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"FORMULATION AND EVALUATION OF HERBAL HAIR CONDITIONER CONTAINING *ABELMOSCHUS ESCULENTUS* MUCILAGE"

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ABSTRACT

Hair is an imperative part of the human body which protects the scalp. Hair Conditioner is a hair care product, which is applied to the hair and hair tips after shampoo in order to condition the hair and then it is rinsed out. Hair Conditioner is used to improve the manageability and to enhance lustrous look of hair. Its main purpose is to reduce friction between the hair strands to allow easier brushing and combing. The main objective is to develop the most effective hair care product to meet people's compliance, and to evaluate the prepared hair care product to establish desired effect on the user. Three types of hair conditioners were formulated, they are Herbal Hair Conditioner, Synthetic Hair Conditioner and Ayurvedic Hair Conditioner. In Herbal Hair Conditioner, Fenugreek and mint were used as main ingredients. In Synthetic Hair Conditioner main ingredient is Sodium Lauryl Sulphate, PABA and Benzophenone were also used. In Ayurvedic Hair Conditioner powered Henna, Amla, Shikakai and Reetha were used as main ingredients. All the formulations of Hair Conditioners were then evaluated and analysed on the basis of various organoleptic properties and physicochemical parameters such as pH, Dirt Dispersion Test, Moisturising Time, Cleaning Action and Stability Testing.

KEYWORDS: Herbal Hair Conditioner, Synthetic Hair Conditioner, Ayurvedic Hair Conditioner, Organoleptic properties, Physicochemical Parameters, Stability testing.

INTRODUCTION

Hair is one of the characteristic features of mammals. Hair composed primarily of the protein keratin. Hair follicle anchors each hair into the skin. The hair bulb forms the base of the Hair follicle. Humans have approximately 5 million hair follicles and 100,000 of them are located on the scalp.

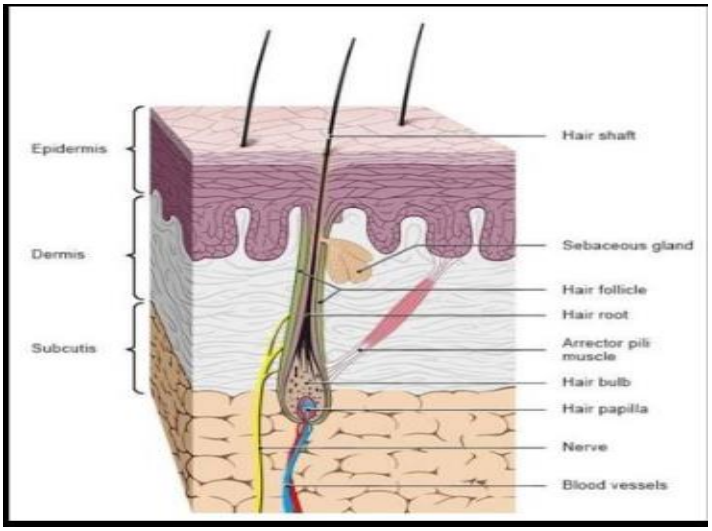
Hair and follicle morphology

Hair follicle

Strands of hair originate from the base of the downward extension of living epithelial cells into the dermis that is called the hair follicle. The essential unit for the generation of hair. It has a continuous growth and rest sequence named hair cycle. Serves as a reservoir for epithelial and melanocyte stem cells and development of hair follicle is related to the interactions of these cells. Capable of being one of the few immune privileged sites of human body.

Hair shaft

Consists of a cortex and cuticle cells and comprises a medulla for some types of hairs. Hair forms in a manner similar to the skin that is rapid division and differentiation of stem cells into keratinocytes that get pushed up and become flattened, dead, keratinized cells. The part of hair that is exposed on the skin surface is called the hair shaft and the rest of the follicle is called the hair root.



HERBAL HAIR CONDITIONER

Herbal conditioners help hair to have natural tone and fine texture. It makes us feel that there are natural ingredients in our hair. Each hair roots have oil glands which are separated because the oil from the gland coats each strand. When natural oil is not able to reach the whole length of the hair strand it becomes dull and dry. That is why we need conditioners to nourish the entire strand from root to tip.

