



DEPARTMENT OF CHEMISTRY
CHANDRAKONA VIDYASAGAR



MAHAVIDYALAYA

Affiliated to

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CHEMISTRY BEHIND AYURVEDA



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From the Principal's Desk

The Chemistry Department is one of the most active departments of Chandrakona Vidyasagar Mahavidyalaya known for its constant participation in several extracurricular activities apart from classroom teaching and learning. This year, the Chemistry Department comes up with a new edition of Chemistry magazine (in collaboration with Narajole Raj college & Kharagpur College) namely "Chemistry Behind Ayurveda" which represents the epitome of the talent and educative value of the Department. It brings me immense pleasure and joy in announcing the launch of the first issue of the Chemistry Magazine with a very contemporary theme and insights into the contribution of Chemistry in Ayurveda.

Ayurveda, an ancient system of medicine originating in India, incorporates principles of chemistry, herbalism, and holistic healing. While the traditional Ayurvedic approach predates modern chemistry, it does involve chemical concepts in its understanding of health and healing. Ayurvedic medicines often contain a variety of chemicals derived from natural sources such as plants, minerals, and metals. These chemicals play a role in the therapeutic effects of Ayurvedic remedies.

I am delighted to see the passion and enthusiasm in the faculty of the Department in encouraging their students to learn new skills and gain additional knowledge inculcating in them the habit of thinking out of the box. I would like to appreciate the efforts of the whole team of the faculty members and students and congratulate them for this issue.

Manoranjan Goswami
Dr. Manoranjan Goswami



CHEMISTRY BEHIND AYURVEDA

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Contents

Sl. No.	Topic	Page No.
1.	What Is Ayurveda	1
2.	Key concepts in Ayurveda	2
3.	Chemistry of Herbs and Spices	4-38
	i) Amla	4
	ii) Cucumber	8
	iii) Turmeric	11
	iv) Aloe vera	15
	v) Hibiscus	19
	vi) Bhringaraj	22
	vii) Sandalwood	25
	viii) Rose water	28
	ix) Neem	32
	x) Shikakai	35
4.	Conclusion	39



What Is Ayurveda?

Ayurveda is an ancient holistic system of medicine that originated in India over 5,000 years ago. The term "Ayurveda" is derived from Sanskrit, where "Ayur" means life, and "Veda" means knowledge or science. Thus, Ayurveda can be translated as the "science of life" or the "knowledge of life."

At its core, Ayurveda views health as a balance between mind, body, and spirit. It emphasizes the interconnectedness of all aspects of life and the importance of maintaining harmony within oneself and with the surrounding environment. According to Ayurvedic principles, when this balance is disrupted, illness and disease can arise.





Key concepts in Ayurveda:

Key concepts in Ayurveda include:

Doshas: Ayurveda categorizes individuals into three constitutional types or doshas: Vata (air and space), Pitta (fire and water), and Kapha (earth and water). Each person has a unique combination of these doshas, which influences their physical, mental, and emotional characteristics. Imbalances in the doshas are believed to contribute to health problems, and Ayurvedic treatments aim to restore equilibrium.

Diet & Lifestyle: Ayurveda emphasizes the importance of diet and lifestyle choices in maintaining health and preventing disease. It recognizes that different individuals may require different approaches to diet and lifestyle based on their dosha constitution and current state of imbalance.

Herbal Medicine: Ayurveda utilizes a wide range of herbs and natural remedies to promote health and treat various ailments. These remedies are often tailored to the individual's dosha constitution and specific health concerns.

Yoga & Meditation: Ayurveda incorporates practices such as yoga and meditation to promote physical and mental well-being. These practices are believed to help balance the doshas, reduce stress, and enhance overall vitality.



Detoxification: Ayurveda emphasizes the importance of detoxifying the body regularly to remove toxins (ama) that accumulate due to poor diet, lifestyle choices, and environmental factors. Panchakarma is a traditional Ayurvedic detoxification therapy that involves various cleansing procedures.

Massage & Body Therapies: Ayurveda utilizes massage, herbal oils, and other body therapies to promote relaxation, improve circulation, and balance the doshas. Abhyanga, or oil massage, is a common Ayurvedic practice that is believed to have numerous health benefits.

Ayurveda is not just a system of medicine but a way of life that encompasses various aspects of health, including diet, lifestyle, mental well-being, and spirituality. While Ayurveda continues to be practiced in India and other parts of the world, its principles are increasingly gaining recognition in the field of holistic and integrative medicine.



Chemistry of Herbs and Spices:

Ayurvedic medicines often contain a variety of chemicals derived from natural sources and these chemicals play a role in the therapeutic effects of Ayurvedic remedies. In this magazine we are discussing the chemistry about few such herbs and spices those are used in Ayurveda.

i) AMLA

Amla, also known as Indian gooseberry or *Phyllanthus Emblica* officinalis, is a fruit that is highly valued in traditional Ayurvedic medicine for its numerous health benefits. Amla, also known as Indian



Phyllanthus emblica

gooseberry, holds significant importance due to its various health benefits and nutritional value. It is a small green and sour fruit that grows on the Indian gooseberry tree. It is native to India and has been used for centuries in traditional ayurvedic medicine.

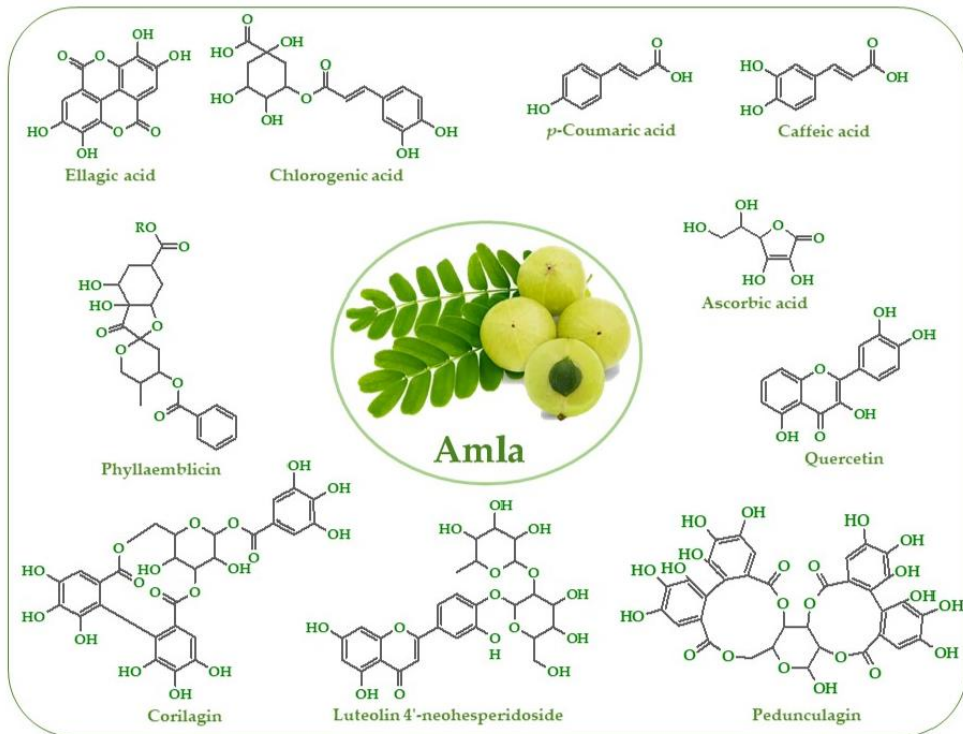
Chemical constituents of Amla:

