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## Formulation and evaluation of wound healing gel using *Tridax procumbens* and *Moringa oleifera*

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#### Abstract

This study presents the formulation and evaluation of an wound Healing Gel utilizing extract of *Tridax procumbens* leaves and moringa leaves. Herbal gels possess a unique property that allows for easy application and removal, making them a widely accepted and effective method for dosage control. *Tridax procumbens*, has been utilized in traditional Indian medicinal systems for its wound healing properties, as well as it possess Antibacterial property. The gel formulation was designed by using Carbapol 940, *Tridax procumbens* leaf extract, propylene glycol, methyl paraben, propyl paraben and required amount of distilled water. In the current investigation, five formulations with various carbapol concentrations as well as *Moringa oleifera* and Tridax extracts were created and optimised. The skin pH was maintained by drop wise addition of Tri-ethanolamine. The physicochemical parameters of formulations such as pH, spreadability, viscosity etc. were determined. For optimised formulations in Trials 1, 2, and 3, the gel's viscosity and spreadability were appropriate. Herbal medications are considered safer than allopathic medicines as allopathic medicines due to their reduced side effects. The survival of the active moiety relies on the preparation of extracts and their formulations for better absorption and penetration into the systemic circulation. Under typical storage conditions, the preparation was stable and did not cause skin irritation.

**Keywords:** Herbal gel, preparation, evaluation, wound healing gel

#### Introduction

Gels and jellies are solid or semisolid systems with at least two constituents, enclosed by a liquid, with a smaller solid mass and a larger liquid. The characteristic of gel and jelly is the presence of some form of cutaneous structure, which provides solid-like property. Herbal remedies are getting increasing patient compliance as they are devoid of typical side effects of allopathic medicines. The present research has been undertaken with the aim to formulate and evaluate the Herbal gel containing *Tridax procumbens* and *Moringa oleifera* leaf extract. One of the method for its survival is preparation of extract and their formulations for better absorption and penetration of the active moiety into the systemic circulation. Polymer is simply a compound made up of repeating units. Polymers are used to give the structural network which is essential for the preparation of gels. One of the method for its survival is preparation of extract and their formulations for better absorption and penetration of the active moiety into the systemic circulation. Polymer is simply a compound made up of repeating units. Polymers are used to give the structural network which is essential for the preparation of gels. For topical treatment of dermatological disease as well as skin care, a wide variety of vehicles ranging from solids to semisolids and liquid preparations is available to clinicians and patients.

#### Advantages of Gel

- Non-greasy application.
- Being easy to formulate with active ingredients.
- Adhering well to the application site.
- Being washable and non-toxic.
- Stability over time.
- Ability to target affected area for rapid treatment and relief.
- Preventing unwanted side effects through bypassing the digestive system.
- Easy spreading.
- Skin retention.
- A cooling effect on the skin.

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### Disadvantages of gel

- Many a times, there is very substantial interaction between the drug or active agent and the polymer, which reduces the hydrophilic nature of the nanogels, causing the structure to be wrecked, entrapping of the drug molecule.
- Some drugs aren't absorbed easily through the skin.
- There's a possibility of an allergic reaction
- The effect of gels initiates slower (but lasts longer)
- Additives in the gel may irritate the skin
- Application site must be monitored for reactions
- Effectiveness may be impacted by temperature, humidity, and other environmental factor.

### *Tridax procumbens*

In both traditional and ayurvedic medical practices, *Tridax procumbens* (also known as coat buttons) is a common herb. *Tridax procumbens*, commonly known as coatbuttons<sup>[1]</sup> or tridax daisy, is a species of flowering plant in the family Asteraceae. The plant has shown effectiveness in treating various ailments, including wound healing, diarrhoea, schizophrenia, malaria, nausea, elevated blood pressure, insulin resistance, hemorrhage, and metabolic syndrome<sup>[2]</sup>

