



Review article

A review on bioactive properties of piper betel leaf and its application in cosmetology

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ABSTRACT

Betel leaf (*Piper betle*) extract offers many benefits for cosmetology, including skin lightening and wound healing. It's used in topical formulations like creams to diminish hyperpigmentation and melanin content. Betel leaf also has anti-inflammatory, anti-microbial, and antioxidant properties, making it valuable for treating skin conditions like itching, pain, and acne. The leaves contain a variety of compounds such as alkaloids, flavonoids, tannins, and saponins, all of which contribute to the constructive role in cosmetology. An extensive assortment of bioactive substances from betel leaf extracts and essential oil (EO), such as polyphenols and terpenes, have been found. The extract and essential oil bio-actives have been considered structurally and functionally using a variety of cutting-edge standard techniques. The current review covers a systematic explanation of extraction methods, bioactive component identification, and their activities.

Keywords: Betel Leaf, Hyperpigmentation, Wound Healing, Cosmetology.

INTRODUCTION

Formulations in the traditional medical systems of many nations, including India. The importance of using medicinal plants as therapeutics has increased recently because they have less contrary effects than manufactured medications. The betel leaf grows on a vine that makes roots. In India, betel leaves, which are heart-shaped and dark green, are also referred to as paan scientifically speaking, the betel plant, which belongs to the Piperaceae family, is known as *Piper betel* L. Betel leaf (*Piper betel*) is known by many different names in different states in India and other countries depending on its structure, color, aroma, taste, and size, including Venmony, Magadhi, Salem, Kauri, Banarasi, Mysore, Bagerhati, Bangla, Kasi, Desavari, Meetha, Ghanagete, Sanchi, and Kapoori. Paan (Betel) was most likely developed in Malaysia India developed a broad variety of betel leaves, which are primarily used as a mouth refresher after meals in India. Many other nations, including Southeast Asian nations, Taiwan, Malaysia, Thailand, and Sri Lanka, also produced betel leaves (Sradha, 2014). There are 100

different species of betel leaf discovered worldwide, 40 of which are only found in India, and the remaining 30 are found in Bangladesh and West Bengal India consumes 15–20 million betel leaves (*Piper betel*) annually, and the country farms betel leaves on an area of 50,000 hectares annually for a total value of 9 billion rupees. In addition to several other nations including Malaysia, Shri Lanka, the Philippine Islands, Bangladesh, and Burma, states like Orissa, Tamil Nadu, Madhya Pradesh, Uttar Pradesh, and Maharashtra are reported to have extensive betel leaf farming. Because betel leaf has qualities including a potent pungent and aromatic flavor, most Asian people utilize it as a masticator. Betel leaves contain a lot of antioxidants, including flavonoids, terpenoids, tannins, alkaloids, saponins, and others. Indian folk medicine uses betel leaf [1, 2]. Widely as an antibiotic and topically on lesions and wounds to promote healing. This unique characteristic opened the way for more experimental research that proved pan extract possesses antimicrobial and antioxidant effects. Betel leaf acts as a

preservative due to having antimicrobial properties like inhibiting and killing microorganisms. The plant is also very useful for several other motives belonging to the genus *Piper* like perfumes, insecticides, oils, spices, fish bait, hallucinogens, foods, etc. Minerals and vitamins are present in betel leaf, and simultaneously it is too nutritive. Histidine, lysine, arginine, and a few other important amino acids are present in significant amounts in betel leaves, along with enzymes like catalase and diastase. In ancient India, betel leaves were regarded as a blessing; today, we still employ them in religious ceremonies. Constipation, wound healing, conjunctivitis, ringworm infestation, brain toxin, gum swelling, diabetes, headaches, leucorrhea, voice problem, cuts and injuries, hypertension, and obesity are just a few of the diseases that betel leaf is very effective in treating. Betel leaves contain saponins, flavonoids, tannins, and EOs. 56.3 % of betel leaf is EO, which has antibacterial properties. Eugenol has been found to make up the bulk of the betel leaf essential oil; its amount changes depending on the agroclimatic conditions. In perfumeries, flavourings, and medicine, eugenol is used as a topical anesthetic and antibacterial. The presence of saponins and tannins changes tissue regeneration during wound healing due to their antioxidant and antibacterial properties, which influence how wounds join and speed up epithelialization. According to Anggi et al. (2022) the saponin component may have antiseptic or cleaning properties. Phytochemicals found in the betel plants include estragol, eugenol, methyl eugenol, hydroxy catechol, caryophyllene, 1, 8-cineole, chavibetol, chavicol, and hydroxychavicol. The hazardous microbes *Laguna*, *Escherichia coli*, *Pseudomonas aeruginosa*, *Staphylococcus aureus*, and others were eradicated through the extraction of betel leaf using methanol and ethanol solvent Subramani, K., Shanmugam, B. K., Rangaraj, S., Murugan, V., Srinivasan, S., Awitor, O. K., et al. (2020). Functional and antimicrobial properties of herbal nanocomposites from *Piper betle* plant leaves for enhanced cotton fabrics. *Journal of Coatings Technology and Research*, 17, 1363–1375 [3, 4].

