelators and sequestrants can only handle a set amount of calcium

hardness, for example, per gallon of water, so the higher the hardness, the more chemical will be needed. We have been witnessing increasing Ca and Mg levels in well water where the aquifer is being depleted faster than it is being replenished.

EDTA, gluconates, phosphonic acids, polyacrilamides, and even phosphates (STPP) are being used to combat hard water problems. Caustic, without help from these chelators and sequestrants can indeed cause Ca, Mg, and silicates to precipitate on the surface. Sequestrants tie up hardness, while a chelator actually will latch on to the hardness. EDTA is effective in chelating Ca, up to a point. The phosphonic acid and gluconate compounds can help do a better job on Ca hardness than EDTA by itself.

Q. Re: degreasing new equipment, are there any alternatives to butyl degreasers? Any comments on using camphor to confirm that equipment is fully degreased?

A. There are some new solvents coming out, but D-Limonene solvent based cleaners work well. Non-caustic cleaners also do a good job of removing grease and oils. I'm not familiar with using camphor to confirm equipment is fully degreased, and so can't comment on that. I think that using an ATP test might be a good supplemental test.

Q. Are the hazards of chlorine dioxide to stainless steel overstated? Is there a difference between contact sanitizers and other types of sanitizers?

A. Oxygenated sanitizers like PAA and ClO_2 are effective but don't have much residual effect, which can be a pro or a con depending on what you want. Iodophor is an old standby with a pretty good residual, but can stain equipment and flavor beer if used improperly. Acid sanitizers are effective but can have some corrosion issues (see earlier question on this topic). Any chlorine-containing product will be corrosive to stainless on the acid side. Chlorine dioxide is an oxygen donor and should not be confused with sodium hypochlorite (bleach). A sanitizer is, by definition, a compound that will give a 5-log order (99.99999%) reduction in bacteria. The EPA controls post rinse sanitizer claims and compounds, while the FDA controls hand (manually applied rather than CIP applied) sanitizer claims and compounds.

Q. Beerstone. Any techniques for maintenance removal and/or serious first aid removal?

A. We use our Acid Brite #2 (phosphoric/nitric) as our workhorse for removal and prevention of beerstone. Chlorinated caustic can be effective in helping to keep beerstone from building up, too. Our Acid Brite #2/noncaustic cleaner comb is second to none for removing tough beerstone and protein deposits and keeping them from coming back. Church and Dwight (Arm & Hammer) has a method of stripping beerstone with a high pressure baking soda slurry.