



## **“ALCOHOL-BASED HANDSANITIZERS: A SYSTEMATIC REVIEW ON EFFECTIVENESS AND EFFECTS”**

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### **ABSTRACT:**

A Hand Sanitizer dispensing machine is automatic, alcohol based hand sanitizer dispenser and non contact which is used in offices, hospitals, schools, work places etc. Basically, alcohol is a solvent and very good disinfectant as compared to liquid or solid soap. It is volatile and vaporizes fast so it does not need water to wash out. It is proved that a concentration of > 70 % alcohol which can kill corona or other viruses in hands ultrasonic sensor which senses hand when placed near it, microcontroller used in that is the Arduino uno and which senses the distance and the result is the sanitizer.

Keywords: Alcohol Based Hand Sanitizer, Pandemic COVID -19, Disinfectant - Disease prevention, Pump, Ultrasonic Sensors.

### **OBJECTIVES:**

- To study the effectiveness and effects of hand sanitizer.
- To understand right way to washing hands.
- To study the preventive measure in combating spread of COVID – 19.
- To study understand correct way to stop the spreading germs and diseases.
- To study appropriate hand hygiene practice when caring for patient with infection diseases.
- To demonstrate correct way to cover sneeze or cough.

### **Introduction:**

Hand Sanitizers were first introduced in 1996 in medical setting such as hospitals and health care facilities Hand sanitizers, It is also known as hand rub, hand antiseptic and hand H<sub>2</sub>O. It can make in different forms such as gel, foam and liquid solution (sprays). [1]

Sanitization means cleaning or sterilizing as object or body part like hand or whole body. There are various ways of sanitization includes alcohol sanitization soap sanitization, UV sanitization and Bleach sanitization. The base of all hand sanitizers is alcohol. Alcohol was found to be more useful for human beings since it is harmless on skin surface, vaporizes easily and removes dirt in our hands. Alcohol may be expensive for mass scale sanitization of buildings or rooms and major disadvantage is that, alcohol is highly inflammable and requires careful storage to avoid catastrophe. Alcohol absorbs moisture, so a hand becomes dry and addition of moisturizers are required. [5]

Isopropanol, ethanol – propanol/povidone - iodine etc. These are alcohols used in hand sanitizers. Alcohol based hand sanitizer is more effective in killing micro – organisms. Alcohol is an organic compound or hydroxyl group (OH) that is bound to a saturated carbon atom. The primary alcohol usually forms the base of hand sanitizer which is about 70 % alcohol is the germ killing ingredient in hand sanitizers and the minimum amount one needs for a sanitizer is 70 %. Hand sanitizers are clearly effective against gastrointestinal and to a lesser extent respiratory infections alcohol rubs also helps, to kill many different kinds of bacteria and TB bacteria and also kills COVID -19 like viruses. But repeatedly touching the hand sanitizer again initiates contact with persons. Which may be risky? So, non contact based hand sanitizer dispenser is needed. Alcohol-Based hand sanitizers can quickly reduce the number of microbes on hands in some situations, but sanitizers do not eliminate all types of germs and water whenever possible because hand washing reduces the amount of all types' germs and chemicals on hands. But if soap and water are not available, using a hand sanitizer with at least 70% alcohol can help to avoid getting sick and spreading germs to others. [6]

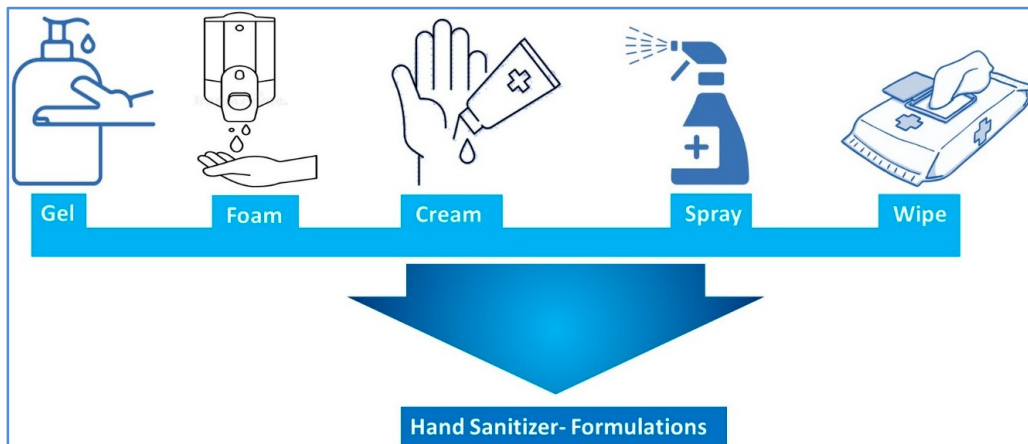


Figure 1:- Dosage forms of hand sanitizer

## CONTENT:

### *Definition*

As per WHO, alcohol-based hand sanitizer is an alcohol- containing preparation in the form of liquid, gel or foam designed for application to hands to in active microorganisms or suppress their growth temporarily