Plant Profile

Betel (*Piper Betle*) is a flowering plant of the Pepper family, native to Southeast Asia, in the Pepper family. It is an evergreen dioecious vine with shiny heart leaves and white catkins. Belly p



lants are grown for their leaves and are mostly used as a flavor for chewing arecan nuts in so called kinbaid (often called "prayer nuts"). This is toxic and is associated with a variety of serious health conditions.

Kingdom: Plantae

Clade: Angiosperms

Clade: Magnoliids

Order: Piperales

Family: Piperaceae

Genus: *Piper*

Clade: Tracheophytes

Species: *P. betel* [5].

Biochemical Composition of Betel Leaf

Nutritional Composition

Betel leaves are incredibly healthful and rich in vitamins and minerals. The leaves also include enzymes like catalase and diastase in addition to a high number of different important amino acids, arginine, lysine, and histidine. Earlier studies on betel leaf tended to concentrate more on the component of the extraction. The importance of phyto-components found in betel leaf cannot be overstated because they may be extracted from the leaf and used for a variety of purposes. The betel plant's leaves are highly nutritive and include a small number of vitamins, minerals, enzymes, essential oils, and quick-acting bioactive substances for therapeutic purposes that aid in the treatment of conditions like heart, liver, and brain disease. Fresh betel leaves are found in green color which includes moisture 85–90 %, chlorophyll 0.01–0.25 %, protein 3–3.5 %, minerals 2.3–3.3 %, fat 0.4–1.0 %, fiber 2.3 %, Vitamin C 0.005–0.01 %, carbohydrate 0.5–10 %, iodine 3.4 µg/100 mg, Thiamine 10–70 µg/100 g, phosphorus 0.05–0.6 %, iron 0.005–0.007 %, calcium 0.2–0.5 %, Vitamin A 1.9–2.9 mg/100 g, Riboflavin 1.9–30 µg/100 g, Potassium 1.1–4.6 %, Tannin 0.1–1.3 %, Nitrogen 2.0–7.0 %, Nicotinic acid 0.63–0.89 mg/100 g, and energy 44 kcal/100 gm. The betel leaves also contain catalase and diastase etc. enzymes along with a valuable number of amino acids, but arginine, lysine, and histidine amino acids exist in trace amounts (Mazumdar et al., 2016). In addition, betel leaves have a potassium nitrate of 0.26–0.42 %. The study of betel leaves found sugar including maltose, fructose, glucose, and sucrose (Perumal et al., 2012). Polyphenolic and flavonoid content is highly concentrated in the betel plant's leaves. From the information given above, it is proved that betel leaves are very nutritious, many minerals and vitamins are present in sufficient quantity [6, 7]. In these leaves, 6 leaves of betel with slaked lime, equal to 300 ml milk of cow because minerals and vitamins such as nutrition are present in the leaf. One of the ingredients in a betel quid in India and other Asian nations is a betel leaf. If slaked lime is added to the leaf before consumption, the calcium content of the leaf is further boosted. The leaf's potassium nitrate content ranges from 0.26 % to 0.42 % when measured in dry weight. Which is noteworthy to note. Several types of products are

made from betel leaf-like powder, betel leaf pieces and extracts are very useful for human diseases such as headaches, arthritis, nervous exhaustion, nerve pain, joint pain, treatment of sore throat, and debility. Analgesic and cooling properties of betel leaf are also very helpful in health problems (Afridi et al.)^[8, 9].