The fruits contain

1. High amounts of ascorbic acid (vitamin C)
2. High density of ellagitannins, such as emblicanin A, emblicanin B, punigluconin and pedunculagin
3. Punicafolin



4. Phyllanemblinin A
5. Phyllanemblin
6. Polyphenols, such as flavonoids, kaempferol, ellagic acid, and gallic acid.



Structure of some chemicals present in Amla

Nutritional Properties and Applications of Amla:

Here are some reasons why Amla is considered important:

Rich in Vitamin C: Amla is renowned for its exceptionally high vitamin C content. It contains more vitamin C than many citrus fruits, making it a potent natural source of this essential nutrient.



Vitamin C is crucial for boosting immunity, promoting skin health, and aiding in the absorption of iron.

Antioxidant Properties: Amla is packed with antioxidants, including polyphenols and flavonoids. These compounds help neutralize harmful free radicals in the body, thereby reducing oxidative stress and lowering the risk of chronic diseases such as cancer and heart disease.

Supports Digestive Health: Amla is known to promote digestive health by stimulating the production of digestive enzymes and improving nutrient absorption. It also has mild laxative properties, which can help alleviate constipation and promote regular bowel movements.

Hair Care: Amla is a common ingredient in many hair care products due to its ability to nourish the hair follicles, strengthen the hair shaft, and promote hair growth. It can also help prevent premature graying and dandruff.

Heart Health: Amla may help maintain heart health by reducing cholesterol levels, lowering blood pressure, and improving blood circulation. Its anti-inflammatory properties may also protect against the development of atherosclerosis and other cardiovascular diseases.

Diabetes Management: Some studies suggest that Amla may have hypoglycemic properties, helping to regulate blood sugar



levels. It may also improve insulin sensitivity, making it potentially beneficial for individuals with diabetes.

Anti-inflammatory Effects: Amla exhibits anti-inflammatory properties, which can help reduce inflammation in the body and alleviate symptoms of inflammatory conditions such as arthritis and asthma.

Brain Health: Amla contains compounds that may support cognitive function and protect against neurodegenerative diseases like Alzheimer's. Its antioxidant properties help combat oxidative stress, which is implicated in brain aging and cognitive decline.

Skin Care: Amla is often used in skincare products due to its antioxidant and anti-inflammatory properties. It can help improve skin texture, reduce acne and blemishes, and delay the signs of aging.

Weight Management: Some research suggests that amla may aid in weight management by boosting metabolism, promoting fat breakdown, and reducing appetite.

Overall, amla is considered a valuable fruit in traditional medicine systems like Ayurveda, offering a wide range of health benefits that contribute to overall well-being and longevity.



ii) CUCUMBER

Cucumber is a widely consumed vegetable that holds significant importance due to its various health benefits, culinary versatility, and skincare properties.

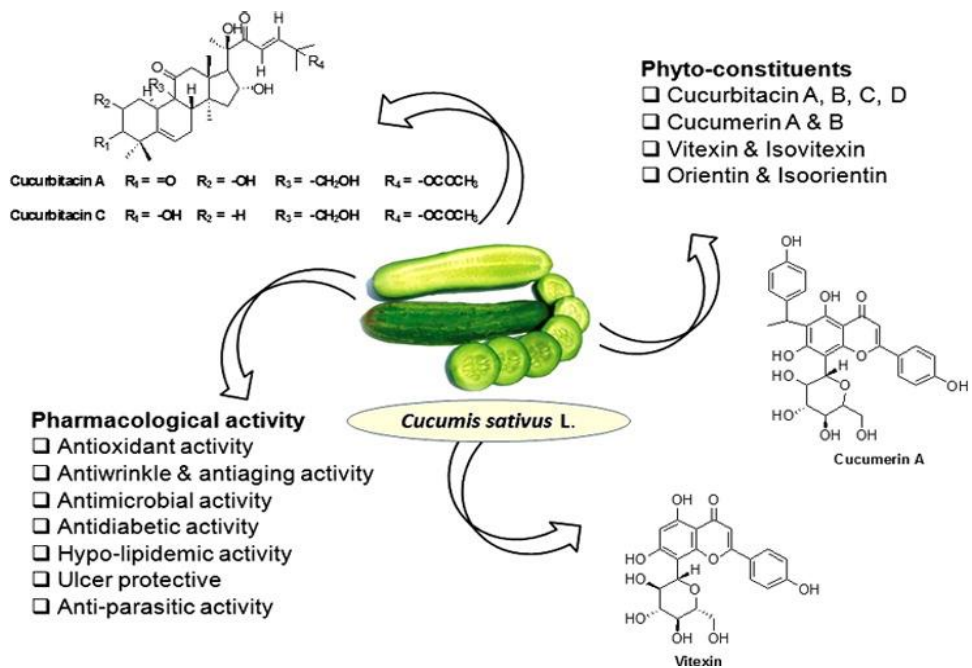


Chemical constituents:

Cucumis sativus

Raw cucumber (with peel) contains-

1. 95% Water
2. Carbohydrates, Protein and contains negligible fat
3. Vitamin K
4. Unsaturated aldehydes, such as (E, Z)-nona-2,6-dienal, and the *cis*- and *trans*- isomers of 2-nonenal
5. Cucurbitacins



Chemicals present in Cucumber



Nutritional Properties and Uses of Cucumber:

Here are some reasons why cucumber is considered important:

Hydration: Cucumbers have a high water content (about 95%), making them an excellent hydrating food. Eating cucumbers can help maintain hydration levels in the body, especially during hot weather or after physical activity.

Nutritional Value: Despite being low in calories, cucumbers are rich in nutrients such as vitamins K, C, and A, as well as potassium, magnesium, and dietary fiber. These nutrients play essential roles in supporting overall health, including bone health, immune function, and digestion.

Weight Management: Due to their low calorie and high water content, cucumbers are often included in weight loss and management diets. They provide a feeling of fullness and satiety while offering essential nutrients, making them a healthy snack option for those watching their calorie intake.

Digestive Health: Cucumbers are a good source of dietary fiber, which promotes digestive health by supporting regular bowel movements and preventing constipation. The fiber in cucumbers also helps maintain a healthy gut microbiome by feeding beneficial bacteria in the digestive tract.

