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## Formulation and evaluation of anti-microbial gel using lavender oil and rosemary oil

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### Abstract

In the present study anti-microbial gels are prepared using Lavender oil and Rosemary oil. The anti-microbial gel was evaluated for appearance and homogeneity, grittiness, pH, viscosity, particle size etc.. The anti-microbial gel was light yellowish in colour which feels smooth on application and have aromatic odour. The antimicrobial activity of herbal gel was compared with standard Povidone iodine and the zone of inhibition is determined against *S. aureus* and *E. coli* bacteria. The gel was stable at room temperature. It was inferred from the result that the gel formulation shows better anti-microbial activity when compared with marketed formulation gel.

**Keywords:** Anti-microbial gel, lavender oil, rosemary oil, viscosity.

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### Introduction

Gels are semisolid preparations intended for application on the skin or the accessible mucous membranes like oral cavity. Gels are composed of two interpenetrating systems where the colloidal particles, also known as the gelator or gellant, are uniformly distributed throughout a dispersion medium or solvent forming a three dimensional matrix known as the gel.[1,2]The present study was designed to develop the anti-microbial gel formulation containing lavender oil and rosemary oil .The active constituents of lavender oil , Linalool and linalyl acetate have been detected as strong antimicrobial agents against foodborne bacteria such as *Escherichia coli* and *Enterobacter cloacae*. [3]Some other essential oil compounds such as limonene,  $\alpha$ -pinene, and  $\beta$ -pinene have antibacterial activity against different human pathogenic bacteria.[4]

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Probuseenivasan et al., confirmed that rosemary essential oil strongly inhibits *E. coli* ATCC 25922. The minimal inhibitory concentration for rosemary oil against *E. coli* was >6.4 mg/L. Other studies have shown the antibacterial activity of rosemary oil against *E. coli*, *Bacillus cereus*, *Staphylococcus aureus*, *Staphylococcus aureus*, *Clostridium perfringens*, *Aeromonashydrophila*, *Bacillus cereus* and *Salmonella choleraesuis*[5-6].

### Material and Method

#### Method for preparation of anti-microbial gel

Carbopol 924 was dispersed in 05 ml of distilled water with continuous stirring and left for overnight for swelling. Further of lavender oil, rosemary oil, Ethanol and PEG 400 was mixed to above mixture and volume was made upto 10 ml by adding remaining part of distilled water. All the ingredient were mixed properly with carbapol 924 to form a smooth anti-microbial gel. Finally different formulation are made for the adjustment of required pH of about 4.5-5.5, to form a gel of required consistency. The prepared anti-microbial gel was subjected to various evaluation parameters.

## Formulation of Anti-Microbial Gel

Table1 Shows Depicting formulation of antimicrobial gel

**Table 1: Depicting formulation of antimicrobial gel**

S.No.	Ingredients	F1	F2	F3
1.	Lavender oil	2 ml	2.5 ml	4 ml
2.	Rosemary oil	1 ml	1.5 ml	2 ml
3.	Carbopol 924	0.15 gm	0.15 gm	0.15 gm
4.	Ethanol	0.4 ml	0.4 ml	0.4 ml
5.	PEG 400	0.5 gm	0.5 gm	0.5 gm
6.	Distilled water	10 ml	10 ml	10 ml

### Evaluation of anti-microbial gel

**Physical Evaluation:** The prepared anti-microbial gel were inspected for visual appearance (colour, homogeneity, consistency), olfactory (smell), tactile (feel upon application). [7]

**pH :** The pH was determined by pH meter. [8]

**Viscosity:** The viscosity of anti-microbial gel is measured by Brookfield viscometer. [9]

**Spreadability:** Spreadability is expressed in terms of time in seconds taken by two slides to slip off from gel and placed in between the slides under the direction of certain load, lesser the time taken for separation of two slides, better the spreadability. It is calculated by using the formula:

$$S = M \cdot L / T$$

Where, M = weight tied to upper slide

L = length of glass slides

T = time taken to separate the slide. [10]

**Stability Studies:** Anti-microbial gel were subjected for stability studies for a period of 3 months at different temperature for physical stability and pH.