The conditioners are used for the easy combing, to improve smoothness and shining. Conditioning agents have no effect on hair growth and cannot affect cellular repair. Rather, they can only temporarily improve the cosmetic appearance of hair and must be reapplied as removal occurs.

Chemicals are widely used in all types of hair conditioners. A more radical approach in reducing chemical ingredients is, by incorporating natural herbal extracts, whose functionality is equally good. People are using herbs for cleaning, beautifying and managing hair since the ancient time. With the advent of new chemical preparations, knowledge of traditional usage of herbs is becoming extinct. Achieving great-looking hair without chemicals is not difficult.

Conditioners are designed to provide a few of the following functions

- Improved wet combing.
- Improved dry combing.
- Increased gloss (shine).
- Increased volume and body.
- Improved moisturisation.

***ABELMOUSCHUS ESCULENTUS* (OKRA)**

Abelmoschus esculentus is one of the most widely known and utilized species of the family Malvaceae and an economically important vegetable crop grown in tropical and sub-tropical parts of the world. *Abelmoschus esculentus* is known by many local names in different parts of the world. It is called lady's finger in England, gumbo in the United States of America, guino-gombo in Spanish, guibeiro in Portuguese and bhindi in India.

Abelmoschus esculentus is a multipurpose crop due to its various uses of the fresh leaves, buds, flowers, pods, stems and seeds. Seeds are source of oil and protein. The seeds have

been used on a small scale for oil production. It can be also used as non-caffeinated substitute for coffee. It may be roasted and ground to form a caffeine-free substitute for coffee. *Abelmoschus esculentus* mucilage refers to the thick and slimy substance found in fresh as well as dried pods. Mucilaginous substances are usually concentrated in the pod walls and are chemically acidic polysaccharides. *Abelmoschus esculentus* mucilage is a renewable and inexpensive source of biodegradable material. Its physical and chemical properties include high water solubility, plasticity, elasticity and viscosity.

The chemical composition of *Abelmoschus esculentus* are 67.5% a-cellulose, 15.4% hemicellulose, 7.1% lignin, 3.4% pectic matter, 3.9% fatty and waxy matter and 2.7% aqueous extract.4 The dietary fiber of *Abelmouschus esculentus* is high.[5] The fibers aid the process of digestion in the body by facilitating proper bowel movement. It is used to prevent and diabetes. The nutrients found in *Abelmouschus esculentus* helps to prevents skin pigmentation to rejuvenate and repairing damages. To prevent heart diseases and ailments occurring due to cholesterol in the blood. *Abelmouschus esculentus* is also good for improving immunity, improving eye sight, weight loss, avoiding anemia.

The mucilage of *Abelmoschus* esculentus can be used as hair conditioner. This is an excellent moisturizer for dry and itchy scalp to leave hair feeling soft and it is not harmful like other cosmetics available in the market. It is great for people with unruly, curly and lifeless hair. *Abelmoschus esculentus* improves the overall scalp conditions and fights dandruff.[7]

Mucilages extracted from plant sources have rheological characteristics with potential for use as thickeners and food stabilizers and are well accepted by consumers because they are natural substances. In the pharmaceutical industry, some mucilages can be used as raw materials to produce natural coatings due to constituents such as pectin, galactans, and glucuronic acid. Studies that characterized *Abelmoschus esculentus* mucilage have reported its physicochemical and rheological properties for pharmaceutical applications and its use as a natural additive in food products and nutraceutical supplements. Its mucilage is a highly viscous polysaccharide that is mostly composed of monosaccharides D-galactose, L-rhamnose, and galacturonic acid, as well as proteins and minerals. The functional properties of *Abelmouschus esculentus* mucilage have been widely studied, mainly for its potential antidiabetic activity; thus, its use as adjuvant or nutraceutical therapy for diabetes is very promising. Due to its rheological properties, it is a potential resource for pharmaceutical and

food applications. *Abelmoschus esculentus* mucilage can be extracted by several methods, which can directly influence its physicochemical characteristics and biological activity.



