Preparation & Evaluation of Herbal Bio functional Flax Seeds Gels with Hair Growth Potential.

Bhagyashree Rajendra Nigude, Khushi Rajendra Naykodi, Prof.Nayna Khedekar, Dr.Tushar T. Shelke

Genba Sopanrao Moze college of pharmacy wagholi, pune.

Abstract

Traditional medicine is well-known in India. Traditional Indian medicine is based on herbs, which were created by ancient sages whose perceptive observations gave rise to constitutional medicine. The preparations used to improve a person's appearance are called herbal cosmetics. The current study set out to create and assess a flax seed herbal gel for the purpose of hydrating and nourishing hair.

Rich in fatty acids and antioxidants, flax seed (also called linseed) aids in clearing the scalp of toxins and dead cells. For both men and women, hair loss is a prevalent issue in the current generation. Shampoos, hair gels, and other hair care products are either directly or indirectly utilized as a result of increased pollution and chemicals. The most prevalent issues that people deal with are hair loss, thinning hair, dandruff, and early hair whitening. In contrast to chemical-based products, a variety of herbal plants can be used to encourage hair growth and give our hair natural minerals and oils.

Flaxseed, also called linseed, is rich in fatty acids and antioxidants that help clear the scalp of impurities and dead cells. Hair growth can be encouraged and existing hair strengthened by using flax seed gel as a moisturizer on the scalp and hair. Hibiscus is a member of the Malvaceae family of medicinal plants. Alopecia is one of the many conditions that Hibiscus is used to treat. Herbal hair gels assist in mitigating the harm caused by chemical agents found in a variety of commercial products.

Herbal cosmetics are aesthetic treatments. Herbal hair gel gets rid of dandruff because it contains natural ingredients and herbal extracts, it aids in the management of hair loss. The goal of this study was to develop and evaluate herbal hair gel that uses flaxseed and Aloe Vera to fight dandruff and encourage hair growth. Flax seed (Linum usitatissimum) contains vitamin E, which fortifies follicles and encourages hair growth. Aloe vera and flax seed extracts were made by aqueous extraction. Five different gel compositions were made and evaluated, each containing different amounts of flax seed and aloe vera extracts.

Keywords

Flax seed, Hibiscus, hair gel, Rosemary, Hair care, Scalp health, Vitamin E.

Aim

The primary aim of this study is to formulate herbal medicated gel using flaxseed as the key ingredient and to evaluate its effectiveness in promoting hair growth. Flaxseed is widely recognized for its rich content of omega-3 fatty acids, antioxidants, and essential nutrients, which are beneficial for scalp health and hair nourishment. The study intends to develop a natural, safe, and cost-effective alternative to chemical-based hair care products.[1,3,6]

Objectives

The objectives of the study include the selection and extraction of suitable bioactive components from flaxseed that support hair growth and scalp conditioning. Another objective is to design a stable gel formulation with appropriate consistency, spreadability, and pH suitable for topical application. The formulation process will focus on ensuring compatibility of ingredients and maintaining the therapeutic properties of flaxseed.[2]

Further, the prepared gel will be evaluated for its physical characteristics such as color, texture, homogeneity, and viscosity. Stability studies will also be conducted under different environmental conditions to ensure the product's shelf life and effectiveness over time. Additionally, the formulation will be assessed for its safety by performing irritation tests on the skin.[4]

The study also aims to analyze the effectiveness of the gel in improving hair strength, reducing hair fall, and enhancing hair growth through observational or experimental methods. Overall, this research seeks to contribute to the development of herbal cosmetic products that are both effective and free from harmful side effects.[6]

Goals

The main goal of this study is to develop herbal medicated gel using flaxseed as a primary natural ingredient and to assess its potential in supporting healthy hair growth. The study focuses on utilizing the nutritional and therapeutic properties of flaxseed, which is known for its high content of omega-3 fatty acids, lignans, and antioxidants that help in improving scalp condition and strengthening hair strands. By formulating this gel, the aim is to provide a natural remedy that minimizes the use of synthetic chemicals commonly found in commercial hair care products**.**

INTRODUCTION

Gels:

A gel is a semi-solid system where a liquid phase is contained in a three-dimensional network of colloidal particles or polymers that are cross-linked.

Gels have both liquid and solid characteristics, which makes them useful in a variety of fields, such as materials science, food, cosmetics, and pharmaceuticals. [7]

Gels can be classified on different criteria such as nature, structure and source.

