

# Properties of Chemical Sanitizers

| SANITIZER PROPERTIES              | INORGANIC CHLORINE: Sodium hypochlorite<br><br><b>CLOX</b>   | ORGANIC CHLORINE COMPOUNDS: di-, tri-chloroisocyanurate; chloramine T  | IODINE COMPOUNDS: iodophor, 12-30% iodine stabilized in surfactant and acid        | ACID ANIONIC: organic acids (formic, acetic, propionic, octanoic) and anionic surfactant            | CHLORINE DIOXIDE  | QUATERNARY AMMONIUM COMPOUNDS: QUATS, QAC, benzalkonium chloride, N-alkyl dimethylbenzyl ammonium chloride (ADBAC)                                      | PEROXYACETIC ACID: peracetic acid, acetic acid and hydrogen peroxide (may have nitric acid additive)                             | MIXED PERACETIC ACID: Stabilized solution of hydrogen peroxide, acetic acid and octanoic acid                                    | MIXED PERACETIC/SULFURIC ACID: Stabilized solution of acetic acid, hydrogen peroxide, sulfuric acid and octanoic acid            | HYPOCHLOROUS ACID: Free available chlorine from 50 ppm - 200 ppm Free Available Chlorine (FAC) | QUAT/ALCOHOL  | PERQUAT  | HOT WATER SANITIZING: Water maintained to at least 77°C (170°F) for at least five (5) minutes. Measure temperature at discharge at end of hold |
|-----------------------------------|--|--|--|---|---|---|--|--|--|--|---|--|--|
| <b>GERMICIDAL ACTIVITY:</b> ➔     | High   | High   | Less Effective than chlorine   | Fair  | High, better than chlorine  | Varied  | High   | High   | High   | High   | High  | High   | High   |
| <b>GERMICIDAL SPECIFICITY:</b> ➔  | Broad spectrum generally effective, reference sanitizer - Will form hydrochloric acid and gas off in acidic solutions  | Generally effective, similar to sodium hypochlorite. May be more effective at lower pH than liquid sodium hypochlorite | Good against yeast, mold, bacteria   | Good, effective against bacteriophage   | Generally effective against all bacteria, viruses, yeast, algae, mold   | Good against molds, ineffective with some gram-negative bacteria  | Good, many types gram negative and gram positive - not as good with yeast and mold   | Good, many types gram negative and gram positive - better than straight peracid with yeast and mold                              | Good, many types gram negative and gram positive - better than straight peracid with yeast and mold                              | Generally effective, even spores, virus  | Generally effective against all bacteria, yeast, mold | Generally effective against all bacteria, viruses, yeast, algae, mold - Also has biofilm claim | Generally effective against all bacteria, viruses, yeast, algae, mold  |
| <b>GERMICIDAL SPEED:</b> ➔        | Fast   | Not as fast as liquid hypochlorite   | Not as fast as hypochlorite  | Good at proper pH. Must be below pH 3.0   | Fast-acting   | Moderate  | Fast   | Fast   | Fast   | Fast   | Moderate  | Fast   | Moderate   |
| <b>FORM:</b> ⬇                    | Concentrated liquid hypochlorite solution  | Powder   | Solution of iodine, stabilized in surfactant and acid                              | Solution of concentrated acid and surfactant  | Must be blended on site   | Concentrated solution   | Stabilized solution of about 25% H <sub>2</sub> O <sub>2</sub> in acetic acid  | Liquid   | Liquid   | Generated on-site from salt water  | Liquid  | 2 parts liquid   | Hot Water  |
| <b>STABILITY</b>                  | Fair as liquid   | Good   | Good at room temp, avoid temp >120°F   | Good  | Good  | Good  | Good   | Good   | Good   | Good   | Fair - alcohol can evaporate                          | Mix and use  | Must maintain temperature  |
| <b>TOXICITY</b>                   | Yes  | Yes  | Yes, some surfactants are toxic  | Relatively low  | Yes   | Yes   | Yes  | Yes  | Yes  | None   | None  | Low  | None   |
| <b>IRRITANCY</b>                  | Yes  | Yes  | Yes  | Yes   | Yes   | Yes, moderate   | Yes, pungent smell, potent and possibly hazardous oxidizer on skin   | Yes, pungent smell, potent and possibly hazardous oxidizer on skin   | Yes, less pungent smell, potent and possibly hazardous oxidizer on skin  | None   | Low   | Low  | Burn, safety hazard  |
| <b>DILUTION:</b> ⬇                |  |  |  |   |   |   |  |  |  |  |   |  |  |
