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"A Novel Formulation and Characterization of Hair Serum Using Wood Apple Extract for Scalp and Hair Health"

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ABSTRACT:

The growing desire for natural and herbal cosmetics has motivated research into plant-based ingredients for hair care applications. In this study, a novel herbal hair serum was created utilizing wood apple (Limonia acidissima) extract, which has antioxidant, antibacterial, and nourishing properties. The composition promises to promote scalp health, reduce hair loss, and improve hair texture without the use of synthetic chemicals.

The serum stayed stable at room temperature, had a significant esthetic appeal, and offered potential scalp and hair benefits. This research supports the use of wood apple in cosmeceutical hair care formulations.

Keywords: Serum, cosmeceutical, formulation, cosmetic, characterization.

Introduction:

Natural and plant-based cosmetic products have been increasingly popular in recent years, as customers seek safer, more environmentally friendly alternatives to conventional formulations.¹ Fruit-based extracts have received special attention due to their high phytochemical content and medicinal potential.² One such neglected fruit is wood apple (Limonia acidissima), a tropical plant native to South and Southeast Asia that has long been used in Ayurveda and folk medicine.³

Wood apple, formally known as Limonia acidissima, is a fruit-bearing tree from the Rutaceae family.⁴ It is indigenous to the Indian subcontinent and parts of Southeast Asia, where it thrives in dry plains and arid areas.⁵ Wood apple, also known locally as Bael, Bel, Koth bel, and Vellaga pandu, has a prominent place in traditional medicinal systems such as Ayurveda, Siddha, and Unani. the fruit has a hard, woody shell and a sticky, dark pulp with a pungent aroma.⁶ While its rough form may appear inconspicuous, wood apple is a nutritional powerhouse with several bioactive components. The pulp is high in tannins, phenolic acids, flavonoids, vitamins (particularly Vitamin C), iron, calcium, and natural sugars, making it both nutritious and medicinally valuable.^{7,8}

Traditionally, the fruit was used to treat digestive ailments, respiratory problems, skin infections, and inflammatory illnesses. Because of its antibacterial, antioxidant, and astringent characteristics, it has long been used in folk treatments to promote wound healing and skin health.⁹ Its natural acids and phytochemicals make it suitable for topical applications, such as hair and scalp treatments. despite its rich phytochemical profile and historical use, wood apple is underutilized in modern cosmetic compositions.¹⁰ Its promise as a natural ingredient in hair care products, particularly aqueous-based formulations, opens up new avenues for sustainable and herbal cosmetic innovation.¹¹

Wood apple extracts contain a variety of bioactive compounds such as phenols, flavonoids, alkaloids, terpenoids, tannins, saponins, fat steroids, glycosides, gum mucilage, and fixed oil, which are responsible for the fruit's pharmacological activity.¹² Since ancient times, numerous plant components, such as roots, fruits, bark, and leaves, have been utilized to cure a number of ailments, including diarrhea and dysentery.¹³ Fruits are nutritious because they include vitamins, minerals, carbohydrates, protein, and other nutrients.¹⁴

Nutritional Fact of Wood Apple:



Fig. No 1 Nutritional Fact of Wood Apple.

Formulation Profile of Hair Serum:

Sr. No	Ingredients	Quantity
1.	Wood apple aqueous extract	40 ml
2.	Glycerine	10 ml
3.	Aloe vera gel	15 ml
4.	Essential oil	3 ml
5.	Water	Q. S

Table No. 1 Formulation of Hair Serum.

Method of Preparation of Hair Serum:

- > Combine glycerin and rose oil in a mortar and pestle or magnetic stirrer.
- > Add Aloe Vera gel and mix thoroughly until smooth gel forms.
- Mix in Wood Apple Aqueous Extract until smooth.
- > Mix until smooth, serum-like consistency is created.
- > Pour into a clean bottle.

Health Benefits of Wood Apple:



Fig. No 2 Health Benefits of Wood Apple.

Prepared Sample of Hair Serum:



Fig. No. 3 Prepare sample for serum.

Physical Evaluation Parameter and Results of Hair Serum.

Sr. No	Parameter	Observation
1.	Color	Yellowish Brown
2.	Oduors	Fragrant
3.	Appearance	Clear
4.	Texture	Smooth
5.	Spread ability	Uniform
6.	Stability	Stable at Room Temp.
7.	Consistency	Semisolid
8.	Homogenecity	Good

Conclusion:

Finally, the study successfully developed a novel hair serum formulation with wood apple aqueous extract, glycerin, aloe vera gel, essential oils, and water. The use of wood apple extract, which is high in antioxidants and nutrients, significantly enhanced the serum's potential to support scalp health and hair nourishment. According to the characterization investigations, the serum possesses acceptable physicochemical properties such as viscosity, pH, and stability. Furthermore, the mixture showed potential moisturizing and soothing qualities due to the synergistic impact of aloe vera and glycerin. These data suggest that the produced serum could be an effective natural treatment for enhancing scalp hygiene and hair condition. Additional clinical trials are required to demonstrate its efficacy and long-term safety.

Conflict of Interests:

The authors state that they have no known competing financial interests or personal relationships that could have influenced the work presented in this study.

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