



Formulation And Evaluation Of Topical Herbal Hand Wash Gel Containing Cinnamon Oil

¹Hemanshi Sharma, ²Dr.Subhasri Mohapatra

¹M.Pharma, ²Professor

¹Department of Pharmaceutics, Royal College of Pharmacy, Raipur, Chhattisgarh, India

²Department of Pharmaceutics, Royal College of Pharmacy, Raipur, Chhattisgarh, India

ABSTRACT- Hands are primary mode of transmission of microbes and infections. Hand-washing is critical in food production, food service and also important in healthcare setting, homes and day care preparations. . The topical system a hand wash gel is created The pH, viscosity, drug content, stability study, skin irritation test, anti-microbial study and other properties of the prepared formulation are evaluated. Many emulgel hand wash cleanser is available in the market which could be challenging for present project work. The plan of the research was aimed to formulate evaluate the antibacterial efficacy of various herbal oils such as Cinnamon oil, Eucalyptus oil, menthol oil and lavender oil and found that cinnamon oil showed better antibacterial activity. Also the research was carried out to formulate and evaluate the poly herbal Hand wash gel containing Cinnamon oil. The anti-microbial activity of the formulated herbal hand wash gel was tested against Escherichia coli, and lactobacillus Salmonella by spread plate techniques and the results obtained were compared with commercial antibacterial standards. Also the efficiency was checked by using the hand wash gel on volunteers. The results from the present work suggest and support the incorporation and utilization of herbs in the formulations to give better effect.

KEYWORD- Cinnamon oil Emulgel, Topical Drug Delivery, Herbal hand wash gel, Antimicrobial activity and Cinnamon oil

1.Introduction:-

HAND WASH GEL:-

Hands are primary mode of transmission of microbes and infections, Hand hygiene is therefore the most important measure to avoid the transmission of harmful germs and prevent the infections. Hand hygiene is the single most important, simplest, and least expensive means of preventing nosocomial infections ^[1].

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^[2]. Hand hygiene, in particular, has become a critical aspect of avoiding the transmission of infectious or communicable diseases^[3]. Hand washing with soap and water has been widely recommended by health authorities one of the most effective methods to maintain hand hygiene^[4]. However, the availability of clean water and soap is not always guaranteed, especially in resourceconstrained settings^[5].

To address this challenge, researchers and scientists have been exploring alternative formulations that can offer effective hand hygiene solutions^[6].

