

# **A Comprehensive Review on Formulation and Evaluation of Herbal Anti-acne Gel**

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## **Abstract**

Acne vulgaris is a Common human skin disease that affects both adults and teenagers is acne. It is a prevalent inflammatory skin condition affecting the pilosebaceous unit. Although it can also affect the back, trunk, and upper arms, it usually shows up on the face. Acne affects 83% of teenage females and 99.5% of teenage boys due to hormonal changes, and it can last all teenage years. Propionibacterium acne and Staphylococcus epidermidis are the microorganisms that cause acne. The public is paying increasing attention to herbal formulations due to their superior qualities and less adverse effects. Furthermore, it supplies the skin with the hydration and nutrients it needs. The herbal gel is essentially an emulsion of water and oil that has less adverse effects. This study reviews recently published research on the creation of herbal anti-acne gels.

Keywords: Anti-acne, herbal formulation, microorganisms, inflammatory skin

## **1. Introduction**

### **1.1 Acne**

Acne is a skin condition that has detrimental social and psychological impacts on those who have it. Both adults and many youngsters struggle with it. The most contributing elements Increased sebum production, keratinocyte shedding, bacterial growth, and inflammation all contribute to

the development of acne. By triggering specific inflammatory mediators, the anaerobic pathogen *Propionibacterium acnes* (*P. acnes*) contributes significantly to the pathophysiology of acne [1]. Individual differences in acne severity can be substantial, and hereditary factors are a major contributing factor. The microbial population, follicular hyperkeratosis, androgen-driven seborrhea, as well as a number of immunological and inflammatory processes, are important causes of acne. Each person's unique acne phenotype is shaped by the interactions between these factors [2]. When the keratinocytes lining the sebaceous follicle shed abnormally, a microplug or microcomedo forms, which is the first step in the development of an acne lesion. Increased amounts of androgens in the blood during puberty cause the pilosebaceous unit to produce more sebum. The commensal bacteria *Propionibacterium acnes* can colonize the area thanks to these modifications. As *P. acnes* grows in number, They produce chemotactic factors and inflammatory chemicals that initiate and maintain the local inflammatory response, which may also result in an increase in keratinocyte proliferation [3].

### 1.2 Factors responsible for acne [4]:

- *Propionibacterium acnes* (*P. acne*)
- Altered follicular keratinization
- Genetics
- Over Washing the Face with Cleansers
- Inflammation
- Androgen-induced enhanced sebum hyper-production
- Medications.
- Due to the Cosmetics Used
- Stress
- Hormonal Changes and Menstruation
- Squeezing the Pimples
- Diet

## 2. Herbal cosmetics

The phrase "herbal cosmetics" describes goods with a greater natural component count that are only intended to provide certain cosmetic advantages. The herbal medicine market is expanding swiftly as they don't have any negative side effects. Herbs and plants are the sole ingredients in herbal cosmetics [5]. There are natural and synthetic formulations for a range of skin disorders, including sunscreen, anti-acne, anti-wrinkle, and skin protection. Herbal medicines offer several benefits, such as anti-inflammatory, antiseptic, antibacterial, and antioxidant properties, which prevent side effects as compared to synthetic formulations [6].

### 2.1 Advantages of herbal cosmetics over traditional cosmetics [7]

1. They have no adverse side effects and don't cause allergic responses.
2. They blend in with skin and hair with ease.

3. Compared to other cosmetics in modest amounts, they are far more effective.
4. Plant extract reduces the cosmetics' bulk qualities and provides the right pharmacological effects.
5. Easily accessible and present in a wide range of plants.
6. Their herbal ingredients are more stable, pure, and effective.
7. Simple to produce.
8. Herbal cosmetics are easy to handle and store for an extended amount of time.

### 3. Gel

Gels are classified as semisolid emulsions that are designed for external application and can be either water in oil (w/o) or oil in water (o/w) in kind. Gels are used for cleaning, beautifying, and enhancing looks in addition to their medical and cosmetic uses. The goal of these topical formulations is to locally administer the drug, either into the underlying layer of the skin or into the mucous membrane. To enhance the site-specific delivery of medicine for skin diseases, these products must be applied topically [8]. The gel's goals are to prevent acne and tan lines, cure any disease, and calm the skin's reaction to different environmental factors. Foundation, vanishing, cleaning, massage, hand, and body gels are among the many types of gels. It is easy to apply gels to any portion of the body. For people of all ages, using gel is convenient [9].

