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Protecting Yourself from COVID-19 (coronavirus) without Toxic Sanitizers and Disinfectants

Fight the coronavirus with common sense prevention and safer disinfection products. Avoid products that increase vulnerability to respiratory problems.

WHY THE CONCERN ABOUT TOXIC SANITIZERS AND DISINFECTION PRODUCTS

The *New York Times* reports an increase in calls to poison control centers regarding illnesses resulting from use or misuse of toxic disinfectants during the pandemic.[1] **Disinfectants** are designed to be used on hard surfaces, while **sanitizers** are made to be used on skin. FDA warns that disinfectant sprays or wipes should not be used on skin because they may cause skin and eye irritation.[2]

Furthermore, we have learned through the COVID-19 crisis that there are people who are more vulnerable to the effects of the virus. These are generally people who have a pre-existing condition or are of advanced age, who may have a weakened immune or respiratory system. With the management of viral and bacterial infections, it is always important that we do not exacerbate the risk to individuals in the process of avoiding or controlling the threat. Many of the products approved as sanitizers and disinfectants have negative impacts on the respiratory or immune system, thus reducing resistance to the disease.

In the case of COVID-19, we have measures of protection—both practices and products—that can protect us without using toxic products that increase risk factors.

PREVENTION

The good news is that toxic chemicals are not necessary to prevent exposure to COVID-19 and eliminate the virus. The Centers for Disease Control and Prevention (CDC) urges simple measures to prevent exposure:

- Avoid close contact with people who are sick.
- Avoid touching your eyes, nose, and mouth.
- Cover your cough or sneeze with a tissue, then throw the tissue in the trash.
- Stay home.
- Practice social distancing: stay at least six feet from other people.
- Wear a mask in public.

How it works: The best way to prevent any infectious disease transmission is to stay out of contact with those who have already contracted the disease.

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HAND CLEANING AND SANITIZING
Eliminating the Virus on Hands

- Wash your hands often with soap and water for at least 20 seconds. If soap and water are not readily available, use an alcohol-based hand sanitizer with at least 60% ethanol or 70% isopropanol. (See list of products below.) Always wash hands with soap and water if hands are visibly dirty.

How it works: Soap breaks down the virus's fat membrane—and the infectious material falls apart—as long as you rub the soap on your hands for at least 20 seconds. Alcohol sanitizers with 60% ethanol or 70% isopropanol do the same thing. These chemicals break down the virus by a similar process, by breaking down the lipid covering of the virus.[3]

The Food and Drug Administration (FDA) regulates hand sanitizers. Only products with active ingredients ethanol, isopropanol, or benzalkonium chloride can qualify as "hand sanitizers" according to FDA. However, CDC says evidence shows that benzalkonium chloride is less reliably effective against the coronavirus than alcohol.[4] An alcohol-based hand sanitizer should contain at least 60% ethanol or 70% isopropanol in order to be effective.[5]

The Good: Soap or Alcohol

The most effective way to remove the coronavirus from your hands is to wash with soap and water, for at least 20 seconds.

If soap and water are not readily available, use an alcohol-based hand sanitizer with at least 60% ethanol or 70% isopropanol. Glycerol or aloe as part of the remainder can help counter the drying effects of alcohol on the skin. Always wash hands with soap and water if hands are visibly dirty. If they are not cleaned first, the success of the sanitizer can be compromised. If hands are visibly dirty and soap and water washing is not possible, rub hands to remove as much dirt as possible.

The Bad: Toxic Sanitizers

Avoid hand sanitizers containing benzalkonium chloride (BAC), which is a quaternary ammonium compound (or "quat"). It is an irritant that can cause asthmatic reactions and adversely affect the respiratory system.[6,7] BAC is also associated with changes in neurodevelopment,[8] selection for antibiotic resistance,[9] and provoking irritant and/or contact dermatitis.[10] In addition, CDC reports that BAC is less reliable than the alcohols.[11]

DISINFECTING SURFACES
Eliminating the Virus on Surfaces

- Clean and disinfect frequently touched objects and surfaces using regular household cleaning sprays and safer disinfectants. (See list of products below.) Disinfectants are ineffective if used on dirty surfaces because their disinfectant power is wasted attacking dirt.[12] Ordinary soap, detergent, and water can be used for cleaning.

