

Choosing an Appropriate Disinfectant: Guidance for Laboratories and Non-laboratory Settings

Overview of Topics in this Guideline

- Introduction – Considerations for choosing an appropriate disinfectant
- Choosing an appropriate class of disinfectants for laboratory and non-laboratory use
 - Table 1: Selecting a class of disinfectants
- Disinfectant recommendations – Laboratory use
 - Table 2: Selected commonly recommended disinfectants for laboratory use
- Disinfectant recommendations – Non-laboratory use
 - Table 3: Selected commonly recommended disinfectants for non-laboratory use

Introduction

EH&S receives many questions regarding appropriate disinfectants for use in all University settings including laboratories, animal facilities and non-laboratory areas. Choosing an appropriate disinfectant requires knowledge of:

- Intended use:
 - General cleaning of non-laboratory areas (e.g. restrooms, office areas, common areas of buildings)
 - Decontamination of work surfaces, equipment and/or potentially infectious wastes in a laboratory
 - Approved animal use area where specific microorganisms must be inactivated and animal welfare must be considered
- Microorganisms to be inactivated:
 - Common bacteria and viruses found in the workplace or in human body fluids

- Specific species or family of bacteria, parasite, virus or other microorganism used in the research area
- Surfaces and items/equipment to be disinfected:
 - Some classes of disinfectants can cause reactions or toxic fumes when mixed with certain chemicals
 - Each class of disinfectant may be incompatible with specific materials or equipment (e.g. bleach and other products using sodium hypochlorite as a primary active ingredient can corrode stainless steel and aluminum surfaces if use is not followed by adequate rinsing)
 - Fabrics and cloth items are difficult to disinfect and can be damaged by specific classes of disinfectants
 - Disinfection of surfaces that will contact food requires careful reading of product labels to ensure appropriate active ingredient, application, and rinsing (if needed) are considered

Choosing an appropriate class of disinfectant for laboratory and non-laboratory use

Table 1 provides general information on disinfectants grouped by type of active ingredient and lists selected advantages, disadvantages, and potential hazards associated with each class. When searching for an appropriate disinfectant, use the information in Table 1 to determine which classes of disinfectants may be appropriate for the intended use.

Table 1: Selecting a Class of Disinfectants

Disinfectant Class	Active Ingredient(s)	Advantages	Disadvantages	Suggested Uses	Potential Hazards
Alcohols	<ul style="list-style-type: none"> - Ethanol (Ethyl alcohol) - Isopropanol (Isopropyl alcohol) 	<ul style="list-style-type: none"> - Readily available and inexpensive - Aqueous solutions can be used to sanitize skin (e.g. hand sanitizers, preparation of skin for injections) 	<ul style="list-style-type: none"> - Presence of water required for killing action - Rapid evaporation makes achieving required 10 minute contact time difficult 	<ul style="list-style-type: none"> - Not recommended for primary disinfectant in laboratories - Use of alcohol-based hand sanitizer when hand washing is not possible is appropriate 	<ul style="list-style-type: none"> - Flammable - May react violently with strong oxidizer - Can cause skin and respiratory tract irritation

Disinfectant Class	Active Ingredient(s)	Advantages	Disadvantages	Suggested Uses	Potential Hazards
Alcohols with additional active ingredients	<ul style="list-style-type: none"> - Combination of ethanol or isopropanol, water, and additional active ingredients, most often quaternary amines or phenolic ingredients 	<ul style="list-style-type: none"> - Mixture of alcohols and additional active ingredients/surfactants ensure appropriate contact time by reducing evaporation - Non-corrosive to many hard surfaces and some electronic equipment 	<ul style="list-style-type: none"> - Usually available as ready to use solutions or wipes restricting use to surface use only 	<ul style="list-style-type: none"> - Consider use for surface decontamination of microscope stages, keyboards, some enclosed electronic equipment - Wipes are convenient for surface disinfection 	<ul style="list-style-type: none"> - Flammable - May react violently with strong oxidizer - Can cause skin and respiratory tract irritation
Aldehydes	<ul style="list-style-type: none"> - Formaldehyde - Glutaraldehyde - Ortho-phthalaidehyde (OPA) - Paraformaldehyde 	<ul style="list-style-type: none"> - Aldehydes rapidly inactivate a wide variety of organisms 	<ul style="list-style-type: none"> - Formaldehyde is a known carcinogen - Aldehydes are sensitizing agents - Irritating to skin and respiratory tract - Toxic and must be collected as chemical waste 	<ul style="list-style-type: none"> - Not recommended for use as disinfectants - Should not be used without prior consultation with EH&S 	<ul style="list-style-type: none"> - Formaldehyde is a known carcinogen - Aldehydes are sensitizing agents - Irritating to skin and respiratory tract - Toxic and must be collected as chemical waste

