

***Butea Monosperma (Palash)* –Based Herbal Hydrogels Phytopharmaceutical Approaches in Wound Healing: A Review**

Achal Lilhare^{1*}, Urwashi Ghughre², Vaishali Budekar²

¹Department Of Pharmaceutics Research Scholler At Gondia College Of Pharmacy Chulod ,Gondia Mh Dr. Babasaheb Ambedkar Technological University, Lonere, Maharashtra 402103

²Department Of Pharmaceutics Assistant Professor At Gondia College Of Pharmacy Chulod ,Gondia Mh Dr. Babasaheb Ambedkar Technological University, Lonere, Maharashtra 402103

ABSTRACT

Wound healing is a complex and highly regulated biological process involving a coordinated sequence of cellular and molecular events. Despite significant advances in wound care management, the treatment of acute and chronic wounds remains a major clinical challenge due to delayed healing, risk of infection, antimicrobial resistance, and the high cost of conventional therapies. Chronic wounds such as diabetic ulcers, pressure sores, and venous leg ulcers continue to impose a substantial burden on healthcare systems and significantly affect patients' quality of life. These limitations have driven the search for safer, effective, and affordable therapeutic alternatives. Herbal phytopharmaceuticals have gained considerable attention in recent years owing to their long history of traditional use, wide therapeutic potential, and relatively low incidence of adverse effects. Medicinal plants are rich sources of bioactive phytoconstituents, including flavonoids, tannins, phenolic compounds, and glycosides, which exhibit antioxidant, anti-inflammatory, antimicrobial, and tissue regenerative properties essential for effective wound healing. The scientific standardization and validation of such herbal medicines under the phytopharmaceutical framework have further strengthened their acceptance in modern healthcare. *Butea monosperma* (Palash), a well-known medicinal plant in traditional systems of medicine, has been extensively reported for its wound healing, anti-inflammatory, antimicrobial, and antioxidant activities. The presence of pharmacologically active constituents such as butrin, isobutrin, and other polyphenolic compounds contributes to its potential in accelerating wound contraction, enhancing collagen synthesis, and promoting epithelialization. The incorporation of herbal extracts into hydrogel-based topical delivery systems offers additional advantages in wound management. Hydrogels provide a moist wound environment, ensure prolonged contact of the drug with the wound surface, and allow controlled release of bioactive constituents, thereby enhancing therapeutic efficacy and patient compliance. The aim of this review is to comprehensively discuss the phytopharmaceutical development and evaluation of herbal hydrogels containing *Butea monosperma* leaf extract for wound healing activity. The review highlights current challenges in wound care, explores the therapeutic relevance of *Butea monosperma*, and emphasizes the role of hydrogel-based topical systems as a promising approach for effective and sustainable wound management.

Keywords: *Butea monosperma*, Palash, Herbal hydrogel, Wound healing, Phytopharmaceuticals, Topical drug delivery

INTRODUCTION

Wound healing is a complex and dynamic biological process that plays a crucial role in maintaining the integrity and function of the skin. Acute and chronic wounds represent a significant global health problem, affecting millions of individuals worldwide and

imposing a substantial burden on healthcare systems. Acute wounds, such as surgical incisions, burns, and traumatic injuries, usually heal in a predictable and timely manner. In contrast, chronic wounds—including diabetic foot ulcers, pressure ulcers, and venous leg ulcers—fail to progress through the normal stages of healing and often persist for

Relevant conflicts of interest/financial disclosures: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

prolonged periods. The increasing prevalence of diabetes, aging populations, obesity, and vascular disorders has contributed to a steady rise in the incidence of chronic wounds, leading to increased morbidity, risk of infection, reduced quality of life, and higher healthcare costs. Conventional wound care therapies primarily include the use of synthetic drugs, antiseptics, antibiotics, and advanced dressings. While these approaches are effective in many cases, they are associated with several limitations. Prolonged use of topical antibiotics can lead to antimicrobial resistance, hypersensitivity reactions, and delayed wound healing. Some synthetic wound care agents may cause skin irritation, cytotoxicity to regenerating cells, or inadequate moisture balance at the wound site. Additionally, the high cost of advanced wound care products and the need for frequent clinical monitoring limit their accessibility, particularly in low- and middle-income regions.