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How it works: Like handwashing with soap or wipes with 60% alcohol, the virus on surfaces can be detached and broken down with soap and alcohol.[13]

The Good: Natural-based substances tend to be safer, while still effective at eliminating the virus on surfaces. Look for products with the following active ingredients (* indicates listed by EPA's Design for the Environment Program (DfE)[14]):

- √ Citric acid*
- √ Ethanol*
- √ Isopropanol*
- √ L-lactic acid*
- √ Hydrogen peroxide*
- √ Sodium bisulfate*
- √ Thymol
- √ Dodecylbenzenesulfonic acid*[15]

The Bad: EPA has approved a long list of products[16] that will eliminate the COVID-19 virus on surfaces. The list includes products containing toxic chemicals, such as chlorine bleach, peroxyacetic acid, quaternary ammonium compounds or "quats," sodium dichloro-s-triazinetrione, and hydrochloric acid. Exposure to these chemicals are associated with a long list of adverse effects, from asthma to cancer.[17,18] Avoid products containing:

- ⊗ Peroxyacetic acid (peracetic acid)[19]
- ⊗ Chlorine compounds (sodium hypochlorite, hypochlorous acid, sodium chlorite, sodium chloride[20])
- ⊗ Sodium Dichloro-S-Triazinetrione
- ⊗ Quaternary Ammonium compounds (quats)
- ⊗ Iodine[21]
- ⊗ Phenolic compounds
- ⊗ Glycolic acid
- ⊗ Octanoic acid[22]
- ⊗ Potassium peroxymonosulfate[23]
- ⊗ Ammonium carbonate[24]
- ⊗ Ammonium bicarbonate[18]
- ⊗ Silver[25]
- ⊗ Glutaraldehyde[26]

All of these ingredients are associated with harm to the respiratory system.[27,28,29,30,31,32] In addition, some quats have been shown to cause mutations, lower fertility, and increase antibiotic resistance.[33] Phenolic compounds include a wide range of toxic chemicals, including cresols, hexachlorobenzene, and chlorophenols. Health effects from breathing or exposure to the skin include headaches, burning eyes, muscle tremors, skin burns, irregular heartbeat, severe injury to heart, liver, kidneys, and lungs, cancer, and death.[34,35]

STAY SAFE

It is important during public health emergencies involving infectious diseases to scrutinize practices and products very carefully so that hazards presented by the crisis are not elevated because of the unnecessary threat introduced with toxic chemical use.

Updated 4/23/2020.

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[1] New York Times, April 22, 2020. As Coronavirus Spreads, Poison Hotlines See Rise in Accidents With Cleaning Products, https://www.nytimes.com/2020/04/21/health/coronavirus-poison-hotlines-rise-in-accidents-disinfectants.html.

[2] https://www.fda.gov/drugs/information-drug-class/qa-consumers-hand-sanitizers-and-covid-19.

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[3] Pall Thordarson, 2020. The science of soap – here's how it kills the coronavirus. https://www.theguardian.com/commentisfree/2020/mar/12/science-soap-kills-coronavirus-alcohol-based-disinfectants. See also: https://www.youtube.com/watch?v=K2pMVimI2bw&feature=youtu.be.

[4] https://www.cdc.gov/coronavirus/2019-ncov/hcp/hand-hygiene-faq.html.

[5] CDC Statement for Healthcare Personnel on Hand Hygiene during the Response to the International Emergence of COVID-19. https://www.cdc.gov/coronavirus/2019-ncov/infection-control/hcp-hand-sanitizer.html.

[6] https://prhe.ucsf.edu/sites/g/files/tkssra341/f/Fact%20Sheet_Information%20for%20Workers.pdf.

[7] Choi, H.Y., Lee, Y.H., Lim, C.H., Kim, Y.S., Lee, I.S., Jo, J.M., Lee, H.Y., Cha, H.G., Woo, H.J. and Seo, D.S., 2020. Assessment of respiratory and systemic toxicity of Benzalkonium chloride following a 14-day inhalation study in rats. *Particle and Fibre Toxicology*, *17*(1), p.5. https://link.springer.com/article/10.1186/s12989-020-0339-8

[8] Herron, J.M., 2019. The Effects of Benzalkonium Chloride Disinfectants on Lipid Homeostasis and Neurodevelopment (Doctoral dissertation).

[9] Kim, M., Weigand, M.R., Oh, S., Hatt, J.K., Krishnan, R., Tezel, U., Pavlostathis, S.G. and Konstantinidis, K.T., 2018. Widely used benzalkonium chloride disinfectants can promote antibiotic resistance. *Applied and environmental microbiology*, *84*(17), pp.e01201-18.