Chemical Composition

65 chemical ingredients are recognized in the EO of betel leaves by using the hydro-distillation extraction method, these are evaluated in a past study by. The main chemical components are 5-(2-propenyl) 1, 3 benzodioxol (25.67 %), followed by 2-methoxy-4-2-propenyl, eugenol (18.27 %), acetate-phenol (8.0 %), as stated in. The EO and an ether-soluble fraction of the leaves previously identified fourteen chemical components. The two most significant chemical components are chavibetol acetate (15.5 %) and chavicol (53.1 %), Other components were camphene (0.48 %), and eugenol (0.32 %), chavibetol methyl ester (methyl eugenol 0.48 %), allyl pyrocatechol diacetate (0.71 %), α -pinene (0.21 %), 1,8-cineole (0.04 %), safrole (0.11 %), (0.14 %) α -limonene, γ -lactone, β -pinene (0.21 %), allyl catechol, dotriacontanoic acid, and allyl pyrocatechol monoacetate. Additionally, betel oil contains several terpenes and terpenoids. Four aliphatic chemicals are produced in pure form by the hexane portion of the *Piper betel* (leaf stalk): pentadactyl 6-hydroxytridecanoate, Penta triacontanol, methyl hexagons-7-enoate, and 6, 9-heptacosa diene. Through the repetition of silica gel, reversion of 2 silica gel, column chromatography, and thin layer chromatography, these chemicals were identified and purified. According to GCMS (gas chromatography-mass spectrometry) investigation, the main substance found in *Piper betel* ethanol extract was phenol two-methoxy-4-(2 propenyl) acetate (61.15 %), while the primary compound in the aqueous extract was 4 chromanol (27.81 %). Both extracts included eugenol (20.37 %) and four chromanol (27.81 %). tocopherol (12.62 %), Squalene (21.78 %), and on the other hand, was solely present in the aqueous extract^[10, 11].

Effects of Betel Leaf on the Body

Around 15 to 20 million individuals in India frequently consume betel leaf because of its health benefits and nutritional value. The betel leaf, known for its bioactive properties, is also rich in phytochemicals and nutritional elements. The substances possess antimicrobial, antioxidant, antifungal, anticancer, anti-inflammatory, anti-diabetic, and digestive and gastro protective qualities, which are thoroughly examined in the following discussion. Antibacterial Impact Betel leaf contains various bioactive properties, with antimicrobial activity being the most prominent among them. The antimicrobial property of betel leaf also acts as a food preservative due to containing many bioactive compounds like chavicol, chavibetol, allyl pyrocatechol, chavibetol acetate, and allyl pyrocatechol diacetate, etc. It is providing protection of food material from unwanted or harmful microorganisms. The antimicrobial efficacy of betel leaf combats E.

coli, streptococcus pyrogen, pseudomonas aeruginosa, staphylococcus aureus proteus vulgaris, etc. Sterol bioactive molecules are responsible for antimicrobial activity. The extract of betel leaf is rich in sterol molecules, with a substantial amount present^[12].

Antioxidant Residence

Antioxidants are a considerable feature of Betelblatt. The presence of polyphenolic compounds such as allylpylocate echo and chavicol in betselblatte extracts is responsible for their ability to govern the radiolipid peroxidation process. According to Dasgupta and De 2004, the extracts of Betelblatt contain better recognition of polyphenolic compounds compared to those determined in tea. found that extracts made from the etanolic prayer blades are a reliable source of vegetable antioxidants. Betelblatt's ethanol and methanol extracts contain numerous phenolic compounds. Ethanol (90%) and methanol (90%) in Prayerblatte contained 202.NINE and 205.2 mg GAE/G material with dry weight phenolic content^[13, 14].

Anti-Hungare Ability

Betelblatt, also known as prayer, was used for long-term use in the long term for recovery skills. It has been described as having antifungal settlements, which has become a reliable remedy for fungal infections. Studies have shown that the important oils acquired by Betel Leaf have robust antifungal skills compared to a unique type of mushroom consisting of *Candida albicans*, *Aspergillus Niger*, and *Trichophyton-Menment Agmité*. The antifungal properties of Betelblatt are attributed to the presence of a variety of energy connections, including Eugenol, Chavicol, and Terpenene. It has also been observed that the Prayerblatte Extract deviates from an increase in skin bacteria that could pos and be mushrooms, and manipulates pores and skin infections in athletes, including feet and ring worms. Furthermore, Prayerblatte extracts have been proven for painting when used with fluconazole along with various antifungal drugs to achieve forward effectiveness. In summary, Betelblatt's antifungal drugs make undoubtedly effective natural treatments for fungal infections. However, more research is needed to determine its effectiveness and security as a tool for fungal infections^[15].

