



# FORMULATION AND EVALUATION OF POLY-HERBAL ANTI-DANDRUFF HAIR GEL

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**Abstract:** Dandruff is a skin condition with symptoms includes flaking and sometimes mild itchiness cause to the scalp. There are many bacteria, fungus causing scalp infections which leads to further hair problem. *Malassezia furfur* is considered to be the cause of dandruff. Dandruff may also be caused by changes in humidity, trauma, seasonal changes or emotional stress. There is one of the common condition dandruff. Herbal extract of neem, amla, aloe vera, tulsi, onion, tea and hibiscus found to be effective in treating dandruff. Neem powder shows antibacterial and antifungal activity on gram positive and gram negative bacteria. Vitamin C in amla which is 20 times more than that of orange prevents premature graying of hairs. Aloe vera nourishes the hairs, hibiscus provides luster to hairs. Tea act as an antioxidant, tulsi is also antibacterial in nature. Onion is used for hair growth and to strengthen the follicle. Gel formulation was prepared using xanthan gum, glycerin. The evaluation tests were performed which include tests for stability, physical and chemical properties.

**Keywords:** Dandruff, Neem, Maceration, Xanthan gum, *Malassezia furfur*

## I. INTRODUCTION

### Introduction:

Hair is a unique character found on all mammals. In human it is special feature which has main function in protection of skin from mechanical damage, physical damage and sensory functions <sup>[1]</sup>. The hair consists of two parts; the hair shaft which is visible to eyes and present outside the skin. Under the skin's surface, there is a hair follicle. Cortex, cuticle and medulla make comprise the hair shaft. Outer root sheath and the inner root sheath make up the hair follicle. The outer root sheath (ORS) is consists of keratinocytes and melanocytes. The Henle layer, the Huxley layer and cuticle layer make up the inner root sheath (IRS), which aids in the growth of the hair shaft into the follicle. The hair papilla conducts the signals that determine the size and colours of hairs. The vessels are responsible for nourishing hair follicle by supplying oxygen and nutrients, eliminating waste and promoting growth <sup>[2]</sup>. A sebaceous gland is exocrine gland that secrete an oily or waxy matter called as sebum. Sebum lubricates the hairs. Sebum is composed of triglycerides ( $\approx 41\%$ ), wax esters ( $\approx 26\%$ ), squalene ( $\approx 12\%$ ) and free fatty acids ( $\approx 16\%$ ) <sup>[3]</sup>. There are various types of hairs are known that are; straight, wavy, curly and coiled. Nowadays there are black, brown, red, auburn, blond, grey and white hair colours can be seen <sup>[4]</sup>.

