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Research Article

Formulation and Evaluation of Antimicrobial Hair Gel from Abrus Precatorius

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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 *Abrusprecatorius* for the purpose of treatment of alopecia and antimicrobial activity. *Abrusprecatorius* 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 *Abrusprecatorius* leaf. It is potent hair growth promotor and suggested to be an effective to synthesis hair growth promotor.

Keywords: Abrusprecatorius 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 disdress [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, antidandruff agents, as well as for the treatment of alopecia and lice infection [8].

Figure 1: Alopecia.

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]. *Abrusprecatorius* 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].

Figure 2: Abrusprecatorius ***Linn***

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 *Abrusprecatorius* Linn.

Materials and Equipments

List of Ingredients for Formulation

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

Table 1: List of ingredients used in formulation.

List of Equipments

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

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, liquirtiginin-7-mono- and diglycosides and toxifolin-3-glucosides.

Colour: Dark Green
Odour: Typical
Taste: Sweet

Figure 3: A. precatorius Leaves.

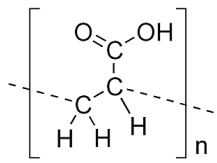
Uses

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

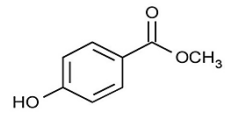
a. Synonym: Carbomer, Polyacrylic acid (PAA).
b. Chemical name/ IUPAC name: Poly (acrylic acid).
c. Emperical formula: $(C_2H_4O_2)n$.
d. CAS No. : 57916-92-4.
e. Chemical structure:



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

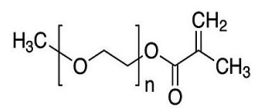
a. Synonym: Carbowax,macrogol, MoviPrep,GlycoLax, TriLyte, Colyte, Halflytely, Fortrans, MiraLAX.
b. Chemical name/ IUPAC name: poly(oxyethylene).
c. Chemical formula: $C_{2n}H_{4n+2}O_{n+1}$
d. CAS Number: 25322-68-3
e. Chemical Structure:



f. Functional Category: as a plasticizer, surfactant.
g. Description:
   i. Colour: Colourless
   i. Odour: Odorless
   ii. Melting Point: -59°C
   iii. Appearance: Colourless liquid
   iv. 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

a. Synonym: Nipagin, Nipagin plain, P-Hydroxybenzoic acid methyl ester, rarechem al bf 0098 .
b. Chemical name/ IUPAC Name: Methyl 4-hydroxybenzoate
c. Chemical formula: $C_8H_8O_3$
d. CAS Number: 99-76-3
e. Chemical Structure:



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

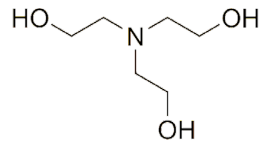
a. Synonym : Trolamine

b. Chemical name/ IUPAC name: 2,2′,2′′-Nitrilotri(ethan-1-ol)

c. Chemical formula : $C_6H_{15}NO_3$

d. CAS No. : 102-71-6

e. Chemical 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

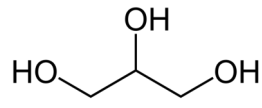
a. Synonym: Glycerin, glycerol.

b. Chemical name/ IUPAC name: Propane-1,2,3-triol.

c. Chemical Formula : $C_3H_8O_3$

d. CAS No. :-56-81-5

e. Chemical 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

S. No.	*Name of contents*	*Quantity of content (100ml)*
1	Abrusprecatorius Leaf Extract (Aqueous)	1 ml
2	Carbopol 940	0.25 gm
3	Polyehtylene Glycol	2 ml
4	Methyl Paraben	0.08 gm
5	Triethanolamine	1.2 ml
6	Glycerin	2 ml
7	Distilled water	q.s.

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 40°C on heating mantle to obtain a concentrated mass.

Figure 4: Soxhlet Apparatus.

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 stirringconstantly until gel is formed.
5. Transferred to a suitable container and stored it.

Figure 5: Herbal Hair Gel.

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.

$$S = wl / t$$

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

For Formulation Herbal Hair Gel

S. No.	*Evaluation Tests*	*Result Obtained*
1	Physical evaluation Colour	Pale yellow in colour
2	Appearance	Smooth
3	Consistency	Good
4	Washability	Good
5	pH	7
6	Homogeneity	No lump
7	Skin irritation	No irritation
8	Antimicrobial activity for Aerobic bacteria	8.1

Table 4: Evaluation tests for Herbal Gel.

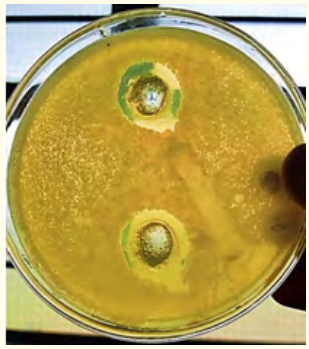


Figure 6: Zone of Inhibition of Standard Sample.

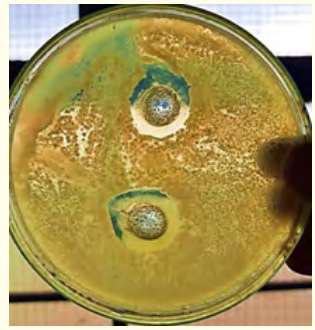


Figure 7: Zone of Inhibition of Test Sample.

Herbal hair gel is used to treat alopecia and stimulate the hair growth. The advantages of herbal cosmetic out thre are there non-toxic nature, reduce allergic reactions and time tested utility of many ingredients.

The prepared herbal anti-microbial hair gel was evaluated for different parametres. 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 heartful 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.

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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.

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30. Abrus precatorius.
31. Polyacrylic acid.
32. Methylparaben.

33. Polyethylene glycol.
34. Glycerol.
35. Triethanolamine.
36. Sodium chloride.
37. Sulfuric acid.

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