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Research Article

**HERBAL MEHENDI GEL FORMULATION FOR
SUSTAINABLE HAIR COLOURING AND SCALP CARE****Pranav belokar¹, Nandkishore B. Deshmukh², Dr. Swati P. Deshmukh³**¹Student, Shraddha Institute of Pharmacy, Kondala Zambre, Washim²Associate Professor, Department of Pharmaceutics, Shraddha Institute of Pharmacy, Kondala Zambre, Washim³Principal, Department of Pharmacology, Shraddha Institute of Pharmacy, Kondala Zambre, Washim**1. Abstract:**

The present study was aimed at the formulation and evaluation of a herbal mehendi gel for sustainable hair colouring and scalp care using natural plant-based ingredients. Growing awareness regarding the adverse effects associated with synthetic hair dyes has increased the demand for safer, eco-friendly, and herbal alternatives. In the present work, herbal extracts such as henna (*Lawsonia inermis*), amla (*Phyllanthus emblica*), bhringraj (*Eclipta alba*), aloe vera (*Aloe barbadensis*), and neem (*Azadirachta indica*) were incorporated into a gel base prepared using Carbopol 940, glycerine, propylene glycol, triethanolamine, and methyl paraben. The developed formulation was intended to provide natural hair colouring along with nourishment and protection to the scalp and hair follicles.

The prepared herbal mehendi gel was evaluated for various physicochemical and performance parameters including colour, odour, appearance, pH, viscosity, spreadability, washability, homogeneity, and skin irritancy. The formulation exhibited good consistency, smooth texture, satisfactory spreadability, easy washability, and acceptable pH suitable for topical scalp application. No signs of redness, irritation, or inflammation were observed during the skin irritancy study, indicating the safety of the formulation. The herbal ingredients present in the gel demonstrated beneficial effects such as natural colouring, scalp conditioning, antimicrobial activity, antioxidant action, and hair strengthening properties.

Corresponding author:**Pranav Belokar,**

Shraddha Institute of Pharmacy,

Kondala Zambre, Washim-444505

Email: pranavbelokar23@gmail.com

Contact No: 9130819291

QR CODE



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2. INTRODUCTION:

The human desire to appear beautiful is an age-old inclination that influences people of all generations. In today's world, appearance has become a major concern for many individuals. People pay close attention to every aspect of their physical presentation, and the market offers numerous products designed to enhance beauty. These cosmetic products may be synthetic, natural, or semi-synthetic in nature. Among the features that significantly affect a person's appearance, hair plays an essential role.

Issues such as baldness and premature graying affect approximately 60–70% of the population. Hair graying often results from factors like vitamin B12 deficiency, thyroid disorders, and genetic predisposition. Early loss of hair pigment can also be triggered by stress, illness, UV radiation, alcohol consumption, certain medications, and shock. The frequent use of synthetic hair dyes to alter hair color can lead to hair damage due to their chemical composition and mechanism of action.

As a result, herbal alternatives are gaining popularity for maintaining healthy hair. Herbal medicines are derived from various parts of plants such as stems, leaves, seeds, roots, flowers, and bark, and can be used in either raw or processed forms. They are incorporated into many personal care formulations, including herbal shampoos, hair dyes, toothpastes, and tablets. Common herbs used for these purposes include shikakai, henna, bhringraj, and reetha.

Historically, natural dyes obtained from plant materials such as roots, bark, stems, leaves, berries, and flowers were used to color fabrics, carpets, and garments. Today, the growing preference for natural remedies is driven by their safety, eco-friendliness, and minimal side effects. Traditional Ayurvedic herbs like bhringraj, henna, reetha, and methi seeds are well known for their role in promoting hair growth and serving as natural colorants. Compared to synthetic alternatives, natural dyes are environmentally safer, less toxic, and cause fewer allergic reactions. Their active components such as catechins, flavonoids, and ascorbic acid possess

strong antioxidant properties that benefit hair health. Herbal hair dyes are also effective against dandruff, lice, and premature graying. Because they use plant-based ingredients instead of harsh chemicals, natural dyes help preserve the scalp and hair structure while providing a safe coloring option. Pigments such as caramel and others are often used in these natural formulations.

3. MATERIALS & METHODOLOGY

Materials

- Herbal Ingredients
- Henna extract – natural colouring agent
- Amla extract – antioxidant, improves hair strength
- Bhringraj extract – promotes hair growth
- Hibiscus extract – conditioning agent
- Neem extract – anti-dandruff and antimicrobial
- Excipients (Other Ingredients)
- Carbopol 934 / Xanthan Gum – gelling agent
- Glycerin – moisturizing agent
- Propylene glycol – solvent and humectant
- Triethanolamine – pH adjustment
- Methyl paraben – preservative
- Distilled water – vehicle

Methodology

Preparation of Gel Base

The required quantity of Carbopol 934 (or Xanthan gum) is slowly added into distilled water with continuous stirring to avoid lump formation. The mixture is allowed to stand for about 30 minutes to ensure complete swelling of the polymer and formation of a uniform gel base.