In recent years, there has been a growing interest in herbal and natural wound healing agents as safer and more cost-effective alternatives to conventional therapies. Medicinal plants have been used for centuries in traditional systems of medicine for the treatment of wounds and skin disorders. Herbal extracts are rich in bioactive phytoconstituents such as flavonoids, tannins, phenolic compounds, and glycosides, which exhibit antioxidant, anti-inflammatory, antimicrobial, and collagen-promoting properties. These multifaceted mechanisms are particularly beneficial in wound healing, as they address multiple pathological factors simultaneously. Moreover, herbal formulations are generally well tolerated, biodegradable, and associated with fewer adverse effects, increasing patient acceptance and compliance. The concept of phytopharmaceutical-based topical systems has emerged as a promising strategy to bridge traditional herbal medicine with modern drug delivery approaches. Phytopharmaceuticals emphasize the standardization, quality control, and scientific validation of herbal products, ensuring reproducible therapeutic outcomes. When incorporated into advanced topical delivery systems such as hydrogels, herbal extracts can be delivered in a controlled and targeted manner directly to the wound site. Hydrogels provide a moist environment that promotes tissue regeneration, enhances drug residence time, and improves the

stability and bioavailability of phytoconstituents. This combination offers a rational and effective approach for improving wound healing outcomes. The objective of this review is to critically analyze the phytopharmaceutical development and evaluation of herbal hydrogels containing *Butea monosperma* leaf extract for wound healing activity. The review aims to highlight the global significance of wound management, discuss the limitations of conventional therapies, explore the therapeutic potential of *Butea monosperma*, and evaluate the role of hydrogel-based topical systems in enhancing wound healing efficacy.

2. Physiology of Wound Healing

Wound healing is a highly organized and dynamic physiological process that restores the structural and functional integrity of damaged tissue. It involves the coordinated interaction of various cell types, growth factors, cytokines, and extracellular matrix components. The process occurs through a sequence of overlapping phases, and any disruption in these stages can delay healing and result in chronic wounds.

2.1 Phases of Wound Healing

Hemostasis

Hemostasis is the immediate response to tissue injury and begins within minutes after wounding. It involves vasoconstriction and the activation of platelets, leading to clot formation at the injury site. The blood clot acts as a temporary matrix that prevents excessive blood loss and serves as a scaffold for the migration of inflammatory cells. Platelets also release growth factors that initiate the subsequent phases of wound healing.

Inflammation

The inflammatory phase follows hemostasis and is characterized by vasodilation and increased vascular permeability. Neutrophils and macrophages migrate to the wound site to remove debris, dead tissue, and invading microorganisms through phagocytosis. These cells release cytokines and growth factors that regulate immune responses and stimulate tissue repair. Although inflammation is essential for wound healing, prolonged or excessive inflammation can impair the healing process.



Proliferation

The proliferative phase involves the formation of new tissue and restoration of the wound surface. Fibroblasts play a key role by synthesizing collagen and other extracellular matrix components. Angiogenesis occurs to supply oxygen and nutrients to the regenerating tissue, while keratinocytes migrate to re-epithelialize the wound. Granulation tissue formation is a hallmark of this phase, indicating active wound repair.

Remodeling

Remodeling, also known as the maturation phase, is the final stage of wound healing and may continue for several weeks or months. During this phase, collagen fibers are reorganized and replaced with stronger collagen, leading to increased tensile strength of the healed tissue. Excess cells undergo apoptosis, and the wound gradually contracts, resulting in scar formation. Although the healed tissue regains strength, it rarely reaches the tensile strength of uninjured skin.