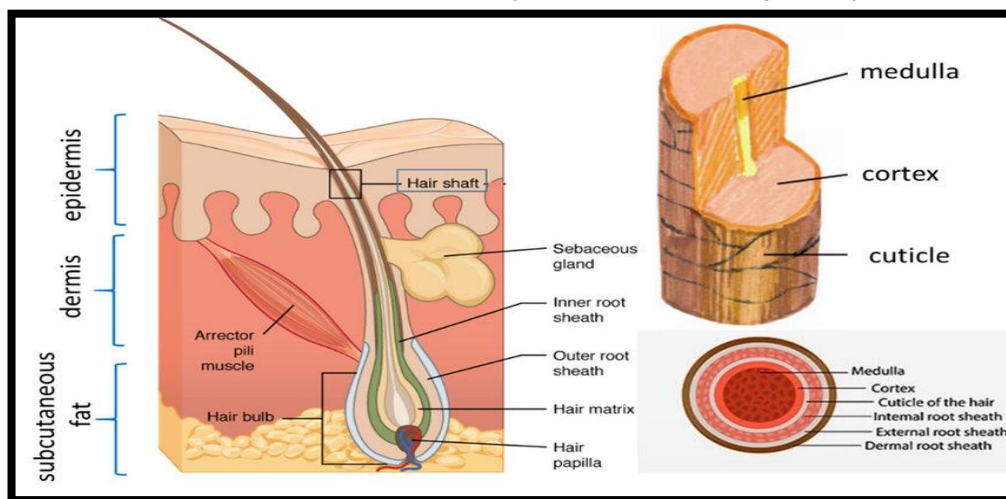


Fig No.1 Structure of Hair

### Dandruff:

Dandruff is common scalp condition that affects most of the population at prepubertal age. The word dandruff is Anglo-Saxon origin which is combination of 'tan' meaning 'tetter' and 'drof' meaning 'dirty'. The dandruff is distributed most commonly in hairy part of head, forehead, the external ear canals, eye brows and eye lashes etc. [6]. Dandruff is a group of corneocytes that have a strong degree of cohesiveness and separate from the surface of stratum corneum's surface [7]. The most prevalent cause of dandruff is the fungus *Malassezia furfur*. This fungus is depended on lipid. It is responsible for many cutaneous diseases like dandruff, seborrheic dermatitis etc. During dandruff there is increased level of *Malassezia furfur* by 1.5-2 times to its normal level is seen [8]. Dandruff may also be caused by frequent exposure to extreme heat and cold. Other factors like family history, food allergies, excessive perspiration, use of alkaline soaps and stress contribute to the dandruff production [9].

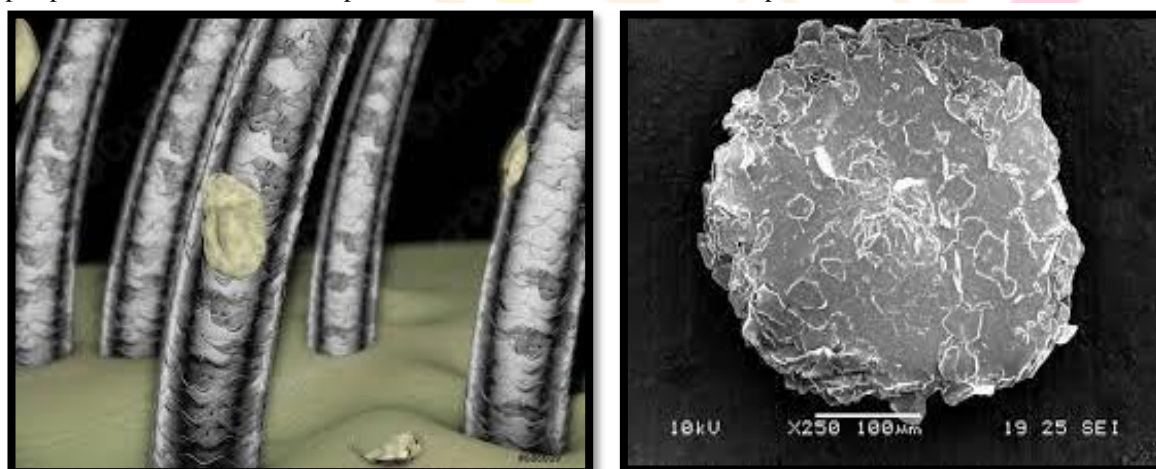


Fig. No.2 Microscopical Structure of Dandruff

### Gel:

Gel is solid, jelly like material with three-dimensional cross-linked network in the liquid. The physical connectors and crystalline or other junctions that are still present in an extended liquid can provide the internal network structure [10]. The gels may be of any type i.e., hydrogels, organogels or xerogels. Aqua gels, a network of hydrophilic polymer chains, are another name for hydrogels. They contain approximately 99% of water with natural or synthetic polymer. Hydrogels contains high flexibility due to high water content. Organogels are thermoplastic, non-crystalline, non-glassy solids made of liquid organic phase that is confined inside a three-dimensional cross-linked network. Mineral oil, vegetable oil, or organic solvents are all acceptable liquids for this gel. These gels are utilised in medications, cosmetics, art conservation and food. A xerogel is solid that is created from a gel by unrestricted drying shrinkage. They have high porosity (25%) and high surface area (150-900sq.m/g), with very small pore size (1-10 nm). Heat treatment at high temperature to xerogel produce dense glass. The various gel forming compounds like natural gums, carbomers, cellulose derivatives are used to produce gel [6].

