



Herbal Extracts In The Treatment Of Melasma: A Comprehensive Review

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Abstract: Melasma is a chronic skin condition marked by hyperpigmented patches, commonly triggered by hormonal fluctuations, sun exposure, and genetic predisposition¹. While conventional treatments - such as hydroquinone and retinoid are effective, their prolonged use is often limited by side effects including irritation, rebound hyperpigmentation, and skin thinning². In recent years, herbal creams formulated with novel plant-based extracts have emerged as a promising alternative for the topical management of melasma³. These formulations leverage the natural tyrosinase-inhibitory, antioxidant, and anti-inflammatory properties of bioactive compounds found in herbs like Bakuchiol (Psoralea corylifolia)⁴, Glabridin from Licorice (Glycyrrhiza glabra)⁵, Alpha-arbutin from Bearberry (Arctostaphylos uva-ursi)⁶, Mulberry extract⁷ and Kojic acid-producing fungi-derived botanicals⁸. Incorporated into emulsion-based creams, these activities not only reduce melanin synthesis but also enhance skin tone uniformity with minimal irritation⁹.

Key words: Melasma, Herbal extract, Mechanism of action, Active constituent, Extraction method

1. INTRODUCTION

Melasma is defined as a localized hyperpigmentation disorder of the facial skin due to increased melanogenesis influenced by hormonal changes, sun exposure, and genetic predisposition¹⁰. Melasma derived from the Greek word, melas meaning black. Melasma is histologically classified into epidermal, dermal, mixed, and indeterminate types based on the depth of melanin, assessed by Wood's lamp or histopathology. Epidermal melasma enhances under Wood's lamp and responds well to treatment, while dermal and mixed types are harder to treat, and indeterminate cases are common in darker skin where depth can't be accurately assessed¹¹. Melasma is caused by factors like sun exposure, hormonal changes, genetics, certain medications or cosmetics, thyroid issues, stress, and exposure to heat or visible light, all of which can over stimulate melanin production in the skin¹². Herbs commonly used to treat melasma include licorice, turmeric, aloe vera, green tea, mulberry, and bearberry, as they contain natural compounds that inhibit melanin production and reduce inflammation¹³. Active herbal components for melasma include glabridin (licorice), curcumin (turmeric), arbutin (bearberry), kojic acid (fermented rice), ellagic acid (pomegranate), vitamin C, flavonoids (green tea), resveratrol (grapes), and silymarin (milk thistle), which mainly work by inhibiting melanin production and reducing pigmentation¹⁴. Herbal extracts are described as concentrated

preparations obtained by extraction of herbs, which contain the active constituents or their soluble derivatives in concentrated form. They may be prepared by using solvents like water, alcohol, or hydroalcoholic mixtures, and are intended for therapeutic use¹⁵. Conventional melasma treatments work quickly and effectively but may cause irritation and sensitivity¹⁶. In contrast, herbal treatments are gentler, with fewer side effects, offering gradual skin lightening while supporting overall skin health for long-term use¹⁷. Plant-based extracts in herbal creams treat melasma by inhibiting tyrosinase to reduce melanin production, while their antioxidants protect skin from UV-induced oxidative stress that triggers pigmentation. Additionally, their anti-inflammatory properties soothe skin irritation, and some extracts promote collagen synthesis and skin renewal to improve texture and reduce dark patches¹⁸.



