



## HAND HYGIENE – AN EFFECTIVE PREVENTIVE MEASURE AGAINST COVID-19

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### ABSTRACT

As healthcare organizations scramble to find out the definitive cure for corona virus, organizations like World Health Organization and Centers for Disease Control and Prevention laid the foundation of the preventive measures against the deadly virus. Hand hygiene is the single most important preventive measure. Simply washing hands for 20 seconds following the five steps and seven techniques of hand hygiene can protect an individual from catching the deadly virus. The most commonly used are beauty and antibacterial soaps. All soaps function similarly, by creating a micelles around the pathogen and removing it from the surface of the skin. Moreover analysis should be done regarding the use of hand sanitizers as a replacement of soap and water in wading off COVID-19. During this global pandemic, public health specialists should promote preventive measures for COVID-19 as the public undermines the most important preventive measure i.e. hand washing.

**KEYWORDS:** COVID-19, Hand Hygiene, Hand Washing, Infection prevention, Infection control.

### INTRODUCTION

The coronavirus disease 2019 (COVID-19) is a highly contagious infectious disease caused by a new strain of coronavirus, an enveloped, single-stranded RNA virus. This pandemic has claimed more than three million lives since the outbreak first began in December 2019.<sup>[1]</sup> Unavailability of a vaccine and the lack of a definitive cure against this disease makes it imperative that measures set in place to slow the rate of spread of the infection are strictly followed.<sup>[2]</sup>

Adequate hand hygiene is a crucial method to prevent an individual from getting infected.<sup>[3]</sup> However, with the availability of multiple types of soap, with each type being manufactured by numerous brands using different ingredients, it is essential to understand the mechanism of action of soap and to assess whether a particular type of soap is more effective in decontamination. Additionally, with hand sanitizers being a popular alternative to conventional hand washing with soap and water, it is important to analyze its effectiveness against coronavirus, and to assess which method is superior in disinfecting hands.

#### How do soaps work?

Soaps are primarily composed of a mixture of fat/oil, water, and an alkaline salt. While water alone can, to a

reasonable extent, remove grease, dirt, and microbes off of hands, soap increases the overall effectiveness in accomplishing this task. It does this by acting as an emulsifying agent, due to its ingredients that have both a hydrophilic, polar carboxylate head, as well as a hydrophobic, nonpolar hydrocarbon chain in its structure (Figure: 1). When used for hand washing, the nonpolar hydrocarbon chain interacts with the nonpolar grease and dirt, breaking up its molecules, and forming a micelle (Figure: 2) which holds the soiling molecules in the center, while the polar, negatively charged carboxylate head interacts with the water molecules, allowing it to be washed away.<sup>[4]</sup>

Most viruses have an outer lipid envelope made from the phospholipids and proteins from its host, along with some viral glycoproteins. This lipid envelope is especially sensitive to the emulsifying effects of soap. The dissolution of the outer layer destroys the ability of the virus to infect an individual. Additionally, the emulsified micelles containing the virus are also washed off from the hands after rinsing with water.<sup>[5]</sup>

#### Basic Ingredients of soaps

Soap is primarily made of animal, or vegetable fats/oils (composed of triglycerides), that have been treated by an alkaline solution. Commonly used alkalis are sodium,

and potassium hydroxide for bar, and liquid soaps, respectively. The different lathering and washing properties of soaps depend on the fatty acids that make up the triglycerides, for example, Lauric acid, Palmitic acid, and Oleic acid. Common ingredient of soap include Sodium Palm Kernelate, Aqua, Glycerin, Perfume, Tetrasodium EDTA, Palm Kernel acid, Sodium Chloride, Sodium Sulfate and Pigments.<sup>[6]</sup>

### Types of soaps

While there are multiple ways of classifying the types of soaps, a common method to do so is based on the usage of soap, which broadly categorizes it into Toilet soaps (bathing soap), Non-toilet soaps, Glycerin soaps and Transparent soaps.<sup>[7]</sup>

### Analysis of toilet soaps and bathing soaps

Antibacterial soaps and beauty soaps are the most commonly used toilet soaps in households around the world. While base ingredients like Sodium Palmate, Glycerin, Tetrasodium EDTA, and Lauric Acid are the same, each of the four samples of soap we analyzed had a variety of distinct ingredients that affect its ability to disinfect hands. Table I illustrates the analysis of soaps and their unique ingredients.