Abelmoschus esculentus

Components

Ingredients	**Importance**
Abelmoschus esculentus mucilage	Conditioning agent
Vitamin E	Antioxidant
Sodium lauryl sulphate	Solubilizer
Glycerin	Humectant
Sodium benzoate	Preservative
Hydroxy propyl methyl cellulose	Viscosity enhancer
Brilliant green	Coloring agent
Rose water	Perfuming agent
Water	Vehicle

1. *Abelmoschus esculentus* mucilage



- Natural thickener.
- Derived from *Abelmoschus esculentus* seeds.
- Pharmaceutical applications (tablet binding, suspension stabilizer).
- Exhibits antioxidant and anti-inflammatory properties.
- Used in cosmetics and food industry as emulsifier and stabilizer.

2. Vitamin E



- Contains antioxidant properties.
- Protects skin from damage.
- On application to skin enhances skin hydration.
- Boosts collagen production.
- It's used in skincare and cosmetics products.

3. Sodium Lauryl Sulfate (SLS)



- It has anionic surfactant property.
- Used as foaming agent in cosmetics.
- Contains cleansing and emulsifying properties.
- Can be a potential skin irritant.
- That is commonly in soaps and shampoos.

Glycerin



- It has humectant property.
- Used to retain skin moisture.
- On application can soothe skin irritations.
- It hydrates hair and skin.
- Used in skincare and haircare products.

Sodium Benzoate



- Acts as Preservative agent.
- Prevents microbial growth.
- Used in food and cosmetics.
- Effective pH range 2.5-4.5.
- Generally recognized as safe (GRAS).

Hydroxypropyl Methyl Cellulose (HPMC)



- It is a Synthetic polymer.
- Thickening and stabilizing agent.
- Vegetable-based substance.
- Used in pharmaceuticals and cosmetics.
- Soluble in cold water.

4. Water

- Universal solvent.
- Hydrates skin and hair.
- Diluent in formulations.
- Essential for biological processes.
- Purified for pharmaceutical use.

5. Brilliant Green



- Triphenylmethane dye.
- Antimicrobial properties.
- Used in biology and medicine.

- Potential skin irritant.
- Not recommended for consumption.

6. Rose Water



- Natural astringent.
- Anti-inflammatory properties.
- Soothes skin irritations.
- Used in skincare and fragrances.
- Derived from rose petals.

MATERIALS AND METHOD[9]

6.1 Materials used

- **Conditioning agent:** *Abelmoschus esculentus* mucilage
- **Antioxidant:** Vitamin E
- **Solubilizer:** Sodium lauryl sulphate
- **Humectant** Glycerin
- **Preservative:** Sodium benzoate
- **Viscosity enhancer:** Hydroxy propyl methyl cellulose
- **Coloring agent:** Brilliant green
- **Perfuming agent:** Rose water
- **Vehicle:** Water

Preparation of mucilage

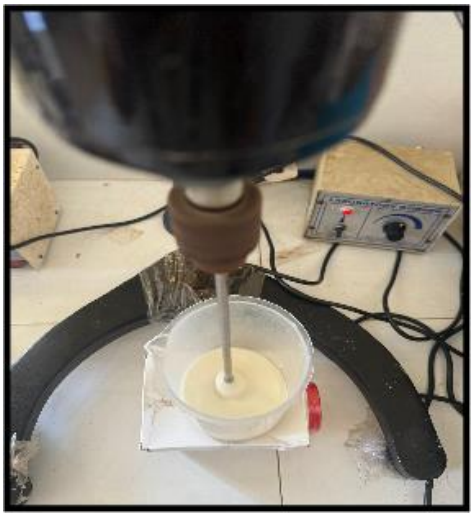
Fresh *Abelmoschus esculentus* were collected, washed with water to remove dust and other pollutants and were then cut into small pieces. These are weighed and soaked in 100 ml of

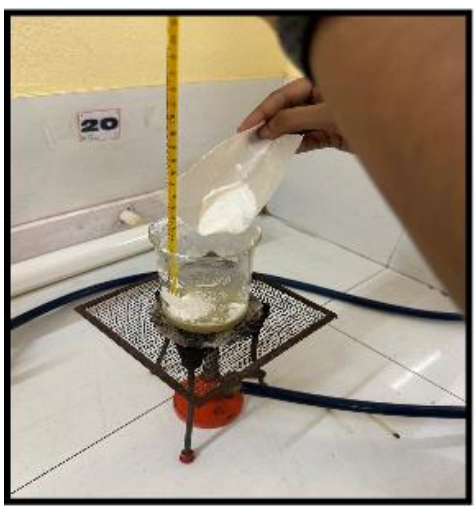
luke warm water for 24 hours. It was then squeezed and strained through strainer to remove the marc from the solution and mucilage was obtained.




