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EXTRACTION OF NEEM OIL FROM SEED: ANTI MICROBIAL ACTIVITY

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INTRODUCTION

The people of India have long revered the neem tree; for centuries, millions have cleaned their teeth with neem twigs, smeared skin disorders with neem-leaf juice, taken neem tea as a tonic, and placed neem leaves in their beds, books, grain bins, cupboards, and closets to keep away troublesome bugs. The neem oil is used for hair for growth of hair Given the use of various neem-derived products as pesticides and the realistic chances of residues derived from the treatments still being present at the time of consumption, there may be a risk for consumers. Therefore, in this study we present a review of the toxicological data from human and animal studies with oral administration of different neem- based preparations.

These preparations can consist of crude plant parts, the seed oil, aqueous extracts of parts of the tree, extracts obtained with non-aqueous solvents, the pure bioactive insecticide ingredients and commercially available neem-based pesticides.

The word NEEM is derived from Sanskrit Nimba which means 'bestower of good health'. It has also been known as **Ravisambha** – sun ray like effects in providing health. The Neem tree has been venerated through the ages in the Indian countryside as it provided hope in any situation and the faith in the miraculous healing powers of this amazing tree led patients with incurable diseases to adopt neem as way life. They lived in the shade of the tree, drank infusion of various part (Leaf, bark, etc) as advised by Ayurvedic tradition. They used young twigs for oral hygiene first thing in the morning, ate tender leaves as salad or cooked leaves with vegetable as food. Neem gums was used as lozenges for dryness of throat and allay thirst. In summer, sweet, ripe fruit were sucked for their sweetish pulp. All this together, probably strengthened their immune system to meet any challenge!!!

Its medicinal properties are documented in the ancient Sanskrit texts – Puranas and it is estimated that Neem is present, in one form or another, in 75% of Ayurvedic formulations.

Neem Oil is generally recommended for skin diseases while neem leaves are used for beauty purposes. Neem oil is a vegetable oil obtained from the fruits and seeds of the Neem tree (Azadirachta indica). It has been used for centuries in traditional Indian medicine and is now used in a wide range of applications due to its many beneficial properties. In recent years, extraction of Neem oil has become increasingly common, and the methods used to extract the oil vary. Neem oil has been used for centuries in traditional Indian medicine for its medicinal properties. It is known to have anti- inflammatory, antimicrobial, and antifungal properties, which makes it beneficial in treating a variety of skin and hair conditions. It is also known to be an effective insect repellent, which is why it is often used in organic farming. In addition, its taste and smell can be used to naturally flavor food, which has become increasingly popular in recent years. This research paper aims to investigate the extraction of neem oil with different methods, as well as the potential applications of the extracted oil in different fields. Neem oil is a vegetable oil obtained from the leaves, bark and seed kernels of the neem tree. The review will evaluate the different extraction methods and discuss their efficacy, cost effectiveness, and safety. Furthermore, the paper will assess the potential uses of neem oil in various fields discuss the benefits and risks associated with them. The extraction of Neem oil is a complex process and there are several methods used to extract the oil from the seeds. These include mechanical pressing, which is the most common method, solvent extraction, and steam pressure extraction. Each method has its own advantages and disadvantages, and it is important to choose the right

Neem leaf extracts have a powerful antiseptic, anti-fungal, antiviral and anti-bacterial effect. Unlike synthetic chemicals that often produce side effects such as allergic reactions, rashes etc. Neem is gentle and does not create any The complications.Unlike Neem seed oil, Neem leaves have a pleasant odor. An extract from neem leaves can be prepared as an alcoholic tincture or as tea. The alcohol extract has a dark green colour and is effective for several weeks. It can be used in anti ageing nourishing formulas, mouthwashes, face washes, shower gels, soothing gels, face masks, skin toners etc

Neem oil is a natural byproduct of the neem tree. The oil is harvested from the trees' seeds and leaves. While it has been used as natural pesticide for hundreds of years, you'll also find it in many products you use in your home, including:
People in India have been using the neem leaf for its medicinal properties for thousands of years to help:

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- Strengthen the immune system
- Detoxify blood
- Improve liver function

The use of plant extracts in the treatment of diseases has become an important interest over the years. This is as a result of the fact that microorganisms are developing resistance to many drugs and as such

Neem oil is extracted from the neem tree. It is very beneficial for both skin and hair health. It is used as a medicine for some skin diseases. Antiseptic properties of neem add immense value to various products such as medicines and beauty and cosmetic products. It is also used in pesticides and as a natural insect repellent. Neem oil has countless benefits

Neem oil was believed to prevent baldness and graying of hair and was used as anti-lice and anti- dandruff treatment. A teaspoon of dried neem leaf powder, mixed with the same quantity of ghee (clarified butter) and honey was known to help control skin allergies.