### *Moringa oleifera*

*Moringa oleifera* Lam, a significant plant in the Moringaceae family, is utilized in food and medicine worldwide. It is called a "miracle tree" or "Tree of Life" because of its medicinal properties that include wound healing, antioxidant, antimicrobial, antidiabetic and anticancer properties, to name a few<sup>[3]</sup>

### Plant Profile

#### Plant Profile of *Tridax procumbens*



Fig 1: *Tridax procumbens*

**Botanical Name:** *Tridax procumbens*

**Kingdom:** Plantae

**Order:** Asterales

**Family:** Asteraceae

**Genus:** *Tridax*

**Species:** *T. procumbens*

**Synonym:** Dagadipala, Kabarmodi

### Plant Profile of *Moringa oleifera*



Fig 2: *Moringa oleifera*

**Botanical Name:** *Moringa oleifera*

**Kingdom:** Plantae

**Order:** Brassicales

**Family:** Moringaceae

**Genus:** *Moringa*

**Class:** *M. Oleifera*

**Common Name:** Drumstick tree, Shevga

### Materials and Methods

Table 1: List of Instruments used for work

Sr. No.	Name of Instrument	Manufacture
1.	Magnetic Stirrer	-----
2.	Electronic Weighing Balance	EQUIP - TRONICS
3.	PH Meter	EQUIP - TRONICS
4.	Heating Mantle	LABLINE

Table 2: List of Chemicals used for work

Sr. No.	Chemicals	Manufacture
1.	Carbapol 934	Thermosile Fine Chem Industries
2.	Propylene glycol	Thermosile Fine Chem Industries
3.	Methyl Paraben	Thermosile Fine Chem Industries
4.	Propyl Paraben	Molychem
5.	Triethanalamime	Loba Chem Pvt.Ltd
6.	Glycerin	-----
7.	Distilled Water	-----

### Experimental Methods

#### Pharmacognostic Investigation

#### Collection and Authentication

Collection of the leaves of *Tridax procumbens* (Kambarmodi) and *Moringa oleifera* (shevga).

#### Organoleptic Characterization

Colour, Odour, shape, and size of the root and texture, fracture were observed.

#### Physicochemical Characters

After botanical evaluation, the shade-dried leaves were subjected to size reduction to get coarse powder and then passed through sieve no. 43 to get uniform powder. Then, the uniform powder was subjected to standardization with different parameters as per literature<sup>[4]</sup>.

#### Moisture Content

To check the water content and chemical quality of dried leave<sup>[5]</sup>.

W2-W3 (100)/W2-W1

Where, W1= weight of empty porcelain dish  
W2= weight of dish with sample before drying  
W3 = weight of dish with sample after drying

### Foaming Index

Foam index test are performed to predict the influence of concern mixture ingredients on dosage of Air Entraining Admixture (AEA) required to achieve a given air content in fresh concrete.

**Foaming index = 1000 a**

Where, a = volume in ml of the decoction in the test tube, showing 1 cm foam height.

### Extraction

#### Preparation of Ethanolic extract of Herbs

Preparing an ethanolic extract of herbs involves extracting bioactive compounds from plant material using ethanol as the solvent.

#### Materials Needed

- **Herbs:** Dried or fresh herbs of your choice.
- **Ethanol:** High-grade ethanol (e.g., 95% ethanol).
- **Grinder or blender:** To crush the herbs.
- **Glass jar with lid:** For maceration.
- **Filtering equipment:** Such as a cheesecloth or filter paper.
- **Storage bottles:** Amber glass bottles are preferred to store the extract

#### 1. Preparation of Raw Material

The herbs are cleaned, dried (if necessary), and sometimes ground or cut into smaller pieces to increase the surface area for extraction. Optionally, dry the herbs if they contain a lot of moisture, as excess water can affect the extraction process [6].

#### 2. Choice of Solvent

Select an appropriate solvent based on the type of compounds you want to extract. Ethanol (alcohol), methanol, water, and hexane are common solvents used depending on the polarity of the target compounds.

#### 3. Ratio of Herb to Solvent

Generally, a ratio of 1:5 to 1:10 (herb) by weight is used, but this can vary depending on the herb and the desired concentration of the extract [7].

