Biosafety Technical Bulletin: Disinfection and Selection of Disinfectants

Disinfection is a procedure that reduces the level of microbial contamination, but there is a broad range of activity that extends from sterility at one extreme to a minimal reduction in the number of microbial contaminants at the other.

When choosing a disinfectant, consider the following:

- What is the item or surface to be disinfected?
- What is the effectiveness of the disinfectant against the pathogen? (*i.e. Cavicide™ is <u>not</u> effective against non-enveloped viruses such as adenovirus*)
- What are the corrosivity or hazards associated with the chemicals in the disinfectant?
- How easy is it to use? (*i.e. 1 minute vs 10 minute contact time*)
- Is it permitted by the US Army Garrison (USAG)/Ft. Detrick Waste Disposal Requirements? (*i.e. Microchem 5% is <u>not</u> permitted by the USAG*)

<u>Procedure for cleaning surfaces:</u>

All work areas and materials that come or may come into contact with biological agents should be disinfected both before and after each use. This provides protection for personnel, the community, the environment, and your experiments.

- *Read and follow the manufacturer's label* directions concerning the recommended disinfectant concentration, contact time and method of application.
- Wear the appropriate gloves, lab coat and eye protection whenever using chemical disinfectants.

Apply disinfectant to contaminated or potentially contaminated area. If visible or gross contamination is present, apply enough disinfectant to saturate the area. The presence of any organic matter necessitates longer contact time with a decontamination method if the item or area is not pre-cleaned. Let stand for the indicated contact time. Wipe thoroughly and place clean-up materials used for disinfecting the area in a biohazardous waste container.

<u>Expiration Dates:</u>

It is important to note that disinfectants are known to have a limited shelf life that reduces the potency of the active ingredients to destroy or limit the growth of microorganisms, especially infectious or pathogenic ones. It is recommended that you follow the manufacturer's expiration date. Most manufacturers will list an expiration date or some identification code that is unique to the day, year, and the manufacturing site. If there is no identification, the manufacturer should be contacted to learn how the shelf life is to be determined or the product replaced. Once determined, the container should be dated and replaced prior to the expiration date. Please contact EHS, if you have any questions regarding disinfectants and expiration date information.

<u>In case of a biological spill:</u>

1. **Post Area** to notify employees and to contain the spill.
2. **Wear** appropriate PPE to collect and dispose of waste.
3. **Cover** spill area with paper towels.
4. **Disinfect** by pouring slowly around perimeter and into the center of spill area and let sit for 20 minutes.
5. **Clean** by absorbing with paper towels and place in a biohazard bag.
6. **Disinfect** by re-spraying the spill area with disinfectant; allow to air dry

References:

Table: Disinfection-University of Viriginia via Barbara Fox
Nellis: Johnson & Johnson Clinical Diagnostics:
http://ehs.virginia.edu/biosafety/bio.disinfection.html
Glutaraldehyde - Occupational Hazards in Hospitals:
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4th Edition of Biological Safety, Principles and Practices, by Flemming and Hunt, 2006
BMBL:http://www.cdc.gov/biosafety/publications/bmbl5/BMBL5_appendixB.pdf
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SELECTION OF DISINFECTANTS

A disinfectant that is tuberculocidal can be expected to control many types of less resistant pathogens since cells of *M. tuberculosis* are among the most resistant vegetative microorganisms known and constitute a formidable challenge to a chemical disinfectant. EPA-approved disinfectants, suitable for decontaminating the surfaces of scientific equipment, include the following generic formulations (categories): iodophors; chlorine solutions (bleach); alcohol (ethanol); and phenolics and quaternary ammonium compounds.

