

The Use of Natural Ingredients as Topical Therapy for the Treatment of Second-Degree Burns: A Review Article

Ni Nyoman Ita Trisnadewi*, Desak Ketut Ernawati, Agung Nova Mahendra

Universitas Udayana, Indonesia

Email: itatrisna20@gmail.com*, ketuternawati@unud.ac.id, novamahendra@unud.ac.id

Abstract

Keywords

second degree burns; natural ingredients; topical therapy; phytochemical compounds.

Second-degree burns are skin tissue damage involving the epidermis and part of the dermis, requiring appropriate treatment to prevent infection and accelerate tissue regeneration. Conventional therapy remains the primary choice, but long-term use can cause certain side effects. This situation has encouraged the increasing use of natural ingredients as alternative therapies because they are considered safer, easier to obtain, and contain bioactive compounds that support the wound healing process. This review article aims to assess the potential of various natural ingredients as topical therapies for healing second-degree burns. The method used is a literature review of research articles published between 2021 and 2026 through Google Scholar, PubMed, ScienceDirect, and DOAJ. The results of this study indicate that various plants such as kepok banana, moringa, breadfruit, red dragon fruit, and other herbal plants are effective in the burn healing process through various dosage forms such as creams, gels, ointments, spray gels, and nanogels. The dominant phytochemical compounds found include flavonoids, saponins, tannins, alkaloids, and terpenoids, which act as anti-inflammatory, antibacterial, and antioxidant agents. Overall, natural ingredients have the potential to be developed as an alternative treatment for second-degree burns that is effective and easily accessible to the public.

INTRODUCTION

Burns are one of the incidents that cause damage to skin tissue. According to data from the World Health Organization (WHO, 2023), burns occur annually and are estimated to cause around 180,000 deaths, with the majority of these incidents occurring in low- and middle-income countries. Etiologically, these burns are most often caused by contact with thermal agents, including hot liquids, flames, electricity, chemicals, and radiation, and carry a high risk of infection due to the loss of skin barrier function.

Clinically, burns are grouped into four categories based on the depth of skin tissue damage, namely degree I (superficial, affecting only the epidermis), degree II (partial thickness, which includes the epidermis and part of the dermis), degree III (full thickness, which involves all layers of the skin to the subcutaneous tissue), and degree IV (reaching muscle, bone, or organs) (Jeschke et al., 2020). At the tissue level, burns cause damage to skin integrity, increase vascular permeability, and trigger inflammatory infiltration that exacerbates tissue damage and slows regeneration (Rowan et al., 2015).

Standard burn therapy using silver sulfadiazine (SSD) has long been the gold standard. Standard topical therapy for burns is effective as an antimicrobial; however, it has been reported to cause local irritation and delayed epithelialization due to inhibition of keratinocyte

migration. Prolonged use of this therapy can trigger mild systemic side effects, necessitating alternative treatment approaches that offer a higher level of safety and support tissue repair and remodeling (Dhua and Manne, 2025).

The novelty of this review article lies in five aspects. First, it comprehensively summarizes 18 plants tested for second-degree burn healing between 2021 and 2026, presenting them in a table for easy comparison. Second, it identifies patterns of plant part use (leaves being the most prevalent), dosage forms (creams, gels, and ointments being the most common), and phytochemical compounds (flavonoids being the most predominant) that have not been widely discussed in previous reviews. Third, it discusses the mechanisms of action of each phytochemical compound (flavonoids as antioxidants, tannins as antibacterials, saponins for collagen formation, alkaloids as anti-inflammatory agents, and terpenoids for tissue regeneration). Fourth, it covers the latest research through 2026, including innovations in dosage forms such as nanogels and spray gels. Fifth, it discusses practical implications for the development of herbal products that are accessible to the public, especially in areas with limited access to healthcare.

This situation may prompt scientific attention to re-explore the potential of natural ingredients as alternatives or adjuvants for topical burn therapy. Natural ingredients have been used in medicine for thousands of years in various healing traditions in Asia, Africa, and Latin America. The use of natural ingredients as alternative wound therapies is growing due to their relatively low side effects compared to synthetic ingredients. This use has attracted significant research attention due to their rich phytochemical content, multi-target mechanisms of action, and relatively better safety profile.