Disinfectant Class	Active Ingredient(s)	Advantages	Disadvantages	Suggested Uses	Potential Hazards
Chlorine compounds	<ul style="list-style-type: none"> - Sodium hypochlorite - Calcium hypochlorite - Chlorine dioxide 	<ul style="list-style-type: none"> - Sodium hypochlorite products (e.g. bleach) are readily available and inexpensive - Chlorine compounds inactivate a wide variety of organisms - Can be used on food prep surfaces 	<ul style="list-style-type: none"> - Can be corrosive to metals (e.g. stainless steel, aluminum) - Incompatible with strong acids, ammonia, amines, or reducing agents - Unpleasant odor - High concentrations irritating to skin and mucous membranes - Damaging to fabrics and some surfaces (bleaching effect) 	<ul style="list-style-type: none"> - Sodium hypochlorite (bleach) is a relatively inexpensive and effective disinfectant in the laboratory and the home - Most commercial sodium hypochlorite products provide ~5% hypochlorite ion <ul style="list-style-type: none"> - 1:10 dilution (v:v) in water for surface disinfection - 1:10 dilution (v:v) in cultures, etc. for liquid decontamination 	<ul style="list-style-type: none"> - Mixture with strong acids results in violent reactions that can release toxic gas - May react explosively with ammonia, amines, or reducing agents - Concentrated hypochlorite and chlorine dioxide products can cause chemical burns

Disinfectant Class	Active Ingredient(s)	Advantages	Disadvantages	Suggested Uses	Potential Hazards
Peroxides	<ul style="list-style-type: none"> - Hydrogen peroxide - Peroxyacetic acid 	<ul style="list-style-type: none"> - Hydrogen peroxide inactivates a wide variety of organisms - Products combining hydrogen peroxide and peracetic acid (peroxyacetic acid) can be used for high level disinfection of medical devices (cold sterilants) - Highly concentrated solutions of peroxide can be vaporized for room decontamination 	<ul style="list-style-type: none"> - Concentrated peroxide solutions are highly reactive and incompatible with flammable solvents and metal salts including acetone, methanol, ethanol, ferric chloride, and magnesium sulfate - Can damage fabrics and some types of surfaces - Material compatibility concerns (brass, zinc, copper, and nickel/silver plating) both cosmetic and functional 	<ul style="list-style-type: none"> - Diluted hydrogen peroxide solutions (0.5-3%) are effective - EH&S does not recommend use of highly concentrated hydrogen peroxide solutions or products combining hydrogen peroxide and peracetic acid - Should not be used without prior consultation with EH&S 	<ul style="list-style-type: none"> - Highly concentrated peroxide solutions are highly reactive and can decompose forming potentially explosive compounds. - Concentrated peroxide solutions and peroxyacetic acid based disinfectants may cause chemical burns for eyes and skin - Peroxyacetic acid based disinfectants are toxic and must be collected as chemical wastes
Phenolics	<ul style="list-style-type: none"> - 2-phenylphenol - O-Benzyl-p-chlorophenol - O-phenylphenol - Thymol 	<ul style="list-style-type: none"> - Inactivate a wide variety of organisms - Available in concentrated formulations - Many formulas also have surfactants which allows surface cleaning as well as disinfection 	<ul style="list-style-type: none"> - Less effective against non-enveloped viruses and specific bacterial species when compared with other classes - Unpleasant odor - Can leave residue on surfaces - Some Phenolics must be collected as chemical waste 	<ul style="list-style-type: none"> - Phenolic disinfectants are appropriate for use in many laboratories and concentrated formulas can be used for decontamination of surfaces and liquid waste - Not recommended for non-laboratory use 	<ul style="list-style-type: none"> - Can cause skin and eye irritation - Concentrated Phenolics can cause chemical burns - Toxic if inhaled, ingested, or applied to skin in high concentrations

