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Formulation and evaluation of polyherbal Hand wash gel

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Abstract

The aim of current work was preparation of polyherbal handwash gels for germ-free hands. There are various formulations are available in the market it includes Hand sanitizer, Hand soap, Soap paper, Hand wash gel. Hand sanitizer are not able to kill all types of germs where Hand wash Gel kill all germs and able to hydrated the skin and keep it fresh. Also, our formulated Hand wash contains herbal leaf extract of curry leaf (*Murraya Koenigii*), Guava leaf (*Psidium guajava* L.) and Papaya leaf (*Carica Papaya*). The formulated herbal hand wash gel was assessed for physical properties like appearance, viscosity, pH, skin irritation test, foam height, foam retention, Antibacterial activity etc. The Antibacterial activity of prepared formulation was checked against pathogen like *Escherichia coli*, *Staphylococcus aureus* by agar diffusion method. Handwash gel is commonly used personal care product that help to maintain hand hygiene and prevent the spread of infection. The result divulged that prepared polyherbal hand wash gel formulation showed significant zone of inhibition compared with marketed formulation So, this herbal plants extract used in preparation of polyherbal hand wash on significant use.

Keywords: Polyherbal hand wash Curry leaves (*Murraya Koenigii*), Guava (*Psidium guajava* L.), Papaya leaves (*Carica Papaya*) antibacterial activity

Introduction

From ancient time medicinal plant was given more preference to. Medicinal plant also known as medicinal herbs have been discovered and used in conventional medicinal practices from ancient period. Plant synthesized various of chemical compounds for several functions including defence and shielding against bacteria, fungi and other diseases.

In recent times, the world has witnessed an unprecedented emphasis on hygiene and sanitation due to the global health crisis caused by the COVID-19 pandemic. Hand hygiene, in particular, has become a critical aspect of avoiding the transmission of infectious or communicable diseases. Hand washing with soap and water has been widely recommended by health authorities as one of the most effective methods to maintain hand hygiene. However, the availability of clean water and soap is not always guaranteed, especially in resource-constrained settings.

To address this challenge, researchers and scientists have been exploring alternative formulations that can offer effective hand hygiene solutions.

Herbal: A type of medicine that uses roots, stem, leaves, flowers or seeds of plant to improve health, prevent disease and treat illness.

Cosmetics: It means any article intended to be rubbed, poured, sprinkled or sprayed on or introduced into or otherwise applied to the human body or any part thereof for cleansing, beautifying, promoting attractiveness or altering the appearance and includes any article intended for use as component of cosmetics.

Hygiene: Hygiene is defined as the maintenance of the practice of cleanliness which is most important in the maintain of well-being, keeping body hygiene and using the cleanser necessary for healthy life this concept understood need of maintain hygiene in disease prevention.

Hand wash: Hand washing or hand hygiene is the act of cleaning one's hands with or without the use of water or another liquid, or with the use of soap for the purpose of removing soil, dirt, and/or micro-organism.

Gel: Gel is a two-phase elastic colloidal material consisting of a dispersed liquid incorporated in the solid phase.

Soap: Soap is a salt of fatty acid used in variety of cleansing and lubricant product.

Sanitizer

“A substance or product that is used to reduce or elimination pathogenic agent on surfaces”. One such formulation gaining attention is polyherbal hand wash gel, which combines the antimicrobial properties of various plant-based ingredients. Polyherbal formulations have long been used in traditional medicine systems across the globe for their therapeutic benefits. Now, they are being harnessed to create innovative

hand wash gels that can provide effective cleansing and disinfection while being gentle on the skin.

The formulation and evaluation of Polyherbal hand wash gels involve a comprehensive scientific approach to select, blend, and optimize the combination of plant extracts and other ingredients. The formulation process takes into consideration the antimicrobial, antiviral, and antifungal properties of different herbal components to create a synergistic effect. These components may include herbs such as Neem, Tulsi, *Aloe-vera*, Tea tree, Lemon, and others, each with its unique beneficial properties.