### Herbal Treatment:

#### 1. Aloe vera

*Aloe barbadensis* Miller. also knows as Curacao aloes, *Aloe perryi* Baker, also known as Socotrine aloes, *Aloe ferox* Miller and hybrid of these species with *Aloe africana* Miller and *Aloe spicata* Baker, also known as Cape aloes, belongs to family Liliaceae. *Aloe vera* contains a gel which is made up of water, glycosides, anthraquinone glycosides, resins, vitamins and amino acid [12].

## 2. Amla

Amla fruit consist of dried as well as fresh fruit of the plant *Emblica officinalis* Gaerth *Phyllanthus emblica* Linn. belonging to family Euphorbiaceae. It contains not less than 1.0% w/w of gallic acid calculated on dry basis <sup>[13]</sup>. Amla contains phenols, tannins, fat with various antioxidants. Amla contains 20 times as much Vitamin C as an orange that prevents premature graying of hairs. Antioxidants presents in amla prevents hair fall <sup>[14]</sup>.

## 3. Tulsi

Tulsi consist of fresh and dried leaves of *Ocimum santum* Linn. belongs to family Labiatae. It contains not less than 0.40% eugenol on dried basis. Tulsi also contains some volatile oils, alkaloids, glycosides, tannins, saponins and vitamin C. the anti-bacterial and anti-fungal benefits of basil help to keep the scalp healthy while anti-inflammatory properties give relief from dryness and itchiness of the scalp <sup>[15]</sup>.

## 4. Tea

Tea is also known as *Camelia thea*. It comprises prepared *Thea sinesis* (Linne) O. kuntze leaf buds and leaves that belongs to family Theaceae. Tea contains flavonols, glycosides, alkaloids, polyphenols and volatile oil. It has antioxidant, anti-inflammatory properties that can help to reduce irritation, redness and swelling <sup>[16]</sup>.

## 5. Neem

Neem consists of all arial parts of plant known as *Azadirachta indica*, belongs to family Meliaceae. Regular application of neem oil to the scalp helps to strengthens hair follicle and encourage hair growth. Neem oil stops overproduction of sebum, which contributes to hair thinning and slow hair development. Neem is rich in essential nutrients and antioxidants <sup>[17]</sup>.

## 6. Hibiscus

The Malvaceae family of flowering plants includes the genus *Hibiscus*. The genus is quite vast, with hundreds of species that are indigenous to warm climate, sub-tropical region all over the world. Large, spectacular flowers on the members of this plant are known as 'Hibiscus' or less usually known as 'rose mallow' <sup>[18]</sup>. Hibiscus contains anthraquinones, tannins, alkaloids, proteins, carbohydrates, terpenoids and vitamins. Hibiscus is an ultra-hydrating and nourishing herb that is rich in protein, calcium, copper, iron, zinc, vitamins-A, B6, C, E and K. the blend of hibiscus flowers and leaves is moisture rich and helps nourish scalp <sup>[19]</sup>. Moreover, it thickens the hair strands to minimize hair loss. Dandruff can be treated with hibiscus because it has astringent properties that stops excess oil production <sup>[20]</sup>.

## 7. Onion

The biological source of onion is *Allium cepa* that belongs to family Alliaceae. Organosulfur compounds, phenolic compounds, polysaccharides, saponins and flavanols are all found in onions <sup>[21]</sup>. Onion is used for hair growth and to strengthen the follicle. It also contains high amount of antioxidants. Onion contains nutrients like sulfur that strengthen hair follicles. Onions helps to maintain pH of scalp that results in improving blood circulation <sup>[22]</sup>.

