Abstract
Herbal cosmetics are the preparations used to enhance the human appearance. The aim of the present research was to formulate safe medicinal formulations from herb *Abrus precatorius* for the purpose of treatment of alopecia and antimicrobial activity. *Abrus precatorius* Linn. Popularly known as Crab’s eye is a slender, woody perennial climber reported to have antioxidant, antibacterial, cytotoxic, anti-diabetic, anti-tubercular and anti-plasmodic activities. The current investigation was carried out to evaluate the hair growth enhancing potentiality of aqueous extract of *Abrus precatorius* leaf. It is potent hair growth promoter and suggested to be an effective to synthesis hair growth promoter.

**Keywords:** *Abrus precatorius* Linn; Antimicrobial; Hair gel; Alopecia

Introduction
Recently, the number of men and women who suffered from hair thinning and/or baldness is increasing in worldwide. Alopecia is a dermatological disorder, and the surge for discovering natural products with hair growth promoting potential is continuous [1, 2]. Hair loss or alopecia is a common patient complaint and a source of significant psychological and physical distress [3]. Many factors such as heredity, hormones, metabolism and side effects of antineoplastic and immunosuppressant drugs, have been negatively affecting the healthy hair growth. According to one survey, androgenic alopecia eventually affects about 50% of world’s adult population [4, 5]. Androgens are considered to be the most important causes of alopecia among various other factors [6]. Thus it is very important to develop new therapeutic formulation to stop hair loss and to increase hair growth [7]. Natural products in the form of herbal formulations are available on the market and are used as hair tonic, hair growth promoter, hair conditioner, hair cleansing agent, antidianduff agents, as well as for the treatment of alopecia and lice infection [8].
Many herbal products have been praised for their hair growth-promoting activities [10]. Traditional Indian medicine praises many herbal remedies for hair growth promotion [11]. *Abrus precatorius* Linn. commonly called as Rosary pea belongs to family Fabaceae. Seeds are bright scarlet-red in color with a black spot [12]. The leaves are sweetish in taste contains up to 10% Glycyrrhizin, pinitol, triterpene glycosides and alkaloids such as abrine, precatorine, choline and hypaphorine. The triterpene glycosides are abusosides A, B and C and three glycosides based on cycloartane – type aglycone, abrutogenin. The leaves have other compounds are triterpenes-abrusgenic acid, abruslactone A and methyl abrusgenate and flavonoids vitexin, liquirtiginin-7-mono and toxifolin-3-glucoside [13].

Antibiotics provide the main basis for the therapy of bacterial infections. Since the discovery of these antibiotics and their uses as chemotherapeutic agents there was a belief in the medical fraternity that this would lead to the eventual eradication of infectious diseases. However, over use of antibiotics has become the major factor for the emergence and dissemination of multi-drug resistant strains of several groups of microorganisms [14]. Plants are rich in a wide variety of secondary metabolites such as tannins, alkaloids and flavonoids, which have been found in vitro to have antimicrobial properties [15]. The antimicrobial efficacy tribute to some plants in treating diseases has been beyond belief. It is estimated that local communities have used about 10% of all flowering plants on Earth to treat various infections, although only 1% have gained recognition by modern scientists [16]. Medicinal plants were used as excellent antimicrobial agents as they form a variety of chemical constituent as nature recently focused on distinguishing extracts and biologically active compounds isolated from popular plant species [17].