Nimba, the great medicine for the cure of pitta – aggravations and for blood purification – Priyanighantu Harotakyadivarga .

- Neem Compounds and Biological Activity

More than 150 compounds have been isolated from different parts of neem. The compounds have been divided into two major classes; isoprenoid (Chatterjee and Pakrashi, 1991) like diterpenoids and triterpenoids containing protomeliacins, limonoids, azadirone and its derivatives, gedunin and its derivatives, vilasinin type of compounds and C- secomeliacins such as nimbin, salanin and azadirachtin) and non-isoprenoids, which are proteins, carbohydrates, sulphurous compounds, polyphenolics such as flavonoids and their glycosides, dihydrochalcone, coumarin and tannins, aliphatic compounds, etc. Nimbidin, is responsible for crude bitter principle extracted Azadirachata, chemistry, medicinal properties, neem, A. indica which possess several biological activities, from this crude principle some tetranortriterpenes, including nimbin, nimbinin, nimbidinin, nimbolide and nimbidic acid have been isolated (Siddiqui, 1942; Schumacher et al., 2011; Naik et al., 2014). Further, Biswas et al. (2002) have reviewed the biological activities some of the neem compounds, pharmacological actions of the neem extracts, clinical study and plausible medicinal applications of neem along with their safety evaluation. Further, neem also possess compounds acts as Anti-inflammatory, Antiarthritic, Antipyretic, Hypoglycaemic, Antigastric ulcer, Spermicidal, Antifungal, Antibacterial, Diuretic, Antimalarial, Antitumour, Immunomodulatory

Medicinal Uses

They are said to be antifungal, antidiabetic, antibacterial, antiviral, contraceptive and sedative. Neem products are also used in selectively controlling pests in plants. Neem is considered a part of Ayurvedic medicine.Neem is also known as the' village pharmacy'. All parts of neem are used for preparing many different medicines, especially for skin disease.A compound from the Neem tree can be used as a spermicide Neem oil is used for preparing cosmetics (soap and shampoo, ozone as well as lotions and others), and is useful for skin care such as acne treatment. Neem oil has been used effectively as a mosquito repellent'

- **1 Leaves**

Neem preparations are reportedly efficacious against a variety of skin diseases, septic sores, and infected burns. The leaves, applied in the form of poultices or decoctions, are also recommended for boils, ulcers, and eczema. The oil is used for skin diseases such as scrofula, indolent ulcers, and ringworm.

- 2. Neem Flower

Dried neem flowers are powdered and mixed with the leaves to prepare beauty packs for treating excess oil secretion, reducing acne and pimple and also to cure itching problems. -Dried neem flowers help in treating blackheads. You need to mix neem oil with dried neem leaves and

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apply these directly on the blackheads.

3. Neem Fruits:

4.Neem Bark

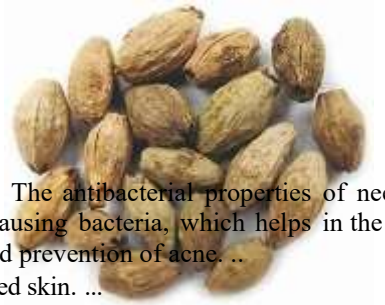
Powder promotes skin health by encouraging natural skin rejuvenation, healthy turnover, and maintaining optimal moisture levels. • It supports digestive health and healthy metabolism with its naturally soothing properties that rekindle the digestive fire while maintaining Pitta levels.

5.Gum

Moisturizes the skin. ...

- Soothes inflamed and irritated skin. ...
- Fight multiple signs of premature aging. ...
- Tackles blackheads and whiteheads. ...
- Treats uneven skin tone. ..
- Fights acne and pimples. ..
- Protects against environmental damage.

6.Seed



- Treats acne. The antibacterial properties of neem fight acne-causing bacteria, which helps in the treatment and prevention of acne. ..
- Pacify irritated skin. ...
- Fight signs of ageing. ...

- **Benefit of neem**
  - High in fat content, neem oil improves the quality of your hair.
  - Use neem oil if your scalp is dry because it nourishes the scalp, and its antifungal agents help treat dandruff.
  - Adding a few drops of neem oil to your hair can help with an itchy scalp.
  - Using neem oil can help you have a healthier scalp and in turn more robust locks.