Ingredients like Tetrasodium Etidronate, Cocamidopropyl Betaine, and Sodium Stearate in beauty soaps B1 and B2 enhance its stability and ability to form foam. The antibacterial soaps A1, and A2, along with ingredients like Cyclodextrin, Sodium C14-16 Olefin Sulfonate, and VP/VA Copolymer that stabilize the structure of the soap and improve its ability to form a foam, also contained ingredients like silver oxide, thymol, and triclocarban that have bactericidal effects. None of these ingredients, however, have a unique effect on the destruction of viruses; the antiviral properties of soap are solely determined by the basic ingredients found in all types of soap.

### How do hand sanitizers work?

A hand sanitizer is a liquid or gel-based product that is used as an antiseptic agent. Its active agent depends on its type, i.e., ethanol, isopropanol, or n-propanol in alcohol-based, and benzalkonium chloride or triclosan in non-alcohol based hand sanitizers.

Alcohol-based sanitizers work by denaturing the proteins of pathogens. However, they are only effective if their alcohol content is at least 60%.<sup>[8]</sup> Hand sanitizers have the advantage of not requiring water to disinfect, making it a convenient option when water is not readily available. Additionally, they require less time to decontaminate hands, as compared to soap and water. It is important to note that they are ineffective against bacterial spores and protozoan oocysts, and their ability to kill viruses varies in different families of viruses.<sup>[9,10]</sup>

A study by Swiss and German researchers found that alcohol-based hand sanitizers if made according to the

two original, and the two modified formulation recommendations of the World Health Organization (WHO) are effective in destroying coronaviruses, reducing viral titers to background levels in 30 seconds.<sup>[11-13]</sup> The recommended volume by the WHO, to ensure that the coronavirus is effectively destroyed, is to apply a coin-sized amount on your hands, thoroughly spreading it to ensure all surfaces of the hand are decontaminated.<sup>[3]</sup>

### Evidence based approach to hand hygiene

Studies have shown that there is no difference in the number of bacteria, and therefore, no additional health benefits, with the use of antibacterial soaps when compared to toilet soap.<sup>[14]</sup> They also showed that the duration of hand washing, and the volume of soap used, determined a decrease in bacterial counts. Hence, one should always wash their hands for a minimum of 20 seconds following the five steps and seven techniques of hand hygiene (Figure: 3). Individuals should also ensure that hands are dried after washing, as wet hands are more likely to spread pathogens when compared to dry hands.<sup>[15]</sup>

While the data is lacking on its in vivo effects, research has shown that long term use of triclocarban can contribute to antibacterial resistance in vitro. Concern has been raised that bacteria exposed to low levels of triclocarban are not killed immediately, thus giving it an opportunity to develop resistance to it, and ultimately to antibiotics. Due to this possibility, the American Food and Drug Administration (FDA) has banned the use of triclocarban in soaps in 2016. Triclocarban is also considered to have estrogen-like effects, and systemic absorption of this product can disrupt hormone levels, leading to adverse effects on health.<sup>[16]</sup>

Hand sanitizers, while being a good alternative when hand washing with soap is not possible, should not be a replacement for it. Although alcohol-based sanitizers can destroy the virus, they lack the mechanical function of soap that helps wash off the virus from hands.<sup>[17,18]</sup> Furthermore, its alcohol content, the volume of product used, and the technique for applying on hands determine its effectiveness. For example, there are certain pathogens, like the norovirus, poliovirus, hepatitis A virus, that are not destroyed, even with sanitizers that have an 80% alcohol content. The American Centers for Disease Control and Prevention (CDC) has also warned against the use of sanitizers when soap and water are available. While they may be able to reduce the growth of pathogens, they lack the ability to kill them completely.<sup>[19,20]</sup> In some cases, the packaging of these hand sanitizers does not outright state that they are alcohol-free, choosing to only state it in small print with the rest of its ingredients, which might be missed by the average consumer.<sup>[21]</sup>

Based on this information, it is highly recommended that individuals regularly wash their hands with soap,

regardless of its type. However, in cases of non-availability of soap, or circumstances where clean water

