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REVIEW ON STANDARDIZATION OF NEEM LEAVES

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ABSTRACT

Azadirachta indica A. Juss. (Meliaceae), widely known as Neem in India, is often referred to as "nature's pharmacy" because of its extensive range of medicinal benefits. It is one of the two species belonging to the genus Azadirachta and is indigenous to India and Burma, thriving in tropical and subtropical climates. The present study focuses on the standardization of Azadirachta indica leaves collected from the Garhwal Himalayas. Various parameters, as per WHO guidelines, were evaluated, including total ash value, acid-insoluble ash, water and alcohol extractive values, moisture content (loss on drying), pH, volatile constituents, heavy metal analysis, phytochemical screening, chromatographic and spectroscopic profiling, as well as macroscopic and microscopic characteristics. Additionally, quantitative estimation of the marker compound was carried out using HPTLC analysis with azadirachtin as the reference standard.

INTRODUCTION

The neem tree (Azadirachta indica A. Juss.) is a tropical evergreen species (becoming deciduous in arid regions) native to the Indian subcontinent. It has been utilized in Ayurvedic medicine for over 4000 years owing to its wide-ranging therapeutic properties. In Sanskrit, neem is referred to as "arista," meaning "perfect, complete, and indestructible." Almost all parts of the plant, including fruits, seeds, leaves, bark, and roots, possess bioactive compounds exhibiting antiseptic, antiviral, antipyretic, anti-inflammatory, antiulcer, and antifungal activities. The term "nimba" is derived from the Sanskrit phrase "nimbati swasthyam dadati," which translates to "bestower of good health." The medicinal significance of neem is documented in ancient texts such as the Charak-Samhita and Susruta-

Samhita, which serve as the basis of the traditional Indian system of medicine, Ayurveda. Commonly known as "Indian lilac" or "Margosa," neem belongs to the family Meliaceae. In Persian, it is called "Azad-Darakht-e-Hind," meaning "the free tree of India." Neem is also regarded as an important component of India's rich genetic heritage.

The neem tree is among the most extensively studied trees worldwide and is regarded as one of the most promising species of the 21st century. It holds significant potential in areas such as pest control, environmental conservation, and medicinal applications. Neem serves as a natural source of insecticidal, pesticidal, and agricultural chemical compounds. It is a large tree, reaching approximately 25 meters in height, with a fairly straight trunk measuring around 3 meters in girth and a wide-spreading canopy formed by its branches. Typically, the tree begins to bear fruits within 3–5 years and achieves full productivity in about 10 years. After this stage, it can yield up to 50 kg of fruits annually. The neem tree is long-lived and may survive for up to two centuries.

Botanical Name: Azadirachta

Indica Scientific Classification:

Kingdom: Plantae Division: Magnoliophata Class: Magnoliopsida Order: Rutales

Family: Meliaaceae

Genus: Azadirachta

Species: A. Indica

Synonyms: Nimba, Vepa, Vembu, Indian lilac.

Biological Source: Neem consists of the fresh or dried leaves and seeds of Azadirachta Indica.

Medicinal Uses:

- Neem exhibits anti-inflammatory, analgesic, and antipyretic properties.
- It acts as an immunostimulant, enhancing the body's defense mechanism.
- Neem is used in the treatment of ulcers and shows antifertility activity.
- It possesses strong antifungal and antiviral properties.
- Neem demonstrates antibacterial activity, effective against various pathogenic microorganisms.
- It has antidiabetic properties, helping in the regulation of blood sugar levels.
- Neem shows antioxidant activity, protecting cells from oxidative stress.
- It is useful in skin disorders such as acne, eczema, and psoriasis.

- Neem supports oral health, helping prevent gum diseases and bad breath.
- It has hepatoprotective activity, aiding in liver protection and detoxification.
- Neem is used in wound healing due to its antiseptic nature.
- It shows antimalarial properties, helping in the prevention of malaria.
- Neem exhibits antiparasitic activity, effective against intestinal worms and parasites.

NEED OF STUDY:

The utilization of herbal products has gained global significance due to their minimal side effects, easy availability, and cost-effectiveness compared to conventional medicines. *Azadirachta indica* is widely used in traditional and indigenous systems of medicine and is known to contain various bioactive constituents such as alkaloids, resins, saponins, glycosides, tannins, flavonoids, cardiac glycosides, steroidal terpenes, anthraquinones, carbohydrates, and other phytochemicals.

According to previously published research, comprehensive comparative studies involving microbiological, pharmacognostical, and phytochemical evaluations of different parts of *Azadirachta indica* are limited. Therefore, the present study has been undertaken to investigate various parts of *Azadirachta indica* in order to assess their antibacterial and pharmacognostical characteristics. This research will contribute to a better understanding and provide valuable scientific data regarding the medicinal potential of *Azadirachta indica*.