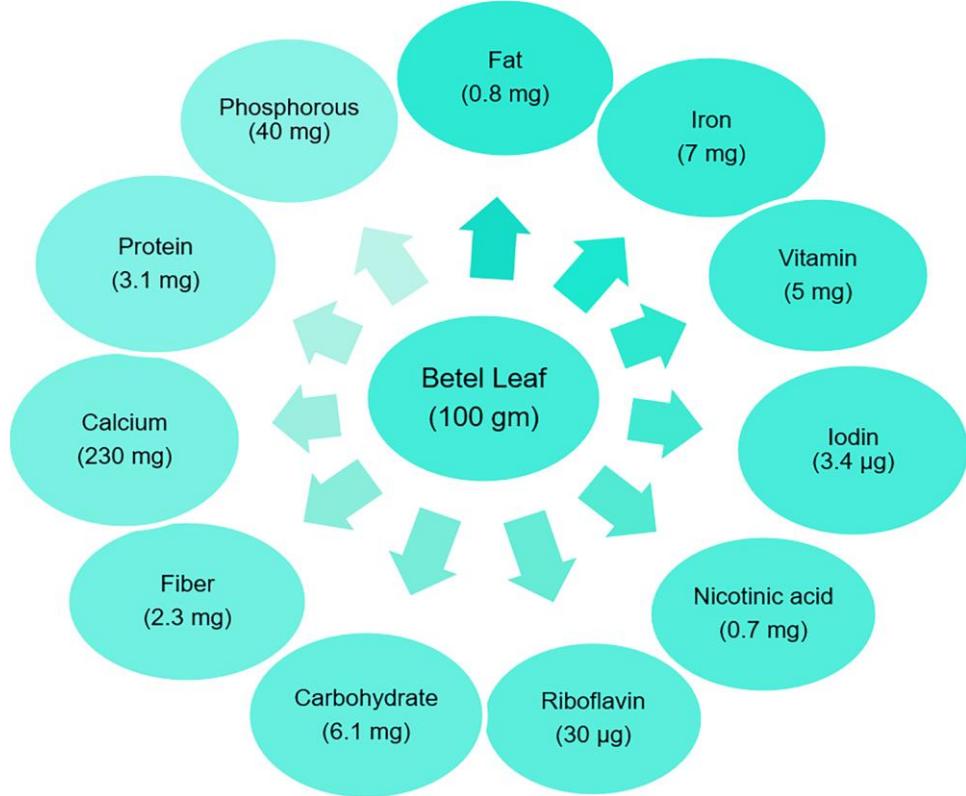
Anti-cancer Properties

The betel leaf also has another important anti-cancerous property because it contains polyphenol compounds. The carcinogenic nature of bioactive components such as chlorogenic and hydroxychavicol in tobacco is linked to the presence of phenolic compounds. In contrast, betel leaf is acknowledged as a traditional herbal remedy. Luteolin and apigenin are two types of phenolic compounds that can be found in red betel leaf. The derivatives of apigenin and luteolin have been discovered to be harmful to cancer cells. Each year, around 1.38 million new cases of breast cancer are reported globally, making it a common disease among women. The disease's high mortality rate is mainly attributed to delayed treatment, which is commonly seen during the metastasis phase.

This stage shows a notable rise in the activity of matrix metalloproteinases (mmp), cell movement, migration, and other events associated with the spread of cancer. Increased levels of matrix metalloproteinases (mmp), cell movement, migration, and other events linked to the metastatic process are responsible for this

stage. As radiation therapy or surgery are the only effective treatments for this condition, the development of chemotherapeutic medicines holds significant importance. The researchers used extracts made from red betel leaf to test their effectiveness in stopping the spread and damaging effects of breast cancer cells [16].

Figure 1: Constituents of betel leaf



Anti -inflammatory

Anti-inflammatory. Anti-inflammation plays a vital role in the complex biological response of blood vessels to harmful substances, such as pathogens, damaged cells, and irritants. It is a natural defense mechanism and is characterized by discomfort, increased body temperature, inflammation, redness, and impaired function. The main active ingredients in betel leaf that help reduce inflammation are substances called phenolic compounds, flavonoids, and terpenoids. These compounds have been scientifically validated to have antioxidant and anti-inflammatory properties, which can help alleviate inflammation within the body. In addition to their ability to reduce inflammation, flavonoids also offer benefits such as anti-allergic, antioxidant, anti-microbial, anti-cancer, and anti-diarrheal properties. Several types of cancer, including hepatic, pancreatic, breast, esophageal, and colon cancers, have been linked to flavonoids that induce cell death. Betel leaf contains a natural compound called eugenol, which has been found to have anti-inflammatory and pain-relieving properties. Studies have indicated that betel leaf extract may have the ability to reduce inflammation in various conditions, such as arthritis, asthma, and skin allergies. Inflammation is the body's response to injury, involving the support and nourishment of the affected tissue through the activation of supporting and vascular components.

