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Research Article

**FORMULATION AND EVALUATION OF HERBAL HAIR
SERUM**¹ Pratik Vishnu Bhalerao, ² Prof. Ankita P. Jatale, ³ Dr. Swati P. Deshmukh,⁴ Prem Gabhane, ⁵ Ruturaj Dhanokar^{1,4,5} Student Shraddha Institute of Pharmacy Kondala Zamre, Washim² Assistant Professor Department of Pharmaceutics, Shraddha Institute of Pharmacy Washim³ Principal Shraddha Institute of Pharmacy Washim.**Abstract:**

Herbal extracts are known to provide microprotein supplements to nourish hair effectively, leading to healthier hair. Herbal cosmetics are gaining popularity in the personal care industry due to their absence of parabens and sulphates. The global herbal industry is thriving and is estimated to be worth over US\$10 billion, with a steady annual growth rate of three to four percent. Europe stands as the largest region in both herbal product production and demand, followed closely by Asia. The herbal hair serum was successfully formulated and evaluated on trial and error basis. The produced herbal hair serum offers a variety of critical nutrients that are crucial for keeping healthy hair and scalp conditions, according to the research study and outcomes shown. It contains natural components that assist hair maintenance and development. The anti-oxidant properties of herbal components including orange peel powder, hibiscus powder, and vitamin E primarily function by halting the premature greying of hair. Castor oil, fenugreek, and flaxseeds are effective stimulators of hair growth. Hibiscus powder can be also employed as a colour agent in this case. In cosmetic formulations, the use of bioactive ingredients has a valuable impact on body characteristics and offers nutrients that are important for preserving good and beautiful hair. It can be inferred that prepared herbal hair serum has a beneficial effect on the mechanism of hair growth and increased consistency. Medicinal plants have been used for the treatment of hair diseases since antiquity because of fewer side effects and hypersensitivity reactions. It is time to dump the chemical-laden hair care products in favour of natural alternatives. The traditional system of medicine in India acclaims a number of herbal drugs for hair growth promotion. The best part is that herbal extracts will provide microprotein supplements to hair and provide enough nourishment, resulting in safe and sound hair.

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INTRODUCTION:

The hair follicle is known to be the most important organ in the mammalian system, determining appearance, gender difference, providing severe temperature protection, and playing a part in self-defence. Many lifestyle-related changes, such as fatigue, anxiety, junk food consumption, and the use of various hairstyling/colouring methods, have caused serious hair loss difficulties in the younger generations. The thinning of one's hair in most situations, it is not transient, but it causes alopecia. Due to excessive anxiety and tension, many people suffering from hair loss seeks different remedies, ranging from mythology to conventional and therapeutic healing to the use of minoxidil and finasteride. Hair root activation is necessary to improve hair development and prevent hair loss. Hair growth is based on a dynamic and precisely regulated mechanism that is not fully understood. It is a cyclical mechanism involving hair shaft synthesis, elongation, and ultimately shedding. Human hair usually comprises follicles of anagen, catagen, and telogen phases. In 1990, the first silicone-based hair serum to coat and protect hair strands was created by British stylist John Freida. Since then, a multitude of serums have been formulated to protect and replenish hair but few targeted aging hairs and many contained ingredients considered unhealthy for daily scalp and hair use. Care of the hair and care of the scalp skin may appear separate, but are actually intertwined because hair grows from beneath the skin. The living parts of hair (hair follicle, hair root, root sheath and sebaceous gland) are beneath the skin, while the actual hair shaft which emerges (the cuticle which covers the cortex and medulla) has no living processes. Damage or changes made to the visible hair shaft cannot be repaired by a biological process, though much can be done to manage hair and ensure that the cuticle remains intact. Scalp skin, just like any other skin on the body, must be kept healthy to ensure a healthy body and healthy hair production. If the scalp is cleaned regularly by those who have rough hair or have a hair-fall problem, it can result in loss of hair. However, not all scalp disorders are a result of bacterial infections. Some arise inexplicably, and often only the symptoms can be treated for management of the condition (example: dandruff). There are also bacteria that can affect the hair itself. Head lice is probably the most common hair and scalp ailment worldwide. Head lice can be removed with great attention to detail, and studies show it is not necessarily associated with poor hygiene. More recent studies reveal that head lice actually thrive in clean hair. In this way, hair washing as a term may be a bit misleading, as what is necessary in healthy hair

production and maintenance is often simply cleaning the surface of the scalp skin, the way the skin all over the body requires cleaning for good hygiene.^[1,2,3,4]

The sebaceous glands in human skin produce sebum, which is composed primarily of fatty acids. Sebum acts to protect hair and skin, and can inhibit the growth of microorganisms on the skin. Sebum contributes to the skin's slightly acidic natural pH somewhere between 5 and 6.8 on the pH spectrum. This oily substance gives hair moisture and shine as it travels naturally down the hair shaft, and serves as a protective substance by preventing the hair from drying out or absorbing excessive amounts of external substances. Even though sebum serves as a protective substance, too much of this oily substance can cause blockage around hair follicles. This blockage is usually from dandruff or even dead skin. As a result, "blocked or obstructed hair follicles" may prevent hair from producing. Sebum is also distributed down the hair shaft "mechanically" by brushing and combing. When sebum is present in excess, the roots of the hair can appear oily, greasy, and darker than normal, and the hair may stick together. Hair is an integrated framework with a unique chemical and physical behaviour. It is a thin flexible keratin thread with extraordinary strength and elasticity. Hair care products are used to improve its appearance, and it is a cyclical medium involving hair shaft conflation, extension, and shedding. Hair is formed of follicles of anagen, catagen, and telogen phases, with a root, shaft, and tip. Cosmetic are available to assist extend growth and stop hair loss because ageing causes hair to turn white. Since it includes significant knowledge and a wide range of data from numerous other scientific fields, cosmetic science is a legitimate science and a multidisciplinary field. Development, formulation, and production of cosmetics and personal care items are all part of its scope. Cosmeceuticals are one of a kind and swiftly developing field inside dermatology and healthy skin industry. "Natural cosmetics or herbal cosmetics" refers to products that are made with a base of diverse legal cosmetic ingredients and one or more herbal ingredients that are utilised solely to deliver specified cosmetic benefits. Herbal cosmetic products are preparation containing phytochemical from different botanical sources. Study objective was to understand characteristics of risk factors to avoid using synthetic products containing local herbs before and after trial, and to study satisfaction of users with hair serum products containing local herbal ingredients.^[5,6,7,8]

Advantages of Hair Serum: -

1. Hair serum can effectively smoothen, soften and make your hair silky.
2. It protects the hair from environmental aggressors. Act as both pre styling treatment and finishing product.
3. It can be used before or after using heat styling.
4. Controls frizz. If your hair is weak and damaged, it may look frizzy or dry.
5. Boosts smoothness.
6. The anti-frizz effect of hair serum also helps improve the smoothness of hair serum.
7. Hair serum is also reduce the tangles and promote the shine.
8. To enhances the straightness and curls.^[10,11]

Hair serum benefits: -

Hair serums offer a range of benefits to the hair.

