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Formulation and Evaluation of Natural Hair Colour

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ABSTRACT

This study details the formulation and evaluation of a herbal hair dye composed of natural ingredients: beetroot, hibiscus, black catechu, alum powder, banana pulp, and rosemary oil. Both powder-based and paste-based dyes were developed. The formulations underwent organoleptic, physicochemical, and preliminary phytochemical screening to assess their suitability as natural hair dyes and their potential as safer alternatives to synthetic colorants. The dye exhibited favorable sensory characteristics, standard pH, moisture, and ash content. Phytochemical screening indicated the presence of carbohydrates, proteins, tannins, anthraquinones, and mucilage, validating the use of herbal constituents. This research suggests that this herbal hair dye presents a potential alternative to synthetic hair colorants, potentially minimizing adverse side effects.

Keywords: Herbal hair dye, natural ingredients, beetroot, hibiscus, black catechu, alum powder, banana pulp, rosemary oil, powder formulation, paste formulation, phytochemical screening, organoleptic evaluation, physicochemical analysis, natural hair color.

I. INTRODUCTION

The hair dyeing industry has seen significant growth, but concerns regarding the health risks associated with synthetic dyes are increasing. Permanent dyes, while effective, often contain ammonia and oxidizing agents that can potentially damage hair and pose health risks with long-term use. This has led to a growing demand for natural and plant-based alternatives.

Herbal dyes, utilizing ingredients like henna and indigo, offer a natural alternative. This study explores the potential of beetroot, hibiscus, black catechu, alum powder, banana pulp, and rosemary oil to create a safe and effective herbal hair dye. Beetroot, hibiscus, and rosemary oil were selected for their unique properties. Black catechu is rich in beneficial compounds, and potassium alum is an FDA-approved mordant. Banana possesses pharmacognostic properties. Hibiscus sabdariffa has demonstrated neuroprotective qualities.

Hair colouring or dying is, practice of changing the hair color. The main reason for this is cosmetic to recover white and grey hair, to change the color regarded as more fashionable or desirable, or to restore the original color after it has been decoloured by hair dressing or sun bleaching. The prepared herbal dye contains all the goodness of natural ingredients. Apart from acting as a hair dye, this formulation, because of the perfect blend of herbal, also acts as a hair growth promoter, hair nourisher. French researchers have found that Egyptians, Greeks, and Romans were using to dye their hair several thousand years ago. Many different extracts from plants were used for hair dyeing in Europe and Asia before the invention of modern dyes. There are three types of hair dye.

Hair Structure and Growth

Hair covers nearly the entire human body surface, except for areas like palms, soles, and mucosal regions. There are two primary types of hair: vellus and terminal. Terminal hairs, found on the scalp, eyebrows, and eyelashes, are thicker, longer, and pigmented. Hair development follows a continuous cycle consisting of anagen (growth), catagen (regression), telogen (rest), and exogen (shedding) phases.

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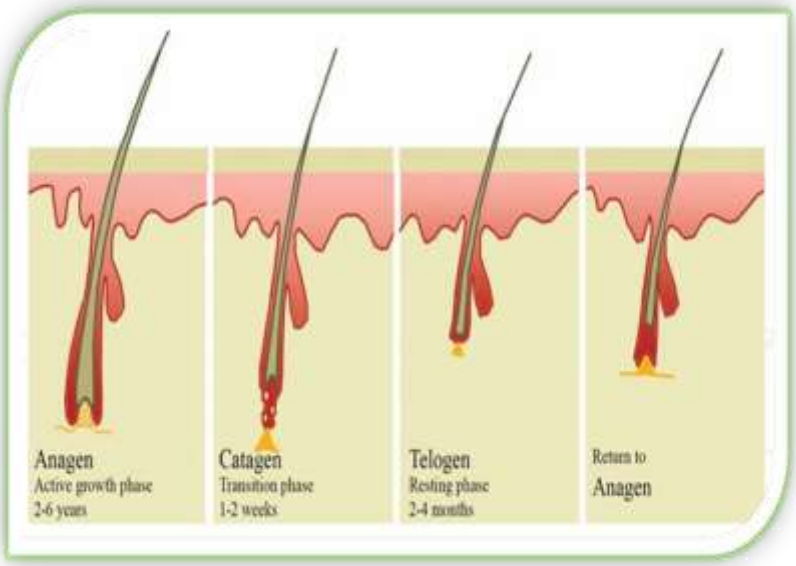


