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Review

An Overview of Natural Bleaching Agents

Bhuvaneshwari. C, Bharathi. R, Akash. S, Ponmadasamy. M*, Vigneshwaran L.V.

RKP College of Pharmacy, Krishnagiri, Tamilnadu, India.

*Author for Correspondence: Ponmadasamy M
Email: ponmadasamymmc@gmail.com

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Abstract

The increasing demand for safer, more environmental friendly and sustainable alternatives to synthetic bleaching agents has sparked a lot of interest in natural bleaching agents from a range of industries, including food processing, cosmetics, dentistry and textiles. Consumer demands for non-toxic, eco-friendly and clean beauty products have led to a rise in the use of natural bleaching agents in cosmetic applications. The natural elements that have the ability to lighten skin and whiten teeth-like arbutin, azelaic acid, aloe vera, antioxidants, cucumber, lemon, banana peel, apple, rosella, green pear and coconut oil-are the main emphasis of this review. Bleaching is caused by the chemical components of these substances.

Keywords: Natural bleaching agents,skin lightening agents, antioxidants, dental bleaching agents.

1.INTRODUCTION

Bleaching agents are fusions that lighten or fade a substrate by changing the light- absorbing rates of the substance or by dissolving colour- producing components.[1] Compounds deduced from natural sources that are supposed to offer an equal tone and aesthetic appearance are known as natural bleaching agents. Skin-lightening composites are used to improve skin tone, lighten dark areas on the skin and treat issues with colourful skin. The most common way that skin- lightening treatments work is by inhibiting tyrosinase and impeding the conformation of melanin. However, the color that distinguishes skin, hair and eyes is melanin, a naturally occurring protective pigment. Our bodies produce melanin through specialized cells called melanocytes, which are set up in the stratum germinativum or rudimentary subcaste. Uneven melanin distribution and deposit can degrade the skin's natural appearance. Because of their reduced toxin and adverse goods, natural skin- lightening agents are recommended over their synthetic coequals.[2] For nearly a century, dulling agents have been essential factors of drawing systems in a variety of Products, including laundry cleansers, detergents, dishwashing greasepaint, face cleaners, cosmetics and wastewater treatments. Bleach was primarily employed for disinfection in the home, healthcare and business sectors throughout the epidemic. A 42 increase in the need for medical help is linked to the increased use of dulling chemicals.[3]

2.NATUTAL INGRIEDIENTS AS SKIN LIGHTENING AGENTS

2.1. ARBUTIN

Arbutin is a naturally occurring glycosylated hydroquinone that is mostly found as beta-arbutin in the leaves of plants in the Ericaceae family, including blueberries, cranberries and bearberries. Arbutin has received recognition as a skin-lightening agent that is generally recommended and accepted worldwide. Since ancient times, bearberries, or *Arctostaphylos uva-ursi,* have been utilized as a rich natural source of arbutin. Alpha-arbutin is an additional type of arbutin that can be produced enzymatically from β-arbutin or hydroquinone. Hydroquinone and beta arbutin have been shown to be less stable, safe and efficacious than alpha arbutin. Through competitive inhibition of tyrosinase biosynthesis, an enzyme involved in melanin synthesis in melanocytes, arbutin has demonstrated possible anti-tyrosinase activity. This action results in a decrease of melanin production and lightening of skin tone. Sunspots, melasma, freckles, senile lentigines, post-inflammatory hyperpigmentation, hyperpigmentation and uneven skin tone are all conditions that arbutin might be used to treat.[2]

Fig 1: Arbutin plant[29]

2.2. AZELAIC ACID

The dicarboxylic acid complex known as azelaic acid is found naturally in barley, wheat, and rye. Malassezia furfur, a yeast that thrives on healthy skin, also naturally creates azelaic acid. Dark spot lightening, hyperpigmentation, melasma, maintaining an indeed skin tone, acne scars and other skin diseases may all be treated with azelaic acid. Through the specific inhibition of the tyrosinase enzyme, which is in charge of our body's melanin conflation, azelaic acid lowers the quantum of melanin produced.[2]