6.2 METHODS[9]

1. *Abelmoschus esculentus* mucilage of 90 ml is taken and divied into three parts of 30 ml each. To the 30 ml of mucilage SLS and vitamin E was added then stir well by using mechanical stirrer for 10 minutes.
2. Then mix it with 30 ml of cold mucilage containing sodium benzoate and glycerine.
3. HPMC was added to another 30 ml of mucilage and heated to 75^0C to make HPMC mixture.
4. Then the mixture was placed on an ice cold water bath and added the above solution into it and carried out stirring until a viscous solution was formed.
5. Finally it was made upto 100 ml with purified water. Then added the colouring and perfuming agent for patient compliance.





6.3 Method of Collection of Data

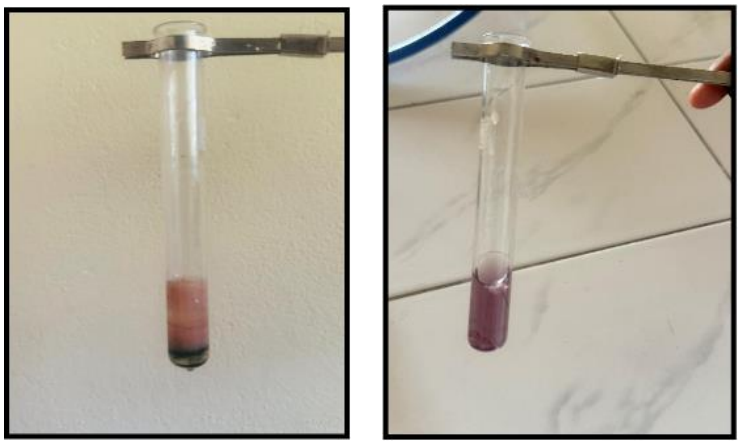
- Determination of phytochemical constituents: The freshly prepared extracts subjected to standard phytochemical analysis for different constituents such as carbohydrates, proteins, tannins, flavonoids and gums and mucilage.
- Formulation of herbal conditioner containing *Abelmoschus esculentus* mucilage.
- Evaluation of herbal conditioner for color and texture, pH parameter, skin irritation test, washability, stability test, dirt dispersion, force of application and solubility test.

CONSTITUENTS	WEIGHT
Abelmoscus eschulentus mucilage	90 ml
VITAMIN E	800 mg
SODIUM LAURYL SULPHATE	0.5 gm
GLYCERIN	2 ml
SODIUM BENZOATE	0.3 gm
HYDROXY PROPYL METHYL CELLULOSE	4 gm
BRILLIANT GREEN	0.2 ml
ROSE WATER	0.1 ml
WATER	100 ml q.s

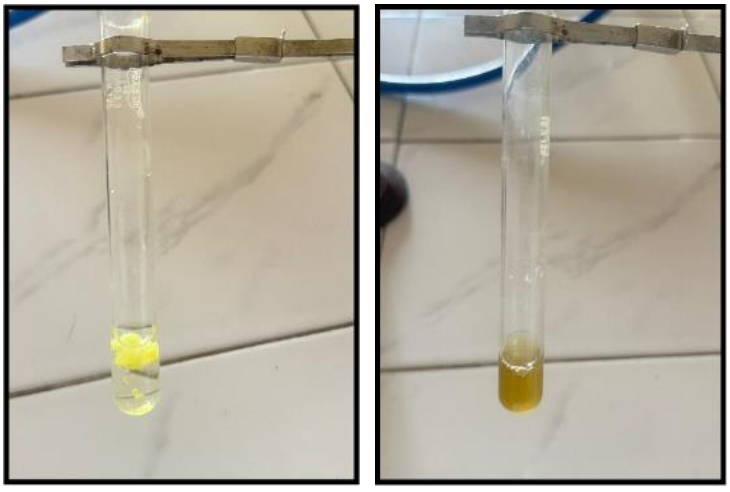
PRELIMINARY PHYTOCHEMICAL SCREENING OF OKRA MUCILAGE[16]