[10] Lachenmeier, D.W., 2016. Antiseptic Drugs and Disinfectants. In *Side Effects of Drugs Annual* (Vol. 38, pp. 211-216). Elsevier.

[11] https://www.cdc.gov/coronavirus/2019-ncov/hcp/hand-hygiene-faq.html.

[12] https://www.cdc.gov/coronavirus/2019-ncov/prevent-getting-sick/cleaning-disinfection.html.

[13] Kampf, G., Todt, D., Pfaender, S. and Steinmann, E., 2020. Persistence of coronaviruses on inanimate surfaces and its inactivation with biocidal agents. *Journal of Hospital Infection*.

[14] https://www.epa.gov/pesticide-labels/design-environment-logo-antimicrobial-pesticide-products.

[15] Inhalation risk is low because dodecylbenzenesulfonic acid is applied using large, non-respirable droplet sizes in order to be effective. (European Chemicals Agency dossier.)

[16] https://www.epa.gov/pesticide-registration/list-n-disinfectants-use-against-sars-cov-2. Unlike other pesticides, EPA must verify the efficacy of disinfectants. EPA says that these have been shown to be effective against SARS-CoV-2, the cause of COVID-19, by demonstrated efficacy against a harder-to-kill virus or demonstrated efficacy against another type of human coronavirus similar to SARS-CoV-2.

[17] https://prhe.ucsf.edu/sites/g/files/tkssra341/f/Fact%20Sheet_Information%20for%20Workers.pdf.

[18] Agency on Toxic Substances and Disease Registry, 2008. ToxFAQs for Chlorophenol. https://www.atsdr.cdc.gov/toxprofiles/tp107-c1.pdf.

[19] Peracetic acid is on EPA's DfE list, but is considered to pose an asthma risk.

[20] Sodium chloride as listed by EPA is actually hypochlorous acid

[21] ZZZ Disinfectant SDS https://cleaningsolutions.delaval.com/wp-content/uploads/2018/07/ZZZ-Disinfectant-2056-SDS_EN.pdf; ZZZ Disinfectant Label https://www3.epa.gov/pesticides/chem_search/ppls/004959-00016-20170614.pdf.

[22] Octanoic acid is listed on EPA's Safer Chemical Ingredients List under surfactants, which are listed based on environmental toxicity and biodegradation. But it is corrosive to skin https://echa.europa.eu/registration-dossier/-/registered-dossier/15370/7/3/1.

[23] SDS: Potassium peroxymonosulfate, Santa Cruz Biotechnology, Inc. http://datasheets.scbt.com/sc-253223.pdf.

[24] Actually Didecyldimethyl ammonium carbonate, a quaternary ammonium compound. Label: https://www3.epa.gov/pesticides/chem_search/ppls/009402-00014-20141020.pdf, Didecyl Dimethyl Ammonium Carbonate and Didecyl Dimethyl Ammonium Bicarbonate; Exemption From the Requirement of a Tolerance https://www.federalregister.gov/documents/2012/08/22/2012-20663/didecyl-dimethyl-ammonium-carbonate-and-didecyl-dimethyl-ammonium-bicarbonate-exemption-from-the

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[27] https://prhe.ucsf.edu/sites/g/files/tkssra341/f/Fact%20Sheet_Information%20for%20Workers.pdf.

[28] Holm, S.M., Leonard, V., Durrani, T. and Miller, M.D., 2019. Do we know how best to disinfect child care sites in the United States? A review of available disinfectant efficacy data and health risks of the major disinfectant classes. *American journal of infection control*, *47*(1), pp.82-91.

[29] Agency on Toxic Substances and Disease Registry, 2008. ToxFAQs for Phenol. https://www.atsdr.cdc.gov/toxfaqs/TF.asp?id=147&tid=27.

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[31] Glycolic acid MSDS. https://www.cdhfinechemical.com/images/product/msds/18_352140617_GlycolicAcid-CASNO-79-14-1-MSDS.pdf.

[32] European Chemicals Agency (ECHA), Octanoic Acid Registration Dossier. https://echa.europa.eu/registration-dossier/-/registered-dossier/15370/7/3/1

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[35] Agency on Toxic Substances and Disease Registry, 2008. ToxFAQs for Chlorophenol. https://www.atsdr.cdc.gov/toxprofiles/tp107-c1.pdf.