

Sun Protecting Factor Fortitude Determination of extract of *Matricaria chamomilla*

L. by dint of UV-Visible Spectrophotometry.

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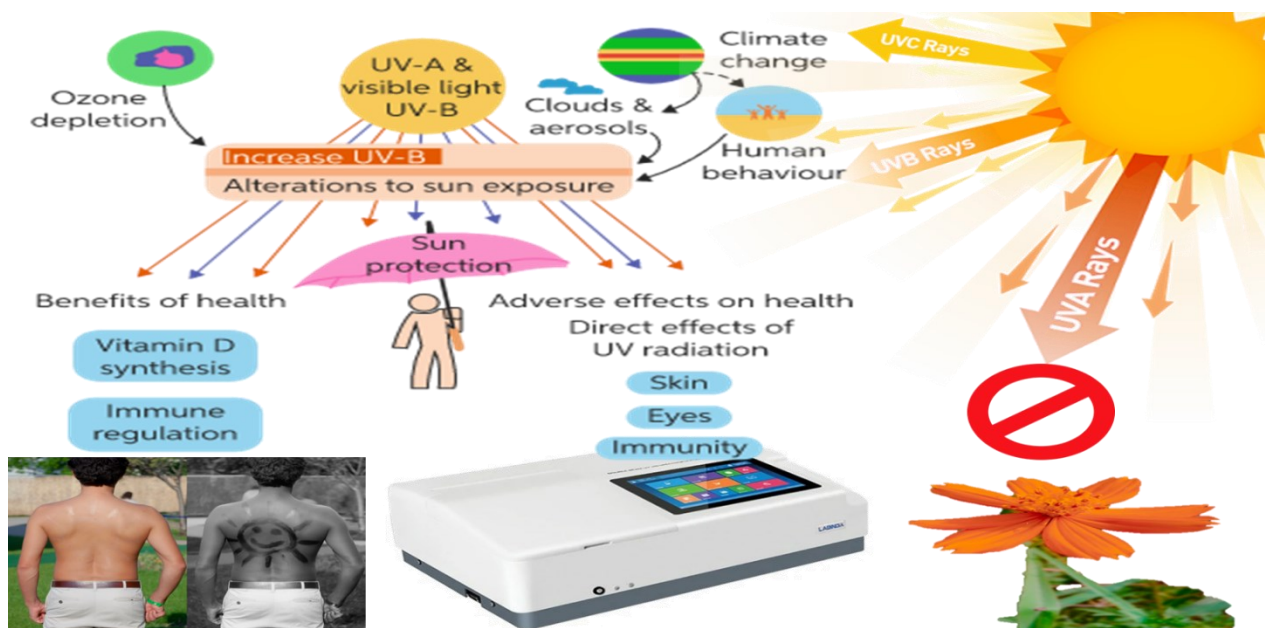
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ABSTRACT

Due to high levels of pollution and depletion in ozone layer sun rays are directly hitting the human skin. There should be trustworthy molecules which will give protection to skin without affecting the normal behavior. The major dictum of research project is to determine SPF (Sun protecting factor) of herbal drug *Matricaria chamomilla L.* from family *Asteraceae*, which is previously used in cosmetics. SPF is a laboratory measure of effectiveness of sunscreen factor. Higher the SPF value more protection against ultraviolet radiation which causes sun burn disease. SPF determination is the in vitro testing of sunscreen activity with the help of UV spectrophotometer (290-320). Here different concentrations of *Matricaria chamomilla* extract were taken under consideration of photo protective test to prove its efficiency in the sunscreen activity. Extract was found to be effective in protecting the sunburn effect through higher SPF. Further study is needed to develop the novel formulation and dose determination.