The present study is an effort to formulate and evaluate hair growth promotion and antimicrobial activity of herbal hair gel, which include extract of *Abrus precatorius* Linn.
Materials and Equipments

List of Ingredients for Formulation

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Materials</th>
<th>Functions</th>
<th>Manufacturer/ Supplier</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Herbal Extract</td>
<td>API</td>
<td>Medicinal Garden of KTPCOP, Osmanabad</td>
</tr>
<tr>
<td>2</td>
<td>Carbopol 940</td>
<td>Gelling Agent</td>
<td>Ozone International, Mumbai</td>
</tr>
<tr>
<td>3</td>
<td>Polyethylene Glycol</td>
<td>Solvent</td>
<td>Ozone International, Mumbai</td>
</tr>
<tr>
<td>4</td>
<td>Methyl Paraben</td>
<td>Preservative</td>
<td>Ozone International, Mumbai</td>
</tr>
<tr>
<td>5</td>
<td>Triethanolamine</td>
<td>pH Modifier</td>
<td>Ozone International, Mumbai</td>
</tr>
<tr>
<td>6</td>
<td>Glycerine</td>
<td>Solvent, Humectant</td>
<td>KTPCOP, Osmanabad</td>
</tr>
<tr>
<td>7</td>
<td>Distilled Water</td>
<td>Vehicle</td>
<td>KTPCOP, Osmanabad</td>
</tr>
</tbody>
</table>

Table 1: List of ingredients used in formulation.

List of Equipments

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Equipments/ Instruments</th>
<th>Model Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Soxhlet Apparatus</td>
<td>J S/L™, 40/38; Dolphin Labs, Pune</td>
</tr>
<tr>
<td>2</td>
<td>Electronic Balance</td>
<td>Model BX 6205 Shimadzu Asia Pacific Pvt. Ltd. Singapore</td>
</tr>
<tr>
<td>3</td>
<td>Morter- pestle</td>
<td>Rajesh Chemicals, Mumbai</td>
</tr>
<tr>
<td>4</td>
<td>Measuring Cylinder</td>
<td>Dolphin Labs, Pune</td>
</tr>
<tr>
<td>5</td>
<td>Glass Rod</td>
<td>Dolphin Labs, Pune</td>
</tr>
<tr>
<td>6</td>
<td>Tripod Stand</td>
<td>Dolphin Labs, Pune</td>
</tr>
<tr>
<td>7</td>
<td>China Dish</td>
<td>Dolphin Labs, Pune</td>
</tr>
<tr>
<td>8</td>
<td>Spatula</td>
<td>Dolphin Labs, Pune</td>
</tr>
<tr>
<td>9</td>
<td>Pair of Tongue</td>
<td>Dolphin Labs, Pune</td>
</tr>
<tr>
<td>10</td>
<td>Beaker</td>
<td>Dolphin Labs, Pune</td>
</tr>
<tr>
<td>11</td>
<td>Magnetic Stirrer</td>
<td>Dolphin Labs, Pune</td>
</tr>
<tr>
<td>12</td>
<td>Heating Mantle</td>
<td>Dolphin Labs, Pune</td>
</tr>
</tbody>
</table>

Table 2: List of Equipments and Instruments used in Formulation.

Drug and Excipient Profile

Drug Profile

a) **Name**: Abrusprecatorius extract
b) **Synonym**: Gunja, Jequirity, Gunchi, rosary pea, Crab’s eye, etc
c) **Biological Source**: Abrusprecatorius L.
d) **Family**: Fabaceae
e) **Part used**: Leaves
Macroscopical Characteristics

Leaves

The leaves are like tamarind leaves having 20-40 leaflets. The leaves which are sweetish in taste contain up to 10% Glycyrrhizin, triterpene glycosides, pinitol and alkaloids such as a brine, precatorine, choline and hypaphorine. The triterpeneglycosides are abusosides A, B, and C, (which are highly sweet) and three glycosides based on cycloartane-type aglycone, abrutogenin. The leaves have other compounds are tritepenesabrusgenic acid, abruslactone A and methyl abrusgenate and flavonoids vitexin, liquiriginin-7-mono- and diglycosides and toxifolin-3-glucosides.

Colour: Dark Green
Odour: Typical
Taste: Sweet

Figure 3: A. precatorius Leaves.

