Basic Sanitizers

Terms

• Sterilize:
   An Agent that will Destroys or Eliminates All Forms of Life, Including All Forms of Vegetative, or Actively Growing Bacteria, Bacterial Spores, Fungi and Viruses.

• Disinfectant:
   An Agent that will Destroy 100% of Vegetative, or Actively Growing Bacteria, or Infectious Fungi. Will not Kill Spores or All Viruses.
Sanitize

The Treatment of a *Cleaned* Surface with a Chemical or Physical Agent to Destroy Disease / Spoilage Causing Organisms.

Reduces Total Vegetative Cell Population to a “Safe Level”.

---

Sanitizers

- **EPA Registration:**
  - No-Rinse Food Contact Surface Sanitizer
  - Non-Food Contact Surface Sanitizer

- **FDA: 21CFR 178.1010**
  - Compliance and Regulations for Sanitizers
  - Identifies Ingredients for Sanitizer Formulations
  - Identifies Sanitizer Concentrations
Sanitizer

• Food Contact Surfaces:
  • By 99.999% or 5 Logs, in 30 Seconds, at 25° C.
    - Concentration Critical for Non-Rinse
    - Surface Must be Allowed to Drain

• Non-Food Contact Surfaces:
  • By 99.9% or 3 Logs, Within 5 Minutes.
    - Concentrations Usually Exceed Label Dilutions for “Non-Rinse” Sanitizer.
    - These Include Sanitizing Solutions Used for:
      Foot Baths, Foot Foam, Walls, Floors, Drains, Ceilings, Conveyor Lubricants & Powder Treatments

Label Information

Usage Restrictions:
• Use Concentrations Must be Accurate
  ➢ To High – Violates Regulation
  ➢ To Low – Efficacy Concerns
  ➢ Typically Labels Allow a Range for Concentration
    ➢ (90 ppm to 200 ppm) or (200 ppm to 400 ppm)

• Only Single Use Allowed
• Manual Preparations Should be Done Daily or More Frequently
How Sanitizers Work

• Reaction Disrupts Cell Membrane
• Reaction Denature Proteins & Inhibit DNA Synthesis
• Reactions Affect Cellular Components

What Can Effect Sanitizer Performance?

Surface Cleanliness
• You Can’t Sanitize a Dirty Surface
• Soil & Detergent Can:
  ➢ Protect the Microbial Cell
  ➢ Inactivate the Sanitizer

Surface Contact
• Must Contact the Cell Wall
• Non-Smooth Surfaces Can Affect Efficacy

Contact Time
• The Longer the Contact Time the Greater the Efficacy
What Can Effect Sanitizer Performance?

Proper Temperature & Concentration

• Generally: Increased Temperature = Increased Efficacy
  ➢ Be Aware of Gas-Off
  ➢ When in Doubt About Your Temperature Control – Go Ambient

• Increased Concentration = Increased Efficacy
  ➢ Must Remain Within FDA Guidelines (Non-Rinse Compliance)

Numbers & Types of Microorganisms

- The More Organisms the More Difficult to Kill All of Them
- Specific Sanitizers Perform Differently on Different Organisms:
  Gram− / Gram+ / Biofilms / Spore Foamers

pH Conditions

Alkaline Residue Test

1 Add 2 drops of DI Water (DW4000) to the swab.
2 Swab a 4" x 4" area of the surface you are testing.
3 Add 1 to 2 drops of Phenolphthalein Indicator (PH1600) onto the swab. Residual Alkalinity (> pH 8.3) will develop a pink/red color.
Biofilms

Biofilm Life Cycle

Free Cell Attachment

Biofilm matures

Mature biofilm discharges new free cells
Most Biocides Fail to Penetrate Biofilm

Build Up of Resistance

- Continued Exposure to Sub-Lethal Levels of Sanitizer Results in an Increase in Resistance.
- Applications Less Than Lethal and in Short Duration can Result in Selective Culturing of Resistant Strains.
- Be Sure Concentration Levels are Met, Maintained and Recorded
- Insure Adequate Contact Time is Reached
- **Alternate Between Differing Sanitizers??**
- Occasional Shocking of the System
Test – Test - Test

Log Results!!!