Fig 2: Azelaic acid[30]

2.3. ALOE VERA

Barbaloin, another name for aloin, is a well- known anthracene glycoside that's present in numerous different types of aloe and is well- known for its long- lasting purgative and ornamental goods. This chemical has a bitter flavor and ranges in colour from unheroic to brown. By competitively inhibiting tyrosinase, an enzyme essential to the conformation of melanin, aloesin, occasionally referred to as aloe resin B, the resinous element found in aloe, has demonstrated significant pledge in crack mending, burn treatment and reducing melanogenesis.[2]

Fig 3: Aloe vera plant[31]

2.4. ANTIOXIDANTS

One system that helps lessen the issue of hyperpigmentation is the use of antioxidants. This is because nonstop UV light causes oxidative stress, which readily triggers the melanogenesis process.According to a study by Huang et al., the skin's product of reactive oxygen species(ROS) and poisonous hydrogen peroxide(H2O2) causes oxidative cellular stress to make gradationally. Accordingly, the generated ROS will concentrate and interact with the tyrosinase enzyme to initiate the melanogenesis process. Therefore, by scavenging and neutralizing these dangerous revolutionaries as well as promoting free radical declination, antioxidants play a critical part in regulating and reducing the product of free revolutionaries in the skin. Also, through chelating copper ions in a tyrosinase enzyme's active point and interacting with o- quinones within melanin interceders, antioxidants may also help to lessen hyperpigmentation situations.Flavonoids, vitamin C and Vitamin E are the most current phytochemicals with antioxidant rates that inhibit melanogenesis.[9]

Fig 4: Antioxidants[32]

2.5. BETEL LEAF

According to reports, *Piper betle* exhibits tyrosinase- inhibiting properties. It has been demonstrated that hydroxychavicol, also known as 1- allyl- 3, 4- dihydroxybenzene, which is contained in Piper betle leaves, is a significant phenolic component that contributes to anti- tyrosinase properties, according to a patent by Majeed et al. Majeed et al. also demonstrated that the tyrosinase inhibition activity at 90 hydroxychavicol content had an inhibitory concentration (IC50) of 8 µg/ mL.[9]

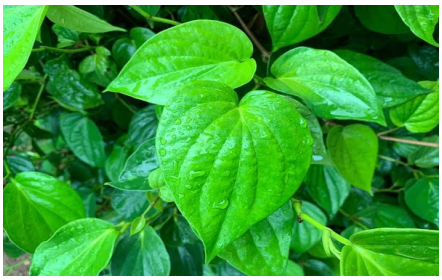

Fig 5: Betel leaf[33]

2.6. GREEN TEA

Green tea or *Camellia sinensis*, is a common component in cosmetic treatments, particularly those that end to lighten skin. One of the primary bioactive factors of green tea extract, epigallocatechin-3-gallate, is one of

the polyphenolic chemicals found in the leaf extract also, it has been demonstrated that epigallocatechin-3-gallate(ECGC) has skin- lightening qualities through a variety of modes of action in the melanin production pathway, including tyrosinase inhibitory, antioxidant and anti-inflammatory actions.[9]

Fig 6: Green tea[34]

2.7. COFFEE

According to scientific research, coffeeberry, also known as *Coffea arabica*, has skin-lightening qualities. Proanthocyanidins , quinic acid, caffeic acid and chlorogenic acid are among the polyphenolic chemicals that are mostly found in coffeeberry fruit extract. Compared to vitamin C and E and green tea extract, coffeeberry has been demonstrated to contribute to an effective antioxidant activity because of the high concentration of polyphenolic components in the fruit extract.[9]

Fig 7: Coffee[35]

2.8. CUCUMBER

A natural anti-inflammatory compound with remarkable moisturizing and skin-calming qualities. Provides modest cell regeneration benefits and aids in skin tightening.[18]

Fig 8: Cucumber[36]