Disinfectant Class	Active Ingredient(s)	Advantages	Disadvantages	Suggested Uses	Potential Hazards
Quaternary Ammonium products	- Various combinations of Alkyl ammonium salts	<ul style="list-style-type: none"> - Detergent action helps remove soil from surfaces - Non-corrosive - Can be used on food prep surfaces - Less toxic than other classes of disinfectants 	<ul style="list-style-type: none"> - Many formulations do not effectively inactivate TB bacteria and some types of viruses - Can leave soapy residue on surfaces - Incompatible with bleach and other chlorine solutions 	<ul style="list-style-type: none"> - Ready to use formulations are available for laboratory use and general cleaning - Some concentrated formulations are available for decontamination of liquid wastes in laboratories 	<ul style="list-style-type: none"> - Repeated exposure may cause contact dermatitis and can trigger asthma in some individuals - Can cause skin and mucous membrane injury

Disinfectant recommendations: Laboratory use

Table 2 provides examples of commonly recommended disinfectants for use in cleaning non-porous high touch surfaces in laboratories. For specific COVID-19 related cleaning concerns, additional brands of quaternary ammonium or hydrogen peroxide disinfectant products appropriate for cleaning hard surfaces may be found on the EPA’s disinfectant list for SARS-COV-2 found at <https://www.epa.gov/pesticide-registration/list-n-disinfectants-use-against-sars-cov-2>.

Laboratories should consult with EH&S before changing a currently approved disinfectant to one that uses a different active ingredient, or if using a disinfectant that is not included in the table of selected products below. The suggested list in Table 2 is not all-inclusive. Additional lists of EPA-registered disinfectants appropriate for specific microorganisms can be found (<https://www.epa.gov/pesticide-registration/selected-epa-registered-disinfectants>).

Table 2: Selected commonly recommended disinfectants for use in laboratories

<i>Alcohols with additional active ingredients (e.g. quaternary amines or phenolics)</i>			
Product Name	Formulation: Ready to Use or Concentrate	Use dilution (if applicable) and contact time	Appropriate for decontamination of liquid wastes*
Cavicide	Ready to use	RTU; 3-minute contact time	No*
CaviWipes	Ready to use	RTU; 3-minute contact time	No*
Lysol® Disinfectant Spray	Ready to use	RTU; 10-minute contact time	No*
<i>Sodium hypochlorite</i>			
Product Name	Formulation: Ready to Use or Concentrate	Use dilution (if applicable) and contact time	Appropriate for decontamination of liquid wastes*
Bleach	Concentrate	500 ppm; 1:10 v:v; 5-minute contact time	Yes
Sani-Cloth Bleach Germicidal Disposable wipe	Ready to use	RTU; 1-minute contact time	No*
<i>Quaternary ammonium</i>			
Product Name	Formulation: Ready to Use or Concentrate	Use dilution (if applicable) and contact time	Appropriate for decontamination of liquid wastes*
Sani-cloth Germicidal Disposable Cloth	Ready to use	RTU; 3-minute contact time	No*
Lysol® Brand All Purpose Cleaner	Ready to use	RTU; 10-minute contact time	No*
Virex™ II / 256	Concentrate	1:256 v:v; 10-minute contact time	Yes
Lysol® Disinfecting Wipes (All Scents)	Ready to use	RTU; 10-minute contact time	No*

<i>Phenolics</i>			
Product Name	Formulation: Ready to Use or Concentrate	Use dilution (if applicable) and contact time	Appropriate for decontamination of liquid wastes*
LpH® IIIse Phenolic Disinfectant	Concentrate	1:128 v:v; 10-minute contact time	Yes
Vesphene IIIse Phenolic Disinfectant	Concentrate	1:128 v:v; 10-minute contact time	Yes
<i>Hydrogen peroxide</i>			
Product Name	Formulation: Ready to Use or Concentrate	Use dilution (if applicable) and contact time	Appropriate for decontamination of liquid wastes*
Peroxigard	RTU or Concentrate	Concentrate (1:16 v:v); 5-minute contact time	Concentrate only - yes
Peridox	Concentrate	1:5 v:v; 3-minute contact time	Yes

* Disinfectants listed as not appropriate for decontamination of liquid wastes may be used on surfaces, but must not be used to decontaminate liquid wastes due to either their availability only as ready to use formulations or chemical waste disposal regulations, or both.

Disinfectant recommendations: Non-Laboratory use

Table 3 provides examples of commonly recommended disinfectants for use in cleaning non-porous high touch surfaces in non-laboratory areas. This suggested list in Table 3 is not all-inclusive, but Units must be aware that many of the disinfectant products appropriate for cleaning hard surfaces found on the EPA’s disinfectant list for SARS-COV-2 are very corrosive and/or toxic and are not appropriate for use in non-laboratory areas. Units should consult with EH&S before using a disinfectant that has a different active ingredient than the selected products below.