METHOD

This review article was compiled using a literature review method *by* collecting and analyzing various scientific articles discussing the use of natural ingredients in healing second-degree burns. The literature search was conducted through several *open access scientific databases*, namely *Google Scholar*, *PubMed*, *ScienceDirect*, and *DOAJ*. The selected articles were research articles published between 2021 and 2026. Keywords used in the article search included "natural ingredients", "second-degree burns", "wound healing", "burn wound", "herbal", and "second-degree burn". Data from the selected articles were analyzed descriptively, including the types of natural ingredients used, active compounds, mechanisms of action, dosage forms, and their effectiveness in the healing process of second-degree burns. The results of the analysis were then systematically compiled to provide a scientific overview of the potential of natural ingredients as alternative therapies for second-degree burns.

RESULTS AND DISCUSSION

Most studies indicate that natural ingredients have good potential as topical therapies for healing burns. Various dosage forms used include creams, gels, ointments, pregels, and nanogels, with varying concentrations influencing wound healing effectiveness. Based on screening results from several articles, several plant species have potential as burn treatments, tested on animal models, as shown in Table 1.

Table 1Plants for Treating Burns

Medicinal plants	Plant Parts	Compound Phytochemicals	Dosage Form	Best Concentration	Library
Durian (<i>Durio zibethinus L.</i>)	Fruit Seeds	– Flavonoid – Alkaloid – Triterpenoid – Phenolic	Ointment	15%	(Irwandi et al., 2021)
Kepok Banana (<i>Musa Paradisiaca Formatypica</i>)	Rind	– Flavonoid – Saponin – Steroid	Cream	2%	(Hariningsih & Hartono, 2022)
Tobacco (<i>Nicotiana tabacum L.</i>)	Leaf	– Alkaloid – Flavonoid – Saponin – Steroids/Trite rpenoids – Tannin – Polyphenols – Essential oil (nicotine)	Gel	12%	(Hutagalung et al., 2022)
Red Dragon Fruit (<i>Hylocereus polyrhizus</i>)	Rind	– Vitamin C – Flavonoid – Tannin – Alkaloid – Steroid – Saponin	Gel	20%	(Aisyah & Asparini, 2023)
Moringa (<i>Moringa oleifera Lam</i>)	Leaf	– Flavonoid – Tannin – Terpenoid – Alkaloid – Saponin	Cream	15%	(Pratama et al., 2023)
Pelleting (<i>Ruellia tuberosa L.</i>)	Leaf	– Flavonoid – Tannin – Saponin	Spray Gel	30%	(Mundriyastutik et al. , 2023)
Kirinyuh (<i>Chromolaena odorata</i>)	Leaf	– Flavonoid – Tannin – Saponin	Cream	30%	(Muhaira et al. , 2024)
Ambon Banana (<i>Musa paradisiaca var sapientum</i>)	Rind	– Alkaloid – Flavonoid – Tannin – Saponin – Terpenoid – Quinone	Gel	15%	(Nofita et al. , 2025)
Starfruit (<i>Averroa bilimbi L.</i>)	Fruit	– Flavonoid – Saponin – Alkaloid	Gel	10%	(Astuti & Fadhilaha, 2025)

Breadfruit (<i>Artocarpus altilis</i>)	Leaf	– Flavonoid – Saponin – Alkaloid – Terpenoid	Nanogel	3.125%	(Fitria & Astryna, 2025)
Honey Mango (<i>Mangifera indica L.</i>)	Leaf	– Flavonoid – Tannin – Saponin – Alkaloid – Phenol	Cream	15%	(Luh Ayu Surya Dianti et al., 2025)
Melinjo (<i>Gnetum gnemon L.</i>)	Leaf	– Flavonoid – Tannin – Saponin – Alkaloid	Cream	10%	(Sulaiman <i>et al.</i> , 2025)
Bidara (<i>Ziziphus mauritiana L.</i>)	Leaf	– Flavonoid – Tannin – Saponin – Alkaloid – Terpenoid	Gel	6%	(Simorangkir <i>et al.</i> , 2025)
Buni (<i>Antidesma bunius (L.) Spreng</i>)	Leaf	– Flavonoid – Tannin – Saponin – Alkaloid	Ointment	10%	(Putra et al., 2026)
Fragrant Pandan (<i>Pandanus amaryllifolius Roxb.</i>)	Leaf	– Alkaloid – Flavonoid – Saponin – Tannin – Polyphenols	Ointment	20%	(Harahap et al., 2026)