Following are the list of herbal plant which show antibacterial activity

Table 1: Herbal plant which shows antibacterial activity

| Sr. no | Herbal Plants | Part of plant used |
|--------|----------------------|--------------------|
| 1. | Mint | Leaf |
| 2 | Garlic | Bulb |
| 2 | Curry leaves | Leaf |
| 4 | Lemon | Fruit |
| 5 | Neem | Leaf |
| 6 | Clove | Fruit |
| 7 | Fennel | Fruit |
| 8 | Senna | Leaf |
| 9 | Amla | Fruit |
| 10 | Spinach | Leaf |
| 11 | Turmeric | Rhizome (root) |
| 12 | Aloe -Vera | Leaf |
| 12 | Tulsi | Leaf |
| 14 | Guava | Leaf |
| 15 | Coriander | Leaf |
| 16 | Marigold | Leaf |
| 17 | Pumpkin | Leaf |
| 18 | Betel | Leaf |
| 19 | Fenugreek | Leaf and seed |
| 20 | Tea | Leaf |
| 21 | <i>Papaya</i> leaves | Leaf |
| 22 | Onion | Bulb |
| 22 | Cinnamon | Bark |
| 24 | Lemon grass | Leaf |
| 25 | Arjuna | Bark |
| 26 | Tamarind | Leaf |
| 27 | Ginger | Rhizome |
| 28 | Congress grass | Leaf and flower |
| 29 | Hibiscus | Flower |
| 30 | Bhringraj | Leaf |

Skin is the largest organ in human body with an area of approximately 1.2-2 square meter. Skin is made up of water, proteins, fats and minerals.

Function of skin ^[21]

- Protection
- Secretion and Excretion
- Heat regulation
- Sensation
- Absorption

Plants or herbs are known for therapeutic components they contain all of these components are removed & added to the hand wash making it safe and healthier to wash your hand. It gives the skin smooth texture gentle appearance. It can achieve with traditional hand wash product. The herbal hand wash fragrance keeps the skin fresh. When using herbal hand




wash, the mild foaming action does not irritate the skin it can improve the lowering of skin elasticity.

Advantages of Herbal Hand wash Gel

1. No side effects.
2. Bacteria on our hands can be minimized.
3. It also helps to clear antiseptic and fungal problem faced by the skin.
4. It also helps to remove dirt and oil effectively from the skin.
5. Easier access compared to using soap and water.
6. The easiest way to get rid of microorganism.
7. Hand wash prevent germs from entering into our body. Easy to apply and no side effect.

Herbal Plant Profile ^[18, 19, 20]

Table 2: Herbal plant profile

| Plant | Information | Plant Image |
|------------------------|--|---|
| 1. | Curry leaves |  |
| Biological Name | <i>Murraya Koenigii</i> | |
| Family | Rutaceae | |
| Antibacterial compound | Mahanine, Linalool | |
| Uses | Antibacterial | |
| 2. | Guava leaves |  |
| Biological Name | <i>Psidium guajava</i> L. | |
| Family | Myrtaceae | |
| Antibacterial compound | Terpinene, Pinene | |
| Uses | Antibacterial and antimicrobial | |
| 3. | <i>Papaya</i> leaves |  |
| Biological Name | <i>Carica Papaya</i> | |
| Family | Caricaceae | |
| Antibacterial compound | Procatechuic, 5, 7- dimethoxycoumarine | |
| | | |

Materials

Collection of Plant and Authentication

Leaves of Curry (*Murraya Koenigii*), Guava (*Psidium guajava*) & Papaya (*Carica Papaya*) were collected from local region and dried it well on the basis of medicinal uses. The plants were identified, confirmed, and authenticated by Dr. S.M. Shendge plant Taxonomist, Balwant College Vita. After authentication process the leaves (Curry, Guava, Papaya) are collected, washed, and shade dried at room temperature. The leaves are blended by electric mixer.

Method -Extraction

Curry leaves- Preparation of Ethanolic extract ^[8]

Fresh leaves are collected, washed and shade dried at room temperature for 3-4 days. These leaves are converted into fine powder by using mixer. Take 20 gm curry leaves mixed in 200 ml ethanol and DW (8:2) covered with aluminium foil and kept at 25 °C-27 °C for 2 days. Then collected supernatant extract, to get final volume of curry leaves and this ethanolic extract used for experiment.