INTRODUCTION

Excessive ultraviolet radiation (UV) from sunlight is hazardous [1]. Approximately half of UV radiation is received between 10 a.m. and 4 p.m., when the sun's rays are the stoutest. Even on a cloudy day, your skin can be tanned by UV radiation. Ultra Violet Radiations (UVR) exposure to skin causes skin disorders such as squamous cell carcinoma, basal cell carcinoma [2], accelerated skin ageing, immune depression of skin and photodermatoses [3,4]. The UV radiations are categories in three categories as such UV-C (200-280nm), UV -B (280-320nm) UV-A (320-400nm). From above three categories of UV radiations, UV-C radiation can cause severe biological damage to skin as compared to UV-B and UV-A radiation. But UV-C radiations are filtered by the ozone layer, so UV-B and UV-A radiation is currently the reason for causing skin cancer [5,16,17,18]. So as to avoid this radiation to cause damages to the skin sunscreen agents are used which act as a protective agent against harmful UV radiations. Sunscreen agent formulations are available in large numbers in market today obtained either for synthetic or natural source. The examples for synthetic agents are Octabenzol, Ocetyl methoxycinnamate, Benzophenone-3, Provatene, 2-Ethoxy ethyl p- methoxycinnamate, Sulisobenzone, Mexenone, Avobenzone, Dioxibenzone, 4-dimethyl amino benzoic acid, etc. and the example to natural agents are Antioxidant (alpha carotene,

Ascorbic acid, Flavonone and Flavones) [19,20], Vitamins and Enzymes (Superoxidedismutase, Peroxidase and Proteolytic)[3]. Sunscreen agents are to be considered effective when they have good sun protecting factor (SPF). SPF is the ratio of UV spectrometric energy required to produce a minimal erythema dose (MED) in protected skin to unprotected skin. The in vitro model for determination of SPF is screen the absorbance of prepared solution of herbal extract between 290-320 nm at every 5 nm intervals. SPF can be calculated by applying the following formula known as Mansur equation [6],

$$SPF = CF \times \sum_{290}^{320} EE(\lambda) \times I(\lambda) \times Abs(\lambda)$$

Where,

CF = Correction factor (10)

EE (λ) = Erythmogenic effect of radiation with wavelength λ

Abs (λ) = Spectrophotometric absorbance values at wavelength λ.

The values of $EE(\lambda) \times I(\lambda)$ are constants and given in table 1.

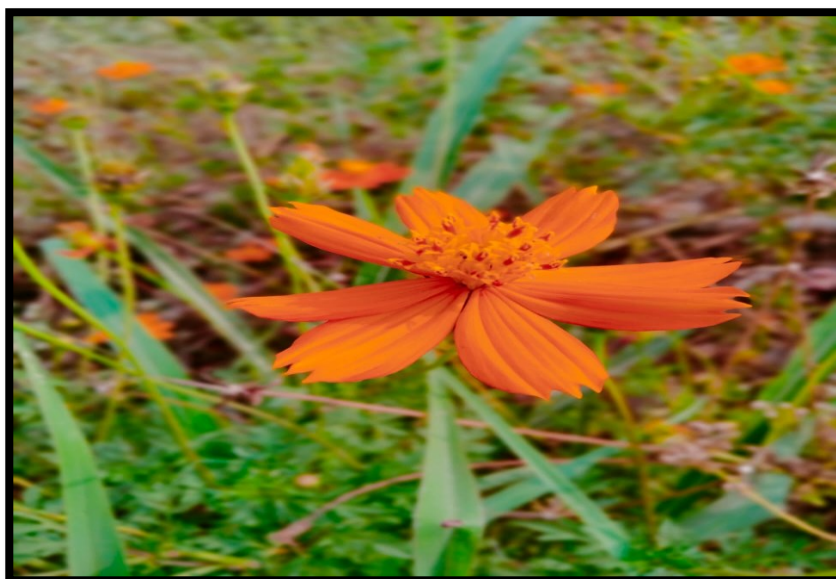


Fig 1: Flower of *Matricaria chamomilla*

Matricaria chamomilla (Asteraceae) is a native plant of southern and eastern Europe. It is also grown in Germany, Hungary, France, Russia, Yugoslavia, and Brazil. It was introduced to India during the Mughal period, now it is grown in Punjab, Uttar Pradesh, Maharashtra, and Jammu and Kashmir. It grows to a height of 10-80 cm. The long and narrow leaves are bi- to tripinnate. The flower heads are placed separately, they have a diameter of 10-30 mm, and they are pedunculate and heterogamous. The golden yellow tubular florets with 5 teeth are 1.5-2.5 mm long, ending always in a glandulous tube. The 11-27 white plant flowers are 6-11 mm long, 3.5 mm wide, and arranged concentrically. The receptacle is 6-8 mm wide, flat in the beginning and conical, cone-shaped later, hollow—the latter being a very important distinctive characteristic of *Matricaria*—and without paleae. The fruit is a yellowish brown achene. The flowers of *M. chamomilla* contain the blue essential oil from 0.2 to 1.9% [1], which finds a variety of uses. Chamomile is used mainly as an anti-inflammatory and antiseptic, also

