Disinfection of Inanimate Surfaces and Equipment

October 19, 2020

SCOPE
This document will serve as guidance on efficacy of disinfectants against SARS-CoV-2. In particular, steps to determine the effectiveness of ready-to-use disposable, germicidal wipes (e.g. PDI). The WHO recommendation states: “to ensure that environmental cleaning and disinfection procedures are followed consistently and correctly. Thoroughly cleaning environmental surfaces with disinfectants approved by the healthcare facility are effective and sufficient procedures.” (WHO, 2020)

Coronaviruses are a lipid enveloped virus, which means they are surrounded by an envelope of lipoprotein in addition to the usual core of nucleic acid surrounded by a coat of protein. Coronaviruses are generally easily inactivated by many types of disinfectants and are among the most susceptible (See Figure 1). The types of disinfectants effective against coronavirus are considered low-level disinfectants. Low-level disinfectants are capable of destroying vegetative bacteria (except tubercle bacilli), lipid viruses, some nonlipid viruses, and some fungi, but not bacterial spores (i.e. Clostridiodes difficile).

PERSON-TO-PERSON SPREAD
The virus is thought to spread mainly from person-to-person:
- Between people who are in close contact with one another (within about 6 feet).
- Through respiratory droplets produced when an infected person coughs, sneezes or talks.
- These droplets can land in the mouths or noses of people who are nearby or possibly be inhaled into the lungs.
- Some recent studies have suggested that COVID-19 may be spread by people who are not showing symptoms. Maintaining good social distance (about 6 feet) is very important in preventing the spread of COVID-19.

SPREAD FROM CONTACT WITH CONTAMINATED SURFACES OR OBJECTS
It may be possible that a person can get COVID-19 by touching a surface or object that has the virus on it and then touching their own mouth, nose, or possibly their eyes. This is not thought to be the main way the virus spreads, but we are still learning more about this virus. CDC recommends people practice frequent “hand hygiene,” which is either washing hands with soap or water or using an alcohol-based hand rub. Frequent disinfection of surfaces in the room of a PUI or those with COVID19 and equipment is important to minimize risk of indirect contact transmission.

STEPS TO ASSESSING EFFICACY OF SURFACE DISINFECTANTS AGAINST SARS CoV 2:
1. The U.S. EPA has published and maintains a list of disinfectants effective against SARS CoV 2. For the most up to date roster of these, visit EPA website at the following URL: https://www.epa.gov/pesticide-registration/list-n-disinfectants-use-against-sars-cov-2.
2. If asked about a disinfectant that is not on List N, apply the following using HICPAC Disinfection and Sterilization guideline, 2008.
   a. Factors that affect the efficacy of disinfection include number and location of microorganisms, the resistance of the microorganisms, the concentration and potency of disinfectants, physical and chemical factors (i.e. temperature and humidity, etc.), the presence of organic and inorganic matter, and the duration of exposure.
b. In the United States, the principal standard used to determine the effectiveness of an antiseptic is a 3 log10 reduction of that microbes once exposed to the antiseptic or disinfectant.
   - Determine minimum contact time for any disinfectant proposed as a substitution for usual product in the event there is a shortage.

c. Verify the proposed product has an EPA registration number and review IFUs as well as any limits on compatibility of the disinfectant with surface material.

d. Multiple investigators have demonstrated the effectiveness of low-level disinfectants against vegetative bacteria (e.g., Listeria, E. coli, Salmonella, VRE, MRSA), yeasts (e.g., Candida), mycobacteria (e.g., M. tuberculosis), and viruses (e.g., poliovirus) at exposure times of 30–60 seconds.

e. If the proposed product has been tested and is effective against other lipid enveloped viruses, e.g. influenza, Herpes simplex, etc., it is logical that it will be effective against SARS CoV 2.

Items must be exposed to the germicide for the appropriate minimum contact time.

Figure 1 shows the relative resistance of pathogens to disinfection and sterilization by many classes of bacteria and viruses. Point of note, coronaviruses are considered at the lower end of the spectrum suggesting they are susceptible to most antiseptics and disinfectants. Source: HICPAC, CDC. Disinfection and Sterilization Guideline, 2008.