Durian seeds (*Durio zibethinus L.*) can be used as an active ingredient for burn healing because they contain alkaloids, phenolics, flavonoids, and triterpenoids, which play a role in the burn healing process. The seeds were chosen because they are rarely used but have a relatively high bioactive content. The seeds are extracted and made into an ointment so that the active ingredients can last longer in the wound area. Research results show that a 15% concentration can provide the best healing results based on wound healing, epithelialization, and histopathology of fibroblasts and collagen (Irwandi et al., 2021) .

Kepok banana peel (*Musa paradisiaca formatypica*) can be used as a burn treatment. Research shows that in the form of a cream preparation with a concentration of 2% has good physical stability and can heal burns faster than other formulations (Hariningsih and Hartono, 2022) . The peel part was chosen because it has previously been considered waste and has a high bioactive content, namely flavonoids, especially flavonoids 5,6,7,4'-tetrahydroxy-3-4-flavone-dio, saponins, and steroids, so it can help accelerate the wound healing process and support fibroblast activity (Hariningsih and Hartono, 2022) .

Tobacco leaves (*Nicotiana tabacum L.*) can be used as a medicine in healing burns because they contain alkaloids, flavonoids, steroids, terpenoids, and saponins that function as antibacterials and help in collagen formation. Research shows that a 15% concentration in gel

form is the most effective formulation with the fastest healing time on the 16th day and has results equivalent to conventional drugs (Hutagalung, Lubis and Klorida, 2022) .

Red dragon fruit (*Hylocereus polyrhizus*) peel is effective in treating burns due to its anti-inflammatory and antibacterial properties, which can accelerate the healing process due to its rich antioxidant content, particularly betalains and flavonoids. Research shows that a 20% concentration provides the best results in reducing the extent of IIA burns compared to concentrations of 10% and 15% (Aisyah, Asparini, and Wahjono, 2023) .

Moringa leaves (*Moringa oleifera* Lam.), known to stimulate breast milk production, can be used to treat burns. Research shows that a 15% concentration is most effective, with a quickest healing time of 13 days. This suggests that increasing the extract concentration significantly impacts burn healing effectiveness (Pratama, Putra, and Puspaningrat, 2023) . Moringa leaves are known to contain flavonoids, tannins, alkaloids, saponins, and terpenoids, all of which have potent anti-inflammatory and antioxidant properties, along with other secondary metabolites (Pratama, Putra, and Puspaningrat, 2023) .

Pletekan leaves (*Ruellia tuberosa* L) or known as purple kencana leaves which are wild plants, apparently contain phytochemical compounds such as flavonoids, saponins, and tannins that can help the anti-inflammatory process and accelerate wound healing. The results of the study showed that a concentration of 30% in the form of a spray gel preparation can provide the most effective burn healing effect compared to other concentrations and the reason for making it in the form of a spray gel preparation is to be more practical to use without direct contact with the wound, thereby reducing the risk of irritation (Mundriyastutik *et al.* , 2023) .

Kirinyuh leaves (*Chromolaena odorata* L.) can be used to treat burns because they contain tannins, phenols, flavonoids, saponins, and steroids, which have antibacterial activity. Research shows that a 30% concentration in a cream preparation can provide the most effective healing results, with a healing rate of up to 79% (Muhaira *et al.* , 2024) .

In addition to Kepok banana peel, Ambon banana peel (*Musa paradisiaca* var. *sapientum*) is known to be used as a burn treatment. The results of the study showed that a concentration of 15% in the form of a gel preparation can provide the best effectiveness in healing burns and cuts compared to concentrations of 5% and 10%. (Nofita *et al.* , 2025) . This shows that Ambon banana peel is known to contain flavonoids, saponins, tannins, alkaloids, quinones, and terpenoids that function as antioxidants and antibacterials.