Figure no. 1: Melasma

2. MECHANISM OF ACTION

- **Inhibition of Tyrosinase Activity**
Tyrosinase is a key enzyme in melanin synthesis.
Herbal compounds inhibit tyrosinase to reduce melanin production.
Examples: Glabridin (Licorice)¹⁹, Arbutin (Mulberry)²⁰, Baicalein (Scutellaria)²¹.
- **Antioxidant Activity**
Neutralize free radicals that stimulate melanin production.
Reduces oxidative stress-related pigmentation.
Examples: Curcumin (Turmeric)²², EGCG (Green tea)²³, Proanthocyanidins (Grape seed)²⁴.
- **Inhibition of Melanocyte Proliferation and Melanosome Transfer**
Limits the production and transfer of melanin to skin cells.
Reduces melanin accumulation in the epidermis.
Examples: Genistein (Soya)²⁵, Niacinamide (from natural sources)²⁶.
- **Blocking UV-Induced Melanogenesis**
Prevents UV-induced activation of melanin synthesis.
Offers natural photoprotection.
Examples: Punicalagins (Pomegranate)²⁷, Glabridin (Licorice)¹⁹.
- **Promoting Skin Renewal and Exfoliation**
Removes pigmented dead skin cells.
Encourages turnover of keratinocytes.
Examples: Papain (Papaya)²⁸, Citric acid (Lemon)²⁹.
- **Anti-Inflammatory Effects**
Reduces inflammation that triggers melanocyte activity.
Prevents post-inflammatory hyperpigmentation.
Examples: Aloesin (Aloe vera)³⁰, Apigenin (Chamomile)³¹.

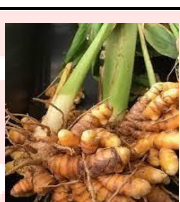
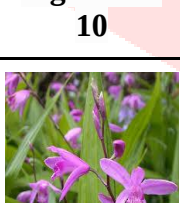
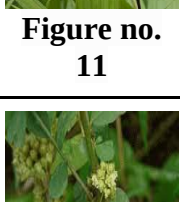
3. SIGNIFICANCE OF HERBAL EXTRACTS

- Safe and Natural Alternatives³²
- Multi-Targeted Mechanisms of Action³³
- Better Tolerability for Long-Term Use³⁴
- Antioxidant and Anti-Inflammatory Effects³⁵
- Hormonal Modulation³⁶
- UV Protection³⁷
- Traditionally Accepted and Culturally Preferred³⁸
- Environmentally Friendly and Sustainable³⁹
- Useful in Combination Therapy⁴⁰
- Innovation in Cosmeceutical Formulations⁴¹

4. HERBAL EXTRACTS IN MELASMA TREATMENT

Table no. 1

SL NO.	HERBS	NAME AND FAMILY	ACTIVE CONSTITUENT	MECHANISM OF ACTION	EXTRACTION
1.	 Figure no.2	Rumex occidentalis, Polygonaceae ⁴²	Flavonoids, Tannins	Tyrosinase inhibition	Ethanollic extraction
2.	 Figure no. 3	Glycyrrhiza glabra (Licorice), Fabaceae ⁴³	Glabridin, Liquiritin	Inhibits tyrosinase, Anti-inflammatory	Supercritical CO ₂ or Ethanol extraction
3.	 Figure no. 4	Morus alba (White Mulberry), Moraceae ⁴⁴	Mulberroside A, Mulberroside F, Oxyresveratrol	Tyrosinase inhibition	Aqueous or Methanolic extraction
4.	 Figure no. 5	Paeonia lactiflora (White Peony), Paeoniaceae ⁴⁵	Paeoniflorin	Anti-inflammatory, Antioxidant	Hydroalcoholic extraction

5.	 Figure no. 6	Arctostaphylos uva-ursi (Bearberry), Ericaceae ⁴⁶	Arbutin	Tyrosinase inhibition	Cold maceration with ethanol
6.	 Figure no. 7	Camellia sinensis (Green Tea), Theaceae ⁴⁷	EGCG, Polyphenols	Antioxidant, Inhibits melanogenesis	Hot water or Ethanol extraction
7.	 Figure no. 8	Silybum marianum (Milk Thistle), Asteraceae ⁴⁸	Silymarin, Silibinin	Inhibits melanin formation, Antioxidant	Ethanol or Acetone extraction
8.	 Figure no. 9	Punica granatum (Pomegranate), Lythraceae ⁴⁹	Ellagic acid	Inhibits tyrosinase, Antioxidant	Hydroalcoholic extraction
9.	 Figure no. 10	Curcuma longa (Turmeric), Zingiberaceae ⁵⁰	Curcumin	Antioxidant, Inhibits melanogenesis	Ethanol or Hexane extraction
10.	 Figure no. 11	Bletilla striata, Orchidaceae ⁵¹	Polysaccharides	Enhances skin repair, Anti-inflammatory	Aqueous extraction
11.	 Figure no. 12	Cuscuta chinensis, Convolvulaceae ⁵²	Flavonoids, quercetin, Cuscutin	Inhibits melanogenesis, Antioxidant	Methanolic extraction

