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Article review

Pharmaceutical Preparation Formulation and Innovation in Active Substance Delivery Technology of *Premna serratifolia*: Literature Review

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The *Premna serratifolia* L. plant is a botanical resource rich in potential secondary metabolites for development into modern pharmaceutical preparations. Over the last decade (2016-2026), research has progressed rapidly from conventional topical formulations to more sophisticated drug delivery systems to overcome the stability issues of active substances. To provide a narrative review of various pharmaceutical formulations of *Premna serratifolia* leaves and evaluate their biological efficacy based on the latest original studies. Methods: Studies published between 2016 and 2026 were reviewed, original scientific literature from reliable databases like ScienceDirect and Google Scholar was reviewed. Various preparations have been successfully optimized, including a peel-off gel mask with antioxidant activity reaching 77.20%, a sunscreen lotion with an ultra SPF value of up to 34.60, and an anti-inflammatory cream combined with sappanwood. Recent delivery technology innovations include Ethocel/Eudragit polymer-based microparticles with a size of 1.024-1.662 µm, and excellent antibacterial potential is demonstrated by biosynthesized silver nanoparticles (AgNPs). *Premna serratifolia* exhibits high formulation flexibility for cosmetic and therapeutic applications, although standardization of marker compounds and validation through human clinical trials remain major challenges for future development.

The use of medicinal plants in global healthcare systems has undergone a fundamental transformation, shifting from less standardized traditional practices to modern, evidence-based pharmaceutical preparations. One botanical entity that has become a focus of pharmaceutical research in Southeast Asia, particularly Indonesia, is *Premna serratifolia* L., locally known as buas-buas leaves or bebuas [1]. This plant, which is taxonomically classified in the family *Lamiaceae* (formerly *Verbenaceae*), is a genetic resource rich in secondary metabolites with a broad spectrum of bioactivities, including antioxidant, anti-inflammatory, antimicrobial, and cytotoxic properties against cancer cells [2, 3]. Although the ethnomedicinal use of bebuas leaves has been well documented in the Ayurvedic system as “Agnimantha” or “Ganakasika”, the technical challenges in maintaining the stability of the active ingredient and ensuring efficacy on the biological target require sophisticated formulation approaches [4]. Over the past ten years, research focus has shifted towards the development of stable,

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safe, and effective pharmaceutical formulations, ranging from conventional topical preparations to advanced nano-delivery systems [5].

The use of the *Premna serratifolia* plant in modern pharmacotherapy is driven by the requirement for substitute natural medicinal substances that have fewer adverse effects than manufactured medications. Botanically, this plant is characterized as a shrub or small tree that grows abundantly in tropical and subtropical areas, such as Southeast Asia, India, and Sri Lanka [6]. The leaves contain an extraordinary wealth of phytochemicals, including flavonoids, phenolics, iridoid glycosides, triterpenoids, and steroids [1]. These compounds, especially the flavonoid and phenolic groups, are known to have the ability to neutralize free radicals through an electron donor mechanism, which is crucial in preventing degenerative diseases and premature aging [7]. However, phenolic compounds are often unstable because of their high sensitivity to light exposure, drastic pH changes, and oxidation during storage. This underpins the importance of pharmaceutical formulation engineering to protect the integrity of these active molecules [8, 9].

The primary objective of this literature review is to present a review of various pharmaceutical formulations from the *Premna serratifolia* plant developed over the past ten years (2016–2026). The review focuses on formulation optimization parameters, physicochemical stability, and the resulting biological efficacy of the final product. This review not only summarizes technical data but also explores the relationship between excipient selection and the product's performance in delivering the active ingredient to the site of action.

The identified research gap shows that although the biological activity of crude extracts has been extensively studied in vitro, standardization of final products and understanding of the release kinetics of active substances from various dosage bases are still very limited [10]. In addition, most of the preparations currently being developed are still at the basic physicochemical evaluation stage, with little data regarding pharmacokinetic profiles and clinical trials in human subjects [11, 12]. The novelty of research in the last decade is characterized by the integration of high technology, such as microcapsules with specific polymers (Ethocel and Eudragit) to increase stability, as well as the synthesis of silver nanoparticles that utilize the extract of the *Premna serratifolia* leaves as an environmentally friendly reducing agent [13–15]. Recent research has also begun to explore synergistic effects through combination formulations with other medicinal plants, such as sappanwood, to enhance topical anti-inflammatory effects [16].

