IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
Impact Factor: 7.53
Volume 4, Issue 4, June 2024

Phytochemical Screening and Evaluation of Antimicrobial Activity of Azadirachta Indica (Neem)

Nitin N. Mali*, Payal B. Phadtare, Ankita L. Pimpale
Vidya Niketan College of Pharmacy, Lakhewadi, Maharashtra, India.
Corresponding Author: nitinmalivncop@gmail.com

Abstract: *This study investigates the phytochemical composition and antimicrobial potential of Azadirachta indica (neem) extracts. The Soxhlet method was used for extraction, and the antimicrobial activity was evaluated using the agar well diffusion method. Phytochemical screening confirmed the presence of bioactive compounds such as alkaloids, flavonoids, and phenolic compounds with known antimicrobial properties. The neem extracts exhibited significant antimicrobial activity against a variety of microorganisms, indicating its potential as a natural source of antimicrobial agents.*

Keywords: Antimicrobial Activity, Azadirachta indica, Neem extracts, agar diffusion method

I. INTRODUCTION

Azadirachta indica, commonly known as neem, has been traditionally used for its medicinal properties, including antimicrobial effects. *Azadirachta indica* or neem is one of the most important medicinal plants ever found in the history of humankind. The use of *A. indica* is from prehistory to contemporary. Siddha medicine (10,000 B.C. to 4000 B.C.), practiced in south India, is believed to be the oldest medicinal system. As per the Tamil literature, neem or margosa was the first medicinal plant found a place in the Siddha system.[1-2] Neem has been used from time immemorial for ailments such as smallpox and infectious diseases. *A. indica* is mainly found in India and neighboring countries. It has been used as a medicinal plant in the Indian subcontinent for more than 4500 years. Plausibly, its uses were started during the Indian great Harappan culture of Indus Civilization. In 1922, during the time of excavations, scientists found several medicinal products including neem leaves from ancient deeds and ruins of Harappa and Mohenjo Daro. Scientists found evidence on the use of *A. indica* on a skull having cranial surgery. These discoveries suggest the use of *A. indica* in both surgical and phytochemical processes in the world's most ancient and developed civilizations. At the beginning of the twentieth century, *A. indica* was distributed to the other places of the world by Indian immigrants. Now, neem tree can be found almost in 72 countries in Asia, Africa, and central and South America.[3-5]

Various parts of the neem plant have been successfully isolated, contain more than 140 chemical compounds, and have been used as herbal medicines for thousands of years . Neem contains various primary compounds including fat derivatives, carbohydrates, and proteins and secondary compounds such as flavonoids, steroids, saponins, terpenoids, alkaloids, glycosides, and tannins. Neem plants are a worldwide interest because of their efficacy without showing side effects. The use of the neem plant traditionally is quite safe, and more than 75% of traditional medicine uses the neem leaf extract. The history of its use, from existing reports, does not indicate any side effects from neem leaves. However, comprehensive safety evaluation of the use of neem leaf formulations has never been done.

In recent literature, antiseptic, anti-inflammatory and chemopreventive activities were described.[6] Moreover, other pharmacological features, such as antidiabetic, hypolipidemic, hepatoprotective, antipyretic, antifertility, hypoglycemic, cardioprotective, antiulcer, neuroprotective, antioxidant, microbicidal, nematicidal and antileishmaniasis properties were described. In addition, more recent scientific reports remarked on the possibility of using it as a biopesticide.[7-10]

This study aims to explore the phytochemical composition and antimicrobial potential of neem extracts. The Soxhlet extraction method was employed to obtain the bioactive compounds, and their antimicrobial activity was assessed using

IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
Impact Factor: 7.53
Volume 4, Issue 4, June 2024

the agar well diffusion method. Understanding the antimicrobial properties of neem extracts can provide insights into their potential therapeutic applicatio

II. MATERIAL METHOD

Sample Collection: Fresh & healthy plant parts of Azadirachta indica leaves were collected from Lakhewadi, Maharashtra. Collected plant parts were examined and identified with the help of regional floras. Specimens were further confirmed with reference to Herbarium sheets available in the department of Botany. Shrimant Babasaheb Deshmukh Mahavidyalay, Atpadi.

