

# **Comparative Study of Herbal and Synthetic Wound Healing Agents**

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**Abstract:** *This review highlights the therapeutic value of medicinal plants and their extracts in promoting wound healing, as evidenced by numerous studies involving both herbal and synthetic wound care formulations. Various combinations of plant-based extracts have shown favorable properties such as good texture, easy application, and effective healing potential. Natural ingredients play a significant role in the formulation of effective wound treatment creams. Innovations in dermal delivery systems have further improved the utility of these natural agents. Collectively, these findings support the potential of herbal creams as safe and efficient alternatives for managing diverse wound types.*

*This comprehensive review provides detailed insights into wound classification, types of creams, their benefits and limitations, and the overall process for cream formulation. Additionally, it offers comparative analysis between herbal and synthetic creams available in the market, including methods for their evaluation. The study serves as a useful reference for researchers aiming to develop or optimize topical wound healing therapies*

*Wound healing is a complex biological process involving inflammation, proliferation, and tissue remodeling. Both herbal and synthetic agents are employed to accelerate wound repair. Herbal agents are derived from natural sources and have gained popularity due to fewer side effects and additional therapeutic benefits. On the other hand, synthetic drugs offer targeted and controlled action. This review compares herbal and synthetic wound healing agents based on mechanisms, efficacy, safety, and regulatory aspects.*

**Keywords:** Plants, Medicinal, Wound healing, Medicine, Traditional, Herbal, Synthetic

## **I. INTRODUCTION**

Medicinal plants and their derivatives have shown promising effects in enhancing the wound healing process, as supported by various scientific studies. Both herbal and commercially available wound care creams have demonstrated positive outcomes in wound management. When combined, different herbal extracts have exhibited excellent formulation properties, including suitable consistency, ease of application, and effective healing action.

Natural ingredients have emerged as crucial components in the development of optimal wound healing formulations. Recent advancements in transdermal drug delivery technologies have further improved the delivery efficiency of these natural agents. Such developments highlight the potential of using plant-based creams as reliable, safe, and effective therapeutic options for treating a wide range of wound types.

Wound healing is a physiological response to tissue injury that restores skin integrity. The process includes hemostasis, inflammation, proliferation, and remodeling. With the growing interest in alternative medicine, herbal products are being evaluated for their wound healing properties. However, synthetic agents remain the mainstream choice in clinical practice due to their standardization and faster results. A comparative study helps to understand their respective strengths and limitations.

### **WOUND:**

A wound is a disruption in the skin's continuity. "Disruption of normal anatomic structures and function" is the explanation provided for it. Wounds continued to be an emotive clinical problem in everyday life, having both early and late repercussions routinely resulting in morbidity and mortality.



### **TYPES OF HERBAL CREAMS**

Skin creams are divided into groups based on their functions, which include massage, foundation, cleansing, and special attributes like cooling or disappearing creams. the emulsion types. Four different kinds of creams,

- **COLD CREAM**
- **VANISHING CREAM**
- **CLEANSING CREAM**
- **MOISTURISING CREAM**

#### **COLD CREAM:**

The water in oil emulsion is alluded to as cold cream. Compared to other semi-solid dose shapes or definitions that are cold cream conveys an amplified contact time at the application location. They make the skin show up more exquisite and less sleek. The oil stage feeds the skin significant emollience. The objective of the cold cream is to cool the body and refill dampness to dry skin through disposing of flotsam and jetsam from the pores. It is easy to evacuate absent and is effortlessly broken up in water. They fall flat to secure the skin in any other way. It deteriorates in common pores at body temperature.

#### **VANISHING CREAM:**

They are mixes of oil portray with water. They spread as a lean, imperceptible oil painting-like layer by layer over the furthest layer of the skin when connected to the confront. They have ended up known as vanishing creams since a result. It is made by utilizing an antacid that incorporates potassium hydroxide, sodium hydroxide, borax, etc. for emulsifying stearic corrosive and water. One of the key components in vanishing cream the truth that gives the cream their magnificent white colour is stearic corrosive. dissipating cream produces improved action in conjunction with less negative results when it is defined with a botanical extricate of neem and turmeric.

