

**NEEM EXTRACT: A NATURAL POWERHOUSE IN MODERN
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ABSTRACT

Neem Because of its many biological properties and natural origin, (*Azadirachta indica*), a commonly used herbal plant of the Indian subcontinent, has drawn a lot of interest from the cosmetics sector. Neem extract is now widely used in many cosmetic formulations due to the growing desire for sustainable and herbal skincare products. Nimbin, nimbidin, azadirachtin, and quercetin are among the many bioactive components found in neem that support its antibacterial, activity.

INTRODUCTION

The Recognized evergreen *Azadirachta indica* tree (Neem) grows swiftly and is repeatedly Grows in Africa, America, and India. Neem is Known as 'arista' in Sanskrit a term that means intact, entire and indestructible.^[1,31] It belongs to category

Azadirachta and is native to the supercontinent of India.^[2,32] Recent investigation has established that passages gathered from neem can be exercised as supplements to reduce inflammation or as nonentity repellents.^[3,34] Neem passages are repeatedly exercised in beautifying Products like cleansers, ointments, and creams because of these appreciative parcels, producing them an significant natural constituent of simultaneous skincare formulas.^[4,33]

Botanical classification of Neem^[5,35]**Name:** Neem**Biological Name:** *Azadirachta indica*

Family: Meliaceae

Species: A.Indica

Genus: Azadirachta

Type: Plantae

Physicochemical composition of neem extract^[6,36]

The medical and cosmetic amount of neem (*Azadirachta indica*) is credited to its presence of a variety of bioactive chemicals, most of which are secondary metabolites. These phytochemicals can be found in the plant's leaves, seeds, bark, and fruits, among other sections.

Category	Examples	Function
Limonoids (terpenoids)	Azadirachtin, nimbin, nimbolide, and salannin	These are Insecticidal, antibacterial, and anti-inflammatory properties.
Fatty Acids	Oleic acid, palmitic acid, stearic acid, and linoleic acid	These are Moisturizing, emollient, and skin-protective.
Flavonoids and Phenolics	Ferulic acid, rutin, quercetin, and catechin	These are Antioxidant that guards against oxidative damage to skin

Mechanism of action in cosmetics

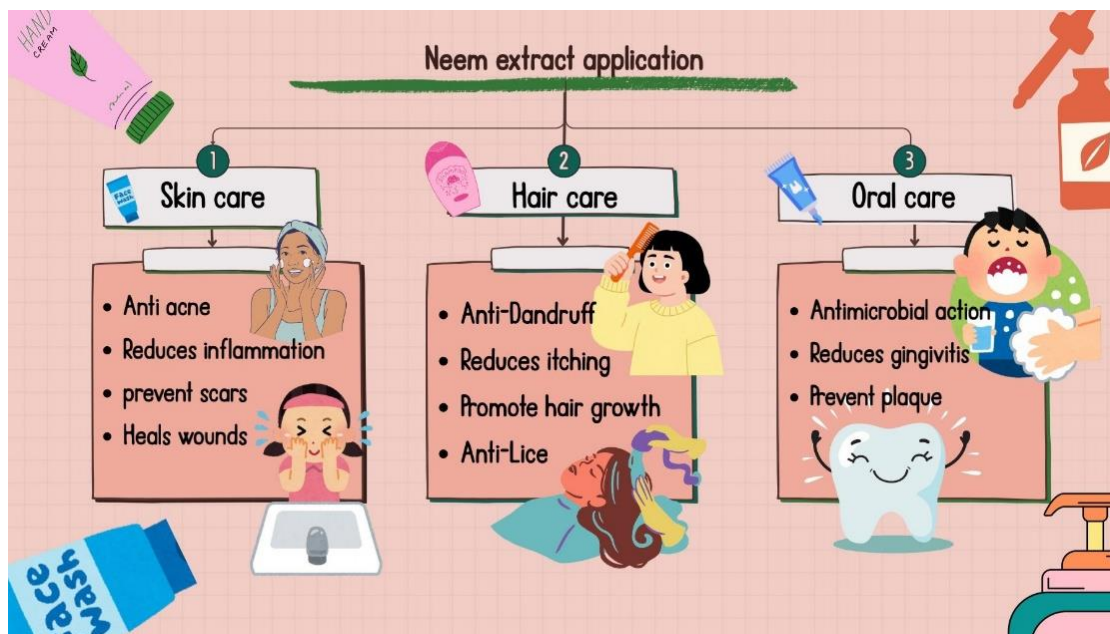
Anticancer Activity: Neem leaf extracts have the ability to prevent cancer in its early stages. Because of substances like azadirachtin, nimbolide, and nimbidin are some of the chemicals that makes neem (*Azadirachta indica*) leaf extracts exhibit anticancer action. They help cells die and stop cancer from spreading. Neem also stops tumors from growing by affecting oxidative stress.^[7,37]

Antioxidant Activity: Flavonoids and phenolic chemicals in neem extracts give them strong antioxidant action. By assisting antioxidative enzymes, they lessen oxidative damage.^[8,38]

Antimalarial Activity: Antiplasmodial action is demonstrated by neem extracts against malaria parasites. Additionally, they aid in the treatment of filarial infections, suggesting a possible defense against parasitic illnesses.^[9,39]