Antioxidant Properties: Cucumbers contain various antioxidants, including flavonoids and tannins, which help



neutralize harmful free radicals in the body. Antioxidants play a crucial role in reducing inflammation, preventing oxidative stress, and lowering the risk of chronic diseases such as heart disease and cancer.

Skin Care: Cucumber is a common ingredient in skincare products due to its hydrating, soothing, and cooling properties. Cucumber slices or cucumber juice can be applied topically to the skin to reduce puffiness, soothe irritation, and hydrate dry skin. Cucumber extract is also used in facial masks, toners, and moisturizers to refresh and rejuvenate the skin.

Culinary Uses: Cucumbers are versatile vegetables that can be enjoyed in various culinary preparations. They can be eaten raw in salads, sandwiches, and wraps, or used as a crunchy topping for dishes. Cucumbers can also be pickled, added to soups and stews, or blended into smoothies and gazpachos.

Cooling Effect: Cucumbers have a natural cooling effect on the body, making them particularly refreshing during hot weather or after physical activity. Cucumber slices are often placed over the eyes to reduce puffiness and soothe tired eyes.

Cucumbers are a nutritious and hydrating vegetable that offers numerous health benefits, from supporting hydration and digestion to promoting skin health and antioxidant protection. Their versatility in both culinary and skincare applications makes them a valuable addition to a healthy lifestyle.



iii) **TURMERIC**

Turmeric, scientifically known as *Curcuma longa*, is a bright yellow-orange spice that has been used for thousands of years in traditional medicine, cooking, and religious ceremonies. Its importance stems from its numerous health benefits, culinary uses, and cultural significance.

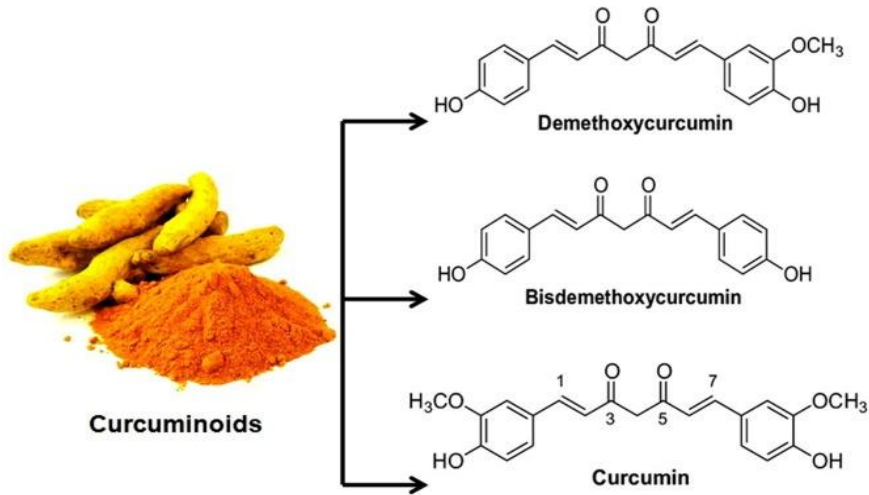


Curcuma longa

Chemical constituents:

Turmeric powder contains-

1. Carbohydrates
2. Water
3. Protein
4. Fat
5. Dietary minerals
6. Essential oils like turmerone, germacrone, atlantone, zingiberene etc.
7. Curcuminoids such as curcumin, demethoxycurcumin, and bisdemethoxycurcumin



Structure of some chemicals present in Turmeric

Properties and Uses of Cucumber:

Here are some reasons why turmeric is considered important:

Medicinal Properties: Turmeric contains a compound called curcumin, which is known for its potent anti-inflammatory and antioxidant properties. Curcumin has been extensively studied for its potential to treat and prevent various diseases, including arthritis, cancer, heart disease, Alzheimer's, and diabetes. It may also help improve digestion, boost immunity, and promote overall well-being.

Anti-inflammatory Effects: Chronic inflammation is linked to many diseases, and turmeric's anti-inflammatory properties are highly valued for their potential to reduce inflammation and



alleviate symptoms of inflammatory conditions such as arthritis, asthma, and inflammatory bowel diseases.

Antioxidant Activity: Turmeric is rich in antioxidants, which help neutralize harmful free radicals in the body and protect cells from oxidative damage. Antioxidants play a crucial role in preventing chronic diseases and slowing down the aging process.

Pain Relief: Turmeric has been used traditionally to relieve pain and discomfort associated with various conditions. It is believed to inhibit pain pathways and reduce inflammation, making it effective for managing conditions like arthritis, muscle soreness, and menstrual cramps.

Skin Health: Turmeric is a common ingredient in skincare products due to its anti-inflammatory and antioxidant properties. It may help reduce acne, improve skin tone, and soothe irritation. Additionally, turmeric paste is used in traditional medicine for wound healing and treating skin conditions like eczema and psoriasis.

Culinary Uses: Turmeric is a staple spice in many cuisines, particularly in South Asian and Middle Eastern cooking. It adds color, flavor, and depth to dishes such as curries, soups, rice, and stews. Turmeric is also used to make beverages like golden milk and teas, which are consumed for their health benefits.



Cultural & Religious Significance: Turmeric holds cultural and religious significance in many societies. It is used in religious ceremonies, festivals, and rituals as a symbol of purity, prosperity, and auspiciousness. Turmeric paste is also applied to the skin in traditional Indian weddings as part of the pre-wedding rituals to enhance the bride's beauty and bless her with good fortune.

Natural Dye: Turmeric has been used traditionally as a natural dye for textiles, fabrics, and food products due to its vibrant yellow color.

Turmeric is a versatile spice with a wide range of health benefits, culinary uses, and cultural significance. Its potent medicinal properties and rich history make it an essential and cherished ingredient in many cultures around the world.



iv) **ÆELOE VERA**

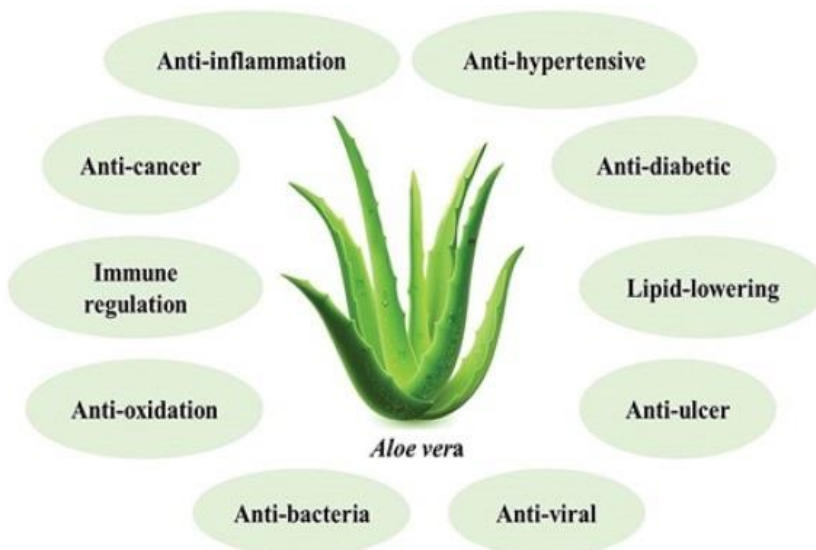
Aloe Vera is a succulent plant species that has been used for centuries for its medicinal, cosmetic, and nutritional benefits.