Guava leaves Extract ^[7]

Fresh leaves are collected, washed and shade dried at room temperature. These leaves are placed in mixer to make a fine powder. Four solvents are used according to their increasing polarity; n-hexane, methanol, ethanol and distilled water use for extraction process. The fine powder is mixed with particular given solvent to make 20% conc. The mixture was added in beaker (500 ml) and covered with aluminium foil for 2 days at 25 °C-27 °C temperature. Then placed beaker at platform shaker at 70 rpm. After 2 days maceration solvents transfer to 50 ml tube for centrifuged at 4000 rpm for 10 mins at 25 °C and collect supernatant extract.

Papaya leaves ^[6]

The leaves are collected, washed and shade dried for 2 weeks. These dried leaves are placed in mixer to make a fine powder. The *Carica Papaya* leaves are extracted with n-hexane and ethanol by using Soxhlet apparatus. Take 50 gm leaves powder in thimble were extracted with 500 ml (n-hexane & ethanol) in round bottom flask. It takes 8 hrs extraction

process completed. Then collect extract and placed in refrigerator.

C. Phytochemical screening ^[1, 4]

Alkaloid Test

2 ml of liquid extract + 5 ml of Hcl +filtered. This filtrate used for alkaloid testing.

Draggendorff's test

2 ml of filtrate + few drops of Draggendorff's reagent, gives orange-red precipitate which indicates alkaloid is present.

Mayer's test

1 ml of filtrate + few drops of Mayer's reagent gives cream-colored precipitate and which indicates alkaloid is present.

Wagner test

1 ml of extract + few drops of Wagner's reagent gives Red brown precipitate and which indicates alkaloid is present.

Tannins Test

5 ml Extract + 1 ml ferric chloride (5%) gives Dark green or Deep blue color and which indicates tannin is present.

Saponin Test

1. 1 ml of extract + 20 ml distilled water + shake for 15 mins it leads to formation of foam and which indicates saponin is present.

2. 1 ml of extract + heat with 1% lead Acetate gives white precipitate and which indicates saponin is present.

Carbohydrate Test (Molisch's Test)

2 ml of extract + 2 ml conc. Sulphuric acid + few drops of Molisch's reagent lead to formation of violet ring at interphase and which indicates carbohydrates is present.

Cardiac Glycoside Test (Keller Killani Test)

5 ml of extract + 2 ml Glacial Acetic Acid + few drops of ferric chloride + 1 ml H₂SO₄ which leads to formation of brown or violet ring, which indicates cardiac glycoside is present.

Flavonoid Test (Shinoda Test)

