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Research Article

Formulation and Evaluation of Alcohol Based Polyherbal Hand Sanitizer

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ABSTRACT

"Hand hygiene" is the primary goal in making a polyherbal hand sanitizer. It is an essential idea for the reduction, management, and prevention of any acquired infection. Generally speaking, hand sanitizers can break the chain of microbes and other bacteria that travel from our hands to other areas of our bodies. Maintaining good hand hygiene is crucial and one of the most important things to do when preparing food in homes, restaurants, and other day care facilities. Using hand sanitizer can prevent side effects such as dermatitis, itching, and irritation. Using five herbal extracts, distilled water, ethanol, methyl paraben, glycerol, and isopropyl alcohol, we made a polyherbal sanitizer. The compounds' antibacterial qualities were taken into account prior to selection. It was discovered that the sanitizer's pH ranged from 6.11 to 6.85. It was discovered that the sanitizer's viscosity ranged from 380 to 800 cps. The range of 6.40 to 7.80 was determined to have high spreadability. For Mentha, the drug content in formulations was 88.6% in F1, 90.2 % in F2, and 92.8 % in F3. Similarly, for Tulsi, the drug content in formulations was 86.4% in F1, 93.1 % in F2, and 95.6% in F3. The results of the in-vitro drug release investigation showed that F1 was 65.9%, F2 was 70.5%, and F3 was 73.9%. The formulation F3 is the best, according to all of these investigations, because it has better drug content, pH, viscosity, spread ability, and in-vitro drug release trials.

INTRODUCTION

Due to its contagious nature, the COVID-19 (Coronavirus Disease 2019) pandemic has become a major global public health problem, prompting widespread usage of hand disinfectants. The single most important tactic for reducing diseases linked to healthcare is practicing effective hand hygiene. Ensuring adequate hand washing and hand sanitization is crucial in preventing the transmission of infectious diseases and safeguarding the skin from harmful germs. Hand cleaning reduces the number of dangerous bacteria on hands and removes visible filth [1]. In a healthcare context, hand sanitizer is simply an alcohol-based disinfection that is usually chosen over hand washing with soap and water. Compared to soap and water, it is often more effective at killing microorganisms and more tolerant. There are three different types of hand sanitizers: liquid, gel, and foam [2].

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The most popular method of hand disinfection is washing with clean water. Though soap and detergents have been added, water alone may not always be safe, hence these alternatives have been employed. However, hand sanitizers with strong bactericidal action and safety claims have recently been released onto the market. There are two types of hand sanitizers on the market: ones that include alcohol and ones that don't. The hand sanitizer with alcohol basis professes to eradicate 99.99% of bacteria, even the most resilient type [3].

Hand sanitizers are available in liquid, foam, and convenient gel formulations that can be rubbed over the palm of the hand and all the fingers and hands until they are dry. Doctors, surgeons, pathologists, researchers, and other medical professionals often use the product, as do restaurants, toiletry companies, and other businesses. Students use hand sanitizer following each practical instruction in the laboratories of medical and applied medical science colleges [4].

The objective of this research was to construct a hand sanitizer using herbal medicinal plants and assess its properties further, including drug content, in-vitro drug release, pH, viscosity, and spreadability.

MATERIALS AND METHODS

Materials

Collection of Sample

The plants *Ocimum tenuiflorum* (Tulsi), *Mentha* (Mint), *Aloe Barbandis* (Aloe Vera), were collected from areas of Kolhapur district.

Methods

Preparation of Extracts

The leaves of various plants, including *Ocimum tenuiflorum* (Tulsi), *Mentha* (Mint), and *Aloe Barbandis* (Aloe Vera), were collected and powdered separately. Each plant was given five grammes of powdered leaf, which was then separately steeped in 200 millilitres of ethanol and allowed to macerate for three to four days. Following maceration, the extracted material was gathered, filtered, and utilised to create hand sanitizer and hand wash [5].

Preparation of Alcohol Based Polyherbal Hand Sanitizer:

Deionized water was combined with carbopol while being continuously stirred. Following homogenous mixing, Triethanolamine (TEA) was added and allowed to sit for 24 hours while being slowly stirred to prevent any potential air bubbles from forming in the final product. In denatured alcohol, glycerine, and extracts of *Ocimum tenuiflorum* (Tulsi), *Mentha* (Mint), and *Aloe Barbandis* (Aloe Vera) were added. Polysorbate 20 was then combined with the aqueous phase Table No 1. To create a homogenous mixture, propyl and methyl paraben were next added and stirred slowly. The finished product was kept in airtight receptacles [6-8].

