

# The preeminence of using benzalkonium chloride as an active ingredient in hand sanitizer

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## Abstract

The purpose of this short literature is to lay out the facts associated with both alcohol-based and non-alcohol-based hand sanitizers. The details presented throughout this paper will provide insight as to why Benzalkonium chloride (BZK) must not be overlooked when deciding on the best method for protecting your body from harmful microbes and protecting your skin from potential damage.

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## Background

Benzalkonium chloride (BZK) is an active ingredient present in many of today's consumer products. The use of BZK was first reported as a promising skin disinfectant in 1935.<sup>1</sup> Since then its use has evolved to being much more than just a skin disinfectant. BZK is currently being utilized not only in personal care products such as hand sanitizers, soaps, lotions, and shampoos, but it is also found in spray disinfectants, pharmaceutical products such as eye drops, skin and wound antiseptics, mouthwashes, surgical disinfection products, burn treatments and more. One of the major actions of BZK relates to its antimicrobial capabilities, the biocidal actions of BZK create a dissociation of the unwanted microbe's membrane lipid bilayers and stimulates the leakage of cellular contents, therefore compromising its permeability and eliminating its presence.<sup>2</sup>

BZK has been proven effective against bacteria, viruses, fungi and protozoa.<sup>3</sup> The reason for its widespread use of application aside from its antimicrobial efficacy is based on the fact that it is easier on the skin than the majority of other skin disinfectants, especially when being compared to alcohol. Unlike alcohol, BZK can be used directly on open skin or an open wound without causing damage to the wound bed or

creating a painful sting and or burning sensation. When it comes to hand sanitizers, there has been a lot of debate as to whether an alcohol-based sanitizer or non-alcohol-based sanitizer is the better option.

## Current Guidelines

Current Center for Disease Control and Prevention (CDC) guidelines suggest that alcohol-based hand sanitizer with a high concentration and or antiseptic hand soap for hand washing are the best options for hand hygiene.<sup>4</sup> Alcohol has been proven to be effective at killing bacteria when concentrations are between 60% and 90%, and works mainly because of its ability to denature proteins.<sup>5,9</sup> However, studies have actually shown these higher concentrations of alcohol essentially lose their effectiveness because water is needed as an adjunct in order for maximum potency to be achieved.<sup>5</sup>

In 2016, the United States Food and Drug Administration (FDA) removed 19 antimicrobial ingredients from the list of allowed consumer products, BZK was not one of them.<sup>6</sup> Although BZK was not removed from the FDA's allowed antimicrobial list, The CDC notes that the reasons for its statements regarding high concentration alcohol-based hand sanitizers instead of BZK or other various quaternary

ammonium products is because such products necessitate further studies.<sup>5,6</sup>

## Research Based Evidence

In a 1998, a study using non-alcohol based sanitizer with benzalkonium chloride as the active ingredient was completed via FDA performance standards and determined that the benzalkonium chloride-based sanitizer performed better than alcohol-based hand sanitizer after repeated use.<sup>7</sup> It wasn't until recently that BZK has begun to once again become a common topic of discussion as it relates to the current COVID-19 pandemic and the measures society is taking in order to eliminate the risk of spreading or contracting microbes responsible for causing illness and disease. Of late, there has been a need for more BZK studies and research regarding hand sanitizer, as the amount of data available is still limited when compared to the more commonly used alcohol-based products.

As history is often known to repeat itself, Newer studies continue to prove what previous research pointed out and that is that benzalkonium chloride hand sanitizer demonstrates greater effectiveness than alcohol-based hand sanitizers throughout various experiments. For example, in an infection control study performed by *Bondurant et. al.* to evaluate the effectiveness of BZK as the active ingredient in reducing transient skin contamination with staphylococcus aureus in health care workers, as compared with the effectiveness of an ethanol-based hand sanitizer, research found that the benzalkonium hand sanitizer significantly reduced staphylococcus aureus versus an ethanol sanitizer and also came to the conclusion that BZK had greater skin presence and persistence.<sup>8</sup>

This same research study was able to reference multiple experiments which have confirmed that BZK- manufactured products demonstrated 'persistent antibacterial efficacy' even up to

four hours after bacterial contact with skin, as opposed to alcohols efficacy duration, which has only been documented to reach around 10 minutes maximum.<sup>8</sup>