| <b>EASE OF PREPARATION</b>        | Easy   | Easy   | Easy   | Easy  | Complex equipment and procedure   | Easy  | Easy   | Easy   | Easy   | Requires Electro-Chemically Activated water (ECA) generator                                    | Ready to Use  | 2 parts to mix and dilute  | Slow to reach temp   |
| <b>EASE OF MEASUREMENT</b>        | Easy, titration test kits available  | Easy, test kits available  | Easy, iodometry, test kits available   | Good, pH is measured plus test kit  | Difficult, titrations, interferences  | Test Kit  | Must be titrated   | Must be titrated   | Must be titrated   | Easy - Free Available Chlorine (FAC) in-line sensor  | None Required   | Special test kit   | Easy - measure temperature at process outlet   |
| <b>STABILITY</b>                  | Good   | Good, lasts longer than hypochlorite   | Stable at room temp and below  | Excellent, even at high temp  | Moderate, decays to chloride  | Excellent   | Good   | Good   | Good   | Good   | Good  | Fair   | Temperature must be maintained   |
| <b>TOXICITY</b>                   | Low at use dilution  | Low  | Some wetting agents may be toxic   | Low   | Moderate  | None  | Low  | Low  | Low  | None   | None  | Low  | None   |
| <b>IRRITANCY</b>                  | Low at use dilution  | Low  | None, used for hand wash   | Low   | Very irritating vapors, even at 17ppm   | None  | Inhalation irritant  | Inhalation irritant  | Inhalation irritant for concentrate  | None   | Low   | Low  | Burn, safety hazard  |
| <b>VAPORS</b>                     | None at correct pH   | None at correct pH   | Iodine odor, vaporizes above 12°F  | None  | Typical odor, yellow-green, dangerous   | None  | Pungent  | Pungent  | Pungent as a concentrate   | None   | Low   | Low  | Steam  |
| <b>COLOR</b>                      | None at correct pH   | None at correct pH   | Red-Brown, used to judge concentration   | None  | Yellow-green or red-brown   | None  | None   | None   | None   | None   | None  | Clear  | None   |
| <b>pH REQUIREMENT</b>             | Most active at pH of 6-7.5   | Best at pH of 6-7.5  | Effective at low pH, 4 or lower  | pH 1.9-2.5 for best activity  | Effective at broad pH, best at 8.5  | Effective over broad pH range   | Effective over broad pH range up to 7  | Effective over broad pH range up to 7  | Effective over broad pH range up to 7  | Best at pH of 6-7.5  | None  | None   | None   |
| <b>TEMPERATURE</b>                | Cold water, maximum temp 115°F   | Cold water, maximum temp 115°F   | Maximum temp 120F  | Broad range   | Use at low temp to avoid vaporization   |   | Cool to hot  | Cool to hot  | Cool to hot  | Cold water, maximum temp 115F  | Ambient   | Ambient  | > 77°C (170°F)   |
| <b>FILM FORMATION:</b> ⬇          |  |  |  |   |   |   |  |  |  |  |   |  |  |
| <b>BACTERIOSTATIC FILM</b>        | No   | No   | Slight, loses activity   | Yes   | No  | Yes   | None   | None   | None   | None   | None  | Yes  | None   |
| <b>PENETRATION</b>                | Poor   | Poor   | Good, depends on wetting agent   | Good, depends on wetting agent  | Poor  | Very good, penetrates porous surfaces   | Good   | Good   | Good   | Good   | Poor  | Very good, penetrates porous surfaces  | Good   |
| <b>WATER HARDNESS:</b> ➔          | Activity decreases in very hard water (>500ppm)  | Activity decreases in very hard water (>500ppm)  | Activity decreases in water of high alkalinity (>500ppm)                           | Slower, more sanitizer needed in harder water   | No Effect   | Inactivated in hard water, higher concentration needed  | Limited Effect - metals can cause issues   | Limited Effect - metals can cause issues   | Limited Effect - metals can cause issues   | No effect  | Not applicable - Ready to Use                         | Similar to Quats   | Can leave hard water film over time  |
| <b>ORGANIC MATTER IN WATER:</b> ➔ | Reacts to form chloramines, dissipates in contact with any organic material.   | Reacts to form chloramines, dissipates in contact with any organic material, separation                                | Somewhat more stable than chlorine   | Reacts with milkstone, low reactivity with organic matter   | Little influence, even at high organic load   | Moderately stable, high concentrations inactivate QUATS   | Less affect than chlorine and iodine   | Less affect than chlorine and iodine   | Less affect than chlorine and iodine   | Reacts to form chloramines, dissipates in contact with protein.                                | Not applicable - Ready to Use                         | Similar to Quats   |  |
