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A COMPLETE REVIEW ON FORMULATION OF HERBAL NEEM FACE WASH

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Abstract *:* Azadirachta indica, commonly known as neem, is renowned for its medicinal properties and is found across the globe. Extracts derived from Azadirachta indica exhibit various beneficial traits such as antibacterial, antifungal, and antioxidant properties. Natural remedies are often preferred due to the perception of being safer with fewer adverse effects compared to synthetic alternatives. Consequently, there's a growing demand for herbal formulations in the global market. This study focuses on developing and evaluating a herbal anti-acne face wash utilizing an aqueous extract of neem leaves (Azadirachta indica). Unlike many existing topical herbal formulations for acne which may incorporate synthetic ingredients, we aim to create a purely herbal formulation. Numerous studies have highlighted the antimicrobial, antioxidant, and anti-inflammatory properties of plants, providing a solid foundation for this endeavor. The formulated face wash underwent comprehensive evaluation, including assessments of color, appearance, consistency, pH, stability, and consumer acceptance. Results indicate that the face wash is non-irritating, stable, and exhibits anti-acne activity. When compared with a standard polyherbal gel, its efficacy was found to be nearly equivalent. This study concludes that the neem extract-based formulation is not only stable but also an effective herbal remedy for treating acne.

***Keywords*: Azadirachta indica (Neem), Neem extract, pH, Stability, Irritancy test, Phytochemical analysis**

I. INTRODUCTION

Azadirachta indica, commonly known as Neem, belongs to the Meliaceae family and has been utilized in Ayurvedic practices for centuries. The medicinal properties of different components of the Neem tree are widely acknowledged, and they are frequently recommended by Ayurvedic, Siddha, and herbal medicine practitioners in India. Neem leaves possess a wide array of properties including antibacterial, anti-parasitic, anti-inflammatory, and antioxidant effects. Its extensive usage in traditional medicine reflects its efficacy in addressing various health concerns. Neem, native to India, is naturally found in tropical and subtropical regions across different countries. Its widespread distribution highlights its significant medicinal value. Chemical constituents extracted from Neem, such as alkaloids, flavonoids, triterpenoids, phenolic compounds, carotenoids, steroids, and ketones, contain numerous biologically active compounds. Other noteworthy compounds found in Azadirachta indica, including salannin, volatile oils, meliantriol, and nimbin, contribute to its biological activity. The leaves of Azadirachta indica have proven effective in treating various skin conditions such as eczema, ringworm, and acne, owing to their anti-inflammatory and antihyperglycemic properties. Additionally, they are utilized in healing chronic wounds, managing diabetic symptoms, and addressing conditions like gangrene. Neem is believed to aid in detoxification, neutralizing free radicals, and purifying the blood. Acne vulgaris, a prevalent skin disorder affecting nearly everyone at some point in their lives, particularly peaks during adolescence. However, a significant portion of individuals aged 20-30 also grapple with this condition. Acne presents in different forms including comedonal, papular, pustular, cystic, and nodular types. Comedonal acne, categorized into whiteheads and blackheads, manifests as either fresh, white-colored bumps or open pores containing dark accumulations of melanin, sebum, and follicular cells. Papules are solid, red, raised lesions typically under 5mm in diameter, while pustules are elevated areas of the skin containing purulent material. Cysts and nodules, solid and elevated lesions, penetrate deeper layers of the dermis and subcutaneous tissue, with cysts being smaller than 5 mm and nodules exceeding this size threshold.

Vernicular names of plant:-

- Hindi–Neem
- Marathi -Kadunimb
- English -Margosa, Neem, Indian Lilac

Taxonomical position of azadirachta indica :-

Order	Rutales
Sub-order	Rutinae
Family	Meliaceae
Sub-family	Melioideae
Tribe	Melieae
Genus	Azadirachta
Species	Indica