## Material and Method:

### 1. Aloe vera

Biological source: Juice of leaves of *Aloe barbadensis* Miller.

Family: Liliaceae

#### Collection of plant

We collected aloe vera leaves from home garden.

#### Extraction process

The fresh aloe vera gel is extracted from plant leaves using cutter. The pulp from the leaves was collected and grinded into mixer to gel uniform gel.



Fig No.3 Aloe vera

## 2. Amla

Biological source: Dried or fresh fruit of plant *Phyllanthus emblica*  
Family: Euphorbiaceae

### Collection of plant

We collected powder of amla from Sukhayu herbals, Osmanabad.



Fig No.4 Amla

## 3. Tulsi

Biological source: Dried and fresh leaves of *Ocimum sanctum* Linn.  
Family: Labiatae

### Collection of plant

We collected powder of tulsi from Sheth Sakharam Nemchand Rashala, Solapur.



Fig No.5 Tulsi

## 4. Tea

Biological source: Leaves and new buds of *Thea sinensis*  
Family: Theaceae

### Collection of plant

We collected powder of tea from Assam tea corporation, Solapur.



Fig No.6 Tea

## 5. Neem

Biological source: Leaves of *Azadirachta indica*  
Family: Meliaceae

### Collection of plant

We collected neem powder from Saiee Pharmachem, Pune.



Fig No.7 Neem

## 6. Hibiscus

Biological source: Flowers of *Hibiscus rosa sinesis*  
Family: Malvaceae

### Collection of plant

We collected hibiscus powder from Yogesh Pharmacy, Nanded.



Fig No.8 Hibiscus

## 7. Onion

Biological source: Bulb of *Allium cepa*  
Family: Alliaceae

### Collection of powder

We collected onion from local market of Osmanabad and chopped it into pieces. Then kept for sundry for 3 days. After sun drying grinded it into powder and macerated for 10 days.



Fig No.9 Onion

### Extraction of Herbal Drugs:

All herbal drugs (except aloe vera) are extracted by using maceration procedure. The powder of plants is taken and dissolved into 20% hydroalcoholic solvent which contains 20% ethanol dissolved in distilled water. 100gm of herbal drug powder is dissolved in 600ml of solvent. Then beakers are covered with aluminium foil secured with rubber. The beakers are placed in dark place for

Ingredient	Concentration given	Quantity taken	Category
Aloe vera	20%	1ml	Moisturizer
Amla	1%	0.100gm	Hair Nourishment
Tulsi	2.25%	0.360gm	Anti-inflammatory
Tea	5%	0.280gm	Antioxidant
Neem	2.5%	0.400gm	Antifungal and Antibacterial agent
Hibiscus	2.07%	0.300gm	Provide Luster
Onion	2.12%	0.320gm	Hair Growth
Xanthan Gum	1%	2gm	Gelling Agent
Glycerin	47.9%	5ml	Humectant
Methyl Paraben	0.3%	0.15gm	Preservative
Propyl Paraben	0.2%	0.1gm	Preservative
Triethanolamine	0.5%	1-2 drops	pH Adjuster
Water	q.s.	q.s.	Vehicle

maceration for 10 days with occasionally stirring. The macerated mixtures are then filtered by using strainer and then by using Whatmann filter paper no. 41 having diameter 125mm.



Fig No.10 Maceration of Herbal Drugs



Fig No.11 Filtration of Macerated Drug

### Formula of Poly-Herbal Anti-Dandruff Hair Gel:

Table No.1 Formula of Poly-herbal Hair Gel using 2gm Xanthan Gum

Research Through Innovation

## Preparation of Antidandruff Hair Gel:

1. Accurately weighed Xanthan gum was taken on butter paper.
2. Take beaker of 100ml filled with 50ml of distilled water.
3. Keep it on magnetic stirrer and add xanthan gum slowly in it while stirring at high speed.
4. Take 1ml of aloe vera extract and add weighed quantity of other herbal extract and mix it well [Solution 1].
5. Methyl paraben and propyl paraben should be added to 5ml of glycerine and thoroughly mixed [Solution 2].
6. Then add the extract [Solution 1] in Xanthan gum gel, mix it and then add [Solution 2] in it.
7. At last, add Triethanolamine [1-2drops] in the gel and sonicate this gel for 20 min.