**TEM (Transmission Electron Microscopy):** It is used to determine a morphology of anti-microbial gel formulation by the help of TEM. It is done from NIPER, Mohali.

### Antimicrobial study

#### Test organism

**Gram positive bacteria:** *Staphylococcus aureus*

**Gram negative bacteria:** *E. coli* Standard: Povidone iodine.

### Result and Discussion

**Physical evaluation :** All the prepared gels using different polymers in different concentrations were light yellowish in colour which feels smooth on application. The prepared gel have an aromatic odour.

**Table 2: Physical evaluation results of formulation F1,F2,F3**

Formulation Code	Appearance	Feel on application	Odour
F1	Light yellowish	Smooth	Aromatic
F2	Light yellowish	Smooth	Aromatic
F3	Light yellowish	Smooth	Aromatic

**pH** :The pH of all the four formulations was in the range of the pH of the skin i.e. 4 to 5.5 which are in range shown in table.

**Table 3: pH results of formulation F1, F2, F3**

S.No.	F1	F2	F3
<b>pH</b>	4.11	4.09	4.10

**Viscosity** : Viscosities of the gels were measured by the Brookfield viscometer in centipoises. The viscosity of different formulations at different rpm are given below:

**Table 4 : viscosity results of formulation F1,F2,F3 at different RPM**

S.No.	F1	F2	F3
<b>RPM</b>	2.5	5	10
<b>VISCOSITY</b>	862	401	216

#### Spreadability

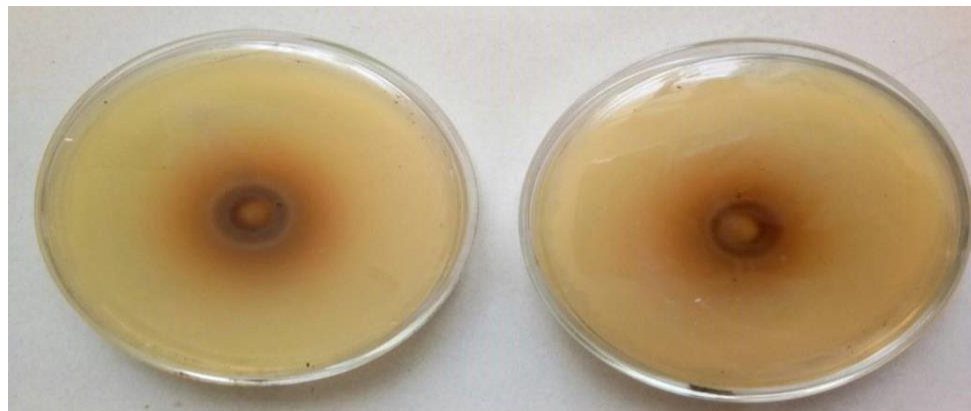
All the prepared gels using different polymers in different concentrations were spreadable. The formulation F-1 showed the maximum Spreadability followed by second and third.

The antimicrobial activity of herbal gel was found to be better than standard Povidone iodine as the zone of inhibition of herbal gel was found to be better than against both the bacteria *S.aureus* and *E.coli* and the values are given in the Table no. 02. It was found that F-3 gel formulation was having best antimicrobial activity when compared with marketed formulation[11].