Uses

A leaf are used as aphrodisiac, tonic, removes bile, useful in eye diseases, curesleucoderma, itching, skin diseases and wounds. In addition it cures fevers, stomatitis, head complaints, asthma, thirst, tuberculosis and tooth decay. It is very beneficial when the leaves are soaked in warm mustard oil and applied on the sore spot for arthritis. Fresh juice, mixed with some blended oils, applied externally, seems to reduce local pain. Powdered leaves mix with sugar in case of leucoderma and menorrhagia. The leaves also used as a diuretic, diarrhoea, gastritis, heart diseases, kidney diseases, insomnia, cancer and CNS sedative.

Excipient for Herbal Hair Gel

Carbopol- 940

a. Synonym: Carbomer, Polyacrylic acid (PAA).
b. Chemical name/ IUPAC name: Poly (acrylic acid).
c. Emperical formula: (C₂H₄O₂)n.
d. CAS No.: 57916-92-4.
e. Chemical structure:
f. Functional category: As a polymer, coating agent.

g. Description:
   i. Colour: White (solid) or colourless (liquid).
   ii. Odour: Odourless or mild acidic.
   iii. Melting point: 12.5°C.
   iv. Solubility: Soluble in ether, chloroform, acetone, ethanol.
   v. Appearance: White fluffy powder.
   vi. Ph: 5.5 – 8.0 for a 1% w/w aqueous solution.

h. Application in pharmaceutical formulation: As an opacifier

Polyethylene Glycol

a. Synonym: Carbowax, macrogol, MoviPrep, GlycoLax, TriLyte, Colyte, Halflytely, Fortrans, MiraLAX.
b. Chemical name/ IUPAC name: poly(oxyethylene).
c. Chemical formula: C_{2n}H_{4n+2}O_{n+1}
d. CAS Number: 25322-68-3

e. Chemical Structure:

![Chemical Structure of Polyethylene Glycol](image)

f. Functional Category: as a plasticizer, surfactant.

g. Description:
   i. Colour: Colourless
   ii. Odour: Odorless
   iii. Melting Point: -59°C
   iv. Appearance: Colourless liquid
   v. PH: 3.6-10.0

h. Application in pharmaceutical formulation: As a solvent, plasticizer, surfactant, ointments, and suppository base, and tablet and capsule lubricant.

Methyl Paraben

b. Chemical name/ IUPAC Name: Methyl 4-hydroxybenzoate
c. Chemical formula: C_{8}H_{8}O_{3}
d. CAS Number: 99-76-3
e. Chemical Structure:

![Chemical Structure of Methyl Paraben](image)
f. Functional category: Anti-fungal agent
g. Description:
   i. Colour: White
   ii. Odour: Odourless
   iii. Taste: Tasteless
   iv. Melting point: 125 to 128°C.
   v. Solubility: Soluble in water, benzene (slightly soluble), carbon tetrachloride (slightly soluble), ethanol, ether, acetone, DMSO, methanol, warm oil, and warm glycerol
   vi. Appearance: Colorless crystals or white crystalline powder.
   vii. pH: 3 to 8.
h. Application in pharmaceutical formulation: As a preservative.

Triethanolamine

a. Synonym: Trolamine
b. Chemical name / IUPAC name: 2,2',2''-Nitrilotri(ethan-1-ol)
c. Chemical formula: C₆H₁₅NO₃
d. CAS No.: 102-71-6
e. Chemical structure:

   ![Triethanolamine structure]

f. Functional category: As a pH adjuster
g. Description:
   i. Colour: Colourless
   ii. Odour: Ammoniacal
   iii. Melting Point: 21.60°C
   iv. Solubility: Soluble in water
   v. Appearance: Colourless liquid
   vi. pH: 5 to 9
h. Application in pharmaceutical formulation: As a buffer and a surfactant.