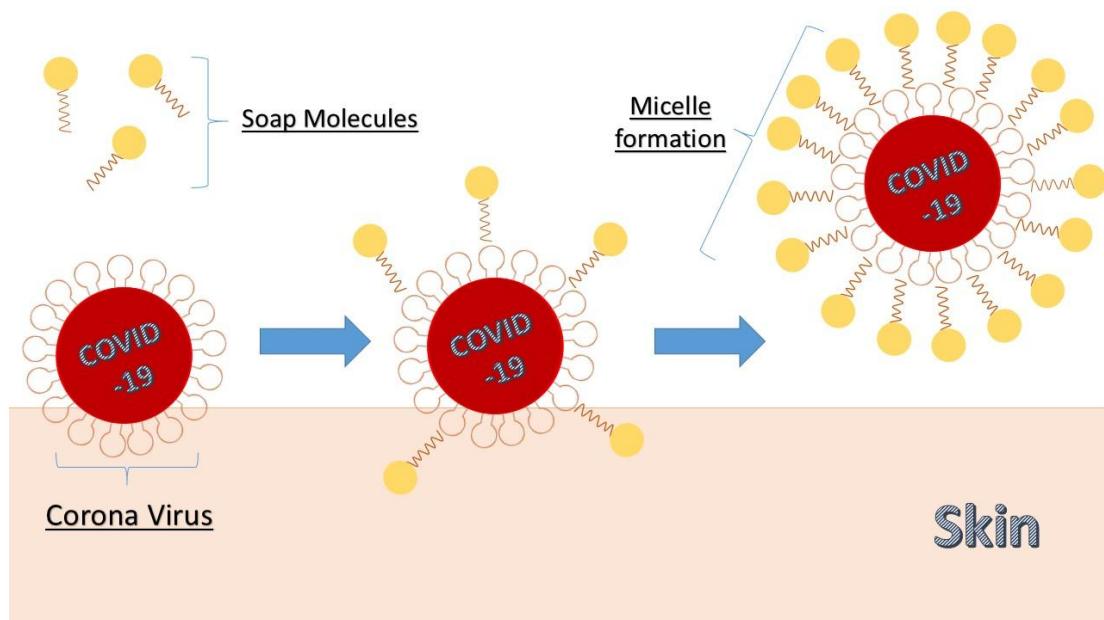
cannot be accessed, hand sanitizers offer an acceptable alternative method for disinfecting hands.<sup>[22]</sup>

**Table I: Analyzed soaps and their unique ingredients as per label disclosure.**

Soap Sample	Category of soap	Unique Ingredient(s)
A1	Medicated Soap (Antibacterial)	Acetic A
		Cyclodextrin
		PEG-7 Amodimethicone
		Sodium C14-16 Olefin Sulfonate
		Triclocarban
		Trideceth-10
A2	Medicated Soap (Antibacterial)	Etodronic Acid
		Silver Oxide
		Thymol
B1	Beauty Soap	Tetrasodium Etidronate
B2	Beauty Soap	Cocamidopropyl Betaine
		Sodium Isethionate
		Sodium Lauroyl Isethionate
		Sodium Stearate
		Tetrasodium Etidronate



**Figure 1: Diagrammatic representation of soap molecule.**



**Figure 2: Mechanism of action of Soap.**

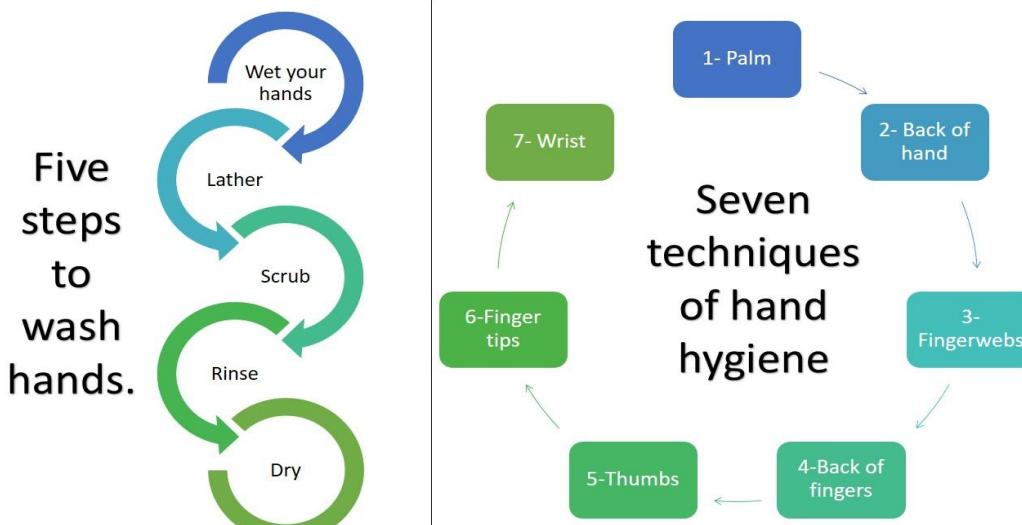


Figure 3: 5 Steps and 7 Techniques of Hand Hygiene.

## CONCLUSION

There is a lack of conclusive evidence on the beneficial effects of antibacterial soaps when compared to toilet soap. Additionally, the primary mechanism of action of soap is sufficient to remove viruses off the hands. This proves that any type of soap can be used to protect an individual from contracting COVID-19 if they wash their hands for at least 20 seconds. Furthermore, attention should be paid to the list of ingredients stated on the packaging of a soap to ensure that products containing triclocarban are not used for hand washing.

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