2.9. LEMON

Lemons or *Citrus limon linn* as they are known scientifically, have strong antioxidant properties that stop the creation of melanin. Hesperidin and ascorbic acid, two major bioactive substances that are widely present in lemon fruit peels, are the cause of this.[9]

Fig 9: Lemon[37]

2.10. LIQUORICE

An isoflavonoid called Glabridin was mostly extracted from the root of the liquorice factory, *Glycyrrhiza glabra*, which is a member of the Fabaceae family. Glabridin was present in the hydrophobic section of the root extract as a unheroic- brown powder. Another substance that was separated from the same plant, liqriritin, may have the capacity to lessen hyperpigmentation.[2]

Fig 10: Liquorice root[38]

3.DENTAL BLEACHING AGENTS

3.1. BANANA PEEL

Both organic and inorganic materials can be found in banana peel. Bananas also contain a significant amount of calcium and minerals. Banana peels contain the highest concentrations of water, calcium, phosphorus and vitamin C. The body benefits greatly from these four components, particularly the teeth. Furthermore, banana peels contain saponins, which have the ability to whiten teeth. Saponins are foam-forming glucosides that have cleaning properties.[27]

Fig 11: Banana peel[39]

3.2. APPLE

Apples are one fruit that has malic acid, which can help get rid of tooth stains. In addition to being eaten raw, apples are constantly consumed as juice.[27]

Fig 12: Apple[40]

3.3. ROSELLA

Rosella *(Hibiscus sabdariffa)* contains anthocyanins, ascorbic acid, salicylic extract, cardiac glycosides, flavonoids, saponins, alkaloids, cardenolide and anthocyanins. The petals of rosella flowers are also known to provide vital nutrients that the body need, like calcium, necessary proteins, vitamin C, vitamin A and 18 amino acids, including arginine and lignin, which are good for cell renewal. The bioactive ingredient rosella (*Hibiscus sabdariffa*) contains saponins that generate a foam that can bind stains and colors, making it suitable for teeth-whitening applications.[27]

Fig 13: Rosella[41]

3.4. GREEN PEAR

The acids that are classified as malic, citric, oxalic, shikimic, fumaric, tartaric and lactic are acids found in *Pyrus communis*. Natural substances called malic and oxalic acids, which are present in green pears *(Pyrus communis)*, have the ability to whiten teeth and eliminate surface Stains.[27]

Fig 14: Green pear[42]

3.5. COCONUT OIL

The coconut palm is referred to in Sanskrit as Kalpa Vriksha, or “tree that provides life necessities,” because almost every part of it has some advantages. Oil pulling has been used for years by Indians to treat foul breath, gingival bleeding and dry mouth. It also supposedly strengthens teeth and prevents decay

Fig 15: Coconut oil[43]

Table 1: A Brief Description of Natural Bleaching Agents

S.No	Bleaching Agents	Biological Source	Family	Chemical Constituents	Uses [Reference]
1	Arbutin	*Aractostaphylos uva ursi*	Ericaceae	hydroquinone glycoside	Used in treatment of urinary tract infections, skin hyperpigmentation, cancer and has anti-inflammatory properties, antioxidant properties.[4,5]
2	Azelaic acid	Initially identified in rancid lipids and present in wheat, rye, barley and other whole grains	-	Chemically dicarboxylic acid	Treatment of rosacea, comedonal and inflammatory acne vulgaris and a number of hyperpigmentation conditions, such as melasma and post-inflammatory hyperpigmentation, either alone or in combination.[6,7]
3	Aloe vera	*Aloe barbadensis miller*	Asphodelaceae (Liliaceae)	From the gel: Polysaccharides: glucomannan and acemannan., From the latex leaf lining: Anthraquinone glycosides: aloin, aloe-emodin, barbaloin	Protective agent,anti-inflammatory agent, antimicrobial agent and immunomodulatory agent.[8]
4	Antioxidants	Commonly used fruits, vegetables, herbs, spices and edible mushrooms are examples of natural sources	-	Phenolic acids, flavonoids, volatile oils, alpha-tocopherol and ascorbic acid	Prevent disease caused by free radicals, diabetes and hypertension.[10,11,12]
5	Betel leaf	*Piper betle linn*	Piperaceae	Chavibetol, Chavibetol acetate, Caryophyllene, campene, eugenol, a-pinene, f-pinene and u-limonene	Antiulcer activity, anti allergic, antibacterial agent, anticancer agent, antidiabetic agent and antidermotophytic agent.[13]

