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Formulation and Evaluation of Neem Infused Anti-Acne Cream

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Abstract: Acne is one of the most common skin issues, affecting the pilosebaceous unit, primarily occurring in adolescents and adults. It mainly appears on the face but can also develop on the upper arms, trunk, and back. Hormonal changes contribute to its prevalence, with about 99.5% of teenage boys and 83% of teenage girls, which often continue throughout adolescence. The primary acne causing bacteria include Propionibacterium acnes and Staphylococcus epidermidis. Herbal formulations are gaining popularity because of their high-quality properties and minimal side effects. Herbal or herb-based medicines serve as safe alternatives using the extracts of natural origin for therapeutic benefits. The purpose of herbal therapy is to provide safe, efficient, and affordable medicines so that the people can easily access them. Additionally, these remedies contribute to skin health by providing necessary nutrients and maintaining moisture levels. The aim of this study is to formulate and evaluate an anti-acne cream with the benefits of rose, lecithin, and neem. The constituents of rose and neem showed desirable anti-acne and anti-bacterial properties and are typically used to treat acne; on the other hand, lecithin is used, which acts as a natural emulsifier and has anti-inflammatory properties. The cream was prepared by the slab technique method for mixing the cream in a geometric manner to provide a smooth texture and for mixing all ingredients properly. Specific evaluation tests are determined to confirm whether cream is appropriate for human skin, ensuring it does not cause irritation when applied.

Keywords: *Acne Vulgaris; Anti-Acne Cream; Propionibacterium Acnes (P. Acne); Neem Extract.*

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I. INTRODUCTION

A cream is a type of semisolid emulsion, either water in oil (w/o) or oil in water (o/w) type intended for topical application. It is classified into two categories: water-in-oil and oil-in-water emulsion. Its main role is to remain longer at the application site when applied to the outer or superficial layers of the skin [1]. A skin cream's serve to protect the skin from various environmental and weather conditions while also providing soothing effect. There are common varieties of creams such as massage, night, vanishing, cleansing, cold, and hand and body creams. [2] Herbal product are preferred over the synthetic ones , As the latter cause several harmful side effects , compare to the herbal product because they have minimal side effect. Acne has become a widespread issue in adults, affecting both males and females.

Two main types of acne are acne rosacea and acne vulgaris. Acne rosacea is a long-lasting, and clinically treatable skin disorder that resembles adult acne. Its symptoms include redness of the face, tiny red pimples, and fine red lines on the facial skin. It can result in a bulbous, red nose, Eye problems include red, puffy eyelids and conjunctivitis. Acne vulgaris, often known as acne, is a prevalent skin ailment that occurs due to changes in the pilosebaceous units, which is a skin structure made up of a hair follicle and the sebaceous gland that is adjacent to it.[3] Acne is a concerning issue, especially for teenagers and adolescents. Global statistics show that approximately 85% of the population will suffer from this skin issue at ages around 12-25 years, nearly 8% adults at age 23-24 years old, and only 3% of adults at age 35-44 years old. [4]

Propionibacterium acne and Staphylococcus aureus are known to contribute to acne, as these microorganisms were found in samples from acne patients. Moreover, the growing resistance of acne-inducing bacteria towards the antibiotic is a significant concern.[5]

We have used a herbal ingredient in our preparation, which is Neem extract. Neem is utilised to advance injury mending, assuage skin dryness, tingling, and redness, and lessen pigmentation and scars.[6]

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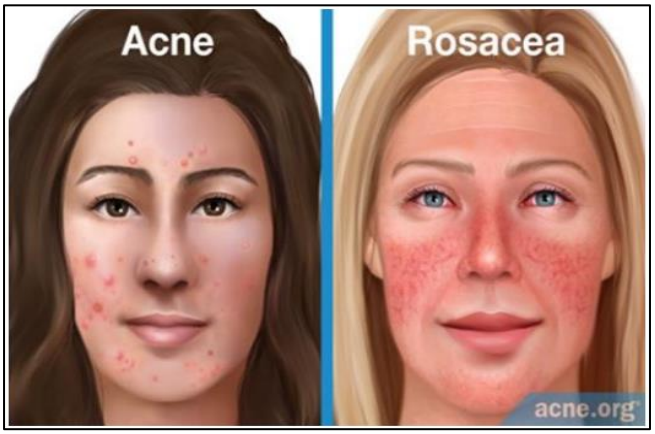

Fig 1 A Visual Comparison of Acne and Acne Rosacea.