12.	 Figure no. 13	Nigella sativa (Black Seed), Ranunculaceae ⁵³	Thymoquinone	Antioxidant, Melanogenesis inhibition	Cold-pressed oil or Methanolic extraction
13.	 Figure no. 14	Azadirachta indica (Neem), Meliaceae ⁵⁴	Nimbin, Azadirachtin	Anti-inflammatory, Melanin control	Cold maceration or Ethanol extraction
14.	 Figure no. 15	Emblica officinalis (Amla), Phyllanthaceae ⁵⁵	Ascorbic acid, Tannins, Gallic acid	Inhibits tyrosinase, Antioxidant	Aqueous or Methanol extraction
15.	 Figure no. 16	Ficus carica (Fig), Moraceae ⁵⁶	Psoralen, Flavonoids, Furanocoumarins, Psoralen-free phenolics	Antioxidant, Melanin inhibition	Ethanol or Aqueous extraction
16.	 Figure no. 17	Sophora flavescens, Fabaceae ⁵⁷	Matrine, Oxymatrine, Kushenol, Flavonoids	Tyrosinase inhibition	Ethanol or Hot water extraction
17.	 Figure no. 18	Berberis aristata (Tree Turmeric), Berberidaceae ⁵⁸	Berberine	Inhibits melanin synthesis	Methanol or Ethanol extraction

18.	 Figure no. 19	Aloe vera, Asphodelaceae ⁵⁹	Aloin, Polysaccharides ,Aloesin	Soothing, Anti- tyrosinase	Cold-pressed or Aqueous extraction
19.	 Figure no. 20	Baccharis trimera (Carqueja), Asteraceae ⁶⁰	Flavonoids	Antioxidant, Anti- inflammatory	Ethanol extraction
20.	 Figure no. 21	Psoralea corylifolia, Fabaceae ⁶¹	Bakuchiol,Psora len	Antioxidant, Inhibits melanogenesis, Retinol-like	Supercritical CO ₂ or Ethanol extraction
21.	 Figure no. 22	Artocarpus lakoocha, Moraceae ⁶²	Oxyresveratrol	Potent tyrosinase inhibitor	Methanolic or Hydroalcoholic extraction
22.	 Figure no. 23	Matricaria chamomilla, Asteraceae ⁶³	Apigenin, Azulene	Reduces melanin, Soothes inflammation	Aqueous or Ethanol extraction
23.	 Figure no. 24	Angelica sinensis (Dong Quai), Apiaceae ⁶⁴	Ferulic acid, Ligustilide	Inhibits UV- induced pigmentation	Ethanol or Water extraction

24.	 Figure no. 25	Sanguisorba officinalis, Rosaceae ⁶⁵	Tannins, Saponins, Flavonoids	Reduces melanin, Improves skin tone	Methanolic extraction
25.	 Figure no. 26	Terminalia chebula, Combretaceae ⁶⁶	Chebulinic acid, Ellagic acid	Anti-tyrosinase, Antioxidant	Water or Methanol extraction
26.	 Figure no. 27	Glycine max (Soybean), Fabaceae ⁶⁷	Genistein, Daidzein	Inhibits pigmentation via estrogenic activity	Ethanol extraction
27.	 Figure no. 28	Atractylodes macrocephala, Asteraceae ⁶⁸	Atractylenolide I–III	Blocks UV-induced melanin production	Methanol extraction
28.	 Figure no. 29	Magnolia officinalis, Magnoliaceae ⁶⁹	Magnolol, Honokiol	Anti-inflammatory, Inhibits melanin synthesis	Ethanol or Methanol extraction
29.	 Figure no. 30	Gardenia jasminoides, Rubiaceae ⁷⁰	Genipin, Crocin, Geniposide	Anti-tyrosinase, Reduces oxidative stress	Hydroalcoholic extraction