Table No. 1. Taxonomical Position of Neem

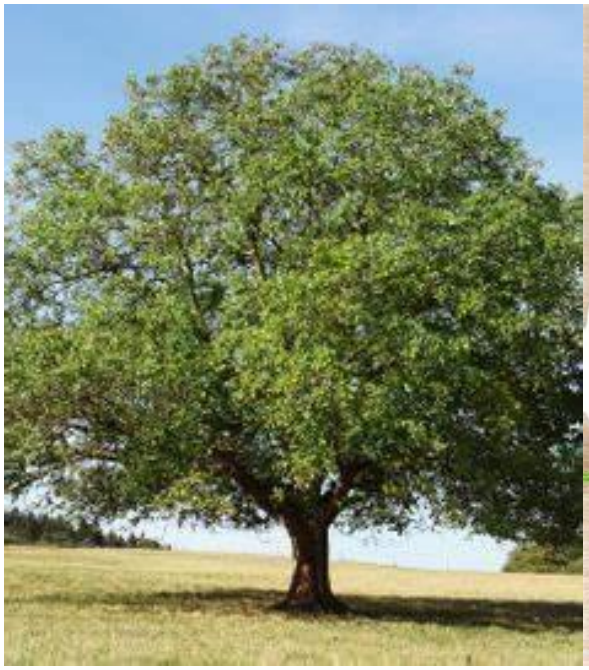


Fig. 1. Neem Tree **Fig. 2. Neem leaves**

Origin and distribution of Azadirachta indica:-

The Azadirachta indica tree is widespread across India, with an estimated population of approximately 20 million trees in the country. Renowned for its ability to withstand drought, it typically flourishes in regions characterized by sub-arid to sub-humid climates, receiving annual rainfall ranging from 400 to 1200 mm. While it can survive in areas with less than 400 mm of rainfall, its growth largely relies on underground water sources. Neem exhibits adaptability to various soil types, but it thrives particularly well in well-drained, deep, and sandy soils with a pH level between 6.2 and 7.0. Being a typical tropical/subtropical tree, it thrives in regions where the annual mean temperatures range from approximately 21 to 32 °C, displaying resilience even in high to very high temperature conditions. However, it cannot endure temperatures below 4 °C.

Chemical Constituents and Properties:

Neem encompasses several chemical compounds such as bitter fixed oil, nimbidin, nimbin, nimbinin, nimbidol, and tannin. These constituents offer a range of therapeutic benefits:

1. Anti-inflammatory properties (nimbidin, sodium nimbidate, gallic acid, catechin, polysaccharides).
2. Anti-arthritic, hypoglycemic, antipyretic, diuretic, and anti-gastric ulcer effects (nimbidin).
3. Antifungal activity (nimbidin, gedunin, cyclic trisulfide).
4. Antibacterial properties (nimbidin, nimbolide, mahmoodin, margolone, margolonone, isomargolonone).
5. Spermicidal effects (nimbin, nimbidin).
6. Antimalarial activity (nimbolidfe, gedunin, azadirachtin).
7. Antitumor potential (polysaccharides).
8. Immunomodulatory effects (NB-II peptoglycan, gallic acid, epicatechin, catechin).
9. Antioxidant properties (neem seed extract).

Medicinal Properties:

- Antibacterial Compounds: Neem exhibits antibacterial activity in oral health, gum disease, cavities, and as a vaginal contraceptive.
- Antifungal Properties: Neem demonstrates efficacy against fungi causing conditions like athlete's foot, ringworm, and Candida infections.
- Anti-Inflammatory: Nimbidin, a Neem component, shows potent anti-inflammatory and anti-arthritis effects by suppressing macrophages and neutrophils involved in inflammation.
- Antioxidant Compounds: Neem protects against oxidative stress-related disorders such as cardiovascular diseases, eye issues, age-related neurodegeneration, and cancer by boosting antioxidant levels.
- Antiviral Compounds: Neem inhibits viruses like Dengue and coxsackie B virus, which causes various infections in humans.
- Malaria: Neem leaf extracts hinder the normal development of the malaria virus and are used as mosquito repellents.
- Skin Diseases: Neem is effective against fungi, parasites, and viruses, making it useful in treating skin conditions like psoriasis, eczema, and persistent infections.

Therapeutic Applications:

- Addressing scalp issues like dandruff, itchiness, and scalp conditions.
- Managing acne.
- Alleviating symptoms of skin disorders such as eczema and psoriasis.
- Facilitating wound healing processes.
- Treating fungal infections, ringworm, infected sores, and burns.
- Managing athlete's foot.
- Treating nail fungus and restoring fragile nails.

A facial cleanser is a crucial skincare product designed to eliminate makeup, dead skin cells, oil, dirt, and various pollutants from the facial skin, aiding in unclogging pores and preventing acne and other skin conditions. Typically, it is part of a skincare routine alongside a toner and moisturizer.