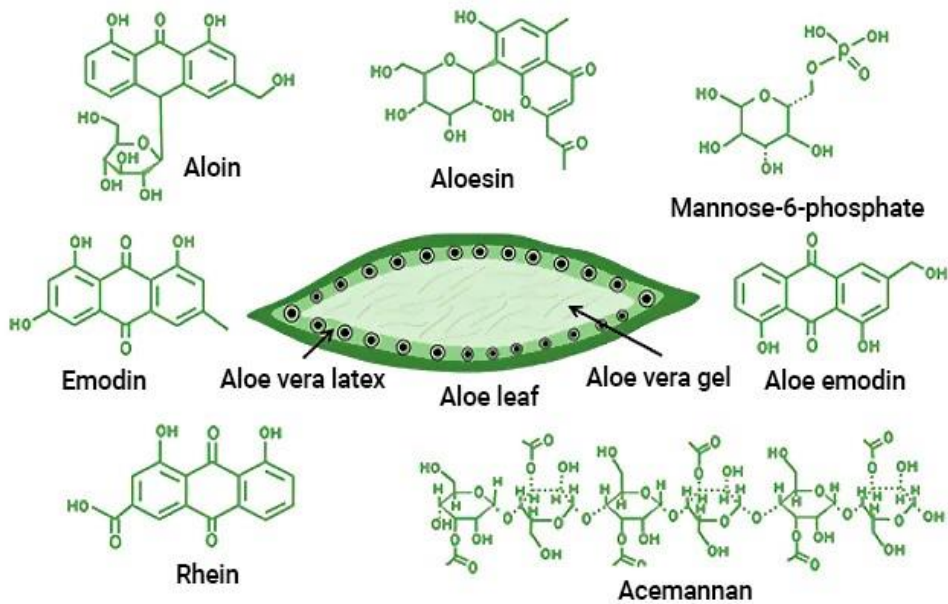
Aloe barbadensis miller

Chemical constituents of Aloe Vera:

1. Water
2. Water-soluble and fat-soluble vitamins
3. Minerals
4. Enzymes
5. Polysaccharides
6. Phenolic compounds like Lupeol
7. Organic acids such as salicylic acid, cinnamonic acid etc.



Properties of Aloe vera



Chemical structure of some phytochemicals of Aloe vera

Nutritional Properties and Applications of Aloe Vera:

Here are some reasons why aloe vera is considered important:

Skin Health: Aloe vera is well-known for its soothing and moisturizing properties, making it a popular ingredient in skincare products. It can help alleviate sunburn, reduce inflammation, hydrate dry skin, and promote wound healing. Aloe vera gel is often used topically to treat various skin conditions such as eczema, psoriasis, acne, and minor burns.

Wound Healing: Aloe vera has natural antimicrobial and anti-inflammatory properties that can help accelerate the healing process of wounds and minor cuts. It forms a protective barrier



over the skin, which can reduce the risk of infection and promote tissue regeneration.

Hair Care: Aloe vera is beneficial for hair health and can be used to nourish the scalp, strengthen hair follicles, and promote hair growth. It helps maintain the pH balance of the scalp, soothes irritation, and conditions the hair, leaving it soft and shiny. Aloe vera gel or juice can be applied directly to the scalp or added to hair care products such as shampoos and conditioners.

Digestive Health: Aloe vera contains compounds called polysaccharides that have a mild laxative effect and can help improve digestion. Drinking aloe vera juice may help alleviate symptoms of gastrointestinal disorders such as indigestion, constipation, and irritable bowel syndrome (IBS). It can also support gut health by promoting the growth of beneficial bacteria in the digestive tract.

Immune Support: Aloe vera contains vitamins, minerals, and antioxidants that can help boost the immune system and protect the body against infections and diseases. It has anti-inflammatory properties that may help reduce inflammation and support overall immune function.

Oral Health: Aloe vera gel can be used as a natural mouthwash or toothpaste ingredient due to its antibacterial and anti-inflammatory properties. It can help reduce plaque buildup,



soothe gum inflammation, and promote oral hygiene. Some studies suggest that aloe vera may also aid in the treatment of oral ulcers and periodontal disease.

Nutritional Value: Aloe vera is rich in vitamins, minerals, amino acids, and enzymes that are essential for overall health and well-being. It contains vitamins A, C, E, B vitamins, calcium, magnesium, zinc, and antioxidants, which contribute to its nutritional value.

Overall, aloe vera is a versatile plant with numerous health and beauty benefits. Its soothing, healing, and hydrating properties make it a valuable natural remedy for various skin, hair, digestive, and immune-related issues.



v) HIBISCUS

Hibiscus is a flowering plant that holds significant importance due to its various uses and benefits.

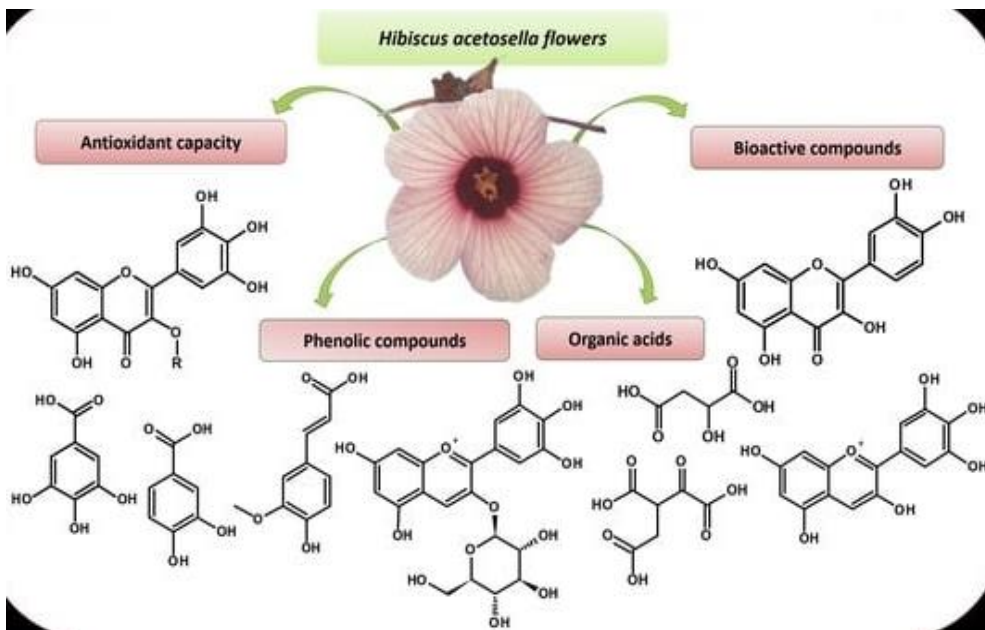


Hibiscus rosa-sinensis

Chemicals presents in Hibiscus:

Main bioactive compounds of the Hibiscus plant are-

1. Phenolic acids
2. Flavonoids
3. Anthocyanins
4. Organic acids (citric, hydroxycitric, hibiscus, tartaric, malic, and ascorbic).