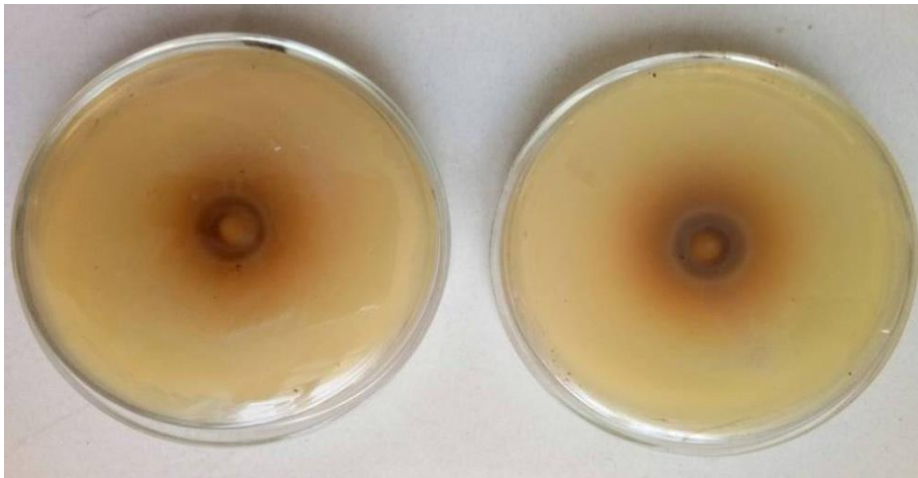
#### Anti-microbial study

**Table 5 : Zone of inhibition of different gel formulation**

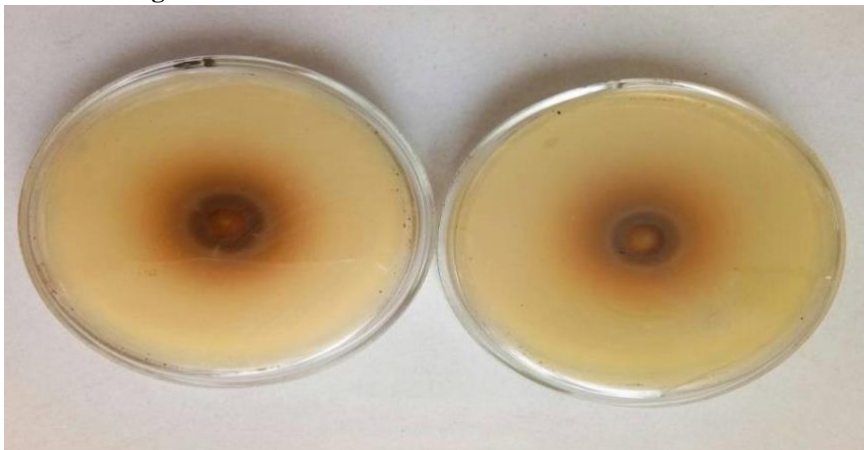
Test organism	Standard	F1	F2	F3
<i>S.aureus</i>	2.7cm	2.5cm	2.6cm	3cm
<i>E.coli</i>	2.5cm	3.4cm	2.5cm	3.4cm



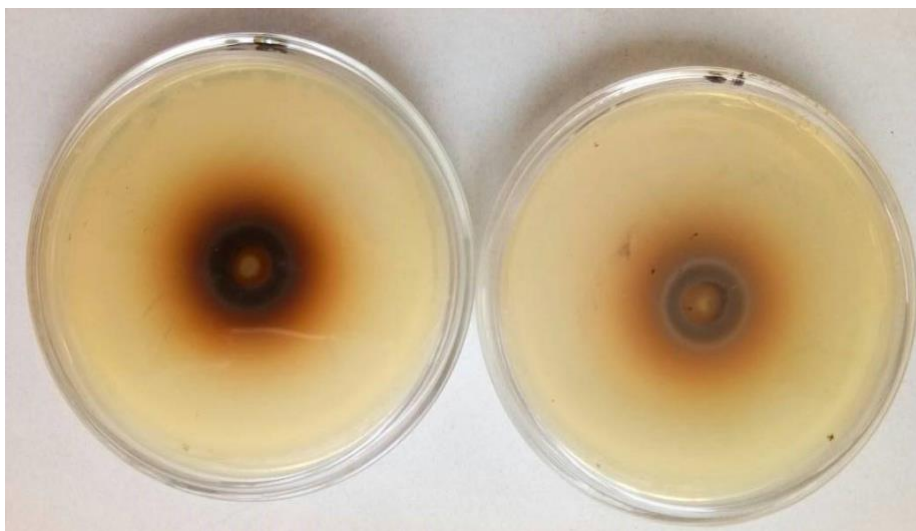
**Figure 01: Zone of inhibition of standard (Povidone iodine) for *S.aureus* and *E.coli***