![Figure 1](image)

The active ingredient in many of the PDI wipes is quaternary ammonium and isopropyl alcohol (IPA). This product can effectively disinfect or inactivate 30 microorganisms on many surfaces found in the healthcare environment. These surfaces include hard nonporous surfaces of: bed railings, blood glucose meters (glucometers), cabinets, carts, chairs, counters, dental unit instruments trays, exam tables, gurneys, isolettes, IV poles, stethoscopes, stretchers, tables, telephones, toilet seats, diagnostic equipment, patient monitoring equipment, patient support and delivery equipment, and others.

If supply of PDI wipe commonly used is running short, other suitable products can be identified. Make sure your ministry's Supply Chain alerts you when they anticipate an alternative surface disinfectant is needed in place of the usual product(s). A study, by Sattar et al. (1989), evaluated the efficiency of 15 antiseptics-disinfectants of various chemical families on four different viruses: two non-enveloped viruses (type b-coxsackievirus and type 5-adenovirus) and two enveloped viruses (HCoV 229E and type 3-
parainfluenzavirus). This study highlighted the fact that enveloped viruses are more sensitive than non-enveloped viruses to the action of antiseptics-disinfectants.

Figure 2

Although SARS-CoV2 is not listed in Figure 2, it is classified among the enveloped viruses shown in the bottom of the table. Common household products were assayed against murine hepatitis virus (MHV), a proposed surrogate for SARSCoV, to determine the effectiveness of viral inactivation and it was shown to be effective.

Common household products have been tested against MHV, a proposed surrogate for SARS-CoV, to determine the effectiveness of viral inactivation. Antiseptic antiviral activity of common household disinfectants or antiseptics (Table 3), containing either 0.05% of triclosan, 0.12% of chloroxylene, 0.21% of sodium hypochlorite, 0.23% of pine oil, or 0.10% of a quaternary compound with 79.0% of ethanol, were investigated. All of them provided at least a 3 log10 reduction in viral titers within a 30 sec contact time, which is consistent with the previous results [Dellano, 2009].

Table 3

<table>
<thead>
<tr>
<th>Product</th>
<th>Contact time</th>
<th>MHV dried plate recovery</th>
<th>Virus present in any wells</th>
<th>Average CPE (because of toxicity of product)</th>
<th>Average log reduction</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.10% Allyl dimethyl benzyl ammonium saccharinate with 79% ethanol</td>
<td>30 seconds (s)</td>
<td>6.20P</td>
<td>No</td>
<td>≤3.20</td>
<td>≥3.00*</td>
<td>Effective</td>
</tr>
<tr>
<td>0.12% PCMX</td>
<td>30 s</td>
<td>6.36</td>
<td>No</td>
<td>≤2.20</td>
<td>≥4.40</td>
<td>Effective</td>
</tr>
<tr>
<td>0.21% Sodium hypochlorite</td>
<td>30 s</td>
<td>6.60</td>
<td>No</td>
<td>≤2.60</td>
<td>≥4.20</td>
<td>Effective</td>
</tr>
<tr>
<td>0.05% Triclosan</td>
<td>30 s</td>
<td>6.85P</td>
<td>No</td>
<td>≤2.52</td>
<td>≥4.34*</td>
<td>Effective</td>
</tr>
<tr>
<td>0.23% Pine oil</td>
<td>30 s</td>
<td>6.43</td>
<td>No</td>
<td>≤2.43</td>
<td>≥4.23</td>
<td>Effective</td>
</tr>
</tbody>
</table>

CPE, cytopathogenic effect; MHV, murine hepatitis virus; PCMX, parachlorometaxylenol.

*Test procedure performed using sephadex columns for test replicates and controls.

CONCLUSIONS

Many PDI wipes are effective for the cleaning of surfaces contaminated by SARS-CoV. In a shortage of PDI wipes, alternative wipes containing similar disinfection properties will also be effective.
Refer to the EPA List N (Page 4 and Page 11) of Disinfectants for Coronavirus (COVID-19) for the most recent list of disinfectants effective against SARS-CoV-19.

There is also a list of disinfectants available to MercyOne acute care ministries on the COVID-19 Resources site. Medical groups, physician offices and all other Health Ministries should work with their environmental services providers or supply chain teams to determine disinfectants available.

REFERENCES