World Journal of Pharmaceutical Science and Research
www.wjpsronline.com
Research Article
ISSN: 2583-6579
SJIF Impact Factor: 5.111
Year - 2025
Volume: 4; Issue: 5
Page: 194-203

FORMULATION AND EVALUATION OF HERBAL FACE SERUM CONTAINING PIPER BETLE EXTRACT

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Article Received: 18 August 2025 | | ***Article Revised: 8 September 2025*** | | ***Article Accepted: 28 September 2025***

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DOI: https://doi.org/10.5281/zenodo.17234690

How to cite this Article: Amit Jadhav and Kalyani B. Sahare (2025) FORMULATION AND EVALUATION OF HERBAL FACE SERUM CONTAINING PIPER BETLE EXTRACT. World Journal of Pharmaceutical Science and Research, 4(5), 194-203. https://doi.org/10.5281/zenodo.17234690

ABSTRACT

Herbal formulations in cosmetic goods are being investigated as a result of the growing need for safe and efficient skincare products. The creation and assessment of a herbal face serum that contains the powerful antioxidant eugenol for its ability to prevent oxidative stress and offer anti-aging advantages is the main goal of this study. Because of its antibacterial, anti-inflammatory, and antioxidant qualities, eugenol—which is mostly extracted from Piper betle (Paan)—is a great choice for skin care products. To guarantee stability, skin penetration, and increased efficacy, a combination of eugenol, plant-based extracts, and an appropriate carrier system were used in the formulation of the herbal serum. The product's appropriateness for everyday skin care use was ensured by evaluating a number of formulation factors, including pH, viscosity, spreadability, and stability. In vitro tests, such as the DPPH (1,1-diphenyl-2-picrylhydrazyl) test, were used to measure the serum's antioxidant potential and the formulation's capacity to scavenge free radicals. The findings showed that adding eugenol considerably improved the serum's antioxidant qualities. Additionally, sensory assessments showed that the product had a nice texture and a pleasing feel on the skin, and it was non-irritating. According to stability tests conducted under various temperature and humidity levels, the serum did not significantly degrade over time and retained its integrity. According to the results, the created herbal face serum with eugenol is a good option for use in cosmetic formulas meant to lessen oxidative damage and encourage skin that is youthful and glowing.

KEYWORDS: Skin care, formulation, evaluation, eugenol, antioxidant, anti-aging, herbal face serum.

1. INTRODUCTION

In many countries' traditional medical systems, including India's, plant-based items comprise the main component of medicinal compositions. Because medicinal plants have fewer side effects than produced drugs, their usage as therapies has grown in relevance recently (Dubey et al., 2022). The betel leaf develops on a rooting vine. The dark green, heart-shaped betel leaves are also known as paan in India (Khan et al., 2012). Piper betel L. is the scientific name for the betel plant, which is a member of the Piperaceae family (Das et al., 2016).[1]

Depending on its structure, colour, aroma, taste, and size, betel leaf (Piper betel) is referred to by a variety of names in various Indian and foreign states, including Venmony, Magadhi, Salem, Kauri, Banarasi, Mysore, Bagerhati, Bangla, Kasi, Desavari, Meetha, Ghanagete, Sanchi, and Kapoori (Madhumita et al., 2020). Malaysia is most likely where paan (betel) was created (Singh et al., 2020). India produced a wide range of betel leaves, which are mainly consumed as a mouthwash after meals. Betel leaves were also produced in a large number of other countries, such as those in Southeast Asia, Taiwan, Malaysia, Thailand, and Sri Lanka (Sradha, 2014).[2] Of the 100 species of betel leaves that have been identified globally, 40 are unique to India, while the remaining 30 are found in Bangladesh and West Bengal (Tholkappian, 2014). India produces 50,000 hectares of betel leaves annually, valued at 9 billion rupees, and eats 15–20 million betel leaves (Piper betel) annually (Mazumder, 2016). States like Orissa, Tamil Nadu, Madhya Pradesh, Uttar Pradesh, and Maharashtra are said to engage in large betel leaf farming, along with a number of other countries such as Malaysia, Sri Lanka, the Philippine Islands, Bangladesh, and Burma (Madhumita et al., 2020).[3] The majority of Asians employ betel leaf as a masticator due to its strong, spicy, and aromatic flavour. Flavonoids, terpenoids, tannins, alkaloids, saponins, and other compounds are among the many antioxidants found in betel leaves (Heliawati et al., 2022).[4] Betel leaf is frequently used in Indian traditional medicine as an antibacterial and topically to help heal wounds and sores. This special quality paved the path for additional experimental studies that demonstrated the antibacterial and antioxidant properties of pan extract. Because of its antibacterial qualities, which include suppressing and destroying microbes, betel leaf serves as a preservative (Nayaka et al., 2021).[5]

