

## **QUICK GUIDE for PAA:**

### Overview:

Peracetic acid (PAA) is formed in an equilibrium mixture of acetic acid and hydrogen peroxide. There are many manufacturers of PAA (e.g., BioSafe Systems, Ecolab); each with their own blend/specific proportion of each compound. PAA decomposes into acetic acid, water, and oxygen, all harmless residuals. PAA is an effective sanitizer that is active against many microorganisms. PAA works by disruption of chemical bonds within the cell membrane. It is also effective in removing biofilms. It is EPA approved for use in fruit and vegetable applications (such as wash water) and surface applications (such as sanitation of food contact surfaces). The FDA does not permit PAA to exceed 80 ppm in produce wash water.

### **Advantages**

- low reactivity with organics and soils (low dilution rate with more stable dosage)
- no pH control necessary
- no rinse required
- no run-off or dumping restrictions
- less corrosive than chlorine

### **Disadvantages:**

- more expensive than chlorine, and some other sanitizers

### Basic Steps (include in Standard Operating Procedure):

1. Remove soil/clean
2. Prepare CORRECT ppm PAA solution\*
3. Submerge produce (via flume/dump or float tank) or spray produce (via spray bar)
4. Monitor PAA level with strips, electric device, or titration; adjust as needed
5. Monitor contact time
6. Dry

\*Note: CORRECT ppm (parts per million) is dependent on specific commodity and type of system (continuous belt spray bar, flume, float/dump tank, etc.). Each manufacturer has guides & literature on recommended ppm/etc.

For example: SaniDate 5.0: <http://www.biosafesystems.com/assets/fs12-35-post-harvest-rates---usage.pdf>

### Post-Harvest Wash Water Obtaining the Target ppm:

- 40 ppm: add 0.09 fluid ounces of SaniDate 5.0 per 1 gallon of water
- 60 ppm: add 0.13 fluid ounces of SaniDate 5.0 per 1 gallon of water
- 80 ppm: add 0.17 fluid ounces of SaniDate 5.0 per 1 gallon of water

### Hard Surface Sanitation/Disinfection Obtaining the Target ppm:

- 230 ppm: add 0.50 fluid oz per 1 gallon of water (pack table, seed cutter, etc.)

## **QUICK GUIDE for Chlorine:**

### Overview:

Chlorine (Cl), often referred to as Bleach, has the active sanitizing ingredient sodium hypochlorite. It is a potent and cheap sanitizer. Chlorine is best used to sanitize food contact surfaces or produce wash water (to prevent cross contamination). It can kill microorganisms present in wash and flume water, but its effectiveness is dependent on the following factors:

- pH of water: Cl is most effective when water is between 6.0-7.5. Below 6.0, noxious Cl gas can be released and above 7.5, little Cl exists in its active sanitizing form.
- Organic matter: Cl can bind with organic matter (leaves, soil, stems) rendering it inactive; therefore, Cl must be routinely added to the system to have enough free (active) Cl to sanitize.
- Contact time: Lower concentrations of Cl = longer contact time vs. higher concentrations of Cl = shorter contact time (balance between safety and quality).
- Water temperature: Lukewarm water is most ideal, as hot water increases corrosiveness/gases and cold water renders Cl less active.

Regulations (21 CFR Part 173) specify two conditions for the permitted use of hypochlorite solutions in washing produce:

- Concentration of sanitizer in the wash water must not exceed 2000 ppm hypochlorite.  
\*NOTE: In practice, concentrations should be MUCH less, often 50-150 ppm of total chlorine (as 4-7 ppm free chlorine is effective at killing microbes in water)
- Produce must be rinsed with potable water following the chlorine treatment if submerged

Regulations (21 CFR Part 178) permit the use of hypochlorite solutions on food processing equipment and food contact surfaces with the following conditions:

- Equipment/surfaces sanitized with the Cl solution must be allowed to drain adequately before contact with food
- Cl solutions used for sanitizing equipment shall not exceed 200 parts per million (ppm) available chlorine, according to federal regulation. If higher concentrations are used, the surface must be rinsed with potable water after sanitizing.

### ***Advantages***

- Low cost/affordable
- Easy to prepare/traditionally been used

### ***Disadvantages:***

- Requires routine monitoring (free chlorine, pH, temperature, organic matter)
- High concentrations can harm employees/corrosive to equipment

- Damage to produce (visual) or sensory flaws (prolonged exposure, high concentrations)
- Disposal (cumbersome in large quantities)

Basic Steps (include in Standard Operating Procedure):

1. Remove soil/clean
2. Prepare CORRECT ppm chlorine solution\*
3. Submerge produce (via flume/dump or float tank) or spray produce (via spray bar)
4. Monitor free Cl levels; adjust as needed
5. Monitor pH levels; adjust as needed
6. Monitor temperature levels; adjust as needed
7. Monitor contact time
8. Rinse required
9. Dry

\*Note: CORRECT ppm (parts per million) is dependent on concentration of sodium hypochlorite (%) in chlorine bleach, specific commodity, and type of system (continuous belt spray bar, flume, float/dump tank, etc.). Also, several guides have recommendations for target ppm on different produce commodities: <http://ucfoodsafety.ucdavis.edu/files/26414.pdf>

For example: Using 5.25% sodium hypochlorite, selected total available chlorine ppm

Post-Harvest Wash Water - Obtaining the Target ppm:

- 50 ppm: add 0.125 fluid ounces per 1 gallon of water
- 100 ppm: add 0.25 fluid ounces per 1 gallon of water
- 200 ppm: add 0.5 fluid ounces (1 Tablespoon) per 1 gallon of water

Surface Sanitation/Disinfection Obtaining the Target ppm:

- Non-porous surfaces (e.g., metal, hard plastic): 100-200 ppm, 2 min contact time, and air dry (not over 200 ppm so not required to rinse)
- Porous surfaces: 600 ppm (add 1.5 fluid ounces per 1 gallon of water), 2 min contact time, rinse thoroughly with potable water, and air dry
- Floors and walls: often higher ppm (1,000-2,000), with rinse and dry

\* Always make sure to clean before you sanitize equipment and surfaces!

\* Make fresh batches (chlorine is unstable, and loses its effectiveness; recommend new batches upon each use or every 24 h