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THURSDAY, JULY 30
2 P.M. CDT

DISINFECTING FOR CORONAVIRUS AND OTHER CONTAGIONS

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DISINFECTION OVERVIEW

Understanding the basics of COVID-19 disinfection

- Disinfection Basics
  - Definition of disinfection
  - Types of microorganisms
  - Levels of Microbial Kill: Cleaners vs. Sanitizers vs. Disinfectants vs. Sterilants
  - Important disinfectant parameters
  - U.S. EPA regulation of disinfectants
  - Types of disinfectants and application methods
- Disinfection of the SARS-CoV-2 virus.
  - The SARS-CoV-2 virus – Structure, Persistence, and Transmission.
- Planning Disinfection Operations
  - The planning process
  - Important properties of an ideal disinfectant.
- Disinfection Application Methods
- Summary

Disinfection is an important tool to protect the public against COVID-19!

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DISINFECTION DEFINITION

What is disinfection?

- A process that eliminates many or all pathogenic microorganisms, except bacterial spores, on inanimate objects (US CDC).
- Can utilize physical or chemical processes.
  - Physical Process Examples – UV Light, Heat
  - Chemical Process Examples – Chlorine Bleach, Hydrogen Peroxide
- The effectiveness can be dependent on many factors.
  - prior cleaning of the object (in some cases);
  - organic and inorganic load present;
  - type and level of microbial contamination;
  - physical nature of the object (e.g., porous vs. non-porous);
  - parameters of the disinfection process (time, temperature, disinfectant concentration, etc.);

All of these factors may vary on a site by site basis!

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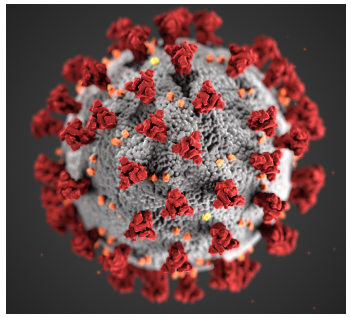
TYPES OF MICROORGANISMS

There are many types of disease-causing organisms

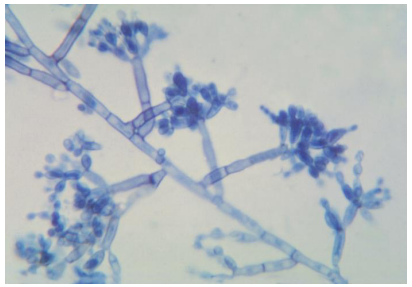
Resistance to Kill/Inactivation



cdc.gov

Viruses
- Common Cold
- Influenza
- Measles

COVID-19



cdc.gov

Fungi (Mold)
- Yeast Infections
- Ringworm
- Athletes Foot
- Aspergillosis

cdc.gov

Bacteria
- Strep Throat
- Tuberculosis
- Bubonic Plague
- Food Poisoning

Bacterial Spores
- Anthrax
- Botulism
- Tetanus
- Colitis

Other infectious agents (i.e., pathogens) include protozoa and prions.

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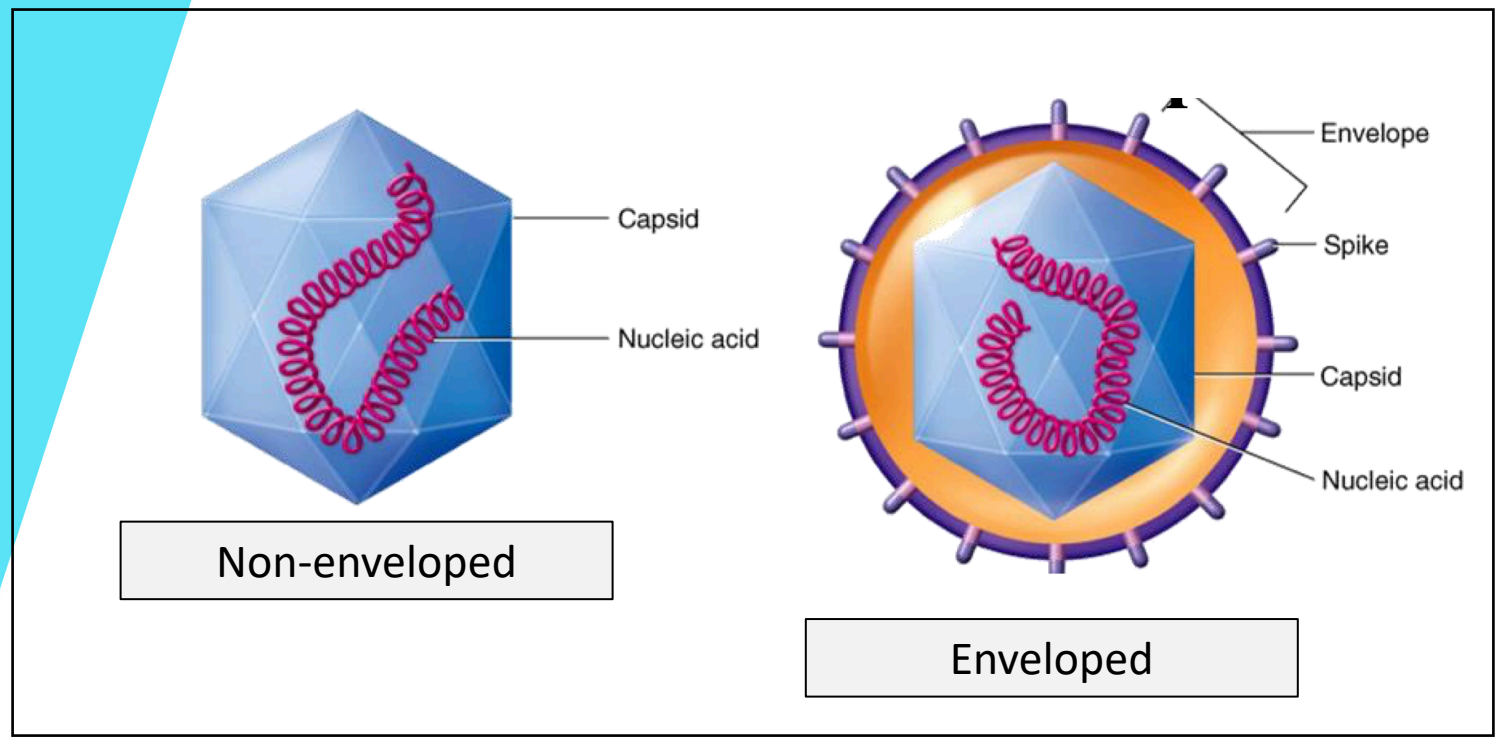
OVERVIEW OF VIRUSES

All viruses are not the same!



Structural Differences in Viruses

- Enveloped vs. Non-enveloped
- DNA vs. RNA
- Many other differences

Viruses are not living organisms. They require a host to replicate.

Image from: Nekhai, S., Virus Structure, howard.edu

SARS-CoV-2 is an enveloped, RNA virus.