Extraction: The air-dried leaves of Azadirachta indica were reduced to coarse powder and around 300 gm of powder was subjected to successive solvent extraction using soxhlet apparatus with different solvents viz. methanol, ethanol, and water. Physical Evaluation of Leaves of Azadirachta indica. The shade-dried leaves were subjected to size reduction to get coarse powder. Then subjected to standardization with different parameters which is prescribed in literature/ Pharmacopoeia.

Antimicrobial Assay

The antimicrobial activity of neem extracts was evaluated using the agar well diffusion method, a well-established technique for assessing the susceptibility of microorganisms to plant extracts and antimicrobial agents. A panel of microorganisms comprising both Gram-positive and Gram-negative bacteria, as well as fungal pathogens, was employed to comprehensively evaluate the broad-spectrum antimicrobial potential of the neem extracts. The microorganisms used in the study were obtained from authenticated culture collections to ensure their purity and identity.

III. RESULT

Phytochemical Screening:

We have collected presence (1) or absence (0) data for six classes of phytochemicals (alkaloids, flavonoids, tannins, saponins, glycosides, and phenolic compounds) across multiple neem leaf extracts.

Table no 1. Phytochemicals in neem extracts using different solvents

Extract	Alkaloids	Flavonoids	Tannins	Saponins	Glycosides	Phenolic Compounds
Methanol Extract	0	0	1	1	0	0
Ethanol Extract	1	1	1	1	1	0
Water Extract	1	1	1	0	0	0

Antimicrobial Activity

Table no 2. Zones of inhibition (in mm) for neem extracts against various microorganisms

Extract	E. coli	S. aureus	C. albicans
Methanol Extract	17.67 mm	21.36 mm	11.74 mm
Ethanol Extract	25.83 mm	28.51 mm	10.40 mm
Water Extract	20.58 mm	11.42 mm	26.65 mm

IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
Impact Factor: 7.53
Volume 4, Issue 4, June 2024

Graphical Analysis

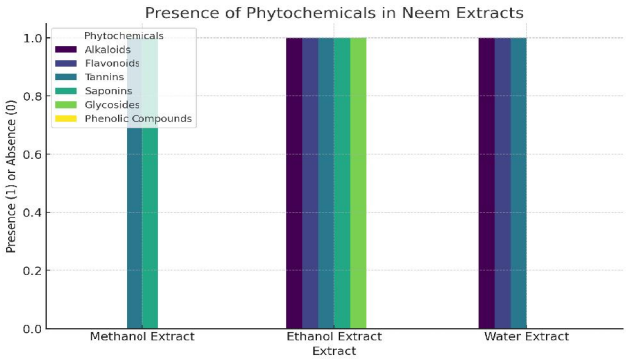

Fig no 1 Graphical Analysis of phytochemicals in neem extracts

The bar chart above displays the presence (1) or absence (0) of various phytochemicals in neem extracts prepared with different solvents. Each color represents a different phytochemical, and we can observe the differences in phytochemical profiles among the solvents used.

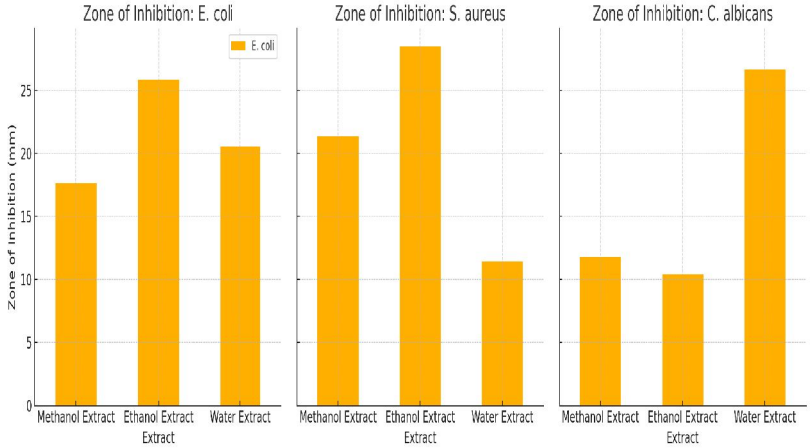

Fig no 2. The bar charts representing the zones of inhibition (in mm) for each extract against E. coli, S. aureus, and C. albicans.

