

**FORMULATION OF SUNSCREEN LOTION BY TAKING MARIGOLD AS AN ACTIVE INGREDIENTS AND PERFORMING ITS EVALUATION**Mukesh Patel¹, Sharanbasavaraj², Mahalakshmi K. S.*³ and Dr. Kavitha P. N.⁴^{1,2,3}K. R. College of Pharmacy, Bengaluru, Karnataka.

*Asso. Prof. Mahalakshmi K.S, K.R. college of Pharmacy, Bengaluru.

*Corresponding Author: Mahalakshmi K. S.

Asso. Prof. Mahalakshmi K.S, K.R. college of Pharmacy, Bengaluru.

Article Received on 14/08/2023

Article Revised on 04/09/2023

Article Accepted on 24/09/2023

ABSTRACT

The main goal of our current study was the formulation and development of an herbal sunscreen lotion that contains more skin-friendly ingredients like marigold, aloe vera, olive oil, turmeric, vitamin E etc. The use of sunscreen lotion has gradually increased over the years as people have become more aware of the harmful effects of UV radiation. Sunscreen lotion is made, and various plant components are extracted. Testing is done using evaluation criteria like pH, spreadability, and feel. The prepared sunscreen lotion has a high SPF rating, good homogeneity, consistency, and appearance, and no signs of phase separation. The use of it on the skin is likewise harmless.

KEYWORDS: MARIGOLD, UV RADIATION, OLIVE OIL, SUNSCREEN LOTION, pH TEST.**INTRODUCTION**

Due to its multiple skin health advantages, sunscreen has recently become one of the most well-liked personal care products. In addition to being sold separately, sunscreens can also be found in other personal care items including those for the skin, hair, lips, and eyes. Although it gives us life and energy, the sun may also damage our skin. Sunlight's ultraviolet (UV) rays can result in sunburn, skin cancer, and early aging of the skin. Sunscreens shield the skin from these negative consequences by preventing UV rays from reaching it. Effective, secure, and reasonably priced sunscreen is the best combination. To offer the most UV protection, it should also have a high sun protection factor (SPF). Additionally, antioxidants should be incorporated in the formulation of sunscreens to help shield the skin against free radicals' long-term harm. However, a lot of the commercial sunscreens available are either harmful or useless. Some synthetic sunscreen components have been connected to eczema-like allergic responses, hormone disruption, DNA damage, and cell mutation. In addition, a lot of sunscreens cost a lot of money and have synthetic, environmentally damaging components. As a result, there is a need to create and assess sunscreen solutions that are economical, safe, and made with natural chemicals. These sunscreens ought ideally be able to shield the skin from free radical damage, sunburn, skin cancer, and premature aging.

MATERIALS AND METHODS

- **Neem**, a natural sunscreen, can help protect skin from the sun's harmful rays. Neem leaves contain a compound called azadirachtin, which has been shown to have sunscreen-like properties. Azadirachtin absorbs UV radiation, preventing them from reaching the skin. Emollient, reconstitutor, and thickening
- Additionally, vitamin E, a natural source of which has antioxidant property.^[1]
- **Lavender oil** has a mild range of photoprotective properties and is used as a scent.
- **Triethanolamine** is a stabilizer and surface-active agent.
- To function, **titanium dioxide** must be applied to the skin's surface where it will reflect, scatter, and absorb ultraviolet (UV) rays. Sunscreens with titanium can aid in preventing skin cancer because UV radiation is the primary cause of the disease.^[2]
- A fat-soluble antioxidant **called vitamin E** can aid in shielding the skin from the damaging effects of ultraviolet (UV) light. It accomplishes this by absorbing UV radiation and stopping them from causing cell damage to the skin. Additionally, vitamin E can aid in the healing of UV-induced damage that has already occurred.^[3]
- **Aloe vera** is widely acknowledged to possess anti-inflammatory, antimicrobial, and wound-healing effects. Additionally, a great moisturizer may ease burnt skin. Several methods of including aloe vera in

sunscreen exist. It can be added to other sunscreen compounds to enhance their performance or utilized as the primary active ingredient. Aloe vera can aid in the defense of the skin against the damaging ultraviolet (UV) rays of the sun by absorbing some of the radiation and assisting in the healing of wounds.^[4]