1. Adding shine

One of the benefits of hair serums is their ability to revive dry, dull-looking hair by infusing moisture into each hair strand. Healthy, moisturized hair tends to be silkier and glossier.

Some hair serums may also have light- reflecting ingredients, which add sheen and lustre to the hair without making it feel greasy.^[15]

2. Controlling frizz and dryness

Damaged hair typically looks dry, brittle, and frizzy. It is also common for dry, damaged hair to have fly aways and split ends. Serums can create help tame unruly hair strands and create a polished finish.

The silicone content in many hair serums helps manage these issues by forming a protective coating around the hair cuticle. This seals the hair and keeps weak and damaged hair hydrated and moisturized. Some hair serums contain hydrolysed keratin proteins, which offer several hair benefits:

- improves the hair's ability to retain moisture prevents strands from splitting repairs damaged hair neutralizes the negative static charge that causes frizz, flyaway, and friction
- improves the tensile strength of dry,^[18,17]

3. Reducing knots and tangles

Hair serums smoothen the hair, causing a detangling effect on the hair. As the serum

makes the hair smoother and silkier, it becomes easier to comb through and manage.^[24,26]

4. Enhancing the hair's natural look

Hair serums improve the natural structure and texture of the hair, resulting in sleeker, more defined hair, enhancing the hair's natural look.

5. Protecting against damage

The serum's protective coating protects the hair from pollutants, dust, photodamage, and heat damage from styling. This is why serums are often applied to the hair before they undergo styling.

Most serums contain ingredients that protect the hair from: heated styling tools such as straightening and curling irons and hair dryers chemical processing used to dye, straighten, bleach, or perm the hairs environmental stress, such as photodamage and weather mechanical damage from repeated treatments and styling

They help protect, improve and recover the hair fibres' properties, including smoothness, elasticity, and hair dryers^[28,29]

Hair serum: -

- Hair serum is the styling product that coats the surface of the hair known as hair serum.
- It is basically a hair care product in liquid form, its consistency thicker than water.
- Hair serum is not just meant for hair styling. They are also for treating multiple hair concerns like dry hair, dull hair, and unmanageable hair.

Intended to be used on wet hair. Several scientific attempts have been made to prevent hair loss and increase hair growth, but nothing has offered any great promise. One of the reasons for the hair loss is due to alpha reductase enzyme which converts testosterone to Dihydrotestosterone (DHT). The hair follicles have receptors of DHT and as a result the dermal papillae cells shrink due to the binding of DHT which cause atrophy of the stem cell-Dermal papillae Minoxidil and finasteride are used for the treatment of hair loss but due severe side effects along with possible treatment failure a definite solution for hair loss remains elusive and evasive.^[33,22]

Suitable types of hairs for using hair serum:- Straight, Wavy, Curly, Coily

How to use hair serum?

Knowing how to use hair serums properly is crucial to getting the most benefit. Below are some recommendations when using hair serums.

❖ **Do: Wash hair before application**

Hair serum is typically a leave-in product and best applied to freshly shampooed hair. The serum's primary purpose is to protect the hair from pollutants. Using it on unwashed hair defeats the purpose. Moreover, applying it on unwashed hair can make the hair look oily and weighed down.

After a person washes their hair, they can towel dry it and then apply the product. A person can also use some after taking a shower at night for a more glossy, soft hair in the morning. However, a person may also use hair serums to touch up their hair throughout the day.

❖ **Don't: Overapply serum**

Over-applying serum can cause the hair to go flat and greasy. Ideally, people should begin with a small amount and gradually add more as needed to prevent this.

❖ **Do: Warm it up before applying to the hair**

Most hair serums have a thick consistency, making them hard to apply. Warming up the product by placing a little product on the palm and rubbing it for a few seconds can make it smoother, which helps ensure a more even application.

❖ **Don't: Apply on roots**

It is important to avoid applying hair serum on the roots as this can weigh the hair down, make the roots appear greasy, and cause product buildup. Since the hair tips are naturally drier, applying the hair serum from the ends to the midshafts is best.

❖ **Do: Consider a person's hair type and hair goals**

Hair serums may have different formulations, meaning certain hair types may benefit more than others, depending on the serum type. It is not only important to know which serum works best for a person's hair type, but vital to check their ingredients to ensure that the serum will provide their desired hair goals.

❖ **Don't: Rinse the serum after application**

Hair serums are leave-in products that work on the hair's surface to moisturize, smoothen, and protect the hair. Washing it off removes

this coating.

❖ **Which hair serum works best for each hair type?**

The best way to get the most benefit from a hair serum is to select the best product for a person's hair type.

People with coarse hair types can opt for serums that offer intense moisturizing. Serums that protect against humidity and seal in hydration may be beneficial for this hair type since this type is prone to fizziness and dryness. A person with coarse hair can look for castor, marula, and rosewood products for intense hydration.

Lightweight, hydrating serums can add bounce and definition to curly hair. Similarly, people with fine hair can also benefit from serums with lighter formulas.

People with straight hair who want to boost its straightness can also use serums. As the serum smoothen and moisturizes the hair, the straighter and glossier it will appear.