Here are the bar charts representing the zones of inhibition (in mm) for each extract against E. coli, S. aureus, and C. albicans. These visualizations clearly illustrate the variation in antimicrobial effectiveness based on the extract solvent and the type of microorganism:

Ethanol Extract shows strong activity against both E. coli and S. aureus but is less effective against C. albicans.

Methanol Extract demonstrates moderate activity across all tested microorganisms.

Water Extract shows variable results, with notably high effectiveness against C. albicans but lower against S. aureus.

This analysis helps in understanding which solvents may yield extracts more potent against specific microorganisms, guiding potential applications of these extracts in antimicrobial treatments.

IV. CONCLUSION

The findings of this study underscore the phytochemical richness and antimicrobial potential of Azadirachta indica (neem) extracts. The presence of bioactive compounds with antimicrobial properties suggests that neem can be a valuable source of natural antimicrobial agents. Further research is warranted to explore the mechanisms of action and potential applications of neem extracts in combating microbial infections.

IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
Impact Factor: 7.53
Volume 4, Issue 4, June 2024

REFERENCES

[1]. Sarkar S, Singh RP, Bhattacharya G. Exploring the role of Azadirachta indica (neem) and its active compounds in the regulation of biological pathways: an update on molecular approach. 3 Biotech. 2021 Apr;11(4):178.

[2]. Kumar VS, Navaratnam V. Neem (Azadirachta indica): prehistory to contemporary medicinal uses to humankind. Asian Pac J Trop Biomed. 2013;3:505–514.

[3]. Lokanadhan S, Muthukrishnan P, Jeyaraman S. Neem products and their agricultural applications. J Biopest. 2012;5(Suppl):72–76.

[4]. Mahmoud DA, Hassanein NM, Youssef KA, Abou Zeid MA. Antifungal activity of different neem leaf extracts and the nimonol against some important human pathogens. Braz J Microbiol. 2011;42:1007–1016.

[5]. Mali AS, Thorat MB, Ghadge DM, Nikam KA, Sawant S, Shaikh F, Vhatkar N, Shinde S, Gonghade K, Tamboli MA (2019) Antinociceptive and antioxidant activities of methanolic extract of leaves of Azadirachta Indica (Neem). bioRxiv. http://doi.org/10.1101/694505

[6]. Saleem, S.; Muhammad, G.; Hussain, M.A.; Bukhari, S.N.A. A comprehensive review of phytochemical profile, bioactives for pharmaceuticals, and pharmacological attributes of Azadirachta indica. Phyther. Res. **2018**, 32, 1241–1272.

[7]. Gonzalez-Coloma, A.; Reina, M.; Diaz, C.E.; Fraga, B.M. Natural Product-Based Biopesticides for Insect Control. In Comprehensive Natural Products II; Mander, L., Liu, H.-W., Eds.; Elsevier: Amsterdam, The Netherlands, 2010; pp. 237–268.

[8]. Banerjee, K.; Thiagarajan, N.; Thiagarajan, P. Formulation optimization, rheological characterization and suitability studies of polyglucoside-based Azadirachta indica A. Juss emollient cream as a dermal base for sun protection application. Indian J. Pharm. Sci. **2017**, 79, 914–922.

[9]. Bhinge, S.D.; Bhutkar, M.A.; Randive, D.S.; Wadkar, G.H.; Kamble, S.Y.; Kalel, P.D.; Kadam, S.S. Formulation and evaluation of polyherbal gel containing extracts of Azadirachta indica, Adhatoda vasica, Piper betle, Ocimum tenuiflorum and Pongamia pinnata. J. Res. Pharm. **2019**, 23, 44–54.

[10]. Farjaminezhad, R.; Garoosi, G. Establishment of green analytical method for ultrasound-assisted extraction of azadirachtin, mevalonic acid and squalene from cell suspension culture of Azadirachta indica using response surface methodology. Ind. Crops Prod. **2020**, 144, 111946.