- **Treating acne**
  Neem is a widely used antibiotic treatment for acne. It is packed with anti-inflammatory properties, which help to reduce acne.
- **Skin nourishment**
  Neem is packed with vitamin E, which helps to get very nourished skin.
- **Removes fungal infection**
  The antifungal property of neem helps to get rid of fungal infections.

USE OF NEEM

Antiulcer Effect

Neem leaf and bark aqueous extracts produce highly potent antiacid secretory and antiulcer activity. A significant antiulcer effect was observed with nimbidin in preventing acetylsalicylic acid, indomethacin, stress or serotonin-induced gastric lesions as well as histamine or cysteamine-induced duodenal ulcers Reddy and Neelima,

Antifungal Activity

From time immemorial it is believed that Neem is effective against certain fungi that infect the human body. Some important fungi against which neem preparations have been found to be effective are: athlete's foot fungus that infects hair, skin and nails; a ringworm that invades both skin and nails of the feet, fungus develops in intestinal tract, bronchi, lungs, and mucous membranes and a fungus that is part of the normal mucous flora that can get out of control leading to lesions in mouth (thrush), vagina, etc. Extracts of neem leaf, neem oil seed kernels are effective against certain fungi including Trichophyton, Epidermophyton, Microspor,Trichosporon, Geotricum and Candida (Kalid et al., 1989)4.10. Antibacterial activity: Neem derives compounds especially Azadirachtin is well known for its role as antibacterial agent. It is a complex tetranorteiterpenoid limonoid present in the seeds as well as leaves which is highly responsible for toxic effect on microbes. (Quelemes et al., 2015; Gupta, et al., 2019). Extracts of the leaves, seed and bark possesses a wide spectrum of antibacterial action against Gram-negative and Gram-positive microorganisms, including M. tuberculosis and streptomycin resistant strains. In vitro, it inhibits Vibrio cholerae Klebsiella pneumoniae, M. tuberculosis and M. pyogenes (Khan and Wassilew, 1987)

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Antimicrobial Effects

of neem extract have been demonstrated against Streptococcus mutans and S. faecalis (Chopra et al., 1952). Apart from azadirachtin, other components such as nimbidin, nimbin, nimbolide, gedunin, mahmoodin, margolone, and cyclic trisulfide contribute to the anti-bacterial activity of neem (Al Akeel et al., 2017; Heyman et al., 2017). Further, neem extracts are a ray of hope to cure deadly diseases viz., Chagas disease in Latin America which was uncontrolled by any other means of medicines. This disease is caused by a parasite which is carried by an insect called kissing bug. Research has shown that feeding neem to the bugs not only frees them of parasites, but azadirachtin prevents the young insects from molting and the adults from reproducing. 4.11. Antiviral activity: Aqueous leaf extract offers antiviral activity against Vaccinia virus, Chikungunya and measles virus (Rao et al., 1969; Baswa et al., 2001). Nimbin and nimbidin have been found to have antiviral activity. They affect potato virus X, vaccinia virus, and fowl pox virus.4.12 .

Anticancer Activity

Neem leaf aqueous extract effectively suppresses oral squamous cell carcinoma induced by 7, 12- dimethylbenz[a] anthracene (DMBA), as revealed by reduced incidence of neoplasm (Gogati and Marathe, 1989). Pramanik et al. (2016) has conducted a study in chemoprotective neem compounds viz., azadirachtin, nimbolide and limonoid enrich extracts on models of buccal carcinogenesis in hamsters. Overall studies were tested positive to reduce the expression and cell proliferation antigens.

Further, researchers have shown prominent anti-cancerous activities from limonoid-derived compounds from neem. Amongst these, both 1-O-deacetylohchinolide B and 15-O-deacetylnimbolindin-B are proved to be beneficial to hinder cell growth in human cervical adenocarcinoma (Zhu et al., 2017; Chen et al., 2018). A very recent study discovered that alkaloid-derived limonoid, azadiramide-A, is primarily found in Neem leaf ethanolic extracts, showed to stop cell growth and induce apoptosis in both the estrogen independent MDAMB- 231 and estrogen dependent MCF-7 cell lines of breast cancer in human beings (Elumalai et al., 2012; Zhu et al., 2017).4.13

Antioxidant Activity

The antioxidant activity of neem seed extract has been demonstrated in vivo during horse- grain germination which is associated with low levels of lipooxygenase activity and lipid peroxides (Balasenthil et al., 1999). An antioxidant principle has also been isolated, which is a potent inhibitor of plant lipooxygenases. Anti-oxidants derived from neem is simple and cost effective way to supplement with natural extracts like those derived from Neem, in forms such as teas and oils, seem to be a simple and cost-effective way to introduce antioxidants (Alzohairy, 2016). 061International Journal of Economic Plants2022, 9(1):059-063 © 2022 PP House4.14.