#### 4. Maceration

Cut or shred the cleaned and dried leaves of *Tridax procumbens* and *Moringa oleifera* into small pieces to increase the surface area for extraction.

Place the prepared herbs separately into clean glass jars or containers.

Pour enough ethanol (or chosen solvent) over the herbs to completely submerge them. The ratio of herb to solvent can vary, but a common ratio is 1:5 to 1:10 (herb) by weight.

#### 5. Sealing and Agitation

Seal the jars tightly with lids to prevent evaporation and contamination.

Shake the jars gently to ensure the herb material is evenly submerged in the solvent. This helps in enhancing the extraction efficiency [8].

#### 6. Extraction Period

Store the sealed jars in a cool, dark place at room temperature. Allow the maceration process to proceed for about 7-14 days. During this time, shake the jars gently every day or every few days to agitate the mixture. The extraction period can vary depending on the herb and solvent used, ranging from a few days to several weeks.

**7. Filtration:** After the maceration period, the mixture is filtered to separate the liquid extract (containing the dissolved compounds) from the solid plant material residue.

**8. Concentration:** The filtrate is then concentrated using methods like rotary evaporation or freeze-drying to obtain a more potent extract.

**9. Analysis and Storage:** Finally, the concentrated extract is analyzed for its phytochemical content and stored in appropriate conditions to maintain its stability and efficacy.

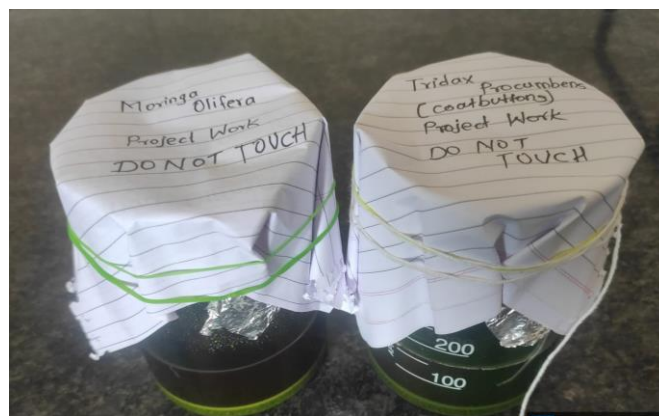


Fig 3: Maceration process

### Experimental Design and Method of Preparation

#### 1. Selection of Active Ingredients

- **Tridax procumbens:** Known for its anti-inflammatory and wound healing properties.
- **Moringa oleifera:** Rich in antioxidants and nutrients that promote skin health.

#### 2. Formulation Components

**Gel Base:** Choose a suitable gel base (e.g., carbomer gel, hydrogel) that provides stability and facilitates skin penetration. The collection of raw materials and chemicals were done from Ashokrao Mane Institute of Pharmacy, Ambap. All Ingredients and excipients used in the Table.

#### 3. Method of Preparation

In order to prepare the gel formulation, first dissolve carbopol 940 in distilled water. Next, add methyl paraben, propyl paraben, and glycerine, and let the mixture sit overnight. Consider the leaf extracts in propylene glycol, to which polymer dispersion was added later. After that, the remaining water was added, then triethanolamine was added while stirring constantly to get the pH down to 7 [9].



The various formulation of wound healing gel are shown in Table

Table 3: Formulation Table

Sr. No.	Ingredients	Batches			Role of Ingredients
		F <sub>1</sub>	F <sub>2</sub>	F <sub>3</sub>	
1.	Extract	0.5 gm	0.10 gm	0.15gm	Therapeutic Agent
2.	Carbopol 934	1.0 gm	1.5gm	1.8 gm	Thickener
3.	Propylene Glycol	8ml	10ml	12 ml	Humectant
4.	Methyl Paraben	0.4gm	0.2 gm	0.3 gm	Preservative
5.	Propyl Paraben	0.4 gm	0.1 gm	0.2 gm	Preservative
6.	Triethanolamine	qs	qs	qs	Neutralizer
7.	Glycerin	2 ml	1.2 ml	2.5 ml	Viscosity enhancer
8.	Distilled Water	Upto 100 ml	Upto 100 ml	Upto 100 ml	Vehicle