antispasmodic and mildly sudorific [1]. It is used internally mainly as a tisane (infuse 1 table-spoonful of the drug in 1 L of cold water and do not heat) for disturbance of the stomach associated with pain, for sluggish digestion, for diarrhea and nausea; more rarely and very effectively for inflammation of the urinary tract and for painful menstruation. Externally, the drug in powder form may be applied to wounds slow to heal, for skin eruptions, and infections, such as shingles and boils, also for hemorrhoids and for inflammation of the mouth, throat, and the eyes. In addition to pharmaceutical uses, the oil is extensively used in perfumery, cosmetics, and aromatherapy, and in food industry. Here the determination of SPF (Sun Protecting Factor) of *Matricaria chamomilla* will prove its Excellency in sunscreen ability.

Matricaria chamomilla, commonly known as chamomile, is a medicinal herb that has been used for centuries for its various health benefits. Here are some of its medicinal properties:

[21,22,23,24]

Anti-inflammatory
Digestive Aid
Antioxidant
Wound Healing
Menstrual Cramp Relief
Oral Health
Hair Care
Eye Health
Allergy Relief
Muscle Spasms
Skin Care
Boosting Immunity
Diabetes Management
Cancer Prevention
Anti-anxiety and Relaxation



1. **Anti-inflammatory:** Chamomile contains compounds like flavonoids and terpenoids that have anti-inflammatory properties. It's often used to reduce inflammation, soothe skin irritations, and ease conditions like eczema or rashes.
2. **Anti-anxiety and Relaxation:** Chamomile is renowned for its calming effects. It contains apigenin, an antioxidant that binds to certain receptors in the brain, reducing anxiety and promoting relaxation. Chamomile tea is frequently used as a natural remedy for stress and insomnia.
3. **Digestive Aid:** Chamomile tea is known to have digestive benefits. It can help relieve indigestion, bloating, gas, and mild stomach upset. Its anti-inflammatory properties may also benefit those with irritable bowel syndrome (IBS).
4. **Antioxidant:** Chamomile contains various antioxidants that help protect cells from damage caused by free radicals, contributing to overall health and potentially reducing the risk of chronic diseases.
5. **Wound Healing:** Chamomile has mild antiseptic properties and can be used topically to help in wound healing. It's sometimes used in creams or ointments to soothe minor burns, cuts, and skin irritations.
6. **Menstrual Cramp Relief:** Some women use chamomile to help alleviate menstrual cramps due to its antispasmodic properties, which may relax the uterus and ease discomfort.
7. **Oral Health:** Due to its anti-inflammatory and antimicrobial properties, chamomile is occasionally used in mouthwashes or gargles to help with oral hygiene and to soothe mouth ulcers or gum inflammation.
8. **Hair Care:** Chamomile is sometimes used in hair care products for its purported ability to lighten hair color naturally. It's also believed to soothe the scalp, reducing dandruff and promoting healthier hair.
9. **Eye Health:** Chamomile tea bags, when cooled, can be used as a compress to soothe tired or irritated eyes. The anti-inflammatory properties may help reduce puffiness and redness.
10. **Allergy Relief:** Some people use chamomile to alleviate symptoms of allergies, such as hay fever. Its

antihistamine properties might help in reducing allergic reactions.

11. **Muscle Spasms:** Chamomile's antispasmodic properties might help in relieving muscle spasms and cramps. Some individuals find chamomile-infused baths or massages helpful for relaxing muscles.
12. **Skin Care:** Chamomile is used in various skincare products due to its soothing and anti-inflammatory properties. It's often found in creams, lotions, and facial masks targeting sensitive or irritated skin.
13. **Boosting Immunity:** Some studies suggest that chamomile may have immune-boosting effects due to its antioxidant content, potentially helping the body fight off infections.
14. **Diabetes Management:** There's some research indicating that chamomile tea might help lower blood sugar levels in individuals with diabetes. However, more extensive studies are needed in this area.
15. **Cancer Prevention:** Some early studies have shown that chamomile extracts could potentially slow the growth of cancer cells. However, more research is required to understand its role in cancer prevention or treatment fully.