Antidiabetic

Anti-hyperglycemic. It is widely acknowledged that betel leaf extract exhibits potent anti-diabetic properties and can successfully regulate blood glucose levels. The liquid extract obtained from betel leaves demonstrated a significant effect on reducing blood sugar levels in rats with low blood sugar, as measured during a nighttime testing period. When compared to untreated diabetic rats, streptozocin (stz) diabetic rats exhibit significantly lower blood glucose levels, glycosylated hemoglobin, and decreased liver glucose-6-phosphatase and fructose-1, 6-bisphosphatase activity, although liver hexokinase levels are higher. In a glucose tolerance test, the extract showed its capability to reduce blood sugar levels when exposed to external glucose [17].

Gastrointestinal and Gastro protective

According to the customary practice, chewing betel leaves is thought to improve digestion and increase salivary gland secretion. The prevention of gastric ulcers can be accomplished by utilizing betel leaf extract, which has been recognized for its capacity to safeguard the stomach. In an initial investigation, it was found that providing betel leaf to rats had a notable effect on their intestinal lining, bile production, and pancreatic enzyme activity. Betel leaves are incredibly nutritious and rich in vitamins and minerals. The leaves also contain enzymes like catalase and diastase, as well as a variety of essential amino acids, such as arginine, lysine, and Histidine. Previous studies on betel leaf mainly concentrated on separating and examining individual components of the extraction.

The importance of phyto-components found in betel leaf cannot be overstated, as they can be extracted from the leaf and used for a wide range of purposes. The leaves of the betel plant are rich in vital nutrients, vitamins, minerals, enzymes, and bioactive substances that possess therapeutic benefits. These substances can be advantageous in managing a wide range of health conditions, such as heart, liver, and brain diseases [18].

Extraction of Essential Oil

Prayer leaves, which are rich in essential oils (eo), are extensively used in traditional Chinese herbal medicines belonging to the piperaceae family, commonly known as bangla. Eo has been proven in different techniques, including distillation and soxhlet extraction. The researchers utilized hydrogenation to extract eo from recently harvested, dried leaves, while adjusting three independent factors: the duration of the process, the size of the particles, and the ratio of solid solvent to eo. The composition of eo-hardened leaves was $0.22 \pm 0.02\%$, while fresh leaves had a composition of $0.18 \pm 0.01\%$. The various types of bangla varieties produced oil with different percentages, ranging from 1.7% in the dry base to 2% in the mitha varieties, and 0.8% in the sanchi varieties. According to Jadhav et al. (2020), the purpose of their research was to extract eo using ultrasonic pretreatment methods that involved betelblatt. The efficiency of time, temperature, and performance was adjusted based on the percentage of extracted eo yield. The ultrasound-based pretreatment method produced better outcomes than the conventional hydropathic process. Both processes result in eos with similar physical properties, such as refractive index and specific weight. This research demonstrates the efficiency of ultrasonic pretreatment methods in extracting eo. During the trial, the team made adjustments to the distillation process by introducing the clevenger device, leading to a substantial rise in eo yield. The procedure using salt leaves on 10% salted salt sole has been shown to be 3 hours for 3 hours with the most effective oil extraction at a solid ratio of 1:1 and initial temperature cooking of the mixture at 80°C and 100°C . The fresh leaf tie samples showed 0.91 ml/kg of oil, whereas the old leaf tie samples (10 days old) exhibited 0.84 ml/kg of oil [19].

Isolation of active ingredients. There are many biologically effective substances in betel leaves. The main active ingredients found in the betel leaf are 4-chromanol, phytol, hydroxychavicol, eugenol, and several other compounds, as shown in the research. The bioactive compounds found in betel leaf contribute to its value as a source of antimicrobial, anti-inflammatory, antioxidant, antiulcer, cardio-protective, and other beneficial activities. The presence of eugenol, anethole, estragole, α -copaene, linalool, chavicol, and caryophyllene was detected in both fresh and preserved leaves of betel leaf. The oil has shown the capability to impede the development of *mycobacterium smegmatis*, *pseudomonas aeruginosa*, and *staphylococcus aureus*. The presence of eugenol (4.86 %), hydroxy chavicol (69.46 %), and 4-chromanol

(24 %) were calculated from betel leaf using the soxhlet equipment and ethanol as the solvent. The extract possesses a wide array of applications, such as antioxidant, anti-platelet, anti-inflammatory, antithrombotic, and antimicrobial properties. According to different kinds of piper betle l. various types of paan, including sanchi, bangla, khasia, misti, and bari paan, were examined using volatile compound analysis. The volatile components were extracted using simultaneous distillation [20].