Chemical structure of some phytochemicals of Hibiscus flower



Applications of Hibiscus:

Here are some reasons why hibiscus is considered important:

Medicinal Properties: Hibiscus is rich in antioxidants, vitamins, and minerals, making it beneficial for health. It is known for its potential to lower blood pressure, reduce cholesterol levels, and improve heart health. Additionally, hibiscus tea is often consumed for its diuretic properties, which may help with weight management and detoxification.

Skin & Hair Care: Hibiscus is a common ingredient in skincare and hair care products due to its nourishing and rejuvenating properties. It is believed to promote hair growth, strengthen hair follicles, prevent premature graying, and add shine to the hair. Additionally, hibiscus extracts are used in various skincare products for their ability to hydrate the skin, improve elasticity, and reduce the appearance of wrinkles and fine lines.

Culinary Uses: Hibiscus flowers are edible and used in various culinary applications around the world. They can be brewed into herbal teas, added to salads, used as a garnish, or even made into jams and jellies. Hibiscus adds a tangy flavor and vibrant color to dishes, making it a versatile ingredient in cooking.

Ornamental Plant: Hibiscus plants are prized for their colorful and attractive flowers, which come in a wide range of hues,



including red, pink, yellow, and white. They are commonly grown as ornamental plants in gardens, parks, and landscapes, adding beauty and visual interest to outdoor spaces.

Traditional Medicine: In many cultures, hibiscus has been used for centuries as a traditional remedy for various health conditions. It is believed to have anti-inflammatory, antibacterial, and anti-allergic properties, making it useful for treating ailments such as coughs, colds, and skin irritations.

Biodiversity: Hibiscus plants contribute to biodiversity by providing habitat and food for various pollinators, including bees, butterflies, and hummingbirds. Their flowers attract pollinators with their nectar and pollen, supporting ecosystem health and biodiversity.

Cultural Significance: Hibiscus holds cultural significance in many countries and regions around the world. It is often used in religious ceremonies, weddings, and cultural celebrations as a symbol of beauty, love, and prosperity.

Overall, hibiscus is a versatile plant with numerous uses and benefits, ranging from health and wellness to culinary and decorative purposes. Its rich history, cultural significance, and wide-ranging applications make it an important and cherished plant in many societies.



vi) **BHRINGRAJ**

Bhringaraj, scientifically known as *Eclipta alba*, is a herb with significant importance in traditional Ayurvedic medicine and other traditional healing systems. It is a hardy crop and can be grown on various types of soil.

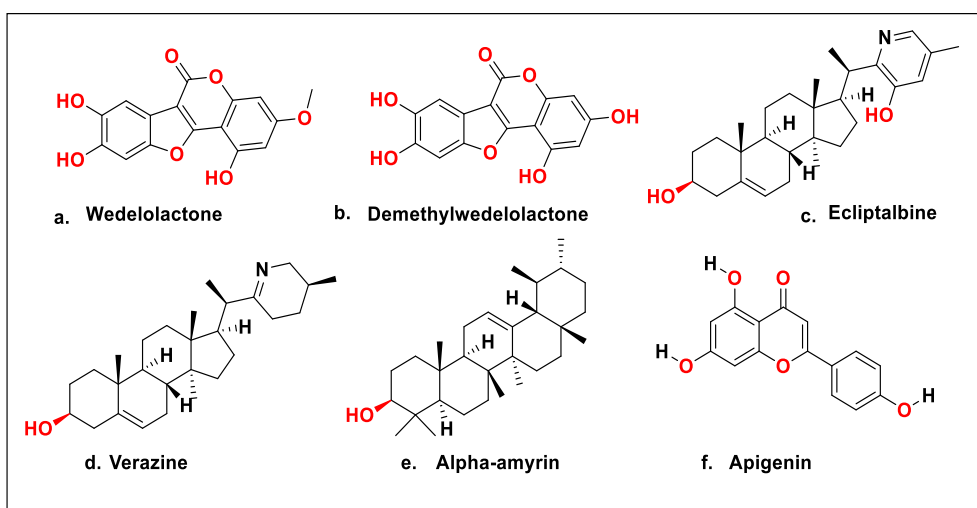


Eclipta alba

Chemical constituents of Bhringaraj:

A wide range of chemical compounds have been isolated from this species which accounts for its pharmacological properties.

1. Alkaloids
2. Flavanoids and their glycosides



Chemical structure of some phytochemicals of *Eclipta alba*



Uses of Bhringaraj:

Here are some reasons why Bhringaraj is considered important:

Hair Care: Bhringaraj is widely used in Ayurvedic hair care formulations due to its ability to promote hair growth, strengthen hair follicles, and improve hair texture. It nourishes the scalp, reduces hair fall, prevents premature graying, and helps maintain healthy hair.

Scalp Health: Bhringaraj has antimicrobial, anti-inflammatory, and antioxidant properties that help maintain scalp health. It soothes scalp irritation, reduces dandruff, and prevents fungal infections, promoting overall scalp wellness.

Liver Health: In Ayurveda, Bhringaraj is considered a potent liver tonic. It helps detoxify the liver, improve liver function, and protect the liver from damage caused by toxins and free radicals. Bhringaraj is often used in Ayurvedic formulations for liver disorders such as jaundice and hepatitis.

Digestive Health: Bhringaraj is known for its digestive properties in Ayurveda. It helps stimulate appetite, improve digestion, and relieve digestive discomfort such as indigestion, bloating, and gas. Bhringaraj stimulates the secretion of digestive enzymes and promotes healthy bowel movements.



Anti-inflammatory Effects: Bhringaraj exhibits anti-inflammatory properties that help reduce inflammation throughout the body. It may help alleviate symptoms of inflammatory conditions such as arthritis, inflammatory bowel disease, and skin disorders.

Antioxidant Protection: Bhringaraj contains antioxidants that help neutralize harmful free radicals in the body, protecting cells from oxidative damage. Antioxidants in Bhringaraj contribute to overall health and well-being and may help prevent chronic diseases associated with oxidative stress.

Immune Support: Bhringaraj is believed to strengthen the immune system and enhance the body's resistance to infections and diseases. Regular consumption of Bhringaraj may help boost immunity and promote overall health.

