of contagion higher than expected. In our opinion, there is very little warning regarding this subject from public-health experts.

In fact, it has been shown that MP could be colonized by microorganisms, including bacteria, fungi[2,3] and even RNA viruses,[4] as it could be the case with the SARS-CoV-2 which is also an RNA virus. Some authors have proposed that MP had amplified previous virus outbreaks like Ebola.[5] SARS-CoV-2 is not an exception. In fact, it has been shown that this new virus can persist on inanimate surfaces like metal, glass, or plastic for up to 9 days.[1] Due to their excessive use,[6] added to the fact that they are rarely cleaned after handling, MP could become a source of virus transmission through repetitive cyclic hand-face contamination.[7] In addition, health care professionals do frequently use MP during their shifts, searching for medical information that could help them in their daily work. This could also be a source of nosocomial infection even in intensive care units.[3,8]To our knowledge, no study has yet addressed the issue related to SARS-CoV-2 transmission through MP. It could indeed explain an important part in the transmission of the infection to patients who claim adopting recommended safety measures.

Hence, several measures should be endorsed to tackle the MP-related SARS-CoV-2 transmission risk. Disinfection with bactericidal wipes adapted to MP could not be completely effective, and specific sanitization protocols should be developed especially for health care workers.[3] Until then, it is crucial during the deconfinment phase to educate the population to limit the use of MP as much as possible, especially in public places and health care institutions. To our opinion, this procedure should be included in the recommended safety measures that are widely broadcasted through the media and science information thread.

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Microbicidal actives with virucidal efficacy against SARS-CoV-2

To the Editor,

Given the practical importance of microbicides having efficacy against SARS-CoV-2 in home, community, and health care settings, we report evidence of the virucidal efficacy of a number of formulated microbicidal actives against SARS-CoV-2, as evaluated per ASTM International[1,2] and EN[3] standards.

Dissemination of SARS-CoV-2 from infected to susceptible individuals is believed to occur directly, via respiratory droplets and droplet nuclei/aerosols, and indirectly through contaminated high-touch environmental surfaces (HITES).[4] SARS-CoV-2 has been reported to remain infectious on contaminated HITES for hours to days,[5] allowing for onward self-infection of new individuals when contaminated hands come into contact with susceptible tissues (mucous membranes of the nose, eyes, and mouth). This *Droplets-HITES-Hands* nexus[6] is central to the chain of infection with SARS-CoV-2, and highlights the critical role that targeted application of effective microbicides against potentially contaminated HITES and hands plays in infection prevention and control during the ongoing COVID-19 pandemic.

Fortunately, enveloped viruses such as SARS-CoV-2 are among the most susceptible of pathogens to formulated microbicidal actives and detergents (including personal care soaps and liquid hand washes).[7,8] Inactivation of such viruses by formulated microbicidal actives and detergents is believed to occur as a result of disruption of the virally modified, host-cell-derived, phospholipid bilayer glycoproteinaceous envelope, and the associated spike glycoproteins that interact with the angiotensin-converting enzyme receptor required for infection of host cells.[8]

Virucidal efficacy of a selection of formulated microbicidal actives against SARS-CoV-2 has, to date, been assumed based on efficacy data obtained using other coronaviruses[8,9] or, as reported recently,[5] based on nonstandardized methods of assessing viral inactivation (ie, $\log_{10}$ reduction in infectious titer) in suspension without details of the testing method used including appropriate controls. To date, virucidal activity against SARS-CoV-2 has not been demonstrated definitively through testing conducted per standardized surface[2] and suspension[1,3] methodologies. In Table 1, we provide definitive evidence of efficacy for inactivation of SARS-CoV-2, on contaminated prototypic HITES and suspensions, of products formulated with the following microbicidal actives: ethyl alcohol, para-chloro-meta-xylenol, salicylic acid, and quaternary ammonium compounds. All of the microbicidal actives were effective for inactivating SARS-CoV-2, demonstrating ≥3.0 to ≥4.7 $\log_{10}$ reduction of infectious virus within the tested 1 to 5 minutes contact time in virucidal efficacy testing conducted per applicable ASTM International and EN standards.

To our knowledge, this is the first report of the virucidal efficacy of formulated microbicidal actives, determined using industry/regulatory-relevant global standardized (ASTM International, EN) methodologies, for inactivating SARS-CoV-2. Products formulated with the microbicidal actives studied here should be useful for healthcare workers, researchers, and the public at large as critical interventions for infection prevention and control of SARS-CoV-2 and the ongoing COVID-19 pandemic.

Table 1
Virucidal efficacy of formulated microbicidal actives against SARS-CoV-2*

Product type	Active ingredient concentration		Temperature (°C)	Contact time (minutes)	Log_{10} reduction in infectious SARS-CoV-2 titer achieved
	In product	Tested			
Tested per ASTM E1052-20 or EN 14476:2013+A2:2019 on SARS-CoV-2 in suspension studies with a 5% FBS organic load					
Antiseptic liquid†	4.7% w/v	0.094% w/v PCMX (tested at 1:50 of supplied)	21	5	≥4.7
Hand sanitizer gel†	61% w/w	49% w/w ethanol (tested at 1:1.25 of supplied)	21	1	≥4.2
Liquid hand wash‡	0.10% w/w	0.025% w/w salicylic acid (tested at 1:4 of supplied)	37	1	≥3.1
Bar soap‡	0.11% w/w	0.018% w/w PCMX (tested at 1:6.25 of supplied)	38	1	≥3.0
Surface cleanser†	0.096% w/w	0.077% w/w QAC§ (tested at 1:1.25 of supplied)	21	5	≥4.1
Tested per ASTM E1053-20 on SARS-CoV-2 dried on a glass surface with a 5% FBS organic load					
Disinfectant wipes‖	0.19% w/w	0.19% w/w QAC¶ (tested as supplied)	21	2	≥3.5, ≥3.5, ≥3.5
Disinfectant spray‖	50% w/w ethanol 0.083% w/w QAC	50% w/w ethanol 0.083% w/w QAC# (tested as supplied)	21	2	≥4.6, ≥4.7, ≥4.5

FBS, fetal bovine serum; *PCMX*, para-chloro-meta-xylenol; *QAC*, quaternary ammonium compound; *SARS-CoV-2*, severe acute respiratory syndrome coronavirus 2 (isolate USA-WA1/2020, obtained from CDC through BRI Resources), *w/v*, weight to volume; *w/w*, weight to weight.
*Virucidal efficacy testing was conducted by Microbac Laboratories, Inc (Sterling, VA). The test cells were Vero E6, an African green monkey kidney cell obtained from American Type Culture Collection (ATCC CRL-1586). The growth medium was minimal essential medium supplemented with 5% FBS, L-glutamine, and antibiotics.
†Tested using EN 14476:2013+A2:2019 methodology.[3]
‡Tested using ASTM E1052-20 methodology.[1]
§Alkyl dimethyl benzyl ammonium chloride (C12-16).
‖Where multiple values are displayed, this reflects the testing of multiple independent lots of the formulated microbicidal actives.
¶Alkyl (50% C14, 40% C12, 10% C16) dimethyl benzyl ammonium chloride.
#Alkyl (50% C14, 40% C12, 10% C16) dimethyl benzyl ammonium saccharinate.

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