Fig. No.12 Polyherbal Antidandruff Hair Gel

## Evaluation:

### 1. Physical Properties:

Colour: Dark Brown

Odour: Distinctive

Appearance: Smooth and Homogenous

### 2. pH Measurement: 6.8

3. **Viscosity:** The viscosity of gel was found to be 4,000-25,000 mPa.s using Brookfield viscometer at 6 rpm.

4. **Appearance and Homogeneity:** Gel was homogenous and smooth in appearance.

5. **Spreadability:** The weighed quantity of gel (about 5gm) was sandwiched between two glass slides. 1000gm of weight was placed on the slides. The weight was placed for specific period of time for 10 min. Then weight was removed and diameter of spread circle was measured at different points. Spreadability was calculated by using formula,

$$S = (M \times L) / T$$

where,

S is spreadability

M is weight placed on the slide

L is diameter of circle in cm and

T is time in sec.

The spreadability of gel was found to be 760g cm/sec.



Fig No.13 Spreadability using Glass Slide

6. **Washability:** The ease and extend of water washing were manually assessed after the formulation was applied to the skin.
7. **Extrudability:** The hair gel formulations were filled into collapsible metal tubes. The tubes were pressed to extrude the material and the extrudability of the formulation was checked.
8. **Microbial Test:** Neem leaf powder was macerated for 10 days and mixtures are filtered through Whatmann no. 1 filter paper and allowed to evaporate at 37 °C to remove the solvent. All mixtures were now dissolved in DMSO (Dimethylsulfoxide). The bacteria *S. aureus* and fungus *C. albicans* are obtain from the microbiology/biotechnology department of K. T. Patil College of Pharmacy Osmanabad. A ethanolic extract of neem leaves at a concentration of 0.400mg/ml produced the best results in the microbial assay at concentration of 0.5, 1, 2 and 5, the results are shown in the table below.

**Table 2: Microbial Assay of Extract**

Species	ZOI(0.5mg/ml)	ZOI(1mg/ml)	ZOI(2mg/ml)	ZOI(5mg/ml)
<i>C.albicans</i> (1)	4.5mm	7.5mm	8.1mm	8mm
<i>C.albicans</i> (2)	5.6mm	6.5mm	7.6mm	7.8mm
<i>S.aureus</i> (1)	4.5mm	7.8mm	8mm	9mm
<i>S.aureus</i> (2)	3.5mm	4.5mm	7.8mm	7.8mm

## Result and Discussion:

Neem leaves shows many benefits in day to day life. Vitamin C present in amla prevent hair fall and premature graying. Onion is riched in nutrients that nourishes hairs and help to strengthen hair follicle. Hibiscus present in gel provide luster to hairs. Neem in addition shows antimicrobial and antifungal activities. The evaluation studies has been performed for physical appearance, pH, viscosity, spread ability and extrudability. As xanthan gum has no gelling property below the concentration of 2%, formulation was done starting from 2%. The physical appearance of gel was reddish brown and smooth in appearance. The prepared gel has pH in range of 6.5-7.0. The drug content in the gel formulation was within permitted limits, demonstrating that it was made in accordance with the established guidelines.

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## Conclusion:

A study involving preparation and evaluation of poly-herbal antidandruff hair gel. A technique of treating scalp dandruff is provided by the composition antidandruff hair gel. In present study poly-herbal antidandruff hair gel was formulated successfully. The topical application of this gel may have minimum side effects as compared to allopathic gel. The quantitative effect of poly-herbal gel formulation definitely promotes hair growth, reduced dandruff, gives shine to hair, etc. The work justifies all the evaluation parameters and resultant value lies within standard limits.

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