Although efficacy is extremely vital when it comes to antimicrobial properties associated with hand sanitizer, the other crucial aspect is the affect it has on people's skin and overall health. It is important to note the differences in the amount of active ingredient present between each set of hand sanitizers, BZK is usually only around .13% of the final end product, while alcohol normally exists in excess or 60% or greater of the final end product. Today, society seems to be much more focused about the ingredients present in consumer products, as well as living a health-conscious and safer lifestyle. There has been an increase in the amount of vegetarians, vegans and plant based diets, there has been an increase in the number of health club memberships, and social media has been helped educate people on the different changes they can make to live a more health-conscious lifestyle.

With that said, appearance and personal care has also become very important and because individuals have become so concerned with what products may harm their bodies, the use of alcohol-based hand sanitizers is no longer the only 'go to' option. Many big-name hand sanitizers use alcohol as an active ingredient and the reasons for this are quite clear. Alcohol is ridiculously cheap, it is effective at eliminating many of the common germs responsible for causing the spread of infection directly on contact, and it is widely available. In addition to these factors, alcohol has been around for a much longer time period and because of this it would be safe to assume that it has become widely accepted by society as the 'only' reliable option. Unfortunately, alcohol is not as safe as many people believe it is and there have been several studies which prove this.

Research has proven that the continued use of alcohol-based hand sanitizers is responsible for

several underlying skin reactions. These reactions include dryness, itching, irritation, cracking and even bleeding.<sup>9</sup> To most individuals, the notion of dry or cracked skin may not seem to be that serious of an issue, but this perception drastically changes when realizing the detrimental health effects that can arise from these 'little' issues.

The cracking and dryness of the skin leads to changes in the skin flora, resulting in more frequent bacterial colonization and bacterial susceptibility, particularly by staphylococcus aureus and gram-negative bacilli.<sup>10</sup> This means that as consumers continue to use alcohol-based hand sanitizers, over time, as the skin dries and the more alcohol-based sanitizer you use increases, so does the risk for infection. Therefore, the product that was originally being used to help eliminate the risk of infection, instead becomes the culprit responsible for inviting infection.

## Conclusion

Overall, when deciding on the best hand sanitizer to use, it is important that the product is both efficacious and as safe as possible for the skin. Although both BZK and alcohol have positive effects when being used as an active ingredient in hand sanitizer there are several factors which differentiate the two.

Alcohol has been around for a much longer time period and has been studied in much greater detail because of this. Alcohol is also readily available, inexpensive, and widely accepted by the general public because there was never enough literature to suggest a superior alternative, until now. As mentioned previously, BZK has been around for over 90 years, yet the amount of research and experiments were never at a level like that of alcohol.

Yet, even with limited data, the FDA still did not remove the ingredient from its approved list of antimicrobial active ingredients for accepted

use in hand sanitizers, and the reasons for this are obvious.

BZK has been proven to be more effective than alcohol as an active ingredient throughout numerous studies. In comparison to alcohol, BZK has specifically been proven to combat some of the more problematic bacterial infections, such as those associated with staphylococci and gram-negative bacteria.

Also, the skin reactions documented with alcohol-based sanitizers tend to be much more common and serious when compared to BZK. Although current CDC guidelines suggest using a high concentration alcohol-based sanitizer in an attempt to prevent bacterial infection, countless studies have been conducted and prove that high concentration alcohols are not potent by themselves and that alcohol-based hand sanitizers come with the increased risk of skin reactions. The continued use of alcohol-based hand sanitizer has been well documented, and the negative affects it has on skin can be debilitating when it comes to providing a reliable defense against infection. This is because as consumers continue to use this type of hand sanitizer, the skin dries and cracks, altering the normal skin flora and becoming susceptible to unwanted bacteria.

The important concept to remember is that there are other available options besides alcohol-based hand sanitizers. Time and time again, BZK based hand sanitizers have been proven to be both efficacious and safer on skin than alcohol. New literature is beginning to focus more on BZK and the hope is that as studies continue to become available and findings are more publicized, the general public will learn that there is another alternative to using alcohol-based hand sanitizers and this alternative is one that has continues to show preeminence over the commonly used alcohol based hand sanitizers currently available.

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