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FORMULATION AND EVALUATION OF WOUND HEALING GEL FROM BULRUSH AND NEEM

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ABSTRACT

Inflammation, tissue development, and skin remodeling are all part of the intricate biological process of wound healing. Because of their antibacterial, anti-inflammatory, and healing qualities, herbal remedies are frequently used to treat wounds. The goal of this study is to create and assess a herbal wound healing gel that contains extracts of Azadirachta indica (neem) and Typha angustifolia (bulrush). Appropriate gelling agents will be used to make the gel, and its pH, viscosity, spreadability, homogeneity, and stability will all be assessed. Additionally, the gel's ability to heal wounds will be investigated. Because of their increased patient compliance, safety, and efficacy, herbal formulations are becoming more and more popular. Flavonoids, tannins, and phenolic compounds are among the active components found in the chosen plants that aid in the production of collagen, lower inflammation, and ward off microbial infection. Neem has potent antibacterial and antiseptic qualities, while bulrush has antioxidant and tissue healing activities. By creating a moist environment for the wound, the gel dosage form speeds up healing and lessens the production

of scars. The goal of this research is to create a topical herbal wound healing gel that is stable, safe, and efficacious.

KEYWORDS: Bulrush, Neem, Herbal Gel, Wound Healing, Extraction.

INTRODUCTION

Any breach in the skin's or tissue's continuity brought on by physical harm, burns, cuts, infections, or surgical operations is referred to as a wound. A number of processes, including inflammation, tissue creation, collagen synthesis, and tissue remodeling, are involved in the intricate and dynamic biological process of wound healing. Restoring damaged tissue's natural structure and function as soon as feasible is the primary goal of wound healing. In order to avoid infection, lessen the creation of scars, and restore normal skin function, proper wound healing is crucial.

The wound healing process mainly occurs in four phases: Hemostasis, inflammation, proliferation, and remodeling are the four primary stages of wound healing. Blood clotting takes place to halt bleeding during the hemostasis phase. White blood cells clear the wound of germs and dead cells during the inflammatory phase. New blood vessels, collagen, and tissue are created during the proliferation phase. The wound shrinks and the tissue gets stronger during the remodeling stage. Infections or persistent wounds may result from any delay in these stages. Therefore, to encourage quicker healing, appropriate wound care and Because they are safer, more effective, and have less side effects than synthetic medications, herbal remedies have attracted a lot of interest in the treatment of wounds in recent years. Numerous phytoconstituents found in medicinal plants, including flavonoids, tannins, alkaloids, glycosides, phenolic compounds, and saponins, are crucial for the healing of wounds. These components enhance tissue regeneration, lower inflammation, stop microbial infection, and encourage the production of collagen. Herbal medications can be used in topical formulations since they are affordable and readily accessible.

Bulrush, or Typha angustifolia, is an aquatic medicinal plant that is a member of the Typhaceae family. It has antioxidant, anti-inflammatory, and wound-healing qualities due to the presence of flavonoids, phenolic compounds, and polysaccharides. Bulrush extract aids in wound contraction, collagen production, and tissue restoration, all of which accelerate healing. Additionally, it exhibits antioxidant activity that promotes tissue regeneration and shields cells from harm. Neem, or Azadirachta indica, is one of the most significant medicinal

plants in the Meliaceae family. Azadirachtin, nimbidin, flavonoids, and tannins are active components found in neem leaves that have antibacterial, antifungal, anti-inflammatory, and antiseptic qualities Neem improves tissue regeneration and collagen synthesis, which speeds up healing and helps avoid microbial infection in wounds.

Because gel formulations are non-greasy, easily spreadable, easily washable, and have a calming and cooling impact on the skin, they are frequently utilized for topical medication administration. Additionally, gels enable appropriate drug release at the application location and improve patient compliance. Because carbopol-based gels have superior viscosity, stability, and spreadability, they are frequently employed in pharmaceutical formulations.

Restoring the integrity of damaged tissue through cellular, biochemical, and molecular mechanisms is the goal of wound healing, a highly coordinated and intricate biological process. Restoring normal skin function and achieving quick tissue recovery with less scar formation are the main goals of wound healing. Hemostasis, inflammation, proliferation, and remodeling are the four overlapping stages of the healing process.

Hemostasis is the initial stage, which starts right after an injury. During this stage, platelets gather at the site of damage to form a blood clot, and blood arteries constrict to minimize blood loss. In addition to stabilizing the clot, fibrin production serves as a transient matrix for cell motility. This stage is crucial for stopping excessive bleeding and getting the wound ready for additional healing.

Inflammation is the second stage, which often lasts for a few days. Neutrophils and macrophages go to the wound site during this phase and use phagocytosis to eliminate pathogens, foreign particles, and dead tissue. The release of several cytokines and inflammatory mediators aids in the start of tissue healing. Long-term inflammation can impede healing and result in chronic wounds, even though inflammation is essential for wound healing.

Granulation tissue development, angiogenesis, collagen production, and epithelialization are the hallmarks of the third phase, proliferation. Collagen and extracellular matrix components, which give the freshly created tissue structural support, are produced by fibroblasts. To provide the repairing tissue with nourishment and oxygen, new blood vessels form.