Anti-Diabetic Effect

Diabetes is one of the major chronic degenerative disorders now the world is facing (Joshi et al., 2010; Shori, 2012; Hieronymus and Griffin, 2015). According to the health survey conservatively by 2030 there is expectancy for diabetes to be the 11th leading cause of death (Mathers and Loncar, 2006). Keeping in view of the severity of disease searching the ways for lower cost treatments must be need of hour. Among the various methods and pharmaco therapies being developed, the use of Neem extracts has steadily grown in interest

LITRATURE REVIEW

1. Marina R. Wylie and D. Scott Merrell*Azedarach indica* (A. Juss), also known as the neem tree, has been used for millennia as a traditional remedy for a multitude of human ailments. Also recognized around the world as a broad-spectrum pesticide and fertilizer, neem has applications in agriculture and beyond. Currently, the extensive antimicrobial activities of *A. indica* are being explored through research in the fields of dentistry, food safety, bacteriology, mycology, virology, and parasitology. *Azadirachta indica* (Neem) seed extracts are known to activate the local cell-mediated immune reactions after a single intrauterine administration, leading to a long term reversible block of fertility. In order to identify and characterize the active fraction responsible for this activity, neem seeds were extracted by both mechanical expression and solvent extraction using a range of polar to non-polar solvents which yielded 3 broad fractions. The mechanically expressed oil was fractionated using different approaches and studied for antifertility activity.
2. Many in the medical field agree that devastating statistics like these are a consequence of entering the “post-antibiotic era,” a time in which the efficacies of antibiotics and other antimicrobials are unreliable (Wang et al., 2020; Streicher, 2021).g Our study used widely available, weedy plant species, which are relatively easy to collect and process and could be developed in to new cash crops for small holder farm use in sub-Saharan Africa and elsewhere. Many other plant species with known pesticidal properties are not always abundant in local areas, e.g., neem and pyrethrum, due to their endemic habitat limitations, and may principally contain highly non-polar active ingredients that are generally more difficult to extract

3. Ugwu Celestina ChibuzoThe antimicrobial activity of Azadirachta indica leaf extract (Neem leaf) was carried out on Staphylococcus aureus, Pseudomonas aeruginosa (ATCC 27853) and Escherichia coli using the agar well diffusion method. Ethanolic, aqueous and methanolic extracts of the plant were used at varying concentrations of 200 mg/ml,100 mg/ml, 50 mg/ml, 25 mg/ml, 12.5 mg/ml, 6.25 mg/ml, 3.125 mg/ml and 1.56 mg/ml respectively. A pilot Neem oil solvent extraction plant of 9.65kg/day Neem seed kernel capacity was designed and fabricated. Grade 304 stainless steel was used for construction of the extractor, evaporator, condensate receiver and the flat blade turbine impeller. The concept of overall heat transfer coefficient was adopted for calculating the heat transfer

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areas of the extractor and evaporator and their sizing. The extraction was carried out at 50°C extraction temperature and particle size of 0.425 – 0.710mm at an efficiency level of 81.91%. The percentage yield obtained was 36.86% when flat blade turbine impeller was operated at 84 rpm for 40 minutes contact time.

4. E. Coventry E. J. Allan The antimicrobial effects of extracts of neem seed (*Azedarach indica* A. Juss.) were investigated using microbial growth inhibition assays. A laboratory-prepared neem seed extract along with a commercially available formulated product, were characterized using HPLC, and shown to be effective against a range of bacteria in an agar diffusion assay.The antimicrobial effects of extracts of neem seed (*Azedarach indica* A. Juss.) were investigated using microbial growth inhibition assays. A laboratory-prepared neem seed extract along with a commercially available formulated product,were characterized using HPLC, and shown to be effective against a range of bacteria in an agar diffusion assay.