### *Types of Hand Sanitizer:*

Hand sanitizers are classified into two types depending on the active ingredient used.

- Alcohol – Based Hand sanitizer.
- Alcohol – Free Hand sanitizer.

### *Alcohol Based Hand Sanitizer:*

It contains between 60 and 95 % alcohol, usually in the form of ethanol, Isopropanol or n- propanol. At those concentrations, alcohol immediately denatures proteins and neutralizing certain types of micro – organism.



Figure 2:- Gel Hand Sanitizer

### *Alcohol Free Hand sanitizer.*

Alcohol – free hand sanitizers are based on disinfectants like benzalkonium chloride (BAC), and antimicrobial agents like triclosan.



Figure 3:- Foam hand sanitizer

- The activity of disinfectants and antimicrobial agents is both immediate and persistent

Also called finger pad method when testing it also measures red<sup>n</sup> in level of viable viruses in

- I. Exposure to test formulation alone.
- II. After past treatment water rinsing
- III. Past – rinse drying of hands.
- IV.

1) **ASTM E-2276**

For testing against bacteria similar to E-1838 (for virus) and E-2276 (bacteria)

2) **ASTM E-2611** Test virus.

3) **ASTM E-2613** Test Fungi

The corona virus has an unique genome sequence which is similar to server acute respiratory syndrome because they have almost same morphology and also belongs to same genus Beta corona virus. These are single stranded RNA viruses and can be removed, deactivated by solvent which is liquid in nature such as propanol, Isopropanol and ethanol also their growth can inhibited by some disinfectants, chloroform and antiseptics 60% to 80% concentrates is potent agent and are effective against lipophilic and hydrophilic viruses.

**According to WHO recommended levels are as follows:-**

- 1) Ethanol – 80 %
- 2) Isopropanol – 75 %
- 3) Propanol – 70 %

However as per studies 60 – 80 % ethanol is effective against viruses. But it cannot said about propanol and Isopropanol on same scale as per above levels.

The study conducted with WHO shows demonstration of effectiveness alcohols as veridical against pathogens like Ebola Virus, corona virus, zika virus, SAR<sub>5</sub>-CoV & MER<sub>5</sub>CoV.

Study in Germany found that ethanol with concentration 42.6% is able to destroy SAR<sub>5</sub> corona virus and MERS Corona virus. Hence, conclusion from this is effectiveness of alcohol based hand sanitizers varies as per concentration levels.

Detergents are able to only wash off microbes but alcohol based hand sanitizers destroy micro-organisms. If agents not killed in process of application of alcohol based hand sanitizer. They can be washed off using soap and water because they have similar properties. Though have different molecules.

According to FDA, hand sanitizers should cotain 60% to 95 % of alcohol for the maximum protection against germs. National and International leading health organizations Such as NCDC, WHO, FDA and NAFDAC are recommends alcohol – based hand sanitizers. It also widely used in hospitals and other health care facilities.

In this manner the effectiveness has been proven time to time.

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## ADVERSE EFFECTS:

There is little adverse effect of alcohol based hand sanitizers and that they are identified as follows;

- Temporal effect on Microbes.
- Weak action against Some microbes (Non-lipophilic virus, bacterial spores and protozoa.
- Flammability.
- Skin Toxicity.
- Antibiotic resistance.
- Alcohol poisoning.
- Hormonal disruption.
- Weaker system.

### *Using Alcohol-based hand sanitizer daily can disrupt your micro biome*

- Adverse impact on skin and promotes ageing.
- We may be creating a stronger agent.
- If you've got cuts on your hands, using hand sanitizer daily will hurt.
- Dry Hands.
- Irritation.
- If you handle chemicals, using hand sanitizer on a daily basis may be dangerous.
- you'll be able to still get sick if you utilize hand sanitizer a day.
- Impaired muscles.