CLASS	RECOMMENDED USE	HOW THEY WORK	ADVANTAGES	DISADVANTAGES	COMMENTS & HAZARDS	EXAMPLES
Alcohols	-Cleaning some instruments -Cleaning skin	-Changes protein structure of microorganism -Presence of water assists with killing action	-Fairly inexpensive	- < 50% Solution not very effective -Not active when organic matter present -Not active against certain types of viruses -Evaporates quickly -Contact time not sufficient for killing	-Flammable -Eye Irritant -Toxic	- 70% Ethanol - DuPont™ Broad Spectrum Disinfectant Solution - Rely-On (DuPont™) - DisCide® (Palmero Health Care)
CLASS	RECOMMENDED USE	HOW THEY WORK	ADVANTAGES	DISADVANTAGES	COMMENTS & HAZARDS	EXAMPLES
Chlorine Compounds	-Spills of human body fluids Bactericidal - Good Fungicidal - Good Sporicidal - Good at >1000ppm Sodium Hypochlorite	-Free available chlorine combines with contents within microorganism, reaction byproducts cause its death -Need 500 to 5000 ppm -Produce chemical combination with cell substances -Depends upon release of hypochlorous acid	-Kills hardy viruses (e.g. hepatitis) -Kills a wide range of organisms -Inexpensive -Penetrates well -Relatively quick microbial kill -May be used on food prep surfaces	-Corrodes metals such as stainless, aluminum -Organics may reduce activity -Increase in alkalinity decreases bactericidal property -Unpleasant taste and odor -Tuberculocidal, with extended contact time	-Follow spill procedure and dilution instructions -Make fresh solutions before use -Eye, skin and respiratory irritant -Corrosive -Toxic	- Chlorox® (sodium hypochlorite) - Dispatch® (Caltech)
CLASS	RECOMMENDED USE	HOW THEY WORK	ADVANTAGES	DISADVANTAGES	COMMENTS & HAZARDS	EXAMPLES
Glutaraldehyde *CONSULT EHS PRIOR TO USE*	Bactericidal - Good Fungicidal - Good Tuberculocidal - Excellent Virucidal - Good Sporicidal - Good	-Coagulates cellular proteins	-Non-staining, relatively noncorrosive -Useable as a sterilant on plastics, rubber, lenses, stainless steel and other items that can't be autoclaved	-Not stable in solution -Has to be in alkaline solution -Inactivated by organic material	-Eye, skin and respiratory irritant -Sensitizer -Toxic	- Sporicidin®

CLASS	RECOMMENDED USE	HOW THEY WORK	ADVANTAGES	DISADVANTAGES	COMMENTS & HAZARDS	EXAMPLES
Iodophors (Iodine with carrier)	-Disinfecting some semicritical medical equipment Bactericidal - Very Good Fungicidal - Excellent Virucidal - Excellent	-Free iodine enters microorganism and binds with cellular components -Carrier helps penetrate soil/fat -Need 30 to 50 ppm -Probably by disorder of protein synthesis due to hindrance and/or blocking of hydrogen bonding	-Kills broad range of organisms -Highly reactive -Low tissue toxicity -Kills immediately rather than by prolonged period of stasis -Not affected by hard water -May be used on food prep surfaces	-May stain plastics or corrode metal -May stain skin/laundry -Stains most materials -Odor -Some organic and inorganic substances neutralize effect -Tuberculocidal, with extended contact time -Sporicidal, some	-Dilution critical -Follow directions! -Use only EPA registered hard surface iodophor disinfectants -Don't confuse skin antiseptic iodophors for disinfectants -Skin and eye irritant -Corrosive -Toxic	- Providone (iodine/ betadine) - Wescodyne
CLASS	**RECOMMENDED USE**	**HOW THEY WORK**	**ADVANTAGES**	**DISADVANTAGES**	**COMMENTS & HAZARDS**	**EXAMPLES**
Phenolic Compounds	Bactericidal - Excellent Fungicidal - Excellent Tuberculodial - Excellent Virucidal - Excellent	-Gross protoplasmic poison -Disrupts cell walls -Precipitates cell proteins -Low concentrations inactivate essential enzyme systems	-Nonspecific concerning bactericidal and fungicidal action -When boiling water would cause rusting, the presence of phenolic substances produces an antirusting effect	-Unpleasant odor -Some areas have disposal restrictions -Effectiveness reduced by alkaline pH, natural soap or organic material -Sporicidal, no	-Skin and eye irritant -Sensitizer -Corrosive -Toxic	- Staphene® (Steris)
CLASS	**RECOMMENDED USE**	**HOW THEY WORK**	**ADVANTAGES**	**DISADVANTAGES**	**COMMENTS & HAZARDS**	**EXAMPLES**
Quaternary Ammonium compounds (QUATS)	-Ordinary housekeeping (e.g. floors, furniture, walls) Bactericidal - Excellent Fungicidal - Good Virucidal - Good (not as effective as phenols)	-Affects proteins and cell membrane of microorganism -Releases nitrogen and phosphorous from cells	-Contains a detergent to help loosen soil -Rapid action -Colorless, odorless -Non-toxic, less corrosive -Highly stable -May be used on food prep surfaces	-Does not eliminate spores, TB bacteria, some viruses -Effectiveness influenced by hard water -Layer of soap interferes with action	-Select from EPA list of hospital disinfectants -Skin and eye irritant -Toxic	- CaviCide® (Metrex) - Coverage Plus® (Steris) *used in animal facility* - Conflikt® (Decon Labs) - Q-128 (Franklin Cleaning & Supply)