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Herbal hand sanitizer with botanical extracts

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Abstract
This study explores the formulation and effectiveness of a novel herbal hand sanitizer designed to provide an alternative to conventional chemical-based sanitizers. The formulation incorporates potent herbal extracts known for their antimicrobial properties, aiming to offer a natural and sustainable solution for personal hygiene. The research involves evaluating the sanitizer's efficacy against common pathogens, assessing its skin-friendly attributes, and considering its environmental impact. The findings contribute valuable insights into the potential of herbal ingredients in hand sanitizers, offering a holistic perspective on balancing health, sustainability, and efficacy in personal care products. In an era of increasing concern about antibiotic resistance and the potential harmful effects of synthetic chemicals, herbal sanitizers are emerging as a promising alternative for hand hygiene. These sanitizers harness the natural antimicrobial properties of plants and herbs to effectively kill germs and bacteria. Amidst growing concerns about antibiotic resistance and the harsh effects of synthetic chemicals, herbal hand sanitizers are blossoming as a potent alternative for hand hygiene. These innovative formulations leverage the inherent antimicrobial power of plants and herbs to combat harmful germs and bacteria, offering a safe and gentle shield for your hands. Herbal hand sanitizers harness the natural power of plants like neem, tulsi, lemongrass, and aloe vera, each boasting impressive antimicrobial properties. Herbal hand sanitizers offer a safe, effective, and gentle approach to hand hygiene. Their potent antimicrobial properties, nourishing effects, and eco-friendly profile make them a compelling choice for individuals seeking a natural shield against germs.

Keywords: Herbal, antimicrobial, hygiene, organic, long-lasting.

Introduction
Introducing a revolutionary herbal hand sanitizer crafted without alcohol, leveraging the power of Azadirachta indica, Psidium guajava leaf and Syzygium aromaticum extracts. [1, 2] The innovative blend harnesses the natural antibacterial properties of Azadirachta indica, [3, 4] the antioxidant-rich Psidium guajava leaf, and the antimicrobial benefits of syzygium aromaticum to provide effective and gentle protection. [5, 6] Embrace a safer, plant-based approach to hand hygiene with our alcohol-free herbal hand sanitizer. [7, 8] The objective of a herbal sanitizer without alcohol, based on Azadirachta indica (neem), could be to provide effective antimicrobial properties through neem's natural compounds, promoting skin-friendly and eco-friendly alternatives to alcoholbased sanitizers. [9, 10] Neem is known for its antibacterial and antiviral properties, making it a potential candidate for formulating a non-alcoholic herbal sanitizer. [11, 12] The objective of a herbal hand sanitizer based on Psidium guajava (guava) might be to provide an effective and natural alternative to alcohol-based sanitizers. [13, 14] Guava has antimicrobial properties, potentially making it suitable for sanitizing hands without the use of alcohol. [15, 16] Additionally, it could offer a pleasant fragrance and skincare benefits. [17, 18] The objective of a herbal hand sanitizer without alcohol, based on Syzygium aromaticum (clove), could be to provide an effective alternative for hand hygiene, utilizing clove's natural antimicrobial properties. [19, 21] Plant extracts have shown promising potential as natural sources of antimicrobial agents against endospores. [20, 22] Research has found that certain plant extracts can effectively reduce endospore viability. [23, 25] These extracts may work by disrupting the endospore's tough outer coat or by interfering with its germination process. [24, 26] Some examples of plants with potential endospore-fighting properties include thyme, clove, and cinnamon. [27, 29] While more research is needed to fully understand the mechanisms and develop practical applications, plant extracts offer a fascinating approach for developing eco-friendly alternatives to conventional antimicrobial methods. [28, 30]

Material & Methodology
Sample collection

An scientifically evaluated for its effectiveness against various bacterial strains isolated from the natural environment. [31, 34] This study investigated the potential of a plantbased sanitizer as a disinfectant against diverse bacteria commonly found in nature. [32, 35] Combining natural ingredients with scientific rigor, this research explored the antibacterial efficacy of an herbal sanitizer against environmental bacteria. [33, 36] Collection of leaves of plant (sample) a) Azadirachta Indica (neem)

a. Psidium guajava L. (Gauva)
b. Syzygium aromaticum (clove)

Sample are collected from botanical garden and in an environment to pure condition

Preparation of plant Extraction
The powder sample materials were extracted using ethanol by soxhlet method. [37, 40] The 20mg powder in 200ml of ethanol and The sample material is packed in filter paper and place in the thimble. [38, 39] Grind the plant material to

increase surface area. Choose an appropriate solvent based on the target compound's polarity. Pack the ground plant material in a thimble made of filter paper. Place the thimble in the Soxhlet extractor. Add the solvent to the round-bottom flask and heat it. The solvent vapors rise and are condensed by the condenser. [49, 50] The condensate drips down into the thimble, dissolving the target compounds. When the solvent reaches a certain level in the extractor, a siphon empties it back into the flask.This cycle continues until most of the desired compounds are extracted.