| <b>CORROSION:</b> ⬇               |  |  |  |   |   |   |  |  |  |  |   |  |  |
| <b>SOLUTION</b>                   | Slight to moderate; highly corrosive above 250 ppm   | Slight to moderate; highly corrosive above 250 ppm   | Is very corrosive to non-stainless metals  | Is very corrosive to non-stainless metals   | Very corrosive at low pH  | None  | Safe for 304, 316 stainless & aluminum   | Safe for 304, 316 stainless & aluminum   | Safe for 304, 316 stainless & aluminum   | None   | Low   | Low  |  |
| <b>VAPOR SPACE</b>                | Possible, through vapor condensation   | Possible, through vapor condensation   | High temperatures make this VERY corrosive - sublimation occurs above 100° F or so | None  | Slight to moderate; highly corrosive above 250 ppm  | None  | None   | None   | None   | None   | None  | None   |  |
| <b>SPECIAL CONDITIONS</b>         | Very corrosive below pH 6  | Very corrosive below pH 6  | Pitting with low pH, high-chloride water   | Corrosion with high-chloride water. Concerns if chlorides are > 100 PPM                             | Vapor space corrosion with high temp.   | None  |  |  |  | None   |   |  |  |
| <b>USED FOR:</b> ➔                | All food contact surfaces, CIP   | Good sanitizer for all stainless utensils, food contact surfaces   | Aluminum, hand sanitizer, plastics, tile, all food contact surfaces                | Combined acid cleaning, rinsing, sanitizing; ideal in CIP systems                                   | High organic load situations: poultry, fruit, ultrafiltration, water treatment  | Non-food contact, porous materials, walls, drains   | All food-contact surfaces  | All food-contact surfaces  | All food-contact surfaces  | All food contact surfaces, CIP   | Exterior only   | Exterior and CIP versions available  | CIP Use only   |
| <b>ADVANTAGES:</b> ➔              | Reference sanitizer for clean stainless food contact surfaces; lower price than organic chlorine   | Fast, effective; excellent for all stainless steel surfaces  | Good for farm uses; effective, eliminates milkstone                                | Eliminates milkstone; best for hard water and CIP   | Not as affected by organic matter; effective against all types of organisms   | Useful on non-food contact surfaces; leaves residual antimicrobial activity; detergent properties; good environmental sanitizer at 1,000ppm; persistent | Use on all food-contact surfaces   | Use on all food-contact surfaces   | Use on all food-contact surfaces   | Safety, non-corrosive at use dilution  | Dry applications                                      | Foam product   |  |
| <b>DISADVANTAGES:</b> ➔           | Requires tight pH and concentration control; highly corrosive to stainless steel when improperly used; produces corrosive gas in acid solution and above 115°F | May be corrosive if not properly used; produces corrosive gas above 115°F and in acid solution                         | Discolors, off-flavors at even low concentrations;                                 | Less active against spores; may leach Cu from dairy metal; amount of foam varies with wetting agent | Complex preparation; corrosive in acid solution; very difficult to handle unless preparation is automated. Gases off when concentration is too high | Slows cheese cultures at 20ppm; irritating to user if fogged  | Odor in confined areas; store concentrate in plastic only because of metal reaction. Corrosive for non-stainless steel materials | Odor in confined areas; store concentrate in plastic only because of metal reaction. Corrosive for non-stainless steel materials | Odor in confined areas; store concentrate in plastic only because of metal reaction. Corrosive for non-stainless steel materials | Requires on-site generator to produce RTU  | Small area application only                           | Is a disinfectant not a no-rinse sanitizer   | Can only be used with CIP  |