Alcohol based hand sanitizers are known to be highly flammable thanks to alcohol concentrates and it can be dangerous when carelessly used near fire source. there have been reported cases of skin burn sustained dueto use of alcohol based hand sanitizers. The victims were said to own handled cooking immediately after applying Alcohol based hand sanitizer while the moist was still abundantly on the skin surface. it's advisable to stay away from fire source after application of Alcohol based hand sanitizers a minimum of until the skin surface is dry. Alcohol based hand sanitizers aren't effective against non-lipophilic virus, bacteria spores and protozoa hence those who don't have this information would assume they're safe when addressing virus that are nonlipophilic after using alcohol based hand sanitizers. It should be noted that alcohol based hand sanitizers is effective against Coronaviruses as they're lipophilic viruses. There also can be case of skin toxicity because of high concentration of alcohol above the recommended limit. Since there are various brands of alcohol based hand sanitizers proliferated in markets without regulation, there are risk of sale and use of products that would cause skin toxicity thanks to potent level of alcohol. it's advisable to pick out products with less irritating agents and moisturizing skin after hand hygiene and avoiding habits which will cause or aggravate skin irritation. Health workers may use products that are effective, safe and compatible with all skin types. To cut back or forestall the issues listed above alcohol based hand sanitizers containing humectants or emollients may be utilised. There are researches and studies on the utilization of Benzethonium Chloride which broadens the effectiveness against viruses and at the identical addresses the adverse effect on skin because it tackles concerns about flammability related to alcohol based hand sanitizers. However, it should be noted that standard hand washing practice is preferable and more practical if the hands are visibly dirty, greasy or contaminated because the hand surface coverage when alcohol based hand sanitizers are used stands at 20-30seconds hence the coverage is limited. Alcohol based hand sanitizers contains ethanol and isopropanol and that they are both effective in killing germs and viruses however high concentration of ethanol in alcohol based hand sanitizers is of major concern in Nigeria. The installation of alcohol based dispensers in hospitals and health centres should resort to consulting with local fire-fighting services because of their level of flammability. More worrisome is that the potential toxicity when ingested accidentally or incidentally. Since they will be easily opened, it should be kept out of the reach of youngsters as its high level of consumption can cause acute alcohol poisoning. Another possible side effect of prolonged use of alcohol based hand sanitizers is that the dryness and cracking of skin (Palm). Alcohol has the ability to get rid of oil on skin surfaces and reduces its ability to retain moist hence the temporary loss of those moist and oils can cause symptoms of dermatitis. Alcohol based hand sanitizers may stain areas where sanitizer dispensers may leak or drip. In the face of the covid-19 scourge, the utilization of hand sanitizers is seen as alternative at hand washing. Triclosan, a typical active ingredient found in hand sanitizers known to be effective in killing microbes found on hands, might also result in the event of antibiotic-resistant bacteria. A 2018 study published within the journal Environment International found this out. There are other side effects of hand sanitizers too, that you need to bear in mind of which includes:

### *Alcohol Poisoning:*

The presence of alcohol concentrates in hand sanitizers is to make sure hand hygiene and simply because it's for hygiene, doesn't mean it's

completely safe. Most of the hand sanitizers have alcohol as an energetic ingredient which kills bacteria. Though, the quantities of the alcohol present in a very sanitizer are fixed, it can still cause poisoning. Experts believe that some squirts of a hand sanitizer are up to a pair of alcohol shots. Now this can be dangerous, especially for youths. While it may be another, it should be utilized in a limited amount.

#### ***Antibiotic resistance:***

Antibiotics are helpful against the expansion of bacteria in body. But we want to ask the question; what if our body develops a resistance against it? Or successively develops a bacterium that's immune to antibiotics? Yes, that would be a possible threat of using hand sanitizers. The active ingredient Triclosan present in hand sanitizers is responsible for the event of antibiotic resisting bacteria. So, in a way, using hand sanitizers to stay diseases away may impact otherwise. It can kill good bacteria that help in fighting diseases. This suggests lower resistance towards diseases and infections.

#### ***Hormonal disruption***

Triclosan has other side-effect—it's accountable for hormonal disruption in body. some studies say that this compound cause bacteria to adapt to its antimicrobial conditions. This further causes antibiotic-resistant strain leading to hormonal fluctuations in body. This has raised serious concerns among caregiver regarding the use of hand sanitizers. They believe that any disruption to the natural environment inside the body has detrimental health effects. This hormonal imbalance can cause infections and diseases.