#### **MOISTURISING CREAM:**

The water in oil emulsion is recognized as moisturizing cream. Contrasting moisturizing cream to other semisolid dosage forms or formulations that are the previous type offers prolonged contact time at the application site. They make the skin appear delicate and less oily. The oil phase nourishes skin various emolliences. In spite of enabling contaminants to be eliminated through pores and refreshing the body, hydrating lotions also serve the purpose of supplementing moisture to dry skin. When applied to the skin, they cause not any discomfort. The water phase preserves the skin even further. At body temperature, it evaporates. It permeates the skin from the epidermis by natural pores

#### **CLEANSING CREAM:**

These creams are used for detoxifying the body and restore one's personal hygiene and splendour, as well as both which are necessary for applying makeup. Makeup, dirt, and oil can be eliminated mainly from the face and neck using cleansing creams or lotions.

### **WOUND HEALING HERBAL CREAMS**

Physical injuries that cause the skin to split or open up are called wounds. For the skin's compromised functional state and damaged anatomical continuity to be restored, wound healing must be done properly. Nowadays, the entire world including affluent nations recognizes the value of traditional medicine and promotes research on herbal or ethnomedical remedies since they are safer and less harmful.

#### **ALOE VERA:**

Aloe vera is widely recognized for its effectiveness in treating dry and irritated skin due to its ability to provide deep nourishment and natural hydration. Aloe vera-based creams typically have a light texture and are quickly absorbed by the skin. The gel-like components of the plant are renowned for their therapeutic properties, particularly in the



management of mild skin conditions. Aloe vera also serves as a beneficial ingredient in anti-aging skincare formulations. Its anti-inflammatory properties may help alleviate symptoms such as itching and redness associated with dermatological conditions like psoriasis. Additionally, it may offer relief for dry, itchy skin commonly seen in eczema. Inflammatory acne can also benefit from aloe vera's soothing effects. The plant contains six antiseptic agents capable of inhibiting the growth of bacteria, viruses, and fungi. When applied topically, aloe vera significantly enhances collagen production by stimulating and proliferating fibroblasts, thereby promoting more efficient wound healing.

#### **CEDRUS DEODARA:**

Creams containing *Cedrus deodara* extracts possess analgesic and anti-inflammatory properties, which help reduce pain, swelling, and inflammation. These qualities make them effective in the management of skin conditions associated with discomfort and itching. Furthermore, their antibacterial and antifungal activities support the treatment of various dermatological issues such as boils, acne, warts, and fungal infections. The presence of antioxidants in these formulations contributes to the protection of skin cells from oxidative stress, thereby helping to prevent or reduce signs of aging, including wrinkles and age spots. Additionally, *Cedrus deodara*-based creams have been shown to accelerate wound healing—such as in burns—by stimulating collagen production, neovascularization, and epithelial regeneration.

#### **Centella asiatica:**

*Centella asiatica* plays a significant role in enhancing skin hydration and reducing transepidermal water loss. Its extract contains a range of bioactive compounds, including triterpenoid saponins, flavonoids, and phenolic acids, which contribute to its moisturizing effects. Additionally, *Centella asiatica* exhibits various pharmacological activities, notably anti-inflammatory properties. The antimicrobial action of its formulations can aid in the treatment of several dermatological conditions such as acne, warts, and boils. Furthermore, *Centella asiatica* has demonstrated both antibacterial and antifungal activities, supporting wound healing and promoting skin regeneration.

#### **Chamomilla recutita:**

Chamomile-based creams possess strong anti-inflammatory properties, primarily due to active constituents such as chamazulene and alpha-bisabolol. These formulations are particularly beneficial for sensitive or inflamed skin, as they help soothe and calm irritation. Chamomile creams can effectively reduce symptoms like redness, itching, and discomfort associated with conditions such as eczema and dermatitis. Rich in flavonoids and other antioxidants, chamomile helps neutralize free radicals, thereby protecting the skin from damage and premature aging. Additionally, its mild antibacterial properties support the natural healing of minor wounds, cuts, and abrasions. The combined anti-inflammatory and antioxidant effects make chamomile a valuable ingredient in dermatological preparations.

