

# A chemist's guide to disinfectants

Has your local store run out of sanitizing wipes? This cheat sheet can help you find and understand alternatives

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Credit: Shutterstock

Retailers face rolling shortages of cleaners and disinfectants amid record demand from consumers.

**“Y**ou’re a chemist, right? We’re almost out of wipes. Do you have any ideas on what else we could use to disinfect?” As supplies in grocery store cleaning aisles dwindle, chemists and other people with science backgrounds are fielding questions like these from friends and relatives about what they can use to kill the novel coronavirus, SARS-CoV-2.

Although manufacturers of disinfectants **are doing all they can to keep up**, demand is through the roof, and some raw material supply chains are strained. So how should you advise your friends and family on their available options?

C&EN constructed this guide to explain the ingredients in disinfectants and help you give good advice. The most important thing is to read the labels. The US Environmental Protection Agency regulates disinfectants used on hard and soft surfaces under its authority to regulate pesticides. The agency vets and stands behind the efficacy promises on the labels, as long as you follow the instructions.

Labels offer guidance on how to use disinfectants safely—for instance, in a ventilated area—and they explain which cleaning products shouldn’t be mixed with other chemicals. Interactions you might not expect can **create toxic gases** or make the mixture stronger or weaker than anticipated.

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Even the type of cloth you use when cleaning hard surfaces might alter how a disinfectant works. For instance, paper towels can decompose after long soaks in some disinfectants and deactivate others. The fabric in wipes is specially formulated to be unreactive, so experts advise that you don't try to make your own premoistened wipes. Instead, you should spray a liquid disinfectant onto the target surface, let it sit for at least the "dwell" or "contact" time listed on the label, and then wipe dry or let the liquid evaporate. For soft surfaces like cloth or food, experts **suggest different cleaning methods.**

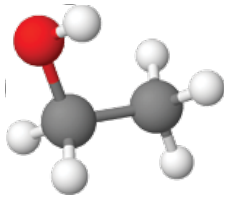
SARS-CoV-2 is an enveloped virus, which means it is surrounded by a lipid membrane. That's good news, because a wide variety of disinfectants can disrupt lipid membranes, killing the virus they were protecting. **Few disinfectants have been rigorously tested** against SARS-CoV-2 in the lab, but the EPA maintains a public database of products it recommends for use against SARS-CoV-2 on the basis of their proven efficacy against similar viruses. Users can search this list by product name, active ingredient, type of product, and more. Users can search **EPA's database, called List N**, by product name, active ingredient, type of product, and more.

Disinfectant wipes and sprays used to clean hard surfaces are currently scarce, so we've curated the list below to describe the chemicals used in those products. You can use this information as a cheat sheet while you read the labels on the products you can find.

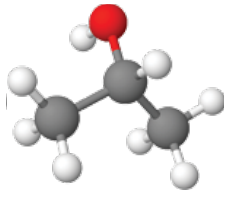
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## Alcohols

### How you'll see them



Ethanol  
(ethyl alcohol)



Isopropanol  
(isopropyl alcohol or 2-propanol)

### How they work

By disrupting a virus's lipid envelope or by clumping or denaturing its proteins

### Wet contact time needed\*

1–5 minutes

### Use notes

Ensure adequate ventilation and wear gloves

### Safety concerns

Flammable, poison risk upon ingestion and can damage plastics and cause heady fumes

### Found in



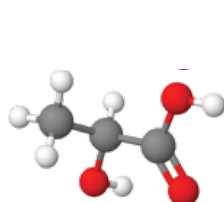
Hand  
sanitizers



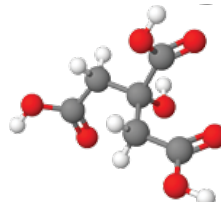
Wipes

## Reducers

### How you'll see them



L-lactic acid



Citric acid

### How they work

By denaturing a virus's proteins, disrupting its lipid envelope, and reducing critical viral components

### Wet contact time needed\*

5 minutes

### Use notes

Wear gloves

### Safety concerns

Generally recognized as safe, though they can irritate skin

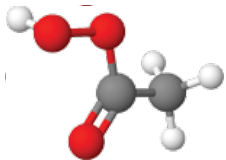
### Found in



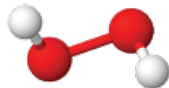
Sprays

## Oxidizers

### How you'll see them



Peracetic  
acid



Hydrogen  
peroxide

**NaClO**  
Bleach  
(sodium hypochlorite)

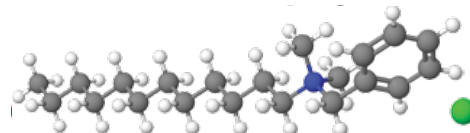
### How they work

By denaturing a virus's proteins, disrupting its lipid envelope, and oxidizing sulfur bonds in proteins, enzymes, and other metabolites

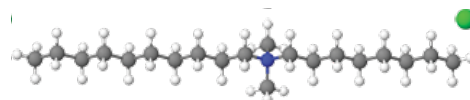
### Wet contact time needed\*

## Quaternary ammonium salts

### How you'll see them



Alkyl dimethyl benzyl ammonium chloride  
(Benzalkonium chloride)




Octyl decyl dimethyl ammonium chloride

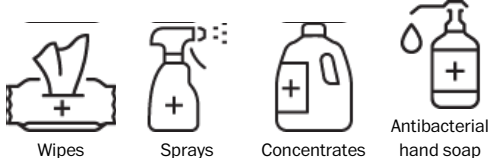
### How they work

By removing a virus's lipid envelope, denaturing its proteins, and disrupting its enzymes

### Wet contact time needed\*

10 minutes

Bleach, 1 minute; hydrogen peroxide, 5 minutes; peracetic acid, 2-5 minutes
<b>Use notes</b> Ensure adequate ventilation and wear gloves
<b>Safety concerns</b> Can irritate skin, mucus membranes, and airways and can damage clothing
<b>Found in</b>  Wipes      Sprays      Concentrates

<b>Use notes</b> Deactivated by hard water and fabric; wear gloves
<b>Safety concerns</b> Can irritate the skin
<b>Found in</b>  Wipes      Sprays      Concentrates      Antibacterial hand soap

\*The time the disinfectant should sit on a surface to ensure it works before being wiped away

**Sources:** US Environmental Protection Agency; Ryan Cotroneo/UNX Industries; Steven Bennett/Household and Commercial Products

Association of Environmental and Cleaning Professionals, *Wipes*, 2019, DOI: 10.1292/jvms.62.85; Kirsten M. Thompson, "The Science of Disinfectants," *Cleaning and Maintenance Management*, April 25, 2012; ScienceDirect.

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To sanitize soft surfaces such as clothes and food, use these tried-and-true methods. To disinfect textiles like your **clothes**, running them through the laundry with detergent is the best choice. For your hands, soap is the best tool, and hand sanitizer is **a good on-the-go alternative** if you're not near a sink. For fruits and vegetables, the **US Department of Health and Human Services** says to cut away any damaged or bruised areas, then rinse under running water without soap, bleach, or commercial produce washes. The agency recommends you don't wash bagged produce marked "prewashed" or meat, poultry, or eggs.

### CORRECTION

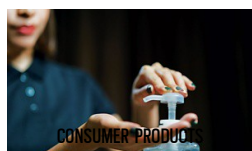
This story was updated on May 2, 2020, because the labels for hydrogen peroxide, L-lactic acid, and peracetic acid did not appear with the corresponding structures. The structures have been moved accordingly.

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