

Disinfectants for COVID-19: Information Review



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The coronavirus SARS-CoV-2 is the cause of coronavirus disease 2019—COVID-19—in people.^{1,2} While data on transmissibility of coronaviruses from surfaces to hands has not been found, there is evidence that a contact time of five seconds can transmit influenza A virus to hands.³ To help prevent transmission of SARS-CoV-2, which can persist on surfaces for as long as nine days,^{3,4} both the Centers for Disease Control and Prevention (CDC) and the World Health Organization (WHO) recommend cleaning and disinfection of high-touch surfaces.

This review was compiled by the Center for Community Health and Evaluation and provides information on disinfectants that are effective against SARS-CoV-2, including alternatives to chlorine bleach and those that can be used in low-resource settings. Sources include WHO, CDC, the Environmental Protection Agency (EPA), and other COVID-19 specific government and nonprofit organization web pages,

as well as disinfectant manufacturers' websites. In addition, the National Library of Medicine's PubMed database was searched during the last week of April 2020 using these keyword phrases (* is a truncation symbol): *covid disinfect**, *covid infection control cleaning*, *alternatives bleach disinfectant*, *covid infection control homeless**.

WHO recommends that healthcare facilities or homes with patients with suspected or confirmed COVID-19 infection use disinfectants that are active against “enveloped” viruses like SARS-CoV-2. Specifically:

- 70% Ethyl alcohol to disinfect reusable dedicated equipment (e.g., thermometers) between uses
- Sodium hypochlorite [e.g., household chlorine bleach] at 0.5% (equivalent 5000ppm) for disinfection of frequently touched surfaces in homes or healthcare facilities.⁵

CDC has detailed COVID-19 specific environmental infection control guidelines for healthcare facilities,⁶ nursing homes,⁷ community settings like schools,⁸ and households.⁹ In all settings, CDC only recommends the use of surface disinfectants identified on Environmental Protection Agency (EPA) **List N**.¹⁰

According to Public Health Seattle & King County, disinfection uses a chemical to kill germs, while sanitizing reduces but does not kill germs.¹¹ The Clorox Company makes a further distinction: sanitizers have claims only for bacteria, while disinfectants have claims against both bacteria and viruses.¹²

While no disinfectants specifically include SARS-CoV-2 on the product label,² all products on List N meet EPA's criteria for use against this virus.¹⁰ EPA does not endorse any product nor does it review common household ingredients like vinegar or rubbing alcohol. The online version of the list can be sorted by EPA registration number found on product labels, brand name, and active ingredient; a downloadable spreadsheet version allows additional filtering by use setting (healthcare, institutional, residential) and type of surface to be disinfected. Most products on the list are for use on hard, nonporous surfaces only. The contact time for each product is noted, i.e., the amount of time the surface being cleaned needs to be wet. Note: surface wipes can dry out during use; they must remain wet to be effective.²

CDC and the Infection Control Africa Network (ICAN) have developed a guide for environmental cleaning and disinfection in low-resource settings.¹³ Ideally, products are nontoxic, easy to use, affordable, and water soluble; disinfectants should require short contact times, remain wet enough to meet contact time in a single application, and be non-polluting. Advantages and disadvantages are listed for four common healthcare disinfectants: quaternary ammonium compounds, isopropyl or ethyl alcohol, bleach, and improved hydrogen peroxide. For example, chlorine bleach is low cost and readily available, but is a skin irritant, has an offensive odor, and can deteriorate if exposed to heat and light, while alcohol is nontoxic and low cost, but evaporates quickly so is not appropriate for large surfaces.¹³



CHLORINE BLEACH

A number of common household products on List N are frequently in short supply, and diluted chlorine bleach may be the most readily available effective disinfectant.⁴ Disinfecting with bleach requires protecting skin by wearing disposable gloves and using in a well ventilated area.⁹

It is recommended that diluted bleach solutions be discarded after 24 hours,^{14,15} though others have suggested it can be used for up to a month if stored at room temperature and not exposed to light (kept in an opaque container).⁴ If mixed in an open container for use with rags, a new batch should be made every 2-4 hours.¹¹ Bleach solution recipes

are based on the percentage of sodium hypochlorite in the liquid bleach; Clorox is 6% and the common recipe is 5 tablespoons or 1/3 c. per gallon or 4 teaspoons per quart of water.^{14,15}

Household bleach loses effectiveness after a year; i.e., the expiration date is one year after production date. Clorox bleach has a code stamped on each bottle that includes the number of the manufacturing plant and the Julian calendar date^a of production (i.e., chronological day of the year); on some bottles the date can be smudged and difficult to read. Michigan State University (MSU) has

^a Julian date conversions are available on the web, e.g., https://people.biology.ucsd.edu/patrick/julian_cal.html

created a user-friendly illustrated explanation of the code.¹⁴

Contact times for sodium hypochlorite products on EPA List N vary and may be inconsistent with product labels. Since March 26, 2020, CDC changed its contact time recommendation to “at least a minute,” while WHO and MSU recommend 5 minutes.^{5,14} The label on Clorox Disinfecting Bleach recommends a stronger solution—1/2 cup per gallon of water—and a contact time of 5 minutes.

