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# DEVELOPMENT AND EVALUATION OF CINNAMON AND ALOE-VERA CONTAINING HERBAL ANTI-ACNE GEL

[*]Nikunj B Gurjar, Bhavesh S Barot, Pragna K.Shelat.

[*]K.B. Institute of pharmaceutical education and research,
Sector-23, Gandhinagar, Gujarat, India – 382 023.

## Abstract

In the present study an attempt was made to formulate gel containing cinnamon oil. The result showed that the optimal formula of anti-acne gel with cinnamon oil and aloevera gel contained cinnamon oil 0.5%, aloevera gel 10%, BHT 1%, Ascorbic acid 0.1%, Carbopol-971 1.75%, Coco diethanol amine q.s. to neutral pH, and water q.s to 100 ml. Anti acne gel with cinnamon oil was clear, transparent, thick, smooth gel. The gel pH was 6.53 and its viscosity was 3600 cP. It was non irritant to skin. In vitro antibacterial activity was performed against *Propionibacterium acnes* MTCC 3297, a causative organism for Acne vulgar for the developed formulations using agar well diffusion method. The measured zones of inhibitions of the formulations were compared with standard antibiotic Clindamycin (Erytop), standard marketed topical preparation for acne. Results of the investigation showed that formulation has greater antibacterial activity (zones of inhibition >18 mm) which is comparable to that of standard marketed topical preparation. The gel was stable at room temperature.

**Keywords:** Herbal anti acne gel, Cinnamon oil, Aloevera gel, *Propionibacterium acne*.

## Introduction

Acne vulgaris is one of the most common skin diseases which can result in comedos or severe inflammatory lesions in the face, back and chest with a large number of sebaceous follicles and the condition of the disease is associated with the elevated rate of sebum excretion. Sebum, which is accumulated in the pilosebaceous channel, facilitates the proliferation of skin bacteria. *Propionibacterium acnes (P. acnes)*, an aero-tolerated anaerobic pathogen, plays an important role in the pathogenesis of acne.[1] It is implicated in the development of inflammatory acne by its capability to activate complements and by its ability to metabolize sebaceous triglycerides into fatty acids, which chemotactically attract neutrophils[2,3]. Although not a serious threat to general health, acne is one of the most socially distressing skin conditions, especially for adolescents, who must deal with a disfiguring disease that erupts just when sexual maturity makes them most sensitive about their appearance. Moreover, severe acne can lead to permanent scarring of the skin that carries the social distress throughout adulthood[4].Acne affects 40 to 50 million people in the United States (16%), and approximately 3 to 5 million in Australia (23%). It affects people of all racial and ethnic groups[5,6]. For many years, antibiotics have been used to treat acne vulgaris. However, antibiotic resistance has been

**Author for Correspondence:**
Nikunj B Gurjar**,**
K.B. Institute of pharmaceutical education and research,
Sector-23, Gandhinagar, Gujarat, India – 382 023.
Email: pr.nikunj@gmail.com

increasing in prevalence within the dermatologic setting. The development of antibiotic resistance is multifactorial, including the specific nature of the relationship of bacteria to antibiotics, how the antibacterial is used, host characteristics, and environmental factors. To overcome the problem of antibiotic resistance, medicinal plants have been extensively studied as alternative treatments for diseases[1].A vaccine against inflammatory acne has been tested successfully in mice, but it is not certain that it would work similarly in humans[7,8].

Cinnamon oil; obtained from *Cinnamon zeylanicum*and other species which contains cinnamaldehyde, cinnamic acid; having potent anti-oxidant and also anti-microbial activity[9]. Scientific evidence for the cosmetic and therapeutic effectiveness of Aloe-Vera is limited and when present is frequently contradictory[10].The present investigation deals with formulation of topical gel formulation, which was hypothesized to act on acne and diminish its growth within short period of time. The developed formulation was expected to have high acceptability profile in patients, as compared to oral treatment. Instead of conventional chemical ingredients used in the treatment of acne, the herbal ingredients were explored to prepare the formulation, due to skin irritation problems with the chemical ingredients and drug resistant. The developed formulation was intended to evaluate with the commercial preparation.