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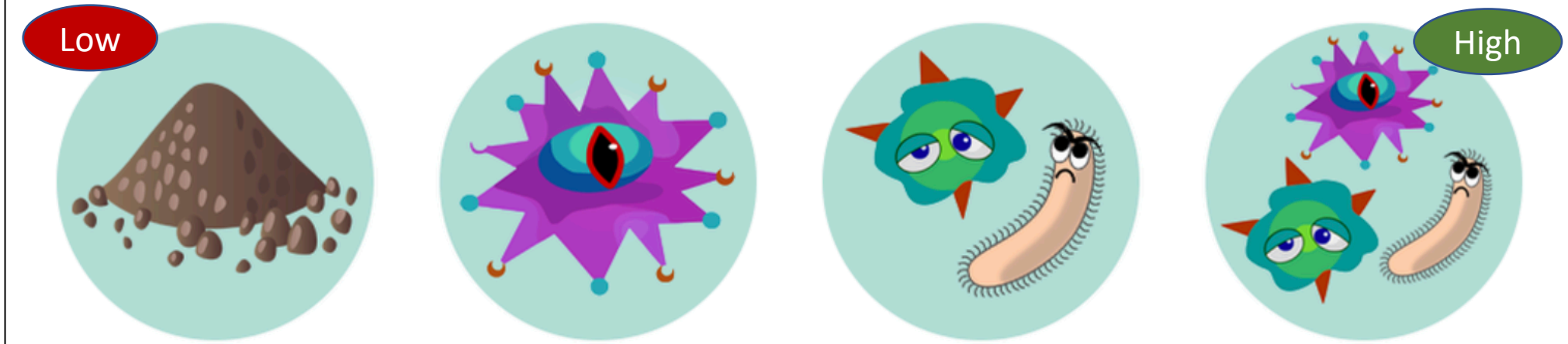
LEVELS OF MICROBIAL KILL

Cleaners, Sanitizers, Disinfectants & Sterilants



Cleaner
Aids in removing soil from a surface. Removes germs, but does not kill them.

Sanitizer
Lowers number of bacteria on a surface. Usually used in food service environments.

Disinfectant
Kills infectious fungi, bacteria and viruses, but not necessarily resistant bacterial spores.

Sterilant
Used for destroying all living microorganisms by physical or chemical means

https://www.alco-chem.com/

There are significant difference between these products.

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IMPORTANT DISINFECTION PARAMETERS

Efficacy – Contact Time – Application Rate – Soil Load

- **Efficacy** – the level of kill or reduction of pathogens for a disinfectant. It is usually expressed as a percent (i.e., Kills 99.9% of bacteria) or as Log kill (i.e., a 3 Log reduction).
- **Contact Time** – the time a disinfectant must be in contact with pathogens to achieve the desired level of kill.
- **Application Rate** – the amount (in weight or volume) of disinfectant that should be used per area (for a surface) or volume (for a space) - i.e., gallons/cubic feet
- **Soil Load** – organic matter, soil, or bodily fluids which often interfere with the performance of a disinfectant.
- **Environmental Factors** – temperature, relative humidity, etc.

If these parameters are not considered – the disinfectant will not work as expected.

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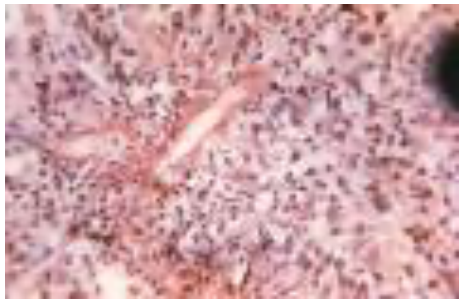
EFFICACY OF DISINFECTANTS

Log Kill Explained!

- When disinfecting surfaces or objects – we are dealing with very large numbers of microorganisms.
- There may be millions of bacteria or viruses on a surface.
- So we need a convenient way of dealing with these large numbers and a large range of numbers.
- To describe the kill level of a disinfectant – we often use the log scale.

cdc.gov



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Log kill is just a convenient way of dealing with large numbers.

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LOG SCALE

A way to deal with numbers over a large range in a compact way

Number	Multiplication	Log_{10}
1	1	0
10	10	1
100	10 x 10	2
1000	10 x 10 x 10	3
10,000	10 x 10 x 10 x 10	4
100,000	10 x 10 x 10 x 10 x 10	5
1,000,000	10 x 10 x 10 x 10 x 10 x 10	6

Log_{10} 100 = 2

The Richter scale and the pH scale are examples of the use of a log scale.

Log_{10} 400,000 = 5.6

The log scale is used in microbiology because we deal with a very large range of numbers to describe the efficacy of a disinfectant.

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EFFICACY OF DISINFECTANTS

Log Kill Explained!

Efficacy of a Disinfectant

Percent Kill	Log Kill	Remaining Viruses (Starting with 1,000,000)	Remaining Viruses (Starting with 10^6)	Log Remaining Viruses Starting with 6 Log)
0	0	1,000,000	10^6	6
90	1	100,000	10^5	5
99	2	10,000	10^4	4
99.9	3	1,000	10^3	3
99.99	4	100	10^2	2
99.999	5	10	10^1	1
99.9999	6	1	10^0	0

The efficacy of a disinfectant can be expressed as a percent or as log kill.

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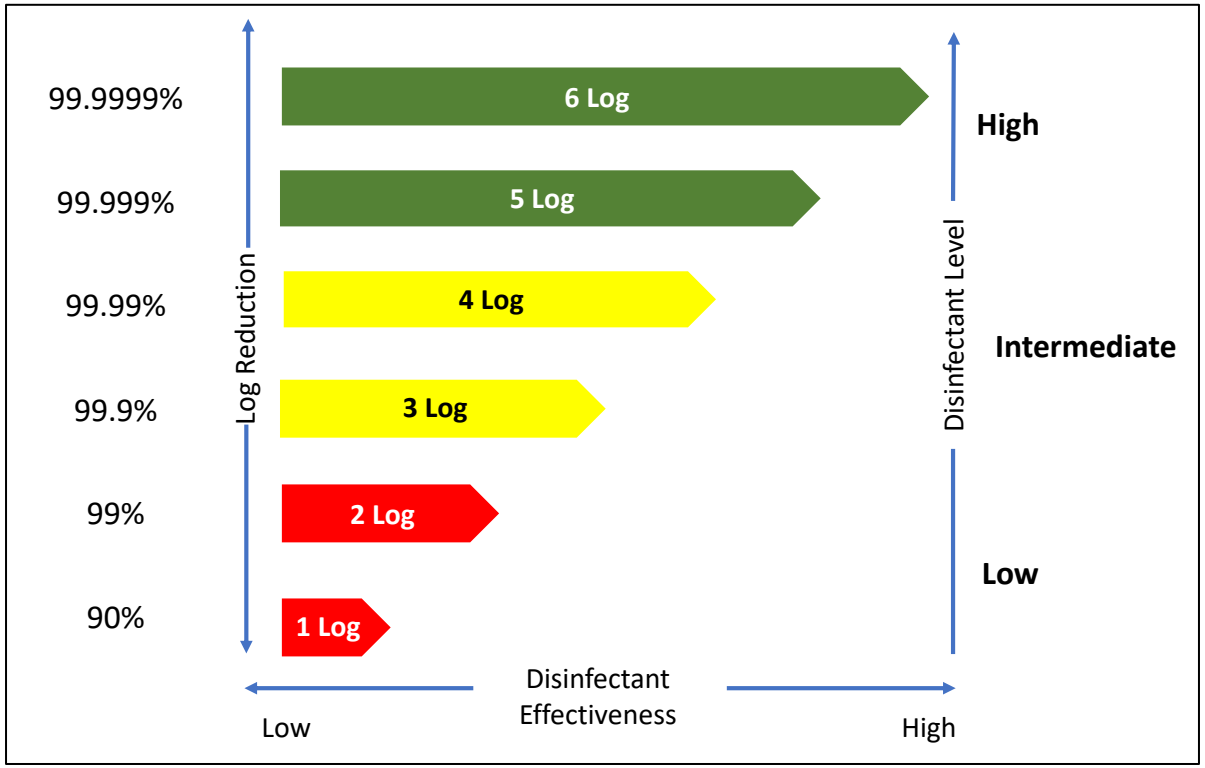
EFFICACY OF DISINFECTANTS