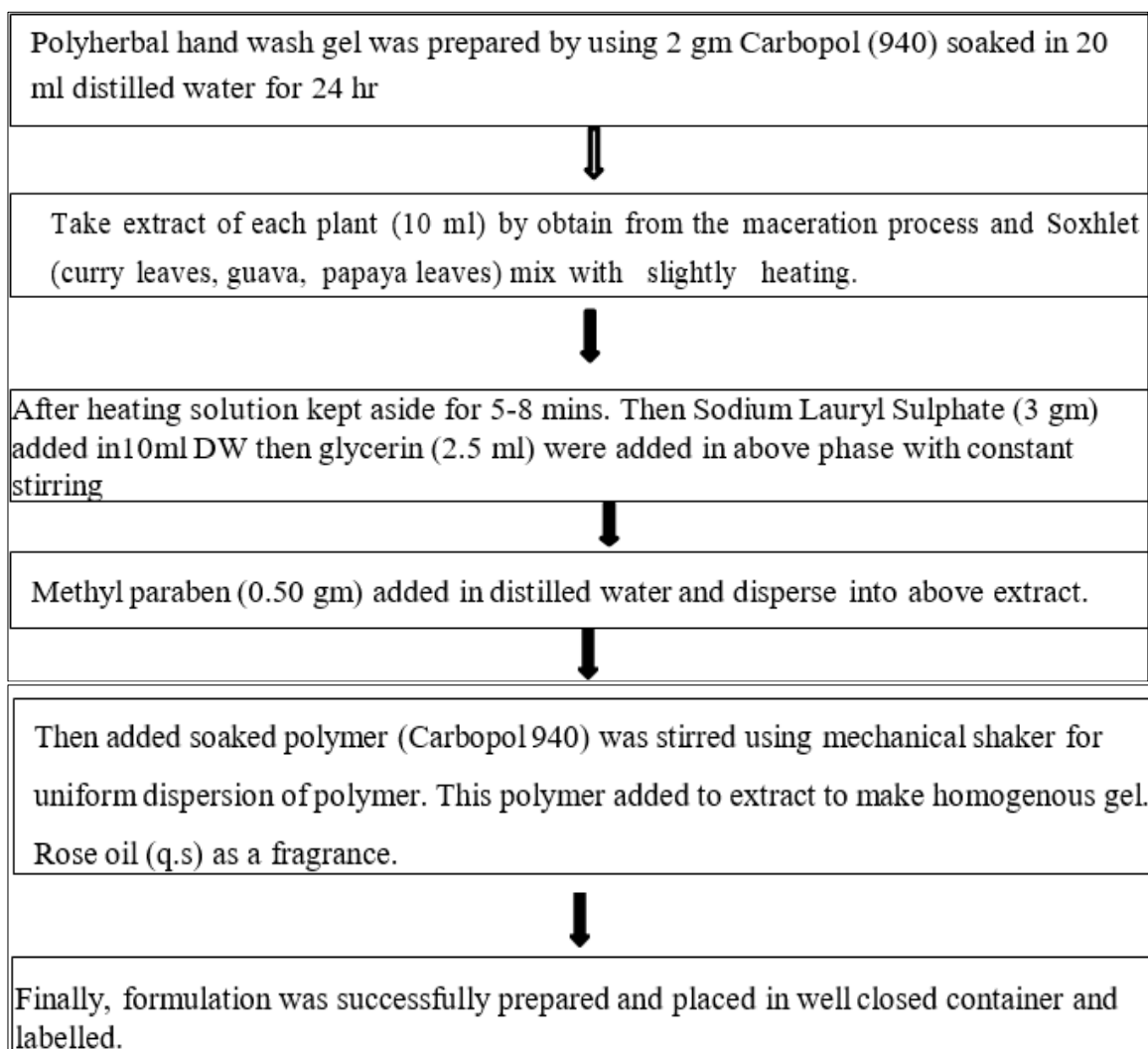
2 ml of extract + Alcohol + conc. Hcl (drop wise) + Heat. Formation of pink color and which indicates flavonoid is present.

Resins Test

2 ml of extract + heat with caustic soda, formation of red color and which indicates resins are present.

Terpenoids Test (Salkowski Test)

2 ml of extract + 1 ml Chloroform + few drops of conc. H₂SO₄ gives reddish brown precipitate and which indicates terpenoids are present. Procedure of Preparation of Handwash Gel ^[9]



Formulation table**Table 3:** Formulation table

| Sr.no | Ingredient | Quantity | | | | | Role |
|-------|------------------------|----------|--------|--------|--------|--------|-----------------|
| | | A1 | A2 | A3 | A4 | A5 | |
| 1. | Curry leaves extract | 10 gm | 10 gm | 10 gm | 10 gm | 10 gm | Antimicrobial |
| 2. | Guava leaves extract | 10 gm | 10 gm | 10 gm | 10 gm | 10 gm | Antimicrobial |
| 3. | Papaya leaves extract | 10 gm | 10 gm | 10 gm | 10 gm | 10 gm | Antimicrobial |
| 4. | Glycerine | 2.5 ml | 2.5 ml | 2.5 ml | 2.5 ml | 2.5ml | Softening agent |
| 5. | Sodium Lauryl Sulphate | 3 gm | 3 gm | 3 gm | 3 gm | 3 gm | Foaming agent |
| 6. | Carbapol(940) | 1 gm | 2 gm | 3 gm | 4 gm | 5 gm | Gelling agent |
| 7. | Methyl Paraben | 0.50 | 0.50 | 0.50 | 0.50 | 0.50 | Preservative |
| 8. | Distilled Water | q.s. | q.s. | q.s. | q.s. | q.s. | Vehicle |
| 9. | Rose oil | 0.3 ml | 0.3 ml | 0.3 ml | 0.3 ml | 0.3 ml | Perfume |

Evaluation parameters for Polyherbal hand wash gel [4, 9]**Organoleptic test**

Organoleptic test includes colour, texture and odour was evaluated by

- Colour- Visual inspection
- Texture- Touch sensation
- Odour- By nosing

Homogeneity and Appearance

Homogeneity and appearance were evaluated by visual surveillance.

