



Review Article

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The effect of chlorine, and alcohol on SARS-CoV-2

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ABSTRACT

Coronavirus disease COVID-19 pandemic has imposed a reality that requires us to protect ourselves from infection, especially as the disease is highly infectious and has no specific treatment. Disinfectants are one of the most important ways to prevent the virus, specifically chlorine and alcohol-based hand sensitizers. This study aims to discuss the efficacy of both alcohol disinfectants and chlorine on the Coronavirus, and that discussion led us to the conclusion that both have an effective role in killing the virus in close proportion if used in the required circumstances and in the right way. Alcohol can also be used to make hand rubs, because of its short duration of action, and reduced side effects. Chlorine can be used to disinfect many types of surfaces and facilities due to its dangerous adverse effects on humans.

Keywords: Coronavirus, COVID-19, Chlorine, alcohol

INTRODUCTION

Since the advent of coronavirus in 2019 in Wuhan, China, it has claimed a large number of lives a day. According to the World Health Organization situation report of August, the number of new cases has broken the 18 million barriers and the number of deaths was 696 147. ¹ At first, there was a widespread belief that Covid-19 only attacks the respiratory system. However, with the increase in studies focusing on the mechanism of infection, it has been discovered that the virus affects not only the lungs, but also different systems of the human body,

because the Coronavirus uses the receptor ACE2 as a gateway, and this gate is present in most parts of the body. ²

On the other hand, it has dangerous tragic outcomes, as an example of which we are currently witnessing as a result of the COVID-19 pandemic. Nowadays, all the global efforts are set in pandemic response, most notably disinfection campaigns for public utilities and homes. ³

Disinfection is cleaning objects to eliminate pathogenic organisms often using chemicals. ⁴ So, to

achieve an effective process, the basic pillar is the disinfectant. Many campaigns promoted and developed hands hygiene through a study of the types of disinfectant most acceptable among the target community. The study concluded that the use of alcohol disinfectants should be enhanced, as it is highly acceptable and effective in the cleanliness of the hands.⁵ Unfortunately, as these campaigns increase, many misconceptions about hygiene and choosing the type of strong disinfectants are increasing, with some people using hot water or weak detergents to clean the house. From the point of view of correcting concepts, hot water and detergent have no role in getting rid of the microbes of the house, though it is negligible. People should replace those disinfectants with one that is proven effective in combating a wide spectrum of pathogens, and even those that must be handled properly for maximum benefit.⁶

Since the appearance of the COVID-19 pandemic, the leading role of antiseptics and hand cleanliness in controlling infection has emerged. In addition, many routes of cleaning and disinfection have flapped on the surface. People are at a loss which of these are the best?

So, we need to determine how commonly used disinfectants effect and place the most powerful on the top. In this review, we are involved in discussing the effectiveness of two of the most prominent disinfectants used, chlorine, and alcohol. For the first time, we will compare the impact of the above-mentioned disinfectants on SARS-CoV-2 in many comparative areas that are necessary to illustrate their advantages and disadvantages.

By this paper, we seek to provide scientific-based guidance on chlorine and alcohol disinfectants, the correct way to use them, and the harmful effects of excessive consumption, so that the principle of infection control is optimally achieved.

Effect of chlorine on SARS-CoV-2

Naturally, chlorine is in the form of toxic gas and this is why it melds in water to remove its toxicity. In addition, it is found in the form of liquid, which is called sodium hypochlorite (bleach) and is found in the form of a powder called calcium hypochlorite

Chlorine is used in its gaseous and liquid shape and both act as a powerful oxidizing substance. Chlorine gas is decomposed in water to produce hypochlorous acid and the latter is a weak acid that dissolves into a proton and hypochlorite ions. Hypochlorous acid is a powerful primary disinfectant that works efficiently in an acidic environment and is more effective than hypochlorite, which works best in alkaline ones.⁷

Sodium Hypochlorite is the result of sodium cation union with hypochlorite anion, usually used to disinfect houses and healthcare facilities and is known as bleach. Its use in disinfection varies depending on where and how you use it. When sodium hypochlorite is used for hand washing, it can be used at 0.05% or 0.25% concentration, where a study found that its use with previous concentrations can dispose of 96.62% and 99.98% of the virus, respectively.⁸ When used to efficiently remove the virus from different types of surfaces, it is used at 0.1% concentration for one minute (table-1).^{9,10}

Effect of alcohol on SARS-CoV-2

Alcohol-based hand sanitizers (ABHS) have been utilized as an effective alternative to hand washing to prevent transmission of the enveloped virus.

Hand-sanitizer preparations containing alcohol include ethanol, isopropyl alcohol, n-propanol, or a combination of these, as well as excipients and humectants. Solutions containing alcohols between 60 - 95% in the volume are most prevalent and effective. Humectants are included to prevent skin dehydration and excipients help stabilize the product as well as prolong the time needed for the evaporation of alcohol, thereby increasing its biocidal activity.¹¹

Disinfectants with alcohol are more irritating than those with benzalkonium chloride, though more recent evidence suggests it may cause contact dermatitis less often than previously thought. The use of humectants, moisturizers, and/or emollients in combination with alcohol-based sanitizers allows for effective hand hygiene without irritating the skin. Although (ABHS) is less user-friendly on the skin, it predominates in healthcare settings given its low cost and efficacy of reducing infection transmission.¹¹

A study in 2017 reported that Zika virus, Ebola virus, severe acute respiratory syndrome coronavirus, and the Middle East respiratory syndrome coronavirus and other enveloped viruses were all efficiently killed by two alcohol-based formulations, one containing ethanol 80% (v/v) and the second containing isopropyl alcohol 75% (v/v), which recommended by the WHO.¹² These data confirm that ABHSs can be successfully used as an effective infection preventive measure during viral outbreaks.