6	Green tea	Extracted from plant *Camellia sinensis*	Theaceae	Complex proteins, amino acids(threonine, tryptophan, glycine), carbohydrates, caffeine, minerals, lipids and polyphenols	Green tea works well for skin care, especially when it comes to reducing eczema and acne symptoms. Used to prevent arthritis, dental caries, diabetes and neurodegenerative disorder.[14]
7	Coffee	*Coffea arabica L.* (Arabica coffee)	Rubiaceae	The primary chemical component of coffee beans is caffeine. Coffee beans also contain minerals, carbohydrates, lipids, cellulose, tannin and polyphenols	Antioxidant, anti-inflammatory and antimicrobial agent. Used to treat neurodegenerative disorder.[15,16]
8	Cucumber	*Cucumis sativus*	Cucurbitaceae	The cotyledons of various varieties of C. sativus seedlings were found to contain the cucurbitacins A, B, C, D, and E. Ascorbic acid is highly concentrated in fruits, whereas lactic acid is present in pulp and peel extracts	Antioxidant activity, anti wrinkle and anti-aging activity, antimicrobial activity and ulcer protective activity.[17]
9	Lemon	*Citrus limon linn*	Rutaceae	Flavonoids, glycosides, Coumarins, polyphenols and volatile oils	Antioxidant activity, antimicrobial activity, antidiabetic activity, anti ulcer activity and anticancer activity.[19]
10	Liquorice	Dried roots and rhizomes of *Glycyrrhiza glabra L.*	Leguminosae	Triterpenenoids, flavonoids and Polysaccharides	Antioxidant, anti-inflammatory agent, antimicrobial agent and antitumor agent.[20]
11	Banana peel	*Musa acuminata Colla*	Musaceae	One of the best sources of vitamin B6 is said to be bananas. There are significant amounts of vitamin C, manganese and digestible food fibers in the fruits	Antiulcerogenic agent, antioxidant and also lowers blood cholesterol levels.[21,22]
12	Apple	*Malus domestica*	Rosaceae	Proteins, polyphenols, dietary fibers, Polysaccharides, carbohydrates, vitamins and minerals	Antioxidant, anti-bacterial, anti-depressant, anti-proliferative, anti-diabetic, anti-obesity and anti-inflammatory properties.[23]

13	Rosella	*Hibiscus sabdariffa L.*	Malvaceae	Protocatechuic acid and anthocyanins are abundant in rosella. The flavonoids sabdaretine, hibiscetine and gossypetine are present in the dried calyces. Daphniphylline has been identified as the primary pigment	Used to treat pyrexia, liver damage and hypertension.[24]
14	Green pear	*Pyrus communis L.*	Rosaceae	Polyphenols, Triterpenes, arbutin, procyanidins, arbutin, Catechins and hydroxycinnamic acids	Helps to prevent osteoporosis, high blood pressure, high cholesterol levels and helps in weight loss.[25]
15	Coconut oil	Extracted from coconut*(Cocos nucifera L.)*	Arecaceae	Fatty acids, phenolic compounds, phospholipids, tocopherol and sterols	Cardioprotective, anti-inflammatory agent, antiviral agent and anti-obesity agent.[26]

4. APPLLICATIONS OF NATURAL BLEACHING AGENTS

Applications of natural bleaching agents include:

- Cosmetics and beauty treatment.
- Surface cleaning.
- Paper industry.
- Laundry.
- Leather industry.
- Swimming pools.[3]

5. CONCLUSION

Natural bleaching agents are a viable and sustainable alternative to synthetic agents, with significant environmental, health and industrial benefits. With continued research and development, these natural agents have immense potential for altering industries and contributing to a greener future.

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