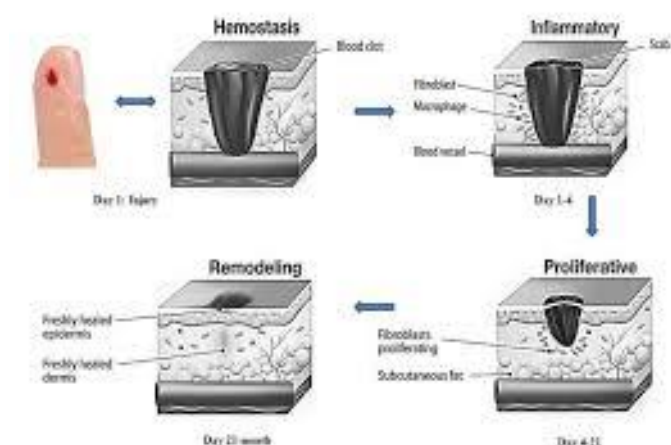


Figure 1: Phases of Wound Healing

2.2 Factors Affecting Wound Healing

Infection

Infection is one of the most common factors that delay wound healing. The presence of pathogenic microorganisms prolongs the inflammatory phase, increases tissue damage, and interferes with collagen synthesis. Infected wounds often exhibit excessive exudate, delayed epithelialization, and increased risk of chronicity.

Diabetes

Diabetes mellitus significantly impairs wound healing due to poor glycemic control, reduced blood flow, and neuropathy. Hyperglycemia alters immune function, reduces collagen production, and delays angiogenesis, leading to prolonged healing time and increased susceptibility to infection.

Oxidative Stress

Excessive production of reactive oxygen species (ROS) at the wound site results in oxidative stress, which damages cellular components and impairs normal healing processes. While low levels of ROS are essential for defense mechanisms, elevated levels can inhibit fibroblast activity and delay tissue regeneration.

Poor Vascularization

Adequate blood supply is essential for delivering oxygen, nutrients, and immune cells to the wound site. Poor vascularization, often seen in elderly patients or individuals with vascular disorders, reduces angiogenesis and delays granulation tissue formation, ultimately slowing the wound healing process.

5. Herbal Drugs in Wound Management

Herbal drugs have been traditionally used for the treatment of wounds due to their natural origin, safety, and therapeutic effectiveness. In recent years, interest



in herbal wound healing agents has increased because of the limitations associated with conventional therapies, such as drug resistance, high cost, and adverse effects. Medicinal plants contain diverse bioactive phytoconstituents that play an important role in tissue repair and regeneration. Plant-derived compounds such as flavonoids, tannins, phenolic compounds, and terpenoids exhibit antioxidant, anti-inflammatory, antimicrobial, and collagen-promoting activities. These properties help in reducing infection, controlling inflammation, and accelerating wound contraction and epithelialization. Unlike synthetic

drugs, herbal agents act through multiple mechanisms, which enhances overall wound healing.

Herbal formulations are generally well tolerated and suitable for long-term use. When incorporated into topical delivery systems, they provide localized action with minimal systemic exposure. Thus, herbal drugs represent a promising and effective approach for wound management and serve as a strong foundation for the development of phytopharmaceutical-based wound healing therapies.