EXPERIMENT	OBSERVATION	INFERENCE
TEST FOR CARBOHYDRATES: Add 2-3 drops of molisch's reagent (α-naphthol) to the sample, followed by 1-2 drops of concentrated sulfuric acid.	A purple ring forms	Carbohydrates are present.
TEST FOR PROTEINS Ninhydrin Test: Heat sample with ninhydrin reagent.	Formation of purple colour	Proteins are present
TEST FOR TANNINS: Lead Acetate Test: Mix sample with lead acetate solution.	A yellow precipitate is formed	tannins are present
TEST FOR FLAVONOIDS: Ferric Chloride Test: Mix sample with ferric chloride solution.	Formation of green colour	Flavonoids are present
TEST FOR GUMS AND MUCILAGE: Mix 1-2 ml of sample with gelatin solution and heat it for 5-10 min.	Gelation occurs	Mucilage and gums are present

MOLISCH'S TEST NINHYDRIN TEST



LEAD ACETATE TEST FERRIC CHLORIDE TEST



GUMS AND MUCILAGES TEST



EVALUATION OF HERBAL HAIR CONDITIONER[9]

- **Appearance:** The appearance of the hair conditioner was observed by visual examination.
- **Colour:** The colour of the hair conditioner was observed by visual examination.
- **Odor:** The odour of the hair conditioner was tested by smelling.
- **pH**: pH of prepared hair conditioner was measured by using both pH paper & digital pH meter.
- **Spreadability:** The spreadability was determined by placing excess of sample between two slides which was compressed to uniform thickness by placing a define weight for definite time. the time required to separate the two slides was measured as spreadability.
- **Skin irritation:** Prepared herbal hair conditioner was applied to the hair of human being and observed for the effect.
- **Microbial stability testing:** The agar media was prepared then the formulated conditioner was inoculated with *Escherichia coli* into it by agar well diffusion method. The plate is then placed in incubator for 24 hours at 370C. After the incubation period, plates were taken out and microbial growth checked.
- **Stability testing at room temperature: S**tability at room temperature is checked by keeping the product at room temperature in dark room for 60 days.
- **Dirt dispersion test**: 2 drops of conditioner were added in large test tube contain 10ml of distilled water, 1 drop of India ink was added, the test tube was stoppered and shakes it 10 times. The amount of ink present in the foam was estimated as none, light, moderate (or) heavy.

- **Wash-ability**: The product will be painted by hand and was observed under running water.









Evaluation results of formulated herbal hair conditioner

Parameters	Herbal ointment
Appearance	Thick viscous liquid
Colour	Brillant green
Odor	Aromatic
p^H	7
Irritation Test	Non-irritable & non allergic on the skin
Spreadability	Easily spreadable

Evaluation results of antimicrobial study

Micro-organisms	Zone of inhibition
Escherichia coli	40 mm

DISCUSSION

The present study carried out on the plant of *Abelmoschus esculentus* revealed the possession of antimicrobial activities. The mucilage of fresh *Abelmoschus esculentus* contains cellulose, hemicelluloses, lignin, pectic matter and aqueous extract. The hair conditioner containing *Abelmoschus esculentus* exhibited antimicrobial activity against tested microorganism *Escherichia coli* hence it is an antimicrobial herbal hair conditioner. The present study includes formulation of an herbal conditioner for extra smoothening of hair and to evaluate its physicochemical, phytochemical screening properties. Main purpose is to reduce friction between strands of hair to allow easier brushing or combing. It is also evaluated for cleansing action, stability studies and dirt dispersion test.

CONCLUSION

- This study aimed to formulate and evaluate various parameters of herbal hair conditioners in a laboratory setting.
- Which contains mainly *Abelmoschus esculentus* mucilage in it.
- The herbal hair conditioner was subjected to various evaluation parameters like pH, Dirt dispertion test, Moisturising time determination, Cleansing Action and Stability testing.
- These natural conditioners are gentle and suitable for all scalp types, promoting healthy hair.
- From the above studies it is concluded that the hair conditioners show an excellent property of conditioning and they were proven to be safe and effective for use.

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