Advantages of Using Face Wash:

- Facilitates the removal of dead skin cells, allowing for the regeneration of new skin cells.
- Promotes a fresh and healthy complexion, imparting radiance to the skin.
- Helps prevent acne, whiteheads, blackheads, and dullness by clearing pores and eliminating excess oil.
- Regular exfoliation reduces the formation of wrinkles by removing dead skin cells, slowing down the aging process.

Properties of Face Wash:

- Accelerates blood circulation and stimulates skin regeneration and rejuvenation through exfoliation.
- Effectively cleanses facial pores and reduces oil buildup in oily skin, often caused by excessive sebum secretion.
- Herbal face washes, enriched with botanicals like neem, are renowned for treating acne and pimples without stripping the skin of its nutrients.
- Ideal face wash should possess stability, appealing appearance, easy application, and a non-greasy feel.
- Upon application, it should spread smoothly without causing any drag on the skin.
- After water evaporation, the residue left behind should not become thick or viscous.
- It should primarily flush the skin and pores rather than get absorbed, leaving a thin emollient film post-use.

Uses of Face Wash:

- Daily removal of makeup residue.
- Cleansing the skin thoroughly.
- Aiding in anti-aging efforts.
- Enhancing the skin's cleanliness and luster during bathing.

- Promoting skin cell regeneration and renewal.
- Assisting in clearing plugged pores for improved skin health.

Preparation Methods of Neem Leaf Extracts (NLEs):

- *Plant Material Selection and Collection:*
Choosing disease-free and healthy plants is crucial for efficient phytoconstituent isolation. Plants should be protected from weeds and insects during collection.

- *Plant Material Drying:*
The drying process is essential for extracting plant materials. Fresh plant materials contain active enzymes that facilitate the production of active constituents and metabolic reactions. Air drying in shaded, dark rooms is commonly employed to prevent loss of volatile substances and light-sensitive constituents. Other drying methods such as microwave drying, oven drying, silica gel or salt drying, and freeze drying are also utilized.

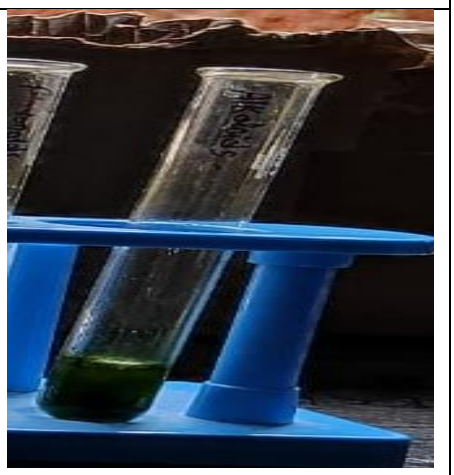
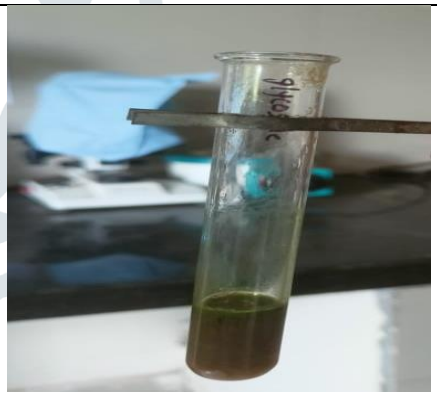
- *Grinding and Size Reduction:*
Grinding and size reduction are necessary for the soxhlet extraction process as smaller particle sizes increase the surface area of powdered particles, enhancing contact with the extraction solvent. Various methods such as hammer mills, fixed head mills, plate mills, roller mills, and cutter mills are used for size reduction.

- *Size Separation/Sieving:*
Uniform particle size is important for efficient soxhlet extraction, ensuring maximum extraction efficiency as the solvent can uniformly pass through the powdered particles. Size separation is achieved through sieving methods to determine particle size.

- *Solvent Selection for Soxhlet Extraction:*
Solvent selection for soxhlet extraction is based on the phytoconstituent isolation process. Solvents should be easily removable and inert. Selection is typically based on increasing polarity order, with options including acetone, petroleum ether, ethyl acetate, chloroform, methanol, ethanol, and water. Ethanol, a semi-polar solvent, is commonly used for extracting many phytoconstituents, while water, a polar solvent, is cost-effective and non-toxic.

- *Post-Extraction Process:*
Following soxhlet extraction, extracted materials undergo post-extraction processes such as concentrate extraction, solvent evaporation, and extract storage. Distillation processes or various evaporators are employed to isolate extracts from solvents. Rotary evaporators and distillation methods are commonly used, and air drying may also be utilized for concentrate extraction. Extracts are stored in well-sealed containers covered with aluminum foil and stored in refrigerators.