#### **Calendula officinalis:**

Calendula-containing creams exhibit notable anti-inflammatory properties that help soothe sensitive and irritated skin. These formulations are commonly used in managing mild burns, eczema, and dermatitis. The presence of flavonoids and terpenoids contributes to their antibacterial and wound-healing capabilities, promoting the recovery of minor cuts, scratches, and abrasions. Calendula creams also enhance skin hydration by minimizing transepidermal water loss. Their use has shown effectiveness in improving the appearance of scars, acne, and pimples. Moreover, the antibacterial activity of calendula supports the treatment of various skin conditions. Regular application may contribute to maintaining smooth, even-toned, and youthful-looking skin.

#### **Chromolaena odorata:**

Extracts of *Chromolaena odorata* incorporated into creams have demonstrated effectiveness in addressing and preventing common signs of skin aging, such as wrinkles, fine lines, sagging, hyperpigmentation, and age spots caused by chronoaging and photoaging. Rich in potent antioxidants, these extracts protect fibroblasts and keratinocytes in vitro, potentially enhancing the skin's natural wound-healing process. Furthermore, *Chromolaena odorata* exhibits antibacterial activity, which supports wound healing and may aid in managing various skin infections.



#### **Azadirachta indica:**

Azadirachta indica, commonly known as Neem, has long been valued for its therapeutic properties in traditional medicine. It is effective in managing a variety of skin conditions, including ulcers, boils, eczema, scabies, burning sensations, and uneven pigmentation. Neem-based formulations may help regulate skin pigmentation and support overall skin health. According to existing medical literature, topical application of Azadirachta indica cream is considered safe, with no reported adverse effects, and it is generally regarded as safe for use during pregnancy and lactation.

#### **Curcuma longa:**

Extracts of Curcuma longa, rich in curcumin, are widely used in topical formulations to manage various skin conditions such as dryness, psoriasis, eczema, hyperpigmentation, dark spots, and acne. Due to its potent germicidal and antioxidant properties, turmeric can help delay skin aging, protect against damage, and support wound healing. The key bioactive compounds contributing to its dermatological benefits include curcumin, desmethoxycurcumin, and turmerones. Turmeric creams are typically formulated as oil-in-water emulsions, often incorporating excipients such as urea, cyclodextrin, titanium dioxide, and cellulose derivatives. Ensuring formulation stability and effective skin penetration is essential for maximizing the therapeutic potential of turmeric-based creams.

#### **Echinacea:**

Creams formulated with Echinacea are beneficial in managing chronic skin conditions such as acne and infected eczema. These products help maintain overall skin health and soothe irritated, blemish-prone skin. Extracts used in such formulations are typically derived from freshly harvested, organically grown Echinacea purpurea herb and root, favoring fresh tinctures over dried plant material to preserve bioactivity. Due to their lightweight and non-greasy texture, Echinacea creams are suitable for daily skincare routines, functioning effectively as facial moisturizers and performing well under makeup.

#### **Ginkgo biloba:**

Ginkgo biloba extract is rich in potent antioxidants such as flavonoids and terpenoids, which help combat oxidative stress and reduce inflammation, thereby promoting overall skin health and appearance. Creams containing Ginkgo biloba may contribute to skin brightening and support a more youthful, revitalized look. Regular application has been associated with improved skin texture, enhanced firmness, and a noticeable reduction in the appearance of fine lines and wrinkles. These visible anti-aging effects, combined with good tolerability, make Ginkgo biloba creams suitable for daily skincare routines.

**Table:1 Wound healing herbs and therapeutic effects**

Main Ingredients	Therapeutic Effects
Aloe Vera	Anti-inflammatory, antimicrobial activity, wounds.
Cedrus deodara	Anti-inflammatory, wound-healing, antibacterial, cure infected wounds.
Centella asiatica	Treatment of skin diseases, wounds, and leprosy
Chamomilla recutita	Antibacterial, anti-inflammatory, antioxidant, and wound-healing medication
Calendula officinalis (marigold)	Anti-inflammatory, antibacterial activities; increase fibroblast migration
Chromolaena odorata	Treatment of soft tissue and burn wounds, wound healing
Azadirachta indica	Antibacterial, antifungal, antiviral, and anti-inflammatory activities, improve wound healing
Curcuma longa	Antiseptic, antimicrobial, <i>antiviral</i> , antifungal, and anti-inflammatory, wound healing
Echinacea	Wound healing and wound contraction