#### ***Weaker immune system***

Our system work on a distinct programming—it's auto-tuned to fight diseases. It reacts actively against diseases when disease causing bacteria or viruses attacks the body. in an exceedingly situation of maximum clean environment, system during a way find no harmful entity to figure against. and so, it leads to its weaker performance. Studies has shown if a personality's is exposed to such clean conditions too soon life, it contributes to weaker defense by system at the later stage. Researchers at University of Michigan School of Public Health found that triclosan can negatively impact system functioning. The study showed that higher levels of triclosan in children and teenagers led to pollinosis and allergy susceptibility in them.

#### ***Adverse impact on skin and promotes ageing***

The alcohols most typically found in hand sanitizers are isopropyl, ethanol, and n-propanol. These alcohols are also accountable for drying out the skin. They strip away the natural oils of the skin and also cause irritation. The acid present in hand sanitizers dehydrate skin cells and should also cause dermatitis. in a very future, it can also damage skin cells. Use of hand sanitizers may additionally cause ageing of the hand's skin. Dry skin and dehydration can cause callous formation, flaky skin, wrinkles and cracks. Increased dehydration also can kill the natural barrier of the skin against infections. this implies reduced ability of skin to safeguard itself resulting in increase in dehydration and dry skin.

#### ***Using Alcohol-based hand sanitizer on a daily basis can disrupt your micro biome.***

One thing hand sanitizer is very good at is killing microbes, which is how it keeps people safe from a good variety of illnesses. However, sanitizer is really a bit too good at killing bacteria, consistent with microbiologist Jonathan Eisen. "One aspect of hand sanitizers that's usually overlooked is that they will affect bodies' microbiomes in a very few ways, and a few of those ways may well be bad," he revealed in an interview with Popular Science. That's because it kills off bacteria that's beneficial for keeping our bodily functions so as. Because hand sanitizer can wreak havoc on our healthy bacterial communities, Eisen advises against using it daily.

#### ***We may be creating a stronger agent***

Hand sanitizer will be a culprit in potentially dangerous conditions. So, if you're using it liberally on a daily basis, that can become problematic, as noted by board-certified medicine physician Seema Sarin. "According to the CDC, hand sanitizer with antibacterial ingredients may additionally contribute to the event of antibiotic-resistant bacteria. What's so scary about antibiotic-resistant bacteria anyway? consistent with the CDC, these pathogens have developed the power to tolerate the drugs that otherwise should be able to kill them. meaning if you catch one in every of these bugs, your normal course of antibiotic medication won't be effective at clearing them from your body. you'll still get sick if you employ hand sanitizer daily

***You can still get sick if you utilize hand sanitizer daily***

The CDC asserts that hand sanitizer does effectively kill germs and may be a good alternative to soap and water when one is unable to clean their hands. Still, hand sanitizer isn't a magical elixir — no matter what the bottle claims. As RN Kristina Duda noted, you cannot always trust the claims of hand sanitizer makers. "The U.S. Food and Drug Administration (FDA) has taken proceeding against some hand sanitizer companies for making unproven claims against salmonella, e. Coli, Ebola, rotavirus, influenza, and MRSA," Duda revealed in a writing for Verywell Health.

That doesn't mean hand sanitizer is ineffective, though, as Duda noted that some science is on the side of hand sanitizer manufacturers. "At the identical time, though, studies are starting to suggest that alcohol-based hand sanitizers is also effective at killing a number of these germs," she continued. Duda added, however, that some manufacturers remain in need of FDA approval, so any claims they create cannot be trusted. And, as is commonly the case, more research is required.

***If you handle chemicals, using hand sanitizer on a daily basis will be dangerous***

If you're employed chemically all day, every day, you certainly want to form sure your hands are clean at the top of your shift. Such would be the case for cleaning service workers, farm workers who handle various types of pesticides, auto technicians, and the other profession wherein you have got to figure with ultra-strong cleaning and de-greasing agents. you actually don't desire to travel home with those everywhere your hands. However, hand sanitizer is that the final thing you wish to achieve for to scrub your paws on a daily basis, as the combination of the liquid gel and chemicals are often every kind of bad for your health. in line with a study published within the Journal of Occupational and Environmental Medicine, farm workers who used hand sanitizer actually had increased levels of pesticides in their bodies as hostile people who didn't use the sanitizer. That's one reason why the CDC cautions against the practice and instead advises you just wash your hands with soap and water. Gloves could also be your friend also, in some situations, though they're not a substitute for handwashing.