Phytochemical Analysis of Azadirachta Indica :-

Sr. No	Test	Procedure	Observation	Photos
1	Test for alkaloids.	2ml of plant extract + few drops of wagner's solution.	Brown, Reddish precipitate.	 Absent
2	Test for flavonoids.	2ml of plant extract + 1ml of 2N NaOH.	Yellow colour shows.	 Present
3	Test for cardiac glycosides.	2ml of plant extract + few drops of conc. H_2SO_4.	Formation of red colour.	 Present

4	Test for amino acid.	2ml of plant extract + 2-5 drop of ninhydrin solution. samples were kept in a boiling water bath for 1-2 min.	Purpul Colour Appear.	 Absent
5	Test for tannins.	2ml of plant extract + 2 drops of 5% ferric chloride solution.	Yellow colour Appear.	 Present
6	Test for reducing sugar.	2ml of plant extract + 2ml of fehilings solution. Samole was kept in water bath for 40◦C.	Brick red precipitation.	 Present

7	Test for steroids.	1ml of plant extract + 2ml of acetic anhydride and 2-3 drops chloroform were added to the test tube, 2 drops conc. H_2SO_4 added.	Blue/orange colour appear.	 Absent
8	Test for phenols.	2ml of plant extract + few drops of 10% aqueous ferric chloride solotion.	Blur or green colour appear.	 Present

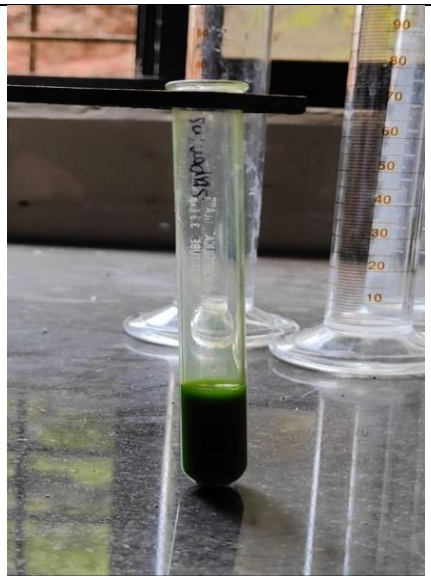
9	Test for saponins.	2ml of plant extract + 2ml of distilled water and shaken vigorously.	Foam on top of sample appear.	 Present
10	Test of carbohydrade.	1ml of plant extract + few drops of molish reagent + 1ml of conc. Sulphuric acid.	Red-violet colour appear.	 Present

Table No. 2. Phytochemical analysis

Formulation Table For Neem Facewash :-

SR. No.	Name of Ingredients	Properties
1	Ethanolic neem (azadirachta indica) extract.	Anti-microbial, anti-oxidents.
2	Carbopol 934.	Gelling agent.
3	Triethanolamine	Neutralizer
4	Propylene glycol.	Humectant.
5	Neem oil.	Preservative.

6	Sodium lauryl sulphate (SLS).	Foaming agents.
7	Distilled water.	Vehical.

Table No. 3. Properties Table.

Preparation Procedure for Neem Face Wash:

1) Carbopol 934 was dispersed in distilled water to form a gel by allowing it to swell, and the mixture was set aside.

2) Distilled water and the appropriate amount of neem oil were heated on a water bath until completely dissolved. After cooling, propylene glycol 400 and sodium lauryl sulfate were incorporated into the solution.

3) The specified quantity of neem extract was introduced into the mixture. This solution was then combined with the Carbopol 940 gel under continuous stirring. Triethanolamine was added gradually to regulate the skin's pH and attain the desired gel consistency.

Formulation table for Neem Face wash :-

Sr. No.	Name of Ingredient.	Formulation Weight.
1	Ethanolic neem extract.	2.5ml.
2	Carbapol 934.	0.83gm.
3	Neem oil.	0.2ml.
4	Triethanolamine	0.1ml.
5	Propylene Glycol.	1ml.
6	Sodium lauryl sulphate (SLS).	1.66gm.
7	Distilled water.	50ml.

Table No. 4. Formulation Table

Evaluation Parameters :-

The prepared face wash formulation was evaluated for following parameter.

- Colour :-

The colour of the face wash formulation was checked visually.