AIM & OBJECTIVES

AIM : Extraction of Neem Oil from Seeds :Antimicrobial activity

OBJECTIVE

1. Neem oil is an effective antimicrobial, antioxidant, biopesticide and insecticide.
2. Promotes Healthy Hair.
3. Soothes inflamed and irritated skin.
4. Protects against environmental damage.
5. To extract neem oil from neem seeds using suitable extraction techniques
6. To compare the antimicrobial efficacy of neem oil with standard antibiotics or antimicrobial agents
7. To analyze the physicochemical properties of the extracted neem oil
8. To identify the active constituents responsible for antimicrobial activity.

PLAN OF WORK

Different type of ingredient are used to the preparation of herbal hair oil are presented in the table

All dried herb such as neem seeds ,coconut oil , neem leaf, tulsi leaves weigh and grind in mixture and mix with coconut oil. Now the content boil for 20 minute and filter throw muslim cloths to the coconut oil is added and make the volume (100ml)

- Neem seeds (10g)
- Tulsi leave (10g)
- Neem leaves(10g)
- Coconut oil (20g)

Process for formulation of neem oil

Weight all ingredient Neem seeds add in coconut oil

Kept into sunlight

Grind tulsi leaves ,neem leaves ,and neem seeds

Filter the all material

make up the volume with coconut oil

DESCRIPTION

History

The legendary medicinal tree of India has grown with the human settlement all over the country and has been an integral part of the Indian way of life for centuries. The history of the Neem tree is inextricably linked to the history of the Indian civilization.[4] The Neem tree (Azadirachta indica A. Juss) was probably India's best kept secret! Ancient India was envied for its Black Pepper, Cardamom, Saffron, Turmeric, Sandalwood, Silk etc. and these prized ingredients were sought after and taken across the seas to Europe for centuries. For Indians, the Neem tree had many fascinating aspects. For the children this evergreen, attractive tree was a haven from sun and rain – they spent hours in its cooling shade, plucked the sweet ripe fruit for a snack and built tree houses, which they shared with butterflies, birds and bees.

1Phytochemistry

The major phytochemicals present in Neem are glycoproteins, triterpenes, limonoids, flavonoids, phenols, tannins, nimbins, saponins, catechins, azadirachtin and gallic acid

2 Etiology

However, the exact origin is uncertain: some say neem is native to the whole Indian subcontinent; others attribute it to dry forest areas throughout all of South and Southeast Asia, including Pakistan, Sri Lanka, Thailand, Malaysia, and Indonesia. It is in India that the tree is most widely used.

Morphology

Neem is a medium-sized tree, reaching 15 to 30 m in height, with a large rounded crown up to 10-20 m in diameter. It is mainly evergreen but sometimes shed its leaves during the dry season , . Neem has a deep taproot and is a mycorrhizal-dependent species. The bark is grey, becomes fissured and flakes in old trees. A sticky foetid sap exudates from old trees in humid climates The branches are numerous and spreading. The leaves are alternate,

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petiolated, clustered at the end of the branches, unequally pinnate, glabrous and dark glossy green at maturity, 20-40 cm in length and bearing 10-20 leaflets The leaflets are 5-10 cm long x 1.2-4 cm broad, sickle- shaped and slightly denticulate; The flowers are numerous, fragrant, white and borne in large clusters (up to 30 cm long). Neem fruits are 1-2 cm long drupes, smooth and green with white milky juice when unripe, turning to yellow to brown when mature. They have a thin epicarp, a mucilagenous fleshy mesocarp and a hard endocarp. They contain a variable number of ovoid (1-2 cm) oil seeds.

MATERIAL & METHOD

.1.**Neem Leaves**

Rank	Scientific name and common name
Kingdom	Plantae
Family	Mahogany
Subfamily	Melioideae
Order	Sapindales
Species	Azadirachta indica
Biological name	Azadirachta indica
Other names	Nimba tree, indian lilac, miracle tree
use	The neem is used for the skin disease septic sores , and infected burns, improve hair growth.

Benefit of Neem

- Treat fungal infection
- Useful in detoxification. ...
- Increases immunity. ...
- Insect & mosquito repellent. ...
- Prevents gastrointestinal diseases. ...
- Treats wounds.
- Control hair fall, maintaining a healthy scalp is important. Neem oil helps to relieve dry and itchy scalps, and its antibacterial, antifungal, and antiviral properties help your scalp stay infection-free.

Neem also has great moisturising and nourishing properties that are sure to hydrate your hair shafts and tips soft and supple. Healthy looking and soft hair are only single hair wash away now.

2 Tulsi Leaves

It is rich in antioxidants and that helps it to prevent premature ageing. Tulsi also strengthens our hair roots, thus preventing hair loss. The antifungal properties of Tulsi prevent the development of fungus and dandruff.