Fig 2 A Visual Representation of Common Acne's Impact on Skin.

➢ *How Common is Acne?*

- Acne is the most prevalent kind of skin ailment, with most significant impact on teenagers, young children, and adults.
- Around 80% of people between the ages of 11 and 30 have acne. For girls, the condition tends to peak between the ages of 14 and 17, while for boys, the condition is most prevalent between the ages of 16 and 19.
- Most people with acne often face recurring bouts or flare-ups, but over time the severity of symptoms is reduced and gets better with time.
- Acne symptoms generally disappear by the time a person reaches their twenties.[7]

➢ *Causes of Acne:*

- Overactive sebaceous glands (Excessive lipid secretion).
- Hyperkeratosis (accelerated keratinisation) at hair infundibulum.

➢ *Symptoms of Acne on your Skin Include:*

- Pimples (pustules): Small, pus-filled bumps (papules).
- Papules: Tiny, discoloured bumps, often red or darker than the skin tone.
- Blackheads: Clogged pores with a black top, visible top.
- Whiteheads: Clogged pores with a white top, closed top.
- Nodules: Large lumps under the skin that are painful.
- Cysts: Painful, fluid-filled lumps under your skin, containing pus.[8]

➢ *Factors Responsible for Acne:*

- Propionibacterium acnes (P. acne)
- Abnormal follicular keratinization
- Inflammation
- Androgen-induced enhanced sebum hyperproduction
- Use of certain medications.
- Due to the Cosmetics Used
- Stress
- Hormonal Changes and Menstruation
- Picking and squeezing the pimples.
- Dietary factors.
- Genetics
- Overuse of facial Cleansers [9]

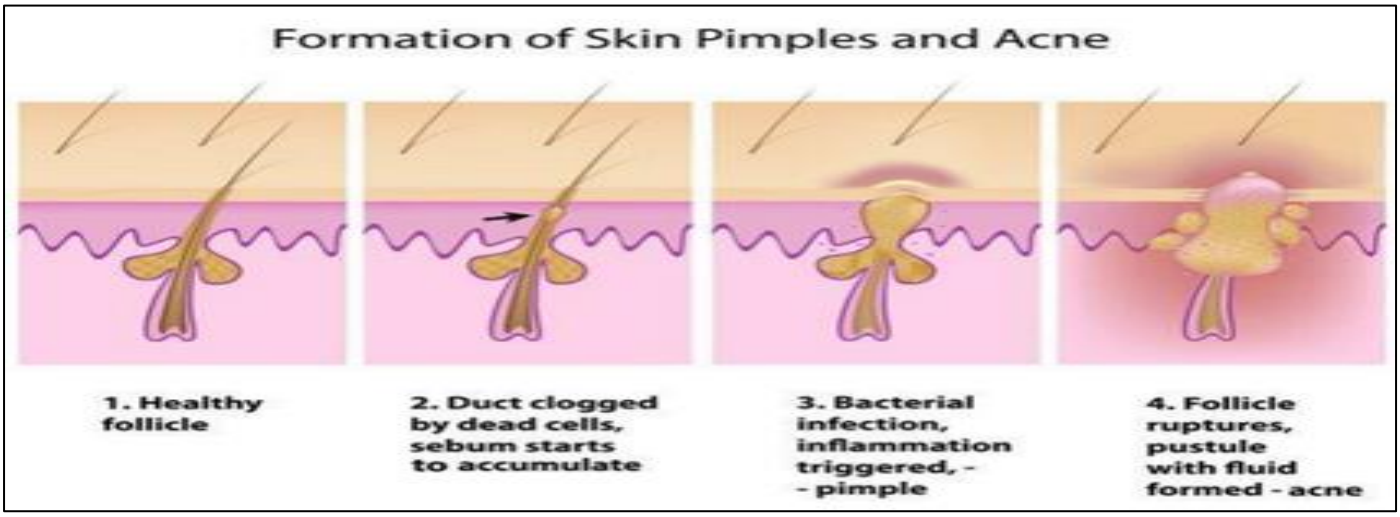

Fig 3 Schematic Representation of the Formation of Acne.