People with damaged hair and split ends should consider keratin serums to bring back the protein in their hair. These serums are often known as "repairing" and "fortifying." Meanwhile, people who use straightening irons or hairdryers may wish to opt for heat-protecting serums. ^[12,14]

2. Literature review :-

Anusha R et al 2023

In the mammalian system the hair follicle is known to be the most significant organ that determines appearance, gender distinction, provides intense temperature protection and plays a role in self-defence. The younger generations have begun to suffer extreme hair loss problem due to many reasons. The hair loss is not temporary in most cases, but it results in alopecia. Many people suffering from hair loss are in search of multiple treatments due to extreme anxiety and tension. To improve hair growth and to prevent hair loss, hair root activation is required. Citrus sinensis is used for antidandruff protection hair care. It has antibacterial and anti-inflammatory properties. Nigella sativa improves the shine, strength, volume, and texture of hair.

Mr Randad Shubham Shrinivas et al 2022

Coconut oil may have several benefits for our hair and scalp, it may help to moisturize and seal hair. This can help to prevent dry, flaky scalp and

dandruff. Vegetable oil conditions hair prevents dandruff, promote hair growth, prevent scalp inflammation and protect hair from heat damage.

Lata Saini *et al* 2023

By Hair is an epidermal by-product that plays an important role in enhancing the overall beauty of the body. Dandruff, Hair fall, grey hair are few problems committed hair faced by people. Many cosmetics are available nowadays to unravel these problems and hair grease is one of them. According to research, herbal hair serum offers a variety of vital nutrients needed to encourage the growth of natural hair and preserve the sebaceous glands' proper operation. The use of herbal cosmetics within the specific hygiene and healthcare system has modified by numerous groups. The lengthening of hair growth was then captured on camera. Cosmetics are used on an excessive scale for their many benefits in daily life. Mankind use a variety of cosmetics to enhance their beauty and elegance so that they appear fresh and charming.

Rohan R. Vakhariya *et al* 2017

Nowadays, cosmetics are becoming more high demand in daily life and it was used frequently by many of people per year. Mankind uses various products to enhance beauty and elegance to look young and charming. Cosmetics thus play a vital role in human life. Now days, herbal cosmetic are widely used because of the belief that they have fewer side effects and better safety. Hair is one of the primary parts of the body which acts as a protective appendage. The main objective of the present work is to develop an herbal hair serum for general purpose (daily use) using various herbs with this evaluate the characteristics of cosmetic serum and to identify the best formulation of cosmetic serum. Three formulations of cosmetic serum (H1, H2 and H3) with different concentration of excipients have been developed. They were evaluated for its physical appearance, pH, homogeneity test, viscosity, spreadability test and stability test. All the parameters were found to be good and within the standards. Current research has revealed that herbal formulations are effective in enhancing hair consistency.

Naman Tyagi *et al* 2014

Flaxseeds, scientifically known as *Linum usitatissimum* and belonging to the family Lineaceae, are commonly referred to as Alsí, Jawas, and Aksebija in Indian languages. The plant yields blue blossoms and tiny, flattened seeds. The color of the seeds varies from golden yellow to reddish brown. It is rich in omega-3 fatty acids, specifically Alpha-

linolenic acid, which helps to minimize hair loss and inflammation of the scalp. This, in turn, aids in the preservation and protection of hair follicles. Flaxseed contains proteins (10.5-31%) that consist of key amino acids such as glutamic acid, serine, arginine, lysine, leucine, and others. These amino acids are crucial for hair health, as they help prevent hair loss and stimulate the creation of new hair. Flaxseed dietary fiber can aid in concealing hair loss and promoting hair density. Flaxseed is a crucial and prominent source of phytochemicals in the functional food industry. Flaxseed exhibits a range of other advantageous impacts, such as promoting newborn brain development, generating blood lipids, safeguarding against cardiovascular diseases,

3. Aim & Objective:

Aim:-

To formulate & evaluate the herbal hair serum

Objective:-

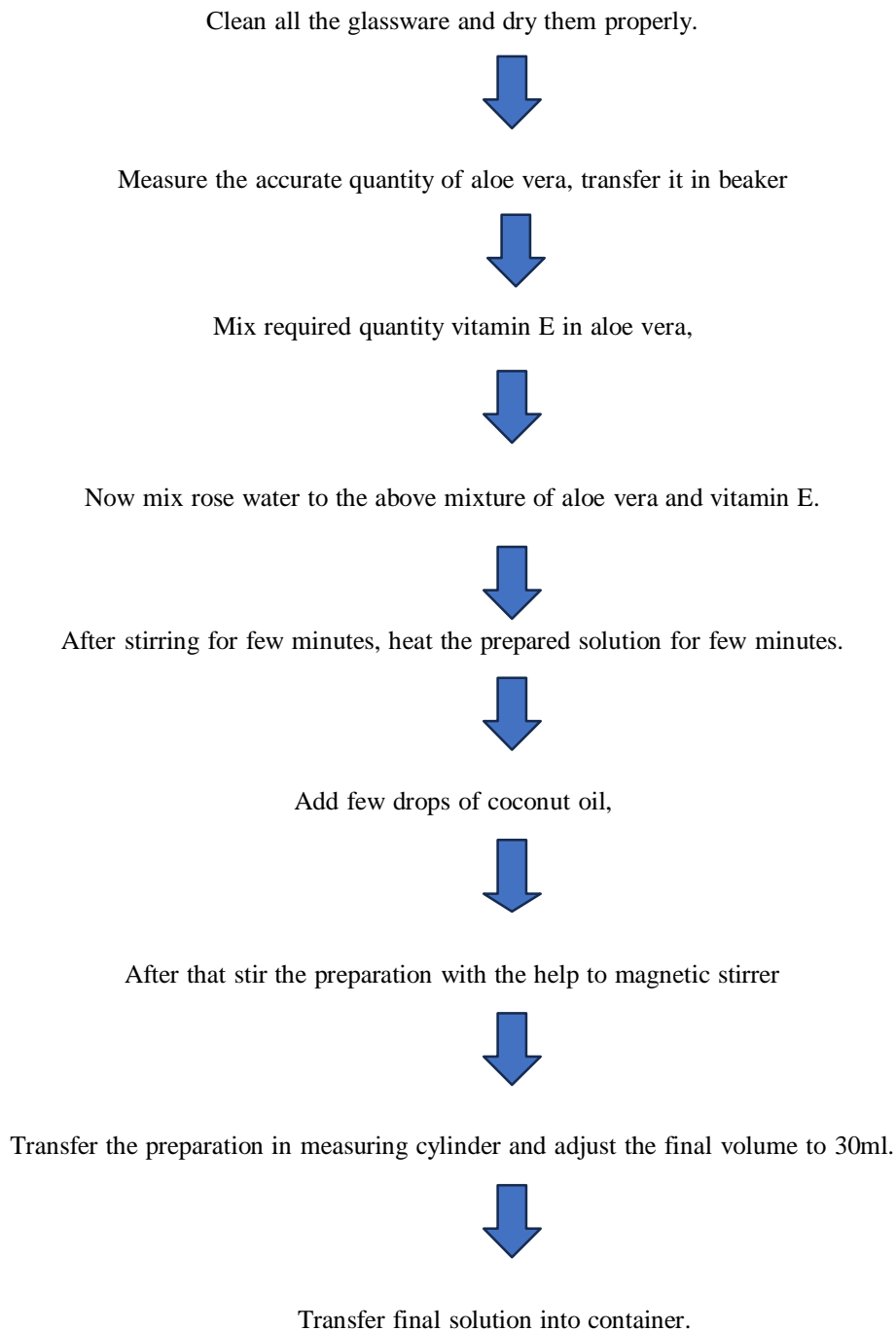
- Promotes Hair Growth.
- Imparts A Natural Shine.
- Prevents Premature Greying.
- Nourishes Hair Roots.
- Minimizes Frizz.
- Prevents Split Ends.
- Protecting in opposition to damage.
- It protects the hair from environment.
- It can be used both before or after using heat styling.
- Boosts smoothness of the hairs
- Multi Purpose