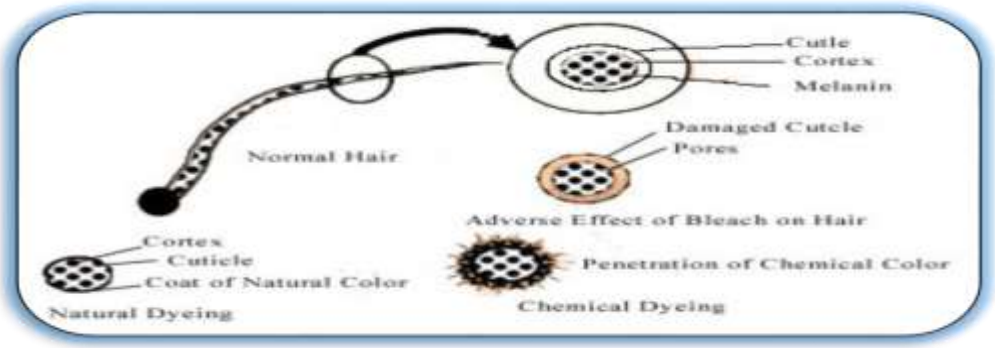
Types of Hair Dyes

Hair dyes are broadly classified into:

- **Permanent Dyes:** Alter hair color permanently by penetrating the hair shaft.
- **Demi-Permanent Dyes:** Last approximately 24 shampoos.
- **Semi-Permanent Dyes:** Deposit color on the hair surface, lasting 4–12 washes.
- **Temporary Dyes:** Wash out after one shampoo.

Benefits of Key Ingredients

- **Beetroot:** Contains betalains, phenolics, vitamins, and antioxidants, offering potential health benefits. Beetroot is rich in minerals and vitamins.
- **Hibiscus:** Contains flavonoids and anthocyanins and may help control dandruff.
- **Black catechu:**Deepens color; provides antimicrobial properties
- **Alum powder:**Tightens scalp pores; reduces oiliness.
- **Banana pulp:**Rich in vitamins, improves hair elasticity]
- **Rosemary Oil:** Used for various applications.



Pharmacognostic account

Beetroot

Kingdom: Plantae
Clade: Tracheophytes
Clade: Angiosperm
Clade: Eudicots
Order: Caryophyllales
Family:Amaranthaceae

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Genus:Beta
Species: B. valguris
Binomial name:Beta vulgaris L.

Hibiscus
Kingdom: Triglmellafoenum-graecum
Kingdom: Plantae
Division: Magnoliophyta
Class: Magnoliopsida
Order: Fabales
Family: Fabaceae
Genus: Trigonella
Species: Feonum-gracecum Linn
Parts used: Seeds

Black catechu
Color: Black or brownish black mass
Oduor: odourless
Taste: Astringent, subsequently sweet taste
Size: Irregular mass
Extra feature: The outer surface is a film and brittle. The fractured surface appears glassy with small cavities.

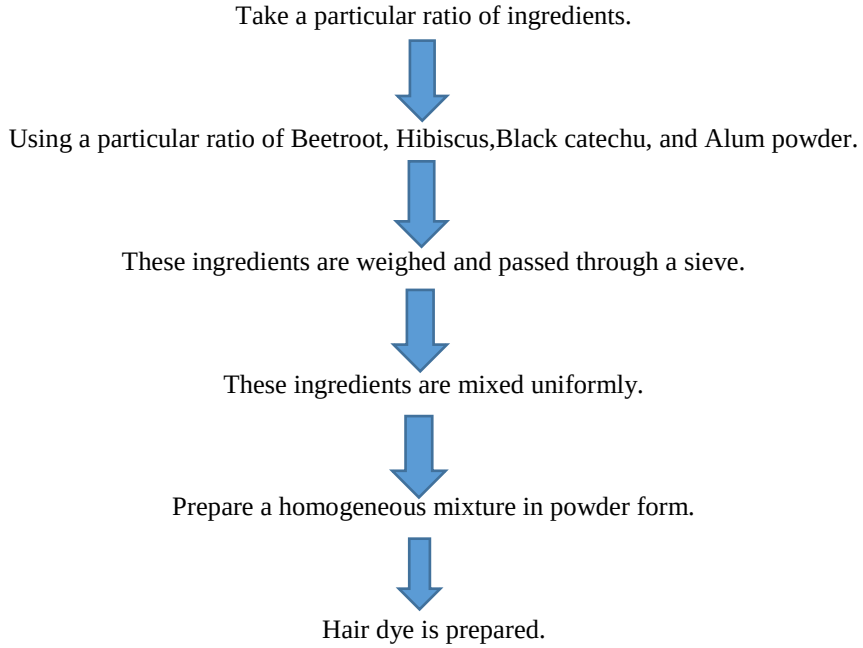
Alum powder
Common name: Potassium alum.
Chemical formula: KAl(SO4)2·12H2O.
Chemical name: potassium aluminum sulfate.
Molar mass: 474.39 g/mol.
Appearance: White crystal or powder form.