Types of Sanitizers

- Chlorine
- Chlorine Dioxide & Acidified Sodium Chlorite
- Acid Sanitizers
- Peracetic Acid
- Quats
- Per-Quat
- Iodine
- SDC (Silver Dihydrogen Citrate)
- Alcohol
- Ozone
Chlorine (Sodium Hypochlorite)

**Advantages:**
1. Broad Spectrum
2. Kills Spores and Phage
3. Liquids or Powders
4. OK in Hard Water
5. Inexpensive

**Disadvantages:**
1. Corrosive
2. Irritating to Skin
3. Very pH Sensitive
4. Sensitive to Organics
5. Keep Below 120° F.
6. Organoleptic Impact
7. THM’s (Trihalomethanes)
Chlorine Sanitizer

- 25 ppm on E. Coli Contamination:
  - pH <7: 15-30 Seconds
  - pH 8: 5 Minutes
  - pH 10: 10 Minutes

Chlorine Dioxide

\[
\begin{array}{c}
\text{O} \\
\text{Cl} \\
\text{O} \\
\text{O}
\end{array}
\]
Chlorine Dioxide

- More Effective than “Regular” Chlorine.
- Chlorine has 2 Electron Receivers, Chlorine Dioxide has Five. 2 ½ more Oxidizing Power.
- Oxidizer
- Generated On-Site.
- Excellent for Water Treatment.
- ClO$_2$

### Advantages:
1. Broad Spectrum
2. Kills Spores / Phages
3. OK in Hard Water
4. Very Economical
5. Safe for Environment
6. Wide pH Range
7. No THM’s (Trihalomethanes)
8. Bio-film Removal
9. Tolerate High Organic Load
10. Low Organoletic Impact
11. Very Active Against Bio-films

### Disadvantages:
1. May Gas-Off
2. On-Site Generators
3. Needs Special Training
4. Must Follow Directions
Acidified Sodium Chlorite

- The Active Ingredient is Acidified Sodium Chlorite that Generates Chlorine Dioxide.
- To Increase the Speed of Kill and Efficacy, the pH of the Solution can be Reduced with any Food Grade GRAS Acid to Acidify the Sodium Chlorite.
- Activation May be Accomplished Manually in Low Volume as Batch Applications or with a Generation System.
- Some Vendor’s ASC is Kosher Certified.

**Advantages:**
1. High Efficacy
2. Residual Benefit
3. Increased Shelf Life
4. Environmentally Safe
5. Can be Applied Up to 1200 ppm
6. Can be Applied At or Near a Neutral pH
7. Does Not Create Organoleptic Issues
8. Can be Applied Throughout the Production Process, to Include Direct Food Contact.
9. Specific FCN for Un-Activated
10. Is Less Corrosive Than Ozone or PAA

**Disadvantages:**
1. Binary Product Requires Mixing Step.
2. Needs Special Training
3. Must Follow Directions
Acid Sanitizer

• Combinations of Acids and Surfactants or Fatty Acids.
• They Kill by Shutting Down the Cell Membrane & Denature Proteins
• Many Different Types.
• Used Since 1954.
Acid Sanitizers

Advantages:
1. Broad Spectrum
2. High Anti-microbial Against G-
3. Organic Tolerant
4. Acid Rinse
5. Stable Solutions
6. Non-Corrosive to SS
7. OK in Hard Water
8. CIP and Manual Use
9. Wide Temperature Range

Disadvantages:
1. pH Sensitive (> pH3)
2. Some Foam in CIP
3. Variable Spore & Phage Kill
4. Contains Phosphate
5. Corrosive to Soft Metals

Peracetic Acid

acetic acid + hydrogen peroxide ⇌ peroxyacetic acid + water
Peracetic Acid

- Combination of Acetic Acid and H₂O₂.
- Used World Wide Since Around 1902.
- Used in U.S. Since mid-80s.
- Oxidizer