Phytochemical Profile of *Premna serratifolia* as a Foundation for Preparation Formulation

The success of a pharmaceutical formulation is largely determined by a thorough understanding of the chemical characteristics of the metabolites it contains. In *Premna serratifolia*, key compounds such as acteoside (a conjugate of iridoid glycoside verbascoside) have been identified as the main active ingredient, having antioxidant activity four times higher as than that of the crude extract [17]. The presence of flavonoids such as quercetin, kaempferol, and luteolin is also an important parameter in the standardization of preparations because of their ability to absorb ultraviolet radiation and inhibit oxidative enzymes [18, 19]. Extraction using 70% ethanol or methanol solvents is often the choice in formulation research because of its ability to optimally extract the spectrum of polar and semipolar metabolites [20]. The yield of the extract obtained, for example, reaching 21.42% through the maceration method, provides a sufficient material base to be developed into various dosage forms [21]. FTIR spectroscopic analysis of the leaf extract of the *Premna serratifolia* plant confirmed the presence of hydroxyl (O-H), carbonyl (C=O), and aromatic C=C functional groups, which collectively contribute to the chemical reactivity and stability of the active compound in the pharmaceutical matrix [22].

Developing Peel-Off Gel Masks Using *Premna serratifolia* Leaf Extract

The formulation of peel-off gel masks is one of the most popular innovations in the use of *Premna serratifolia* leaves for cosmetic preparations. This dosage form is favored for its occlusive effect on the skin, which promotes stratum corneum hydration and enhances the penetration of active antioxidants into the dermis [23]. A key component in this formulation is a film-forming agent such as Polyvinyl

Alcohol (PVA), which provides elasticity and mechanical strength to the mask after it dries. Research has shown that using PVA in combination with Carbomer 940 produces a gel with viscosity and spreadability that meet pharmaceutical standards. The concentration of *Premna serratifolia* leaf ethanol extract was varied from 1% to 3% to assess its effect on the physical stability of the preparation. In cycle tests involving storage at varying temperatures of 4°C and 40°C, the gel mask formulation demonstrated organoleptic stability, maintaining a consistent greenish-brown hue and a pH within the physiological range of the skin, specifically between 4.5 and 6.5. This is important to prevent skin irritation and maintain the efficacy of flavonoids, which are sensitive to pH extremes. A thorough analysis of the viscosity data showed that increasing the extract concentration led to an increase in gel viscosity, which in turn decreased the spreadability of the preparation but accelerated the film formation time. This effect is related to the increase in total dissolved solids in the gel matrix. The highest antioxidant activity, reaching 77.20% in Formula III (3% extract), indicates that the gel delivery system can effectively maintain the bioactivity of *Premna serratifolia* leaf flavonoids against DPPH radicals [21].

Premna serratifolia Sunscreen Lotion Formulation

A lotion based on *Premna serratifolia* leaves has been developed as a natural photoprotective agent to mitigate skin damage caused by ultraviolet (UV) radiation exposure. The sunscreen properties of this plant are derived from its total flavonoid content (3.70 ± 0.02 mg/g QE), which has an absorption capacity at a wavelength of 290-320 nm. The lotion formulation generally uses an oil-in-water (O/W) emulsion system that provides a light sensation and ease of washing off. In developing this lotion, the selection of oil phase components such as liquid paraffin and stearic acid, as well as emulsifiers such as Tween 80, is crucial to prevent phase separation (creaming or coalescence). Recent research shows that a lotion preparation with a 3% extract concentration produces a Sun Protection Factor (SPF) value of 34.60, which falls into the ultra protection category. The findings substantiate the use of *Premna serratifolia* leaves as a viable alternative to synthetic sunscreens like oxybenzone, which are frequently linked to environmental and health safety issues. The relationship between extract concentration and SPF value showed a very strong linear correlation (R^2 0.9717), confirming that flavonoids are the main components responsible for the sunscreen's activity. The increase in viscosity from 33,385 cP at 1% concentration to 46,677 cP at 3% concentration also indicated that the addition of the extract contributed to the viscosity of the preparation without disturbing the homogeneity of the emulsion particles [24].