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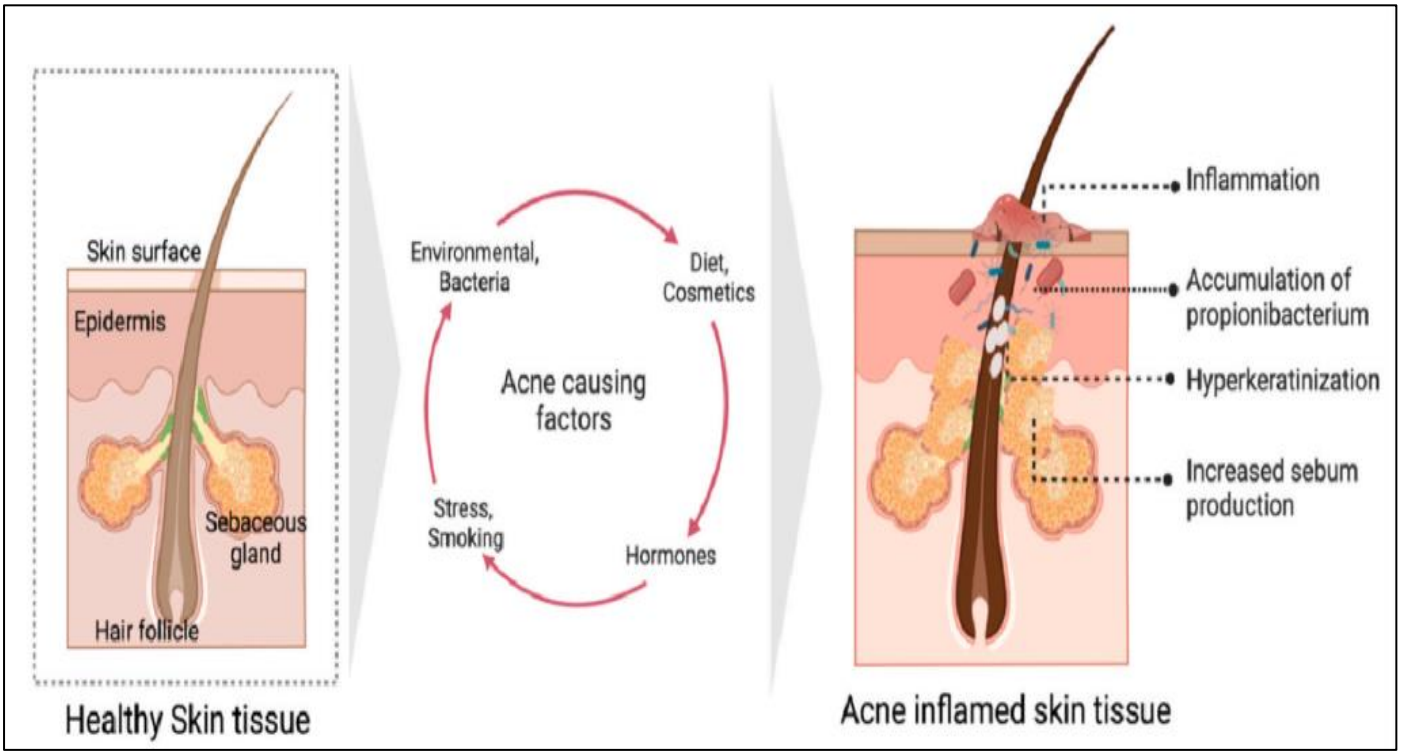

Fig 4 "Visual Representation of Healthy Skin Versus Acne vs Inflamed Skin, showing (Environmental Factors, Bacterial Presence, Dietary Habits, Stress levels, Smoking, and Hormonal Imbalances) all Play a Role in acne Formation and Progression."