Starfruit (*Averroa bilimbi* L) contains alkaloids, flavonoids, and saponins that can aid in anti-inflammatory and skin tissue regeneration. Research shows that a 10% concentration provides the best healing effect, with a healing rate of 86%, and a sampir equivalent to the positive control (Astuti and Fadhilaha, 2025) .

Breadfruit leaves (*Artocarpus altilis*) contain secondary metabolites that play an important role as anti-inflammatory and antibacterial agents so that they can accelerate the process of burn wound healing. The results of the study showed that a concentration of 3.125% in the nanogel preparation can provide the most effective results with a percentage reduction in wound diameter of 92.84% within 21 days (Fitria and Astryana, 2025) . The extract was made in the form of a nanogel preparation because it can increase the absorption of active substances through the skin and provide a more even distribution in the civet area (Fitria and Astryana, 2025) .

Honey mango leaves (*Mangifera indica* L.) are known to contain antioxidant and anti-inflammatory compounds that can help the healing process of burns. The results of research using mango leaf extract with a concentration of 15% in the form of a cream preparation can provide the most effective results in healing second-degree burns and provide the best effectiveness with an average wound healing of 0.41 ± 0.26 mm (Luh Ayu Surya Dianti, Aisyah and Hardiana, 2025) .

Gnetum *gnemon* L. leaves in the form of extracts made into cream preparations with a concentration of 10% can provide the best results in increasing the number of fibroblasts compared to concentrations of 2.5% and 5% (Sulaiman *et al.* , 2025) . It is known that gnetum leaves can increase the number of fibroblasts and can help collagen formation in burns.

Bidara leaves (*Ziziphus mauritiana* L) can be used to treat burns because they contain alkaloids, flavonoids, tannins, saponins, and terpenoids, which act as antibacterials and aid in skin regeneration. Research shows that a gel preparation with a concentration of 6% can accelerate the healing process of burns (Simorangkir *et al.* , 2025).

Buni leaves (*Antitisma buni* (L.) Spreng) in the form of an extract formulated in the form of an ointment and in a concentration of 10% showed the best results compared to concentrations of 2.5% and 5% because it provided a significant difference in accelerating the closure of burn wounds (Putra, Trias and Kusuma, 2026) . Buni leaves are known to contain flavonoids, tannins, saponins, and alkaloids which can accelerate the process of new tissue formation and prevent wound infection (Putra, Trias and Kusuma, 2026) .

Pandanus amaryllifolius leaves (*Pandanus amaryllifolius*) were used in the study because they are known to contain flavonoids, tannins, alkaloids, daponins, and polyphenols, which have anti-inflammatory and antibacterial activity, thus accelerating the regeneration process of burn tissue. Research shows that a 20% concentration in ointment form provides the best results in accelerating the reduction of burn wound diameter compared to concentrations of 10% and 15% (Harahap, Jayanti, and Gunawan, 2026) . This is because the higher the concentration of the extract, the greater the content of active compounds that work as anti-inflammatories and antibacterials in the wound area.

The use of natural ingredients as topical therapeutic agents for burn healing is currently gaining popularity because they are considered safer, readily available, have relatively few side effects, and contain various bioactive compounds that play a role in accelerating the wound healing process. Furthermore, people are also starting to utilize herbal plants as alternative treatments due to their more affordable prices. Various studies have shown that natural ingredients such as leaves, fruit peels, and other plant parts contain various phytochemical compounds with anti-inflammatory, antibacterial, and antioxidant activities, thus potentially being developed into topical preparations for burn therapy.

Based on the results of studies from various articles, the most commonly used dosage forms in burn therapy are creams, gels, and ointments, compared to nanogels and spray gels. The choice of dosage form is based on the characteristics of the natural extract and its ability to deliver the active ingredient to the core of the skin. In general, the choice of topical dosage form aims to increase the stability of the active ingredient, accelerate penetration into skin tissue, maintain wound moisture, and provide comfort during the treatment process.