A hair serum solves a lot of hair issues and not just one problem. There is a reason it is called a one stop solution for all your hair woes. Hair serum transforms a bad hair day into a good hair day. With just a few drops, your hair will feel and look different.

- Protects Hair

Hair serum forms a layer on hair strands. It thus acts as an excellent protect against heat, sun damage, dirt, dust and pollution. It prevents your hair from getting damaged. This is why it is advised to use a heat protecting serum before using hot styling tools.

- Gives Shine to the Hair The layer formed by hair serum acts as a reflector of light^[25,27]

4. Plan of work:

5. Drug & Excipient

Drug profile:-

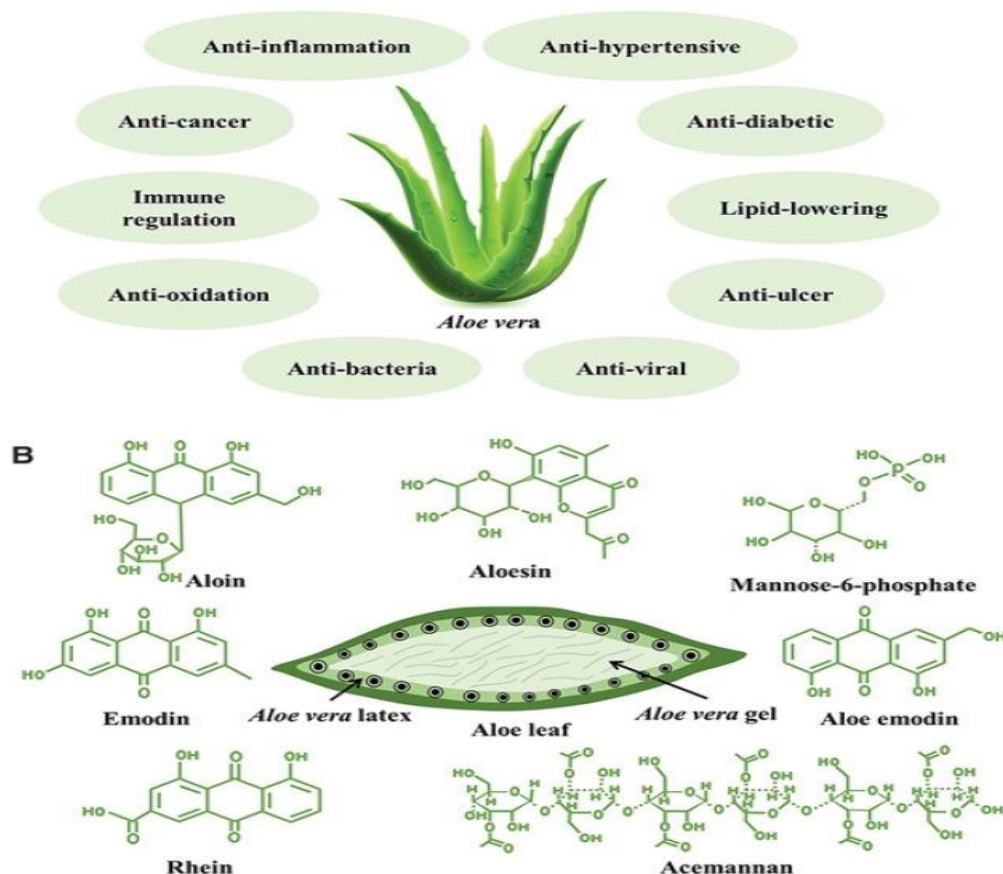
1. Aloe vera

Synonyms: Aloe, Musabbar, Lolesara(in kannada).

Biological source: Aloes is obtained from the dried juice of the leaves of *Aloe barbadensis* Miller, known as Curacao aloes, (*Aloe Vera*). *Aloe perryi* Baker, known as Socotrine aloes. *Aloe ferox* Miller and hybrids of this species with *Aloe africana* Miller and *Aloe spicata* Baker, known as Cape aloes, belonging to family Liliaceae.