Extraction (SDE) with 1:1 (v/v) events: diethyl ether. The highest eugenol concentrations were present in all types, followed by household classes, valencene, eucalyptol, and chavicol and caryophyllene oxide. Scientists have used ethanol prayer extracts to discover a connection between biological activities. The extract consisted of a variety of compounds, including steroids, tannins, flavonoids, terpenoids and flavonoids. The extract showed antibacterial activity against bacteria. Rahman et al. (2022) suggests that a green extraction technique called Print Heated Water Extraction (PHWE) can extract phenolic chemicals from prayer leaves. The main factors optimized were overall phenolic content (TPC) and antioxidant activity. The ideal condition was 210°C , 5 min, 15% solid stress, resulting in the antioxidant activity of 8.079 mg GAE/G TPC. Additionally, a plantchemical study in Chakraborty & Shah, 2011 showed that prayer leaf extraction contains alkaloids, amino acids, saponins, tannins, flavonoids, phenols, steroids and many other chemicals. Eight components of the major 3 ISC comamari lquinic acid and two of the 4-chromalylquinic acid in Bethelblat extracts were found using electrospray ionization mass spectrometry analysis (HPLC). Another study showed that solutions containing 61.15% phenol-2-methicloxy-4-(2-propenyl) acetic acid could be identified using gas chromatography mass spectrometry. The aqueous Bethelblat extract contains 4-chonol, and eugenol has a total proportion of 4-chomanol of 27.81%. In addition to this state, Betelblatt contains several important compounds such as Chavicol, Carvacrol, Hydroxy chavicol, Methyl eugenol, and Isoeugenol. The most frequently discovered phytochemical hydroxychavicol was identified in prayer extracts, improving the ability of the leaves to interfere with cell growth. We investigated the anti-tyrosinases, antioxidants, and antioxidants, as well as the antibacterial properties of processed Piper Beer (Kincell) and Anacardium Occidentale (Cashew) using microwave extraction methods using methanol as the solvent. Blanched leaves showed a low phenol content for the overall phenol, coffee party acid, and flavonoid content [21].

Color and Dye Extraction

Natural dyes are pigments derived from invertebrates, plants, or minerals. The rich natural dyes are plant-based, plant-based dyes from a variety of sources, including berries, roots, bark, wood, leaves, and even fungi. The amount of chlorophyll in the prayer leaves makes it look green. The colors of the prayer sheets we

re extracted with distilled water for 24 hours at room temperature with the help of a magnetic shaker. The coloured liquid was placed in the pasta dough. Improved the color and standard of Hokkien noodles.

The other researchers have utilized betel leaf to dye the cotton fabric, resulting in a vibrant and unique color. Cotton fabrics were dyed with eucalyptus and betel leaf powder extract, simultaneous mordanting with catechu, alum, and malachite green,

essentially maximum usage of dyestuffs and reduction of the dyeing procedure was achieved as a result of the dip principle used before drying shows green color. Cotton dye extraction is more prevalent in this scenario due to the widespread utilization of the common exhaustion method. After the cloth was dried, it was screen printed with a dye made from hibiscus flowers using a gum acacia, a natural adhesive.