**Advantages:**
1. Broad Spectrum
2. Kills Spores
3. No Foam
4. Environmentally Safe
5. Good on Bio-films
6. Stable Solutions
7. Wide pH Range

**Disadvantages:**
1. Strong Oxidizer
2. Pungent Odor
3. Not an Acid Rinse
4. Special Training Needed
5. Limited Manual Use
Quats

- Combination of Cationic Surfactants and Water.
- Many Varied Formulas.
- Kills by Shutting Down the Cell Membrane.
- Usually Product of Choice for Environmental Sanitizing
- Also Available in Powder for Entryway Sanitation
Quats

Advantages:
1. Low Toxicity
2. Non-Irritating
3. Non-Corrosive
4. Heat / Organic Stable
5. High Activity for G+
6. Yeast / Mold Control
7. Residual
8. Non-Volatile
9. Can be Acidified

Disadvantages:
1. Low Activity for G-
2. Anionic Contamination Reduces Activity
3. Residual
4. Foam in CIP

PerQuat™

\[ \text{H}_2\text{O}_2 + \text{Quat}^+ \xrightleftharpoons{\text{high pH}} [\text{Quat}^+ \cdot \text{OOH}] \]

Oxidative and hydrolytic OH- anion transported by Phase Transfer Catalyst

\[ \text{OOH} + \text{Quat}^+ \xrightleftharpoons{\text{phase transfer}} [\text{Quat}^+ \cdot \text{OOH}] \]
PerQuat™

• Proprietary Disinfectant / Sanitizer Specifically Designed to Remove Biofilms & Kill Biofilm Bacteria

• Used on Food Contact Surfaces (Must be Rinsed), Environmental Surfaces, Injection Systems, Floors, Walls & Drains.

• PerQuat™ Technology also Available in a Powdered Floor Application

PerQuat™

Advantages:

1. Recommended by USDA as a “Best Practice” for Listeria Control
2. Allows for Disinfection Past the Trap
3. Used on a Rotational Basis
4. Superior Drain Bacteria Control

Disadvantages:

1. Cost
2. 2-Part System – Must be Mixed
3. Short Shelve Life After Mixing
4. Requires a Potable Water Rinse
Iodophor

- Very Successful Since the 1940s.
- Surfactant + Iodine = Iodophor
- Disrupts Cell Membrane & Denatures Proteins
- Used at Very Low Concentrations.

Iodine
Iodine

Advantages:
1. Broad Spectrum
2. Color Coded
3. Non-Irritating
4. Manual Use
5. Stable Solutions
6. CIP Use
7. Economical

Disadvantages:
1. pH Sensitive
2. Use Under 120° F
3. Odor
4. Corrosive if Abused

Silver Dihydrogen Citrate (SDC)
**Silver Dihydrogen Citrate (SDC)**

- Patented Technology Developed by Pure Bioscience
- Ready-to-Use: Citric Acid & Silver Ions (12 ppm to 50 ppm)
- Applied as a Fine Mist or Spray
- NSF Registered D2 Classification & Non-Toxic – EPA Category IV
- EPA-Registered - Ready-To-Use Product Approved for:
  - Food-Contact Surface Sanitization with No Rinse
  - Environmental Surface Sanitization & Disinfection
  - No Rinse Disinfection with 24 Hour Residual Protection

---

**SDC**

**Advantages:**

1. Broad-Spectrum Efficacy
2. Residual Activity
3. Safe / Non-Toxic
4. Does not Induce Bacterial Resistance
5. Tasteless, Odorless, Colorless
6. Non-Corrosive / Non-Flammable
7. Stable Solution
8. Doesn’t Stain Or Bleach Fabric

**Disadvantages:**

1. Residual Activity
2. Tasteless, Odorless, Colorless
Alcohol

Isopropyl alcohol
(CH₃)₂CHOH

Alcohol-Based D2 Surface Sanitizers

What to Look for When Selecting an Alcohol-Based Food Surface Sanitizer:

• Is it EPA Registered?
• What are the Kill Claims?
• What are the Dwell Times?
• Is it NSF Listed?
• Does it have Kosher, Pareve and Halal Certifications?
Alcohol-Based D2 Surface Sanitizers

**Advantages:**
- Ready-to-Use: No Mixing & Reduced Room for Error
- No Rinse Options
- Certain Sanitizers have a 60 Second Kill on Food Contact Surfaces
- Certain Sanitizers have a 10 Second Kill Claim on Non-Food Contact Surfaces Such as Rubber Footwear.
- Highly Evaporative (Quick Drying) / Ideal for Low-Moisture Environments

**Disadvantages:**
- Cost of a Ready-to-Use Over a Concentrate That can be Diluted

---

**Ozone**

\[
\text{Ozone } (O_3)
\]
Ozone

- Ozone is formed when oxygen molecules collide with oxygen atoms to produce $O_3$
- Is an effective antimicrobial agent
- Oxidizer
- Is a powerful and naturally unstable oxidizing gas
- Excellent broad spectrum of germicidal activity

Advantages:
- Very strong oxidizer and is fast reacting
- Decomposes rapidly with no harmful residual
- Superior antimicrobial properties
- Effective against a wide spectrum of microorganisms

Disadvantages:
- Extremely unstable – as a result must be generated on site
- Safety concern: is very irritating
- Extremely reactive and corrosive
- Temperature sensitive
- No measurable residual to detect for efficacy
- No organic tolerances
- Costly: initial capital cost of generator and operational costs
- Special training needed
Organic Processing

• USDA National Organic Program (NOP): Fed Regulatory

• Certification by: State – Non-Profit – Private Agencies
  • i.e. Organic Materials Review Institute (OMRI)

• Sanitizers are Certified “Organic”
  • Chlorine & ClO₂ / ASC – Ozone – Peracetic Acid – H₂O₂
  • Quats & Alcohol (?) are Not Certified for Food Contact Surfaces

• Cleaners are Not Certified

Proper Sanitizer Application

• When to Apply
  ➢ Immediately After Cleaning
  ➢ Manual Step
    ➢ Flood Sanitizing
  ➢ Automated Program Step
    ➢ CIP System
    ➢ Separate Program Step (i.e. Pre Start-Up)
  ➢ Re-Sanitize After 4 Hours of Non-Use
Sanitizers
Coverage & Contact Time is Critical

Sanitizers: Concentration is Critical

- Hose Injector Systems
- Portable Tank Sprayers
- Pump-Up Sprayers
- In-Line Injecting
  - Venturi Action
  - Dosatron (Water Driven)
  - Metering Pumps
Get Airborne

Fog and Mist Units

- Portable and Wall-Mounted Systems
- Different Nozzles / Micron Sizes are Available
- Delay Timer (Optional)

360° Contact

Foam for Drain Sanitation

- Foam Pushes Through Drains, Providing 360° Chemical Contact with Pipe Walls
- Liquid Products May not Contact the Entire Pipe Wall
- Drain Foam Attachments for Floor, Trench and Sink Drains
- Also Use with a Battery Foam Unit for Maximum Portability (No Air Lines)
360° contact
Foam for Drain Sanitation

Comparing Properties of Common Sanitizers
**Microbial Specificity**

<table>
<thead>
<tr>
<th></th>
<th>Gram Negative</th>
<th>Gram Positive</th>
<th>Yeast</th>
<th>Mold</th>
<th>Spore Former</th>
</tr>
</thead>
<tbody>
<tr>
<td>PAA -</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Iodophor -</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Acid Quaternary -</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Quaternary -</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Acid Type -</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chlorine / ClO2 -</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Recommended = 😊 Mixed Bag = 😐 Poor = 😐

---

**Effective pH Range**

- ClO2
- PAA
- Iodophor
- Quaternary
- Acid Quaternary
- Acid Type
- Chlorine

Effective pH Range:

0 1 2 3 4 5 6 7 8 9 10 11 12 13 14