A) Based on Nature of Dispersing Medium Hydrogels:

Hydrogels are networks of three-dimensional, hydrophilic polymers that can absorb and hold a lot of water or biological fluids without dissolving**.**

1) Organogels:

Organogels are semi-solid systems in which a three-dimensional network of gelator molecules immobilizes an organic liquid (such as oils or non-polar solvents).

2) Xerogels:

Xerogels are dry, solid gels that are created when a gel's liquid component evaporates, leaving behind a porous network structure.

B) Based on Source of Gels Natural gels:

Derived from organic materials such as alginate, gelatin, and agar. The food and pharmaceutical industries make extensive use of these biodegradable gels**.** [8]

1) Synthetic gels:

Composed of synthetic polymers that offer greater control over characteristics like mechanical strength and stability, such as polyvinyl alcohol and polyethylene glycol**.** [9]

C) Based on the type of Cross Linking Physical Gels:

Physical gels are created by non-covalent interactions like ionic and hydrogen bonding.

Van der Waals forces are interactions. These gels are sensitive to changes in their surroundings and reversible.[10]

D) Chemical Gels:

A gel is a semi-solid system in which a liquid is trapped within a three-dimensional network of chemical substances (such as polymers or small molecules), giving it a jelly-like structure.

Applications of Gels:

1) Gels are used in medicines for pain relief and inflammation, such as muscle and joint gels.

2) They help in wound healing by keeping the affected area moist and protected.

3) Medicated gels are applied for skin infections and allergies.

4) Gels are commonly used in drug delivery systems for controlled and slow release of medicines.

5) Cosmetics, gels are used as moisturizers and face gels to hydrate and soothe the skin.

6) Hair gels are used for styling and maintaining hairstyles.

7) Gels like aloe vera gel provide cooling and soothing effects on burns or irritated skin.

Hair

The keratinized structure known as hair is produced by hair follicles found in the dermis. Thermoregulation, protection, sensory perception, and social or aesthetic significance are just a few of its many uses. The medulla, cortex, and cuticle are the three primary structural layers of hair. Anagen (growth phase), catagen (regression phase), and telogen (resting phase) are the three cyclic growth phases that the hair follicle, a complex mini-organ, experiences. These phases are controlled by genetic, hormonal, and environmental factors. [11,12]

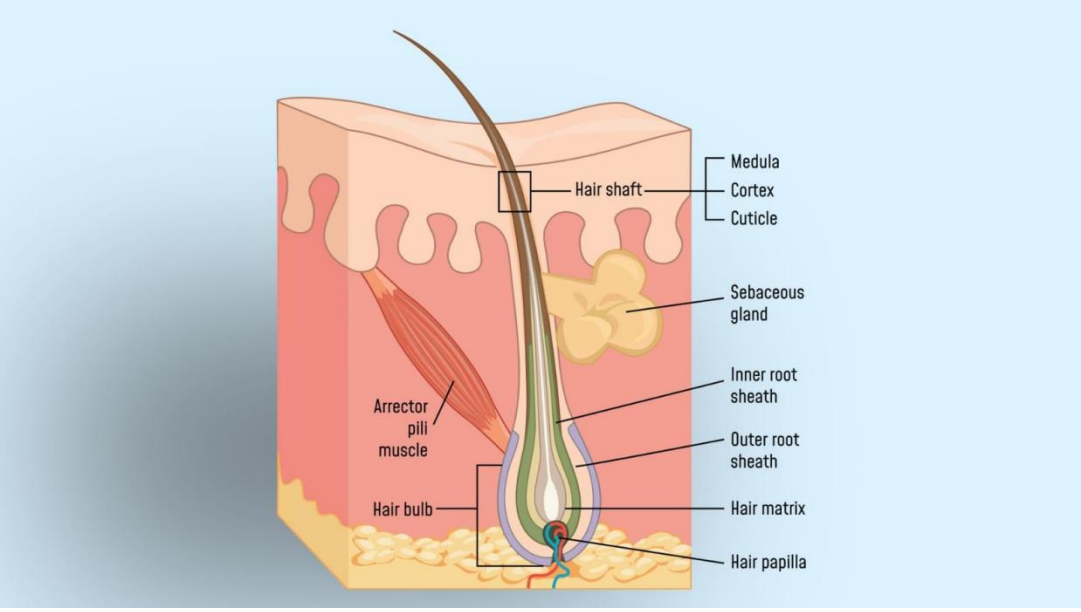

Fig. 1: **Anatomy of hair**

Structure of hair

Hair consist of two main parts:

1) Anatomy of Hair

2) Physiology of hair

1.Anatomy of Hair

Hair has two main parts: the hair shaft and the hair follicle**.**

The hair shaft is the visible, non-living part of hair. It has three layers. The cuticle is the outer protective layer made of overlapping cells. The cortex is the middle and thickest layer, which gives hair its strength, elasticity, and color. The medulla is the innermost layer, mainly present in thick hair.