High, Intermediate, and Low Level Disinfectants



A more effective disinfectant has a higher log kill (or log reduction) - But there may be tradeoffs.

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SOIL/ORGANIC LOADING

The big difference between Laboratory Testing and the Real World!

- Almost all environmental surfaces have dirt, grease, or grime.
- These materials often **inactivate** chemical disinfectants making them less effective (or even ineffective).
- In addition, viruses and bacteria may be surrounded by bodily fluids (e.g., saliva, nasal mucous, etc.) which may protect them from disinfectants (e.g., SARS-CoV-2)
- This is a primary reason why bacteria and viruses may survive a disinfection process and cause future infections.
- **Many disinfectants may require a cleaning step prior to use.**

Bacteria Kill Test vs Chlorine Bleach

Soil Load	Log Kill
None	>6
0.5%	0.3-1.9
1.0%	0.5-1.4

Bloomfield et al., 1991

Some disinfectants can pass lab testing but fail in real world use because of the soil/organic load or the presence of bodily fluids!

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REGULATION OF DISINFECTANTS

Disinfectants are regulated by the U.S. EPA

- All disinfectants must be registered with the U.S. Environmental Protection Agency (EPA) under the Federal Insecticide, Fungicide and Rodenticide Act (FIFRA).
- A company selling a disinfectant must submit stringent laboratory testing results for the specific pathogen to be registered under FIFRA.
- FIFRA regulates **label claims** – i.e., "Kills 99.9% of bacteria".
- Disinfectants regulated by the EPA are for inanimate objects – products applied to humans are regulated by the FDA.
- All disinfectants that meet EPA's criteria for use against SARS-CoV-2 are on the U.S. EPA List N.

Caution: Just because a disinfectant is on the EPA List N doesn't mean it is a good choice for your application.

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REGULATION OF DISINFECTANTS

Disinfectants for SARS-CoV-2 – the EPA List N

- The U.S. EPA List N contains a list of disinfectants for SARS-CoV-2.
- There are three ways a disinfectant can be on the list:
  - Demonstrated efficacy against SARS-CoV-2 (COVID-19);
  - Demonstrated efficacy against a virus that is harder to kill than SARS-CoV-2 (COVID-19); or
  - Demonstrated efficacy against another type of human coronavirus similar to SARS-CoV-2 (COVID-19).
- Disinfectants on the EPA List N are not guaranteed to inactivate SARS-CoV-2. Many are on this list because they are effective against similar or harder-to-kill viruses.
- The EPA List N only contains chemical surface disinfectants – hand sanitizers, antiseptic washes, and antibacterial soaps are regulated by the FDA.
- Website: https://www.epa.gov/pesticide-registration/list-n-disinfectants-use-against-sars-cov-2-covid-19

From the website: "EPA expects all products on List N to be effective against SARS-CoV-2 when used according to label directions."

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REGULATION OF DISINFECTANTS

The EPA-Approved Label for disinfectants includes…

- EPA Registration Number
- Information about the efficacy of the disinfectant (i.e., claims)
  - Bacteria, Viruses, Fungi, and other organisms that it can be used against;
  - Level of kill (i.e., efficacy) information for registered microorganisms;
- How to safely handle and use the disinfectant.
  - Ingredients
  - Safety/Hazard Information
  - Directions for Use (i.e., how to apply it)
  - And more…
- The label can be found directly on or attached to a disinfectant or its packaging.
- EPA Registration Website: https://iaspub.epa.gov/apex/pesticides/f?p=PPLS:1

Always verify that a product is registered before using it. There are companies taking advantage of the COVID-19 crisis.

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REGULATION OF DISINFECTANTS

EPA-Approved disinfectants are for hard, non-porous surfaces

- Hard, Non-porous Surface Examples: Stainless Steel and Other Metals, Glass, Plastics, Varnished Wood.
- Soft, Porous Surface Examples (non-launderable): Carpet, Furniture Upholstery
- The EPA does not allow disinfectants to make a claim for soft, porous surfaces – CONFUSING?
- Instead – these surfaces should be cleaned or sanitized which will reduce the level of most pathogens
  - The EPA does allow Soft Surface Sanitizer claims (kills 99.9% of bacteria) – mostly for use in healthcare facilities
  - Not up to disinfectant standards but still reduces the level of pathogens
  - The EPA List N shows the type of surface the disinfectant can be used on
- There are EPA-approved products for soft, launderable items (e.g., clothing, aprons, etc.)

Soft, porous surfaces don't transmit pathogens as easily – so cleaning and/or sanitizing will likely reduce the spread of germs.

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REGULATION OF DISINFECTANTS

Disinfection of food contact surfaces

- There are special requirements for disinfection of food contact surfaces.
  - Countertops
  - Utensils/Dishes
  - Food Preparation Surfaces
  - Beverage Equipment
- Many disinfectants require a pre-cleaning step before use on food contact surfaces.
- Some disinfectants require a rinsing step after use on a food contact surface to remove residuals.
- Instructions in the disinfectant label will inform the user if food contact surfaces must be pre-cleaned or rinsed.

The EPA label instructions should be followed if disinfectants are applied to food contact surfaces.

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TYPES OF DISINFECTANTS

Chemical vs. Physical Disinfectant Processes

Our Topic

CHEMICALS

- Liquids (usually in aqueous solutions – sometimes are sold as solids/powders)
  - Chlorine Bleach
  - Hydrogen Peroxide
  - Ethyl Alcohol
- Gases
  - Ozone
  - Chlorine Dioxide

Gases are not on EPA List N.

PHYSICAL

- UV Light
- Heat
- Heat/Steam (Autoclave)
- Sonic
- Radiation

Physical processes are considered devices and are not on the EPA List N for COVID-19.

The focus is on liquid chemical disinfectants since these are on the EPA List N.