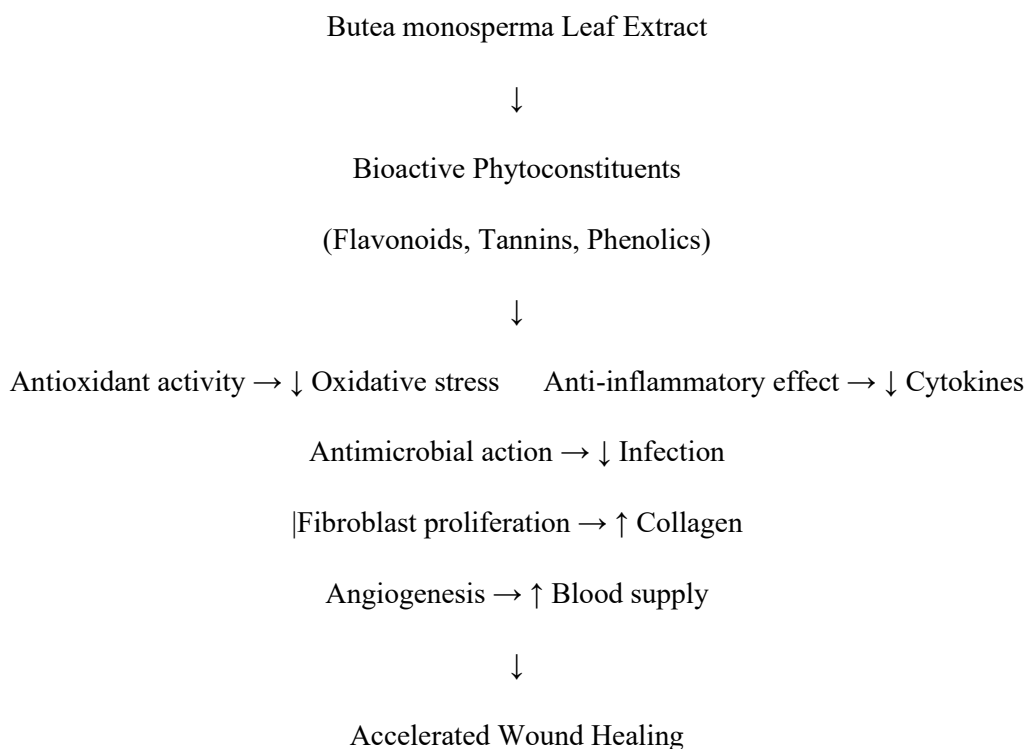


Figure 2: Role of Butea monosperma in Wound Healing

3. Botanical and Pharmacognostical Profile of *Butea monosperma*



Figure no 3 Butea monosperma

3.1 Taxonomical Classification

Butea monosperma (Lam.) Taub. belongs to the family **Fabaceae**. It is commonly known as Palash or Flame of the Forest and is a well-recognized medicinal plant in traditional systems of medicine.

3.2 Botanical Description

Butea monosperma is a medium-sized deciduous tree characterized by trifoliate leaves, rough grayish bark, and bright orange-red flowers. The leaves are large, leathery, and broadly ovate, while the plant exudes a reddish gum when injured, which is also used medicinally.

Table 1: Taxonomical Classification of *Butea monosperma*

Rank	Classification
Kingdom	Plantae
Division	Angiosperms
Class	Dicotyledonae
Order	Fabales
Family	Fabaceae
Genus	<i>Butea</i>
Species	<i>Butea monosperma</i> (Lam.) Taub.

4. Phytochemical Constituents of *Butea monosperma*

3.3 Geographical Distribution

The plant is widely distributed throughout India, Sri Lanka, Nepal, Myanmar, and other tropical regions of South and Southeast Asia. It commonly grows in dry deciduous forests and open grasslands.

3.4 Traditional and Ethnomedicinal Uses

Traditionally, *Butea monosperma* has been used for the treatment of wounds, burns, ulcers, skin infections, inflammation, and microbial disorders. Various parts of the plant, including leaves, bark, flowers, and gum, are used in folk medicine for their healing and protective properties.

Butea monosperma is rich in bioactive phytoconstituents such as flavonoids (butrin and isobutrin), tannins, glycosides, steroids, and phenolic compounds. These constituents are responsible for its broad pharmacological and therapeutic potential, particularly in wound healing applications.

4.1 Role of Phytoconstituents in Wound Healing

The antioxidant properties of flavonoids and phenolic compounds help reduce oxidative stress at the wound site, protecting newly formed tissues. These phytoconstituents enhance fibroblast proliferation, leading to increased collagen deposition and faster wound contraction. Additionally, they promote angiogenesis, improving blood supply and nutrient delivery to the healing tissue.