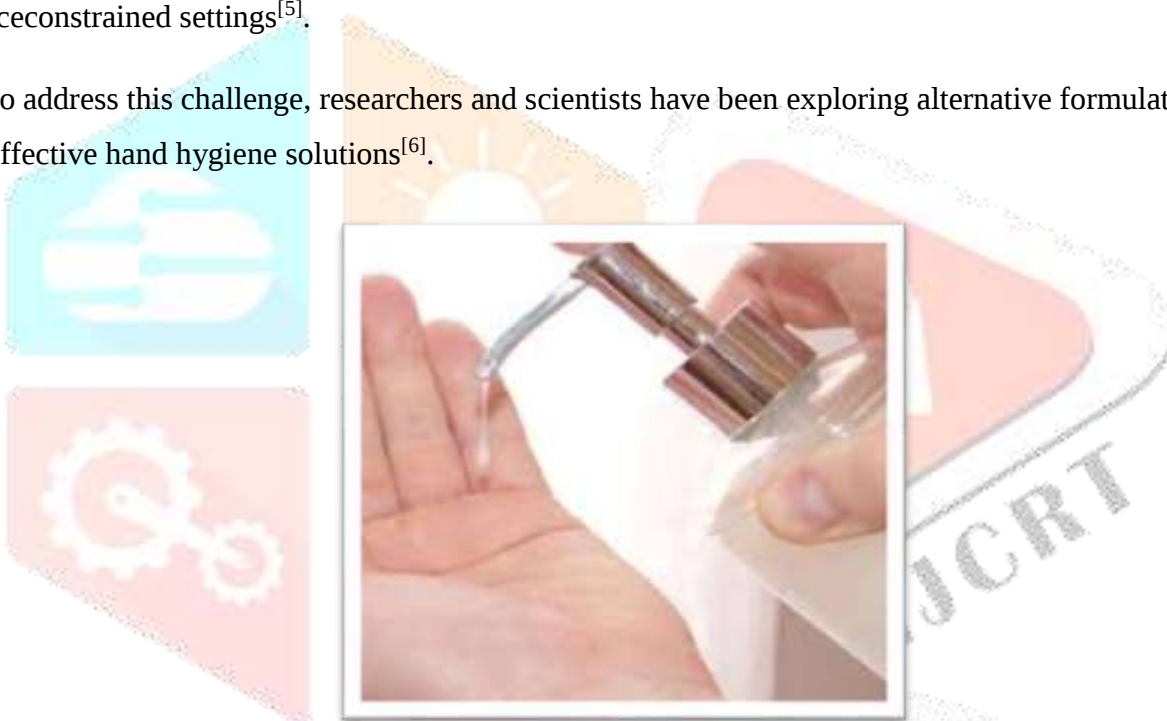


Fig 1: Hand wash gel

Herbal:- A type of medicine that uses roots, stem, leaves, flowers or seeds of plant to improve health, prevent disease and treat illness^[7].

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^[8].

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^[9].

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^[10]. Soap is an emulsifier o hand wash can be a form of emulgel. It is viscous in nature.

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^[11].

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^[12,13,14].

TYPES OF HAND WASH GEL

1. Routine hand wash- Use of water and non antimicrobial soap for the purpose of removing soil and transient microorganisms

Time :20 seconds

2. Antiseptic hand wash- Use of water and antimicrobial soap (e.g chlorhexidine, iodine and idophors , chloroxylenol, triclosen etc.)

For the purpose of removing or destroying transient micoorgnism and reduce resident flora

Time : 40 to 60 seconds

3. Surgical hand wash- USE of water and antimicrobial soap (e.g. chlorohexidine, iodine and idophors, chloroxylenol, triclosan etc.).

For the purpose of destroying or removing transient micro organisms and reduce resident flora.

Time: 40 to 60 seconds

4. Antiseptic hand rub- Use of alcohol based hand rub.

2 .Material and method :-

Cinnamon oil- Cinnamon oil obtained from the dried inner bark of the shoot of the coppiced tree of cinnamomum zeylanicum..

Table 1:Taxonomical classification of Cinnamon.

Synonyms	cinnamon bark, kalmi dalchini, Ceylon cinnamon
Kingdom	Plantae
Phylum	Magnoliophyta
Class	Magnoliopsida
Order	Laurales
Family	Lauraceae
Genus	Cinnamomum
Species	Cinnamomum Zeylanicum

In addition to being used as a spice and flavoring agent, cinnamon is also added to flavor chewing gums due to its mouth refreshing effects and ability to remove bad breath ^[15]. Cinnamon can also improve the health of the colon, thereby reducing the risk of colon cancer ^[16].

Cinnamon is a coagulant and prevents bleeding ^[17]. Cinnamon also increases the blood circulation in the uterus and advances tissue regeneration ^[18].

Hydroxyl propyl methyl cellulose (HPMC)- Hypromellose (INN), short for hydroxypropyl methylcellulose (HPMC), is a semisynthetic, inert, viscoelastic polymer used in eye drops, as well as an excipient and controlled-delivery component in oral medicaments, found in a variety of commercial products [19,20].

As a food additive, hypromellose is an emulsifier, thickening and suspending agent, and an alternative to animal gelatin ^[21].

Sodium lauryl sulphate (SLS)- SLS is a surfactant. SLS used as a foaming agent and emulsifying agent.

Glycerine-Glycerol also called glycerine, is a simple triol compound.

Triethanolamine (TEA) :- TEA is an oily, viscous organic chemical compound that is a tertiary amine and a triol.

Colorant (Amaranth):- Amaranth is a colouring agent. Amaranth is an anionic dye.

Perfume (Orange oil) :- Orange oil is an essential oil produced by cells within the rind of an orange fruit.

Methyl paraben- Methyl paraben is an anti-fungal agent often used in a variety of cosmetics and personal-care products.

Purified water :- Purified water is water that has been mechanically filtered or processed to remove impurities and make it suitable for use.

Formulation of Herbal Hand Wash Gel-Various herbal hand wash gel formulation batches were prepared. (table.1)The desired concentration of gelling agent, foaming agent, emollient were measured accurately and dispersed in purified water with moderate stirrer speed. The required quantity of methyl paraben was dissolved in remaining quantity of purified water by gentle heating. Desired quantity of herbal oil, flavorent, colorant was added to the above formulation. Triethaanolamine was added to adjust the pH. The formulated hand wash gel was filled in suitable containers and stored at cool and dry place.