Figure 2: Betel leaf shows major medicinal properties and its function

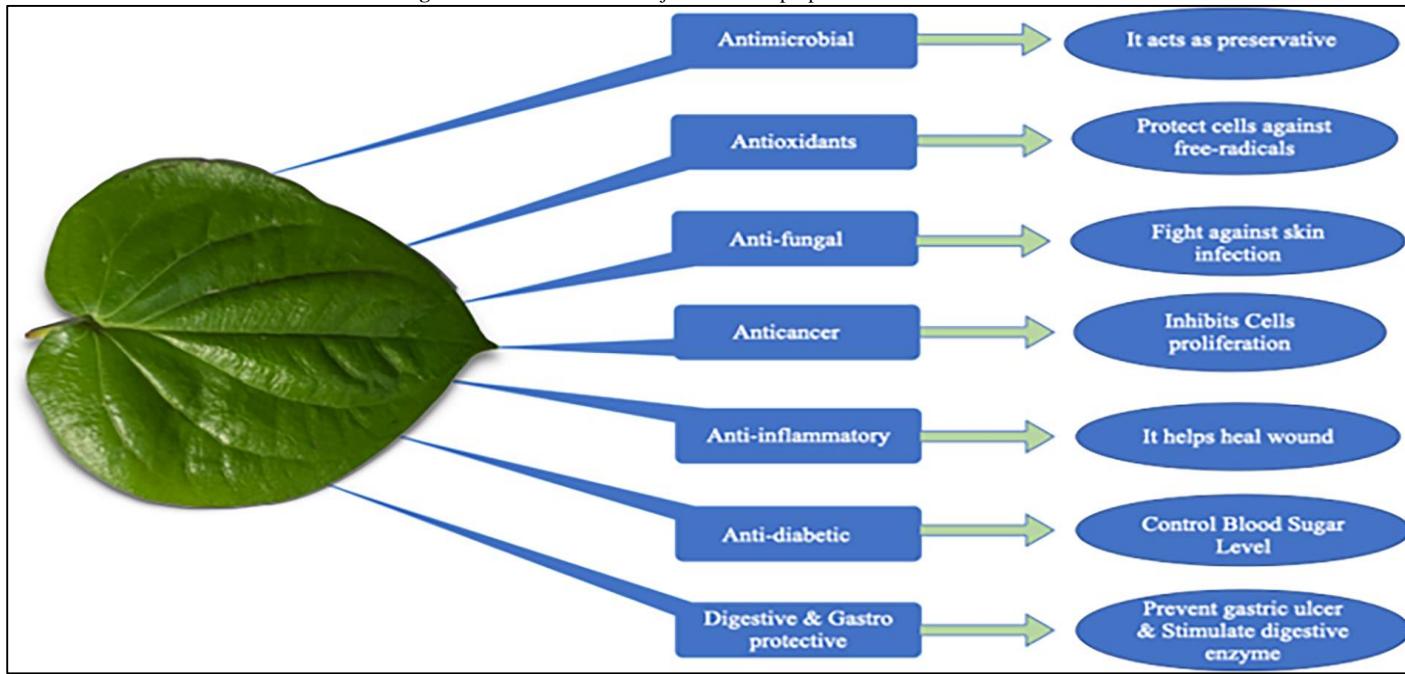
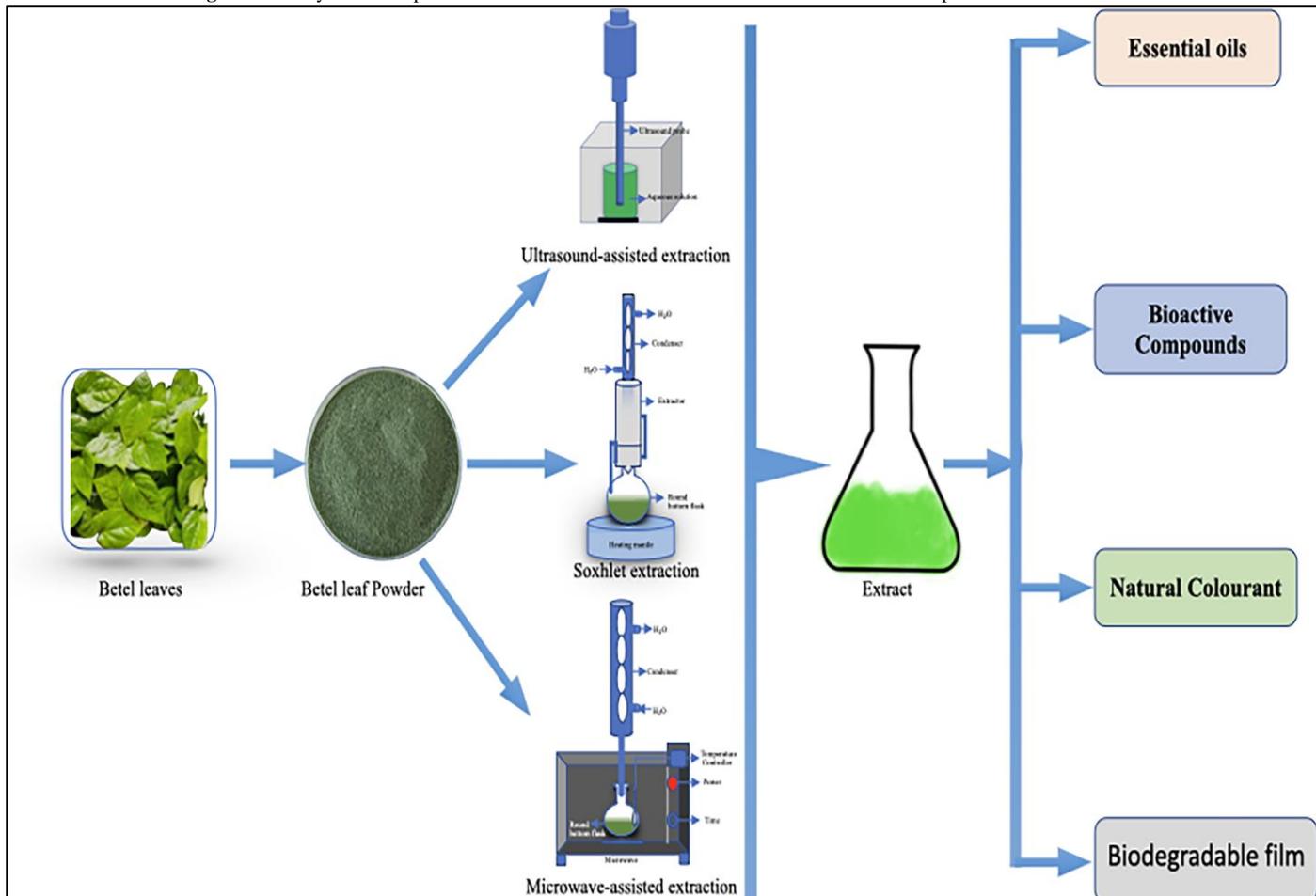