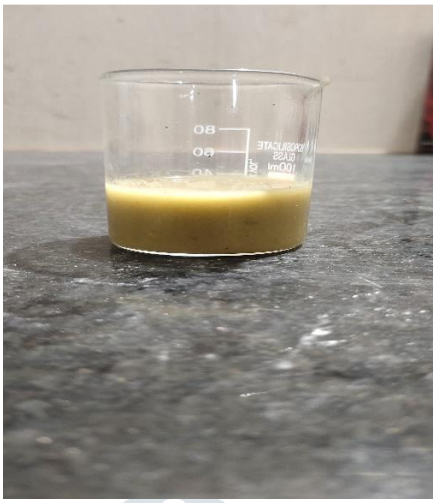


Fig. 9. Colour of face wash

- pH :-

pH of 1% aqueous solution of the formulation was measured by using a caliberated digital pH meter at constant temperature.

Fig 10. Marketed Product pH

Fig 11. Formulated Product pH

- Odour :-

The formulation was evaluated for its odour by smelling it.

- Consistency :-

It was determined manually.

- Washability:-

Formulation was applied on the skin and then ease and extent of washing with water was checked manually.

- Foamability :-

Small amount of gel was taken in a beaker containing water. Initial volume was noted, beaker was shaken for 10 times and the final volume was noted.

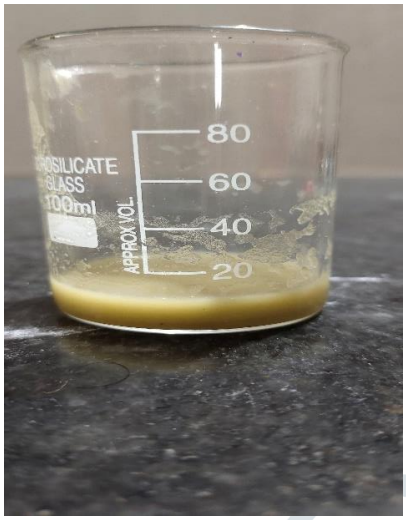


Fig. 12. Before Foaming test

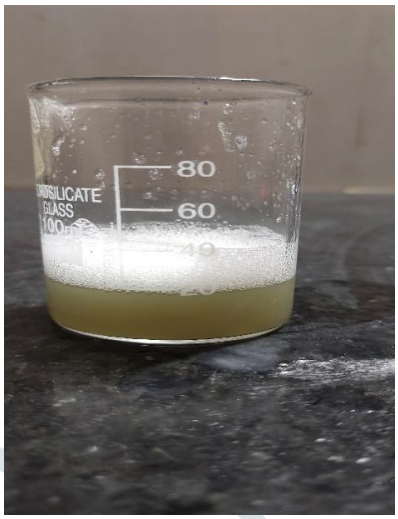


Fig. 13. After Foaming test

- Viscosity :-

About 10ml of formulated sample was taken in the beaker and checked on digital viscometer and record the observation were recorded.

- Irritancy test :-

The face wash was applied on left hand dorsal surface of 1 sq. cm and observed in time interval 1 to 2 hrs.

Fig. 14. Applied Face wash

Fig. 15. Washed Face wash

Observation and evaluation of neem face wash :-

Sr. No.	Parameters	Marketed Formulation	Formulated Batch
1	Colour	Green colour	Green Colour
2	Odour	Characteristic	Characteristic
3	Consistency	Semisolid	Semisolid
4	pH	5.74	5.16
5	Washability	Good	Good
6	Foamability	Foam Appears	Foam appears
7	Irritancy test	Non irritant	Non irritant

Table No. 5. Observation and evaluation of neem face wash

Conclusion

There is a growing preference for natural remedies due to their perceived safety and minimal side effects compared to synthetic alternatives, leading to an increasing demand for herbal formulations in the global market. The development of a herbal face wash utilizing aqueous extracts of neem leaves represents a commendable effort in this direction. Our study demonstrates that the formulated herbal product outperformed existing marketed formulations.

Neem face washes are widely recognized for their effectiveness in treating acne while providing moisturization and cleansing benefits. They are particularly suitable for both oily and dry skin types, delivering essential nutrients necessary for maintaining optimal skin health and imparting a natural radiance. The evaluation of various parameters including color, pH, consistency, washability, irritability, and foamability confirmed the superiority of the formulated neem face wash over commercial alternatives.

Importantly, the all-natural composition of this formulation ensures its safety and reliability, as it avoids any potential harm to the skin. Overall, our findings suggest that this herbal face wash offers significant benefits and represents a trustworthy option for skincare needs.

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