Family: Asphodelaceae

Chemical constituents: Anthracene glycosides (11 to 40%). Barbaloin or Aloin, a C glycoside (not easily hydrolysable with dil. Acids and linkage between the sugar and the aglycone is through C-C). Is barbaloin, alo-emodin and aloes one. Aloinosides A and B (only in Cape aloes). Resins (resinotannol + cinnamic acid or coumaric acid) Also contains Aloetic acid, homonataloin etc^[33,39]



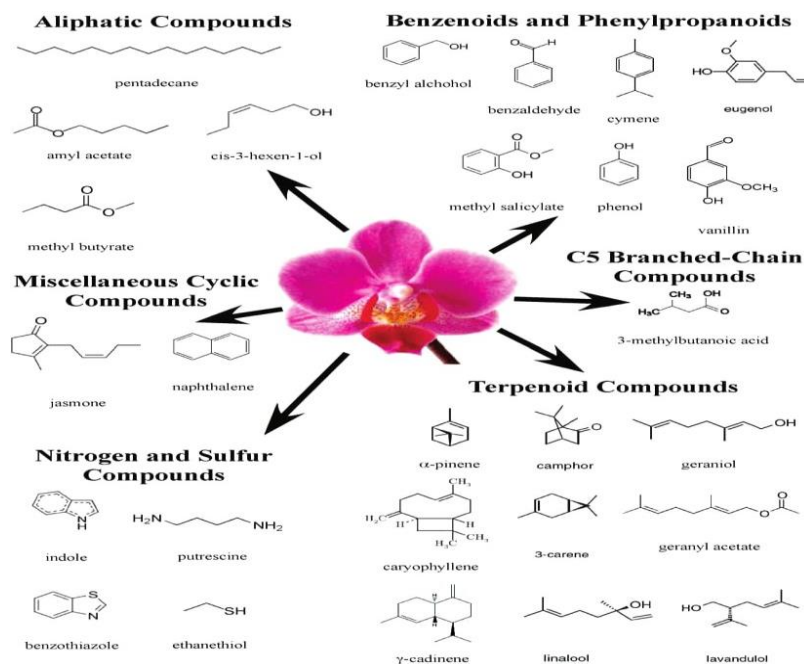
2. Rose water

Biological Source: Rose water is extracted from the flowers of *Rosa damascene*.

Family: Rosaceae

Chemical constituents: Rose water contains citronellol, geraniol, nerol, linalool, phenyl ethyl alcohol, pinene, limonene and p-сугтеле.

Use in cosmetic: Used in the preparation of soaps, body lotions, face cream etc. Used as moisturizer^[19,18]



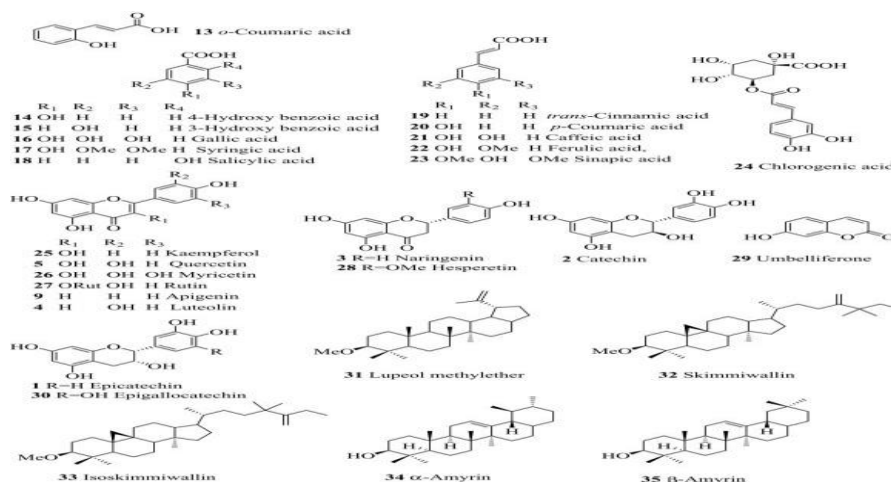
3. Coconut Oil

Synonyms:- Coconut oil, Coconut butter, Copra oil

Biological Source:- Coconut oil is the oil expressed from the dried solid part of endosperm of coconut, *Cocos nucifera* L.,

family Palmae.

Chemical constituents:- Coconut obtained from the hard, dried endocarp consists of a mixture of triglycerides of saturated fatty acids. The oil contains about 95% of saturated fatty acids with 8 and 10 carbon atoms. It shows the presence of caprylic acid, 2%; capric acid, 50-80%; lauric acid, 3%; and myristic acid about 1%.^[25,22]



6. Materials and methods: -



Fig.1 Aloe Vera

Aloe Vera:

Aloe vera has long been used for treating hair loss. It also soothes the scalp and conditions hair. It can reduce dandruff and unblock hair follicles that may be blocked by excess oil. You can apply pure aloe vera gel to your scalp and hair a few times per week which large amount of melanin is synthesized. This generally happens due to excess exposure of the skin to the sun. In reaction to UV rays in sunbeams, the skin cells called melanocytes initiate to synthesize melanin. This increased synthesis of melanin is responsible for the emergence of darkened patches on the skin. Aloe vera has the property of diminishing the pigmentation and dark spots on the face. Aloe vera is a succulent plant with fleshy leaves that contains gel- like substance and grows in sunny climates all over the world. This gooey substance inside aloe vera leaves possesses moisturising and nourishing properties that can even heal sunburned skin and surface wounds. In fact, you'll find mention of aloe vera in the history of several cultures across the world as it was used to address a myriad of concerns. Aloe vera is rich in vitamins, minerals, and fatty acids, and its antimicrobial and anti-inflammatory properties have made it immensely popular in DIY beauty rituals. Now that you know that aloe vera is a versatile, medicinal plant, let's address the question you have been dying to ask- is aloe vera good for hair? All the remarkable properties that make aloe vera a highly coveted traditional remedy also makes it the perfect moisturizer for dry hair that desperately needs an intense dose of hydration. And, another

factor that makes aloe vera popular is that it suits most hair types. Using aloe vera for hair has yielded numerous desirable results. Aloe vera is rich in vitamins, essential amino acids, plant steroids, fatty acids, and minerals such as copper and zinc that contribute to hair growth. Oily hair can disrupt your hair- washing schedule, and sprinkling talcum powder on your scalp won't get rid of the greasiness. Aloe vera gel comes in handy in such emergency situations as it cleanses the hair shaft gently, and does a thorough job of it. It removes the excess sebum and residue from your scalp and even gets rid of any build-up that might be adding to your hair's greasiness. Moreover, unlike chemical hair products, when you use aloe vera for your hair, it deeply cleanses your hair strands without stripping your hair of its natural moisture. One of the most alluring benefits of aloe vera for hair is that it gives you long and strong hair. Aloe vera gently cleanses your scalp and conditions your hair, thereby reducing the chances of hair breakage. It slows down the process of hair loss. Using aloe vera for hair growth yields desirable results as the plant is rich in vitamin C, E, B-12, folic acid, and choline that aid hair growth. Using aloe vera for your hair before you go out gives you the much-needed protection from the sun. Aloe vera creates a natural protective layer around your hair and keeps it hydrated throughout the day. Moreover, it even keeps your tresses protected from damage caused by other environmental factors.^[44,45]

Vitamin E:



Figure 2: vitamin E.

