Available online on 15.05.2026 at http://jddtonline.info

Journal of Drug Delivery and Therapeutics

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Research Article

# Formulation and Evaluation of Polyherbal Hand Sanitizer

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## Article Info:

### Article History:

Received 09 Feb 2026
Reviewed 05 March 2026
Accepted 14 April 2026
Published 15 May 2026

### Cite this article as:

Venkateshwari D, Ilango KB, Alageshwari V, Dhanush Kumar N, Mohammed IM, Nithish G, Sekar P, Formulation and Evaluation of Polyherbal Hand Sanitizer, Journal of Drug Delivery and Therapeutics. 2026; 16(5):18-26
*DOI:*
*https://dx.doi.org/10.22270/jddt.v16i5.7645*

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## Abstract

**Background:** Hand hygiene plays a crucial role in preventing the transmission of infectious diseases, especially during pandemics such as COVID-19. Although alcohol-based hand sanitizers are effective, their frequent use is associated with skin dryness, irritation, and other adverse effects. Herbal formulations containing bioactive phytoconstituents offer a safer and skin-friendly alternative with broad-spectrum antimicrobial activity. **Objective:** The present study was aimed at formulating and evaluating a polyherbal hand sanitizer using selected medicinal plants and to assess its antimicrobial efficacy, physicochemical properties, and safety for regular use. **Materials and Methods:** Polyherbal extracts were prepared from *Azadirachta indica* leaves, *Ocimum tenuiflorum* leaves, *Rubia cordifolia* roots, *Eclipta alba* roots, and *Pongamia pinnata* oil using Soxhlet extraction and maceration techniques with ethanol as the solvent. Preliminary phytochemical screening was carried out to identify active constituents. The hand sanitizer gel was formulated using Carbopol as a gelling agent along with aloe vera gel, ethanol, herbal extracts, and natural fragrance. The formulation was evaluated for organoleptic properties, pH, viscosity, spreadability, and skin irritancy. In vitro antimicrobial activity was assessed by agar well diffusion method against *Staphylococcus aureus*, *Escherichia coli*, and *Pseudomonas aeruginosa*. **Results:** Phytochemical analysis confirmed the presence of flavonoids, tannins, alkaloids, saponins, terpenoids, and glycosides. The formulated polyherbal hand sanitizer showed acceptable physicochemical properties with suitable pH, good spreadability, and non-irritant nature. Significant zones of inhibition were observed against all tested microorganisms, indicating effective antimicrobial activity comparable to the standard drug. **Conclusion:** The developed polyherbal hand sanitizer demonstrated effective antimicrobial activity along with good stability and skin compatibility. Hence, it can be considered a safe, economical, and natural alternative to conventional chemical-based hand sanitizers for routine hand hygiene.

**Keywords:** Polyherbal hand sanitizer, Antimicrobial activity, Medicinal plants, Phytochemical screening, Hand hygiene.

## 1 INTRODUCTION

Hand sanitizer, also known as the hand antiseptic or a hand rub, is a product that is applied to the hand to remove the common pathogens in the hand, Hand sanitizers are usually available in form of a foam, gel, or liquid. They are recommended for use when there is unavailability of a water and soap or there is a other medicals concerns. In early year of 2020, WHO declared a pandemic, better known as the COVID-19. Exponential rise has been seen in the cases despite authorities setting down in their best efforts. Prophylaxis is the easiest methods to reduce transmission, proper hand washing and hygiene is the most effective pandemic strategies. Hand sanitizers have emerged to alternative to be alternative to soap and water for washing both in healthcare and public institutions. It used to break the chain of the infection, making them as the one of the important protocols for reducing the burden on the healthcare [1].

The United state Centres for the disease control and prevention promoted washing hands and use of disinfectants. Hand sanitizers are used commercially available on a variety of forms, such as alcohol or water-based hand sanitizers, which has commonly utilised in the hospital setting. Various types of distribution structure has also been developed, such as the gel, spray, wipe, cream, or a foam. Alcoholic hand sanitizer is the commonly recommended by the world health organization on the basis of the already proven benefits of the rapid work and the proven spectrum of the bacterial activity that has protects against the germs. Because of hand serve as a major route for the transmission of various types of microbes, hand hygiene plays a vital role in preventing and controlling infection.