The hair follicle is the living part present inside the skin. It includes the hair bulb, where hair growth begins, and matrix cells, which divide to form new hair. It also has root sheaths that protect and guide the hair, a sebaceous gland that produces oil to keep hair soft, and the arrector pili muscle, which causes goosebumps. [13]

2.Physiology of Hairs

Hair growth occurs in a cyclic process with three main phases:

A)Anagen (Growth Phase)

- Longest phase (about 2–7 years).
- Hair actively grows due to rapid cell division.
- Hair grows around 1 cm per month.
- Duration decides the length of hair.

B)Catagen (Transition Phase)

- Short phase (2–3 weeks).
- Hair growth slows down.
- Hair separates from blood supply (dermal papilla).
- Follicle begins to shrink.
- Lasts about 3 months.
- Hair stops growing but stays in place.
- Natural shedding occurs (50–100 hairs/day).
- New hair starts growing, and cycle repeats [14]

Functions of Hairs

1.Protection:

Hair protects the scalp from sunlight, dust, and minor injuries. Eyelashes and eyebrows protect the eyes from sweat and dirt.[15]

2.Temperature regulation:

Hair helps maintain body temperature by trapping heat and keeping the body warm.[15]

3.Sensation:

Hair is connected to nerve endings, so it helps us feel light touch or movement on the skin.[16]

4.Appearance (Aesthetic role):

Hair plays an important role in personal appearance and boosts confidence.

Prevents foreign particles:

Hair in the nose and ears prevents dust and small particles from entering the body.[17]

Ingredients Used:

- **Hibiscus:**

Fig. 2: Hibiscus

Hibiscus is a member of the **Malvaceae** family. Numerous studies have demonstrated the antiinflammatory, antimicrobial, antidiabetic, anti-ulcer, hepatoprotective, antifertility, and antioxidant qualities of the various parts of Hibiscus plants that aid in the treatment of a wide range of illnesses. The report listed tannins, flavonoids, steroids, alkaloids, saponins, total phenols, total flavonoids, and total proanthocyanidin.[19]
Furthermore, anthocyanins and flavonoids, such as cyanidin-3,5-diglucoside, cyanidin-3-sophoroside-5-glucoside, quercetin-3,7-diglucoside, and quercetin-3-diglucoside, have been reported to be its main constituents.[19]

Uses:

It is used to treat disorders of the scalp and prevent premature greying. It was utilized in hair washes, treatments, and vinegar rinses and was regarded as a natural emollient hair conditioner. The flowers of Hibiscus are promising sources of potential antibacterial value and may be effective in preventing certain diseases.[20,21]

- **Flaxseed**

Fig 3: Flaxseed

Alsi, Jawas, or Aksehija flax (Linum usitatissimum) are common Indian language names for flaxseed, also known as linseed (Linum usitatissimum), which belongs **to** the **Lineaceae** family. Nutritious fiber, fat, and protein are all abundant in flaxseed. The composition of flaxseed can be influenced by genetics, growing conditions, and seed processing methods.[22] Flaxseed, also known as linseed, is becoming an important functional food ingredient because of its high levels of fiber, lignans, and alpha-linolenic acid (ALA, omega-3 fatty acid).[23] "Flaxseed oil, fiber, and flax lignans can help prevent cardiovascular disease, atherosclerosis, diabetes, cancer, arthritis, osteoporosis**,** autoimmune, and neurological disorders.[24]

Uses:

Flax seeds are very helpful for hair and skin care. They improve hair growth, reduce hair fall, and make hair smooth and shiny. For skin, they help in keeping it soft and glowing and may reduce acne and dryness.