A recent study reveals that both commercial alcohols and the WHO-recommended alcohol-based hand rubs can effectively inactivate SARS-CoV-2, the virus responsible to cause COVID-19.¹³

Strikingly, one of these two, ethanol or 2-propanol, can eliminate the virus within 30 seconds at the lowest concentration equals or more than 30%.¹¹ This provides strong evidence to support the use of

ABHS amid the COVID-19 outbreak. The efficacy of alcohols in hand sanitization is also dependent on various other factors, such as the quantity applied to

the hands (the dose), the exposure time, and the application/rubbing technique (Table 1).

Table 1. A comparison of chlorine, and alcohol in terms of impact on SARS-CoV-2

Aspect of comparison	Chlorine	Alcohol
Substance	Sodium hypochlorite, or calcium hypochlorite	In the healthcare setting, “alcohol” refers to ethyl alcohol and isopropyl alcohol. ¹⁴
Mechanism of action	There's no specific mechanism, but oxidation hydrolysis and deamination reactions have the potential to affect the virus ¹⁵ .	It damages vital components of the virus such as the envelope, the protein capsid, and genetic agent. However, the final mechanism is still not well understood. ^{16, 17}
Duration of action	30minutes of contact time minimum, at pH<8.0. ¹⁸	Ethanol and 2 propanol disrupt the virus with a concentration above 30% in half a minute. ¹³
Effective concentration	0.1% for general environmental use. ¹⁹	According to WHO remedies, the effective disinfectant contains 80% ethanol, 1.45% glycerine, and 0.125% hydrogen peroxide (1 st formula). Or 75% isopropanol, 1.45% glycerine, and 0.125% hydrogen peroxide (2 nd formula).
Degree of effectiveness	More than 3 log10 inactivation of human coronavirus.	The first formula had inactivation power of >3.8, and the modified first formula had >5.9. The second formula had a log10 reduction of >3.8, and the modified second formula had a log10 reduction of >5.9.
Side effects due to high concentration	<ol style="list-style-type: none"> 1. Metal corrosion, and skin or mucous membrane sensitivity. 2. Immediate symptoms: Blurred vision, Burning pain, redness, and vesicles on exposed skin. 3. Skin lesions resemble frostbite 4. Liquid chlorine: burning sensation in the 5. Nose, throat, and eyes, cough, chest compression, or dyspnea. 6. Pulmonary edema 7. Nausea and vomiting 8. Lacrimation 9. Wheezing. 	1. Dry skin ²⁰⁻²³

DISCUSSION

Since the emergence of the Corona pandemic in Wuhan, Hubei Province in 2019, the need for appropriate disinfectants such as chlorine and alcohol sensitizers to combat the disease has increased.

Both alcohol and chlorine of both liquid and powder types have a high capacity to kill the virus, although their work mechanism is different, which means that both are potent disinfectants. But alcohol is superior to its equivalent, as it can eliminate a wide spectrum of viruses.

Also, alcohol is superior to the time required to kill the organism, completing the task in just 30 seconds compared to chlorine, which takes 30

minutes. We can infer that we can use alcohol compounds as antiseptics, or if we want an effective and rapid result. This vast difference in time can be explained by the fact that chlorine needs other factors to function optimally, including Water that is required to be pure, pH less than 8.0, and the exact correct concentration is used. All of these can be seen as obstacles if they are not available. On the other hand, alcohol disinfectants are usually made ready for use and do not require other helpers.

As for effectiveness degree, the results seemed close and we can only prefer one by adding a comparative aspect, the side effects, where the vast majority of the adverse reactions fall under chlorine

compared to the alcohol for which little has been recorded, and all of which do not exceed the skin damage. From the previous point, we infer that we can use chlorine to disinfect various types of surfaces, public utilities, and health facilities. On the other hand, the limited side effects enhance the use of alcohol disinfectants for personal purposes.

Compared to another study, it was found that the alteration of the disinfection protocols to use chlorine harmed surfaces, as they noted that their damage rate had accelerated. In addition, although the infection of water by the virus has not been proven, WHO instructions have urged chlorinated water to avoid infection, the latter has proved to be highly effective, and the virus can remain active in untreated water for 48 hours.²⁴⁻²⁶

In terms of alcohol use elsewhere, it has been proven that spraying it to disinfect air, vehicles, and people is useless and that some of the alcohol used may have a negative effect. While the use of alcohol in surface cleaning has proven effective in eliminating coronary viruses in just two minutes.²⁴⁻²⁹

CONCLUSION

Chlorine and alcohol can destroy and kill Covid-19. However, contrary to the power of each and its side effects.

Conflicts of Interest

All contributing authors declare no conflicts of interest.

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None

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