The hand is host for both resident and transient bacterial populations, and healthcare workers can carry pathogenic organism including staphylococcus aureus etc. as ordinary handwashing may not effectively eliminates these pathogens thus using of herbal hand sanitizers are strongly recommended [2].

1.1TYPES OF HAND SANITIZER

Hand sanitizer are classified into two types they are,

1] Alcohol based hand sanitizer

2] Alcohol free hand sanitizer

1.] ALCOHOL-BASED HAND SANITIZER

They are significantly lowers the germs which covers a wide germicidal spectrum with no need of water for cleaning than cloths for drying. Alcohol-based hand-sanitizer has single or multiple type of alcohol. The incorporation of adjuvants and hydration enhancers helps to kill the germs and for the short term it inhibit their development during the time of administration in hands. It is formulated using of 60-95% of alcohol

2.] ALCOHOL -FREE HAND SANITIZER

They chemicals used with antiseptic properties to exert the anti-microbial effect. their mode of action is based on the functional group present in the chemicals. They are non-flammable and used in low concentration, safer to use among children than the ABHS [3].

1.2 ANTIMICROBIAL ACTION

*Staphylococcus aureus* is a Gram-positive, spherical bacterium that typically forms clusters, resembling bunches of grapes. It is commonly found on the skin and mucous membranes of humans and animals, making it part of the normal human microbiota. While many strains of S. aureus are harmless, it is a well-known opportunistic pathogen that can cause a wide range of infections, from minor skin conditions like boils to more severe infections such as pneumonia, septicemia, and endocarditis [4].

**Figure:1.2.1 *Staphylococcus aureus***

***Escherichia coli (E. coli)*** is a Gram-negative, rod-shaped bacterium that normally inhabits the intestines of humans and animals, where it is a key part of the gut microbiota. Most strains of E. coli are harmless and play a crucial role in the digestion of food, but certain pathogenic strains can cause illness. The pathogenic potential of E. coli has made it a significant concern in food safety and public health. Additionally, E. coli can develop resistance to antibiotics, contributing to the growing issue of antibiotic resistance [5].

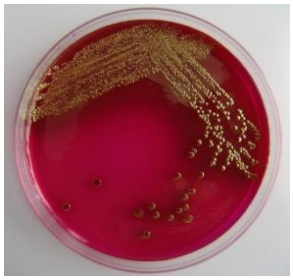

**Figure:1.2.2 *Escherichia coli (E. coli)***

***Pseudomonas aeruginosa*** is a Gram-negative, aerobic, rob-shaped bacterium belonging to the family Pseudomonadaceae. It is widely distributed in nature, particularly in Soil, water, hospital environments, and moist surface [6]. The organism is non-fermentative, oxidase-positive, and produces characteristic blue-green pigments such as pyocyanin and pyoverdine, which contribute to its virulence. Its is a major opportunistic pathogen, causing infection primarily in immunocompromised individuals, burn patients, cystic fibrosis patients, and those with indwelling medical devices [7].

**Figure:1.2.3 *Pseudomonas aeruginosa***

## 2 MATERIALS AND METHODS

**2.1 Collection of raw materials:** The crude leaf of *Azadirachta indica* and *Ocimum tenuiflorum*, cured root of *Rubia cordifolia* and *Eclipta alba* and crude oil *Pongamia pinnata* were collected form the authentified shop and the collected crude drug was washed cleaned and shade dried.