Vitamin E-rich oil can help replace that protective layer and bring back shine. Oil in general also helps seal out moisture, reduce breakage, and protect the hair from damage. The Tocopherol (Vitamin E) A vitamin E- rich oil can help to restore shine by rebuilding the protective layer. In general, oil helps to seal in moisture, minimize breakage, and protect the hair from harm.³⁵ Vitamin E may help support a healthy crown and hair since it contains natural antioxidants that may aid in hair growth. Vitamins and antioxidants can reduce the quantity of oxidative stress and free radicals that lead to the deterioration of the hair follicle cells in one's crown. Vitamin E refers to a set of eight fat-soluble molecules, consisting of four tocopherols (α -, β -, γ -, and δ -tocopherol) and four tocotrienols (α -, β -, γ -, and δ -tocotrienol). Tocopherols, specifically vitamin E, are the most powerful antioxidants that can dissolve in fat. The four homologous isomers accessible are: (5, 7, 8- trimethyltocol), (5, 8-dimethyltocol), (7, 8-dimethyltocol), and (8-methyltocol). These isomers vary in the number and position of methyl groups in the molecules. The biological effects of different tocopherols vary, as does their ability to prevent fats and oils from undergoing oxidative rancidity. The antioxidative and biological activity of the isomers generally follow the order of alpha, beta, gamma, and delta with increasing and decreasing levels respectively. The importance of tocopherol is particularly notable in the context of using flaxseed for animal feed, as it has been discovered that an increase in dietary flaxseed leads to a reduction in both alpha and gamma tocopherols in rats. Moreover, tocopherol, an inherent component of food, has been strongly associated with polyunsaturated fatty acids due to its ability to alleviate potential oxidative stress caused by lipids in the diet. The concentration of tocopherol in plants is contingent upon the concentration of unsaturated fatty acids; an augmentation in unsaturation leads to the production of more antioxidants to safeguard the oil. The variation in tocopherol levels in sesame

seed oil is attributable to factors such as genotype, maturation level, and ambient temperature. Various factors, such as seed development, oil preservation, and processing, have been observed to influence the levels of tocopherol in vegetable oils. Among the various seeds and oils, flaxseed and flaxseed oil had the most elevated content of tocopherol, with poppy seed, safflower seed, and oil following closely behind.⁶¹ In 1994, a commercially bred flaxseed variety was created with specific amounts of R-, α -, γ -, and δ -tocopherols and total tocopherols, which were measured at 0.88, 2.42, 9.2, 0.24, and 12.74 mg/100 g of seed (wb) correspondingly. However, this variety had very low levels of tocotrienols. The tocopherol concentration of 9 flaxseed varieties cultivated in 13 distinct geographical locations varied from 39.5 to 50 mg/100 g of oil, with an average value of 43.6 mg/100 g of oil. The differences in content were primarily attributed to the different locations. Research has demonstrated that alpha-tocopherol has a specific and localized effect when applied topically, without affecting other organs. It has been observed that alpha-tocopherol significantly enhances blood circulation in the superficial layers of the skin, as evidenced by increased skin temperature and blood volume in the peripheral areas. Additionally, it has been observed that the cold temperature restricts blood flow in the arterioles, but alpha-tocopherol counteracts this effect. Considering these factors, it is logical to infer that the active impact of alpha-tocopherol on peripheral blood flow can accelerate hair development by increasing the volume of blood circulation in the area. Like the skin, the scalp also undergoes the aging process, resulting in a decline in the function of melanocytes or graying of hair, as well as a decrease in hair production or alopecia. Evidence has shown the existence of inflammation and oxidative stress in both dermal papilla cells and plasma of patients with androgenetic alopecia (AGA). Application of vitamin E oil topically has demonstrated efficacy in preventing premature aging, dilating capillaries, hence promoting improved blood circulation in the scalp, and moisturizing the hair. Nevertheless, there is a scarcity of evidence regarding the impact of vitamin E administration. A solitary study revealed that the administration of a tocotrienol blend on a daily basis for a duration of 4-8 weeks resulted in an augmentation of hair count among the participants. Conversely, a separate study revealed that the daily consumption of excessive amounts of vitamin E (270 mg or 600 IU) for a duration of 28 days had an adverse impact on the growth of hair in the participants.^[30,21]

Rose Water:**\Fig 3. Rose water**

Rose petals are excellent for the hair, particularly when combined with other healing elements like oil, rosemary oil, and honey. It strength and strengthens hair while providing the skin with intense nourishment and hydration. Rose water is a mild stringent which may help to reduce oiliness and dandruff has until inflammatory properties, which may make it beneficial for certain scalp conditions like psoriasis and eczema. Many women with curly hair swear by rose water's ability to calm down frizz and add shine. With its pleasant scent and antioxidant properties, rose water has become a popular ingredient in skincare as studies have shown that the extracts in rose water may have anti-inflammatory capabilities and can help the skin. And while many scalp concerns can be traced back to irritation and inflammation, rose water has also been used on the scalp and hair.

Rose water has been a part of beauty routines for centuries. Originally from Iran, the rosa damascene, or “dusk rose” as it is popularly known, has been cultivated for its essential oils since the 7th century A.D. Created by combining dusk rose essential oil with water, rose water is a solution that can be misted or poured. [48,47]