It's essential to note that while chamomile is generally considered safe for most people, some individuals might experience allergic reactions, especially if they have allergies to plants in the daisy family, like ragweed.

MATERIALS AND METHODS

Collection of Plant Material

The herbs used for determination of SPF were collected in the month of April 2021 from the sudumbare area near Siddhant college of pharmacy, Pune and the flower powder extract are used for determination of SPF.

Preparation of Standard Solutions: The dry powder of petals of *Matricaria chamomilla* L. is extracted with ethanol for 18 hrs. After completion of extraction the filtered extract is concentrated to reduce the volume 1/10th^[12, 29] and remaining solvent is evaporated to get a reddish brown extract is used for determination of SPF. 10 mg of extract was dissolved in 100 ml ethanol solvent to produce 100ppm (parts per million) solution. From prepared 100ppm solution 0.2ml, 0.4ml & 0.6ml solution is pipette out and diluted up to 10ml to produce 2ppm, 4ppm & 6ppm. And this solution is subjected to further process for determination of SPF.



Determination of SPF Value

The absorbance of working standards were taken in the fixed wavelength mode and wavelengths are 390nm, 295nm, 300nm, 305nm, 310nm, 315nm and 320nm with the help of UV spectrophotometer (Lab India UV 3000) and obtained absorbance were multiplied with EE values and their summation was multiplied with correlation factor 10. [25, 26, 27]

RESULTS AND DISCUSSION

The extracts' ability to absorb or transmit UV light was determined by measuring the absorbance in the UV area and spectroscopy of all the preparations at varying doses. Every

solution's 30 µg/ml spectra and wavelength were examined, and the greatest absorbance spectra were recorded along with their corresponding wavelengths. Significant absorption was seen in every extract across the UV spectrum (UV-A, UV-B, and UV-C). Due to their ability to absorb UV rays, natural compounds found in plants have lately been researched for their potential as sunscreen candidates. Studies on the aforementioned extracts have demonstrated the antioxidant properties of flavonoids and other phenolic substances. The platform created by this data allows extracts to be used in combination as possible components in sunscreen compositions.

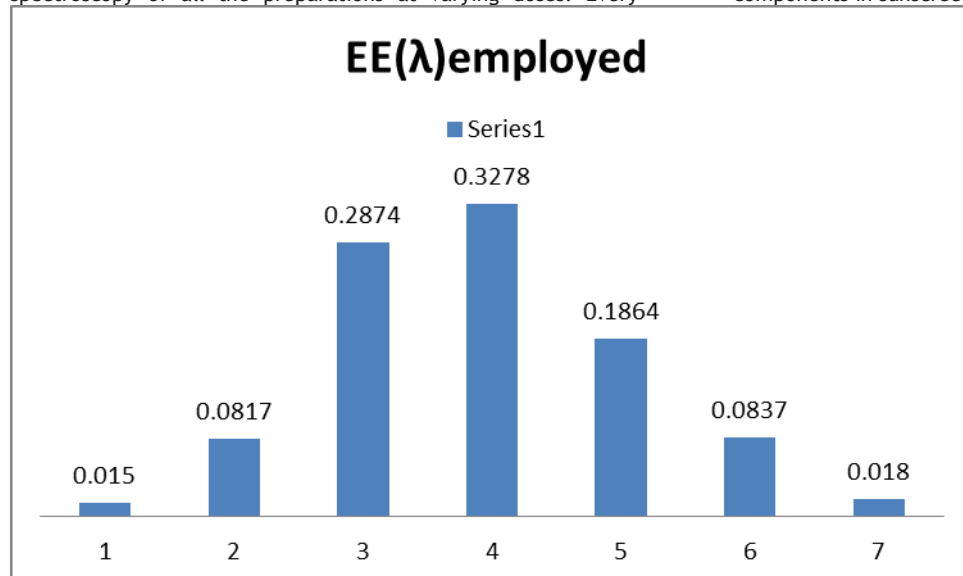


Fig 2: Spectrophotometric analysis of extract of *Matricaria chamomilla*.L.