Organoleptic Evaluation:

This refers to the assessment of a drug using the sensory organs. It includes the evaluation of characteristics such as colour, odour, taste, size, shape, and texture.

Microscopic Evaluation:

This involves the examination of the drug by preparing powdered samples, thin sections, or macerated tissues. It helps in identifying structural and cellular features of the plant material.

- Measurement of vein-islet number
- Determination of stomatal number
- Calculation of stomatal index

Physical Evaluation:

Physical parameters are important in the assessment of crude drugs. These include characteristics such as fibre elasticity, viscosity of drugs, swelling index of mucilage-containing materials, froth number for saponin-containing drugs, congealing point of volatile

and fixed oils, melting and boiling points, and moisture content. Such parameters play a crucial role in determining the quality, purity, and stability of drugs.

Physical evaluation is widely applied to active constituents of drugs, including alkaloids, volatile oils, and fixed oils, to ensure their standardization and identification.

- Moisture content
- Viscosity
- Solubility
- Ash value
- Extractive value
- Swelling factor
- Loss on drying
- Bulk density
- Angle of repose (flow property)
- Refractive index
- Particle size
- Melting point

Future Prospective:

The use of various parts of medicinal plants for the treatment of specific ailments has been practiced since ancient times. Herbal medicine, often referred to as green medicine, continues to gain global acceptance due to its safety, cost-effectiveness, and wide range of therapeutic benefits. *Azadirachta indica* (Neem) is a rich source of diverse bioactive compounds, making it a promising candidate for future drug development programs aimed at utilizing its pharmacological and biological properties.

The hepatoprotective potential of *Azadirachta indica* has shown encouraging results, motivating researchers to undertake more comprehensive preclinical and clinical investigations. In addition, further studies are required to explore its efficacy in the treatment of chronic diseases such as diabetes, cancer, cardiovascular disorders, and microbial infections. Standardization of extracts, identification of active constituents, and determination of appropriate dosages are essential for its safe and effective therapeutic use.

Advanced research techniques such as molecular biology, biotechnology, and nanotechnology can be applied to enhance the therapeutic potential of neem. Development of novel drug

delivery systems, including nanoformulations and targeted delivery methods, may improve the bioavailability and efficacy of neem-based compounds.

There is also significant scope for the development of neem-based products in pharmaceuticals, cosmetics, agriculture, and environmental protection. Neem-derived biopesticides and eco-friendly formulations can play a crucial role in sustainable agriculture and reducing dependence on synthetic chemicals.

In the modern era, emphasis should be placed on controlling diseases affecting humans, animals, and the environment through non-toxic and plant-based alternatives. Although substantial research has been conducted and several herbal formulations have been developed from neem, there is still vast potential for further exploration, innovation, and commercialization. Continued scientific validation and interdisciplinary research will help in better utilization of this valuable and versatile medicinal plant.

CONCLUSION:

The findings of the present investigation clearly demonstrate that *Azadirachta indica* (Neem) possesses significant pharmacological potential, particularly in terms of its antioxidant and antimicrobial activities. The evaluation of free radical scavenging activity, along with the estimation of total phenolic content, revealed that the butanol and methanol crude extracts of neem leaves are rich in phenolic compounds and act as potent natural antioxidants. These results highlight the ability of neem extracts to neutralize free radicals, thereby preventing oxidative stress-related cellular damage. Consequently, neem-derived extracts can be considered as promising natural alternatives to synthetic antioxidants, which are often associated with adverse effects.

Furthermore, the antimicrobial study confirmed that neem leaf extract exhibits strong inhibitory effects against a variety of pathogenic microorganisms. This broad-spectrum antimicrobial activity supports its traditional use in the treatment of infections and suggests its potential role in the development of plant-based antimicrobial agents. The study also indicates a possible synergistic interaction between neem extract and certain conventional antibiotics, enhancing their antibacterial effectiveness. Such combinational therapy could be highly beneficial in overcoming the growing problem of antibiotic resistance, which is a major global health concern. However, this aspect requires further detailed investigation, including optimization of dosage, formulation, and mechanism of interaction.

In addition to its antimicrobial and antioxidant properties, neem has shown potential applicability in various therapeutic areas, including its use as a biocompatible irrigating

agent. Although in vitro studies have demonstrated promising outcomes, these results must be validated through extensive in vivo studies and well-designed clinical trials to ensure safety, efficacy, and compatibility with biological systems. Toxicological evaluation and standardization of extracts are also essential prerequisites for its acceptance in modern medical practice.

In conclusion, *Azadirachta indica* stands as a versatile and promising medicinal plant with immense therapeutic potential. Continued interdisciplinary research, scientific validation, and technological advancements are essential to fully harness its benefits and to establish it as a reliable and effective natural alternative in modern healthcare systems.

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