## Material and Methods

### Materials

Cinnamon oil is purchased from local market of Ahmedabad, C. M. Saraiya at laldarwaja, Ahmedabad. Aloe vera gel is purchased from LVG, paldi, Ahmedabad.The following chemicals were used, BHT (ButylatedHydroxy Toluene), Ascorbic acid, Ethanol, Carbopol, TriEthanol amine, Coco-diethanol amine, Anti biotic assay medium.

### Procedure

According to different concentration of excipients and excipients compatibility different formulation were prepared. Cinnamon oil was taken and BHT was added in that. On other side aloevera gel was mixed with water and ascorbic acid dissolved in that. Both the phases mixed and required quantity of ethanol was added. In this solution carbopol was dispersed and allowed to soaked for 24 hours. Then after neutralize with triethanolamine or coco-diethanolamine and clear gel was formed. By their evaluation appropriate gel was selected. Then final formulation is prepared.

**Micro-organism:** *Propionibacterium acne MTCC 3297*

**Determination of clarity and colour:**

It was done with naked eyes against white background.

**Determination of clarity and odour:**

It was done by mixing gel in water and taking the smell.

**Determination of viscosity**

Viscosities of the formulated gels were determined using Brookfield Viscometer. Spindle no. 7 and spindle speed 60 rpm at 25° C were used for gels, the corresponding dial reading on the viscometer was noted. Then the spindle was successively lowered .The dial reading was multiplied by the factor given in the Viscometer catalog.

**Determination of spreadability**

Spreadability of formulations was determined by an apparatus suggested by Multimer et al. which was fabricated in laboratory and used for study. The apparatus consist of a wooden block, with a fixed glass slide and movable glass slide with one end tied to weight pan rolled on the pulley, which was in horizontal level with fixed slide.

**Procedure**

An excess of gel sample 2.5 g was placed between two glass slides and a 1000g weight was placed on slides for 5 minutes to compress the sample to a uniform thickness. Weight (60g) was added to the pan. The time (seconds) required to separate the two slides was taken as a measure of spreadability.

It was calculated using the formula,

$$S = ( m \times l ) / t$$

Where, S -Spreadability in g.cm / sec; m - Weight tied to upper slide; l - Length of glass slide; t - Time in seconds.

Length of glass slide was 12 cm and weight tied to upper slide was (63g) throughout the experiment.

**Anti-bacterial activity**

**Preparation of Innoculum**

For evaluation of anti-bacterial activity, 24 hours fresh culture of *Propionibacterium acne* MTCC 3297 was suspended in sterile water to obtain a uniform suspension of microorganism.

**Determination of Zone of inhibition**

Antibacterial activity was checked by agar well diffusion method. In this method a previously liquefied medium was inoculated with 0.1 ml of Bacterial suspension having a uniform turbidity at temperature of 40°C. 20 ml of culture medium was poured into the sterile petridish having a internal diameter of 8.5 cm. Care was taken for the uniform thickness of the layer ofmedium in different plates. After complete solidification of liquefied inoculated medium, the wells were made aseptically with cork borer having 6 mm diameter. In each of these plate extract and gel solution was placed carefully. Plates were kept for pre Diffusion for 30 min. After it normalized to room temperature; the plates were incubated at 37°C for 24 hrs in incubation period was over, the zone of inhibition was measured with help of Scale. It was compared with market formulation of Clindamycin gel (Erytop) because it has same anti bacterial spectrum and widely used.

## Result and Discussion

**Table No. 01: Solubility of cinnamon oil**

| Volume of cinnamon oil | Volume of water | Solubilizer | Observation |
|---|---|---|---|
| 2 ml | 8 ml | Tween 20 | White stable emulsion form |
| 2 ml | 8 ml | Tween 60 | White stable emulsion form |
| 2 ml | 8 ml | Tween 80 | White stable emulsion form |
| 2 ml | 8 ml | Propylene glycol | White stable emulsion form |
| ***2 ml*** | ***8 ml*** | ***Ethanol (95%w/v)*** | ***Clear transparent solution obtained*** |

So, from table no. 01, in ethanol clear solution is obtained. From this, I conclude that for solubilize cinnamon oil in water ethanol is good solubilizers to obtained clear transparent liquid.

