Chemical Disinfectants - Understanding Label Claims

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Agenda

- Presentation
  - Fundamentals
  - Hierarchy of resistance
  - Drug Identification Number (DIN)
  - Classes of chemicals
  - Issues with QUATs
  - Dilution

- Tool

- Exercises
What are the categories of liquid chemical disinfectants?

1. Sterilants
2. High Level Disinfectants
3. Low Level Disinfectants
   - Hard surfaces and noncritical equipment
     • Spaulding’s classification system
     • (#1 page 26, #2)
4. Sanitizers
   - Kitchens
Fundamentals

- You can’t disinfect dirt
- Follow the manufacturer’s instructions
  - For the disinfectant
  - For the equipment
- Check the material compatibility of the disinfectant
  - Fabric
  - Rubber
  - Silicone
  - Some Metals: Copper, Zinc, Brass, Aluminum
Cleaning vs Disinfection

• Cleaning:
  - Cleaning = Physical removal
  - Accomplished with water, **detergents** and mechanical action (#1) = water, soap, scrub
  - Soap = detergent = emulsifier = breaks apart oils
  - Result = Reduces the reservoir

• Disinfection:
  - The inactivation of disease-producing microorganisms
Disinfectant vs Antiseptic

• Disinfectant:
  – Applied only to inanimate objects (#1)
  – Used on medical equipment or environmental surfaces

• Antiseptic:
  – Applied only to living tissue and skin (#2)
  – Not for medical equipment or environmental surfaces
1-Step vs 2-Step Disinfectants

• Visible filth always removed first

• 1-Step (Less work)
  – Full cleaning step is not required before disinfecting
  – These products include soap (detergent or emulsifier) to break up oil and dirt

• 2-Step (More work)
  – E.g. “Apply to pre cleaned surfaces”
  – A full cleaning step is required before these disinfectants can be applied
  – Manufacturers do not promote this information
Why are some pathogens harder to kill?

- Different outer layers
- Like the shell of a nut...some nuts are harder to crack
- (#4)
Why are some pathogens harder to kill?

• Spores
  – Most durable form of life on earth
  – Clostridium spores from Greenland ice cores from a depth of 834 m (4,000 years old) started to germinate within the first 5 min (#5)

• Mycobacteria
  – Lack an outer cell membrane
  – Thick waxy cell wall (#6)
Why are some pathogens harder to kill?

- **Viruses**
  - Not all viruses are created equal
- **Lipid = Enveloped**
  - Soft envelope is an easy target for disinfectants
  - Examples: HIV, HBV, Influenza, RSV, Ebola, SARS (#7)
- **Non-lipid = Non-enveloped**
  - Examples: Norovirus, Rhinovirus, Hepatitis A, Adenovirus, Enterovirus (#7)
What is a DIN?

• What is a DIN?
  – Drug Identification Number

• Why is it critical?
  – Proves the product has been tested according to the standards set by Health Canada
  – **Allows us to trust the label claims**
  – **Every product used in healthcare must have a DIN**

• Health Canada DIN Search:

• NPN (Natural Product Number) Number
  – Not equivalent to a DIN
What are the keys to analyzing a disinfectant?

• Chemical class (active ingredients)
  – E.g. Hydrogen peroxide, sodium hypochlorite
  – Different chemicals have different strengths and weaknesses

• Label claims and Kill claims
  – Technical sheet may be available online

• Contact time
  – How long the surface must remain wet

• Dilution (if applicable)
  – Liquid concentrate
What are the main classes of chemicals used in disinfectants?