Figure 3: The systematic representation of different extraction methods and its extracted compounds from Betel leaf.



The results showed that natural coloring and screen printing was successful using natural dyes and natural dyes and natural binders on cotton fabric. Hafiz et al. (2021) says that natural color extraction sources from five many plants: Betel Leaf (*Piper Betle*), Dragon Fruit (*Hylocereus costaricensis*), Beetroot (*Beta vulgaris*), Roselle (*Hibiscus sabdariffa*), and Red Cabbage (*Brassica oleracea*),

olea Cea, emfunt decision forced, Balsam. There are various ways to extract color from a particular plant, each containing a different type of solvent. Compared to methanol and distilled water, the results of this study show that ethanol is the best solvent for all extraction techniques. The higher yield of extracted colours achieved when ethanol is used as a solvent serves as evidence. 117.6 mL of dye is produced by roselle plants, 300 mL is produced by soaking dragon

fruit, and 300 mL, 250 mL, and 100 mL are produced by other sources. Dragon Fruit offers a dark purple shade that turns pink in association with the natural chemicals of lip balm, but the roselle dark red dye produced with lip balm. In contrast, the Dragon Fruit Peel produces a delicate pink shade and looks yellowish yellowish on the lip balm. The red cabbage produces a bright purple dye that looks purple on the lip balm, the prayer blade creates a dark green dye that looks green on the lip balm, and the beetroot produces a dark purple color [22].

Application in Cosmetology

Promotes hair growth: Betel leaves can be used to create a natural scalp tonic by blending them with water and applying it to the scalp, which can encourage hair development and reduce hair loss.

Combats scalp issues: Betel leaves possess antifungal and antibacterial properties that can help address issues like dandruff, itchiness, and scalp acne

Strengthens hair: Regular use of betel leaf-infused hair oil or applying a paste made from crushed betel leaves on the scalp can nourish hair follicles, leading to reduced hair fall and breakage.

Prevents premature graying: Betel leaf has the potential to delay premature graying and restore the original color of hair. Betel leaves can also help with itching, dandruff, and split ends, enhancing hair texture and promoting thickness and length. Betel leaf assists in increasing blood circulation to the scalp, which promotes hair growth.

Mix with oil: Grind betel leaves and mix in a few drops of sesame oil or coconut oil, then apply this paste all over your hair and scalp for an hour, before rinsing off and washing with a gentle shampoo. Skin care: Betel leaves possess antibacterial and skin-lightening properties that can aid in reducing and brightening dark spots and blemishes.

Skin bleaching: Piper betle leaf extracts have been known to have therapeutic properties, such as skin-lightening effects, which can help reduce hyperpigmentation.

Anti-inflammatory and antioxidant properties: The polyphenol and flavonoid content in betel leaves serves as an antioxidant and anti-inflammatory agent, safeguarding hair and skin from harm inflicted by inflammatory skin conditions and free radicals.

Herbal face packs: Face masks made from herbal powders, such as betel leaves, can improve blood flow, revitalize the skin, and preserve its elasticity. Other advantages:

Antimicrobial properties: Betel leaf oil possesses antibacterial, antifungal, and antiviral properties, making it an effective ingredient in oral hygiene products and as a natural preservative. Because of its delightful scent, betel leaf oil is also utilized in aromatherapy and as a fragrant ingredient in personal care products.

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