Table 2: Formulation composition of herbal hand wash gel

Composition	Formulation code								
	F1	F2	F3	F4	F5	F6	F7	F8	F9
Cinnamon oil	0.1ml	0.1ml	0.1ml	0.1ml	0.1ml	0.1ml	0.1ml	0.1ml	0.1ml
HPMC	1 gm	2 gm	3 gm	4 gm	4 gm	4 gm	6 gm	8 gm	10 gm
SLS	1gm	1 gm	1 gm	1 gm	2 gm	2 gm	4 gm	6 gm	8 gm
Glycerin	1 ml	1 ml	1 ml	1 ml	1 ml	2 ml	4 ml	6ml	8 ml
TEA	*q.s	q.s	q.s	q.s	q.s	q.s	q.s	q.s	q.s
Perfume	q.s	q.s	q.s	q.s	q.s	q.s	q.s	q.s	q.s
Colorant	q.s	q.s	q.s	q.s	q.s	q.s	q.s	q.s	q.s
Methyl paraben	q.s	q.s	q.s	q.s	q.s	q.s	q.s	q.s	q.s
Purified water q.s to	100ml	100ml	100ml	100ml	100ml	100ml	100ml	100ml	100ml



Fig 2: Formulation of herbal hand wash gel

3. Result and Discussion –

Various herbal hand wash gel formulation batches were prepared.

- The desired concentration of gelling agent, foaming agent, emollient were measured accurately and dispersed in purified water with moderate stirrer speed.
- The required quantity of methyl paraben was dissolved in remaining quantity of purified water by gentle heating.
- Desired quantity of herbal oil, flavorent, colorant and other required reagents was added with a fix proportion to the above formulation. Different formulations with 2% cinnamon oil mixture are prepared
- All tests were done in triplicate. For stability studies, prepared formulations were kept for 0, 5, 10 and 15 days and pH, viscosity and spreadability test were performed.
- Various evaluation tests such as anti microbial efficacy by agar disc diffusion method, pH, viscosity, spreadability were carried out.

Evaluation test for gel

- **Physical appearance:-** All hand wash gel formulations (F1-F9) were dark pink or magenta in color, showing a homogeneous mix and a honey-thick consistency. No phase separation was observed.
- **Solubility:-** All 9 formulations are water soluble.
- **Measurement of pH :-** The pH of the herbal hand wash gel formulations (F1-F9) ranged from 6.5 to 7.7, indicating a neutral pH. This range is suitable for skin and compares favorably to the nasal mucosal pH, which is 5.5 to 6.5 under normal conditions but can rise to 7.2 to 8.3 in rhinitis.



Fig 3: pH meter and pH paper

- **Determination of viscosity :-** The viscosity measurements for all formulations fall below the ideal range of 2000-4000 cps. **F2** has the highest viscosity at 1700 cps, but none of the formulations meet the ideal standard. Adjustments to increase viscosity may be needed.



Fig 4 .Brookfield viscometer

- **Foam height :-** The hand wash gel with a 1.5% w/v SLS concentration achieved a foam height between 3.4 and 5.0 cm after 25 strokes, while maintaining viscosity at 1608 cP and spreadability at 66 mm. These results suggest that the gel meets the required performance standards for foam production.



Fig 5. Formulation of Foam hight

- **Stability studies** :- The herbal hand wash gel showed no color change or phase separation after one week at 25°C, 37°C, and 40°C. After six months, all stability parameters remained consistent, indicating robust stability.
- **Spreadability** :- The spreadability of the polyherbal hand wash gel ranges from 2.63 to 6.13 cm, with formulation F2 at 5.70 cm. F2 is close to the ideal spreadability of 6.6 cm but may need minor adjustments for optimal performance.
- **Pourability** :-The gel demonstrated an optimal pourability with a calculated pourability percentage of 99.99%, indicating minimal spillage. As temperature increased, the gel became more viscous due to enhanced molecular mobility, affecting its flow rate.



Fig 6. Pourability test

Table 3: Comparative flow rate and viscosity study of F1-F9 formulation.

s.r no,	Formulation Triplicate	Average Time of flow	Viscosity
1.	F1	2:30min	1700cps
2.	F2	2:39min	2000cps
3.	F3	3:01min	941cps
4.	F4	2:50min	435cps
5.	F5	3:40min	1100cps
6.	F6	3:55min	938cps
7.	F7	2:55min	641cps
8.	F8	3:59min	438cps
9.	F9	3:20min	1500cps

The formula of pourability is number of times and event occur by total number of trials

- **Skin irritation test :-** The results from Table No. 16 indicate that after applying the herbal hand wash gel and waiting 30 minutes, there were no reports of itching, rashes, or redness observed on the skin. This suggests that the hand wash gel is likely non-irritating for the tested individuals.
- **Antibacterial efficiency of herbal hand wash gel:-** Antibacterial efficiency was assessed by applying herbal hand wash gel to volunteers' hands, then culturing samples on nutrient agar to count CFUs after overnight incubation at 37°C. The CFU count per ml was used to evaluate the gel's effectiveness.