Sr.no	Wavelengths (nm)	Value of $EE(\lambda) \times I(\lambda)$
1.	290	0.0150
2.	295	0.0817
3.	300	0.2874
4.	305	0.3278
5.	310	0.1864
6.	315	0.0837
7.	320	0.0180

Table 1: Erythrogenic effect of radiation

Wavelength (nm)	EE(λ)employed	Concentration 1. (2ppm)	Concentration 2. (4ppm)	Concentration 3. (6ppm)
290	0.0150	0.4518	2.1211	2.7031
295	0.0817	0.4513	2.1434	2.7855
300	0.2874	0.4360	2.1208	2.8109
305	0.3278	0.4192	2.0619	2.8060
310	0.1864	0.3744	1.9139	2.6821
315	0.0837	0.3452	1.8320	2.6291
320	0.0180	0.3575	1.8629	2.6453

Table2: The SPF values of different concentrations are 2ppm, 4ppm, & 6 ppm determined by UV-visible Spectrophotometry.

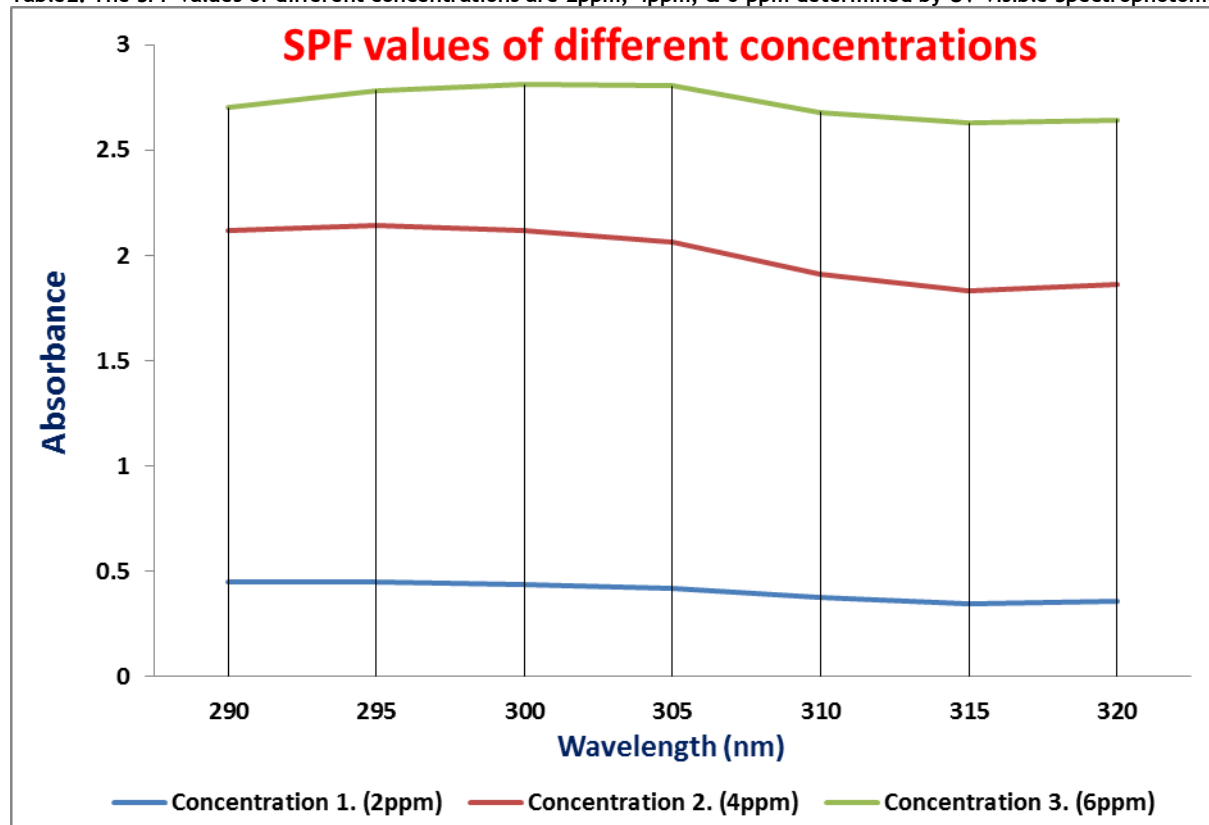


Fig 3 : The SPF values of different concentrations are 2ppm, 4ppm, & 6 ppm determined by UV-visible Spectrophotometry.