- **Olive oil** can also help to improve the performance of herbal sunscreen lotions. Olive oil can help to absorb and scatter UV rays, and it can also help to prevent the sunscreen from breaking down too quickly.^[5]
- **Sunflower oil** is a beneficial ingredient to include in sunscreen lotions. It can help to improve the SPF, water resistance, spreadability, and moisturizing properties of the sunscreen. It is important to note that sunflower oil does not have a very high SPF on its own. It is recommended to use a sunscreen with an SPF of 30 or higher, even if it contains sunflower oil.^[6]
- **Stearic acid** is also considered to be a safe ingredient for the skin. It is non-irritating and non-comedogenic, which means that it is unlikely to clog pores. Overall, stearic acid is a beneficial ingredient in sunscreen lotions. It helps to moisturize the skin, emulsify the sunscreen, thicken the lotion, and provide a barrier against the sun's harmful UV rays.^[7]
- **Green tea** can also help to improve the performance of sunscreen lotions. Green tea can help to increase the SPF of sunscreen lotions, make them more water resistant, and improve their spreadability.^[8]
- **Cetearyl alcohol** is a different type of alcohol than the drying alcohols that are sometimes used in skincare products. Cetearyl alcohol is a fatty alcohol, which is safe and effective to use on the skin. Drying alcohols, on the other hand, can irritate and dry out the skin

Methodology

Extraction of marigold extract oil for API.

Marigold oil

- Marigold petals were taken out from the flower and dried in the sunlight.

Formulation Table

INGREDIENTS	F1	F2	F3	F4
ALOE VERA	6 gm	5 gm	6 gm	4gm
CETOSTEARYL ALCOHOL	2 gm	1.5 gm	1 gm	2.5 gm
VITAMIN E	750 mg	800 mg	750 mg	750 mg
STEARIC ACID	3 gm	1.5 gm	3 gm	2.5 gm
TITANIUM DIOXIDE	3gm	4 gm	4 gm	5 gm
GREEN TEA	1 ml	2 ml	1 ml	1 ml
LAVENDER OIL	1 ml	1.5 ml	0.5 ml	1 ml
MARIGOLD EXTRACT	3 gm	3 gm	2 gm	5 gm
OLIVE OIL	2 ml	1 ml	2ml	1 ml
NEEM EXTRACT	1 ml	2 ml	1 ml	2 ml

- The dried petals were put in the olive oil and boiled for 10 min at 55°C.
- The boiled oil is cooled down and poured into the jar.
- The jar was kept aside for 10das and was shaken daily.
- After 10-12 days, the petals were strained out from the jar.

Marigold oil is obtained

The Methods

An herbal sunscreen is created using the following procedures:

Preparation of the oily phase

The oil phase should be prepared as follows

- Ceto stearyl alcohol and stearic acid and sunflower oil should be combined in a China dish.
- Next, we should add marigold oil, olive oil, and vitamin E respectively.
- Heat and mix until a homogeneous mixture is obtained.

Preparation of the aqueous phase

- Aloe vera gel, green tea extract, neem extract should all be mixed in a specified quantity in a beaker with distilled water on water bath.
- The extraction is heated on the burner until it reaches to the temperature of 45 degrees.
- Add titanium dioxide and triethanolamine.
- The mixture should be thoroughly mixed after 5-10 min minutes of stirring.

Combining the aqueous and oily phases

- Slowly pour the viscous liquid from the beaker into the oily phase of the China dish while continuously spinning.
- Don't forget to include the essential ingredients for this marigold extract. Additionally, lavender oil ought to be used.
- Continue to stir the mixture until it is thoroughly combined.
- After pouring, level it in the container.
- The herbal sunscreen lotion is now ready for application.

TRIETHANOLAMINE	2 ml	3 ml	2 ml	1 ml
SUNFLOWER OIL	2 ml	1 ml	2 ml	1 ml
DISTILLED WATER	Q.S.	Q.S.	Q.S.	Q.S.