**Table No. 02: Minimum concentration of ethanol as solubilizer**

| Volume of cinnamon oil | Volume of water | Concentration of ethanol | Observation |
|---|---|---|---|
| 0.1 ml | 9 ml | 1 ml | White solution |
| 0.1 ml | 8 ml | 2 ml | White solution |
| 0.1 ml | 7 ml | 3 ml | Turbid solution |
| ***0.1 ml*** | ***6 ml*** | ***4 ml*** | ***Clear solution*** |
| 0.1 ml | 5 ml | 5 ml | Clear solution |
| 0.1 ml | 4 ml | 6 ml | Clear solution |
| 0.1 ml | 3 ml | 7 ml | Clear solution |
| 0.1 ml | 2 ml | 8 ml | Clear solution |
| 0.1 ml | 1 ml | 9 ml | Clear solution |

From table no. 02, at 40% ethanol clear solution is obtained. From this, I conclude that to 448olubilize 1% cinnamon oil in water minimum 40% ethanol is required.

**Table No. 03: Batch-1: Optimization of CARBOPOL 971**

| Formulation | F1 | F2 | F3 | *F4* | F5 |
|---|---|---|---|---|---|
| Cinnamon Oil | 1 % | 1 % | 1 % | 1 % | 1 % |
| BHT | - | - | - | - | - |
| Aloe Vera gel | 5 % | 5 % | 5 % | 5 % | 5 % |
| Ascorbic acid | - | - | - | - | - |
| Ethanol (95 % $^{W}/_{V}$) | 40 % | 40 % | 40 % | 40 % | 40 % |
| Water | q.s. to 100 | q.s. to 100 | q.s. to 100 | q.s. to 100 | q.s. to 100 |
| *Carbopol 971* | 0.5 | 1.0 | 1.5 | *1.75* | 2.0 |
| TEA (Tri Ethanol Amine) | q.s. neutral pH | q.s. neutral pH | q.s. neutral pH | q.s. neutral pH | q.s. neutral pH |
| **Result** | Thin gel | Thin gel | Viscous gel | **Thick gel** | Very thick gel |

As per table no. 03, formulation F4 having optimum viscosity. F1-F3 having low viscosity while F5 having high viscosity. So, F4 was selected.

**Table No. 04: Batch-2: Evaluation of Neutralizing Agent**

| Formulation | F6 | *F7* |
|---|---|---|
| Cinnamon Oil | 1 % | 1 % |
| BHT | 1 % | 1 % |
| Aloe Vera gel | 5 % | 5 % |
| Ascorbic acid | 0.1 % | 0.1 % |
| Ethanol (95 % $^{W}/_{V}$) | 40 % | 40 % |
| Water | q.s. to 100 | q.s. to 100 |
| Carbopol 971 | 1.75 % | 1.75 % |
| TEA(Tri Ethanol Amine) | q.s.to neutral pH | - |
| ***Coco diethanol amine*** | - | **q.s. neutral pH** |
| **Result** | Turbid gel | **Clear gel** |

Here as per table no. 04, formulation F7 was selected because F6was turbid while F7 is clear, transparent gel.

**Table No. 05: Batch-3: Cinnamon Oil Conc.**

| Formulation | *F8* | *F9* | *F10* | F11 | F12 |
|---|---|---|---|---|---|
| *Cinnamon Oil* | **0.5 %** | **0.75%** | **1 %** | 1.5 % | 2 % |
| BHT | 1 % | 1 % | 1 % | 1 % | 1 % |
| Aloe Vera gel | 5 % | 5 % | 5 % | 5 % | 5 % |
| Ascorbic acid | 0.1 % | 0.1 % | 0.1 % | 0.1 % | 0.1 % |
| Ethanol (95 % $^{W}/_{V}$) | 40 % | 40 % | 40 % | 40 % | 40 % |
| Water | q.s. to 100 | q.s. to 100 | q.s. to 100 | q.s. to 100 | q.s. to 100 |
| Carbopol 971 | 1.75 % | 1.75 % | 1.75 % | 1.75 % | 1.75 % |
| Coco diethanol amine | q.s. neutral pH | q.s. neutral pH | q.s. neutral pH | q.s. neutral pH | q.s. neutral pH |
| Irritation observation | No irritation | Negligible irritation | Negligible irritation | Irritation | More Irritation |

Here from table no. 05, formulation F8, F9, F10 was selected as per Irritation parameter. In this formulation, Irritation was negligible.