Stress Relief: Bhringaraj is considered an adaptogenic herb in Ayurveda, meaning it helps the body adapt to stress and promotes resilience. It has a calming effect on the nervous system, reduces stress levels, and promotes relaxation.

Generally, Bhringaraj is a versatile herb with various health benefits, particularly in hair care, liver health, digestion, and immunity. Its traditional use in Ayurvedic medicine highlights its importance as a potent remedy for promoting overall health and well-being.



vii) SANDALWOOD

Sandalwood is a highly valued tree species known for its fragrant wood, essential oil, and various medicinal properties.

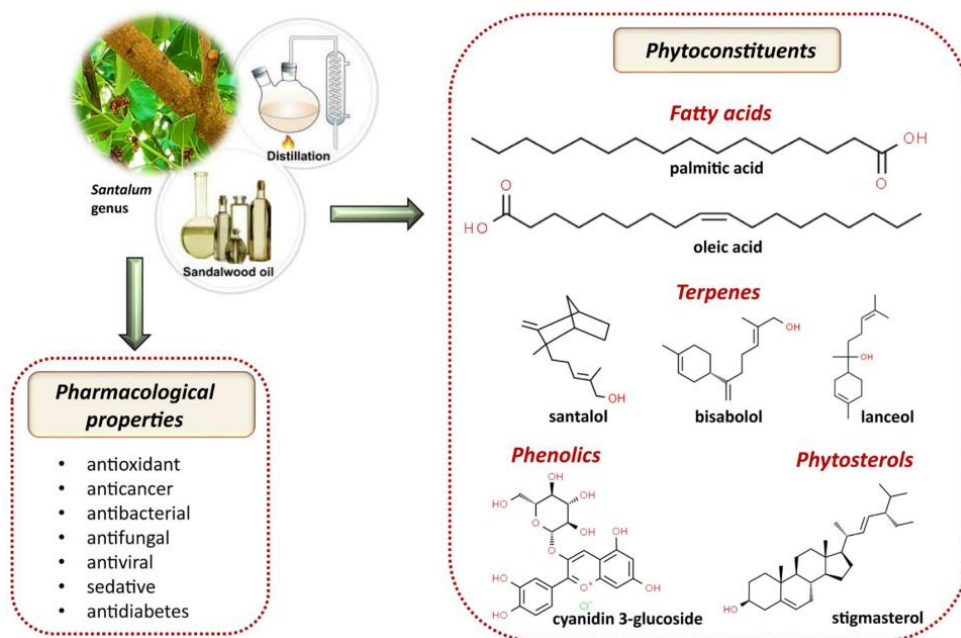


Santalum album

Chemicals in Sandalwood:

The main constituents of the sandalwood are-

1. α -Santalol and
2. β -santalol
3. santenone



Properties & chemical structure of some phytochemicals of *Santalum album*



Uses of Sandalwood:

Here are some reasons why sandalwood is considered important:

Fragrance and Aromatherapy: Sandalwood is renowned for its rich, woody aroma, which is prized in perfumery and aromatherapy. Sandalwood essential oil is used in perfumes, candles, incense, and skincare products for its calming, grounding, and soothing fragrance. In aromatherapy, sandalwood oil is believed to promote relaxation, reduce anxiety, and enhance mood.

Skin Care: Sandalwood has been used for centuries in traditional medicine systems such as Ayurveda and traditional Chinese medicine for its skincare benefits. It has antimicrobial, anti-inflammatory, and astringent properties that help soothe irritated skin, reduce acne, and promote overall skin health. Sandalwood powder or oil is often used in face masks, creams, and lotions to improve complexion and treat various skin conditions.

Medicinal Uses: Sandalwood has a long history of medicinal use in various cultures. It is believed to have anti-inflammatory, antiseptic, analgesic, and anti-aging properties. Sandalwood oil is used topically to relieve skin irritation, inflammation, and itching. It is also used in traditional medicine for its calming effects on the nervous system and its ability to alleviate anxiety, depression, and stress.



Religious and Spiritual Significance: Sandalwood holds significant religious and spiritual importance in many cultures. It is used in religious ceremonies, rituals, and meditation practices for its purifying and grounding properties. Sandalwood paste is applied to idols, prayer beads, and sacred objects in Hinduism, Buddhism, and other spiritual traditions as a symbol of reverence and devotion.

Woodworking and Handicrafts: The heartwood of sandalwood trees is highly prized for its fine-grained, fragrant wood, which is used in woodworking, carving, and handicrafts. Sandalwood is used to make furniture, sculptures, musical instruments, and decorative items such as beads and boxes. Its aromatic wood is also used in the production of luxury items like perfumed fans and handcrafted accessories.

Incense and Rituals: Sandalwood incense has been used for centuries in religious ceremonies, meditation practices, and rituals. It is believed to purify the environment, promote spiritual awareness, and enhance concentration. Sandalwood incense sticks, cones, and powders are burned as offerings and used to create a sacred atmosphere in temples, shrines, and meditation spaces.

In general, sandalwood is a versatile and valuable resource with a wide range of uses and cultural significance. Its fragrant wood, essential oil, and medicinal properties make it an important ingredient in perfumery, skincare, traditional medicine, and spiritual practices around the world.



viii) ROSE WATER

Rose water is versatile floral water derived from the distillation of rose petals. It has been used for centuries for its various beauty, culinary, and medicinal properties. Here are some reasons why rose water is considered important:



Rosa damascena

Chemical Constituents of Rose Water:

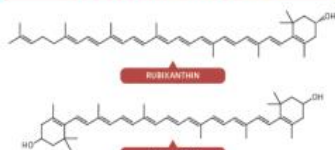
Following monoterpenoid and alkane components are detected in rose water-

1. Citronellol
2. Nonadecane
3. Geraniol
4. Phenyl ethyl alcohol
5. Henicosane
6. 9-nonadecen
7. Eicosane
8. Linalool
9. Citronellyl acetate
10. Methyleugenol
11. Heptadecane
12. Pentadecane
13. Docosane
14. Nerol
15. Disiloxane
16. Octadecane
17. Pentacosane



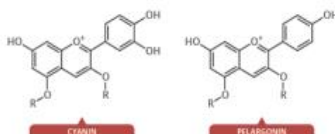
THE COLOUR AND AROMA OF ROSES

THE COLOURS OF ROSES



Other carotenoids include lutein, lycopene, beta-carotene, toruloxanthin, and maskefinin

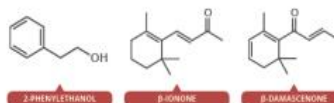
Roses come in a variety of colours, and different chemical pigments are responsible for the different shades. A large variety of carotenoids (above) give yellow and orange hues, while a smaller number of anthocyanins (below) give the more typical reds. Combinations of compounds from the two classes of pigments give the variety of different shades of these colours.