Anti-inflammatory cream formulation combining *Premna serratifolia* leaf extract and *Caesalpinia sappan* extract

Formulation innovation is also directed at topical cream preparations to treat skin inflammation and joint pain. A notable study involves the combination of ethanol extract from *Premna serratifolia* leaves with sappan wood (*Caesalpinia sappan*). The rationale behind this combination is the synergistic effect between the anti-inflammatory compounds from both plants to reduce inflammatory mediators more effectively than either used alone. The combination cream formulated in a base demonstrated good physical stability and significant efficacy in reducing edema in a carrageenan-induced rat model. The combination concentration of 3.75% resulted in 32.77% inflammation inhibition, which was statistically equivalent to the positive control hydrocortisone acetate in terms of reducing skinfold thickness [16]. This efficacy is associated with the ability of flavonoids in *Premna serratifolia* leaves to inhibit the cyclooxygenase (COX) enzyme and the synthesis of pro-inflammatory cytokines, including TNF-α and IL-6 [2]. The lower AUC value at 3.75% concentration indicates that the degree of swelling during the observation period (6 hours) was minimal. The occlusive mechanism of the cream base also has a significant role in maintaining moisture at the site of inflammation, which accelerates the tissue healing process [16].

Microparticle Technology for Stability of *Premna serratifolia* Extract

The degradation of active ingredients in *Premna serratifolia* leaves during long-term storage is a major obstacle in developing commercial products. To address this issue, research has implemented

microencapsulation technology using a single emulsion solvent evaporation (O/W) method [25]. In this system, *Premna serratifolia* leaf extract is entrapped within a solid polymer matrix that acts as a barrier to oxygen and light. The effectiveness of ethyl cellulose polymer (Ethocel) and a cationic copolymer (Eudragit E100) in forming uniform microparticles has been evaluated. The results showed that Ethocel polymer at a concentration of 20% provided the best physical characteristics, with a smooth surface morphology and minimal pores as observed by SEM. These microparticles ranged in size from 1.024 to 1.662 µm with an encapsulation efficiency of 85.57%. Particle sizes in this micrometer range are ideal for protecting the active ingredient without triggering excessive aggregation. The high encapsulation efficiency indicates that the interaction between the polymer's hydrophobic groups and the extract components was very efficient during the evaporation process of dichloromethane (an organic solvent). The denser microparticle structure used in Ethocel is predicted to provide a slower release profile of the active ingredient (sustained release), which is very advantageous for long-term oral and topical applications [15, 26].

Pharmaceutical Nanotechnology: Biosynthesis of Silver Nanoparticles (AgNPs)

One of the most significant innovative leaps in *Premna serratifolia* research is the use of leaf extract as a bioreductant for the synthesis of silver nanoparticles (AgNPs) [27, 28]. This method, known as green synthesis, provides a safer and greener alternative to traditional chemical reduction techniques. Phenolic and flavonoid compounds in the extract act as reducing agents for silver ions to function as capping agents in metallic silver, stabilizing the nanoparticles to prevent agglomeration. The formation of AgNPs is characterized by a color change in the colloid from transparent green to yellow or reddish brown, confirmed by a surface plasmon resonance (SPR) peak at a wavelength of 400–415 nm. The resulting nanoparticles are very small, with an average size of 58.7 nm, allowing for very high cellular penetration. The antibacterial activity of AgNPs synthesized with wild-clawed leaves is significantly more potent against Gram-negative (Escherichia coli) and Gram-positive (Staphylococcus aureus) bacteria compared with the crude extract. This is due to the release of silver ions from the large surface area of the nanoparticles. This disrupts intracellular metabolism and damages the bacterial cell wall [27, 29]. The use of AgNPs also opens up opportunities for the development of new pharmaceutical preparations, such as nanoantiseptic gels or wound dressings that have accelerated healing properties [30, 31]. The stability of nanoparticles maintained for at least one month of storage indicates that *Premna serratifolia* leaf metabolites have superior surface protection capabilities [27].