Anti-inflammatory: Strong dose-dependent anti-inflammatory effects are demonstrated by nimbidin and sodium nimbidate; bark polysaccharides (GIIa, GIIIa) also have notable anti-inflammatory activity.^[10,40]

Cosmetic application of neem extract^[11,41]



Formulation aspects

There some formulation prepared by using neem extract

Skin solution soaps: By adding neem extracts with bioactive substances like nimbin and azadirachtin to a soap base, antibacterial activity against bacteria like *Staphylococcus aureus* is guaranteed while the pH remains skin-friendly (5.5–6.5).^[12,13]

Cold cream: Neem cold cream is made as a water-in-oil emulsion by combining the oily phase (beeswax + liquid paraffin) with the heated aqueous phase (borax + water), then adding perfume and preservatives.^[14,42]

Neem Anti-acne cream: The slab method produces a stable, smooth, non-greasy cream by combining heated oil and aqueous phases, adding neem extract and rose water, and using lecithin as an emulsifier.^[13,44]

Neem face wash: In order to extract the active elements for a neem face wash, ground 50 g of fresh neem leaves, 20 g of turmeric, 30 ml of rose water, and 70 ml of distilled water into a smooth paste. To create a uniform, herbal mixture for treating acne-prone skin, this paste is

then moved to a beaker, diluted with an extra 30 milliliters of distilled water, and completely churned.^[14,45]

Safety and Toxicity

Neem (*Azadirachta indica*) extract is widely incorporated in cosmetic formulations due to its antimicrobial and anti-inflammatory properties, but its safety depends on proper usage and formulation.^[15,19,23] In topical applications, neem is generally considered safe when used in diluted concentrations within creams, lotions, or shampoos.^[16,18,24] However, direct or undiluted application of neem oil on the skin may lead to irritation, redness, or allergic contact dermatitis, especially in individuals with sensitive skin.^[16,25] In rare cases, neem-based products may contribute to pigmentation changes such as leukoderma.^[17]

Advantages of neem in cosmetic application

Neem (*Azadirachta indica*) has emerged as a valuable botanical ingredient in cosmetic formulations due to its diverse biological activities.^[15,20,24] Its multifunctional properties make it suitable for a wide range of skincare and haircare products.^[19,26]

1. Potent Antimicrobial Activity

Neem has shown activity against various pathogenic microorganisms, including acne-causing bacteria and dermatophytes.^[20,27] This property supports its use in formulations such as anti-acne creams, cleansers, and medicated soaps.^[19,24]

2. Anti-inflammatory and Soothing Effects

Bioactive compounds such as nimbidin and nimbolide present in neem help reduce inflammation and skin irritation.^[7,10] These properties are beneficial in managing conditions like acne, eczema, and psoriasis.^[15,24]

3. Antioxidant Protection

Neem contains phenolic compounds like flavonoids and coumarins which provide antioxidant benefits.^[19,22] These help neutralize reactive oxygen species (ROS) and delay aging signs such as wrinkles and pigmentation.^[22,28]

Limitations of neem extract in cosmetic applications

The strong and disagreeable smell of neem (*Azadirachta indica*) extract may limit its use in cosmetic goods. Additional fragrances are frequently added to enhance smell, perhaps changing the native formulation.^[19,26]

Geographical location, climate, and extraction technique are some of the variables that affect neem extract composition. This variation may result in inconsistent product efficacy, safety, and quality.^[20,26]

Since the majority of research is based on data from laboratories or animals, there is little clinical evidence to support neem's long-term safety and efficacy in people.^[16,20,29]

It may have harmful consequences at greater quantities, particularly when neem oil is present. As a result, it's critical to keep safe boundaries when formulating.^[16,18,25]

Recent advances

In order to guarantee regular quantities of active chemicals and trustworthy results, recent research on neem (*Azadirachta indica*) focuses on standardizing extracts.^[20,26]

To increase stability, bioavailability, and skin penetration, nano-based delivery technologies such as liposomes and nanoemulsions are being developed.^[22,30]

Research is investigating how neem and antimicrobial drugs can work together to improve efficacy and fight resistance.^[21,23]

Neem's effectiveness against resistant bacteria and its mode of action are being assessed by advanced study.^[21,22,23]

Additionally, efforts are focused on creating more stable and user-friendly herbal cosmetic formulations, such as shampoos, lotions, and gels.^[19,26,4]

CONCLUSION

Neem (*Azadirachta indica*) extract is a valuable natural ingredient in cosmetic formulations due to its antimicrobial, anti-inflammatory, antioxidant, and moisturizing properties. It is widely used in products for acne control, skin protection, and hair care, making it highly versatile in the cosmetic industry.^[15,19,23]

Its natural origin, biodegradability, and eco-friendly nature make neem an attractive alternative to synthetic ingredients. With increasing demand for herbal and sustainable products, neem plays an important role in modern cosmetic formulations.^[19,26]

With advancements in formulation technologies and increasing scientific research, the potential of neem in cosmetics continues to grow. It can be effectively utilized as a safe and sustainable ingredient when used under control.^[46,47]

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