Test for Grittiness

1 ml of handwash gel was taken between two finger tips and rubbed it then evaluated the formulation

Test for skin irritation

Test for skin irritation was carried out was by applying Polyherbal Hand wash Gel on hand for 30 min, after 30 minutes of washing observe any itching, rashes or redness on hand by visual surveillance.

Test for pH detection

A Polyherbal hand wash gel (1 gm) dissolved into 100 ml DW. The pH was measured by using potentiometric pH meter.

Spreadability test

Polyherbal Hand wash Gel (0.5 gm) was kept and pressed between two glass slides and left for 5 mins were no more spreading. Diameter of spreaded circle was measured in cm.

Test for viscosity

Polyherbal hand wash gel viscosity was determined through Brookfield viscometer.

Test for foam height

Polyherbal Hand wash Gel (1gm) was mixed in 50 ml distilled water (A). From (A) withdraw 10 ml solution in 100 ml volumetric flask and makeup volume (B). Take 10 test tube and then add 1 ml, 2 ml, 3 ml,... 10 ml in 10 different test tubes from (B) and make up the volume 10 ml with distilled water. Then test tube were shaken for 10 seconds and allow to stand for 5 mins and finally measure the foam height.

Test for foam retention

Polyherbal hand wash gel (25 ml) transferred into 100 ml measuring cylinder and shaken for 15 times. The volume of foam was checked after 1 min, 2min and 4min interval was recorded, foam retention and it remains stable atleast 5mins.

Test for stability

The Stability of Polyherbal Hand wash Gel was evaluated by storing at different temperature conditions such as 25 °C, 37 °C and 40 °C upto 1 week. During the stability no change in colour, no change in texture or no phase separation and no were observed.

Antibacterial Activity of Herbal Handwash [10, 11, 12]**Procedure: Antibacterial activity against *staphylococcus aureus*, *E. coli* bacteria by well diffusion method**

Take 15 ml nutrient agar (Hi media) were prepared from bacterial culture. The inoculums of the microorganism were prepared from the bacterial cultures. 15 ml of nutrient agar (Hi media) medium was poured in clean sterilized Petri plates and allowed to cool and solidify. 100 µl of broth of bacterial strain was pipette out and spread over the medium evenly with a spreading rod till it dried properly. Once the agar was hardened, then Sample Slides was placed on the plate in the manner and the plates were incubated at 37 °C for 24 hr. Antibacterial activity was evaluated by measuring the diameters of the zone of inhibitions (ZI). Take 15 ml of nutrient agar (Hi media) in clean and sterilized petri plate. Allow to stand for 15-20 mins to cool and solidify the media. Then withdraw a 100 µl of broth of bacterial strain with the help of pipette, spread over the agar media with spreading rod and dry properly. Then sample slide are incubated at 37 °C for 1 day (24 hr). Antibacterial activity was assessed by measuring the area of the inhibition zone.

Result**Procurement and authentication of plant**

Fresh leaves of curry leaves (*Murraya Koenigii*), Guava leaves (*Psidium guajava*) and Papaya leaves (*Carica Papaya*), were collected and dried properly from local region. The plant was identified, verified and authenticated by Dr. S.M. Shendge plant taxonomist, Balwant College Vita.

Preparation of powder

Plant leaves were converted into powder.