➢ *Treatment of Acne*

- Mild acne: Benzoyl peroxide
- Moderate acne: Topical retinoids/ antibiotics
- Severe acne: Hormonal therapy

To help with this problem, there are varieties of medications prepared by the pharmaceutical industry, like anti-acne pills, lotion, moisturiser, creams etc. Cream is a semisolid emulsion that is either oil in water (o/w) or water in oil (w/o), and both of these semisolid emulsions are designed to be applied externally.

Creams are typically made from a blend of water and oil. It is applied to the outer skin, and its main benefits is that it lasts longer at the application site. Their main benefit include soothing the skin, healing infections, removing tans and acne, and protecting the skin from various environmental factors.[10] The cream is applied on the skin, which has a topical drug delivery system.

➢ *Benefits of Topical Drug Delivery System:[11]*

- Bypasses first-pass metabolism.
- Allow the patient to stop taking the drugs if required.
- Broad application area when compared to the nasal or oral drug delivery system.
- The ability to more precisely target a desired area for medicine delivery.
- Enhances pharmacological and physiological response.
- Improve patient adherence.
- Offer suitable self-medication.

II. MATERIALS REQUIRED

Table 1 Materials for Anti-Acne Cream

Sr. No	Material
1	Neem Extract
2	Bees Wax
3	Liquid Paraffin
4	Borax
5	Methyl paraben
6	Rose water

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Table 2 Active Ingredient in Anti-Acne Cream [12]

Fig 5 NEEM

Scientific name: Azadirachta indica
Family: Meliaceae
Kingdom: Plantae
Use: It helps extract excess sebum from the skin and tightens the pore, acts as anti-bacterial agent.

III. METHODOLOGY

➢ *Plant Material and Preparation of Extract*

Neem (Azadirachta indica) leaves were sourced from a native plant nursery in Hyderabad, Telangana, India, and the collected leaves were thoroughly cleaned from foreign material, washed with distilled water, and left to dry in the shade for 72 hours. Once dried, they were coarsely ground, weighed, and stored in airtight jars. To prepare the extract, one litre of ethanol (95% v/v) was added to 250 g of powdered Azadirachta indica for 3 to 4 days. The mixture was stirred with a sterile glass rod every 12 hrs and was filtered using Whatman's filter paper No. 1. In a rotary evaporator, the solvent was removed under reduced pressure at a temperature of less than 50°C, leaving a dark green residue stored in the airtight glass jars.

IV. FORMULATION

Table 3 Formula for Herbal Cream Formulation

S. No	Ingredients	Quantity taken (30gm) F1	Quantity taken (30gm) F2	Use
1	Neem extract	6ml	5ml	Anti-acne, Anti-bacterial
2	Bees Wax	10gm	12gm	Base
3	Liquid Paraffin	3.0gm	3.0gm	Emollient
4	Borax	2.5gm	1.75gm	Alkaline agent
5	Methyl Paraben	2.5gm	1.74gm	Preservative
6	Lecithin	-	0.6gm	Emulsifier
7	Rose Water	q.s	q.s	Anti-oxidant, Fragrance

