preprocessinc ®

Typical Cleaning and Sanitizing Solutions

Cleaning and sanitization solutions are usually stock chemicals diluted with water. The dilutions are commonly from drums or bottles and can be made up using automatic dosing pumps. Many times batch dilutions ae completed to have the needed solutions on hand. Automated systems can also dose directly into flowing water streams. The creation of ozone can only be completed by ozonation of a flowing water stream.

Water

The make up water for the solutions should not contain levels of minor constituents that would interfere with the efficacy of the active ingredients being diluted. The make up water can be one of the most troublesome sources of contamination and source of failure mechanisms for various cleaning and sanitization procedures. At a minimum the dilution water should be filtered and softened. The water supply hardness should not exceed 50 ppm as CaCO3.

Make Up of and Alkaline (Caustic) Solution

50% Liquid NaOH diluted with soft water

For routine soils, concentration should be 1000 ppm NaOH by weight
Use temperature should be 140 F
Exposure time should be 20 minutes

Caustic Solution Make Up Procedure – 1000 ppm NaOH

1. Add 35 gallons (approximately 292 lbs) of ambient temperature (70 F) soft water to a pre-sanitized 55 gallon HDPE drum or a stainless steel mix tank
2. Don 50% NaOH Personal Protective Equipment (PPE) which should include the following:
    a. Safety Glasses
    b. Face Shield over the Safety Glasses
    c. Chemical Duty elbow length gloves
    d. Chemical Apron
3. Add 125 ml of 50% NaOH to the drum
4. Recirculate the drum or tank for 5 minutes to thoroughly mix

For heavy soils or first of season pre-processing cleaning, the caustic solution should be made up to 5X stronger in concentration.

In milk operations concentrations, temperatures and contact times for the alkaline solutions can be even higher. Typical could be a solution concentration of 1 wt% NaOH, a temperature of 180F and 60 minutes of circulation.

Automatic in-line continuous dosing systems can be set up based upon the flow ratio of the cleaning solution.

In a one inch line, the minimum volumetric flow to achieve the minimum 5 ft/sec velocity would be 15 gpm. The 50% NaOH addition rate to the 15 gpm water stream would have to be set at 75 ml/min.

Make Up of Inorganic Acid Solutions

Phosphoric acid has traditionally been the inorganic acid of choice for acidic cleaning and sanitization solutions. The concentration is usually determined based upon the post caustic water rinse residual that is required to reduce the pH in the system to 6.5. The strength of the phosphoric acid solution for the application is many times determined by sampling of the system characteristics. Other acids are also used as phosphoric acid does have environmental disposal issues. Citric acid and acetic acid are two organic acids that are commonly used.

Cost is a significant factor in the choice of the acid.

To minimize the amount of acid consumed, the post caustic water rinse must be optimized for its volume and the variability in the soil build up in areas that may have variable loads due to product making characteristics or response to the routine of the cleaning and sanitization cycle.

For example, if a pulpy or liquid product with suspended components has a build up frequency the current procedures may be subject to a natural declining efficacy. That in combination with slack adherence to SOPs for manual operations could render the variability more than what the system was designed to handle. Many times, system acid consumption is an indicator as to whether procedures and practices in place are rigorously applied consistently.

In a batch system, titrations in the lab determine the needed amount of inorganic stock acid to be made up in the diluted use solution.

For an inline system, many times a control loop utilizing an in line pH probe is used to determine the addition rate of the acidic solution. To realize stable pH control, the concertation of the acid solution must have a resolution that meets the pumps ability to deliver controlled flow at the needed rate. In addition, mixing and placement of the in line pH probe is critical to the systems success. Acid consumption rates can be used to determine the health of the installed system.

Oxidizer Solutions

After a water flash and usually at elevated temperature, an oxidizing solution is usually run through the system.

Bleach

Bleach solutions are most effective at the lowest pH possible, however chlorine gas will be released if the pH drops below 6. As a safety precaution most bleach solutions ae made up with excess caustic and the pH is usually 12. Many times the caustic solutions is chlorinated. In other words, bleach is added to the caustic solution.

Bleach works well at most common temperatures. Bleach degrades at elevated temperatures.

Bleach solutions are usually targeted to have a 200 ppm as NaOCl residual after sanitizing measured using a common titration technique. Bleach is commonly available in 12.5 wt% NaOCl or 7.0 wt% NaOCl supply. Bleach that has been at elevated in temperature or contaminated with metal contact will lower the NaOCl concentration rapidly and will degrade into salt water rendering its disinfecting efficacy useless.

Contact time for bleach solutions is usually 10 minutes.

To make up bleach solutions, using 12.5% hypochlorite (industrial strength bleach) in a 1:10 dilution (one part industrial strength bleach and nine parts water) yields 12,500 ppm or a 1.25% hypochlorite solution. Using 7.0 % hypochlorite (concentrated household bleach) in a 1:12 dilution (one part household bleach and twelve parts water) yields 5,250 ppm or a 0.53% hypochlorite solution.

Peracetic Acid (PAA)

PAA is usually made up to 100 ppm solutions. Contact time is usually 20 minutes.

Calculating the concentrations and blend ratios for both a batch make up and a continuous flow injection follows the same techniques as described above for the caustic make up.

PAA is safer than chlorine to humans and the environment.

PAA has a short shelf-life and fresh solution must be made frequently.
PAA is made up of a reaction of acetic acid and hydrogen peroxide. Solutions of hydrogen peroxide alone are relatively slow and limited as germicides.

Both Hydrogen peroxide and PAA can be corrosive to metals such as aluminum, copper, brass, and zinc, and can also decolorize fabrics, hair, skin, and mucous membranes.

Quat

Quats are used to disinfect at concentrations of 0.1-2% for vegetative bacteria and non-lipid-containing viruses.

Quats are not effective against spores.

Quats are neutralized by anionic detergents.

Quats can require extended contact times to be effective.

Quats will leave films. They are good for long term storage preparation cleaning.

Ozone

Ozone must be generated at the point of use. Typical concentrations are 10 ppm.

Ozone is most effective in cold water, not hot.