Banana pulp
Microscopic Features: Epidermis: The outer layer of the epidermis may have papillae.
Epicarp and Mesocarp: These layers contain tannin-containing cells, starch grains, and calcium oxalate crystals.
Phytochemical Studies: Banana fruits, peels, and other parts contain various phytochemicals
Antimicrobial compounds: Tannins and other compounds can inhibit the growth of microorganisms.
Other constituents: Alkaloids, glycosides, terpenoids, and other compounds with potential therapeutic applications.

Rosemary oil
Family: Lamiaceae
Origin: Native to the Mediterranean region; cultivated globally, including in Europe, North Africa, and parts of Asia.
Plant Description: An evergreen shrub reaching up to 2 meters in height, with rigid, linear, and coriaceous leaves measuring approximately 3.5 cm in length and 2–4 mmin breadth. The lower leaf surface is grey and woolly due to numerous branched trichomes, while typical labiate glandular hairs contain the volatile oil.

II. MATERIALS AND METHODS

Preparation of herbal dye



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Preparation of herbal dye paste form.

Take a particular ratio of ingredients.

↓

Using a particular ratio of Beetroot, Hibiscus, Black catechu, and Alum powder.

↓

These ingredients are weighed and passed through a sieve.

↓

These ingredients are mixed uniformly.

↓

Prepare a homogeneous powder mixture.

↓

Add banana pulp and rosemary oil.

↓

Triturate it in motorpestle.

↓

Hair paste is prepared.

III. PHYTOCHEMICAL SCREENING

Preliminary phytochemical screening was conducted to detect the presence of carbohydrates and proteins using tests like Molisch's, Biuret, Millon's, Xanthoprotein, and sulfur-containing protein tests. General chemical tests were also performed to identify tannins, anthraquinones, and mucilage.

IV. EVALUATION

The formulated herbal hair dye underwent a comprehensive evaluation:

- **Organoleptic Assessment:** Color, taste, odor, and texture were evaluated.
- **Physicochemical Analysis:** pH measurement, moisture content (via loss on drying), and total ash value determination were performed.
- **Rheological Studies:** [Details of rheological studies were not provided in the text.

V. RESULTS AND DISCUSSION

The dye displayed favorable sensory characteristics and acceptable pH, moisture, and ash content. Phytochemical screening indicated the presence of carbohydrates, proteins, tannins, anthraquinones, and mucilage, validating the use of herbal constituents. The presence of these compounds suggests potential benefits, aligning with the known properties of the individual ingredients.

VI. CONCLUSION

This study demonstrates the feasibility of formulating a herbal hair dye using beetroot, hibiscus, black catechu, alum powder, banana pulp, and rosemary oil. The resulting dye exhibits favorable characteristics and the presence of beneficial phytochemicals. Further research is needed to optimize the formulation, assess its dyeing efficacy, and conduct thorough safety evaluations. However, this study provides a promising foundation for developing a natural alternative to synthetic hair dyes with reduced risk of side effects.

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Beetroot: Rich in betalains, beetroot imparts a reddish hue to the hair. Its antioxidant properties may also promote scalp health.

Hibiscus (Hibiscus rosa-sinensis): Known for its conditioning properties, hibiscus contains flavonoids and anthocyanins, which can contribute to hair color and strength. It also helps in preventing dandruff and adds shine to the hair.

Black Catechu (Acacia catechu): Traditionally used as a natural dye, black catechu contains tannins that can enhance the color intensity and longevity of the dye on hair fibers.

Alum Powder: Acts as a mordant, helping in fixing the dye onto the hair shaft, thereby improving color retention.

Studies have shown that herbal formulations combining multiple plant-based ingredients can have synergistic effects, leading to improved coloring outcomes and hair health benefits.

Sr.no	Ingridients	Role in Dye	Hair Benefits
01	Beetroot powder	Provides a reddish tint	Rich in antioxidants,it promotes a healthy scalp.
02	Hibiscus powder	Enhances color depth	Conditions hair, strengthens roots,and prevents dandruff
03	Black catechu powder	Acts as a natural dye mordant	Deepens color; provides antimicrobial properties
04	Alum powder	Fixes color onto hair	Tightens scalp pores; reduces oiliness
05	Banana pulp	Moisturizes and softens hair	Rich in vitamins,it improves hair elasticity
06	Rosemary oil	Stimulates hair growth	Improves circulation; adds shine; has antimicrobial properties

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