**Table No. 06: Batch-4: Aloe Vera gel and Cinnamon oil ratio**

| Formulation | F8 | *F8a* | F9 | F9a | F10 | F10a |
|---|---|---|---|---|---|---|
| *Cinnamon Oil* | 0.5 % | **0.5 %** | 0.75 % | 0.75 % | 1 % | 1 % |
| BHT | 1 % | 1 % | 1 % | 1 % | 1 % | 1 % |
| *Aloe Vera gel* | 5 % | **10 %** | 5 % | 10 % | 5 % | 10 % |
| Ascorbic acid | 0.1 % | 0.1 % | 0.1 % | 0.1 % | 0.1 % | 0.1 % |
| Ethanol (95 % $^{W}/_{V}$) | 40 % | 40 % | 40 % | 40 % | 40 % | 40 % |
| Water | q.s. to 100 | q.s. to 100 | q.s. to 100 | q.s. to 100 | q.s. to 100 | q.s. to 100 |
| Carbopol 971 | 1.75 % | 1.75 % | 1.75 % | 1.75 % | 1.75 % | 1.75 % |
| Coco diethanol amine | q.s. neutral pH | q.s. neutral pH | q.s. neutral pH | q.s. neutral pH | q.s. neutral pH | q.s. Neutral pH |
| Result | Clear gel, Thin gel | **Clear gel, Viscous gel** | Turbid gel | Turbid gel | Turbid gel | Turbid gel |

Here from table no. 06, formulation F8a was selected. Because in this formulation, clear and viscous gel was obtained while in other formulations turbid and thick or clear and thin gel was obtained. So, it was preferred.

**Table No. 07: Final Formulation: *F8a***

| Ingredients | Concentration |
|---|---|
| Cinnamon Oil | 0.5 % |
| BHT | 1 % |
| Aloe Vera gel | 10 % |
| Ascorbic acid | 0.1 % |
| Ethanol (95 % $^{W}/_{V}$) | 40 % |
| Water | q.s. to 100 |
| Carbopol 971 | 1.75 % |
| Coco diethanol amine | q.s. Neutral pH |

**Evaluation**

1. Organoleptic parameters:
   a) Colour: Clear gel
   b) Odour: Cinnamon fragrance
   c) Texture: Smooth
   d) Clarity: Clear, Transparent
2. Rheological study / Viscosity: 3600 cP
3. pH measurement: 6.53
4. Effect on skin:
   a) Water washability: Easily washable
   b) Irritation on skin: No irritation
   c) Spreadability: 24.5gm-cm/sec
5. Anti-bacterial activity:
   Cinnamon oil shows good anti-bacterial activity against *Propionibacterium acne* MTCC 3297.

**Table No. 08: Zone of inhibition (activity of different gel containing different conc. of cinnamon oil)**

| Formulation | Zone of inhibition (mm) | Zone of inhibition of market formulation (mm) |
|---|---|---|
| **F8a** ( 0.5 % C.oil) | 18 | 12 |
| **F9a** (0.75 % C.oil) | 22 | 12 |
| **F10a** (1.0 % C.oil) | 24 | 12 |

Here, as per table no. 08, we can conclude that all the three gel had good anti bacterial activity. But F8a was selected because it has no irritation and it was clear transparent gel.

**Table No. 09: Zone of inhibition (activity of cinnamon oil, aloevera gel, ethanol, market formulation)**

| Formulation | Zone of inhibition (mm) |
|---|---|
| Aloe Vera gel solution (10%) | 8 |
| Ethanol 95%w/v | 0 |
| Market Formulation (Clindamycin) | 12 |

Here, as per table no. 09, it concluded that ethanol has no activity on *P. acne* while aloevera gel has somewhat inhibitory effect on them. Its zone of inhibition is 8mm. Market formulation of Clindamycin (Erytop) has also effect on that. Its zone of inhibition is 12mm.

## Conclusion

Cinnamon oil containing gel was developed. The optimal formula of anti-acne gel was cinnamon oil 0.5%, aloevera gel 10%, BHT 1%, Ascorbic acid 0.1%, Carbopol-971 1.75%, Coco diethanol amine q.s. to neutral pH, and water q.s to 100 ml. this gel was clear, transparent, thick, smooth. The pH was 6.53 and its viscosity was 3600 cP. It was non irritant to skin. It gave high effectiveness in inhibiting the growth of *P. acne* MTCC 3297. The gel was stable at room temperature.

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