Table 2: Phytochemical Constituents and Their Role in Wound Healing

Phytoconstituent	Major Compounds	Role in Wound Healing
Flavonoids	Butrin, Isobutrin	Antioxidant, angiogenesis
Tannins	Polyphenols	Astringent, antimicrobial
Glycosides	Various	Tissue regeneration
Steroids	Phytosterols	Anti-inflammatory
Phenolic compounds	Phenolic acids	Free radical scavenging

5. Pharmacological Activities Relevant to Wound Healing

Butea monosperma exhibits significant anti-inflammatory activity by modulating inflammatory

mediators, thereby preventing prolonged inflammation. Its antimicrobial properties help protect wounds from bacterial and fungal infections. The strong antioxidant activity aids in neutralizing free radicals, supporting tissue regeneration.



Furthermore, the plant enhances collagen synthesis and improves tensile strength of healed tissue, contributing to faster and more effective wound healing.

6. Phytopharmaceutical Approach in Herbal Wound Therapy

The phytopharmaceutical approach focuses on the scientific development, standardization, and validation of herbal medicines to ensure consistent quality, safety, and efficacy. Unlike traditional herbal formulations, phytopharmaceuticals emphasize the identification of active phytoconstituents, quality control of raw materials, and reproducible therapeutic outcomes. This approach helps bridge the gap between traditional medicine and modern pharmaceutical science. In wound healing therapy, phytopharmaceuticals offer a rational strategy by utilizing standardized herbal extracts with proven pharmacological activities. Regulatory frameworks such as those provided by WHO, AYUSH, and CDSCO support the development of herbal products with defined specifications. The phytopharmaceutical concept enhances the credibility and clinical acceptance of herbal wound healing formulations.

7. Hydrogel Drug Delivery System

Hydrogels are three-dimensional, hydrophilic polymeric networks capable of absorbing and retaining large amounts of water. They are widely used in topical and wound care applications due to their ability to maintain a moist environment, which is essential for effective wound healing. Hydrogels also provide cooling and soothing effects, reducing pain and discomfort at the wound site. In wound management, hydrogel systems offer several advantages, including prolonged contact time with the wound surface, controlled release of active constituents, and improved drug stability. Both natural and synthetic polymers such as carbopol, HPMC, chitosan, and sodium alginate are commonly used in hydrogel formulations. When herbal extracts like *Butea monosperma* are incorporated into hydrogels, the system enhances bioavailability and therapeutic efficacy, making hydrogel-based phytopharmaceuticals a promising approach for wound healing.

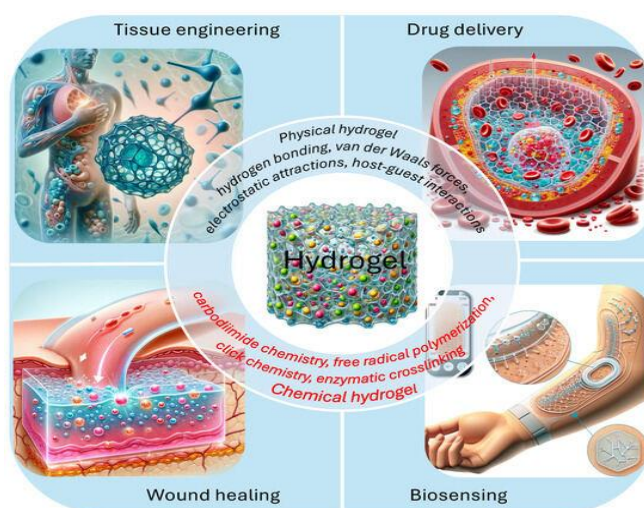


Figure 3: Herbal Hydrogel-Based Topical Delivery System

8. Herbal Hydrogel Formulation Containing *Butea monosperma*

8.1 Selection of Extract and Solvent

The selection of plant extract and extraction solvent plays a crucial role in determining the therapeutic

efficacy of the herbal hydrogel. Hydroalcoholic or alcoholic solvents are commonly used for *Butea monosperma* leaf extraction as they efficiently extract flavonoids, phenolic compounds, and other bioactive constituents responsible for wound healing activity.