Glycerine

a. Synonym: Glycerin, glycerol.
b. Chemical name / IUPAC name: Propane-1,2,3-triol.
c. Chemical Formula: C₃H₈O₃
d. CAS No.: -56-81-5
e. Chemical structure:

   ![Glycerine structure]
f. Functional Category: As a moisturizer, Osmotic laxative

g. Description:
   i. Colour: Colourless
   ii. Odour: Odourless
   iii. Taste: Sweet
   iv. Melting point: 17.8°C
   v. Solubility: water-soluble
   vi. Appearance: Colorless hygroscopic liquid
   vii. pH: 7-7.5

h. Application in pharmaceutical formulation: As a humectant, moisturizer, etc.

Experimental Work

**Preparation of Herbal Hair Gel**

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Name of contents</th>
<th>Quantity of content (100ml)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Abrusprecatorius Leaf Extract (Aqueous)</td>
<td>1 ml</td>
</tr>
<tr>
<td>2</td>
<td>Carbopol 940</td>
<td>0.25 gm</td>
</tr>
<tr>
<td>3</td>
<td>Polyethylene Glycol</td>
<td>2 ml</td>
</tr>
<tr>
<td>4</td>
<td>Methyl Paraben</td>
<td>0.08 gm</td>
</tr>
<tr>
<td>5</td>
<td>Triethanolamine</td>
<td>1.2 ml</td>
</tr>
<tr>
<td>6</td>
<td>Glycerin</td>
<td>2 ml</td>
</tr>
<tr>
<td>7</td>
<td>Distilled water</td>
<td>q.s.</td>
</tr>
</tbody>
</table>

*Table 3: Formula for Hair Gel.*

**Method of Extraction**

1. The plant material collected was cleaned, shade dried and powdered.
2. Leaf powder weighing 250gm was defatted with petroleum ether and then exhaustively extracted with water at 60ºC to obtain the crude aqueous extract by using Soxhlet assembly.
3. It was then concentrated at 40ºC on heating mantle to obtain a concentrated mass.

![Figure 4: Soxhlet Apparatus.](image-url)
**Method of Preparation**

1. The measured quantities of Methyl paraben, Glycerin and weighed quantity of Polyethylene glycol were dissolved in 35 ml of water in beaker and stirred at high speed using mechanical stirrer.
2. Then Carbopol 940 was added slowly to the beaker containing above liquid while stirring.
3. Add the concentrated extract slowly with continuous stirring.
4. Neutralized the solution by slowly adding triethanolamine solution with stirring constantly until gel is formed.
5. Transferred to a suitable container and stored it.

![Figure 5: Herbal Hair Gel.](image)

**Evaluation of Herbal Hair Gel**

*Physical evaluation*

Physical parameters such as colour, appearance, and consistency were checked.

*Washability*

Formulation was applied to the skin and then ease and extent of washing with water were checked manually.

*pH*

The pH of the prepared polyherbal hair gel in distilled water (10%v/v) was assessed by placing drop of solution on a piece of pH paper and comparing the paper with the pH scale.

*Spreadability*

Spreadability of gel was measured with glass slide apparatus, more gel was placed in two slides and 1kg weight was placed on slide for 5 min to compress the sample to uniform thickness, time in seconds to separate two slides was taken as a measure of spreadability.

\[
S = \frac{wl}{t}
\]

Where,

- \(S\) = spreadability (g cm/ sec)
- \(W\) = weight on upper slide (g)
- \(l\) = length of slide (cm)
- \(t\) = time taken in sec
**Homogeneity**

After the gel was set in container spread on slide, by visual inspection, the developed gels were tested for the presence of any lumps, flocculates or aggregates.

**Skin Irritation**

The skin irritation was carried out on human volunteers. For formulated gel, five volunteers were selected and 1.0g of formulated gel was applied over an area of two square inches to the back of the hand the human volunteers were observed for irritation or any skin reaction.

**Microbial Assay**

The antimicrobial activity of gel formulations was determined by modified agar well diffusion.