As a member of the genus Piper, the plant is also highly beneficial for a number of other purposes, including meals, oils, spices, fish bait, fragrances, pesticides, and hallucinogens (Rai et al., 2019). In addition to being nutrient-dense, betel leaf contains vitamins and minerals. Along with enzymes like catalase and diastase, betel leaves contain considerable amounts of histidine, lysine, arginine, and a few other essential amino acids.[6] We still use betel leaves in religious ceremonies today since they were considered a boon in ancient India. Betel leaf is highly useful in treating a number of illnesses, including constipation, wound healing, conjunctivitis, ringworm infestation, brain toxin, gum swelling, diabetes, migraines, leucorrhea, voice problems, cuts and injuries, hypertension, and obesity (Kantura et al., 2020.

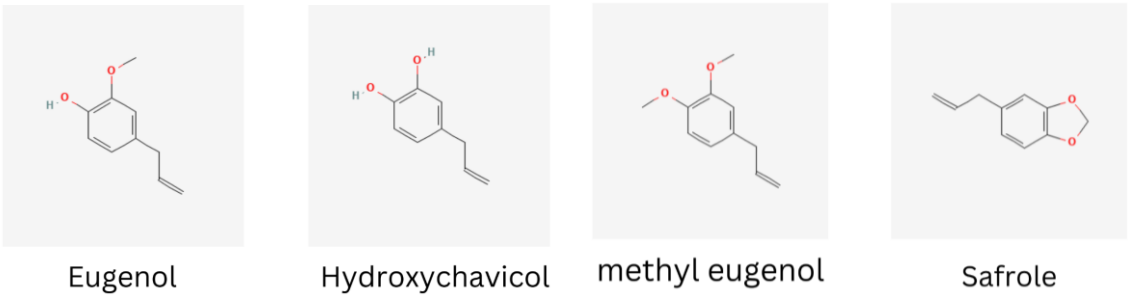


Fig. 1: Structures of Phytoconstituents present in the Piper betle obtained from PubCem.

Flavonoids, tannins, EOs, and saponins are all found in betel leaves. With antibacterial qualities, EO makes about 56.3% of betel leaves.[7] The majority of the betel leaf essential oil is eugenol, while the proportion varies according to the agroclimatic conditions. Eugenol is utilized as an antibiotic and topical anaesthetic in medicine, flavourings, and perfumes (Das et al., 2016). Because saponins and tannins have antibacterial and antioxidant qualities that affect how wounds join and accelerate epithelialization, their presence alters tissue regeneration during wound healing.[8] Anggi et al. (2022) claim that the saponin component might have cleansing or antibacterial qualities. Estragole, eugenol, methyl eugenol, hydroxy catechol, caryophyllene, 1,8-cineole, chavibetol, chavicol, and hydroxychavicol are among the phytochemicals present in betel plants. Saxena and associates (2014) The extraction of betel leaf using methanol and ethanol solvent eliminated the dangerous microorganisms Laguna, Escherichia coli, Pseudomonas aeruginosa, Staphylococcus aureus, and others (Valle et al., 2015).[9]

1.1. Antimicrobial properties

Although betel leaf contains a variety of bioactive qualities, its antibacterial activity is by far its most significant characteristic. Because betel leaf contains a variety of bioactive chemicals, including ally pyrocatechol, chavicol, chavibetol, chavibetol acetate, and ally pyrocatechol diacetate, among others, its antibacterial properties also serve as a food preservative. It shields dietary ingredients from undesirable or dangerous microbes (Roy & Guha, 2021). E. coli, streptococcus pyrogen, pseudomonas aeruginosa, staphylococcus aureus proteus vulgaris, and other microorganisms are all susceptible to the antibacterial properties of betel leaf. Antimicrobial action is caused by bioactive sterol molecules. The betel leaf extract contains a significant number of sterol molecules (Pradhan et al., 2013; Stuper-Szablewska et al., 2023).[10]