❖ **Rosemarry Oil**

Fig 4: Rosemary

Salvia rosmarinus, a synonym for Rosmarinus officinalis, or rosemary, is a shrub with purple or occasionally white, pink, or blue flowers and fragrant, evergreen, needle-like leaves. It belongs to the **Lamiaceae** family of mints. [25,26]

Uses:

Rosemary (Salvia rosmarinus) is a versatile herb that is widely used in everyday life for its health, culinary, and beauty benefits. It is commonly used in cooking to add a rich aroma and flavor to dishes like soups, meats, and vegetables. In traditional medicine, rosemary is valued for improving digestion, boosting memory, and relieving stress due to its natural antioxidant properties. It is also very popular in hair care, as rosemary oil helps promote hair growth, reduce dandruff, and strengthen hair roots. [27,28]

❖ **Vitamin E:**

Fig 5: Vitamin E Capsule

Vitamin E acts as a powerful, natural antioxidant stabilizer by neutralizing free radicals, preventing lipid oxidation. Regular use of vitamin E may help people with problems like dull hair, split ends, or hair loss. Additionally, it can promote a healthier scalp environment and lessen dandruff. [29,30]

Uses:

1.It supports stronger, healtaahier hair.

2.Vitamin E helps improve blood flow to scalp.

3.Reduce hair fall.

4.Make hair look shinier.

5.Keep your scalp from becoming too dry.

❖ **Methyl Paraben**

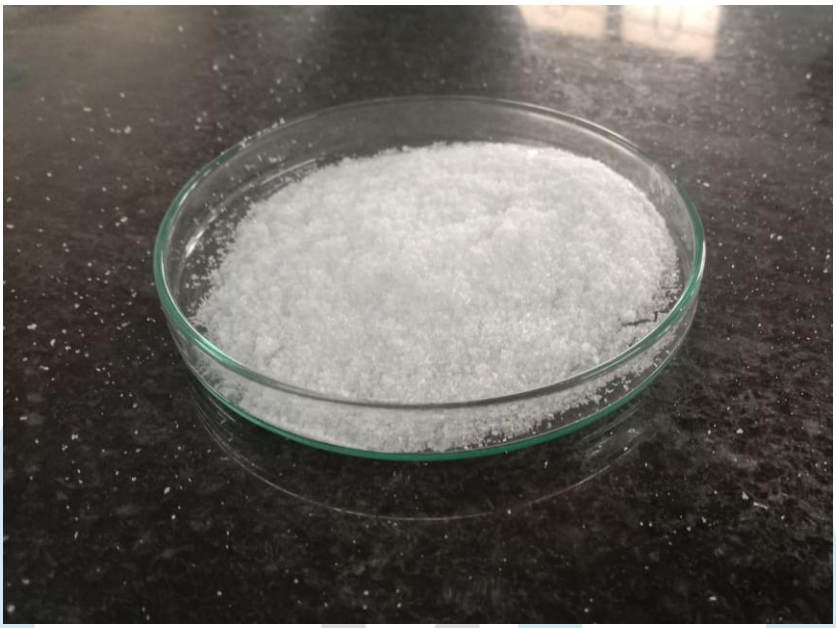

Fig 6: Methyl Paraben

P-bydroxybenzoic acid is the methyl ester of methyl paraben (CAS No. 99-76-3). This stable, nonvolatile material has been used as an antibacterial preservative in food, medicine, and cosmetics for more than 50 years. Methyl paraben is readily and completely absorbed through the skin and gastrointestinal tract. It is hydrolyzed to produce p-hydroxybenzoic acid, which is subsequently conjugated and rapidly excreted in the urine. There is no sign of accumulation. For those with normal skin, methyl paraben basically doesn't cause any irritation.[31]

Materials and Methods:

1.Material needed for flaxseed extract

Flaxseed, cheese cloth, hot plate, stirrer, beaker, water.

Extraction process

1) Get the Cloth Ready: Cover a bowl with muslin or cheesecloth.

2) Pour the Gel: Cover the cloth with the heated gel mixture.

3) Squeeze: Squeeze the gel into the bowl by gathering the cloth's edges into a pouch.

when squeezing hot gel, exercise caution and allow it to cool slightly if necessary. [32]

Fig. 7: Extraction Process.

2.Material Needed for Hibiscus Extract:

Hibiscus flower (fresh or dried), methanol (99.9% purity), glass container with lead and filter paper.

Extraction process

Gathering and Preparing Hibiscus

1.Fresh hibiscus flowers should be gathered and dried in a cool, dry location. Use dried hibiscus flowers instead.

2. Weighing and Grinding: Using a mortar and pestle or a grinder, weigh ten to twenty grams of dried hibiscus flowers and grind them into a fine powder.[33,34]



Fig. 8: Extraction of Hibiscus Flower

3. Materials needed for rosemary extract:

1. Dried rosemary leaves, glass jar, strainer or cloth, strainer or cloth.

2.Lightly crush the dried rosemary.