**Method**

Keep open Petri plates with exposure to air of previously molten agar media, shake well to disperse equally and immediately pour in a sterile plates allow to solidify taking care that the thickness of layer is uniform and incubated for 24 hours at 22-270°C n method.

**Procedure for activity**

Keep open petri plates with exposure to air of previously molten agar media, shake well to disperse equally and immediately pour in a sterile plates allow to solidify taking care that the thickness of layer is uniform. Two wells were prepared in each agar plate. Pour the standard solution in one plate with 50ug/ml concentration. In another plate prepared formulation is transferred into the well with 50 ug/ml concentration. Plates are kept for incubation for 24 hrs at 22-270°C.

**Result and Discussion**

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Evaluation Tests</th>
<th>Result Obtained</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Physical evaluation Colour</td>
<td>Pale yellow in colour</td>
</tr>
<tr>
<td>2</td>
<td>Appearance</td>
<td>Smooth</td>
</tr>
<tr>
<td>3</td>
<td>Consistency</td>
<td>Good</td>
</tr>
<tr>
<td>4</td>
<td>Washability</td>
<td>Good</td>
</tr>
<tr>
<td>5</td>
<td>pH</td>
<td>7</td>
</tr>
<tr>
<td>6</td>
<td>Homogeneity</td>
<td>No lump</td>
</tr>
<tr>
<td>7</td>
<td>Skin irritation</td>
<td>No irritation</td>
</tr>
<tr>
<td>8</td>
<td>Antimicrobial activity for Aerobic bacteria</td>
<td>8.1</td>
</tr>
</tbody>
</table>

*Table 4: Evaluation tests for Herbal Gel.*
Herbal hair gel is used to treat alopecia and stimulate the hair growth. The advantages of herbal cosmetic are the non-toxic nature, reduce allergic reactions and time tested utility of many ingredients.

The prepared herbal anti-microbial hair gel was evaluated for different parameters. It is pale yellow in color and looks smooth and well washable and promotes homogeneity, pH 7, as well as the natural health of hair and promotes hair growth.

Acknowledgement

I take this opportunity to express my heartfelt gratitude to my reverend guide. Her discipline, principles, simplicity, caring, attitude and provision of fearless work environment will be cherished in walks of my life. I am very much grateful to her for her invaluable guidance and ever-lasting encouragement throughout the course.

I am immensely thankful to Dr. Amol Joshi Sir, Principal A. S. P. M.'s K. T. Patil College of Pharmacy, Osmanabad, for providing me all facilities for the successful completion of this project.

I owe my warmest and humble thanks to other staff members of A. S. P. M.'s K.T. Patil College of Pharmacy, Osmanabad, for their timely help, encouragement, boosting my confidence in the progress of my academics.

Summary

Gunja is an evergreen shrub having many biological activities. The active components that stimulate hair growth, antimicrobial, anti-inflammatory, etc. It is used for a variety of medical procedure like treatment of topical infection, inflammation.

Thus, topical delivery can be suitable to produce hair growth promotion activity. Gunja hair gel formulated using carbopol 940, Polyethylene Glycol, Methyl Paraben, Triethanolamine and glycerin. These are selected due to their well-established activity reported in literature.

The herbal gel was evaluated for its colour, feel, appearance, pH and spreadability. The tests were performed manually. The pH was determined by the pH paper. Further optimization studies are required for finding its benefits on humans as cosmetic product.

References

21. Abhilashashourie and Kuntalkalra. "Analysis of phytochemical constituents andpharmacological properties of Abrusprecatori-
30. Abrus precatorius.
31. Polyacrylic acid.
32. Methylparaben.
33. Polyethylene glycol.
34. Glycerol.
35. Triethanolamine.
36. Sodium chloride.
37. Sulfuric acid.

Volume 1 Issue 3 November 2021
© All rights are reserved by Arunadevi Birajdar, et al.