#### 3.1 Formulation of herbal gel

Several papers over the previous several years have been examined by us. Our research clearly shows that the herbal anti-acne gel consists of two components: excipients and chief elements.

#### 3.2 Chief constituents

These are the primary pharmacologically active ingredients that provide the gel its anti-acne properties. These are the natural medications that are obtained from natural resources. During our investigation, we discovered a lot of medications, which are listed below:

***Eucalyptus globules:*** The eucalyptus leaf is a component of the anti-acne gel composition. *Propionibacterium acnes* (P. acnes) is among the many bacteria that the essential oil of eucalyptus exhibits antibacterial action against. 10 We concluded from our investigation that it can be utilized at levels as low as 2% [10] and as high as 4% [11].

***Iris ensata:*** An anti-acne lotion made of polyherbal ingredients contains iris extract. It was made by combining the iris roots with 60:80 petroleum ether in the Soxhlet's Equipment. It is utilized at a 1.5% concentration. [11]

***Azadirachta indica:*** This medication is commonly referred to as neem. Because of its antimicrobial qualities, it is widely utilized in India. Since ancient times, it has been utilized for its many advantages. Additionally, it exhibits antibacterial properties against acne-causing microorganisms. Its extract is utilized to make the polyherbal anti-acne gel. In the Soxhlet's apparatus, it was made by combining neem leaves with petroleum ether in a 60:80 ratio. As little as 0.5% [13] and as high as 5% [12] can be achieved using it.

***Cyperus rotundus*:** It is frequently referred to as nut grass. Africa, southern and central Europe, and southern Asia are the natural habitats of *Cyperus rotundus*. It is an excellent component for cosmetics because of its antifungal, antibacterial, and antimicrobial qualities [14]. In the Soxhlet's apparatus, its extract is also made by using its roots in a 60:80 petroleum ether ratio. As little as 1.5% [11] or as high as 2% [14] can be employed.

***Nyctanthes arbortristis*:** Harsinghar is its native name. The Indian traditional medical system makes use of it. It works well as an antibacterial. Its extract, which may be created by combining its steam with petroleum ether in a 60:80 ratio, is used in its formulation. It is utilized at a 1.5% concentration [11].

***Astragalus sarcocolla*:** Anjira is the local name for it. It is a traditional herbal remedy as well. Its anti-oxidant properties will help to promote skin health. It was extracted using a 50:50 ratio of alcohol to distilled water. It is utilized at a 1.5% concentration [11].

***Aloe barbadensis*:** In India, it's generally referred to as aloe vera. Aloe Vera gel is used as a moisturizer, to heal burn wounds, and to lessen acne and pimples [13]. Aloe Vera is utilized for its calming and skin-glow properties. possesses anti-inflammatory and antioxidant properties as well [15]. The sterile knife was used to cut away the colorless parenchymatous tissue, which is aloe vera gel. The fibers and contaminants are then eliminated by filtering it through muslin fabric. The clear aloe vera gel filtrate or filter product can then be utilized in the process [13]. Its use ranges from as low as 0.63% [16] to 3% [11].

***Matricaria chamomilla*:** Baboona is the name of the medication. Its essential oil is utilized in the creation of polyherbal anti-acne lotion. Its preparation involves the usage of monkey flowers. The conc. of 0.5% uses it [11].

***Vetiveria zizanoides*:** When making a polyherbal anti-acne gel, it is utilized. Khas is its local name. Its essential oils are extracted and employed in the formulation. It can be applied to a 0.3% concentration [11].

***Commiphora myrrha*:** it is also called Mur-makki. A multi-herbal anti-acne gel is made with its essential oil. Its antimicrobial, astringent, and anti-inflammatory properties make it useful. The conc. of 0.2% uses it [11].

***Boswellia serrata*:** Gugal/Luban is its native name. Because of its anti-inflammatory qualities, it is a component in the polyherbal anti-acne gel. Its essential oils are employed in the preparations. In the conc, it is used. ranging from 0.2% [11] to 4% [18].

***Jasminum officinalis*:** Another name for it is Chameli. It emits a really nice scent. It is utilized in the creation of polyherbal anti-aging products as an antioxidant and anti-wrinkle agent. gel for acne. Very little of its essential oils are utilized. It is utilized at a concentration of 0.3% [11].