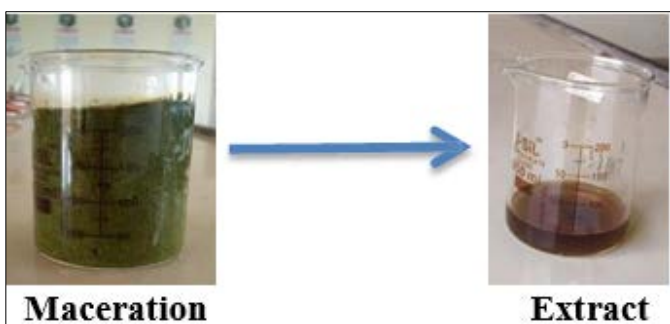
**Fig 1:** a) Guava leaves b) Curry leaves c) Papaya leaves

Extraction

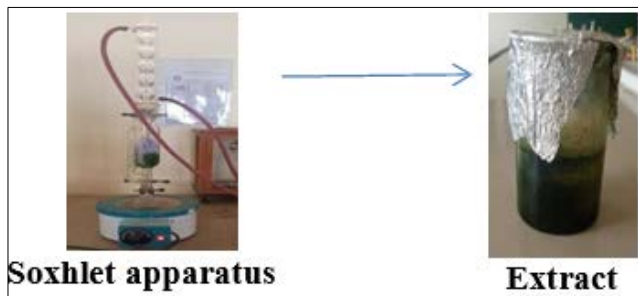
Murraya Koenigii extract was obtain by using Maceration process



Psidium guajava extract was obtain by using Maceration process



Carica Papaya extract was obtain by using Soxhlet apparatus



Characterization of Extract

Description

The general appearance of an extract, its nature, colour, odour was found to be follows:

Table 4: General appearance of Extract.

| Parameters | Observations |
|------------|----------------|
| Nature | Aqueous |
| Colour | Brownish green |
| Odour | Characteristic |

Phytochemical screening of extract

Table 5: Phytochemical evaluation test of curry leaves extract.

| Phytochemicals | Observations |
|-------------------|--------------|
| Alkaloids | Present |
| Carbohydrates | Present |
| Cardiac glycoside | Present |
| Phenol | Present |
| Terpenoid | Present |

Table 6: Phytochemical evaluation test of Guava leaves extract.

| Phytochemicals | Observations |
|-------------------|--------------|
| Saponin test | Present |
| Phenol and Tannin | Present |
| Cardiac glycoside | Present |
| Terpenoid | Present |
| Flavonoid | Present |

Table 7: Phytochemical evaluation test of *Papaya* leaves extract.

| Phytochemicals | Observations |
|-------------------|--------------|
| Alkaloids | Present |
| Saponin test | Present |
| Phenol and Tannin | Present |
| Flavonoid | Present |

Formulation of Polyherbal hand wash gel [Table no 8]



Fig 2: Formulation of handwash gel

Evaluation Test of Polyherbal Handwash Gel
Organoleptic Test

Table 8: Organoleptic test

| Colour | Homogeneity | Consistency |
|------------|-------------|-------------|
| Dark green | Excellent | Excellent |

Appearance

Appearance and homogeneity were evaluated by visual surveillance and it found to be good.

Grittiness

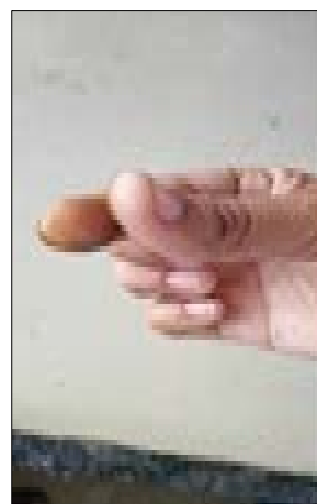


Fig 3: Grittiness test

Grittiness of Polyherbal hand wash gel was found to be non-gritty

Test for Skin irritation

Applying polyherbal hand wash gel on hand for 30 mins. After 30 mins washing hand there is no irritation, redness or itching was observed.



Fig 4: Applying hand wash gel



Fig 5: After washing hand.

pH

pH of formulated Polyherbal hand wash gel was calculated by using potentiometric pH meter and result was observed to be **7.90** it was good pH range it is safe for skin.