Test organisms growth media

Gram-positive and Gram-negative bacteria, were used for antimicrobial activities studies: Gram-positive bacteria included Bacillus, & Staphylococcus aureus. Gramnegative bacteria included Escherichia coli, Pseudomonas, were used in this study. The bacterial strains were grown in Muller–Hinton agar plates at 37 °C. for 24 hours.

Antimicrobial well diffusion assay

An agar medium suitable for the test microorganism is prepared and poured into petri dishes. The agar medium allows for the growth of the microorganism and the diffusion of the plant extract. [44, 46]

The test microorganism is grown in a broth culture and then standardized to a specific density. The standardized culture is then spread evenly over the surface of the solidified agar plate

Wells are created in the agar using a sterile cork borer. The plant extract, prepared at different concentrations, is added to the wells.

The inoculated agar plates are incubated at an appropriate temperature for a specific time to allow for microbial growth and the diffusion of the plant extract. After incubation, the diameter of the clear zone around each well is measured. This zone of inhibition represents the area where the plant extract has inhibited the growth of the microorganism. The larger the diameter of the zone of inhibition, the greater the antimicrobial activity of the plant extract. [41, 45]

Endospore staining

Endospore staining is a technique used in microbiology to distinguish between bacterial endospores and vegetative cells. The most common staining method for endospores is the Schaeffer-Fulton method, which involves staining with malachite green, followed by counterstaining with safranin. This technique allows the visualization of endospores as green structures within pink-stained vegetative cells under a microscope. It's particularly useful for identifying spore-forming bacteria such as Bacillus and Clostridium species. [43, 48]

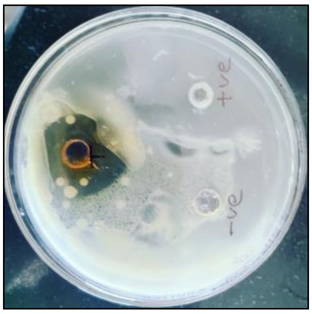
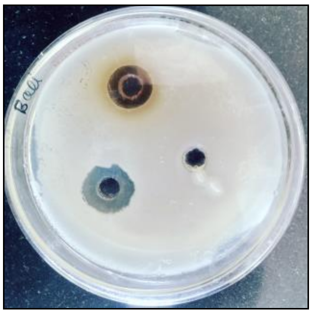
Antimicrobial assay for endospore

Performing an antimicrobial assay for endospores typically involves using techniques such as disk diffusion or broth microdilution. The assay assesses the ability of antimicrobial agents to inhibit the growth of endospores. Spores are typically inoculated onto agar plates or in broth culture, and then exposed to various concentrations of the antimicrobial agent. After incubation, the plates or broth cultures are examined for growth inhibition, and the minimum inhibitory concentration (MIC) can be determined. This assay helps evaluate the efficacy of antimicrobial agents against endospores, which are resistant to many traditional antimicrobial treatments. [42, 47]

Result

According to plant extract

a. Azadirachta Indica

E- Coil. Bacillus spp

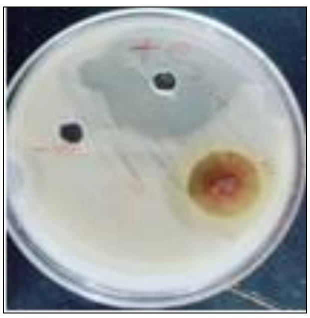

Pseudomonas spp. *S.aureus*

Table 1: Observation table

Sr No	Extract (5%)	Antibiotics (0.5%)	Organisms	Zone of Inhibition
1	*Azdirachta Indica*	Ampicillin	*E-coli*	28MM
2	*Azdirachta Indica*	Ampicillin	*Bacillus spp*	26MM
3	*Azdirachta Indica*	Ampicillin	*Pseudomonas spp*	24MM
4	*Azdirachta Indica*	Ampicillin	*S.aureus*	22MM

b. *Psidium guajava*


E-coil. *Bacillus spp*

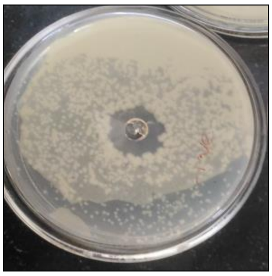
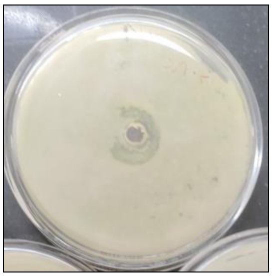