V. PREPARATION

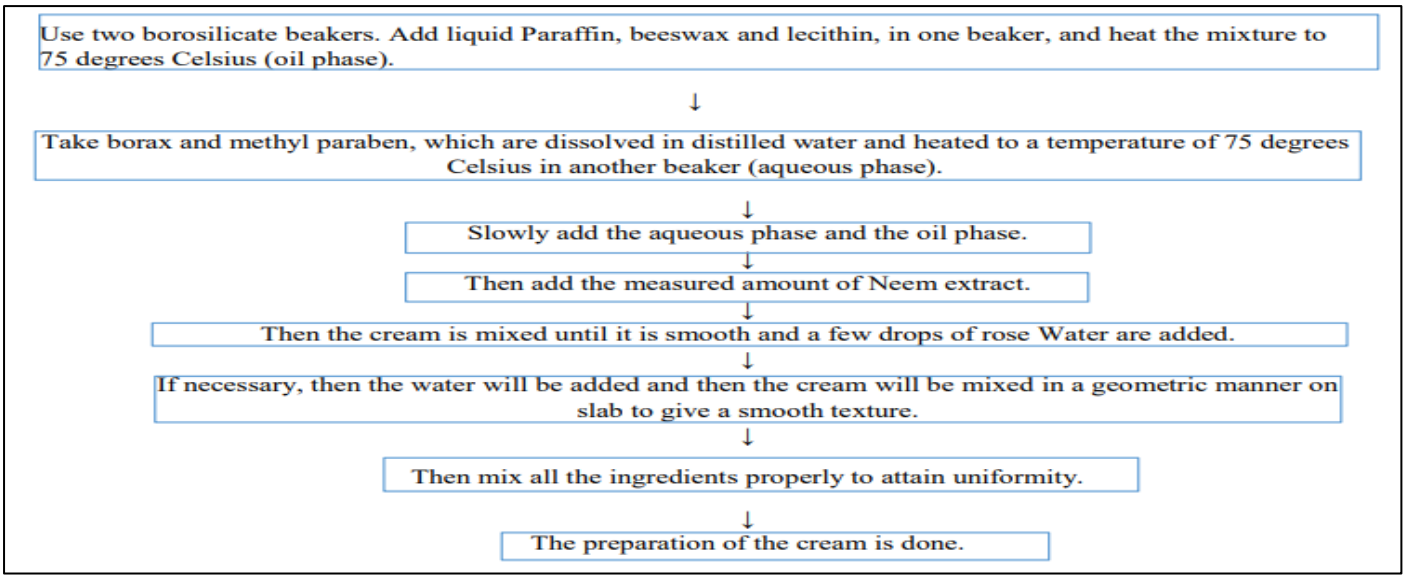

Fig 6 Preparation

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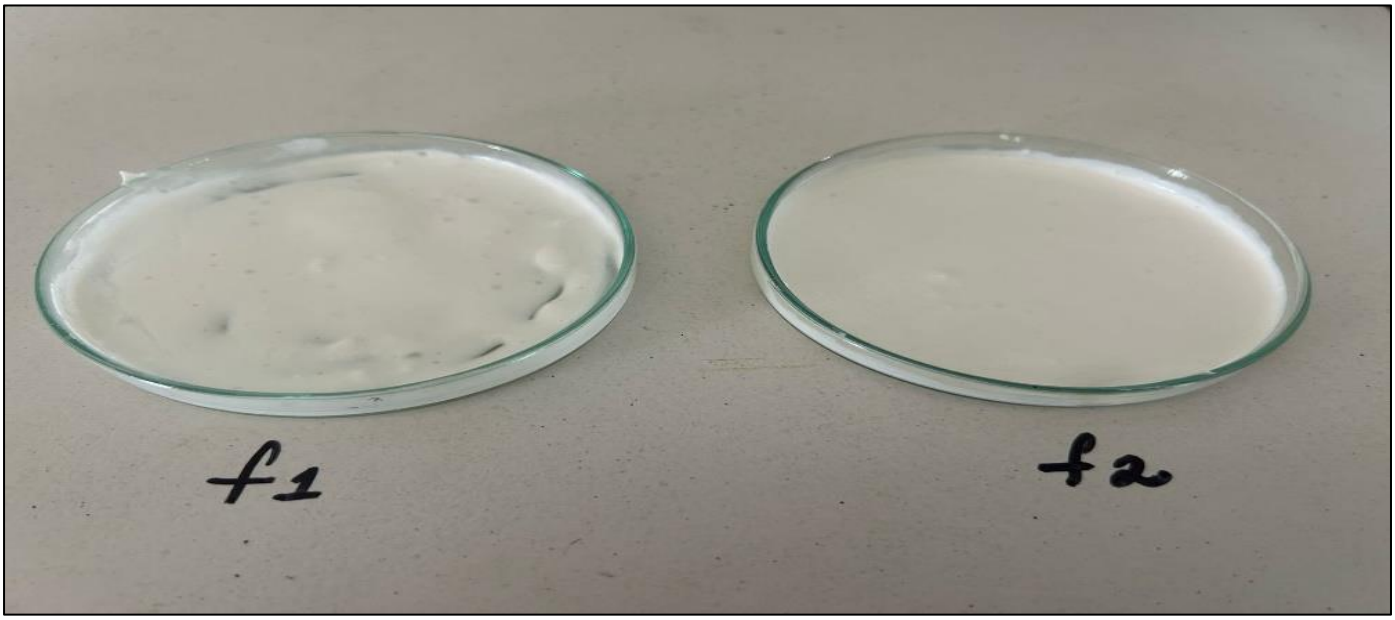

Fig 7 Comparison of Anti-Acne Cream Formulations (F1 and F2). F1 Exhibited Phase Separation, whereas F2 showed a Uniform Texture with No Phase Separation.