***Olea europaea:*** In India, it's referred to as both Olive and Zaitoon. It has anti-oxidant and moisturizing qualities. A multi-herbal anti-acne gel is made with its fixed oil. The conc. of 5% uses it [11]. It functions as a supportive agent as well.

***Salix alba:*** It is known as The White Willow. It is a species of willow native to Europe and western and central Asia. In this poly herbal gel preparation the bark of white willow is used. It helps in the exfoliation of skin and promotes new cell growth. It is used in the conc. Of 0.63% [16].

***Saccharum officinarum:*** We call it sugar cane. It contains a lot of sugar. In the composition of the polyherbal gel, it also serves as an exfoliating agent. As an excipient, it also serves a supportive function. The conc. of 0.63% contains sugar cane juice [16].

***Cucumis sativus:*** It is commonly known as Cucumber. It provides cooling, healing and soothing to irritated skin, whether caused by sun, or the effects of cutaneous eruption, due to high anti oxidant nature. For the formulation it is prepared by using the fruit of cucumber in the Soxhlet apparatus and extracted with petroleum ether (60 to 80°C) to defat the drug. It is used in the conc. of 1.5% [14].

***Daucus carota:*** We call it wild carrot. It has high levels of both vitamin A and vitamin C. Additionally, vitamin A is an excellent antioxidant that slows down the aging process. The body uses vitamin C to make collagen, a protein that is necessary for our skin to be elastic. Additionally, it keeps the skin from getting wrinkles. Because of its anti-oxidant and anti-aging properties, it is utilized in the formulation of herbal anti-acne gels. It is utilized at a concentration of 0.5% [19].

***Ocimum sanctum:*** It is frequently referred to as holy basil, or tulsi. Because of its antibacterial properties and ability to reduce black spots, tulsi is frequently used in skin preparations and primarily in herbal cosmetics and medicine. Tulsi cleanses the body of impurities and detoxifies the blood. Antioxidants found in tulsi prevent aging by counteracting the negative effects of free radicals. Because of its antibacterial properties against acne germs, it is incorporated into the composition. Because of its flexibility, it offers several skin-benefitting properties. It is utilized at a concentration of 0.5% [19].

***Casuarina equisetifolia:*** Pakistan, India, Sri Lanka, and tropical Africa all cultivate this attractive shrub. Antibacterial, antifungal, anti-inflammatory, anti-cancer, antioxidant, and analgesic properties are all present in this plant. As an astringent, C. equisetifolia bark is utilized. Five percent utilize it [20].

***Cinnamomum verum:*** In common parlance, it is also known as cinnamon. It is referred to as darchini in unani preparation. It is utilized for its main antiseptic activity. It is used to make herbal anti-acne gel. It is utilized in the 1% conc. [21].

***Rubia cordifolia:*** Manjishtha is a kind of flowering plant that belongs to the Rubiaceae family, which also includes coffee. According to the Unani herbal classification, it is known as Husune Yusuf. Its antibacterial and anti-inflammatory properties make it useful. It is used in the preparation in conc. as low as 0.3% to as high as 1% [21].

***Catharanthus roseus:*** Vinca is the name of it. The vinca flower is used in the herbal anti-acne gel formulation. Acne can be effectively treated using its astringent, disinfectant, and antibacterial qualities. It is utilized in the 0.9% conc. [22].

***Foeniculum vulgare:*** Fennel is its common name. It possesses strong antibacterial, antioxidant, and anti-inflammatory properties. The southern Mediterranean area is where it first appeared. It was grown by the Romans for its fragrant seeds. It is a component in herbal anti-acne gel formulations. In the context of 1%, it is utilized [23].

***Camellia sinensis:*** In the flowering plant family Theaceae, *Camellia sinensis* is a species of evergreen shrub or small tree whose leaves, leaf buds, and stems can be used to make tea, also known as Green Tea. Its moisturizing, skin-protecting, and anti-melanogenesis qualities make it a perfect candidate to be used in the formulation of herbal anti-acne gel in conjunction with other medications; it is used in the concentration of 10% [24].