Tulsi has very good anti-fungal and anti-bacterail properties. It helps to reduce dandruff and keeps the scalp infection free. It keeps the hair & scalp hydrated to ensure that there is no dryness and itchinessvitamins, minerals, & phytonutrients, tulsi rejuvenates the hair follicles and strengthens the root, which reduces hair fall & promotes hair growth.

Rank	Scientific Name And Common Name
Kingdom	Plantae
Family	Lamiaceae
Subfamily	Ocimum Sanctum
Order	Lamiales
Species	Holy Basil
Biological Name	Ocimum Tenuiflorum
Other Name	Tulsi Or Tulasi
Use	• Improve Hair Growth • Keeps Scalps Healthy

Benefit of tulsi leaves

1 Prevents Hair Loss.
2 Treats Dandruff.
3 Prevents Premature Graying Of Hair.

3.Neem Fruit

The regenerative properties in neem oil stimulate hair follicles, thereby encouraging hair growth. It also increases blood circulation in the scalp, which in turn prevents excessive hair fall and thinning caused by factors like pollution, stress and medication.

The fruit of the neem tree is pressed to extract its oil, which can then be applied to the scalp to remove dandruff and is also used as a preventive measure against dandruff. This extracted oil can also be used as an effective mosquito repellant and is typically found as a component in many commercially available room fresheners as well.

Rank	Scientific Name And Common Name
Kingdom	Plantae
Family	Lamiaceae
Subfamily	Ocimum Sanctum
Order	Lamiales
Species	Holy Basil
Biological Name	Ocimum Tenuiflorum
Other Name	Tulsi Or Tulasi

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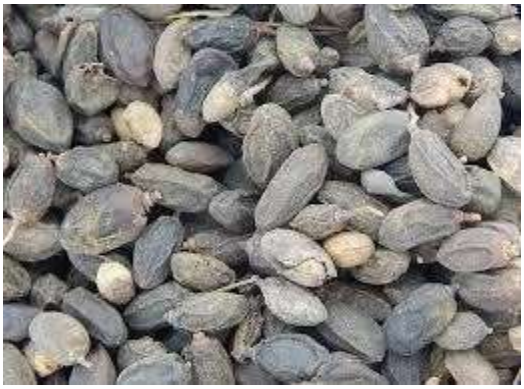
Benefit of Neem Fruit

- Treats Acne. Neem has an anti-inflammatory property which helps reduces acne. ...
- Nourishes Skin. ...
- Treats Fungal Infections. ...
- Intensify hair growth. ...
- Avert premature greying of hair. .
- Conditions under nourished hair.



Coconut oil

Coconut oil can improve the health and condition of your hair. It works by helping prevent protein loss in your hair. It is beneficial to apply it to hair both before and after washing it.

Rank	Scientific Name And Common Name
Kingdom	Plantae
Family	Arecaceae
Subfamily	Subtribe Butiinae
Order	Arecales
Species	C. Nucifera
Biological Name	Cocos Nucifera
Other Names	Coconut Oil, Palm Oil, Copra Oil
Use	• Improve The Health And Condition Of Your Hair • Keeps Scalp Healthy

Benefit of Coconut Oil

It Can Help Repair Split Ends. ...
It Can Make Hair Shiny and Smooth. ... It Can Help Fight Dandruff. ...
It Strengthens the Cuticle. ... It Tames Frizz.

RESULT

The neem hair oil are used to treat the various hair related problems. Herbal hair oil is one of the most fine recognized hair treatments. Herbal hair oil not only moisturizes scalp but also reverses dry scalp and dry hair condition. It provides numerous essential nutrients compulsory to maintain normal function of sebaceous glands and promotes natural hair growth. The herbal hair oil was arranged from the above mentioned ingredients and it is subjected to the qualitative chemical analysis for identification of various plant constituents .The various parameters like Colour, Odour, Specific gravity (density), pH, Viscosity, Acid value, Saponification value, Refractive index and irritation test, of three concentrations of poly herbal hair oils were evaluated.

CONCLUSION

concluded that both ethanolic and methanolic neem extract showed better antimicrobial efficacy against E. faecalis, Escherichia coli, and Streptococcus aureus. 33 in bacterial strains resistant to antibiotics, it has become necessary to explore herbal medications and their antibacterial properties that help to improve the results of biomechanical preparations. 20 Endodontic irrigants may be made from a variety of plant extracts that have antibacterial, anti-inflammatory, and therapeutic properties.

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