Oral and Nutraceutical Preparations for Anemia Therapy

Pharmaceutical exploration of *Premna serratifolia* is not limited to topical applications but also includes the development of oral preparations and functional food products (nutraceuticals). One prominent research focus is the evaluation of the anti-anemia effect of *Premna serratifolia* leaf extract. The leaves of this plant are rich in essential micronutrients such as iron, phosphorus, calcium, and ascorbic acid, which collectively support the process of erythropoiesis [32–34]. In a study using a Wistar rat model of anemia induced by phenylhydrazine, hematological parameters were improved when *Premna serratifolia* leaf extract was administered at doses of 100 mg/kg and 200 mg/kg body weight. The results confirmed that the 200 mg/kg dose resulted in a more rapid recovery of hemoglobin (Hb) levels and red blood cell (RBC) count compared to the standard drug ferofumarate. These findings support the potential development of "functional snacks" such as biscuits and vadam enriched with *Premna serratifolia* leaf powder as a nutritional intervention strategy to address iron deficiency anemia in the community. The success of this oral formulation indicates that the active ingredients in *Premna serratifolia* leaves have good bioavailability despite having to pass through the digestive system. However, for broader clinical application, the development of standardized capsule preparations (e.g., 250-500 mg capsules) needs to be further evaluated through more rigorous pharmacokinetic studies [32].

Challenges and Future of *Premna serratifolia* Formulation

The future of *Premna serratifolia* leaf formulation research is predicted to lead to targeted drug delivery systems. The use of technologies such as nanostructured lipid carriers (NLCs) or ethosomes could be a solution to increase transdermal flavonoid penetration into arthritic joints [35]. Furthermore, formulation factors like polymer ratio and emulsifying agent concentration are beginning to be optimized using the Quality by Design (QbD) strategy to create preparations with predefined quality criteria [36].

Conclusion and Recommendations

A literature review of original research over the past ten years indicates that *Premna serratifolia* is a highly versatile botanical candidate for the development of a variety of modern pharmaceutical dosage forms. Topical formulations such as peel-off gel masks and sunscreen lotions have reached a good stage of research maturity, with highly competitive physicochemical stability data and antioxidant/SPF efficacy. Microencapsulation technology and silver nanoparticle biosynthesis represent the next frontier of innovation, successfully overcoming stability constraints while enhancing the plant's therapeutic potential as a potent antimicrobial and anti-aging agent.

For future promising research, several strategic points are recommended: First, marker-based standardization, requiring the determination of one or two specific marker compounds (e.g., acteoside or luteolin) and monitoring throughout the manufacturing process to ensure consistent product quality. Second, pharmacokinetic and bioavailability studies are conducted in-depth research on the absorption, distribution, metabolism, and excretion (ADME) of the main active ingredients of *Premna serratifolia* leaves after administration in nano- or micro-dosage forms. Third, advanced randomized controlled clinical trials should be conducted to validate the efficacy of anti-inflammatory capsules and sunscreen lotions in a broader human population and to meet the requirements for standardized herbal medicine or phytopharmaceutical registration. Finally, the nanoemulgel preparation is explored: the development of a combination nanoemulgel preparation to enhance transdermal penetration of active ingredients in the treatment of chronic arthritis, one of the most common traditional uses of this plant.

With the synergy between modern pharmaceutical technology and ethnomedicinal knowledge, *Premna serratifolia* has great potential to become a key pillar in the development of natural-based medicines capable of addressing future health challenges.