1.2. Antioxidant Properties

Another significant characteristic of betel leaf is its antioxidant content. The presence of polyphenol chemicals like allyl pyrocatechol and chavicol, among others, is what gives betel leaves this characteristic. These substances exhibit inhibition of the radiation-activated lipid peroxidation process when present in betel leaf extract (Subramani et al., 2020).[11] According to Dasgupta and De (2004), the polyphenol components found in betel leaf extract are more prevalent than those found in tea. Ethanolic betel leaf extracts are a good source of natural antioxidants, according to Nouri et al. (2014). There are numerous phenolic chemicals in the betel leaf's ethanolic and methanolic extracts. The phenolic content of the ethanolic (90%) and methanolic (90%) betel leaf extracts was 202.9 and 205.2 mg GAE/g dry weight, respectively (Kaintura et al., 2020).[12]

1.3. Antifungal Properties

Betel leaf, sometimes known as piper betel, has long been used in a variety of therapeutic applications. It is useful against fungal infections since it has been reported to possess antifungal properties. Research has indicated that the essential oil derived from betel leaf exhibits noteworthy antifungal properties against a number of fungal species, including as Trichophyton mentagrophytes, Aspergillus Niger, and Candida albicans (Nayaka et al., 2021).[13] Eugenol, chavicol, and terpenes are among the active chemicals that provide betel leaf its antifungal properties (De Castro & Capal, 2019). Additionally, it has been discovered that betel leaf extract inhibits the growth of dermatophytes, which are fungi that cause skin illnesses including ringworm and athlete's foot. Furthermore, it has been demonstrated that betel leaf extract works in concert with other antifungal medications, including fluconazole, to increase their efficacy (Sivareddy et al., 2019). All things considered betel leaf is a promising natural treatment for fungal diseases due to its

antifungal qualities. Its effectiveness and safety as a therapy for fungal infections, however, require further investigation.

1.4. Anticancer Properties

Because the betel leaf contains polyphenol chemicals, it also exhibits another crucial anti-carcinogenic characteristic. Tobacco's carcinogenic properties are destroyed by the presence of bioactive substances such hydroxychavicol and chlorogenic (Chowdhury & Baruah, 2020). Betel leaf is used as herbal medicine because of its phenolic components. Red betel leaves contain phenolic chemicals called luteolin and apigenin. According to Zulharini et al. (2018), luteolin and apigenin derivatives are cytotoxic to cancer cells. Breast cancer is a relatively frequent disease in women, with 1.38 million new cases reported worldwide each year (Nafisi et al., 2013). The high death rate, which is discovered during the metastatic phase, is primarily caused by delayed treatment of the illness.[14] The expression of matrix metalloproteinases (MMPs), cell invasion, migration, and other processes linked to the metastatic cascade is notably elevated at this stage. This stage is produced by high levels of matrix metalloproteinases (MMPs), cell invasion, migration, and other processes linked to the metastatic cascade. The discovery of chemotherapeutic medications is crucial because this sickness may only be treated by radiation therapy or surgery. The anti-migration and cytotoxic effects on metastatic breast cancer are assessed using methanolic red betel leaf extracts (Zulharini et al., 2018).

1.5. Anti- Inflammatory Properties

Vascular tissue's intricate biochemical reaction to irritants, infections, and damaged cells is known as anti-inflammation. It is a normal defense response characterized by pain, fever, redness, swelling, and loss of function (Pawar et al., 2021). The main components of betel leaf that give it its anti-inflammatory properties include terpenoids, flavonoids, and phenolic chemicals. Due to their established anti-inflammatory and antioxidant properties, these substances may aid in lowering inflammation in the body (Aara & Ramadas, 2020).[15]

Flavonoids have a number of health benefits, including anti-inflammatory, anti-allergic, anti-cancer, anti-microbial, and anti-diarrheal effects.

Hepatic, pancreatic, breast, oesophageal, and colon cancers are among the tumors linked to flavonoids that increase apoptotic activity (Anchal et al., 2023). The natural compound eugenol, which is present in betel leaf, has been shown to have anti-inflammatory and analgesic properties (Dewi & Fatonah, 2019). In a variety of conditions, including as skin allergies, asthma, and arthritis, betel leaf extract has been shown to reduce inflammation (Biswas et al., 2022). Inflammation occurs when tissue's vascular and supporting components respond to any type of damage (Afridi et al., 2021).