***Dry hands***

Using hand sanitizer on a daily basis causes hands to become incredibly dry? there is a reason for that, as noted by Janette Nesheiwat, a family and medical specialty doctor. "Hand sanitizers contain alcohol, which can dry out your skin, but that may be fixed with moisturizer and staying hydrated. It's also worth noting that dry skin is over just annoying. If your hands are dry to the purpose they become cracked, you will be more liable to infection. "It a minimum of seems plausible," microbiologist David Coil told Reader's Digest. So if you absolutely must use hand sanitizer, try and limit it to at least one time after your hands become contaminated rather than repeatedly

***Irritation***

Using hand sanitizer daily can cause some unpleasant skin irritation, in line with surgical oncologist Trevan Fischer. "Repeated use of anything, including hand sanitizer, can cause chronic irritation, skin breakdown, and damage," he explained to MSN. that might make it pretty tough to induce things done, especially if you work extensively together with your hands.

This is especially the case if you decide for specific forms of hand sanitizer, as noted by Fischer. "If you're using very high concentrations of alcohol, it can cause ... cracks within the skin," he continued. "Not only does it not feel good when the alcohol hits the skin, then again the skin won't heal likewise." feels like that might be a problem for a while!

If you wish to avoid the adverse skin issues, you'll be able to select an alcohol-free hand sanitizer instead, but know that it'll be far less effective than alcohol-based formulas. In fact, the CDC only recommends using hand sanitizer that contains a minimum of 60 percent alcohol.

***If you have got cuts on your hands, using hand sanitizer daily will hurt***

Are you somebody who reaches for an alcohol swab immediately after cutting yourself? Because it seems, that's an antiquated practice, per wound care expert Dr. Kazu Suzuki. "In the wound care world, we say, 'don't put anything in your wound that you simply wouldn't put in your eye,'" he shared with the la Times. "Yes, it will kill some bacteria, but it also kills and irritates healthy skin and also the wound bed." it is also visiting pack quite the sting!

That's also the mechanism at work after you use alcohol-based hand sanitizer on a cut — which if you've ever accidentally done, you recognize it can hurt quite bit. Specifically, alcohol on a wound stimulates the vanilloid receptor-1, or VR1, in your body, as noted by analytical chemist Joseph Glajch. "So, all of a sudden, you feel like you're getting burned, while you are not getting burned," he said in an interview with Live Science.

***Impaired muscles***

While a number of the negative side effects of using hand sanitizer a day are relatively minor, a number of them can be significantly more

concerning. One alarming impact hand sanitizer can potentially wear our body is impairing our muscles — that's, if it contains triclosan, which many sanitizers do.

According to a piece within the Atlantic, researchers at the University of Colorado and therefore the University of California, Davis found that triclosan prevented shortening just 10 to twenty minutes after exposure. It also reduced both grip strength and heart function in mice, and impaired the swimming ability of fathead minnow larvae.

While the implications of the study don't pose much of a threat to healthy people, those with failure could experience dangerous muscle impairment thanks to triclosan. Wild animals may additionally be vulnerable, which isn't excellent news for his or her survival rates if exposed.

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### EXPECTED OUTCOMES:

As compared to other hand washing like soap and water, Alcohol Based Hand Sanitizer was right way to washing hands and kills microorganisms on hands quickly. So effectiveness and their adverse effects were analyzed.

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### CONCLUSION:

Alcohol –Based hand sanitizers are simple to make, but they can only be used after through testing of their efficiency. Antibacterial and antiviral sanitizers are successful against the majority of bacteria and viruses. Hand sanitizers the simplest and most convenient way to keep your hand everywhere you go. Hand hygiene is an important infection prevention strategy because it can significantly reduce the risk of microorganism transmission, either directly or indirectly.

Because of their rapid action and efficiency in destroying microorganisms, the use of ABHS is becoming more widespread, as handwashing with soap and water is no longer practical or convenient.

Alcohol-based hand sanitizers are effective against lipophilic viruses which means they are effective against corona virus. To ensure efficacy of product, the recommended ethanol should be regulated .Alcohol - based hand sanitizer having concentration between 60% to 80% ethanol is effective to prevent COVID-19.

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