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TYPES OF DISINFECTANTS

Classes of Chemical Disinfectants (Part 1)

Class	Alcohols	Aldehydes	Chlorine Compounds	Iodophors
Examples	Ethyl Alcohol Isopropyl Alcohol	Formaldehyde Glutaraldehyde	Sodium hypochlorite Hypochlorous acid	Providone-Iodine
Disinfectant Level	Intermediate	Intermediate to High	Intermediate to High	Intermediate to High
Advantages	▪ Low toxicity	▪ Broad spectrum ▪ Noncorrosive	▪ Broad spectrum ▪ Fast acting	▪ Broad spectrum ▪ Fast acting
Disadvantages	▪ Flammable ▪ Fast evaporation ▪ Corrosive to some materials ▪ Inactivated by organic load ▪ Not effective against some viruses	▪ Toxic (Carcinogen) ▪ Irritating fumes and odors ▪ Slow acting ▪ Affected by pH and temperature ▪ Inactivated by organic load, hard water, soaps, detergents	▪ Corrosive ▪ Inactivated by organic load ▪ Can form toxic byproducts with other materials ▪ Some toxicity	▪ Corrosive ▪ Stains some materials ▪ Requires frequent re-application ▪ Inactivated by organic load

Disinfectants have advantages and disadvantages that must be evaluated.

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TYPES OF DISINFECTANTS

Classes of Chemical Disinfectants (Part 2)

Class	Peroxygen Compounds	Phenols	Quaternary Ammonium Compounds	Combination (Peroxygen + Detergents)
Examples	Hydrogen Peroxide Peracetic Acid	ortho-phenylphenol orthobenzylpara- chlorophenol	benzalkonium chloride alkyldimethyl ammonium chloride	Peroxide + PAA + Detergents Peroxide + Detergents
Disinfectant Level	Intermediate to High	Low to Intermediate	Low to Intermediate	High
Advantages	▪ Low toxicity ▪ Fast acting ▪ Broad spectrum	▪ Broad spectrum ▪ Mostly noncorrosive ▪ Active in organics	▪ Broad spectrum ▪ Noncorrosive (except to some metals)	▪ Broad spectrum ▪ Active with organic loads ▪ No pre-cleaning required
Disadvantages	▪ Mild corrosivity ▪ Inactivated by heavier organic loads (highly variable depending on compound)	▪ Some skin/eye irritation ▪ Some damage to rubber and plastics ▪ Toxic to some animals	▪ Inactivated by organic load, hard water, soaps, detergents ▪ Some irritation to skin, eyes, and respiratory tract	▪ Higher cost due to more ingredients ▪ May require more preparation before use

Disinfectants have advantages and disadvantages that must be evaluated.

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APPLICATION METHODS

The application method for disinfectants is important

Application Methods of Disinfectants on the EPA List N

- Spray (including electrostatic spray)
- Fog
- Mist
- Wipe (including impregnated wipes)
- Vapor
- Pressurized Liquid

The disinfectant must actually contact the virus to work!

A disinfectant will not work if it is applied incorrectly. The application method for a disinfectant is shown on the label.

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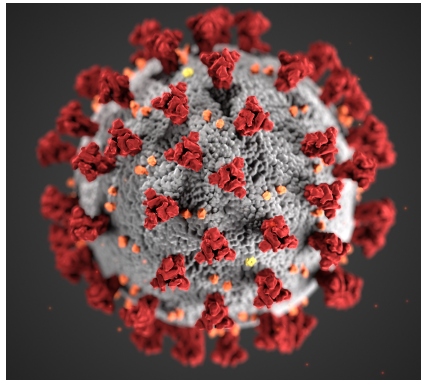
THE SARS-COV-2 VIRUS

Basic facts about SARS-CoV-2



cdc.gov

- Coronaviruses are a large family of viruses that can cause illness ranging from the common cold to more severe diseases such as Middle East Respiratory Syndrome (MERS-CoV) and Severe Acute Respiratory Syndrome (SARS-CoV).
- SARS-CoV-2 is a new strain that has not been previously identified in humans.
- Many coronaviruses naturally infect animals, but some can also infect humans.
- Coronaviruses are thought to spread through the air by coughing/sneezing and close personal contact, or by touching contaminated objects or surfaces and then touching your mouth, nose, or eyes.
- SARS-CoV-2 is a small, enveloped, RNA virus.

RNA viruses are especially dangerous because they can mutate.

Although viruses, in theory, are not difficult to disinfect – SARS-CoV-2 can be challenging.

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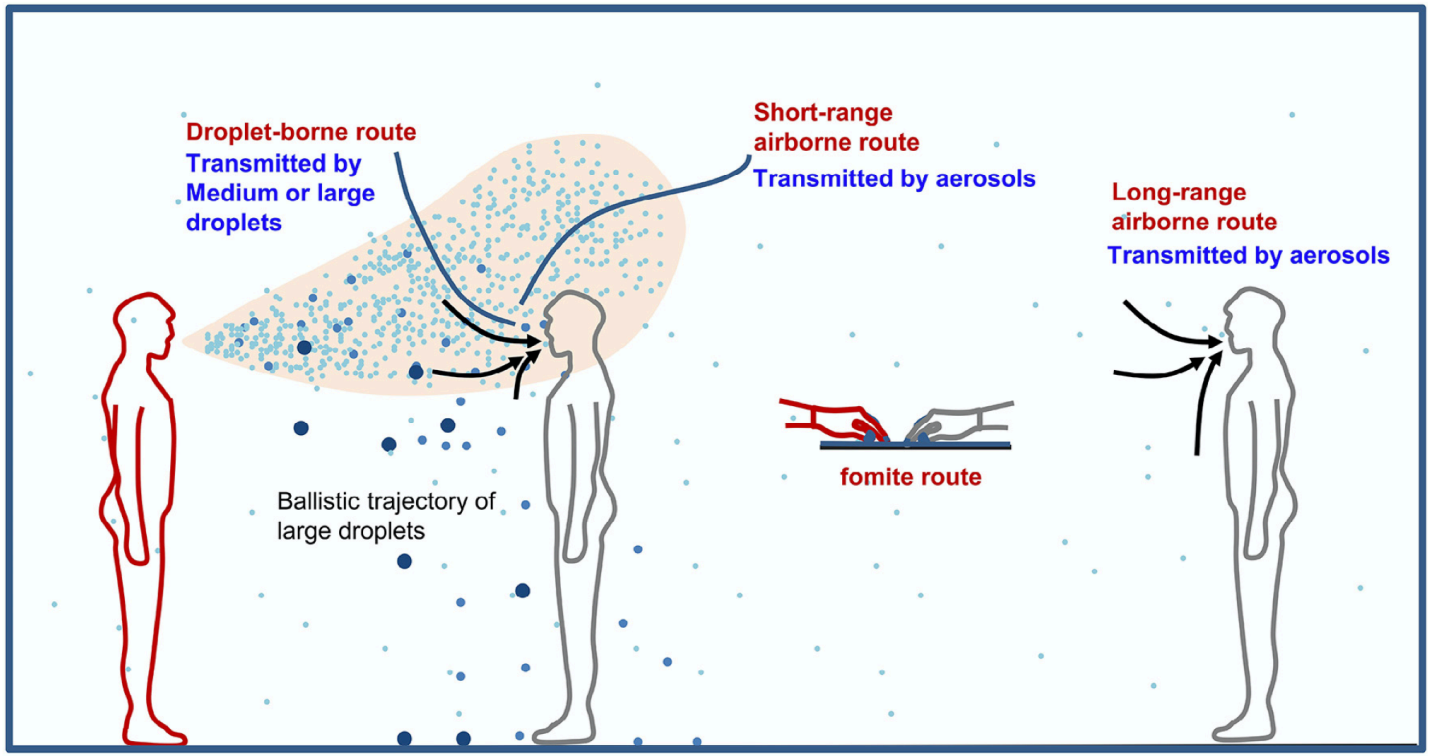
THE SPREAD OF SARS-COV-2