Evaluation Tests

Determination Sun Protection Factor (SPF)

Calculating the sun protection factor (SPF) may be used to determine how effective a sunscreen product is. It is sometimes referred to as the difference between the UV energy required to create a minimum erythema dose (MED) on sunscreen-applied human skin and the UV energy required to produce a MED on unprotected skin.

$$SPF = \frac{\text{minimal erythema dose for protected skin (product applied skin)}}{\text{minimal erythema dose for unprotected skin (product not applied)}}$$

It shielded skin. The minimal erythema dose (MED) is the amount of UV radiation that must be administered in order to cause the least amount of erythema on the exposed layer of skin.^[9]

Spreadability test^[10]

A key element of a sunscreen is the spreadability indicator of the cream. It looked at how quickly it spreads and how much residue there is after touching it. There is an extra technique for the spreadability test that requires us to take a sample of a slide, apply sunscreen to the area, place another slide on top of it, and then wait for the slides to slide off. The time required to separate the slides is how it is defined. A formula exists that is.

$$\text{Spreadability} = \frac{W \times L}{T}$$

Where, W = weight attached to the upper slide. (250 g)

L stands for the slide's length (20 cm)

T = time taken in seconds.

❖ Thermal Stability^[11]

The assessment procedure for sunscreen places a significant emphasis on thermal stability. It is necessary to assess the sunscreen's expression's stability at increased temperature. It aids in defining the sunscreen's therapeutic effectiveness and shelf life. In this test, we'll raise the temperature to a specified level and see what temperature the product declines at.

❖ In Vitro Occlusion Test^[12]

Skin occlusion is indicated by the full content of the skin's face.

$$\text{Occlusion factor } F = \frac{A-B}{A} \times 100$$

You may determine the exclusivity of lotion by multiplying A by the water loss without sample and B by the water loss with sample. After that, a beaker covered with filter paper is used. The water content of the paper is checked after 24 hours. Calculate the water content and weigh the filter paper together.

The occlusion factor varies from zero, meaning there is no occlusion effect, to one hundred, meaning the whole amount of topical expression on the face.

❖ Irritancy Test^[13]

An essential element in the assessment exam is the irritability test. Topical ingredients, which are applied to the skin, can cause oedema and erythema as well as occasionally be antagonistic and hypertensive. Since we're employing herbal substances, a standard 24-hour irritancy test should be run and reported.

Erythema 0 – No Erythema 1 – Small Erythema 2 – Visible Erythema 3 – Medium Erythema 4 – Severe Erythema.

Edema No Edema 1 – Small Edema 2 – Visible Edema 3 – Medium Edema 4 – Severe Edema.

Removal Test

Sunscreen is applied to skin on the face, hands, and legs in addition to other parts, therefore it should be simple to remove after use. The convenience of wearing sunscreen is increased by easy removal after use, hence a removal test should be conducted and reported.

Feel Test

During this test, the lotion's cooling or scorching sensations are evaluated after being applied to the skin. We would assess and report on emollience and grease content.

Tyes of Film Forming

It's important to assess the type of smear that forms following sunscreen application. Describe the type of movie that has been made.

Homogeneity: By touching and looking at the sunscreen, we can quickly determine its homogeneity. pearlescence, consistency, and roughness.

pH Test

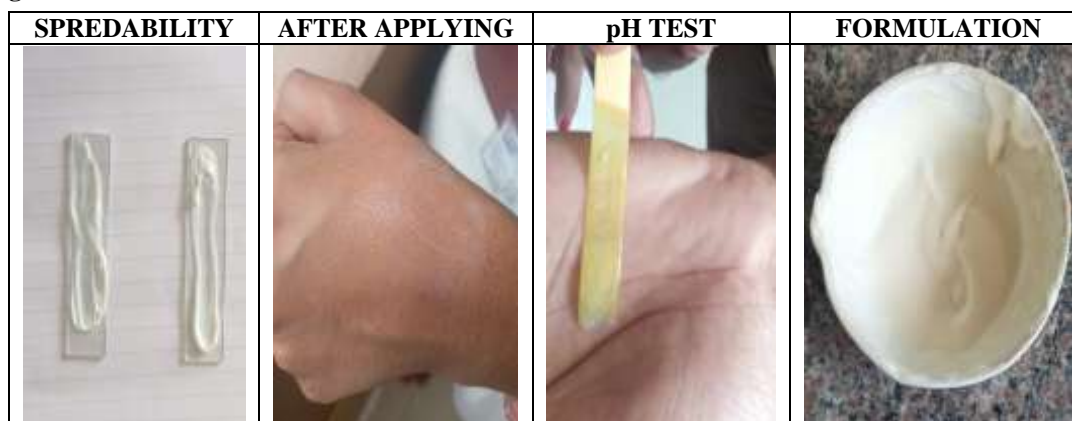
For improved product stability and expression of sunscreen, the proper pH should be checked. Dissolve 0.5 g of lotion in 50 ml of distilled water to measure pH in a buffer, we can calculate the pH of the sunscreen by looking at the color of the pH paper. This process is repeatedly done, and the findings will be verified more than twice. It should be noted if there are any discrepancies. After this for better accuracy this formulation was kept under observation in digital pH meter.