Based on the plant parts used, most studies utilize leaves more than other plant parts, such as the fruit flesh, fruit peel, and other plant parts. This is because leaves are the primary

site of secondary metabolism in plants, resulting in higher bioactive compound content. Furthermore, leaves are easier to obtain, easier to process, and abundantly available without damaging the main plant. Some studies also use fruit peels, such as banana peels and dragon fruit peels, because these parts still contain high levels of active compounds, even though they are often considered waste. The use of fruit peels is attractive because they not only have economic value but also support the utilization of plant waste into useful products. Meanwhile, seeds, such as durian seeds, are used because they contain secondary metabolites that have the potential to accelerate tissue regeneration and collagen formation in burns.

The results of several article reviews also indicate that the most abundant phytochemical compounds found in these plants are flavonoids, saponins, tannins, alkaloids, and terpenoids. Of all the phytochemical compounds, flavonoids were the most dominant, found in almost all the plants studied. The antioxidant activity of flavonoids can ward off free radicals in damaged tissue, thereby accelerating the skin cell regeneration process.

CONCLUSION

Overall, the review results indicate that natural ingredients have significant potential as topical therapies for second-degree burns. The most commonly used plant part is the leaves due to their high secondary metabolite content and easy availability. The most frequently used dosage forms are creams, gels, and ointments because they can increase the effectiveness of active ingredient delivery, maintain wound moisture, and provide comfort during application. The most dominant phytochemical compounds found are flavonoids, supported by other metabolites such as saponins, tannins, alkaloids, and terpenoids. These compounds act as anti-inflammatory, antibacterial, and antioxidants, thus helping to accelerate skin tissue regeneration. Overall, the use of natural ingredients has shown good effectiveness and has the potential to be further developed as an alternative therapy for burn treatment that is safe, effective, and easily accessible to the public.

REFERENCES

- Aisyah, C., & Asparini, R. R. (2023). The Effect Of Red Dragon Fruit Peel Extract Gel On Rattus Norvegicus Strain Wistar Of Grade Iia Burns Surface Area. *APISIO Medica*, 1(1), 11–17.
- Astuti, D. P., & Fadhilaha, A. (2025). Effectiveness of Healing Second Degree Burns Gel Preparation of bilimbi Extract (*Averroa bilimbi* L.) Against Male Wistar Rats. *Journal of Pharmaceutical and Sciences*, 2025(2), 903–912. <https://doi.org/10.36490/JOURNAL-JPS.COM.V8I2.847>
- Fitria, F., & Astrya, S. (2025). Aktivitas Antiinflamasi Nanogel Ekstraks Etanol Daun Sukun Pada Tikus Putih Jantan Yang Mengalami Luka Bakar Derajat II. *Jurnal.Uui.Ac.IdF Fitria, SY Astrya, S Samaniyah* *JOURNAL OF HEALTHCARE TECHNOLOGY AND MEDICINE*, 2025•*jurnal.Uui.Ac.Id*, 11(1), 2615–109.
- Harahap, M. S., Jayanti, N., & Gunawan, B. S. (2026). Formulation and Evaluation of a Pandanus amaryllifolius Leaf Ethanol Extract Ointment for Burn Wound Healing in Male Rats. *JURNAL FARMASIMED (JFM)*, 8(2), 1203–1213. <https://doi.org/10.35451/A2NWPP71>
- Hariningsih, Y., & Hartono, A. (2022). Formulasi Krim Ekstrak Etanol Kulit Pisang Kepok