**Figure: 2.1.1** Collection of raw materials

**Grinding:** the shade dried crude drug was coarsely powdered using mixer at pulse mode for sufficient quantity [8].

**Figure: 2.1.2 Grinding**


**Figure: 2.1.3 Coarse Powdered Sample**

### 2.2 Preparation of extract for sanitizer

For the process of extraction two major methods were followed they are namely,

1] Soxhlet method

2] Maceration method

**1] Soxhlet Method:** The Soxhlet extraction is one of the commonly used technique for extracting the organic compounds. In the method, the leaves of the Azadirachta indica, and root of the Eclipta alba is thoroughly dried and grind into a coarse powder. The coarse powder is packed with filter paper and placed in a thimble. Thimble is a part of a Soxhlet apparatus. Then the thimble is connected to the condenser and the collection flask. Before connecting with Soxhlet apparatus solvent is added in collection flask at the ratio of Azadirachta indica -1:4 and Eclipta alba 1:4, ensuring it is below the thimbles level. The heating mantle is used to vaporize the solvent, causing it to rise into condenser and return to a thimble. This process extract the compounds from the leaves – Azadirachta indica, and root – Eclipta alba. The solvent, now containing the extracted compounds, leaving the solid material behind. This process is repeated until the desired extraction time is reached, after which the solvent containing the extraction is collected [9].

**Figure 2.2.1 Construction of Soxhlet apparatus**

**Figure 2.2.2 Soxhlation of *Azadirachta indica***

**2] Maceration Method:** The maceration technique used for extract the active compounds from the leaves of the Ocimum tenuiflorum and roots of Rubia cordifolia involve the several steps. First, the leaves and roots are thoroughly cleaned to eliminate impurities and then dried to a moisture content of approximately 10%. The leaves and roots are grinded into a coarse powder to increase the surface area. Now the powdered plant material was transferred to a clean, airtight container. Now ethanol is added as extracting solvent at the ration of 1:5 to 1:10 to the coarse powder. The mixture is left undisturbed at room temperature to macerate for a period of 72 hours, but no longer than 14 days. During this time the sample is occasionally agitated. After completion of the extraction process the mixture is filtered using grade-1 whatman filter paper to separate the extract [10].


**Figure: 2.2.3 Maceration of the *Rubia cordifolia***


**Figure: 2.2.4 Maceration of *Ocimum tenuiflorum***

### 2.3 Qualitative Phytochemical Study

**Test for alkaloids**

**Mayers test :** Crude extract was mixed with 2ml of 1% Hcl and heated gently. Mayers is then added to the mixture. Turbidity of the resulting precipitate was taken as evidence for the presence of alkaloids.

**Test for tannins :** Crude extract was mixed with 2ml of 2% solution of $FeCl_3$ . A blue -green or black coloration indicated the presence tannins [11].

**Test for flavonoids**

**Alkaline reagent test :** Crude extract was mixed with 2ml of 2% solution of NaOH. An intense yellow colour was formed which turned colourless on addition of few drops of diluted acid which indicated the presence of flavonoids [12].

**Test for glycosides**

**Keller-kilani test:** Crude extract was mixed with 2ml of glacial acetic acid containing 1-2 drops of 2%solution of $FeCl_3$. The mixture was then poured into another test tube containing 2ml of concentrated $H_2SO_4$. A brown ring at the interphase indicated the presence of cardiac glycosides [13].

**Test for saponins**

Crude extract was mixed with 5ml of distilled water in a test tube and it was shaken vigorously. The formation of stable foam was taken as an indication for the presence of saponins.

Crude extract was dissolved in 2ml of chloroform and evaporated to dryness. To this, 2ml of concentrated $H_2SO_4$ was added and heated for about 2 min. a grayish colour indicated the presence of

### 2.4 Formulation Preparation Procedure

- Herbal extract was prepared for the required amount [15].
- For gel base Carbopol was activated (24 hours) using the distilled water [16].
- Now the required amount of Carbopol was weighed and taken in a beaker and required amount of aloe vera
- gel was added to it and the mixture was stirred [17].
- Now the cold press Pongamia oil was added to the mixture and stirred.
- Ethanol of 30ml was added to the mixture and stirred for 10 min.
- Now in separate beaker the herbal extract (A. indica, O. tenuiflorum, R. cordifolia, E. alba) was measured and
- taken [18].
- The herbal mixture was continuously added to the Carbopol mixture with the constant stirring.
- Now the remaining 40ml of alcohol was added to the mixture and homogenized for 45 minutes.
- After that tea is added to the mixture as neutralizing agent and lemongrass oil was added as natural fragrance.
- The mixture was volume up to 100ml using distilled water [19].