3.Transfer it to a sanitized glass jar (½–¾).

4.Cover completely with carrier oil (such as coconut or olive oil).

5.Gently heat for two to three hours.

6.Use a cloth to strain the oil.

7.Keep in a cool location in a dark bottle.[35]

Fig. 9: Extraction of Rosemary Oil

FORMULATION TABLE:

Ingredient	Function	Quantity (%)	Quantity (for 100ml)
Flaxseed (Linum usitatissimum)	Natural gelling agent	5%	5g
Distilled Water	Solvent/base	85%	85ml
Hibiscus extract	Conditioning, hair straightening	5%	5ml
Methyl Paraben	Preservative	0.2%	0.2g
Rosemary Oil	Hair growth, fragrance, scalp stimulation	0.5%	0.5ml (~10 drops)
Vitamin E	Antioxidant, nourishes scalp	0.3%	0.3ml(6drops)
Total	-	100%	100ml

PROCEDURE:

Step1: Flaxseed Gel Base

Start with freshly extracted gel from Flax:

Filter the extracted gel through a muslin cloth to remove seed particles.

Collect a smooth, clear gel in a clean beaker.

Step 2: Prepare Herbal Additives

A) Hibiscus (Color & conditioning agent)

Crush or use powdered Hibiscus rosa-sinensis.

Mix with a small amount of warm distilled water to form a smooth slurry (no lumps).

B) Rosemary (Preservative & antioxidant support)

Use rosemary extract (preferred for better stability).

Step 3: Warm the Flaxseed Gel Heat the flaxseed gel gently to 40–50°C.

Stir continuously.

Step 4: Add Hibiscus Slurry Slowly add hibiscus mixture into warm gel.

Stir continuously to avoid clumping.

Gives natural pink-red color and conditioning effect.

Step 5: Add Rosemary Extract/Infusion Add rosemary solution gradually.

Mix gently to maintain smooth texture.

Acts as antioxidant and supports preservation.

Step 6: Add Preservative (Methyl Paraben)

Pre-dissolve Methylparaben in a small amount of warm distilled water.

Add when gel temperature is below 45°C.

Ensures proper antimicrobial effectiveness and shelf stability.

Step 7: Add Vitamin E

Add a few drops of Vitamin E.

Stir slowly for even distribution.

Acts as antioxidant and improves hair nourishment.

Step 8: Adjust Consistency

If too thick → add small amount of distilled water.

If too thin → gently warm and stir until desired texture is achieved.

Step 9: Final Mixing & Filtration (Optional)

Stir thoroughly for uniformity.

Pass through fine muslin cloth for a smooth final gel.

Step 10: Packaging

Transfer into a sterilized airtight container.

Avoid air bubbles and contamination.

Store in a cool place or refrigerator for better shelf life.[36-43]