Observation**1. Organoleptic Test**

FORMULA	COLOUR	ODOUR	HOMOGENEITY
F1	Cream like Greenish	Characteristic	Homogeneous in nature
F2	Cream like Greenish	Characteristic	Homogeneous in nature
F3	Cream like Greenish	Characteristic	Homogeneous in nature
F4	Cream like Greenish	Characteristic	Homogeneous in nature

Evaluation Test

FORMULA	F1	F2	F3	F4
SPF VALUE	26	24	22	28
SPREADABILITY(gm.cm/Sec)	20.6	23.4	22.3	21.6
REMOVAL TEST	Easily removal	Easily removal	Easily removal	easily removal
FEEL TEST	Cool sensation	Cool sensation	Cool sensation	Cool sensation
IRRITANCY TEST	No Erythema	No Erythema	No Erythema	No Erythema
PH	7.0	6.8	6.9	7.2
VISCOSITY (cps)at 10 rpm	180	179	188	200
OCCLUSION TEST	62	78	73	66
THERMAL STABILITY	Stable in accelerated temperature	Stable in accelerated temperature	Stable in accelerated temperature	Stable in accelerated temperature

Test Images**RESULTS**

The sun protection factor (SPF) of the sunscreen formulation was assessed. By measuring the quantity of UV light that the formulation was able to block, the SPF was calculated. The sunscreen's SPF was a high 28 which is good. It also has good spreadability and it is easily removal, and it gives a cool sensation effect after applying on the skin and it not irritant and pH is 7.2 and occlusion factor is 66 and is stable in accelerated temperature.

DISCUSSION

The results of this study demonstrate that an herbal topical sunscreen formulation shields skin from UV rays. The formulation is photostable and has an excellent SPF. The formulation is safe and good for the skin because it is manufactured with natural components. There are a total of four formulas, and F4 has shown the best outcomes when compared to the others.

Because the pH of the generated lotion is more like the pH of our skin, lotion generates homogeneous, emollient,

non-greasy, and easily removed qualities after application.

Marigold sunscreen lotion is a type of sunscreen that uses the marigold flower as its main ingredient. Marigold has been used for centuries for its medicinal properties, and it is now being used in a variety of beauty products, including sunscreen. Marigold sunscreen lotion is said to be effective at protecting the skin from the sun's harmful UV rays. It is also said to be gentle on the skin and to have anti-inflammatory and antioxidant properties.

However, it is important to note that marigold sunscreen lotion may not be as effective as traditional sunscreens that contain chemical sunscreen ingredients. It is also important to choose a marigold sunscreen lotion that has an SPF of 28. Overall, marigold sunscreen lotion is a safe and effective way to protect your skin from the sun. It is a good choice for people with sensitive skin and those who prefer to use natural products.

CONCLUSION

Sunlight's UV rays can damage the skin and cause sunburn, skin cancer, premature aging, and other problems. The three basic subtypes of UV radiation are UVA, UVB, and UVC. The deepest layers of the skin are penetrated by UVA, which has the longest wavelength and can age and tan the skin. Skin cancer and sunburn are brought on by UVB because it has a shorter wavelength and can damage DNA. UVC cannot penetrate the surface of the Earth because of the ozone layer.

Herbal Sunscreen Lotion Containing Marigold and Sunflower Oil Is a Safe and Effective Way to Protect Your Skin from The Harmful UV Rays of The Sun. Marigold Has Anti-Inflammatory and Antioxidant Properties That Can Help to Soothe And Protect The Skin, While Sunflower Oil Is A Rich Source Of Vitamin E, Which Also Has Antioxidant And Anti-Aging Properties.

In Addition to These Ingredients, Herbal Sunscreen Lotion May Also Contain Other Natural Ingredients Such as Aloe Vera, Which Can Help to Nourish and Moisturize the Skin. Herbal Sunscreen Lotion Is Generally Free of Harsh Chemicals and Fragrances, Making It a Good Choice for People with Sensitive Skin.