30.	 Figure no. 31	Camellia japonica (Japanese Camellia), Theaceae ⁷¹	Saponins, Polyphenols	Photoprotective, Reduces hyperpigmentation	Cold press or Ethanol extraction
31.	 Figure no. 32	Zanthoxylum piperitum (Japanese Pepper), Rutaceae ⁷²	Piperidine alkaloids, Flavonoids, Limonene	Inhibits melanosome transfer	Methanol or Ethanol extraction
32.	 Figure no. 33	Eclipta prostrata (False Daisy), Asteraceae ⁷³	Wedelolactone, Luteolin, Flavonoids	Tyrosinase inhibition, Antioxidant	Methanol or Ethanol extraction
33.	 Figure no. 34	Melaleuca alternifolia (Tea Tree), Myrtaceae ⁷⁴	Terpinen-4-ol	Anti-inflammatory, Antimicrobial	Steam distillation
34.	 Figure no. 35	Alpinia galanga (Greater Galangal), Zingiberaceae ⁷⁵	Galangin	Tyrosinase inhibition, Antioxidant	Ethanol extraction
35.	 Figure no. 36	Vaccinium myrtillus (Bilberry), Ericaceae ⁷⁶	Anthocyanins, Vitamin C	Protects against UV damage, Reduces melanin	Solvent extraction

36.	 Figure no. 37	Coffea arabica (Green Coffee), Rubiaceae ⁷⁷	Chlorogenic acid, Caffeine	Inhibits pigmentation, Antioxidant	Aqueous ethanol extraction
37.	 Figure no. 38	Cinnamomum verum (Cinnamon Bark), Lauraceae ⁷⁸	Cinnamaldehyde, Eugenol, Cinnamic acid	Melanin regulation, Anti-inflammatory	Ethanol or Steam distillation
38.	 Figure no. 39	Boswellia serrata (Frankincense), Burseraceae ⁷⁹	Boswellic acids	Reduces inflammation and hyperpigmentation	Methanol or Hexane extraction
39.	 Figure no. 40	Scutellaria baicalensis, Lamiaceae ⁸⁰	Baicalin, Wogonin, Baicalein	Reduces melanogenesis, Anti-inflammatory	Ethanol or Methanol extraction
40.	 Figure no. 41	Broussonetia papyrifera (Paper Mulberry), Moraceae ⁸¹	Broussonetiflavonol B, Kazinol F,	Potent anti-tyrosinase activity	Methanolic extraction
41.	 Figure no. 42	Vitis vinifera (Grape Seed), Vitaceae ⁸²	Proanthocyanidins, Flavonoids	Antioxidant, Tyrosinase inhibition	Ethanol or Methanol extraction

42.	 Figure no. 43	Orchis mascula (Orchid extract), Orchidaceae ⁸³	Phenolics, Flavonoids	Inhibits melanin, Improves skin tone	Water or Methanol extraction
43.	 Figure no. 44	Panax ginseng, Araliaceae ⁸⁴	Ginsenosides, Cinnamic acid	Anti-tyrosinase, anti-inflammatory	Ethanol extraction
44.	 Figure no. 45	Rubia cordifolia (Indian Madder), Rubiaceae ⁸⁵	Alizarin, Purpurin, Rubiadin	Inhibits tyrosinase, Anti-inflammatory, Depigmenting effect	Methanol or Ethanol extraction
45.	 Figure no. 46	Crocus sativus (Saffron), Iridaceae ⁸⁶	Crocin, Safranal, Picrocrocin	Tyrosinase inhibition, Suppresses melanin synthesis	Methanol or Ethanol extraction

CONCLUSION

The exploration of novel herbal extracts in the treatment of melasma represents a promising shift toward safer, more sustainable, and effective therapeutic alternatives. Numerous plant-based agents, such as *Scutellaria baicalensis*, *Glycyrrhiza glabra*, *Atractylodes macrocephala*, and *Eclipta prostrata*, have demonstrated significant depigmenting, antioxidant, anti-inflammatory, and tyrosinase-inhibitory activities, contributing to the regulation of melanogenesis. These herbal extracts offer multi-targeted mechanisms with fewer adverse effects compared to conventional therapies. However, further clinical trials, standardization of extraction methods, and identification of bioactive constituents are essential to validate their efficacy and ensure consistent therapeutic outcomes. Integrating these novel botanicals into topical formulations may enhance patient compliance and pave the way for future advancements in herbal dermatotherapy for melasma.

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