VI. EVALUATION TESTS FOR CREAM

From the above analysis of the formulations included in this study, it was observed that these evaluation tests are used frequently and are commonly performed to ensure a stable, safe, and effective product.

- *PH of cream* [13, 14]: To measure the PH, the PH meter is calibrated using a standard buffer solution. About 0.5 g of the cream is to be weighed and dissolved in 50.0 ml of distilled water, and its pH is measured.
- The pH of the cream should be in the range of 5.6-5.8, to avoid skin irritation.
- *Viscosity* [14, 20]: Viscosity of the formulation can be determined by using a Brookfield viscometer at 100 rpm, using spindle no. 7. The cream shows a normal viscosity range, i.e., 48890 cp.
- *Homogeneity* [15]: The formulations should ensure even distribution of the extracts in the cream. This was confirmed by both visual appearance and touch.
- *Physical Evaluation* [13]: The physical parameters of cream-like colour, odour, consistency, and state of formulation are tested for further evaluation of the formulation.
- *After feel* [16]: Emolliency, slipperiness, and the amount of residue left after the application of a fixed amount of cream are to be examined.
- *Washability* [17]: A small amount of cream was applied, and its ability to wash off with tap water is tested.
- Phase Separation [17]: The cream is stored in a closed container at a temperature of 25-100^{o}C away from light. phase separation is checked every 24 hours for 30 days. Any change in the phase separation is observed and noted.
- *Irritancy test* [13]: This test is done to check the safety and the quality of the material and the chemicals used, as well as whether or not they are damaging to the skin. Mark an area 1 sq.cm on the left-hand dorsal surface.

The cream is applied to the specified area, and time is noted. Irritancy, erythema, and oedema are checked, if any, at regular intervals up to 24 hrs and reported.

- *Greasiness* [18]: This test is done to determine whether cream is greasy or oily.

VII. EVALUATION RESULT [19]

Table 4 Results of Evaluation Test

Sr. No	Evaluation Test	Formulation 1(f1)	Formulation 2(f2)
1.	Physical Evaluation		
	Colour	White colour	White colour
	Odour	Pleasant smell	Pleasant smell
	Texture	Uneven	Smooth
	State	Semisolid in nature	Semisolid in nature
2.	Washability	Protective film is not formed	Protective film is formed
3.	Irritability	No irritancy	No irritancy
4.	Phase separation	Phase separation	No phase separation
5.	Homogeneity	Negative	Positive
6.	Greasiness	Negative	Positive

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VIII. RESULT

The neem infused herbal anti-acne face cream was successfully prepared by using the w/o emulsion method with neem extract as an active ingredient.

The final product passed all evaluation parameters, including physical evaluation, pH, irritancy, washability, homogeneity, type of smear and emolliency showing its stability and effectiveness.

In F1, phase separation was observed, whereas in F2, phase separation signs were not observed. This is likely due to the addition of lecithin in F2 which resulted in preventing the phase separation. Which helps in maintaining texture and ensuring even distribution of active ingredient that is neem extract.

IX. CONCLUSION

Nowadays herbal cosmetics are gaining popularity as there is significant demand for herbal cosmetics in the world market, and they are invaluable gifts of nature.

By using Neem extract, the cream showed an anti-acne effect, and these herbal ingredients showed significant result. The formulations were stable at room temperature and can be safely used on the skin.

The Formulation of cream was done by slab method. This cream is non-irritant and easily washable. The cream is formulated from natural origin; it must have less side effects as compared to the marketed synthetic cream. The cream can be spread easily, and it gives its effect. It is less greasy and has no leftover residue of the cream.

The odour of rose water makes cream more pleasant. The texture is so smooth, and it also acts, as a moisturizer and gives a glow to the face.

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