### Evaluation of gel

**1. Physical Appearance:** All the formulated herbal gels were checked for colour homogeneity by visual observation.

**2. pH:** A pH METER was used to measure the pH of a 1% aqueous solution of the produced gel formulations.

**3. Homogeneity:** Visual Inspection of herbal gel. All the formulated herbal gels were checked for colour homogeneity by visual observation. Look for any signs of uneven texture, color variations, or visible particulates that could indicate uneven distribution of herbal extracts or additives.

**4. Spreadability:** One gram of gel spread between two horizontal plates was used to measure the spread ability of gel

formulations 24 hours after penetration.

**5. Viscosity:** Gel compositions' viscosity was measured at 10 rpm using a Brook Field viscometer equipped with spindle no. 4.

### 6. Skin Irritation Test

**Patch Testing:** This involves applying a small amount of the herbal gel to a small area of skin, usually on the forearm or back, and observing for any immediate reactions like redness, itching, or swelling.

### Results and Discussion

#### Physicochemical evaluation of Gel

#### Extraction of powders

Table 4: Extraction values of Tridax and Moringa

Sample	Extraction Method	Solvent used	Wt. of sample	Extraction Value (%w/w)
<i>Tridax procumbens</i>	Maceration	Ethanol	100 gm	10% w/w
<i>Moringa oleifera</i>	Maceration	Ethanol	100 gm	10% w/w

### Physical Appearance

Table 5: Physical Appearance of gel

Sr. No.	Batch	Colour	Appearance
1.	F <sub>1</sub>	Light Green	Green
2.	F <sub>2</sub>	Green	Green
3.	F <sub>3</sub>	Dark Green	Green

All formulation batches were found to be homogeneous green gel preparations.

### Homogeneity

All developed gels were tested for homogeneity by visual inspection after the gels have been set in the container.

Table 6: Homogeneity of formulation

Sr. No.	Batch	Homogeneity
1.	F <sub>1</sub>	Homogenous
2.	F <sub>2</sub>	Homogenous
3.	F <sub>3</sub>	Homogenous

### Measurement of pH

The pH values of all prepared formulation ranged from 6-7 which are considered acceptable to avoid the risk of irritation upon application to the skin because adult skin pH is 5.

### Spreadability

The time in seconds require to separate the two slides was taken as measure of spreadability.

Table 7: PH and Spreadability of leaves extract formulation

Sr. No	Batch	PH	Spreadability (gm.sm/sec)
1.	F <sub>1</sub>	6.8/±0.03	16.10/±0.005
2.	F <sub>2</sub>	7.0/±0.03	15.40/±0.005
3.	F <sub>3</sub>	7.1/±0.03	15.35/±0.005

### Viscosity

Viscosity of gel was determined by using Brookfield rotational viscometer at 5, 10, 20, rpm. Each reading was taken after equilibrium of the sample at the end of two minutes. The samples were repeated three times.

Table 8: Viscosity Value of Herbal Gel

Sr. No.	rpm	Viscosity (Cps)
1.	5	3610±0.10
2.	10	3710±0.21
3.	15	4137±0.44

### Optimization of Batches

The formulation batches underwent optimization through physical examination, including pH, viscosity, spreadability, greasiness, homogeneity, washability, and stability studies. Batch F<sub>2</sub> from the formulation of the leaf extract gel was optimized by examining the evaluation parameters of all batches.

### Conclusion

The combination of *Tridax procumbens* and *Moringa oleifera* in wound healing formulations shows promising potential.

Both plants have been traditionally used for their medicinal properties, including anti-inflammatory, antimicrobial, and wound healing effects. By harnessing their synergistic properties, such formulations could offer enhanced wound healing capabilities, promoting faster recovery and reduced risk of infection. Further research and clinical studies are needed to fully explore and validate the efficacy and safety of these formulations for broader medical applications.

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