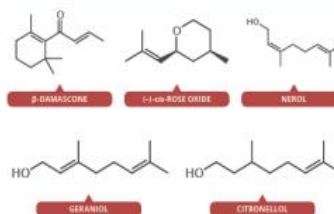
R groups = glucose (in both molecules)



THE AROMA OF ROSES



The aroma of roses is contributed to by a number of different chemical compounds; some key contributors are shown here. Their contribution to the aroma varies and isn't tied to their concentrations; in fact a number of them have very low concentrations! Important contributors are rose ketones (including damascenones, damascones, and ionones) and (-)-cis-rose oxide.



Chemical structure of some phytochemicals presents in Rose

Applications of Rose Water:

Skin Care: Rose water is known for its soothing, hydrating, and toning properties, making it a popular ingredient in skincare products. It helps balance the skin's pH, reduce redness and inflammation, and maintain moisture levels. Rose water can be used as a facial toner, makeup setting spray, or as an ingredient in face masks, cleansers, and moisturizers to promote healthy, radiant skin.

Hydration: Rose water has natural hydrating properties that help refresh and rejuvenate the skin. It is often used as a facial mist or



spritz to provide instant hydration and relief, especially during hot weather or after sun exposure. Rose water can also be added to bathwater to soften and hydrate the skin.

Anti-inflammatory: Rose water contains anti-inflammatory compounds that help soothe irritation and reduce redness and swelling. It is commonly used to calm sensitive or irritated skin, including conditions such as sunburn, eczema, and rosacea. Applying rose water topically can help alleviate discomfort and promote skin healing.

Antioxidant: Rose water is rich in antioxidants, including vitamin C and flavonoids, which help protect the skin from free radical damage and premature aging. Antioxidants in rose water help combat environmental stressors, such as pollution and UV radiation, and promote a youthful, radiant complexion.

Aromatherapy: The delicate floral scent of rose water has a calming and uplifting effect on the mind and emotions. In aromatherapy, inhaling the aroma of rose water can help reduce stress, anxiety, and tension, promoting relaxation and emotional well-being. Rose water can be used in diffusers, room sprays, or added to bathwater for a therapeutic experience.

Culinary Uses: Rose water is used as a flavoring agent in culinary preparations, particularly in Middle Eastern, Indian, and Mediterranean cuisines. It adds a subtle floral aroma and flavor to



desserts, beverages, and savory dishes. Rose water is commonly used in recipes for sweets such as baklava, Turkish delight, and rosewater lassi.

Hair Care: Rose water can be used to nourish and condition the hair, leaving it soft, shiny, and fragrant. It helps balance the scalp's pH, soothe scalp irritation, and reduce dandruff. Rose water can be added to homemade hair masks, rinses, or hair sprays to promote healthy hair and scalp.

Overall, rose water is a versatile and multipurpose ingredient with numerous benefits for skincare, aromatherapy, culinary, and hair care applications. Its gentle yet effective properties make it a valuable addition to beauty routines and daily wellness practices.



ix) NEEM

Neem, scientifically known as *Azadirachta indica*, holds a significant place in Ayurveda, the traditional Indian system of medicine.

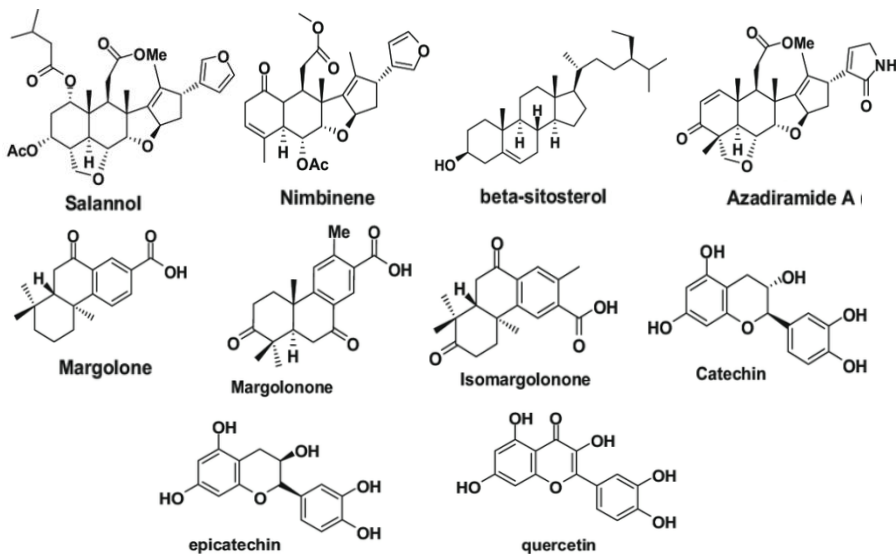
Chemical Constituents of Neem:

Azadirachta indica L. (neem) shows therapeutic role in health management due to rich source of various types of ingredients. The most important active constituents are-



Azadirachta indica

1. Azadirachtin
2. Nimbolinin
3. Nimbin
4. Nimbidin
5. Nimbidol
6. Gedunin
7. Quercetin.



Chemical structure of some phytochemicals of Neem



Applications of Neem:

Here are some of the prominent uses of neem in Ayurveda:

Antibacterial and Antifungal Properties: Neem is renowned for its potent antibacterial and antifungal properties. It is used in various Ayurvedic formulations to treat skin infections, wounds, and other bacterial or fungal ailments.

Blood Purification: In Ayurveda, neem is considered a powerful blood purifier. It helps in detoxifying the blood and removing toxins, which can help in treating various skin disorders and improving overall health.

Anti-inflammatory: Neem possesses anti-inflammatory properties, making it beneficial in reducing inflammation in the body. It is used to alleviate conditions such as arthritis, joint pain, and inflammatory skin disorders like eczema and psoriasis.

Immune Booster: Neem is believed to enhance the immune system. Regular consumption of neem or neem-based supplements is thought to boost immunity and aid in preventing various infections and diseases.

Dental Care: Neem twigs have been traditionally used in India for oral hygiene. Chewing neem twigs is believed to strengthen gums, prevent cavities, and fight off oral infections due to its antibacterial properties.

Digestive Health: Neem is beneficial for digestive health. It is used to treat various digestive disorders like constipation,



bloating, and indigestion. Neem leaves or extracts are sometimes included in Ayurvedic formulations targeting gastrointestinal issues.

Skin Care: Neem is extensively used in Ayurvedic skin care preparations. Its antibacterial and antifungal properties make it effective against acne, pimples, and other skin infections. Neem-based creams, lotions, and oils are popular for promoting clear and healthy skin.

Hair Care: Neem oil is commonly used in Ayurvedic hair care products. It is believed to nourish the scalp, strengthen hair follicles, and prevent dandruff and scalp infections.

Anti-parasitic: Neem is also known for its anti-parasitic properties. It is used to treat various parasitic infections, including intestinal worms.

Diabetes Management: Some studies suggest that neem may have a positive impact on managing blood sugar levels. In Ayurveda, neem is sometimes recommended as a supportive therapy for individuals with diabetes.