Antibacterial procedure :- Inoculate Mueller-Hinton Agar with a sterile swab, streaking three times at 60° angles, and punch four wells (8-10 mm diameter, 0.3-0.5 cm deep) after sterilizing the cork borer. Incubate at 37°C for 24 hours, then measure and record the zones of inhibition.

Table 4: Antibacterial sensitivity of different concentrations of herbal hand wash gel and standard against different microorganisms

Formulation	Zone of inhibition (in cm)	
	E .coli	Lactobacillus bacteria
F2	1.4cm	1.3cm
F7	1.3cm	1.1cm
F8	1.1cm	1.3cm
Standard	1.6cm	1.5cm

Well diameter-0.5cm

Amount of gel sample in each well-0.2 ml



Fig 7: Zone of inhibition of formulated hand wash gel against E.coli and Lactobacillus bacteria.

Table 5: Evaluation parameters of herbal hand washgel

Evaluation parameter	F1	F2	F3	F4	F5	F6	F7	F8	F9
Colour	Dark Pink	Dark Pink	Dark Pink	Dark Pink	Dark Pink	Dark Pink	Dark Pink	Dark Pink	Dark Pink
Odour	Sweet	Sweet	sweet	Sweet	Sweet	Sweet	Sweet	Sweet	Sweet
Texture	Smooth	Smooth	smooth	Smooth	Smooth	Smooth	Smooth	Smooth	Smooth
Consistency	Honey Thick	Honey Thick	Honey Thick	Honey Thick	Honey Thick	Honey Thick	Honey Thick	Honey Thick	Honey Thick
Homogeneity	Good	Good	Good	Good	Good	Good	Good	Good	Good
Solubility	Water soluble	Water soluble	Water soluble	Water soluble	Water soluble	Water soluble	Water soluble	Water soluble	Water soluble
pH	6.5	7.7	7.5	6.9	6.7	7.4	7.6	7.0	6.8
Viscosity (cp)	1300cps	1700cps	941cps	435cps	1100cps	938cps	641cps	438cps	1500cps
Foam height	3.4cm	5 cm	3.8cm	4.2cm	4.0cm	3.5cm	4.9cm	3.9cm	4.7cm
Stability studies	Stable	Stable	Stable	Stable	Stable	Stable	Stable	Stable	Stable
Spreadability	4.9cm	5.70cm	5.10cm	4.30cm	6.13cm	2.63cm	3.90cm	5.10cm	4.5cm
Pourability	99.99%	99.99%	99.99%	99.99%	99.99%	99.99%	99.99%	99.99%	99.99%
Skin irritation	No irritation	No irritation	No irritation	No irritation	No irritation	No irritation	No irritation	No irritation	No irritation

4. Future scope

The hand wash liquid and gel market is set to experience substantial growth in the coming years, driven by heightened awareness of hand hygiene and favorable market conditions. The aesthetic appeal and perceived health benefits of products, such as those featuring attractive pink colors and herbal ingredients, are likely to enhance their market appeal. Specifically, the promising results of the cinnamon oil herbal hand wash gel indicate a positive outlook, as it aligns with the growing preference for safer, natural alternatives over synthetic options.

Hand washing remains a fundamental practice for preventing the spread of harmful diseases and protecting skin health. Herbal hand washes, such as the one formulated with cinnamon oil, are increasingly favored for their safety and effectiveness, with less risk of adverse effects compared to synthetic drugs. The successful formulation of this herbal hand wash demonstrates excellent uniformity, appealing appearance, and efficacy against pathogenic microorganisms without causing skin irritation. As a result, this product stands out as a safe, effective option for maintaining hand hygiene and exemplifies the benefits of incorporating herbal ingredients into personal care products.

5. Conclusion

The topical system a hand wash gel F1–F9 is created by preparing an emulsion by incorporating cinnamon oil in water with addition of emulsifying agent such as HPMC, SLS. The pH, viscosity, drug content, stability study, skin irritation test, anti-microbial study and other properties of the prepared formulation are evaluated. Many emulgel hand wash cleanser available in the market which could be challenging the present project work. The ph of the hand wash gel is measured within the neutral ph range such as 6.6-7.7,viscosity range 435cps-1700cps. As a reslt the productbwas found successful without any skin irritation and non pathogenic.

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