Fig 6: pH of formulated Polyherbal hand wash gel

Spreadability

Spreadability of formulated poly herbal hand wash gel was calculated in cm. the diameter of circle was found to be (D =1.2 cm).

Formula – $S = M \times D / T = 0.5 \times 1.2 / 300$ $S = 0.002$



Fig 6: Spreadability of Polyherbal handwash gel

The above result shows the Good spreadability of Polyherbal handwash gel.

Viscosity (Brookfield Viscometer)

The viscosity of Polyherbal hand wash gel was estimated by using Brookfield viscometer and result are as follows.



Fig 7: Viscosity of Polyherbal hand wash gel using Brookfield viscometer

| Sample | Viscosity (Centi poise) |
|--------------------------|-------------------------|
| Polyherbal Hand wash Gel | 513 |

Foam Height

Table 8: Foam height

| Test tube No. | Sample: water | Foam height (cm) |
|---------------|---------------|------------------|
| 1 | 1:9 | 1 |
| 2 | 2:8 | 1.5 |
| 3 | 3:7 | 2 |
| 4 | 4:6 | 1 |
| 5 | 5:5 | 1.2 |
| 6 | 6:4 | 1.7 |
| 7 | 7:3 | 2.1 |
| 8 | 8:2 | 3 |
| 9 | 9:1 | 2.3 |
| 10 | 10:0 | 3 |
| | mean | 1.8 |

Formulated Polyherbal Hand wash Gel was found to be Good.



Fig 8: Foam height of Polyherbal Hand wash Gel

Table 9: Foam retention

| Time | Foam Retention (ml) Polyherbal Hand wash Gel |
|-------|--|
| 1 min | 38 |
| 2 min | 35 |
| 3 min | 33 |
| 4 min | 30 |
| Mean | 34 |



Fig 9: Foam retention

It was observed good foam retention

Stability

Table 10: The stability study was performed by Polyherbal hand wash gel at different temperature condition like 25 °C, 37 °C and 40 °C.

| Parameter | Initial study | 25 °C | 37 °C | 40 °C |
|-----------|----------------|----------------|----------------|----------------|
| Nature | Gel | Gel | Gel | Gel |
| Colour | Brownish green | Brownish green | Brownish green | Brownish green |
| Odour | Rose like | Rose like | Rose like | Rose like |
| Texture | Smooth | Smooth | Smooth | Smooth |

During stability study no changes were observed in above parameter so, it was good stability at above temperature condition.

Antibacterial Activity of Polyherbal hand wash gel: The antibacterial activity was tested by using well plate diffusion method against bacteria *E. coli* and *Staphylococcus aureus*.

Table 11: Antibacterial activity of Polyherbal Hand wash Gel

| Sr.no | Sample | Concentration on (mg/ml) | Zone in diameter (mm) <i>Staphylococcus aureus</i> | Zone in diameter (mm) <i>E. coli</i> |
|-------|-------------------------|--------------------------|--|--------------------------------------|
| 1 | Control | - | - | - |
| 2 | Standard (Streptomycin) | 1 | 30 | 32 |
| 3 | Sample -S1 | 100 | 6 | 8 |
| | | 200 | 10 | 12 |



Fig 11: *S. aureus* bacterial test



Fig 12: *E. coli* bacterial test

The sample -S1 used for antibacterial activity by using bacteria *E. coli* and *staphylococcus aureus* at the concentration 10 mg/ml showed good activity as compared to standard.

Conclusion: In current study the active constituent of *Murraya Koenigii* (Linalool, Mahanine) *Psidium guajava*

(Terpinene, Pinene) *Carica Papaya* (Papain, 5, 7-dimethoxycoumarine, Procatechuic show antimicrobial activity) were present in extract of hand wash which shows surpassing inhibition against skin pathogens. These compounds were extracted and incorporated in order to formulate a Polyherbal hand wash with substantial activity, which having less or no side effects. The formulated

Polyherbal hand wash gel of batch A2 shows better result as it shows antibacterial activity. From the above result we can conclude that the prepared polyherbal hand wash gel is good in appearance and stable. Finally, it is determined that Polyherbal Hand wash Gel gives effective and safe results compared with marketed hand wash.

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