References

1. Khairunnisa KQ, Febriyanti RM, Muhaimin M. Phytochemistry and Pharmacological Potentials of *Premna serratifolia* L.: Traditional Medicinal Plant Used by Local People in Kalimantan. Indones J Biol Pharm 2022; 2: 178.
2. Febriyanti RM, Rafif S, Mikdar N, et al. Anticancer Potential of Bioactive Compounds in *Premna serratifolia*, Premna odorata, and Premna tomentosa: A Review of In Vitro Evidence. Cancer Manag Res 2025; Volume 17: 1029–1045.
3. Simamora A, Santoso AW, Timotius KH, et al. Antioxidant Activity, Enzyme Inhibition Potentials, and Phytochemical Profiling of *Premna serratifolia* L. Leaf Extracts. Int J Food Sci 2020; 2020: 1–11.
4. Ralte L, Sailo H, Singh YT. Ethnobotanical study of medicinal plants used by the indigenous community of the western region of Mizoram, India. J Ethnobiol Ethnomed 2024; 20: 2.
5. Ingle N, Sawant P, Shinde A, et al. A Comprehensive Review on Formulation and Development of Pharmaceutical Products. Res J Sci Technol 2025; 225–230.
6. Sreekumar PL. Phytochemical Evaluation Of *Premna serratifolia* L. Int J Biol Pharm Allied Sci; 13. Epub ahead of print 1 February 2024. DOI: 10.31032/IJBPAS/2024/13.2.7779.
7. Muhaimin M, Iskandar Y, Hazrina A, et al. Antioxidant Activity of *Premna serratifolia* Linn. Leaf Extracts: A Comprehensive Analysis Using Various Testing Methods. Indones Food Sci Technol J 2024; 8: 89–99.

8. Pasquet PL, Julien-David D, Zhao M, et al. Stability and preservation of phenolic compounds and related antioxidant capacity from agro-food matrix: Effect of pH and atmosphere. Food Biosci 2024; 57: 103586.

9. Xiao J. Recent advances on the stability of dietary polyphenols. eFood; 3. Epub ahead of print 19 June 2022. DOI: 10.1002/efd2.21.

10. Costa M do C, Gomes AP, Vinhas I, et al. Process Development for GMP-Grade Full Extract Cannabis Oil: Towards Standardized Medicinal Use. Pharmaceutics 2025; 17: 848.

11. Lai Y, Yanev S, Liu Z. Editorial: Clinical trials in drug metabolism and transport: 2022. Front Pharmacol; 14. Epub ahead of print 13 June 2023. DOI: 10.3389/fphar.2023.1223428.

12. Askarizadeh M, Esfandiari N, Honarvar B, et al. Kinetic Modeling to Explain the Release of Medicine from Drug Delivery Systems. ChemBioEng Rev 2023; 10: 1006–1049.

13. Dua TK, Giri S, Nandi G, et al. Green synthesis of silver nanoparticles using Eupatorium adenophorum leaf extract: characterizations, antioxidant, antibacterial and photocatalytic activities. Chem Pap 2023; 77: 2947–2956.

14. Shahzadi S, Fatima S, ul ain Q, et al. A review on green synthesis of silver nanoparticles (SNPs) using plant extracts: a multifaceted approach in photocatalysis, environmental remediation, and biomedicine. RSC Adv 2025; 15: 3858–3903.

15. Nurhasana S, Iskandar Y, Muhaimin M, et al. Polymer type effect on *Premna serratifolia* extract-loaded microparticles preparation by solvent evaporation method with single emulsion system. Int J Appl Pharm 2024; 250–256.

16. Isnindar, Purnamaputra A, Luliana S. An Effectiveness Test Combination of Ethanol Extracts of Buas-buas Leaves (*Premna serratifolia* L.) and Sappan Wood (Caesalpinia sappan L.) as Topical Antiinflammatory Agent in Male White Rats (Rattus novergicus). J Farm dan Ilmu Kefarmasian Indones 2024; 11: 356–365.

17. Bose L V, Varghese GK, Habtemariam S. Identification of acteoside as the active antioxidant principle of *Premna serratifolia* root wood tissues. Phytopharmacology 2013; 4: 228–236.

18. Zhang Q, Yang W, Liu J, et al. Identification of Six Flavonoids as Novel Cellular Antioxidants and Their Structure-Activity Relationship. Oxid Med Cell Longev 2020; 2020: 1–12.

19. Arikan B, Yildiztugay E, Ozfidan-Konakci C. Protective role of quercetin and kaempferol against oxidative damage and photosynthesis inhibition in wheat chloroplasts under arsenic stress. Physiol Plant; 175. Epub ahead of print 30 July 2023. DOI: 10.1111/ppl.13964.