Airborne Droplets and Surface Contamination

Droplets Generated From:

- Exhaling
- Talking
- Coughing
- Sneezing



Large Droplets (>100 µm): Surface Transmission

Medium Droplets (5-100 µm)

Small Droplets (<5 µm): Airborne Transmission

Wei and Li, Amer. J. Infect. Control, 44, 2016

The small droplets may stay airborne for many minutes while the larger droplets fall to surfaces.

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THE SPREAD OF SARS-COV-2

The number of droplets generated from expiratory activity

Activity	Number of Droplets (1-1000 µm)*
Normal Breathing	~0
Talking Loudly (for five minutes)	3000 - 4000
Single Cough	3000 - 4000
Single Sneeze	30,000 - 40,000

*Atkinson et al., Natural Ventilation for Infection Control in Healthcare Settings, WHO, 2009.

These droplets may contain large numbers of viruses.

Other studies have shown greater numbers of droplets

This is the typical way most respiratory diseases are spread – why is SARS-CoV-2 different?

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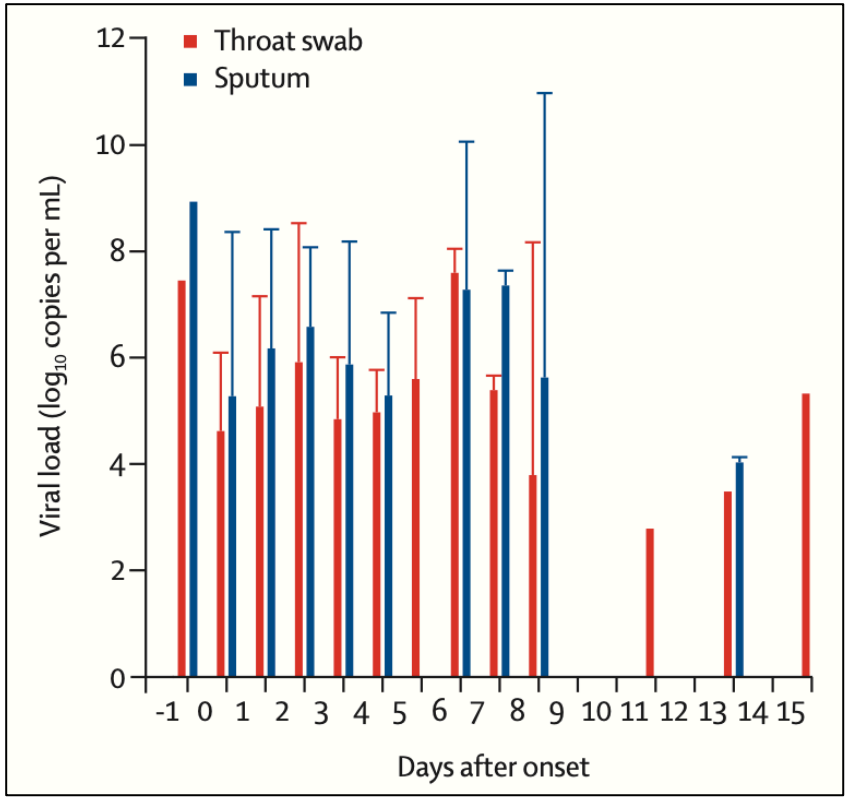
THE SPREAD OF SARS-COV-2

SARS-CoV-2 has a very high viral load



A large number of these viruses are in the upper respiratory tract.

Results from mathematical analyses and research studies have shown that as many as 200,000,000 SARS-CoV-2 viruses may be expelled during a single sneeze. This high number of viruses can overwhelm a lower level disinfectant.

Cough and sneeze droplets contain viruses and bodily fluids (e.g., saliva and nasal mucous).

Pan et al.,
https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7128099/pdf/main.pdf

This high viral load in the upper respiratory tract may lead to many more viruses on a surface as compared to other respiratory illnesses.

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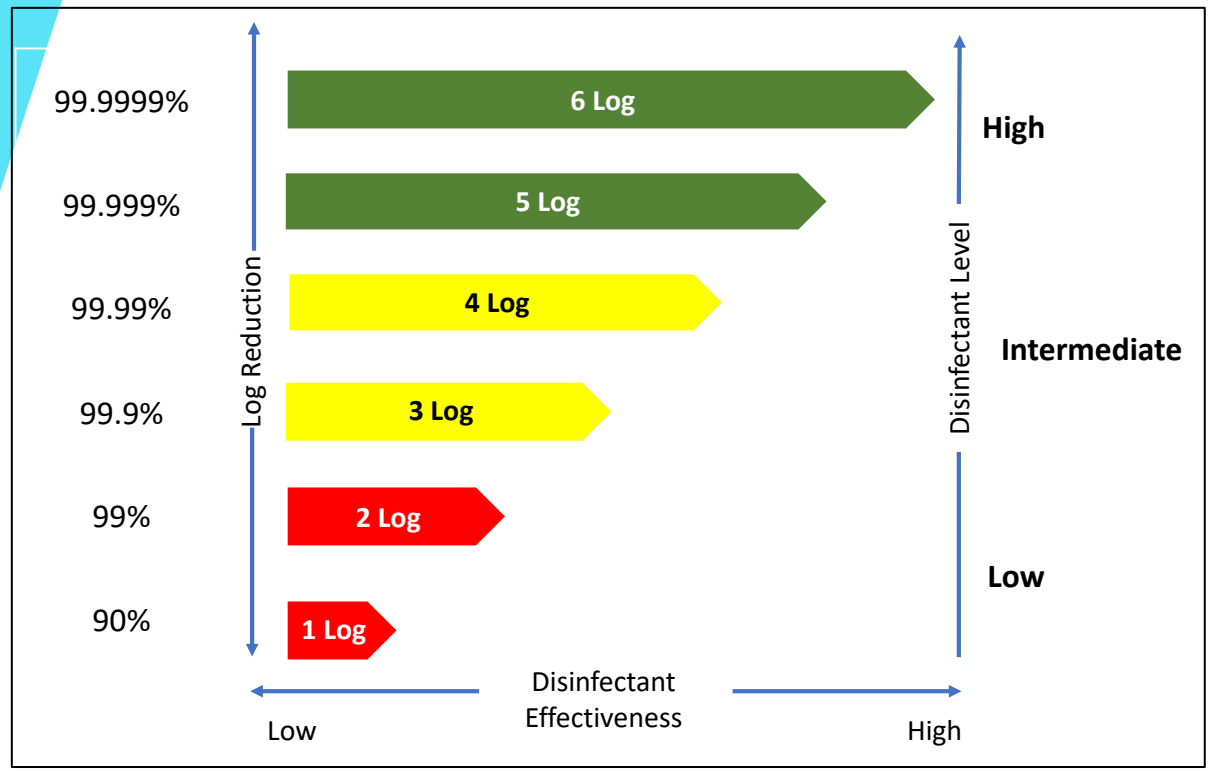
THE SPREAD OF SARS-COV-2