These are just some of the many uses of neem in Ayurveda. It has been an integral part of traditional Indian medicine for centuries and continues to be valued for its therapeutic properties. However, it's essential to consult with a qualified Ayurvedic practitioner before using neem or any other herbal remedy for medicinal purposes.



x) **SHIKAKAI**

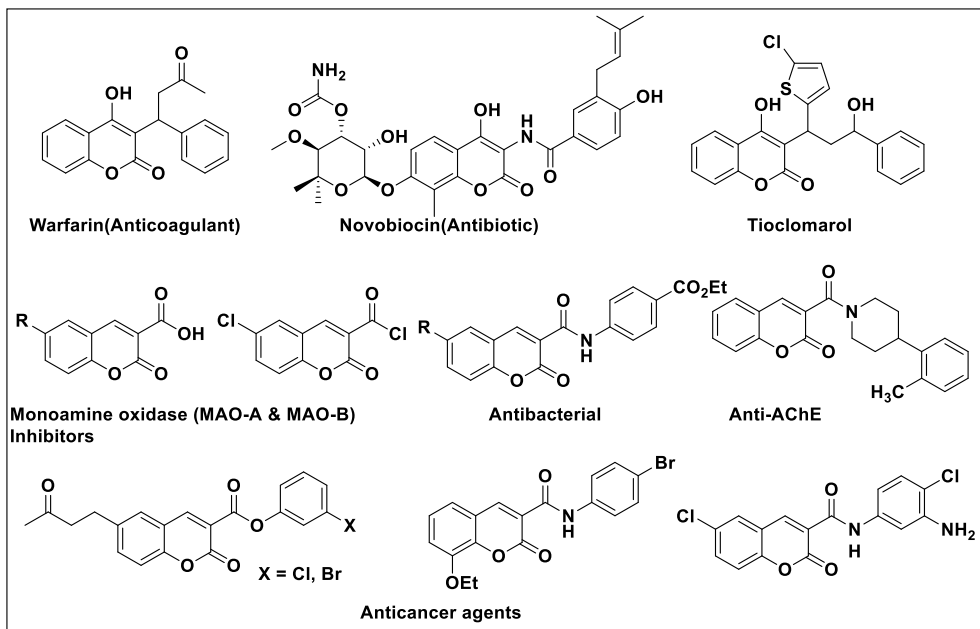
Shikakai, botanically known as *Acacia concinna*, is a traditional Ayurvedic herb that has been used for centuries in India for hair care.



Acacia concinna

Shikaki contains-

1. Lupeol
2. Spinasterol
3. Acacic acid
4. Lactone
5. Natural sugars such as glucose, arabinose and rhamnose
6. Hexacosanol
7. Spinasterone
8. Oxalic acid
9. Tartaric acid
10. Citric acid
11. Succinic acid
12. Ascorbic acid
13. Alkaloids like calyctomine and nicotine.



Chemical structure of some phytochemicals present in Shikakai

Applications of Shikakai:

Here are some of the key uses of shikakai in Ayurveda:

Hair Cleansing: Shikakai is a natural hair cleanser. It contains saponins, which are natural surfactants that lather up when mixed with water. Traditionally, shikakai powder is used to wash hair instead of commercial shampoos. It cleanses the scalp and hair effectively without stripping away natural oils, making it suitable for all hair types, including sensitive scalp.

Hair Growth and Strengthening: Shikakai is believed to promote hair growth and strengthen hair follicles. It contains



essential vitamins and antioxidants that nourish the scalp and hair roots, promoting healthier and stronger hair growth.

Scalp Health: Shikakai is beneficial for maintaining scalp health. It helps to balance the scalp's natural oils, preventing dryness, itchiness, and dandruff. Regular use of shikakai can soothe the scalp and reduce inflammation, promoting a healthier environment for hair growth.

Dandruff Treatment: Shikakai has antifungal properties that make it effective in treating dandruff and other scalp infections. It helps to cleanse the scalp, remove dead skin cells, and control the growth of dandruff-causing fungi.

Hair Conditioning: Shikakai acts as a natural conditioner, leaving hair soft, smooth, and manageable. It helps to detangle hair, reduce frizz, and improve hair texture without the use of chemical-based conditioners.

Prevention of Premature Graying: Shikakai is believed to help prevent premature graying of hair. Regular use of shikakai can help maintain the natural color of hair by nourishing the hair follicles and promoting overall hair health.

Natural Alternative to Chemical Hair Products: Shikakai is a natural and eco-friendly alternative to commercial hair care products that often contain harsh chemicals. It is gentle on the



hair and scalp, making it suitable for long-term use without causing any side effects.

Overall Hair Health: Shikakai is rich in vitamins, antioxidants, and other nutrients that are beneficial for overall hair health. It nourishes the hair shaft, repairs damaged hair, and prevents hair breakage, resulting in healthier, shinier, and more lustrous hair.

In Ayurveda, shikakai is often used in combination with other herbs such as amla (Indian gooseberry) and reetha (soapnut) to create natural hair care formulations known as "triphala" or "trifala." These herbal combinations provide comprehensive care for hair and scalp, addressing various hair concerns effectively.



Conclusion:

Ayurveda incorporates a rich array of herbs and plants, each with its unique chemical constituents and Ayurvedic properties. The synergy of these natural elements aligns with the holistic principles of Ayurveda, focusing on promoting balance and well-being in mind, body, and spirit.

The chemistry of Ayurvedic herbs reveals a diverse range of bioactive compounds, such as antioxidants, vitamins, minerals, and phytochemicals. These compounds contribute to the therapeutic effects attributed to various Ayurvedic plants. From the rejuvenating properties of Amla to the anti-inflammatory effects of Turmeric and the soothing qualities of Aloe Vera, Ayurvedic herbs are used for a multitude of purposes, including supporting digestion, promoting hair and skin health, and balancing the body's doshas.

While Ayurvedic practices have stood the test of time and continue to be embraced by many for their holistic approach to health, it's essential to approach these remedies with caution. Consultation with healthcare professionals is advisable, especially when incorporating Ayurvedic herbs into one's routine, to ensure compatibility with individual health conditions and to avoid potential interactions with medications.



The chemistry of Ayurveda reflects a deep understanding of the medicinal properties of plants, and ongoing research continues to unveil the scientific basis behind the traditional uses of these herbs. As interest in holistic and natural approaches to health grows, Ayurveda remains a valuable source of knowledge and inspiration for promoting well-being and balance in life.

“LIFE (AYU) IS THE COMBINATION (SAMYOGA) OF BODY, SENSES, MIND, AND REINCARNATING SOUL. AYURVEDA IS THE MOST SACRED SCIENCE OF LIFE, BENEFICIAL TO HUMANS BOTH IN THIS WORLD AND THE WORLD BEYOND.” “THE GREAT THING ABOUT AYURVEDA IS THAT ITS TREATMENTS ALWAYS YIELD SIDE BENEFITS, NOT SIDE EFFECTS.”