**Ginko biloba**

Improved mental clarity, antioxidant, membrane stabilizing, pro-healing, and increased blood fluidity

### **Synthetic Wound Healing Creams:**

In the fields of biotechnology and medicine, antibiotics are highly compatible with formulations that have specific chemical structures. Over the past few decades, various antibiotic-infused hydrogels have been developed for use as antibacterial coatings and for treating conditions such as diabetic wounds, burns, and minor injuries. These materials promote faster healing and help prevent infections by delivering antibiotics directly to the wound site. The localized application of antibiotics significantly reduces the unwanted side effects that are often associated with systemic administration.

#### **Soframycin:**

**Soframycin creams contain the antibiotic framycetin, which helps stop the growth of bacteria on the skin. These creams** are effective in treating minor burns, cuts, and skin infections. They are also used for managing external ear infections, germ-infected open wounds, and bacterial infections affecting the skin, hair, and nails. Soframycin-based creams are particularly beneficial in treating bacterial skin conditions like impetigo, boils, and infected hair follicles.

#### **Neosporin:**

Neosporin creams contain three key antibiotics: polymyxin B, bacitracin, and neomycin. These formulations are used to treat and prevent surface-level bacterial infections that may result from accidental cuts, scrapes, minor burns, wounds, or surgical stitches. They are effective against bacterial skin conditions like boils, infected hair follicles, and impetigo. Neosporin works by inhibiting the growth of bacteria responsible for skin infections, thereby supporting the healing process of minor injuries.

#### **Silver Nitrate:**

Silver nitrate creams contain silver nitrate, a compound known for its antiseptic and antibacterial properties. It functions by releasing silver ions into the skin, which destroy or inhibit the growth of harmful microorganisms. These creams are used to treat minor skin injuries by stopping bleeding, cauterizing the affected tissue, and preventing infection. Additionally, silver nitrate can be used for the removal of skin tags and warts.

#### **Cetrimide:**

Cetrimide-based creams are effective in preventing and treating infections in minor burns, cuts, abrasions, and wounds. They help maintain cleanliness in the affected area. These creams can also be used to manage skin inflammation such as seborrheic dermatitis. Due to its antibacterial, antifungal, and antiseptic properties, cetrimide kills microorganisms and prevents their growth.

#### **Betadine:**

Betadine creams contain povidone-iodine, a powerful antiseptic effective against harmful bacteria, viruses, and fungi. These creams are used to treat minor burns, cuts, scrapes, and abrasions. By forming a protective barrier, they help prevent infections and support the healing process. Betadine is also useful for treating conditions affecting the skin and mucous membranes, such as cold sores, canker sores, and oral discomfort.

#### **Silver Sulfadiazine:**

Silver sulfadiazine creams contain an antibiotic that prevents bacterial growth on the skin. These creams are used to treat and protect against infections in minor burns, cuts, and wounds. By inhibiting bacterial activity, they reduce inflammation and promote faster healing.

#### **Ciprofloxacin:**

Ciprofloxacin creams contain the active ingredient ciprofloxacin and are used to treat various conditions, including bacterial skin infections, fluid accumulation in the retina, and fungal infections in skin folds and the underarm area. These creams work by stopping bacteria from multiplying through the inhibition of DNA synthesis.





#### Minocycline:

Minocycline creams contain the active ingredient minocycline and are used to treat skin conditions such as rosacea, acne, impetigo, cellulitis, and folliculitis. These creams help reduce inflammation, support healing, and inhibit the growth of bacteria responsible for infections.

#### Cotrimoxazole:

Cotrimoxazole creams contain a combination of antimicrobial agents, including sulfamethoxazole, as their active ingredients. These creams are used to treat fungal infections, acne breakouts, rosacea, and various microbial skin infections. They work by reducing inflammation, speeding up healing, and preventing the growth of bacteria and fungi that cause infections.

#### Clindamycin:

Clindamycin creams contain clindamycin as the key active ingredient and are used to treat bacterial and fungal infections, as well as acne, rosacea, and other skin conditions. These creams work by reducing inflammation and promoting healing through the inhibition of bacteria and fungi that cause infections.