Disinfection effectiveness with a high viral load



Remaining viruses at each efficacy level (starting with 2,000,000 viruses).
< 2
20
200
2000
20,000
200,000

The infectious dose of SARS-CoV-2 is thought to be around 1000 viruses. This can come from more than one breath or more than one droplet

The combination of a high viral load and low disinfection efficacy could result in a person receiving more than the infectious dose.

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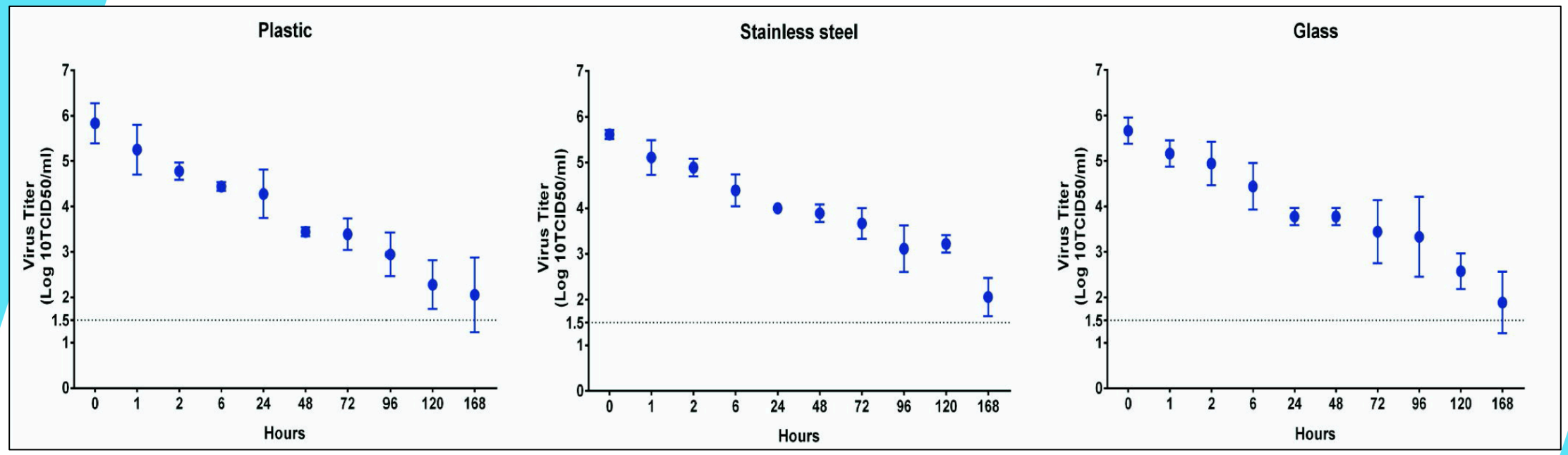
THE SPREAD OF SARS-COV-2

SARS-CoV-2 on surfaces is likely protected by bodily fluids



Liu et al., MedRxiv, May 2020.

Persistence of SARS-CoV-2 on surfaces for days is likely on transmission mode for COVID-19 which suggests that disinfection is important.

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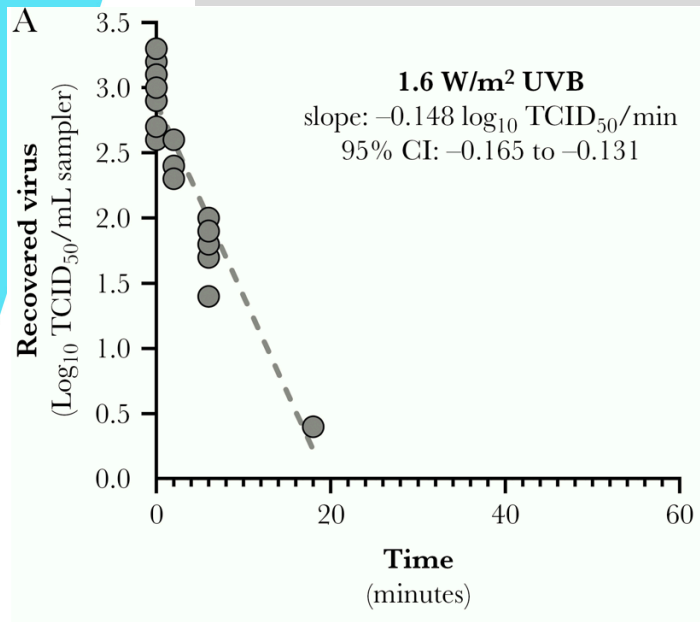
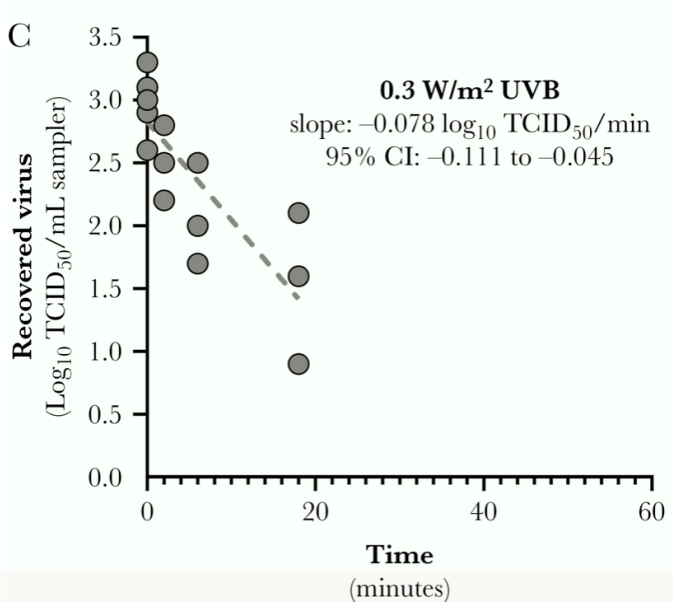
THE SPREAD OF SARS-COV-2