Table 1: Formulation Table

Sr. No.	Ingredient	Formulation Batches		
		F1	F2	F3
01	*Ocimum Tenuiflorum* (Tulsi)	0.30	0.45	0.60
02	*Mentha* (Mint)	0.30	0.45	0.60
03	*Aloe Barbandis* (Aloe Vera)	0.45	0.45	0.45
04	Eucalyptus oil	0.15	0.30	0.45
05	Carbopol 940	0.25	0.25	0.25
06	Glycerine	0.70	0.70	0.70
07	Polysorbate 20	0.15	0.15	0.15
08	Triethanolamine	0.21	0.21	0.21
09	Methyl paraben	0.15	0.15	0.15
10	Propyl paraben	0.15	0.15	0.15
11	Denatured alcohol	20	20	20
12	Deionized water	upto 30 mL	upto 30 mL	upto 30 mL

Characterization of Alcohol Based Polyherbal Hand Sanitizer

Visual Appearance

The prepared sanitizer was examined visually to check for particles and for clarity, colour, odour, and transparency. The glass side of the sanitizer smear was made, and it was examined under a microscope to check for any particles or grittiness [9].

pH

An alcohol-based herbal hand sanitizer formulation's pH was measured with a digital pH metre. One gramme of gel was distributed in 100 millilitres of distilled water, and the mixture was allowed to stand for two hours. Each formulation's pH should be measured three times, and average values should be determined [10].

Viscosity

The viscosity of an alcohol-based herbal hand sanitizer composition was measured at 37 °C using a brook field viscometer. A Brook field viscometer that was attached to a T-bar spindle (S-94) had been used to measure viscosity. After filling a 10 mL beaker with 5 g of solution, the spindle was lowered perpendicularly, being

cautious not to let the spindle come into contact with the bottom of the beaker. The spindle was rotated at 50, 60, and 100 rpm in order to provide a torque greater than fifty percent. Measurements were taken 60 seconds after the measurement was taken [11].

Spreadability

A laboratory-made apparatus with two glass slides-the bottom one glued to a wooden plate, the top one connected to a balance by a hook-was used to assess the spreadability of an alcohol-based herbal hand sanitizer [12].

The Spreadability of sanitizer was calculated by using formula:

$$S = \frac{m \times l}{t} (gram\ cm/sec) \quad (1)$$

Where, m = wt. Tied to upper slide
L = length of glass slides
T = time taken to separate the slides

Drug Content

The hand sanitizer's medication content was ascertained by dissolving a precisely weighed 1000 mg sample in 100 mL of solvent (ethanol). For the formulations to completely dissolve, the solutions were shaken for four hours and then left for six hours. Following filtering, dilutions, and spectrophotometer analysis, the solutions were then examined. Using a UV/visible spectrophotometer, the drug content was calculated for *Mentha* (Mint) at 292 nm and *Ocimum Tenuiflorum* (Tulsi) at 340 nm [13].

***In-vitro* Drug Release Study**

The drug release tests used a Franz diffusion cell, which has an effective diffusion area of 3.14 cm^2 and a cell volume of 15.5 mL. A 200 mg dose of herbal hand sanitizer with alcohol was equally administered to the membrane's surface. Between the diffusion cell's donor and receptor chambers, the membrane was pinched. Phosphate buffer (7.4) was added to the receptor chamber. At 0, 0.5, 1, 2, 4, 6, 8, and 24 hours, a new sample was added through the sampling port and replaced with the original buffer. Following appropriate dilutions, the absorbance was measured at 292 nm using spectrophotometry [13].

RESULT AND DISCUSSION

Visual Appearance

The prepared hand sanitizer's physicochemical characteristics were ascertained. Aspects like colour, smell, and look were evaluated. The formulations showed pleasing visual qualities.

Table 2: Physicochemical Parameters of Hand Sanitizer

Sr. No.	Parameter	Formulation Batches		
		F1	F2	F3
01	Colour	Faint Green	Faint Green	Faint Green
02	Odour	Aromatic and Characteristics	Aromatic and Characteristics	Aromatic and Characteristics
03	Transparency	Clear	Clear	Clear

pH

Following dispersion in distilled water, the pH of each sanitizer formulation was measured, and the results were recorded as seen in Fig. 1 and Table 3. The manufactured herbal hand sanitizer can be applied to the hand since the alcohol-based herbal hand sanitizer's pH range of 6.11 to 6.85 was determined to be well within the typical range of 5.5-7.