Concentrations	SPF value
2ppm	5.295
4ppm	19.379

6ppm	40.156
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Table 3: Higher the concentration of extract having higher the SPF value.

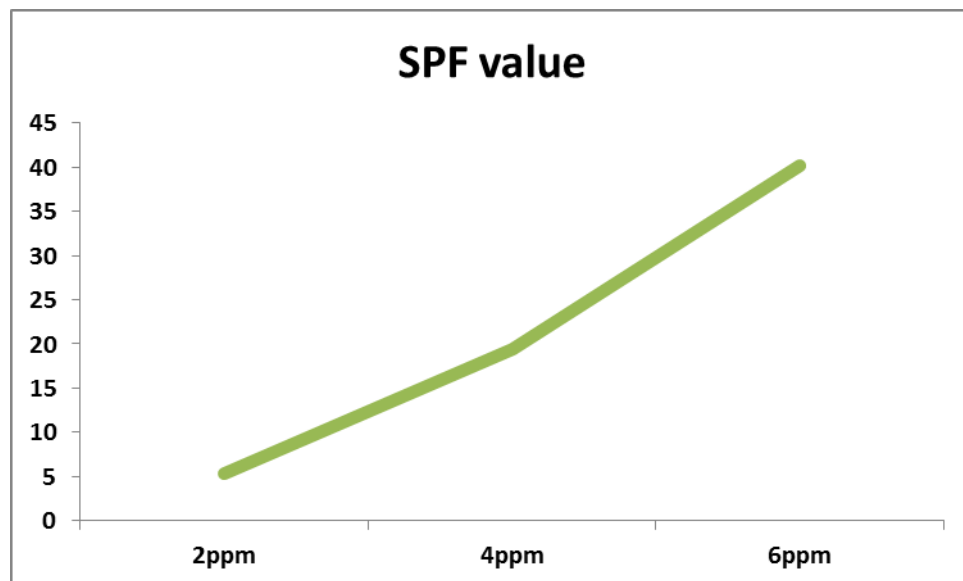


Fig 4: Higher the concentration of extract having higher the SPF value.

The SPF is a quantitative measurement of the effectiveness of a sunscreen formulation. To be effective in preventing sunburn and other skin damage, a sunscreen product should have a wide range of absorbance, viz., between 290 and 400 nm. The *in vitro* SPF is useful for screening test during product development, as a supplement of the *in vivo* SPF measure. In this research, volatile herbal oils were evaluated by UV spectrophotometry. The SPF of different concentration of *Matricaria chamomilla* L. was determined by using UV spectrometric analysis is shown in table 2. (Lab India UV 3000) and the spectrometric analysis is recorded in Image 2. Similarly SPF values for volatile oils were found to be in between 1 and 2. Hence it can be concluded that *M. Chamomilla* oil have the best SPF values, a finding that will be helpful in the selection of perfumes during the formulation of sunscreens. Thus to develop sunscreens with better safety and high SPF, the formulator must understand the physicochemical principle, not only the UV absorbance of the actives but also vehicle components, such as esters, emollients, emulsifiers and fragrances used in the formulation, since sunscreens can interact with other components of the vehicle, and these interactions can affect the efficacy of sunscreens.

CONCLUSION

This primary study revealed the UV absorbing capacity and sun protection property of the plant extracts. Along with their many therapeutic benefits, these botanicals could become beneficial, cost effective, and easily available ingredients to prove sun protection property. These plants were studied for various bioactive components such as alkaloids, tannins, phenols, and flavonoids which have known as a free-radical scavenger and strong antioxidants and useful to protect the skin from sun radiation induced damage. The research provides highlight on the use of herbal ingredient in the preparation of sunscreen formulation by proving its potency against sun burns and the proposed UV spectrophotometric method is simple, rapid, employs low-cost reagents and can be used in the *in vitro* determination of SPF values in many cosmetic formulations. In current study *Matricaria chamomilla* petals extract was previously used for herbal cosmetics and here we are proving its effectiveness in sunscreen which proves its excellency in the use of safe herbal preparations and we can say that use of this type of natural ingredient in the formulations is step towards healthy and safe cosmetics.

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