Keratinocytes encourage re-epithelialization by migrating over the wound surface. During this phase, wound contraction also takes place, greatly lowering the size of the wound.

Remodeling or maturation is the last stage, which could take weeks or months. Collagen fibers strengthen and restructure during this stage, increasing the tissue's tensile strength. The wound gradually returns to its original appearance and function as scar tissue forms. Nonetheless, recovered tissue typically regains 70–80% of its initial skin strength.

Age, diet, infection, diabetes, oxygen supply, stress, and medication are some of the variables that affect wound healing. Because bacteria prolong inflammation and harm good tissue, infection is one of the main causes of delayed wound healing. Antimicrobial drugs are therefore crucial to the treatment of wounds.

Thus, the creation and assessment of a herbal wound healing gel combining extracts of Typha angustifolia and Azadirachta indica are the main objectives of this work. The physical appearance, pH, viscosity, spreadability, extrudability, homogeneity, medication content, and stability of the prepared gel will all be assessed. Additionally, the gel's ability to heal wounds will be investigated. The goal of the project is to create a topical herbal wound healing gel that is stable, safe, and effective.

PLANT PROFILE

Bulrush

Fig.: Bulrush.

Taxonomical classification

Kingdom	Plantae
Subkingdom	Tracheobionta
superdivision	Spermatophyta
Division	Angiosperms
Class	Monocotyledonae

Order	Poales
family	Typhaceae
Genus	Typha
species	Typha angustata

Biological source

Scientific name: Typha angustifolia

Common names: Bulrush

It consist of dried inflorescence of plant Typha angustifolia

Family: Typhaceae

Chemical constituent

- Flavonoids-quercetin, kaempferol
- Tannins-gallic acid, tannic acid
- Phenolic compounds-gallic acid, caffeic acid
- Sterols-stigmasterol, campesterol
- Polysaccharides-cellulose, hemicellulose
- Glycosides-flavonoid glycosides

Uses

- Promotes wound healing
- Anti-inflammatory activity
- Antimicrobial effect
- Helps in tissue repair
- Used in burns and cuts
- Acts as antioxidant.

NEEM

Fig.: Neem.

Taxonomical classification

kingdom	Plantae
subkingdom	Tracheobionta
superdivision	Spermatophyta
division	Angiosperms
Class	Dicotyledonae
Order	Sapindales
family	Meliaceae
Genus	Azadirachta
species	Azadirachta indica

Biological source

Scientific name: Azadirechta indica

Common names: Neem It consist of dried as well as fresh leaves of plant Azadirechta indica

Family: Meliaceae

Chemical constituent

- Nimbidin
- Azadirachtin
- Nimbin 9
- Quercetin
- tannin

Uses

- Acts as antibacterial agent → prevents wound infection
- Shows antifungal activity → protects from fungal growth
- Provides anti-inflammatory effect → reduces pain and swelling
- Promotes tissue regeneration → speeds up healing
- Works as antiseptic → keeps wound clean

MECHANISM OF HERBAL GEL IN WOUND HEALING

Through a variety of biological processes, including antibacterial, anti-inflammatory, antioxidant, and tissue-regenerative properties, herbal wound healing gel facilitates healing. The gel foundation keeps the wound wet, promoting quicker healing and preventing infection. Flavonoids, tannins, alkaloids, and phenolic compounds are among the active phytochemicals found in herbal substances like bulrush and neem that promote healing.The mechanism of wound healing by herbal gel occurs in four phases:

1) Hemostasis Phase: By shielding the wound area, the gel aids in the development of clots and regulates bleeding.

2) Inflammatory Phase: Herbal ingredients lessen swelling, discomfort, redness, and inflammation. Antimicrobial substances shield the wound from infection by stopping bacterial development.

3) Proliferative Phase: Faster tissue repair and wound contraction result from the gel's stimulation of fibroblast proliferation, collagen production, angiogenesis, and granulation tissue development.

4) Remodeling Phase: Herbal ingredients reinforce newly produced tissue and enhance epithelialization, which leads to appropriate scar development and skin integrity repair.

Herbal extracts' antioxidants also lessen oxidative stress and neutralize free radicals, hastening the healing of wounds. As a result, herbal gels offer a low-risk, cost-effective, and safe method of managing wounds.

LIMITATION OF SYNTHETIC WOUND HEALING GEL

Although synthetic wound healing gels are frequently used to treat wounds, they have a number of drawbacks and adverse effects when compared to herbal preparations.

1) Skin Irritation and Allergic Reactions: On sensitive skin, certain synthetic chemicals may result in redness, itching, burning, or allergic reactions.

2) Toxicity on Prolonged Use: Using synthetic substances continuously can harm skin tissues and impede the body's natural healing process.

3) Antibiotic Resistance: After repeated usage, synthetic antimicrobial agents and antibiotics may cause the emergence of resistant microbes.

4) Delayed Tissue Regeneration: While some synthetic gels primarily manage infection, they might not be able to adequately encourage the production of collagen and tissue regeneration.