**Figure: 2.4.1 homogenization of mixture**

### 2.5 Invitro Antimicrobial Activity

#### 2.5.1. AGAR- WELL DIFFUSION METHOD

#### a. Nutrient Agar Medium

The medium was prepared by dissolving 2.8 g of the commercially available Nutrient Agar Medium (HiMedia) in 100ml of distilled water. The dissolved medium was autoclaved at 15 lbs pressure at 121°C for 15 minutes. The autoclaved medium was mixed well and poured onto 100mm petriplates (25-30ml/plate) while still molten.

#### b. Nutrient broth

Nutrient broth was prepared by dissolving 2.8 g of commercially available nutrient medium (HiMedia) in 100ml distilled water and boiled to dissolve the medium completely. The medium was dispensed as desired and sterilized by autoclaving at 15 lbs pressure (121ºC) for 15 minutes [20].

#### PROCEDURE

Petri plates containing 20 ml nutrient agar medium were seeded with 24 hr culture of bacterial strains were adjusted to 0.5 OD value according to McFarland standard. Wells were cut and concentration of test sample AE of three different formulation (500 µg/ml) was added. The plates were then incubated at 37°C for 24 hours. The antibacterial activity was assayed by measuring the diameter of the inhibition zone formed around the wells. Gentamicin was used as a positive control. The values were calculated using Graph Pad Prism 6.0 software (USA) [21].

### 2.6 Evaluation Study

#### 1. Organoleptic test

An organoleptic test is used to evaluate the sensory qualities of a product, such as appearance, odour, taste, texture, and sound. For a polyherbal hand sanitizer, the organoleptic test can focus on the following aspects:

#### Appearance

• Colour: Note the colour of the hand sanitizer. Polyherbal hand sanitizers might have a slight tint depending on the herbs used, but it should not be too cloudy.

#### Odor

• Fragrance: Evaluate the smell of the hand sanitizer. Since it is polyherbal, the scent might contain natural herbal or botanical notes, which should be pleasant and not overpowering.

• Intensity: The fragrance should not be too strong or harsh. It should be subtle and refreshing, typical of herbal extracts used in the formulation**.**

#### Texture

• Feel on Skin: Assess how the sanitizer feels when applied to the hands. It should spread easily and be absorbed without leaving a greasy or sticky residue.

• Smoothness: It should not feel rough or cause irritation when applied. The skin should feel smooth and hydrated after use [22].

#### 2. pH Determination

The pH determination for a polyherbal hand sanitizer is an important quality control step, as the pH of the product can affect its stability, effectiveness, and skin compatibility. Hand sanitizers are typically formulated to have a pH within a specific range, usually between 4.5 and 7.0, to ensure they are gentle on the skin while still being effective in killing germs. Testing with pH Meter: Pour a small amount of the polyherbal hand sanitizer into a clean container (avoid contamination). Place the electrode into the sample and wait for the reading to stabilize. Once the reading has stabilized, record the pH value displayed on the meter [23].

#### 3.Viscosity Test

The viscosity test is an important evaluation for polyherbal hand sanitizers because it helps determine the flow properties and consistency of the product. A proper viscosity ensures that the hand sanitizer is neither too runny nor too thick, making it easy to apply without being excessively sticky or difficult to spread. To measure the viscosity of a polyherbal hand sanitizer using a Brookfield Viscometer, choose an appropriate spindle, Place the sample in a clean container, and submerge the spindle. Set the rotational speed (30–60 RPM) and allow the device to stabilize. Record the viscosity reading in centipoise (cP). The ideal viscosity for hand sanitizers typically falls between 400–1000 cP. Repeat measurements at different speeds to confirm consistency if needed [24].

#### 4. Spreadability

According to the methods outlined in, the spreadability of the produced hand sanitizers was assessed by spreading 0.5 gm of each formulation gel over a pre-marked transparent glass with a 2 cm diameter. After that, a second clear glass was added on top, and the contents were distributed over five minutes by adding a 500 g weight. Using this technique, the spreadability was assessed based on the gels' properties of slip and drag. The borders were scraped clean of extra gel (14). The diameter of the spreading area of each formulation was determined and represented by the mean ± SD of three replicates [25].