Table 3: pH of Alcohol-based Herbal Hand Sanitizer

Sr. No.	Formulation Batch	pH
01	F1	6.11
02	F2	6.53
03	F3	6.85

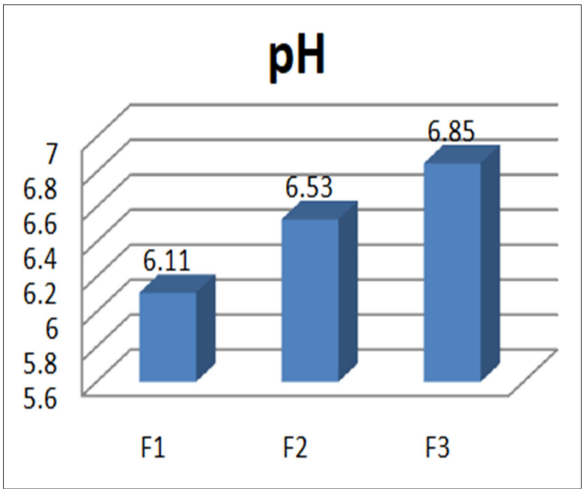

Figure 1: Graphical Representation of pH

Viscosity

Using a Brook field viscometer, the viscosity of an herbal hand sanitizer composition based on alcohol was measured at 37°C. The viscosity measurements varied between 380 and 800 cps, shown in the Table 4 and Fig. 2.

Table 4: Viscosity of Alcohol-based Herbal Hand Sanitizer

Sr. No.	Formulation Batch	Viscosity (cps)		
		50 rpm	60 rpm	100 rpm
01	F1	380	420	732
02	F2	395	460	769
03	F3	400	490	800

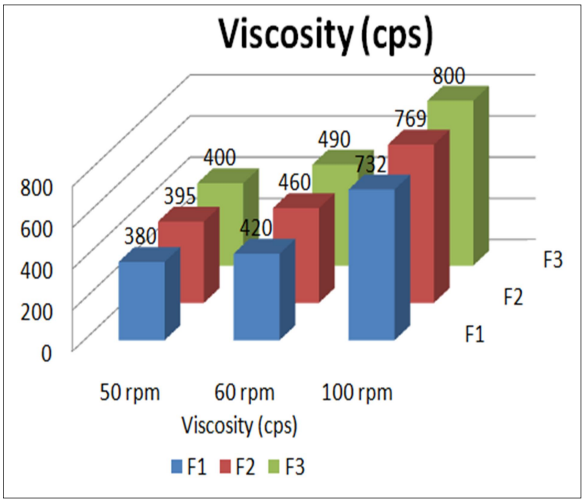

Figure 2: Graphical Representation of Viscosity

Spreadability

The sanitizer's spreadability was determined to be between 6.40 and 7.80 g-cm/sec, indicating that it can spread evenly and smoothly shown in Table 5 and Fig. 3.

Table 5: Spreadability of Alcohol-based Herbal Hand Sanitizer

Sr. No.	Formulation Batch	Spreadability (g-cm/sec)
01	F1	6.40
02	F2	6.90
03	F3	7.80

Drug Content

A precisely weighed quantity of 1000 mg was dissolved in 100 millilitres of solvent (ethanol) to ascertain the drug content of the hand sanitizer. For the formulations to completely dissolve, the solutions were shaken for four hours and then left for six hours. The solutions were screened after that. Next, 100mL of solvent (ethanol) was mixed with 2mL of this solution once more. The serial dilutions, such as 2µg/mL, 4µg/mL, 6µg/mL, 8µg/mL, and 10µg/mL, were then created shown in Table 6 and Fig. 4.

Table 6: Percent Drug Content of Alcohol-based Herbal Hand Sanitizer

Sr. No.	Formulation Batch	*Mentha* (Mint) Drug Content (%)	*Ocimum Tenuiflorum* (Tulsi) Drug Content (%)
01	F1	88.6	86.4
02	F2	90.2	93.1
03	F3	92.8	95.6