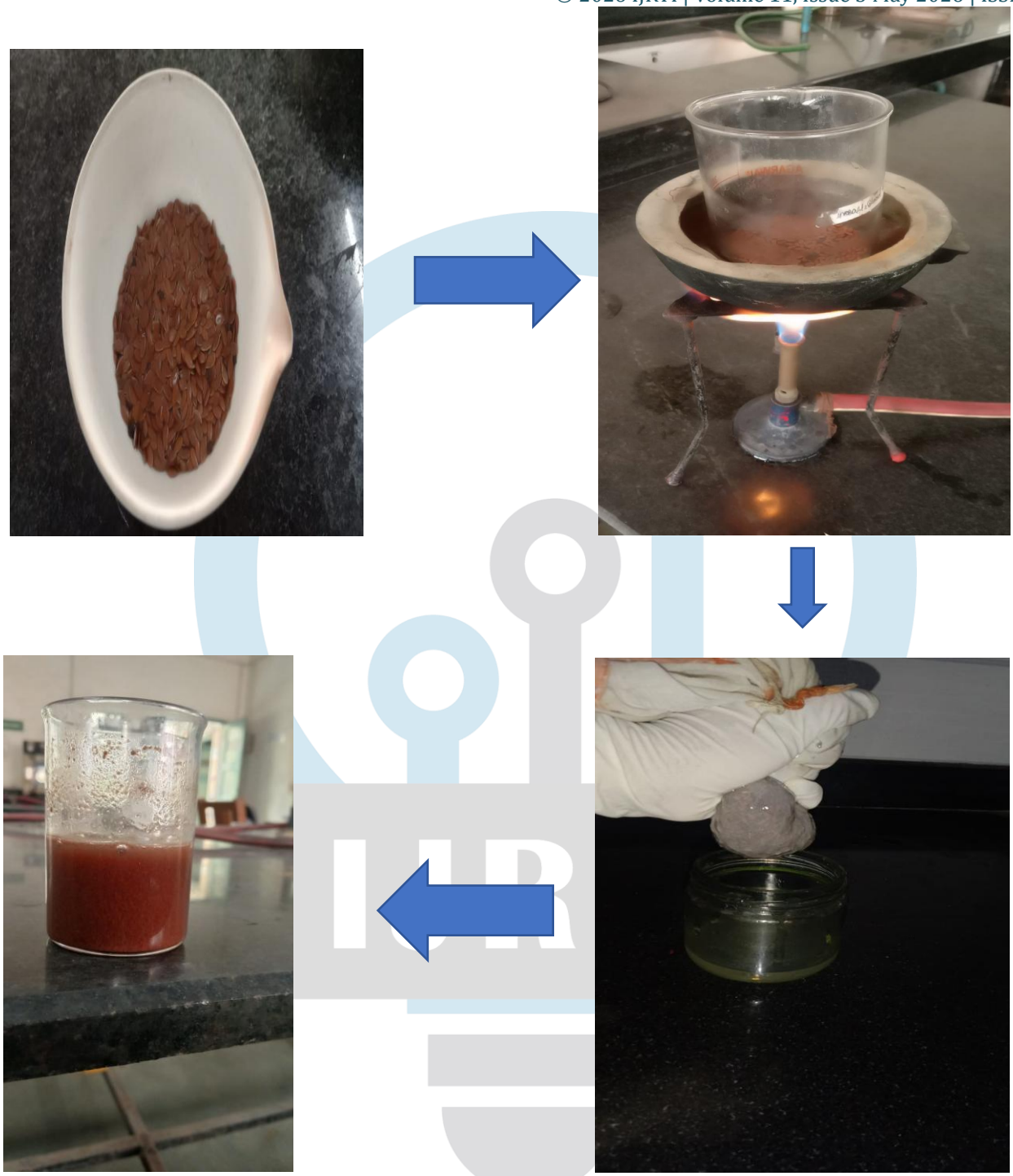

Fig. 10: Method of Preparation of Flax Seeds Gel.

Evaluation Parameters

1.Look and Appearance:

First, observe how the gel looks.

A good flaxseed gel should be smooth and even in texture. It should appear clear or slightly cloudy, without any lumps, grains, or uneven color.

2. Smell :

Gently check the fragrance of the gel.

It should have a light, natural smell. Any strong, sour, or unpleasant odor indicates spoilage.

Herbal scents are acceptable if ingredients like hibiscus or rosemary are added.

3. Feel and Texture:

Take a small amount and rub it between your fingers.

The gel should feel soft, smooth, and non-gritty. It should not feel too sticky or oily and should spread easily on skin or hair.

4. pH Balance:

Test the pH using strips or a pH meter.

For safe use on scalp and skin, the gel should fall in the slightly acidic range of about 4.5 to 6.5.

5. Thickness (Viscosity):

Check how the gel flows.

It should have a balanced consistency—not too runny and not too thick—so that it can be applied easily and evenly.

6.Stability Over Time:

Keep the gel stored and observe it over several days or weeks.

A stable gel will not separate, change color, or develop an unusual smell or spoilage.

7. Safety from Microbes:

Make sure the gel remains clean and free from contamination.

There should be no mold growth or bad odor, especially when preservatives are used properly.

8. Ease of Application:

Check how smoothly it spreads during use.

It should coat hair or skin evenly without clumping or dragging.

9. Skin and Scalp Response:

Apply a small amount on skin or scalp to test compatibility.

It should not cause itching, redness, or irritation, indicating it is safe to use.

10.Separation Check:

Leave the gel undisturbed for some time.

A good formulation will stay uniform without forming any water layer or separation at the top or bottom.[44-49]

Result and Discussion

Sr. No	Test	Result
1.	Physical properties	Pink colour
2.	Odor	Rosemary fragrance
3.	Texture	Smooth, soft and slightly slippery
4.	pH	6.4
5.	Viscosity	Moderate
6.	Stability test	Stable
7.	Separation check	Uniform
8.	Spreadability	Easily spreadable [20.9-25.7g cm^2]
9.	Skin and scalp response	No irritation,redness and itching

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