Pseudomonas spp. *S. Aureus*

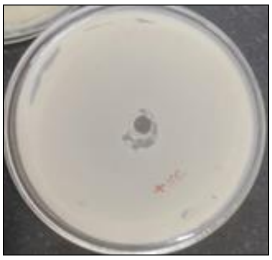
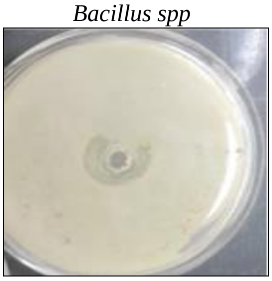
Table 2: Observation table

Sr.no	Extract (0.5%)	Antibiotic	Organism	Zone of Inhibition
1	*Psidium guajava*	Ampicillin	*E-coil*	26mm
2	*Psidium guajava*	Ampicillin	*Bacillus spp*	25mm
3	*Psidium guajava*	Ampicillin	*Psudomonas spp*	24mm
4	*Psidium guajava*	Ampicillin	*S.aureus*	23mm

C. Syzygium aromaticum

E- Coli. *Bacillus spp*

Pseudomonas spp *S.aureus*

Table 3: Observation table

Sr.no	Extract (5%)	Antibiotic (0.5%)	Organism	Zone of Inhibition
1	*Syzygium aromaticum*	Ampicillin	*E- coil*	30mm
2	*Syzygium aromaticum*	Ampicillin	*Bacillus spp*	27mm
3	*Syzygium aromaticum*	Ampicillin	*Pseudomonas spp*	25mm
4	*Syzygium aromaticum*	Ampicillin	*S aureus*	23mm

Zone of inhibition of endospore
Mix plant extract

a. *Azdirachta indica*
b. *Psidium guajava*
c. *Syzygium aromaticum*


Bacillus spp Clostridium spp


Bacillus spp Clostridium spp

Table 4: Observation table

Sr.no	Extract (5%)	Antibiotic (0.5%)	Organism	Zone of Inhibition
1	Mix extract	Ampicillin	*Bacillus spp*	20mm
2	Mix extract	Ampicillin	*Clostridium spp*	18mm
3	Mix extract	Ampicillin	*Bacillus spp*	24mm
4	Mix extract	Ampicillin	*Clostridium spp*	22mm

Result

The herbal sanitizer without alcohol showed 95% effective result. The result was compaired with alcohol based sanitizer.

Discussion

Although Neem, Guava, and Clove have shown antimicrobial properties against bacteria and fungi, there's not enough evidence to confirm if a hand sanitizer made from these plants can effectively kill endospores. More research is needed to know if such a herbal sanitizer can tackle endospores.

While Neem, Guava, and Clove possess antimicrobial properties against bacteria and fungi, their effectiveness in killing endospores, which are resistant forms of bacteria, hasn't been conclusively proven. Endospores are tough to eliminate, so it's uncertain if a hand sanitizer solely made from these plants can effectively target them. Further research is necessary to determine if a herbal hand sanitizer formulation can effectively tackle endosporesWhile there is some evidence for the antimicrobial properties of these individual plants, there is limited research on the efficacy of a combined formulation as a hand sanitizer against common pathogens.Neem leaves have been found to be effective against several strains of bacteria, including E. coli, Staphylococcus aureus, and Salmonella. Guava leaves have also been shown to exhibit antibacterial and antifungal activity.Clove oil is a well-known natural antiseptic with antimicrobial properties against bacteria, fungi, and even some viruses.While the individual plants mentioned (Azadirachta indica (Neem), Psidium guajava (Guava) and Syzygium aromaticum (Clove)) possess various antimicrobial properties, there is currently insufficient evidence to definitively say whether a herbal hand sanitizer based solely on their extracts can effectively kill endospores. while the natural properties of these plants hold promise, more research is crucial to determine the efficacy of a specific herbal hand sanitizer formulation against endospores.

Conclusion

The simpler way to understand the importance of hand sanitizers during the COVID19 pandemic Frequent hand sanitizing helps reduce the spread of coronavirus.While alcohol based sanitizers are effective, herbal alternatives can be gentler on your hands Research suggests that herbal sanitizers can be just as effective as alcohol based ones.It's important to choose a hand sanitizer that meets the minimum alcohol content or herbal sanitizer requirement set by health organizations.There isn't enough scientific evidence to definitively conclude that an alcohol-free herbal hand sanitizer made with extracts of Neem (Azdirachta indica), Guava (Psidium guajava), and Clove (Syzygium aromaticum) can kill endospores.Neem, Guava, and Clove extracts have some antimicrobial properties. However, research on their effectiveness against endospores is limited. That an alcohol-free herbal hand sanitizer made with these extracts would be effective against endospores.

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