## 3 RESULTS AND DISCUSSION

### 3.1 MACROSCOPIC CHARACTERISTICS

#### *PONGAMIA PINNATA*(OIL)

colour : yellowish brown

odour : characteristic, unpleasant, nut-like

state: liquid

nature : oily, viscous

touch : greasy

taste : bitter

*Pongamia* oil is yellowish-brown to dark brown colour and they have a possesses a characteristic, unpleasant odour. It is a liquid state and oily and viscous in nature. On touch, it feels greasy, and the taste is bitter and acrid

***AZADIRACHTA INDICA*(LEAF)**

Colour : green

Odour :L characteristic, slightly, pungent

State : solid

Nature : bitter

Touch : slightly rough

Taste : bitter

Petiole : long, slender, compound leaves

The neem leaf is green in colour and has a characteristic, slightly pungent odour. It is a solid in state and shows a bitter and astringent nature. On touching, suface feels smooth to slightly rough, and the taste is distinctly bitter. The petiole is long, slender and green bearing compound leaves.

***OCIMUM TENUFLORUM*(LEAF)**

Colour : green, purplish green

Odour : strong, aromatic

State : solid

Nature : slightly pungent

Touch : soft, slightly hairy

Taste : pungent and slightly bitter

Petiole: long, slender, green to purplish

Tulsi leaf green to purplish green in colour and has a strong, aromatic odour. It is solid in state and aromatic with slightly pungent nature. on touch, it feels soft and slightly hairy and the taste is pungent. The petiole is long and slender.

***RUBIA CORDIFOLIA (ROOT)***

Colour : reddish brown externally, orange- red internally

Odour : characteristic, slightly aromatic

State : solid

Nature : astringent

Touch : hard, rough

Taste : bitter and astringent

*R.cordifolia is* reddish- brown in colour externally and orange- red internally, with a characteristic, slightly aromatic odour. It is solid in state and astringent in nature. On touch, the root feels hard and rough, and the taste is bitter and astringent.

***ECLIPTA ALBA (LEAF)***

Colour : light brown to brown

Odour : characteristic

State : solid

Nature : slightly bitter

Touch : hard rough

Taste : bitter

*E.alba* is green in colour and has a characteristic, mild odour. It is solid in state and slightly bitter in nature. On touch, the plant feels hard, rough and slightly rough and the taste is bitter.

### 3.2 EXTRACTION EVALUATION

**Table 3.2.1 Extraction Evaluation**

| S.N O | PLANT | TYPES OF EXTRACTOIN | PERCENTAGE YIELD | COLOUR | CONSISTENCY |
|---|---|---|---|---|---|
| 1. | *Pongamia pinnata* | Cold press oil | 99.9% purity | Yellow | Oily in nature |
| 2. | *Azadirachta indica* | Ethanolic extract | 3.83 | Green | Semisolid consistency |
| 3. | *Ocimum teniflorum* | Ethanolic extract | 4.92 | Green | Semisolid consistency |
| 4. | *Rubia cordifolia* | Ethanolic extract | 2.52 | Brick red | Semisolid consistency |
| 5. | *Ecliptaalba* | Ethanolic extract | 3.31 | Brown | Semisolid consistency |

**DISCUSSION OF EXTRACTION EVALUATION OF SELECTED PLANT**

The physical characteristic of the selected plant extracts were evaluated in terms of percentage purity, colour and consistency. The extract of *Azadirachta indica* showed a percentage purity of 3.84%. it appeared green in colour and exhibited a semisolid consistency. The extract obtained from *Rubia cordifolia* showed a purity of 2.529% and was brick red in colour with a semisolid consistency. The extract of *Ocimum tenuiflorum* demonstrated a relatively higher purity 4.920%. it was green in colour and showed a semisolid consistency. The extract of *Eclipta alba* showed a purity of 3.318% appeared brown in colour, with a semisolid consistency.