Coconut oil**Fig. 4 Coconut Oil**

Coconut oil (or coconut fat) is an edible oil derived from the kernels, meat, and milk of the coconut palm fruit. Coconut oil is a white solid fat below around 25 °C (77 °F), and a clear thin liquid oil in warmer climates. Unrefined varieties have a distinct coconut aroma. Coconut oil is used as a food oil, and in industrial applications for cosmetics and detergent production. The oil is rich in medium-chain fatty acids. Coconut oil can be extracted through a wet or dry process. More simply (but perhaps less effectively), oil can be produced by heating the meat via boiling water, the sun or a slow fire. The all-wet process uses coconut milk extracted from raw coconut rather than dried copra. The proteins in the coconut milk create an emulsion of oil and water. The more problematic step is breaking up the emulsion to recover the oil. This used to be done by prolonged boiling, but this produces a discoloured oil and is not economical. Modern techniques use centrifuges and pre-treatments including cold, heat, acids, salts, enzymes, electrolysis, shock waves, steam distillation, or some combination thereof. Despite numerous variations and technologies, wet processing is less viable than dry processing due to a 10–15% lower yield, even taking into account the losses due to spoilage and pests with dry processing. Wet processes also require investment in equipment and energy, incurring high capital and operating costs. Virgin coconut oil (VCO) can be produced from fresh coconut milk, meat, or residue. Producing it from the fresh meat involves either wet-milling or drying the residue, and using a screw press to extract the oil. VCO can also be extracted from fresh meat by grating and drying it to a moisture content of 10–12%, then using a manual press to extract the oil. Producing it from coconut milk involves grating the coconut and mixing it with water, then squeezing out the oil. The milk can also be fermented for 36–48 hours, the oil removed, and the cream heated to remove any remaining oil. A third option involves using a centrifuge to separate the oil from the other liquids. Coconut oil can also be extracted from the dry residue left over from the production of coconut milk. A thousand mature coconuts weighing approximately 1,440 kilograms (3,170 pounds) [clarification needed] yield around 170 kg (370 lb) of copra from which around 70 litres (15 imp gal) of coconut oil can be extracted. may have several benefits for your hair and scalp. Using it as a hair mask and leave-in treatment may help moisturize and seal hair. This can help prevent a dry, flaky scalp and dandruff, as well as split ends and hair breakage. Like other oils, coconut oil can leave the hair glistening and smooth in appearance. Some people use a few drops as a shine serum on dry hair. People who want to avoid silicones and similar

ingredients may choose to replace silicon enrich

shine serums with coconut oil. [42,43]

Formulation table

Ingredients	Batch 1	Batch 2	Batch 3	Role Of Ingredients
Aloe vera	2.5	3	3.5	Conditioner
Vitamin E	1	1	1	For Hairgrowth
Rose water	15	17	19	Perfume
Distilled water	10.5	8	5.5	Vehicle
Coconut oil	1	1	1	For Nourishment

Table no.1 3: Formulation table

7. Evaluation parameters for hair serum

1. Physical Appearance

The physical appearance, colour, and feel of the prepared herbal hair serum are visually tested. Table 2 reflects the outcomes.

2. Homogeneity Test

A clean and dry object glass was smeared with the hair serum, and a cover glass was sealed. The appearance under the light of some coarse particle/homogeneity was investigated. Herbal hair serum was tested by visual examination for homogeneity and tested for some lumps, flocculates, or aggregates

3. pH Test

The pH meter was calibrated using pH 4 and pH 7 buffer solutions. Then, the electrode was soaked in the hair serum and left until the pH normalized after a few minutes

4. Viscosity

The viscosity measurement was performed with spindle number 6 on a Brookfield viscometer (RVDV-II+PRO). In the beaker, 50 ml of hair serum was placed, and the viscosity was measured at various rpm, i.e., 10, 20, 50, 100

5. Spreadability

Spreadability was measured by a parallel plate process typically used to assess and measure the spreadability of semi- solid preparations. One gram hair serum was pressed between two horizontal plates of dimension 20x 20 cm. the upper of which weighed 125 g. The spread diameter was measured after 1 min Spreadability was calculated using the following formula:

$$S = \frac{MXL}{T}$$

Where, S= Spreadability. M= Weight in the pan (tied to the upper slide), L= Length moved by the glass slide, and T = Time (in sec) taken to

separate the slides completely [51,40,41]

8. RESULT & DISCUSSION:

1. Physical Appearance: -

Consistency: Herbal hair serums can vary in consistency, ranging from lightweight oils to thicker creams. The consistency often depends on the ingredients used and the desired effect. Some people prefer lightweight serums that absorb quickly into the hair without leaving a greasy residue, while others may prefer thicker formulas for more intense hydration.

Color and Clarity: Herbal hair serums can range in color from clear to various shades of yellow, green, or brown, depending on the ingredients. Clarity also varies, with some serums being transparent and others having a more opaque appearance due to the presence of herbal extracts or suspended particles.

Scent: The scent of herbal hair serums is often influenced by the natural ingredients used, such as herbs, flowers, or essential oils. Some serums have a subtle, earthy aroma, while others may have a more pronounced herbal fragrance. The scent can contribute to the overall sensory experience of using the serum.

Packaging: The packaging of herbal hair serums can vary widely, from simple bottles to more elaborate containers. Pump bottles, dropper bottles, and squeeze tubes are common options for dispensing the product. The packaging should be practical and convenient to use while also protecting the serum from light and air exposure, which can degrade the quality of the ingredients.

Presence of Visible Particles: Depending on the formulation, herbal hair serums may contain visible particles such as herbal extracts or microcapsules. These particles can provide additional benefits, such as nourishing the hair or providing a subtle shimmer, but they should be evenly distributed throughout the serum to ensure smooth application

Parameters	Results
Physical appearance	Yellowish-brown
Homogeneity	Good
p H	6.7 0.022
Spreadability	Good

Table no. 2 Physical Appearance**2 .Homogeneity: -**

Homogeneity in a herbal hair serum refers to achieving uniformity in the distribution of herbal extracts, oils, and other active ingredients throughout the product. When discussing homogeneity in herbal hair serums, several key points should be addressed:

Ingredient Selection: The choice of herbal extracts and oils plays a crucial role in determining the effectiveness of the serum. Selecting high-quality, compatible ingredients ensures better homogeneity and optimal performance.

Formulation Technique: Proper formulation techniques are essential to ensure uniform distribution of ingredients. Emulsifiers and stabilizers may be used to prevent ingredient separation and maintain homogeneity throughout the product's shelf life.

Manufacturing Process: The manufacturing process should be carefully controlled to maintain consistency and uniformity in the product. Proper mixing, blending, and emulsification techniques are employed to achieve homogeneity.

Quality Control: Rigorous quality control measures should be implemented to monitor the homogeneity of the product during manufacturing. Sampling and testing procedures are conducted to ensure that each batch meets predetermined standards.