Table 3: Selected commonly recommended disinfectants for use in non-laboratory areas

Product name	Company	Ready to Use	Concentrate	Active Ingredient	Contact Time
Benefect Botanical Daily Cleaner Disinfectant	Cleanwell LCC	Spray Bottle/Wipes	N/A	Thymol	10 minutes
Clorox Healthcare® Bleach Germicidal Cleaner Spray	Clorox Professional Products Company	Spray Bottle	N/A	Sodium hypochlorite	1 minute
Clorox Commercial Solutions® Clorox® Clean-Up Disinfectant Cleaner with Bleach1	Clorox Professional Products Company	Spray Bottle	N/A	Sodium hypochlorite	5 minutes
Clorox Commercial Solutions® Clorox® Disinfecting Biostain & Odor Remover	Clorox Professional Products Company	Spray Bottle	N/A	Hydrogen peroxide	5 minutes
Clorox Commercial Solutions® Clorox® Disinfecting Spray	Clorox Professional Products Company	Spray Bottle	N/A	Quaternary ammonium; ethanol	10 minutes
Clorox Commercial Solutions® Clorox® Disinfecting Wipes	Clorox Professional Products Company	Wipes	N/A	Quaternary ammonium	4 minutes
Clorox Commercial Solutions® Hydrogen Peroxide Cleaner Disinfectant	Clorox Professional Products Company	Spray Bottle	N/A	Hydrogen peroxide	1 minute

Product name	Company	Ready to Use	Concentrate	Active Ingredient	Contact Time
Clorox Commercial Solutions® Hydrogen Peroxide Cleaner Disinfectant Wipes	Clorox Professional Products Company	Wipes	N/A	Hydrogen peroxide	2 minutes
Clorox Healthcare® Bleach Germicidal Wipes	Clorox Professional Products Company	Wipes	N/A	Sodium hypochlorite	3 minutes
Clorox Healthcare® VersaSure® Wipes	Clorox Professional Products Company	Wipes	N/A	Quaternary ammonium	5 minutes
CloroxPro™ Clorox® Germicidal Bleach	Clorox Professional Products Company	N/A	Yes (1:10 dilution)	Sodium hypochlorite	5 minutes
Clorox Clean Up Cleaner + Bleach	The Clorox Company	Spray Bottle	N/A	Sodium hypochlorite	1 minute
Clorox Disinfecting Bleach	The Clorox Company	N/A	Yes (1:10 dilution)	Sodium hypochlorite	10 minutes
Clorox Disinfecting Wipes	The Clorox Company	Wipes	N/A	Quaternary ammonium	4 minutes
Clorox Multi Surface Cleaner + Bleach	The Clorox Company	Spray Bottle	N/A	Sodium hypochlorite	1 minute
Clorox Pet Solutions Advanced Formula Disinfecting Stain & Odor Remover	The Clorox Company	Spray Bottle	N/A	Hydrogen peroxide	5 minutes
Ultra Clorox Brand Regular Bleach	The Clorox Company	N/A	Yes (1:10 dilution)	Sodium hypochlorite	5 minutes

Product name	Company	Ready to Use	Concentrate	Active Ingredient	Contact Time
Soft Scrub with Bleach	Combat Insect Control Systems	Bottle	N/A	Sodium hypochlorite	3 minutes
PURELL Professional Surface Disinfectant Wipes	GOJO Industries Inc	Wipes	N/A	Ethanol	5 minutes
Thymox Disinfecting Spray	Laboratorie M2	Spray Bottle	N/A	Thymol	4 minutes
LEXX™ Liquid Sanitizer and Cleaner Concentrate	ProNatural Brands	Spray Bottle/Wipes	Yes (1:64 dilution)	Citric acid	10 minutes
Lysol Brand Bleach Mold And Mildew Remover	Reckitt Benckiser	Spray Bottle	N/A	Sodium hypochlorite	30 seconds
Lysol disinfecting wipes (all scents)	Reckitt Benckiser	Wipes	N/A	Quaternary ammonium	10 minutes
Lysol Brand Clean & Fresh Multi-surface Cleaner	Reckitt Benckiser LLC	N/A	Yes (1:128 dilution)	Quaternary ammonium	3 minutes
Lysol Brand Deodorizing Disinfectant Cleaner	Reckitt Benckiser LLC	N/A	Yes (1:64 dilution)	Quaternary ammonium	10 minutes
Lysol Brand Heavy Duty Cleaner Disinfectant Concentrate	Reckitt Benckiser LLC	N/A	Yes (1:64 dilution)	Quaternary ammonium	5 minutes
Lysol Neutra Air® 2 in 1	Reckitt Benckiser LLC	Spray Bottle	N/A	ethanol	30 seconds
Lysol® Brand All Purpose Cleaner	Reckitt Benckiser LLC	Spray Bottle	N/A	Quaternary ammonium	2 minutes