SARS-CoV-2 is killed by direct sunlight – but time is required

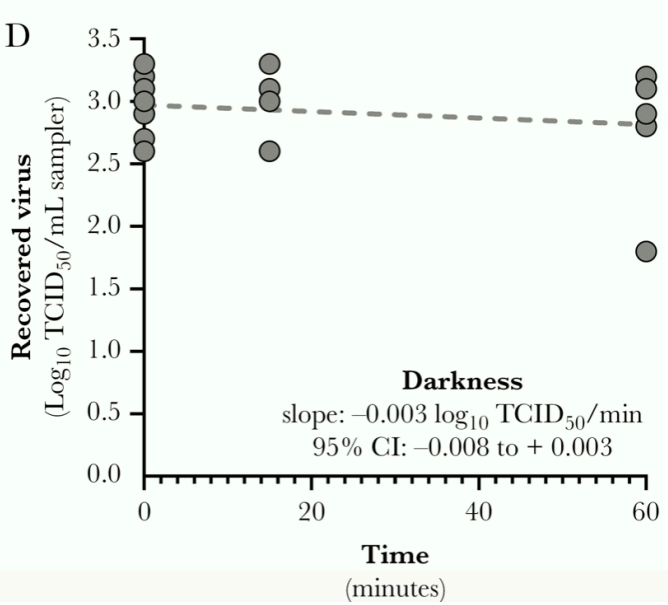
Summer Day 40°N - Noon



Winter Day 40°N - Noon



Darkness



Ratnesar-Shumate et al. J. Infect. Diseases, 222(2), 2020

SARS-CoV-2 will likely survive in low levels of sunlight and in shaded areas.

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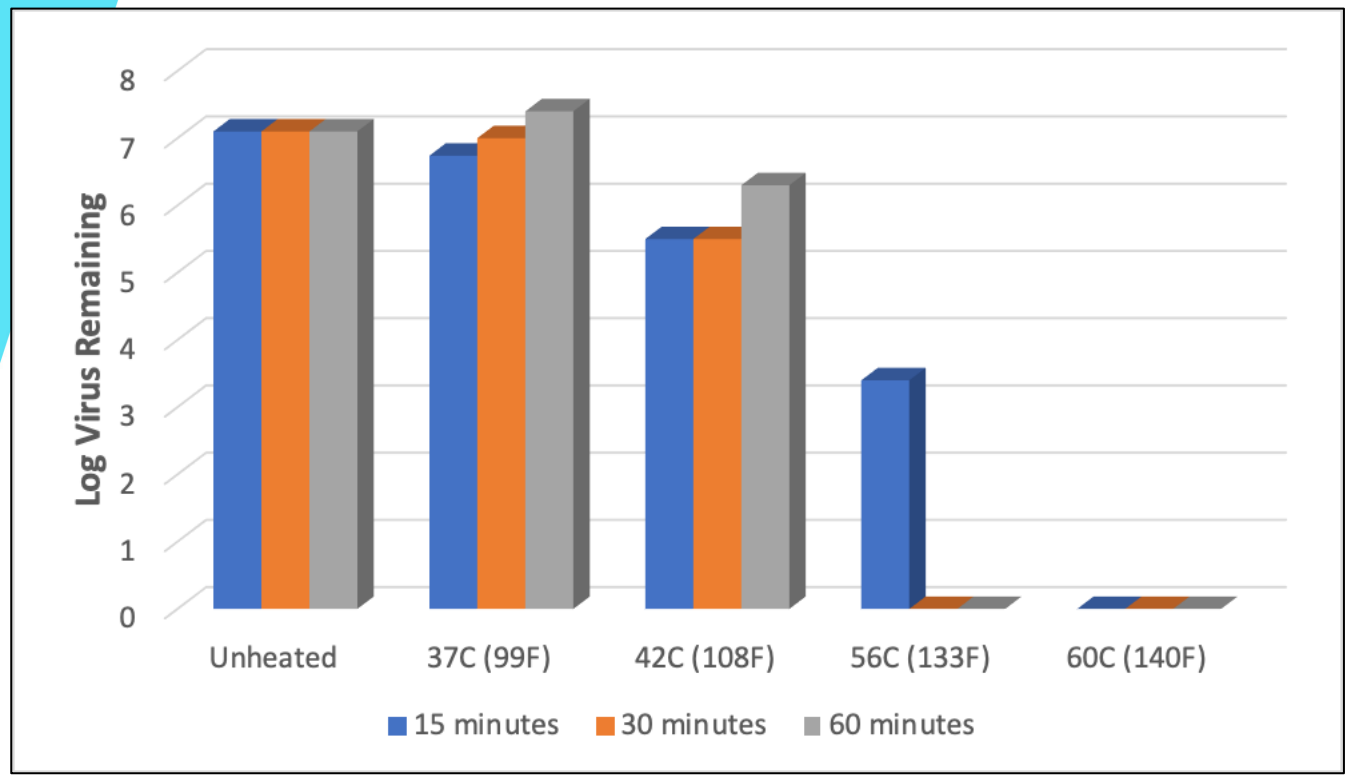
THE SPREAD OF SARS-COV-2

Heat Inactivation of SARS-CoV-2



The combination of heat and relative humidity is not very effective at killing SARS-CoV-2 unless the heat is above 130°F with a 30 minute exposure.

Faster kill (15 minutes or less) requires a temperature of 140°F.

Wang et al., https://www.medrxiv.org/content/10.1101/2020.04.29.20085498v1.full.pdf

Heat + humidity is not a very practical way to kill the SARS-CoV-2 virus.

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DISINFECTION OF SARS-COV-2

There is a strong case that surface disinfection is needed because…

- High viral loads may leave dangerous, infectious levels of viruses on surfaces from sneezes or coughs.
- Viruses may survive on surfaces for many hours or days.
- Sunlight (e.g., UV light) will only kill the virus under certain circumstances (i.e., direct and high intensity).
- Heat + Humidity will only kill viruses in a short period of time (e.g., thirty minutes or less) at high temperatures (140°F or greater).

Surface Disinfection = Disinfectant + Application Method

Active, surface disinfection should be considered for SARS-CoV-2 in most circumstances.

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DISINFECTION PLANNING

Process for selecting a disinfectant and application method

1. Identify an expert or experts
2. Conduct Facility Evaluation (Break facility into units where disinfection operations will be similar)
3. Design Disinfection Operations for Each Facility Unit
4. Identify Disinfection Operations Personnel
5. Conduct Disinfection Operations and Update Plans

These are general guidelines – every facility is different.

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DISINFECTION PLANNING

Process for selecting a disinfectant and application method

STEP 1

1. Identify an Expert or Exports
    a. Staff (person with expertise or who is willing to learn or be trained)
    b. Consultant (person with experience in disinfectants and disinfection operations)
    c. Reputable Company
        - Expertise in this area
        - References (similar projects)
        - Willing to train personnel

It is important to have an expert to guide disinfection operations/decisions.

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DISINFECTION PLANNING

Process for selecting a disinfectant and application method

STEP 2

2. Conduct Facility Evaluation
   a. Goal: Divide the facility into units where disinfection operations will be similar
   b. Outdoor vs. Enclosed vs. Semi-enclosed
   c. High traffic areas vs. low traffic areas (e.g., number of personnel and proximity)
   d. High touch points (hand rails, payment devices, escalator rails, elevator buttons, etc.)
   e. Public vs. non-public areas
   f. Frequency of use (i.e., Daily Use vs. Game Day Use)
   g. Types of Use: Locker rooms, Food preparation areas, others
   h. Material/surface types
   i. Organic/soil loading

This facility evaluation is dynamic and should be repeated frequently.