FORMULATION OF WOUND HEALING GEL (30gm)

Sr. no	INGREDIANT	F1	F2	F3	ROLE
1	Bulrush extract	0.9	0.9	0.9	Wound healing agent
2	Neem extract	0.9	0.9	0.9	Antimicrobial and healing
3	Carbopol 940	0.15	0.30	0.45	Gelling agent
4	Propylene glycol	1.5	1.5	1.5	Humectant
5	Methyl paraben	0.06	0.06	0.06	Preservative
6	Triethanolamine	q.s	q.s	q.s	Neutralizer
7	Distilled water	q.s	q.s	q.s	Vehicle

METHOD OF PREPARATION

Extraction of bulrush

1) Fresh bulrush plant material was collected and shade dried.
2) The dried material was powdered using a grinder.
3) About 50 g of powdered bulrush was transferred into a beaker
4) 500 mL of 70% ethanol was added to the flask and tightly closed.
5) The mixture was kept for 72 hours at room temperature with occasional shaking.
6) After completion of maceration, the mixture was filtered through muslin cloth followed by Whatman filter paper.
7) The obtained extract was stored in an airtight container .

Extractionn of neem

1) Fresh neem leaves were collected, washed properly, and shade dried.
2) The dried leaves were powdered using a grinder.
3) About 50 g of powdered neem leaves was transferred into a clean beaker.
4) 500 mL of 70% ethanol was added to the flask and tightly closed.
5) The mixture was kept for 72 hours at room temperature with occasional shaking.
6) After completion of maceration, the mixture was filtered through muslin cloth followed by Whatman filter paper.
7) The obtained extract was stored in an airtight container.

Formulation of gel

1) Accurately weigh all the ingredients required for 30 g formulation.
2) Take required quantity of distilled water in a beaker.
3) Slowly add Carbopol 940 into distilled water with continuous stirring to avoid lump formation.
4) Keep the dispersion aside for 30–45 minutes for complete swelling of Carbopol.
5) Dissolve methyl paraben in propylene glycol separately.
6) Add Bulrush extract and Neem extract into the propylene glycol mixture and stir properly.
7) Add this mixture slowly into the swollen Carbopol dispersion with continuous stirring.
8) Add Triethanolamine dropwise while stirring continuously until transparent gel consistency is obtained.
9) Adjust the final weight to 30 g using distilled water

EVALUATION PARAMETER

1) Organoleptic evaluation

- Colour-light yellow
- Odour-characteristic
- Texture-smooth and non sticky
- Consistancy-gel looks smooth and homogenous

2) Ph measurement

- The ph of the gel was determined using a standard buffer solution.about 1 gm of the gel was weighed and dissolved in 100ml of distilled water and its ph was measured and it is found to be 5.70

3) Viscosity

Viscosity was determined by using Brookfield viscometer spindal no.1 (S-62, model LVDV-E) at 33degree celcius with a spindal speed of the viscometer rotated at 6rpm.

4) Clarity of gel

The clarity of gel was determined by visual insoection.

5) Microscopic analysis

Microscopic study by optic microscope with magnification of 10 and 40 for uniformity, gel texture.

6) Homogenicity

Gel formulations were tested for homogeneity by visual inspection after the gels have been set in to the container.

7) Spreadability

Using a two-glass-slide approach, the hydrogel's slip and drag characteristics were assessed in order to determine its spreadability. To put it briefly, 2 g of the hydrogel was placed between two glass slides to create a homogenous film and release air. Any extra gel was then removed. The top slide was then subjected to an 80 g weight force, and the time (in seconds) needed for it to traverse a predetermined distance of 7.5 cm was noted. Smoother glide and better spreadability were indicated by shorter time intervals. The weight attached to the upper

slide (80 g), the length the slide moved (7.5 cm), and the time required for total separation were used to calculate the spreadability coefficient.

8) Evaluation Of Drying Time

By applying a thin, even layer of the formulation to a spotless glass slide and letting it air dry at room temperature, the hydrogel's drying time was assessed. When the gel turned into a dry, non-sticky film, which took about 8 minutes, the drying time was noted.

Staphylococcus aureus – Gram-positive bacterium.

CONCLUSION

Using Carbopol 940 as the gelling agent, the current study effectively created and assessed a herbal wound healing gel including neem and bulrush extracts. decent appearance, homogeneity, smooth texture, appropriate pH, decent spreadability, and acceptable viscosity were among the favorable physical attributes of the manufactured gel. Because neem and bulrush extracts include a variety of phytoconstituents, they have antibacterial and wound-healing effects. The formulation was found to be stable, non-irritating, and appropriate for topical administration based on the evaluation parameters. Bulrush aided in wound contraction and tissue restoration, while neem had strong antibacterial and anti-inflammatory properties. When compared to synthetic formulations, the combination of these herbal substances showed promise for improving wound healing naturally with few side effects.

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RESULT

1. Formulation of gel was prepared suscessfully.
2. Evaluation test for gel was performed suscessfully.
3. The formulation showed the good organoleptic properties such as colour odour etc.

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