Packaging: The choice of packaging also plays a role in maintaining homogeneity. Packaging materials should be compatible with the product formulation and protect it from factors that could affect its stability, such as light and air exposure.

User Experience: Achieving homogeneity not only ensures the effectiveness of the product but also enhances the user experience. A consistently blended serum is easier to apply and provides uniform results across the hair.

Regulatory Compliance: Compliance with regulatory standards is essential to ensure the safety and efficacy of the product. Manufacturers must adhere to guidelines and regulations set forth by regulatory bodies governing cosmetic products.

3. pH Determination: -

Importance of pH in Hair Care: The pH level of a hair serum is vital because it affects the hair cuticle's integrity and the scalp's health. The ideal pH for hair products typically ranges from 4.5 to 5.5, which is slightly acidic, resembling the natural pH of the scalp. This acidity helps to keep the hair cuticle closed, maintaining smoothness and preventing damage.

Testing Methods: There are several methods to determine the pH of a herbal hair serum. One common method is using pH test strips, which change color based on the acidity or alkalinity of the solution. Another method involves using a pH meter for more accurate results.

Procedure: To test the pH using pH test strips, you would typically dip a strip into the hair serum solution and compare the resulting color to a chart provided with the strips. For a pH meter, you would calibrate the meter according to the manufacturer's instructions and then immerse the electrode into the serum to obtain a direct pH reading.

Factors Affecting pH: It's essential to recognize that various factors can influence the pH of a herbal hair serum, including the formulation's ingredients. Herbal extracts, essential oils, and other additives may have inherent pH values that contribute to the final pH of the serum. It's crucial to account for these factors during formulation and testing.

Adjusting pH: Depending on the initial pH measurement, adjustments may be necessary to bring the serum into the desired pH range. Acids such as citric acid or lactic acid can lower pH, while bases like sodium hydroxide can raise it. Care must be taken during pH adjustment to avoid overcorrection, which could lead to irritation or other adverse effects.

Regulatory Considerations: In some regions, hair care products must meet regulatory standards for pH levels to ensure consumer safety. Therefore, accurate pH determination and documentation are essential for compliance with these regulations.

Consumer Perception: Apart from regulatory requirements, maintaining the optimal pH level

enhances consumer satisfaction. A serum with an appropriate pH feels comfortable on the scalp and

leaves the hair looking healthy and vibrant, which can lead to positive reviews and repeat purchases.

pH		Viscosity at 100 rpm (centipoise)	
initial \pm	final \pm	initial \pm	final \pm
6.7 0.022	6.6 0.012	1110 0.002	1124 0.117

Table no 3. pH Determination

9. SUMMARY & CONCLUSION:

The use of herbal hair serums has been shown to provide essential nutrients that support sebaceous gland function and natural hair growth. This has led to a significant shift in the personal hygiene and healthcare industry towards herbal cosmetics. The demand for herbal-based cosmetics is growing rapidly, indicating a promising future for this market. Bioactive ingredients in cosmetic formulations are recognized for their positive impact on body characteristics and their ability to offer vital nutrients for healthy and beautiful hair. The use of herbal hair serums is believed to promote hair growth and improve hair consistency with minimal side effects and hypersensitivity reactions. Traditional Indian medicine has a rich history of herbal remedies for hair growth promotion. Herbal extracts are known to provide microprotein supplements to nourish hair effectively, leading to healthier hair. Herbal cosmetics are gaining popularity in the personal care industry due to their absence of parabens and sulphates. The global herbal industry is thriving and is estimated to be worth over US\$10 billion, with a steady annual growth rate of three to four percent. Europe stands as the largest region in both herbal product production and demand, followed closely by Asia. The herbal hair serum was successfully formulated and evaluated on trial and error basis. The produced herbal hair serum offers a variety of critical nutrients that are crucial for keeping healthy hair and scalp conditions, according to the research study and outcomes shown. It contains natural components that assist hair maintenance and development. The anti-oxidant properties of herbal components including orange peel powder, hibiscus powder, and vitamin E primarily function by halting the premature greying of hair. Castor oil, fenugreek, and flaxseeds are effective stimulators of hair growth. Hibiscus powder can be also employed as a colour agent in this case. When compared to synthetic chemicals, the components are not dangerous. People now days are really interested in the herbal sector. Due to its strength, effectiveness, and growing use in cosmetics, the herbal business has a promising future.

Since all the added ingredients have many benefits and all the parameters indicated that they are within acceptable ranges, this hair serum will support the growth of natural hair while preserving healthy hair growth and supplying the sebaceous glands with the vital nutrients they require to continue functioning as intended. The usage of herbal cosmetics has undergone significant modification within the context of personal hygiene and the healthcare system. As a result, the sector for herbal cosmeceuticals, which truly focuses and pays special attention to the creation of herbal cosmetics, has a great deal of glitter. During the testing time, the formulations didn't cause any redness or itching. The compositions were shown to have strong antibacterial properties. Results have shown that herbal hair serum provides various essential nutrients needed to preserve the proper function of the sebaceous glands and support the growth of natural hair. In the personal hygiene and health care system, the use of herbal cosmetics has changed by several folds. Therefore, the herbal cosmeceutical individual care or personal health care industry, which is actually concentrating and paying extra care on the production of herbal-based cosmetics, has a considerable clamour. As nowadays, in the coming years, it is a fast-developing market with a mammoth scope. In cosmetic formulations, the use of bioactive ingredients has a valuable impact on body characteristics and offers nutrients that are important for preserving good and beautiful hair. It can be inferred that prepared herbal hair serum has a beneficial effect on the mechanism of hair growth and increased consistency. Medicinal plants have been used for the treatment of hair diseases since antiquity because of fewer side effects and hypersensitivity reactions. It is time to dump the chemical-laden hair care products in favour of natural alternatives. The traditional system of medicine in India acclaims a number of herbal drugs for hair growth promotion. The best part is that herbal extracts will provide microprotein supplements to hair and provide enough nourishment, resulting in safe and sound hair. Herbal cosmetics have become

increasingly common in the personal care industry, and there is a high demand for them in everyday life due to their lack of parabens and sulphates. The global herbal industry is projected to be worth more than US\$10 billion dollars, and it is increasing at a rate of three to four percent per year due to increased demand. In terms of production and demand of herbal products, Europe is the largest region, followed by Asia.

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