Product name	Company	Ready to Use	Concentrate	Active Ingredient	Contact Time
Lysol® Disinfectant Max Cover Mist	Reckitt Benckiser LLC	Spray Bottle	N/A	Quaternary ammonium; ethanol	10 minutes
Lysol® Disinfectant Spray	Reckitt Benckiser LLC	Spray bottle	N/A	Quaternary ammonium; ethanol	10 minutes
Lysol® Kitchen Pro Antibacterial Cleaner	Reckitt Benckiser LLC	Spray Bottle	N/A	Quaternary ammonium	2 minutes
Windex disinfectant cleaner	S.C. Johnson & Sons	Spray Bottle	N/A	L-Lactic acid	5 minutes
Fantastik Multi-Surface Disinfectant Degreaser	S.C. Johnson Professional	Spray Bottle	N/A	Quaternary ammonium	5 minutes
CleanCide	Wexford Labs	Wipes	N/A	Citric acid	5 minutes
Salsa (aka: Purell Professional Surface Disinfectant)	GOJO Industries	Spray Bottle	N/A	Ethyl Alcohol	1 minute
<u>BATHROOM SPECIFIC CLEANERS AND DISINFECTANTS</u>					
The Works® Basic Disinfectant Toilet Bowl Cleaner	Bio-Lab Inc	Bottle	N/A	hydrogen chloride	10 minutes
Claire Disinfectant Bathroom Cleaner	Claire Manufacturing Company	Spray Bottle	N/A	Quaternary ammonium	10 minutes
Lysol Bathroom Cleaner	Reckitt Benckiser LLC	Spray Bottle	N/A	Citric acid	5 minutes

Product name	Company	Ready to Use	Concentrate	Active Ingredient	Contact Time
Lysol Brand Cling & Fresh Toilet Bowl Cleaner	Reckitt Benckiser LLC	Bottle	N/A	Quaternary ammonium	30 seconds
Lysol Brand Foaming Disinfectant Basin Tub & Tile Cleaner II	Reckitt Benckiser LLC	Spray Bottle	N/A	Quaternary ammonium	10 minutes
Lysol Brand Lime & Rust Toilet Bowl Cleaner	Reckitt Benckiser LLC	Bottle	N/A	hydrochloric acid	10 minutes
Lysol Brand Power Plus Toilet Bowl Cleaner	Reckitt Benckiser LLC	Bottle	N/A	hydrochloric acid	10 minutes
Lysol Brand Toilet Bowl Cleaner with Bleach	Reckitt Benckiser LLC	Bottle	N/A	Sodium hypochlorite	5 minutes
Scrubbing Bubbles Bubbly Bleach Gel Toilet Bowl Disinfectant	S.C. Johnson & Son Inc	Bottle	N/A	Sodium hypochlorite	10 minutes
Scrubbing Bubbles Disinfectant Restroom Cleaner II	S.C. Johnson & Son Inc	Spray bottle	N/A	Quaternary ammonium	5 minutes
Scrubbing Bubbles Power Stain Destroyer Non-Bleach Toilet Bowl Disinfectant	S.C. Johnson & Son Inc	Bottle	N/A	hydrochloric acid	10 minutes
Scrubbing Bubbles® Bathroom Disinfectant Bathroom Grime Fighter	S.C. Johnson & Son Inc	Spray bottle	N/A	Quaternary ammonium	5 minutes
Clorox Disinfecting Bathroom Cleaner	The Clorox Company	Spray Bottle	N/A	Quaternary ammonium	10 minutes
Clorox Scentiva Bathroom Disinfecting Foam Cleaner	The Clorox Company	Spray Bottle	N/A	Quaternary ammonium	5 minutes

Product name	Company	Ready to Use	Concentrate	Active Ingredient	Contact Time
Clorox Toilet Bowl Cleaner with Bleach	The Clorox Company	Bottle	N/A	Sodium hypochlorite	10 minutes
Comet Disinfecting Bathroom cleaner	The Proctor & Gamble Company	Spray Bottle	N/A	Citric acid	10 minutes