Table:2 Wound healing synthetic and therapeutic effects

MAIN INGREDIENTS	THERAPEUTIC EFFECTS
Soframycin	Healing wounds, cuts, burns, inflammation.
Neosprin	Burns infections, minor cuts, and wounds.
Silver Nitrate	Wounds, anti-infective agent, antiseptic.
Cetrimide	Antiseptic, Healing wounds, minor burns, scalds.
Betadine	Antiseptic, minor cuts, abrasions, burns.
Silver Sulphadiazine	Treat wound, burns wounds.
Ciprofloxacin	Antibiotics, wound healing.
Minocycline	Antimicrobial, Acne vulgaris.
Cotrimoxazole	Soft tissue infections, Cellulitis, and abscess.
Clindamycin	Antibiotic, antimicrobial, Acne vulgaris.

Table:3 Comparative Analysis Table:

Parameter	Herbal Wound Healing Agents	Synthetic Wound Healing Agents
Source	Derived from natural plant-based materials (e.g., Aloe vera, turmeric, neem, etc.)	Chemically synthesized in laboratories (e.g., Silver sulfadiazine, povidone-iodine)
Mechanism of Action	Anti-inflammatory, antioxidant, antimicrobial, and cell-proliferation activities	Antimicrobial, enzymatic debridement, and moisture balance control
Side Effects	Generally fewer side effects; low toxicity	May cause allergic reactions, irritation, or cytotoxicity
Cost	Often less expensive due to raw material availability	Usually more expensive due to production and regulation
Availability	Easily available through traditional medicine	Require prescription and are regulated
Shelf Life	Shorter due to natural	Longer due to chemical stability



	composition	
<b>Regulatory Approval</b>	May lack standardization; not always FDA/WHO approved	Well-regulated, standardized formulations
<b>Example Agents</b>	Aloe vera, Centella asiatica, Curcuma longa, honey	Silver sulfadiazine, Nitrofurazone, Povidone-iodine, Bacitracin
<b>Patient Acceptance</b>	Preferred by those seeking natural remedies	Preferred in clinical settings for standardized action
<b>Clinical Evidence</b>	Limited controlled trials; mostly traditional use	Extensive clinical trials and established evidence

### Regulatory and Quality Considerations

Herbal products often face challenges in standardization, quality control, and regulatory approval. Synthetic drugs undergo rigorous trials and quality checks before market release. Regulatory bodies like WHO, FDA, and AYUSH are involved in ensuring safety and efficacy.

## II. CONCLUSION

Both herbal and synthetic agents have valuable roles in wound healing. Herbal remedies offer holistic benefits with minimal side effects, especially in chronic or minor wounds. Synthetic agents are essential for acute, infected, or severe wounds due to their rapid and targeted action. A combination approach or integrated wound care using both types may offer enhanced outcomes. The herbal/traditional therapeutic segment is restricted due to the need of clinical confirmations; be that as it may, it isn't a significant issue in current elective and complementary restorative period. The utilize of home grown items as helpful drugs, nutraceuticals and treatment choices for numerous a long time and eras without critical side impacts are affecting analysts around the world. Besides, being in normal shapes, these home grown restorative items are more secure than synthetic drugs. Within the setting of understanding atomic components, it is exceptionally troublesome to ponder pharmacokinetics and pharmacodynamics due to the accessibility of the numerous constituents, complexity, and their broad-spectrum bioactivity. The complexity, accessibility in purest shapes, species contrasts, and hereditary compositions of the plant constituents diminish the chances of standardization of strategies, quality, security, and viability measures. More or less, combination of 'omics' thinks about with bioinformatics and other expository methods may give apparatuses for analyzing these compounds at biomolecular level, their instrument of activity and metabolic changes in natural frameworks. In expansion, these expository strategies may be valuable in setting up the standardized chemical, pharmacological, and toxicological conventions. Inside another few a long time, it is likely to extend the evidence-based home in home grown medication and establish a all encompassing approach for both community drug specialists and customers with well-designed medicine conventions nearby in general pharmacovigilance of these items.

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