8.2 Formulation Components



The formulation mainly consists of *Butea monosperma* leaf extract, a suitable gelling polymer, humectants, preservatives, and purified water. Polymers such as carbopol, HPMC, chitosan, or sodium alginate are preferred due to their biocompatibility, film-forming ability, and wound-friendly nature.

8.3 Preparation Methods

Herbal hydrogels are typically prepared by dispersing the polymer in water followed by hydration and swelling. The plant extract is then incorporated under

continuous stirring to ensure uniform distribution. pH adjustment is carried out to obtain a skin-compatible formulation with good consistency and stability.

8.4 Drug–Polymer Compatibility

Drug–polymer compatibility studies are essential to confirm the stability of the formulation. These studies ensure that there is no chemical interaction between the herbal extract and the polymer, which could otherwise affect the therapeutic efficacy and shelf life of the hydrogel.

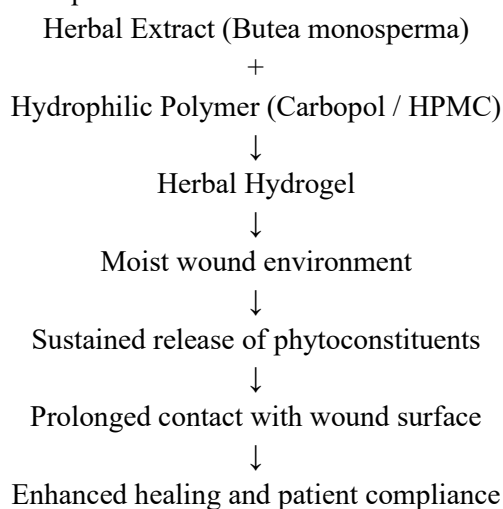


Figure no. 4 Formulation concept diagram

9. Evaluation Parameters of Herbal Hydrogel

9.1 Physicochemical Evaluation

The pH of the hydrogel is measured to ensure skin compatibility and minimize irritation. Viscosity is evaluated to assess the flow behavior and ease of application. Spreadability determines the ability of the hydrogel to spread uniformly over the wound surface, while homogeneity ensures the absence of lumps and uniform distribution of the extract.

9.2 In-Vitro Evaluation

In-vitro drug release studies are performed to assess the release pattern of bioactive constituents from the hydrogel. Antimicrobial studies evaluate the formulation's effectiveness against wound-associated microorganisms, confirming its protective role in wound healing.

9.3 In-Vivo Wound Healing Models

In-vivo evaluation is commonly carried out using animal models. The excision wound model is used to study wound contraction and epithelialization time. The incision wound model assesses tensile strength and collagen formation, while the dead space wound model evaluates granulation tissue formation and collagen deposition.

Table 3: Evaluation Parameters of Herbal Hydrogel

Evaluation Type	Parameters
Physicochemical	pH, viscosity, spreadability, homogeneity
In-vitro	Drug release, antimicrobial activity



Evaluation Type	Parameters
In-vivo	Wound contraction, epithelialization time, tensile strength

10. Reported Studies on *Butea monosperma*-Based Wound Healing Formulations

Several preclinical studies have reported the wound healing potential of *Butea monosperma* using different dosage forms such as extracts, gels, ointments, and topical preparations. These studies have demonstrated significant improvement in wound contraction, reduced epithelialization time, and enhanced tensile strength in experimental animal models. The wound healing activity has been mainly attributed to the presence of flavonoids, tannins, and phenolic compounds, which exhibit antioxidant, anti-inflammatory, and antimicrobial effects. Formulation-based studies have shown that topical delivery systems, particularly gels and hydrogels, enhance the therapeutic performance of *Butea monosperma* extracts by improving drug retention at the wound site and providing controlled release of bioactive constituents. However, most reported studies are limited to in-vivo animal models, and there is a lack of well-designed clinical trials to validate their efficacy in humans.