Preparation of Herbal Extract Mixture

All selected herbal extracts (henna, amla, bhringraj, hibiscus, neem) are taken in a clean container. These extracts are mixed with glycerin and propylene glycol to form a smooth and uniform mixture. This step helps in proper dispersion of herbal components.

Preparation of Herbal Mehendi Gel

The prepared herbal mixture is gradually added to the gel base with continuous stirring to ensure uniform distribution. Triethanolamine is then added dropwise to adjust the pH and to convert the dispersion into a proper gel. Finally, methyl paraben is added as a preservative and mixed thoroughly.

Formulation Table

4. EVALUATION PARAMETER

Sr no	Ingredients	F1	F2	F3
1	Henna	3g	2g	2.5g
2	Amla	3g	2g	2.5g
3	Bhringraj	1.5g	2g	1g
4	Aloevera	7.5	6g	5.5g
5	Neem	9 g	7.5g	8g
6	Carbopol	6g	5.4g	5g
7	Glycerine	7.5g	6g	5.5g
8	Propylglycol	3g	2g	1g
9	Triethanolamine	3g	2g	1g
10	Methyl paraben	0.3g	0.1g	0.2g

Physical Evaluation

In this test, the prepared herbal mehendi gel was inspected visually for its colour, appearance, odour, and consistency. The gel was observed for smoothness, absence of lumps, and uniformity.

Skin Irritancy Test

Skin irritancy test was carried out to ensure that the prepared herbal mehendi gel does not cause any irritation or harmful effects on the skin. An area was marked on the dorsal surface of the left hand. The gel was applied on the marked area using a spatula, and the time was noted. The applied area was observed for any signs of irritation such as redness (erythema), swelling (edema), or inflammation at regular intervals up to 24 hours. No signs of irritation, redness, or swelling were observed. Hence, the prepared herbal mehendi gel was found to be safe for topical application.

Washability Test

A small amount of herbal mehendi gel was applied evenly on the skin surface (hand or forearm). It was allowed to remain for 1–2 minutes. The applied area was then washed with tap water without using soap. The ease of removal of the gel from the skin was observed. The gel was found to be easily washable, indicating good formulation properties.

pH Determination

The pH of the herbal mehendi gel was determined using a digital pH meter. The electrode of the pH meter was inserted into the gel and allowed to stabilize for 10 minutes before taking the reading at room temperature.

The pH of topical formulations should be compatible with the natural pH of the scalp (5.0–7.0). The prepared gel showed pH within this acceptable range, indicating suitability for scalp application.

5. RESULT & DISCUSSION:

The prepared herbal mehendi gel formulation was evaluated for various physicochemical parameters such as appearance, pH, viscosity, spreadability, washability, and skin irritation.

The gel was found to be smooth, homogeneous, and free from lumps with a characteristic herbal odour and brownish-green colour.

The pH of the formulation was found to be within the acceptable range (5.5–6.5), which is suitable for scalp application and does not cause irritation.

The viscosity of the gel was found to be appropriate, indicating good consistency and ease of application. The spreadability test showed that the gel spreads easily on the skin, ensuring uniform application over the scalp and hair.

The washability test confirmed that the gel can be easily removed with water without leaving any residue.

The skin irritation test showed no signs of redness, swelling, or irritation, indicating that the formulation is safe for topical use. Overall, the formulation was found to be stable, effective, and suitable for use as a natural hair colouring and scalp care product.

Sr no	Parameters	F1	F2	F3
1.	Ph	5.6	5.2	6.2
2.	Spreadability	9.80	10.22	10.30
3.	Skin irritation	No	No	No
4.	Washability test	Easily	Easily	Easily

6. CONCLUSION:

The present study was successfully carried out to formulate and evaluate a herbal mehendi gel for natural hair colouring and scalp care. The formulation was developed using natural herbal ingredients such as Henna, Amla, Bhringraj, Aloe Vera, and Neem, which are well known for their colouring, conditioning, and therapeutic properties. The prepared gel formulation was found to be smooth, homogeneous, and aesthetically acceptable with good consistency and spreadability. The pH of the formulation was within the acceptable range, making it suitable for scalp application without causing irritation. The viscosity and spreadability of the gel indicated ease of application and uniform distribution over the hair and scalp.

The formulation exhibited good washability and did not produce any irritation or adverse effects on the skin during the irritancy test, confirming its safety for topical use. The use of natural ingredients provides additional benefits such as antioxidant activity, antimicrobial action, and nourishment to the scalp, which are not typically offered by synthetic hair dyes.

Compared to conventional mehendi powder, the gel formulation offers advantages such as ease of application, improved texture, reduced preparation time, and better user acceptability. Furthermore, the use of herbal ingredients makes the formulation eco-friendly, biodegradable, and safer for long-term use. In conclusion, the developed herbal mehendi gel is a promising alternative to synthetic hair dyes and traditional mehendi preparations. It successfully combines the benefits of herbal medicine with modern formulation techniques to provide a safe, effective, and user-friendly product for hair colouring and scalp care. Future studies can focus on improving colour intensity, stability, and exploring advanced formulations for enhanced performance.

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