1.6. Anti-diabetes

It is commonly recognized that betel leaf extract can control blood glucose levels and has strong anti-diabetic effects (Hossain et al., 2017). When rats with low blood sugar were examined overnight, the aqueous extract of betel leaves dramatically lowered their blood sugar levels. Streptozocin (STZ) diabetic rats had significantly reduced blood glucose levels, glycosylated haemoglobin, and decreased liver glucose-6-phosphatase and fructose-1, 6-bisphosphatase activity compared to untreated diabetic rats. However, their liver hexokinase levels are higher (Kumar et al., 2022). The extract demonstrated antihyperglycemic action in the external glucose level during a glucose tolerance test (Chauhan et al., 2016).

1.7. Gastro-Protective and digestive

According to tradition, chewing betel leaves increases salivary gland secretion and enhances digestion (Patra et al., 2022). Because betel leaf extract is known to have gastroprotective qualities, it helps prevent gastric ulcers. Oral betel leaf administration significantly increases rat intestinal mucosa and bile production, as well as pancreatic digesting enzymes, according to a preliminary study (Roy & Guha, 2021). According to Baviskar et al. (2017), betel leaves are extremely nutritious and high in vitamins and minerals. Along with arginine, lysine, histidine, and many other essential amino acids, the leaves also contain enzymes such as catalase and diastase (De, 2018). Previous research on betel leaf tends to focus more on the extraction component (Rintu et al., 2015). Because the Phyto-components in betel leaves can be isolated and used for a number of reasons, their significance cannot be emphasized. According to Pradhan et al. (2013), the leaves of the betel plant are very nutrient-dense and include a tiny amount of vitamins, minerals, enzymes, essential oils, and quick-acting bioactive compounds for medicinal purposes that help treat diseases of the heart, liver, and brain.

1.8. Serum

Face serum comes in both water-based and oil-based forms and is a highly concentrated emulsion. Because serums, also known as concentrates, contain roughly 10 times as many biologically active ingredients as creams, they can be used to treat skin issues more effectively. Within a month or less, adding a few drops of face serum to your daily skin care routine will show effects. This is because the tiny molecules that make up face serums enable them to swiftly and deeply permeate the skin. A serum is a product that is distinguished by its intense formula with a very high concentration of active ingredients, its non-greasy finish, and its quick absorption and penetration of the skin's deeper layers.[22]

A skincare product with a gel, light lotion, or moisturizing consistency that can go deeper to deliver active ingredients to the skin is called a serum.[23] A excellent face serum can boost moisture levels, make pores look smaller, and give your skin a smoother, firmer texture. For topical skin conditions, several serum compositions are employed. Topical antibiotics, topical retinoids, and other substances can be used to create the serum compositions.

A concentrated product that is frequently used in cosmetics is serum. The name in professional cosmetology is self-explanatory. The water or oil concentration of the cosmetic serum is the same as that of any other cream. A concentrated preparation with ten times as much organic stuff as a cream is called a serum. As a result, it swiftly and efficiently resolves the aesthetic issue. ijcrt.org © 2023 June 2023 | ISSN: 2320-2882 IJCRT2306095 | Volume 11, Issue 6 www.ijcrt.org International Journal of Creative Research Thoughts (IJCRT) A834 Face serum comes in both water-based and oil-based forms and is a highly concentrated emulsion. Because serums, also known as concentrates, include roughly 10 times as many biologically active ingredients as creams, they can be used to treat skin conditions more effectively.

Within a month or less, adding a few drops of face serum to your daily skin care routine will show effects. This is because the tiny molecules that make up face serums enable them to swiftly and deeply permeate the skin. Antioxidants, ceramides, amino acids, and other nutrients are among the many beneficial active ingredients and nutrients found in serum. This explains why the most expensive product in a skin care kit is always face serum. Antioxidants, cell-communicating compounds, and skin-identical substances should be present in all products, whether they are moisturizers, anti-aging or anti-wrinkle treatments, or skin serums.

2. MATERIALS AND METHODS

2.1. Material collection

Piper Betle leaves from the Akurdi market in Pune. The remaining materials were acquired from Dr. D.Y. Patil College of Pharmacy in Akurdi, Pune, and included 199arbopol, sodium metabisulfite, glycerine, methylparaben, 96% ethanol, a rotary evaporator (IKA), and a viscometer from Brookfield Field.