**Figure 02: Zone of inhibition of F-1 for *E.coli* and *S.aureus***



**Figure 03: Zone of inhibition of F-2 for *E.coli* and *S.aureus***

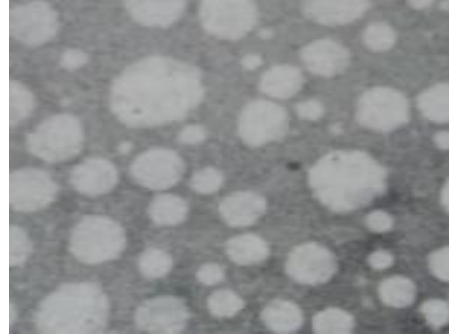
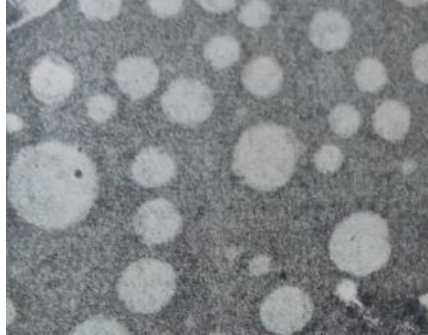


**Figure 04 : Zone of inhibition of F-3 for *E.coli* and *S.aureus***

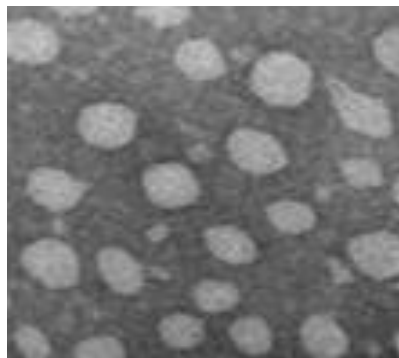
**Transmission Electron Microscopy**

The morphology of hydrogel was analysed by the help of transmission electron microscope [FEI

Technai G<sup>2</sup> F20 Netherland]. The result are shown in figure given below. Most of the particles were spherical with only few irregular shaped particles



**Figure 05 : TEM image of formulation F1      Figure 06 : TEM image of formulation F2**



**Figure 07: TEM image of formulation F3**

**Stability study** After one month of Storage at Room Temperature, in Humidity Chamber and refrigerated temperature there is no change in appearance of the prepared gel formulations. After 30-90 days in different storage conditions the colour of F-3 gel does not fades in

refrigerated condition where other formulation were not stable in their state and decreases the pH. Formulation F-3 was more stable as compared to other formulation and colour was not change.

**Table no. 06 : Effect of temperature on (pH) stability of Anti-microbial gel**

Sr. No	Storage conditions	C-1	F-1	F-2	F-3
1.	Room Temperature	4.02	4.06	4.15	5.17
2.	Humidity Control	3.85	4.00	4.07	4.15
3.	Refrigration Temperature	4.03	4.10	4.12	4.22

## Conclusion

It was inferred from the result that anti-microbial gel was good in appearance, homogeneity and easily spreadable. The anti-microbial gel was prepared using gelling agent like carbopol 924 along with polyethylene glycol and the formulation were subjected to various evaluation parameters. Viscosity of anti-microbial gel was measured using Brookfield viscometer. The pH of all three formulations were in the range of the pH of the skin i.e. 4-5.5. The antimicrobial gel was more effective than commercial gel as they have rosemary oil and lavender oil as their key ingredients because of their anti-microbial property.

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