20. Tourabi M, Faiz K, Ezzouggari R, et al. Optimization of extraction process and solvent polarities to enhance the recovery of phytochemical compounds, nutritional content, and biofunctional properties of Mentha longifolia L. extracts. Bioresour Bioprocess 2025; 12: 24.

21. Puspita W, Puspasari H. Physical Stability and Antioxidant Activity of Peel-Off Gel Mask Ethanol Extract of Buas-buas Leaf (*Premna serratifolia* L.). Maj Obat Tradis 2022; 27: 93–99.

22. Panchami B, P RB. Evaluation of Pharmacological Properties of *Premna serratifolia* L . Seed Extract. Am J Biomed Sci Res 2026; 1523–1533.

23. Tarung AF, Cristin B, Maulidia Y, et al. Comparing Antioxidant Activity of Extracts and Gel Preparations Combination of Buas-buas Leaves (*Premna serratifolia* l.) and Secang Wood (Caesalpinia sappan). Maj Obat Tradis; 28. Epub ahead of print 30 November 2023. DOI: 10.22146/mot.77740.

24. Shabrina A. Formulasi Dan Penetapan Nilai Spf Secara In Vitro Lotion Ekstrak Etanol Daun Buas-Buas (*Premna serratifolia* L.). Media Farm Indones 2024; 19: 98–105.

25. Morales E, Burgos-Díaz C, Zúñiga RN, et al. Influence of O/W emulsion interfacial ionic membranes on the encapsulation efficiency and storage stability of powder microencapsulated

astaxanthin. Food Bioprod Process 2021; 126: 143–154.

26. Zambrano V, Bustos R, Arozarena Y, et al. Optimization of a Microencapsulation Process Using Oil-in-Water (O/W) Emulsion to Increase Thermal Stability of Sulforaphane. Foods 2023; 12: 3869.

27. Octavianus C, Silalahi IH, Gusrizal G. Synthesis of Silver Nanoparticles Using *Premna serratifolia* Linn. Leaf Extract as Reducing Agent and Their Antibacterial Activity. J Pharm Sci Community 2022; 19: 34–40.

28. Arockia John Paul J, Karunai Selvi B, Karmegam N. Biosynthesis of silver nanoparticles from *Premna serratifolia* L. leaf and its anticancer activity in CCl4-induced hepato-cancerous Swiss albino mice. Appl Nanosci 2015; 5: 937–944.

29. Vanlalveni C, Lallianrawna S, Biswas A, et al. Green synthesis of silver nanoparticles using plant extracts and their antimicrobial activities: a review of recent literature. RSC Adv 2021; 11: 2804–2837.

30. Nqakala ZB, Sibuyi NRS, Fadaka AO, et al. Advances in Nanotechnology towards Development of Silver Nanoparticle-Based Wound-Healing Agents. Int J Mol Sci 2021; 22: 11272.

31. Kalantari K, Mostafavi E, Afifi AM, et al. Wound dressings functionalized with silver nanoparticles: promises and pitfalls. Nanoscale 2020; 12: 2268–2291.

32. Kaviya K, Ponne S. Effect of P. serratifolia Leaf Extract on Hematological Parameters and Standarization of Snacks using P. serratifolia Leaf Powder. FoodSci Indian J Res Food Sci Nutr 2018; 5: 1.

33. Dianita R, Jantan I. Ethnomedicinal uses, phytochemistry and pharmacological aspects of the genus Premna : a review. Pharm Biol 2017; 55: 1715–1739.

34. Herawan Timotius K. Health Benefits of Edible Leave of *Premna serratifolia* L. Food Sci Nutr 2021; 7: 1–6.

35. Basu N, Buragommula N, Hephzibha B. A Brief Review on Formulation and Evaluation of Ethosomal Gel for Arthritis with Herbal Extracts. Int J Pharm Biol Sci 2023; 13: 36–45.

36. Sindi AM, Hosny KM, Rizg WY, et al. Utilization of experimental design in the formulation and optimization of hyaluronic acid–based nanoemulgel loaded with a turmeric–curry leaf oil nanoemulsion for gingivitis. Drug Deliv; 30. Epub ahead of print 31 December 2023. DOI: 10.1080/10717544.2023.2184311.