2.2. Method of Extraction

The leaves of the piper betle were thoroughly cleaned with water and let to air dry for seven days. The dried leaves of the Piper betle were then crushed into a powder and stored for later use in an airtight container. Eugenol was extracted from the powdered piper betle leaf using the solvent extraction method. The piper betle leaf powder was put into the Soxhlet thimble, which was then placed inside the main chamber and sealed. The Soxhlet device, which was heated to almost 70°C for almost 24 hours until solvent vapor filled the main chamber, was connected to a litre of 70% ethanol and water (7:3). Following that, the solvent vapours were forced into the piper betle extract chamber. 70% ethanol was used to extract the piper betle leaf, which was then evaporated over a water bath at 40°C and condensed into a semi-solid mass.

Fig.1: Extraction of Eugenol from piper betle leaves using Soxhlet apparatus.

2.3. Secondary metabolite screening by photochemistry

Test for Terpenoid

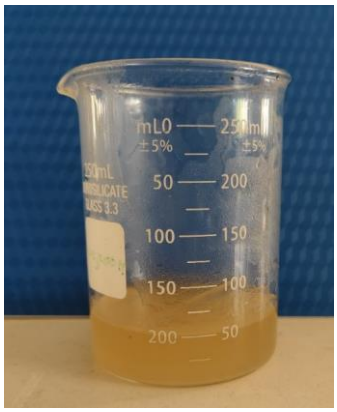
a. **Salkowski Test:** combine some chloroform with a part of the plant extract. To create a layer on top of the chloroform layer, carefully add strong sulfuric acid. Examine the interface where the two layers meet. Good Outcome: Terpenoids are indicated by a reddish-brown colouring near the contact.
b. **The Burchard-Liebermann Test:** Terpenoids can also be found with this less popular assay. Acetic anhydride and sulfuric acid are added to the extract, and a change in colour (such as dark green) signifies a successful outcome.

2.4. Herbal serum formulation

Table 1 shows the formula design for serum piper betle extracted eugenol. Methylparaben was dissolved in ethanol, and Carbopol was dissolved in water using a homogenizer set to 1200 rpm. Glycerine was added to it. Aqua Deion was used to dissolve sodium metabisulfite and sodium hydroxide, respectively (16). It was added to the Carbopol dispersion first, followed by the NaOH solution. Additionally, a homogenizer with a speed of around 1200 rpm was employed in the homogenization process, and it was later increased to 1500 rpm.

Table 1: Formulation of herbal face serum containing piper betle leaf extract.

Material	F1(%)	F2(%)	F3(%)
Piper betle leaves Extract	0.08	0.16	0.24
NaOH	0.3	0.3	0.3
Carbopol	1.5	1.5	1.5
Glycerine	10	10	10
Sodium metabisulfit	0.5	0.5	0.5
Methyl paraben	0.25	0.25	0.25
Ethanol	3	3	3
Aqua deion	Ad 100	Ad 100	Ad 100



3. Evaluation

3.1. Organoleptic Properties

Serum formulations are subjected to visual organoleptic testing, which include shape, color, and smell.

3.2. The pH

Using a pH meter, the pH of the serum preparations was measured both before and after the circumstances were imposed. The pH value of the serum preparation is determined by immersing the pH meter into it until it reaches the mark.

3.3. Solubility

Solubility of piper betle extract were evaluated on various polar and non-polar solvents.

3.4. Viscosity

Using a spindle type model S6 and 4.5 ml of the serum, the Brookfield viscometer measures the formulation's viscosity at 100 rpm. About five minutes before to the measurement, the spindle will be immersed in the serum in a large mouth container.

3.5. Stability Test

For three months, the herbal face serum was stored at two different temperatures—4± 2°C and 30± 2°C—with 65% relative humidity. The pH and viscosity of the herbal face serum were measured three months later and compared to the initial values.

3.6. Homogenicity

The face serum was applied on a dry, clean object glass, and a cover glass was then sealed. In the presence of some coarse particles or homogeneity, the appearance was looked into. Visual inspection was used to check the homogeneity of the herbal face serum and look for any lumps, flocculates, or aggregates.

3.7. Spreadability

A circular glass with 0.5 grams of serum is covered with another glass that has been weighed. After a minute, a load of fifty grams was added, and the spread's diameter was measured. After a minute, the spread's diameter was measured once more.