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DISINFECTION PLANNING

Process for selecting a disinfectant and application method

STEP 3

3. Design Disinfection Operations
   a. For each facility unit type
   b. Disinfectant
      - Efficacy (with and without soil/organic loading)
      - Toxicity/Corrosivity
      - Other parameters
   c. Frequency of disinfection
   d. Application method (for general area and touch points)

Input from experts is critical for this step!

Avoid the "one size fits all" approach.

It is possible that the same disinfectant may be used in all units but other operational parameters may be different.

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DISINFECTION PLANNING

Process for selecting a disinfectant and application method

STEP 4

4. Identify Disinfection Operations Personnel
   a. Facility Staff
      - Identify training needs & conduct training
      - Determine if additional staff are needed
   b. Contractor (e.g., company supplying disinfectant)
   c. Combination
      - Facility Staff + Contractors
      - Identify areas of responsibility

If facility staff are used – make sure they are appropriately trained.

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DISINFECTION PLANNING

Process for selecting a disinfectant and application method

STEP 5

5. Conduct Disinfection Operations
   a. Follow disinfection plan for each facility unit
   b. Acquire/maintain necessary materials
   c. Monitor operations (especially if conducted by recently trained personnel)
   d. Re-evaluate – Re-assess – Update plans if necessary

The COVID-19 situation is dynamic – the disinfection plan should also be dynamic!

The disinfection plan should change based on the changing COVID-19 situation.

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AN IDEAL DISINFECTANT

Properties of an ideal disinfectant for SARS-CoV-2

- Can kill/inactivate a broad spectrum of microorganisms with high efficacy.
- Works in intended area (enclosed space, semi-enclosed space, outdoors, etc.)
- Remains effective in heavy organic or soil loads or bodily fluids.
- Can overcome biofilms (for some situations).
- Performance not inhibited by bacterial resistance or virus mutations.
- Easy to use, provides for minimal disruption of operations, and economical.
- Has low toxicity and corrosivity properties.
- Multiple application methods to adopt to any situation.
- Can reach hidden areas (e.g., HVAC) where pathogens may reside.
- Must have regulatory approval.

This is a difficult set of properties for a disinfectant to achieve!

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APPLICATION METHODS

How to determine the best application method(s) for your facility

- Overall size of the facility
- Unique features within the facility
- Hard to reach areas
- Occupancy

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APPLICATION METHODS FOR DISINFECTION

Cold Fogging

- An efficient method of evenly distributing disinfectant to surfaces in a wide range of environments.
- Effective in hard to reach areas
- Can be used through ventilation systems

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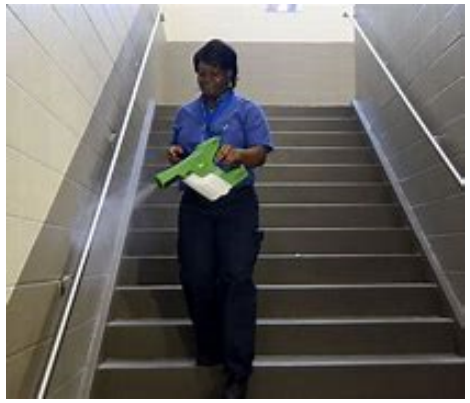
APPLICATION METHODS FOR DISINFECTION

Electrostatic Spraying

- An efficient method of evenly distributing disinfectant to surfaces in a wide range of environments
- Effective in hard to reach areas
- Can be used through ventilation systems



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APPLICATION METHODS FOR DISINFECTION

Spraying

Spraying applications can range from handheld spray bottles, gravity fed backpack sprayers to air or electric broad area sprayers. While spraying utilizes much more disinfectant than cold fogging or electrostatic spraying, it is important for gross contamination disinfection.

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APPLICATION METHODS FOR DISINFECTION

Wiping

Whether using a microporous cloth or a mop, disinfecting surfaces using these methods is time consuming and generally less ideal for large area disinfection. However, wiping methods can be done during hours of operation when facilities are occupied.

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APPLICATION METHODS FOR DISINFECTION

Application Equipment

- Handheld: Sprayers, Foggers, Electrostatic Sprayers
- Backpack: Sprayers, Foggers, Electrostatic Sprayers
- Mobile Portable: Cart Foggers, Aeroclave Systems
- Fixed Facility: Engineered Systems

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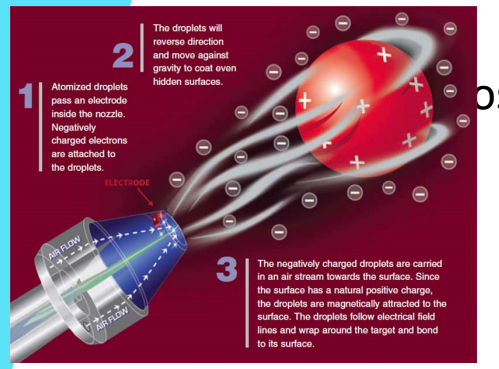
APPLICATION METHODS FOR DISINFECTION

Application Equipment



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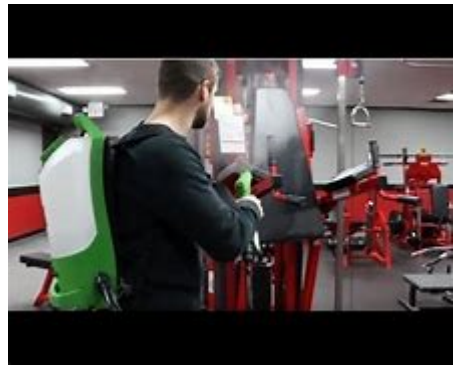

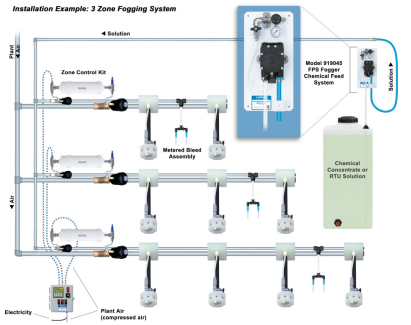

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SUMMARY

Surface Disinfection for SARS-CoV-2

- Surface disinfection is important to control the spread of COVID-19.
  - High viral loads potentially means large numbers of viruses on surfaces.
  - SARS-CoV-2 can exist on surfaces for hours or days likely because it is protected by soil/organic loads and bodily fluids.
  - Heat and sunlight will likely not be an important factor to minimize COVID-19 spread.
- It is important to select a disinfectant that is EPA-registered for the pathogen of interest.
- Not all disinfectants are the same - Disinfectants have different levels of efficacy and other properties that must be considered – A high efficacy is important for SARS-CoV-2.
- The level of soil/organic loading and the ability to penetrate bodily fluids is an important consideration for the selection of a disinfectant.
- The application method is important for success.
- A dynamic disinfection plan should be developed and implemented for a facility following a rigorous process. Avoid the "one size fits all" approach.

Facilities should consider continuing disinfection operations after COVID-19 to improve public health and safety.

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