• Chemical class:
  – Alcohols
  – Chlorines
  – Hydrogen peroxide enhanced action
    • AKA: Accelerated Hydrogen peroxide
    • AKA: Stabilized Hydrogen peroxide
  – Quaternary ammonium compounds (QUATs)

• Uncommon:
  – Hydrogen peroxide (standard, not enhanced action), Iodophors, Phenolics

• PIDAC Best Practices for Environmental Cleaning (#2 Appendix E)
Chlorines (e.g. bleach)

• **Chemical:** Sodium hypochlorite

• **Advantages/Comments**
  – Kills everything (depending on the concentration)

• **Disadvantages/Comments**
  – Inactivated by organic material
  – Must be stored in **CLOSED** containers away from light & heat to prevent evaporation & deterioration
  – Material compatibility

• (#2 Appendix E)
Hydrogen peroxide enhanced action formulation (HP-EAF)

- **Chemical:** Hydrogen peroxide
- “Enhance action formula”
  - Surfactants, wetting agents or chelating agents
  - Drastically improves results over plain hydrogen peroxide (#2)

- **Advantages/Comments**
  - Kills everything (depending on the concentration)
  - Active in the presence of organic materials
  - Excellent cleaning ability

- **Disadvantages/Comments**
  - Material compatibility

(#2 Appendix E)
Quaternary ammonium compounds (QUATs)

- **Chemical:** Ammonium chloride
- **Advantages/Comments**
  - Good cleaning ability
- **Disadvantages/Comments**
  - **Do not use to disinfect instruments**
  - **Limited use as disinfectant because of narrow microbicidal spectrum**
- Generally not tuberculocidal or virucidal against hydrophilic (i.e. non-enveloped) viruses, does not kill spores (#8)
- (#2 Appendix E)
QUATs and Cotton Cloths

- Quaternary ammonium compounds (QUATs) **CANNOT** be used with cotton cloths
- When used with cotton, QUAT disinfectants **bind** to the cotton rendering the disinfectant ineffective
- When using QUAT disinfectants, microfiber cloths are recommended
- (#8 & #9)
QUAT + Alcohol Combination

- QUAT Alcohols:
  - Many popular brands
- Mycobacterium Tuberculosis is highly susceptible to alcohol (#8)
- Adding alcohol to a QUAT often makes it effective against TB
QUAT Alcohols

- Kill TB but not non-enveloped viruses
- Skip a step in the hierarchy of resistance

**Public Health**
What is a dilution ratio?

• CRITICAL: **Dilution Ratio** differs from **Dilution Factor**

• **Dilution Ratio**
  – Used on disinfectant labels
  – Dilution ratio of 1:10 = 1 part chemical to 10 parts water for a total of 11 parts

• **Dilution Factor**
  – Dilution factor of 1:10 = 1 part chemical to 9 parts water for a total of 10 parts
What is a dilution ratio?

- Example:
  - Instructions are to mix at 1:7
  - Supplied: Concentrated liquid = 4%
  - Goal: Final concentration after dilution = 0.5%

<table>
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<tr>
<th></th>
<th>Dilution Ratio</th>
<th>Dilution Factor</th>
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<tbody>
<tr>
<td>Parts concentrate</td>
<td>1</td>
<td>10 mL</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>10 mL</td>
</tr>
<tr>
<td>Parts water</td>
<td>7</td>
<td>70 mL</td>
</tr>
<tr>
<td></td>
<td>6</td>
<td>60 mL</td>
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<tr>
<td>Total parts</td>
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</tr>
<tr>
<td></td>
<td>7</td>
<td>70 mL</td>
</tr>
<tr>
<td>Final concentration</td>
<td>(1/8)*0.04 =</td>
<td>0.5%</td>
</tr>
<tr>
<td></td>
<td>(1/7)*0.04 =</td>
<td>0.571%</td>
</tr>
</tbody>
</table>
What are the important label claims and kill claims?

• Beware of marketing
  – More kill claims does not indicate a superior product

• Canadian vs American technical sheets
  – Different licensing rules in the United States
  – DIN vs EPA#
  – Great to see DIN on technical sheet

• Handout: Guide to Label Claims (#10)
References


References

Exercise

• What are the active ingredients?
• What are the label claims?
• Is the product a broad-spectrum virucide?
• What are the product’s strengths?
• What are the product’s weaknesses?