4. RESULT AND DISCUSSION

4.1. Organoleptic properties

The manufactured herbal hair serum is visually examined for texture, color, odor, and look. The results are shown in **Table 2.**

Type of examination	Result
Colour	Pale yellow
Smell	Strong and Aromatic
Consistency	Thick

4.2. pH

To make sure a product is safe to use, its acidity or basicity is specified using the pH scale.

Formulation	pH
1	6.03
2	6.12
3	6.07

4.3. Solubility

Table 3: contains the value that was obtained.

Chemical	Solubility
Water	Partially soluble
Ethanol	Soluble
Ether	Soluble
Chloroform	Soluble

4.4. Viscosity

The viscosity of the material is measured using a Brookfield viscometer.

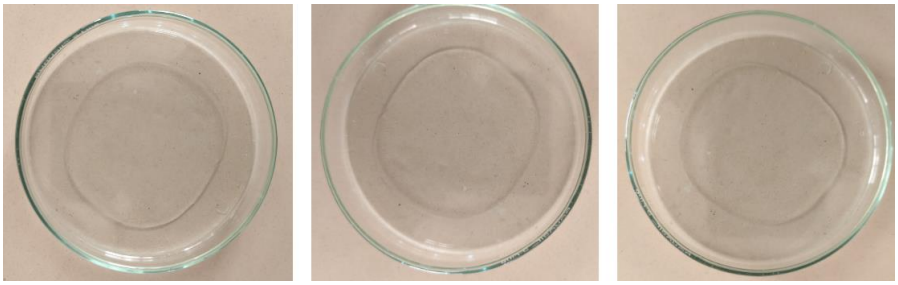
Table 3: Formulation contains the value that was obtained.

Formulation	Viscosity
F1	2129 ± 11
F2	2135 ± 12
F3	2141 ± 11

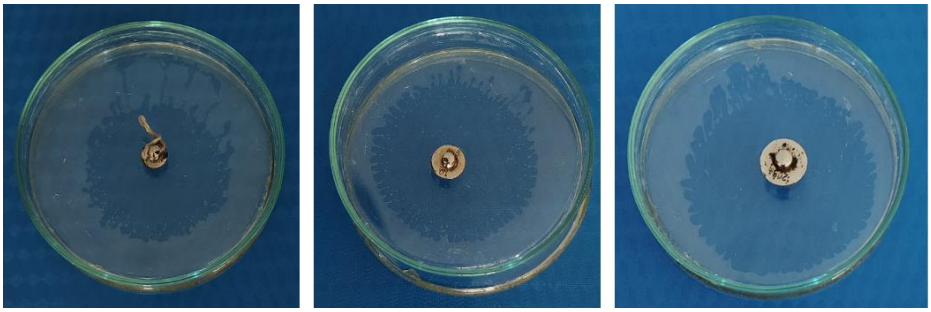
4.5. Stability Studies

Since there was no physical instability and no discernible change in pH before and after the trial, Table 4 shows that the herbal face serum was stable throughout the research period.

4.6. Homogeneity



4.7. Spreadability



5. CONCLUSION

This report's goal was to investigate the precise definition of face serums. The study comprises the appropriate application sequence and selection. Given the vast array of serums available on the market today for all skin types and skin issues, it is crucial to know exactly what one wants from a serum. It is safe to state that notable improvements can be observed, resulting in positive outcomes, when an ethical formulation is chosen after carefully examining each key skin concern. A good skin care regimen that includes the right serum for you can help maintain aging skin and prevent further damage. Skin health is an important component of overall body health. It gets rid of wrinkles, dark spots, fine lines, and other imperfections. Certain substances address particular skin issues; therefore, a blend of all the best ingredients may yield astonishing results. This indicates that the beauty industry benefits greatly from the use of facial serums, which are essential for skin maintenance. Data about betel leaf and its compounds, as well as their bioactivity and other biological properties, were reviewed in this study. Phenolic chemicals, which are abundant in betel leaves, have numerous medicinal applications and are beneficial for a variety of health conditions. Finding new bioactive compounds should be the main focus of future research. Betel leaf has a lot of potential to develop into a green medicine in the future due to its biological activities, which include its antibacterial, antioxidant, antidiabetic, and anticancer benefits.

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