11. Challenges and Future Perspectives

Despite promising experimental evidence, several challenges remain in the development of *Butea monosperma*-based phytopharmaceuticals for wound healing. Variability in phytochemical composition due to differences in plant source, extraction method, and environmental conditions poses a major challenge for standardization and quality control. Limited clinical data and regulatory constraints further restrict large-scale commercialization of herbal wound care products. Future research should focus on the standardization of *Butea monosperma* extracts, identification of bioactive markers, and establishment of robust quality parameters. Advanced delivery systems such as nano-hydrogels, bioactive wound dressings, and polymer-based composite systems may further enhance therapeutic efficacy. Well-designed clinical trials are essential to confirm safety and effectiveness, paving the way for the successful

translation of *Butea monosperma*-based hydrogels into clinically acceptable wound healing formulations.

CONCLUSION

Wound healing remains a major clinical challenge, particularly in the management of chronic and non-healing wounds. The limitations associated with conventional wound care therapies have encouraged the exploration of safer and more effective alternatives. Herbal medicines, supported by traditional knowledge and emerging scientific evidence, offer a promising approach for wound management due to their multi-targeted actions and favorable safety profile. *Butea monosperma* possesses significant wound healing potential, which can be attributed to its rich phytochemical composition, including flavonoids, tannins, and phenolic compounds. These bioactive constituents contribute to antioxidant, anti-inflammatory, antimicrobial, and collagen-promoting activities that are essential for effective tissue repair. The incorporation of *Butea monosperma* leaf extract into hydrogel-based topical delivery systems further enhances its therapeutic efficacy by providing a moist wound environment, prolonged drug residence time, and controlled release of active compounds. The phytopharmaceutical approach ensures scientific validation, standardization, and quality control of herbal formulations, improving their clinical acceptance. Although preclinical studies demonstrate encouraging wound healing outcomes, further research is required to address standardization challenges and to establish clinical efficacy through well-designed human trials. Overall, herbal hydrogels containing *Butea monosperma* represent a promising and sustainable strategy for wound healing and have significant potential for development into effective phytopharmaceutical wound care products.

REFERENCES

1. Guo S, DiPietro LA. Factors affecting wound healing. J Dent Res. 2010;89(3):219–229.
2. Martin P. Wound healing—aiming for perfect skin regeneration. Science. 1997;276(5309):75–81.
3. Sen CK, Gordillo GM, Roy S, et al. Human skin wounds: a major and snowballing threat to public