- (Musa Paradisiaca Formatypica) Sebagai Penyembuh Luka Bakar. *Pengembangan Ilmu Dan Praktik Kesehatan*, 1(2), 48–56. <https://doi.org/10.56586/pipk.v1i2.213>
- Hutagalung, M., Lubis, U., & Klorida, L. (2022). Pengujian Efektivitas Penyembuhan Luka Bakar Gel Ekstrak Etanol Daun Tembakau (*Nicotiana tabacum* L.) Pada Tikus. *Scholar.Archive.OrgM HutagalungJurnal Penelitian Farmasi Dan Herbal*, 2022•*scholar.Archive.Org*, 4, 2021–2022.
- Irwandi, I., Nessa, N., & Iisranu, A. (2021). Uji Aktivitas Ekstrak Etanol Biji Buah Durian (*Durio Zibethinus* L.) terhadap Penyembuhan Luka Bakar pada Mencit Putih Jantan (*Mus Musculus*). *Prosiding Seminar Kesehatan Perintis*, 4(2), 152–158.
- Luh Ayu Surya Dianti, N., Aisyah, R., & Hardiana, I. (2025). Efektivitas Sediaan Krim Ekstrak Daun Mangga Madu (*Mangifera Indical*.) Terhadap Penyembuhan Luka Bakar Derajat II Pada Tikus. *Jks.Stikesbuleleng.Ac.Id*, Volume 2,.
- Muhaira, W. T., Luthvia, Wahyuni, N., Simatupang, I. A., & Ariatama, B. (2024). Uji Ekstrak N-Heksan Daun Kirinyuh (*Chromolaena Odorata* L.) Terhadap Model Hewan Luka Bakar Derajat IIA. *Researchgate.NetWT Muhaira, L Luthvia, N Wahyuni, IA Simatupang, B AriatamaJurnal Riset Ilmu Kesehatan Umum Dan Farmasi (JRIKUF)*, 2024•*researchgate.Net*, Volume 2 N. <https://doi.org/https://doi.org/10.57213/jrikuf.v2i4.514>
- Mundriyastutik, Y., Muslimah, A. C., Hasriyani, H., & Lestari, D. T. (2023). Penyembuhan Luka Bakar Dengan Sediaan Topikal Spray Gel Ekstrak Daun Peletakan (*Ruellia Tuberosa* L) Pada Tikus Putih (Wistar). *IJF (Indonesia Jurnal Farmasi)*, 8(2), 84–92. <https://doi.org/10.26751/IJF.V8I2.2230>
- Nofita, N., Salza Fadilla, S., Pratiwi, I. A., Ayu, G., Saputri, R., & Hermawan, D. (2025). Efektivitas Sediaan Gel Ekstrak Kulit Pisang Ambon (*Musa paradisiaca* var *sapientum*) Terhadap Penyembuhan Luka Bakar dan Luka Sayat. *Jurnal Mandala Pharmacon Indonesia*, 11(1), 308–317. <https://doi.org/10.35311/JMPI.V11I1.815>
- Pratama, K. A. K., Putra, A. P., & Puspaningrat, D. (2023). Formulasi Krim Ekstrak Daun Kelor (*Moringa Oleifera* Lam) Sebagai Penyembuhan Luka Bakar Pada Tikus Putih Jantan (*Rattus Norvegicus*). *JURNAL FARMASI KRYONAUT*, 2(2), 85–96. <https://doi.org/10.59969/JFK.V2I2.55>
- Putra, I. M. A. S., Trias, N. K. P., & Kusuma, I. G. A. W. (2026). Uji Efektivitas Salep Ekstrak Etanol Daun Buni (*Antidesma bunius* (L.) Spreng) Sebagai Penyembuhan Luka Bakar Grade II (A) Pada Mencit. *Usadha*, 5(1), 25–34. <https://doi.org/10.36733/USADHA.V5I1.13940>
- Simorangkir, D., Puspita, R., Umayra, C., & Rimta, B. (2025). Formulasi Sediaan Gel Ekstrak Etanol Daun Bidara (*Ziziphus Mauritiana* L) Sebagai Penyembuhan Luka Bakar Terhadap Tikus Putih Jantan. *Jurnal Penelitian Farmasi Dan Herbal*, 7(2), 105–111. <https://doi.org/10.36656/JPFH.V7I2.2266>
- Sulaiman, A. A., Maslachah, L., Utama, S., Yuniarti, W. M., Sukmanadi, M., & Hidajati, N. (2025). The Effectiveness of melinjo leaf (*Gnetum gnemon* L.) extract cream on the number of fibroblast cells in the second degree burn (deep partial thickness) of white rats (*Rattus norvegicus*). *Journal of Pharmaceutical and Sciences*, 2025(1), 216–223. <https://doi.org/10.36490/JOURNAL-JPS.COM.V8I1.693>