#### 4 Excipients

An excipient is a material that is added to a drug in addition to the active component. Excipients are used in a variety of objectives, such as boosting the therapeutic qualities of the active component in the finished dosage form, bulking up solid formulations with strong active ingredients in tiny doses, or providing long-term stability. They can improve solubility, decrease viscosity, or aid in medication absorption. The qualities of the chosen necessary excipient are taken into consideration while choosing the excipients. After examining how the recently released research publications were written. We found that an excipient's primary contribution to the final formulation determines whether it should be included in the formula or not.

##### A. Thickening agents:

A material that may raise a liquid's viscosity without significantly altering its other characteristics is known as a thickening agent or thickener. For example: Steric acid, Carbopol 940, PEG1500, Cetyl alcohol etc

We discovered that steric acid is utilized more frequently than any other agent based on these data. Therefore, we can confidently state that, in comparison to other medications, it is an excellent thickening agent. Additionally, it's an excellent binder. It ranges from as low as 3% [12] to as high as 16.2% [16] in conc.

##### B. Anti-Inflammatory Agents:

These are chemicals that lessen the body's inflammation, which includes pain, swelling, and redness. Anti-inflammatory drugs prevent some chemicals that lead to inflammation in the body. Additionally, these excipients strengthen the primary constituents' anti-inflammatory properties. For example: Spermaceti, Almond oil, White beeswax, Salicylic acid, Castor oil etc.

**C. Moisturizing Agent:**

A. To hydrate the skin and stop moisture loss, moisturizing ingredients are added to cosmetics. They offer the skin a smooth look and aid in preserving its natural moisture content. These consist of emollients, occlusives, and humectants. For example: Glycerylmonostearate, White petroleum, PEG1500, Silicone oil, Glycerin, White bees wax, Petroleum jelly, Mineral oil, Propylene glycol etc.

We may conclude from our analysis of these data that glycerin would make a good moisturizer in our recipe of herbal anti-acne gel. Glycerin exhibits the highest hydrating properties with fewer adverse effects and other medication interactions. It is suitable for usage at concentrations as low as 1.9% [16] and as high as 12% [21].

**D. Antioxidants:**

Compounds known as antioxidants prevent oxidation, a chemical process capable of generating free radicals. These free radicals' existence will result in the herbal or spoiling components, which will ultimately impact the product's shelf life. By interacting with oxygen before the active chemicals in the medication, the antioxidants will shield the active compounds. For example: Citric acid, Sodium metabisulfite, Zinc oxide etc.

We can confidently state that zinc oxide is a good option for antioxidants based on our analysis of these data. Zinc will display several attributes in the interim, including astringent and will give the gel its freshness. Zinc oxide serves as an antioxidant in a variety of formulations. It may range from as low as 0.76% [16] to as high as 1.5% [11] in the conc.

**E. Buffering agent:**

A solution that can withstand a pH shift when acidic or basic substances are added is called a buffer. It can counteract trace levels of additional basic or acid, keeping the solution's pH comparatively constant. These substances are employed to keep the mixture stable under different circumstances. For example: Sodium citrate, Potassium hydroxide, Triethanolamine, Borax, EDTA.

**F. Preservative:**

These are the substances or medications that will aid in preventing our preparation from spoiling. Microbial growth will cause these compounds to break down. For example: Methyl paraben, Propyl paraben, Borax, Disodium EDTA, EDTA etc.

We can confidently conclude from our analysis of these facts that both Propyl and methyl paraben are excellent preservatives. This is simple to add to the majority of formulas. There are several articles that utilize methyl paraben. It is applicable to Conc. ranging from 0.01% [14] to 0.6% [25].

**G. Skin protectant:**

Skin protectant is a thin layer or barrier that can be applied to skin that has been damaged or is susceptible to harm. The shield offers a protective layer that both shields the injured skin and speeds up the healing process. For example: Mineral oil, Zinc oxide, Lanolin, Bismuth subnitrate, Ammonium acryloyldimethyltaurate etc.

Based on our analysis of these data, we may conclude that Lanolin and zinc oxide will both promote healing and offer a protective layer. Lanolin is used in as low as 2% [11] to as high as 4.3% [22] in the conc.

**H. Emulsifier:**

Emulsifiers are surface-active substances, which means they create connections by floating inside the aqueous-oily phase interfaces. crucial prerequisite for emulsifiers. These substances

will enable the creation of an emulsion. For example: Cetostearyl alcohol, Cetyl alcohol, Borax, Sodium lauryl sulfate, Tween60, Polysorbate, Polyethylene glycol etc.