In contrast, the extract of Pongamia pinnata showed a very higher purity of 99.9%. it was yellow in colour and was found to be oily in nature, unlike the extracts which were semisolid.

### 3.3 PHYTOCHEMICAL SCREENING

**Table:3.3.1 phytochemical screening**

| Plant name | Alkaloids | Tannins | Flavonoids | Glycosides | Saponins | Terpenoids |
|---|---|---|---|---|---|---|
| *P. pinnata* | – | + | + | + | - | + |
| *A. indica* | - | + | + | + | - | + |
| *O. tenuiflorum* | - | + | + | - | - | + |
| *R. cordifolia* | - | + | + | + | - | - |
| *E. alba* | + | + | + | - | + | + |

**(+) Present (-) Absent**

**DISCUSSION OF PHYTOCHEMICAL SCREENING OF SELECTED PLANTS**

In *P. pinnata,* its shows the presence of tannins, flavonoids, glycosides and terpenoids. Alkaloids, saponins, and steroids are absent.

In *A. indica*, it shows the presence of tannins, flavonoids, terpenoids and steroids but alkaloids and saponins are absent.

In *O. tenuiflorum,* it contains tannins, flavonoids and terpenoids, but alkaloids, glycosides, saponins and steroids are absent.

In *R. cordifolia,* it shows the presence of alkaloids, tannins, flavonoids and glycosides. But alkaloids, saponins, terpenoids and steroids are absent.

In *E. alba,* it shows the presence of alkaloids, tannins, flavonoids, saponins and steroids but glycosides and steroids are absent.

### 3.4 FORMULATION OF POLYHERBAL SANITIZER:

**Table 3.4.1 different types of formulation concentration for 100ml**

| INGREDIENTS NAME | FORMULATION 1 | FORMULATION 2 | FORMULATION 3 |
|---|---|---|---|
| Ethanol | 70ml | 60 | 40 |
| *P. pinnata* oil | 3ml | 6ml | 9ml |
| *A. indica* extract | 3ml | 6ml | 9ml |
| *O. tenuiflorum* extract | 3ml | 6ml | 9ml |
| *R. cordifolia* extract | 3ml | 6ml | 9ml |
| *E. alba* extract | 3ml | 6ml | 9ml |
| Carbopol 940 | 5g | 5g | 3.5g |
| Aloe vera gel | 3g | 2g | 2g |
| Triethanolamine | 0.25ml | 0.5ml | 0.75ml |
| Lemongrass oil | 0.25ml | 0.5ml | 0.75ml |
| Distilled water | q. s | q. s | q. s |

### 3.5 IN VITRO ANTIMICROBIAL ACTIVITY



**Figure 3.5.1: Effect of sample against *P. aeruginosa* Figure 3.5.2: Effect of sample against *E. coli***

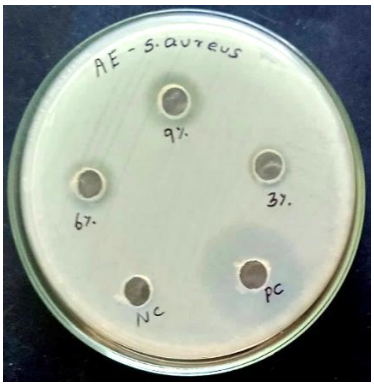


**Figure 3.5.3: Effect of sample against *S. aureus.***

**Table 3.5.1 Invitro antimicrobial activity**

| S NO | NAME OF THE TEST ORGANISM | ZONE OF INHIBITION (MM) MEAN±SD | | | |
|---|---|---|---|---|---|
| | | F1 | F2 | F3 | PC |
| 1 | *P. aeruginosa* | 7.25±0.07 | 8.55±0.21 | 13.7±0.14 | 26.2±0.28 |
| 2 | *E. coli* | 7.15±0.21 | 9.1±0.28 | 15.55±049 | 26.65±0.45 |
| 3 | *S. aureus* | 7.1±0.14 | 10.45±0.65 | 13.85±0.07 | 26.75±0.21 |