- health and the economy. *Wound Repair Regen.* 2009;17(6):763–771.
4. Frykberg RG, Banks J. Challenges in the treatment of chronic wounds. *Adv Wound Care.* 2015;4(9):560–582.
 5. Boateng J, Catanzano O. Advanced therapeutic dressings for effective wound healing—A review. *J Pharm Sci.* 2015;104(11):3653–3680.
 6. Atiyeh BS, Costagliola M, Hayek SN, Dibo SA. Effect of silver on burn wound infection control and healing. *Burns.* 2007;33(2):139–148.
 7. Cowan MM. Plant products as antimicrobial agents. *Clin Microbiol Rev.* 1999;12(4):564–582.
 8. Thakur R, Jain N, Pathak R, Sandhu SS. Practices in wound healing studies of plants. *Evid Based Complement Alternat Med.* 2011;2011:438056.
 9. Patel S, Srivastava S, Singh MR, Singh D. Mechanistic insight into wound healing properties of herbal medicines. *J Ayurveda Integr Med.* 2019;10(1):1–10.
 10. Kumar B, Vijayakumar M, Govindarajan R, Pushpangadan P. Ethnopharmacological approaches to wound healing—Exploring medicinal plants of India. *J Ethnopharmacol.* 2007;114(2):103–113.
 11. Kokate CK, Purohit AP, Gokhale SB. *Pharmacognosy.* 55th ed. Pune: Nirali Prakashan; 2019.
 12. Kirtikar KR, Basu BD. *Indian Medicinal Plants.* Vol 1. Dehradun: International Book Distributors; 2005.
 13. Nadkarni KM. *Indian Materia Medica.* Vol 1. Mumbai: Popular Prakashan; 2007.
 14. Bhaskar VH, Balakrishnan N. Evaluation of wound healing activity of *Butea monosperma* in rats. *Indian J Pharmacol.* 2010;42(5):297–300.
 15. Sharma A, Shanker C, Tyagi LK, Singh M, Rao CV. Herbal medicine for wound healing: A market potential in India: An overview. *Acad J Plant Sci.* 2008;1(2):26–36.
 16. Trease GE, Evans WC. *Pharmacognosy.* 16th ed. London: Saunders Elsevier; 2009.
 17. Pandey A, Tripathi P, Pandey R, Srivastava R, Goswami S. Alternative therapies useful in the management of diabetes: A systematic review. *J Pharm Bioallied Sci.* 2011;3(4):504–512.
 18. Lodhi S, Pawar RS, Jain AP, Singhai AK. Wound healing potential of *Tephrosia purpurea* extract. *J Ethnopharmacol.* 2006;108(2):204–210.
 19. Boateng JS, Matthews KH, Stevens HN, Eccleston GM. Wound healing dressings and drug delivery systems: A review. *J Pharm Sci.* 2008;97(8):2892–2923.
 20. Gupta A, Kumar R. Healing potential of herbal drugs: A review. *Int J Pharm Sci Res.* 2015;6(3):918–926.
 21. Peppas NA, Bures P, Leobandung W, Ichikawa H. Hydrogels in pharmaceutical formulations. *Eur J Pharm Biopharm.* 2000;50(1):27–46.
 22. Ahmed EM. Hydrogel: Preparation, characterization, and applications. *J Adv Res.* 2015;6(2):105–121.
 23. Kamoun EA, Kenawy ERS, Chen X. A review on polymeric hydrogel membranes for wound dressing applications. *Arab J Chem.* 2017;10(S2):S3058–S3075.
 24. Singla R, Soni S, Patial V, Kulurkar PM, Kumari A, Mahesh S. Cytocompatible anti-microbial dressings of alginate–silver nanocomposites. *Int J Biol Macromol.* 2017;95:471–479.
 25. Shukla A, Rasik AM, Jain GK, Shankar R, Kulshrestha DK, Dhawan BN. In vitro and in vivo wound healing activity of asiaticoside isolated from *Centella asiatica*. *J Ethnopharmacol.* 1999;65(1):1–11.
 26. Chithra P, Sajithlal GB, Chandrakasan G. Influence of Aloe vera on collagen characteristics in healing dermal wounds in rats. *Mol Cell Biochem.* 1998;181(1–2):71–76.
 27. Mukherjee PK, Maity N, Nema NK, Sarkar BK. Bioactive compounds from natural resources against skin aging. *Phytomedicine.* 2011;19(1):64–73.
 28. World Health Organization. WHO guidelines on good agricultural and collection practices (GACP) for medicinal plants. Geneva: WHO; 2003.
 29. Ministry of AYUSH, Government of India. Guidelines for phytopharmaceutical drugs. New Delhi: AYUSH; 2015.
 30. Das S, Baker AB. Biomaterials and nanotherapeutics for enhancing skin wound healing. *Front Bioeng Biotechnol.* 2016;4:82.



HOW TO CITE: Achal Lilhare*, Urwashi Ghughre, Vaishali Budekar, Butea Monosperma (Palash) – Based Herbal Hydrogels Phytopharmaceutical Approaches in Wound Healing: A Review J. Pharm. Sci., 2026, 2 (2), 374-383.
[https:// 10.5281/zenodo.18684169](https://10.5281/zenodo.18684169)