We can confidently state that borax and cetyl alcohol are both effective emulsifying agents based on our analysis of these facts. Borax can be utilized at concentrations ranging from 0.1% [15] to 0.8% [18]. However, the percentage of cetyl alcohol that can be employed ranges from 0.95% [16] to 5.8% [21].

### **I. Antimicrobial Agent:**

Preservatives with antimicrobial properties serve two purposes: (i) to stop the growth of bacteria that might cause the product, and (ii) to stop the development of harmful bacteria that might endanger the user's health when used repeatedly over long periods of time—often by several people. This covers both antifungal and antibacterial properties. For example: White bees wax, Sulfur, Castor oil etc.

We can confidently state that white beeswax has strong antibacterial action based on our analysis of these data. In particular, it has strong antibacterial properties that might extend the duration of the preparation. It appears in several articles. Its confidence level might range from 1.6% [15] to 16.67% [18].

**J. Fragrance Agents:** These are the substances that will give the mixture a pleasing scent.

Despite the minimal quantity of scent included in cosmetics, it is a necessary component of makeup. For example: Rose water, Min etc.

Based on our analysis of these data, we conclude that mint and rose water work well together to provide the formulation aroma. Rose water also gives anti-ageing property to the skin. Since they give aroma, they are often employed in drips based on demand.

## **5. Evaluation tests for gel**

### **5.1 PH of gel**

The pH meter is calibrated using a standard buffer solution. Weighing and dissolving approximately 0.5 g of the gel in 50.0 ml of purified water is required, along with its They measure the pH. To avoid irritating the skin, the gel's pH should be between 5.6 and 5.8.

### **5.2 Viscosity**

Using spindle number seven, the Brookfield Viscometer can measure the formulation's viscosity at 100 rpm.

### **5.3 Phase Separation**

The prepared gel is stored away from light in a covered container between 25 and 1000C. Phase separation is then monitored for 30 days at 24-hour intervals. days. The phase separation is seen to shift.

### **5.4 Acid value**

After dissolving 10 grams of material in 50 milliliters of an equal amount of alcohol and solvent ether, the flask is attached to a reflux condenser and heated gradually until the sample is fully dissolved. One milliliter of phenolphthalein is then added, and the mixture is titrated with 0.1N NaOH until After 30 seconds of shaking, a subtle pink hue emerges.

Acid value =  $n \times 5.61 / w$

n = the number of ml of NaOH required.

w = the weight of substance.

### 5.5 Saponification value

After 30 minutes of refluxing about 2 grams of the material with 25 milliliters of 0.5 N alcoholic KOH, add 1 milliliter of phenolphthalein and titrated right away using 0.5 N HCL.

Saponification value =  $(b-a) \times 28.05/w$

The volume in ml of titrant = a

The volume in ml of titrate = b

The weight of substance in gm = w

### 5.6 Irritancy test

The purpose of these tests is to assess the material and chemical quality and establish whether or not they are harmful to the skin. To check for irritation, the gel is first applied to the hand and kept on for a while. On the dorsal surface of the left hand, mark a 1 sq. cm area. Time is recorded as the gel is administered to the designated region. Erythema, edema, and irritation are monitored for up to 24 hours at regular intervals and reported.

### 5.7 Accelerated stability testing

Two of the most stable produced formulations undergo accelerated stability testing at room temperature, followed by a seven-day study at  $40^{\circ}\text{C} \pm 1^{\circ}\text{C}$  for 20 days. The formulations are maintained at room temperature and at a higher temperature, and stability parameters are measured on the 0th, 5th, 10th, 15th, and 20th days.

### Conclusion

We came to the conclusion that the herbal anti-acne gel is a very efficient composition with little negative effects after carefully reviewing the papers in our study. Our Research looked at the amounts of different natural herbs used in anti-acne gel formulations, as well as how they were evaluated. Our study's objective is to present comprehensive details on the various herbs and excipients used in the herbal anti-acne gel. The stability, safety, and effectiveness of a herbal anti-acne gel may be ascertained by evaluating the assessment parameters.

Following our investigation, we developed a broad anti-acne gel composition. We have attempted to construct a range of each and every element, therefore this is only suggested in nature. that a person may start their job by creating a formula at random and then use optimization techniques to get the best suited formulation. We believe that a method for creating an ideal formulation may be designed by analyzing a large number of formulations of any dosage form and calculating the average percentage of constituents.

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