SD – standard deviation, F1 - Formulation one, F2 - Formulation two, F3 - Formulation three, PC – positive control

**DISCUSSION ON RESULT OF INVITRO ANTIMICROBIAL ACTIVITY**

The in vitro antimicrobial activity of the formulation was evaluated by measuring the zone of inhibition against *Pseudomonus aeruginosa, Escherichia coli,* and *staphylococcus aureus*. The result were expressed as mean ± standard deviation. For *P.aeruginosa*, formulation F1 showed a zone of inhibition of 7.25 ± 0.07 mm, F2 showed 8.55 ± 0.21 mm, and F3 exhibited a higher activity with 13.7 ± 0.14mm, while the positiive control showed a maximum inhibition of 26.2 ± 0.28mm. against *E. coli*, F1 produced an inhibition zone of 7.15 ± 0.21 mm, F2 showed 9.1 ± 0.28mm, and F3 demonstrated increased activity with 15.55 ± 0.49 mm, wheres the positive control showed 26.65 ± 0.45 mm,in the case of *S.aureus* formulation F1 showed an inhibition zone of 7.1 ±0.14 mm, F2 exhibited 10.45 ± 0.65 mm, and F3 showed 13.85 ±0.07 mm, while the positive control exhibit the highest zone of inhibition of 26.75 ± 0.21 mm. overall, formulation F3 demonstrated superior antimicrobial activity compared to F1 and F2 against all the tested organisms, through the activity was lower than that of the positive control.

**3.6 EVALUATION OF HERBAL HAND SANITIZER**

**Table : 3.6.1 evaluation of herbal hand sanitizer**

| PARAMETERS | FORMULATION 1 | FORMULATION 2 | FORMULATION 3 |
|---|---|---|---|
| **colour** | Pale green | Light green | Dark green |
| **Odour** | Pleasant, mild herbal | Pleasant herbal | Strong herbal |
| **Texture** | smooth | Smooth | Slightly sticky |
| **Ph** | 5.3 ± 0.1 | 5.7 ± 0.1 | 6.3 ± 0.1 |
| **Viscosity (cP)** | 520 ± 50 | 469 ± 45 | 429 ± 40 |
| **Spreadability (gcm/sec)** | 6.5 ± 0.2 | 7.2 ± 0.3 | 8.1 ± 0.3 |

**DISCUSSION ON RESULT OF EVALUATION OF HERBAL HAND SANITIZER**

All three formulation exhibits acceptable organoleptic characteristic. Formulation 1 showed a pale green, mild herbal odour with a smooth texture, whereas formulation 2 appeared in light green with a pleasant herbal odour and smooth texture. Formulation 3 exhibited a dark green colour with astrong herbal odour and slightly sticky texture.

The pH values of formulation 1, formulation 2, and formulation 3 were found to be 5.3 ± 0.1, 5.7± 0.1, and 6.3 ± 0.1 respectively, indicating compatibility with skin pH

Viscosity measurements showed values of 520 ± 50 Cp for formulation 1, 469 ± 45 Cp for formulation 1, 2 and 3 respectively, suggesting ease of application.

Overall, all formulations exhibited satisfactory evaluation parameters suitable for herbal hand sanitizer preparation.

## 4. CONCLUSION

Polyherbal formulation are still mainstay of about 75-80% of the world population manily in developing countries for the primary health care because of better compatibility with the human body and lesser side effects. In pursuit of a safer and more natural defence against disease transmission this study out to create an innovative alcohol based herbal sanitizer. The polyherbal formulation containing herbal extract as shown antimicrobial activity with the blent of skin moisturizing and smoothing benefits. The use of herbal ingredients confirms the eco-friendkiness and user safety.

**Conflict of Interest:** The authors declared no conflict of interest regarding this manuscript.

**Acknowledgement:** We would like to thank Shree Venkateshwara College of Paramedical Science, College of Pharmacy for giving us this opportunity to do the research work. We would like to express our gratitude to the Chairman, Secretary, C.E.O, Principal and Guide for their support and for providing the necessities required to finish our work.

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