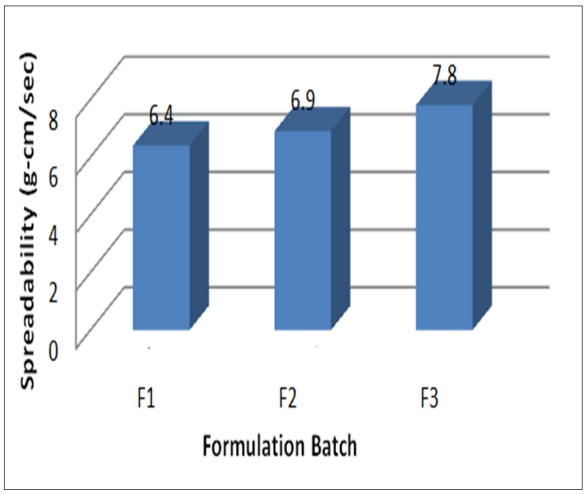

Figure 3: Graphical Representation of Spreadability (g-cm/sec)

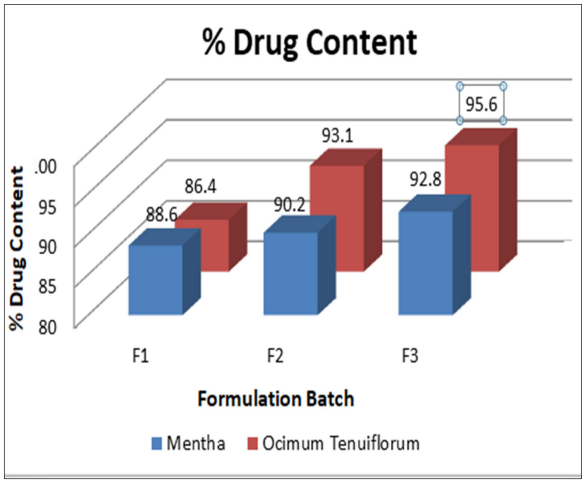

Figure 4: Graphical Representation of % Drug Content

In-vitro Drug Release Study

To determine the quantity of medication that can pass through the biological membrane, in-vitro drug release tests were conducted on the formulation of an alcohol-based herbal hand sanitizer. A comparative *in-vitro* release profile through dialysis membrane from sanitizer is present in Fig. 5. The data from the release profile is present in Table 7.

Table 7: Percent of Drug Release from Alcohol-Based Herbal Hand Sanitizer

Time (Hr)	Formulation Batches		
	F1	F2	F3
0	0	0	0
0.5	7.2 ± 0.42	8.5 ± 0.63	9.9 ± 0.56
1	12.5 ± 0.96	13.8 ± 0.63	15.9 ± 0.35
2	15.5 ± 0.25	16.3 ± 0.52	18.9 ± 0.57
4	18.6 ± 0.42	19.3 ± 0.85	25.5 ± 0.59
6	25.6 ± 0.78	28.9 ± 0.75	32.3 ± 0.42
8	42.9 ± 0.56	45.3 ± 0.48	55.9 ± 0.61
24	65.9 ± 0.61	70.5 ± 0.25	73.9 ± 0.85

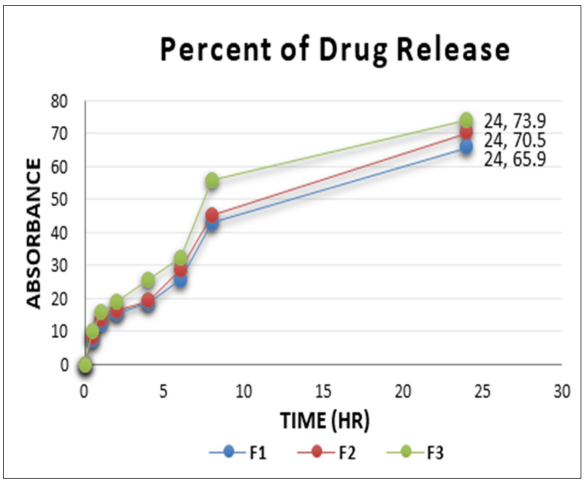

Figure 5: Graphical Representation of % Drug Release

CONCLUSION

The goal of the current project was to create a herbal hand sanitizer with alcohol. It is a generally chemical-free, advantageous, safe, and efficient method of halting the spread of illness. The alcohol-based herbal hand sanitizer with aloevera, *Mentha* (Mint), and *Ocimum Tenuiflorum* (Tulsi) contains a variety of antibacterial properties that aid in the treatment of bacterial illnesses and the removal of pathogens to preserve sanitization. The method used to prepare the herbal hand sanitizer with alcohol base was very easy to use and reasonably priced. Three formulations, designated F1, F2, and F3, were developed. The optimal outcome is displayed by the developed F3 formulation.

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