At the beginning of March 2020, the daily number of calls to poison control centers related to cleaners and disinfectants increased sharply, including for bleaches and hand sanitizers.¹ Although a causal association could not be determined, the timing of these calls corresponds to increased media coverage of the COVID-19 epidemic. Many of the reported exposures were likely related to using more of a product than indicated on the label, mixing multiple chemicals together, not wearing protective gear such as gloves, and using products in poorly ventilated areas.



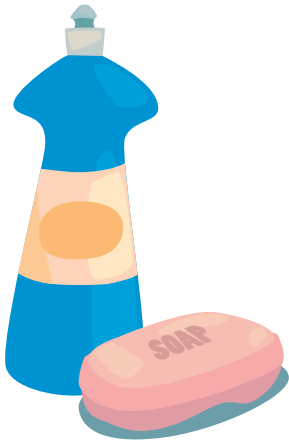
BLEACH ALTERNATIVES

The nonprofit Environmental Working Group (EWG)^b has reviewed products either on list N or with an approved claim against non-enveloped viruses (harder to kill than enveloped viruses like SARS-CoV-2) and has recommended 16 “well rated products with fewer ingredient concerns.”¹⁶ Common products from EPA’s List N with EWG-recommended ingredients may not be available online or in stores, based on a Google search by product name, as shown in the table below. If those products are unavailable, EWG suggests looking for active ingredients with lower toxicity and recommends avoiding sodium hypochlorite—bleach—because of its corrosive qualities, as well as quaternary ammonium compounds—the active ingredient in Clorox Disinfecting Wipes—because of suspected reproductive toxicity and effect on asthma.¹⁶

rite—bleach—because of its corrosive qualities, as well as quaternary ammonium compounds—the active ingredient in Clorox Disinfecting Wipes—because of suspected reproductive toxicity and effect on asthma.¹⁶

^b EWG is a nonprofit, nonpartisan organization dedicated to protecting human health and the environment through research and education; funders include the William and Flora Hewlett and David and Lucile Packard foundations; <https://www.ewg.org/>.

EWG “SAFER” ACTIVE INGREDIENT ^c	EXAMPLE PRODUCT	COST/ AVAILABILITY (4/30/2020)
Citric acid	Lysol Bathroom Cleaner	\$2.97, Walmart; out of stock
Hydrogen peroxide	Clorox Pet Solutions Advanced Formula Disinfecting Stain & Odor Remover	\$6.99 sale price, vonbeau.com; expected to sell out
Ethyl alcohol (Ethanol)	Lysol Disinfectant Spray, Neutra Air 2 in 1	\$3.97, Walmart; out of stock
L-lactic acid	Windex Disinfectant Cleaner	\$6.49, Bartell Drugs (Seattle area); limited stock
Caprylic acid (octanoic acid)	1 product listed, only for healthcare/institutional use (65 Heavy Duty Acid Bathroom Cleaner)	
Thymol	Thymol is the active ingredient in Seventh Generation products, e.g., Disinfecting Multi-Surface Cleaner Lemongrass Citrus Scent ^d	\$3.64, Walmart; high demand
<p>^cIf products with these ingredients are unavailable, EWG suggests using 3% household hydrogen peroxide by itself</p> <p>^dSeventh Generation has a list of its products that are in accordance with EPA List N; the EPA registration number is 84683, which appears on the list as thymol under brand name Cleanwell®, a Seventh Generation partner; https://www.seventhgeneration.com/blog/coronavirus-information-and-resources</p>		



CONSIDERATIONS FOR FACILITIES SERVING THE HOMELESS

Facilities serving homeless individuals and families, including shelters and soup kitchens, are at increased risk of disease outbreaks, in part because of crowding, lack of ventilation, and the large number of transient clients without regular access to basic hygiene supplies and shower facilities.^{17,18} After the 2003 severe acute respiratory syndrome (SARS) outbreak in Toronto, a number of homeless service providers noted they lacked specific infection control training and guidelines, including appropriate surface cleaning and disinfection in the event of an outbreak.¹⁷

Public Health–Seattle & King County has created a Sanitation & Hygiene Guide for Homeless Service Providers. The guide has simple instructions with illustrations for preparing disinfectant bleach solutions plus checklists for choosing and storing products (recipe in body of guide is somewhat different from CDC’s and MSU’s and assumes using bleach with 8.25% sodium hypochlorite; Clorox is 6%). The guide’s appendix includes templates for making cleaning schedules, instructions for setting up temporary handwashing stations, a detailed graphic guide to understanding disinfectant product labels, and a recommended label for disinfectant solutions.¹⁹

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