Overall, Herbal Sunscreen Lotion Containing Marigold and Sunflower Oil Is a Safe and Effective Way to Protect Your Skin from The Sun and Its Harmful UV Rays. It Is a Good Choice for People with Sensitive Skin and Those Who Prefer to Use Natural Products.

ACKNOWLEDGEMENT

It is a joy for me to take this opportunity to thank dear Prof. Dr. Kavita P.N., Director and Principal, K R College of Pharmacy, Bengaluru, for her kind encouragement and support, as well as all the required assistance and facilities, which she has generously offered.

I would like to express our sincere appreciation to our outstanding research advisor Associate Prof. Mahalakshmi K. S. for her important advice and ongoing encouragement during our research project.

REFERENCES

- Paula AR, Ribeiro A, Lemos FJA, Silva CP, Samuels RI. Neem oil increases the persistence of the entomopathogenic fungus *Metarhizium anisopliae* for the control of *Aedes aegypti* (Diptera: Culicidae) larvae. *Parasit Vectors*, 2019 Apr 11; 12(1): 163. doi: 10.1186/s13071-019-3415-x. PMID: 30975207; PMCID: PMC6460681.
- Ghamarpoor R, Fallah A, Jamshidi M. Investigating the use of titanium dioxide (TiO₂) nanoparticles on the amount of protection against UV irradiation. *Sci Rep*, 2023 Jun 16; 13(1): 9793. doi: 10.1038/s41598-023-37057-5. PMID: 37328531; PMCID: PMC10275892.
- Keen MA, Hassan I. Vitamin E in dermatology. *Indian Dermatol Online J.*, 2016 Jul-Aug; 7(4): 311-5. doi: 10.4103/2229-5178.185494. PMID: 27559512; PMCID: PMC4976416.
- Surjushe A, Vasani R, Saple DG. Aloe vera: a short review. *Indian J Dermatol*, 2008; 53(4): 163-6. doi: 10.4103/0019-5154.44785. PMID: 19882025; PMCID: PMC2763764.
- González-Acedo A, Ramos-Torrecillas J, Illescas-Montes R, Costela-Ruiz VJ, Ruiz C, Melguizo-Rodríguez L, García-Martínez O. The Benefits of Olive Oil for Skin Health: Study on the Effect of Hydroxytyrosol, Tyrosol, and Oleocanthal on Human Fibroblasts. *Nutrients*, 2023 Apr 25; 15(9): 2077. doi: 10.3390/nu15092077. PMID: 37432217; PMCID: PMC10181161.
- Arianto A, Cindy C. Preparation and Evaluation of Sunflower Oil Nanoemulsion as a Sunscreen. *Open Access Maced J Med Sci.*, 2019 Nov 14; 7(22): 3757-3761. doi: 10.3889/oamjms.2019.497. PMID: 32127969; PMCID: PMC7048364.
- Mukherjee S, Edmunds M, Lei X, Ottaviani MF, Ananthapadmanabhan KP, Turro NJ. Stearic acid delivery to corneum from a mild and moisturizing cleanser. *J Cosmet Dermatol*, 2010 Sep; 9(3): 202-10. doi: 10.1111/j.1473-2165.2010.00510.x. PMID: 20883293.
- Prasanth MI, Sivamaruthi BS, Chaiyasut C, Tencomnao T. A Review of the Role of Green Tea (*Camellia sinensis*) in Antiphotoreactive, Stress Resistance, Neuroprotection, and Autophagy. *Nutrients*, 2019 Feb 23; 11(2): 474. doi: 10.3390/nu11020474. PMID: 30813433; PMCID: PMC6412948.
- Wood, C. Murphy, E. Sunscreen efficacy. *Global Cosmetics India*. Duluth, 167: 38-44.
- Sabale V, Kunjwani H, Sabale P. Formulation and in vitro evaluation of the topical antiageing preparation of the fruit of *Benincasa hispida*. *J Ayurveda Integr Med*, 2011 Jul; 2(3): 124-8. doi: 10.4103/0975-9476.85550. PMID: 22022154; PMCID: PMC3193683.
- Mukund manikrao doglikar, sharada laxman deore : development and evaluation of herbal sunscreen. *Pharmacogn j.*, 2017; 9(1): 83-97. doi: 10.5530/PJ.2017.1.15.
- Hamishehkar H, Same S, Adibkia K, Zarza K, Shokri J, Taghaee M, Kouhsoltani M. A comparative histological study on the skin occlusion performance of a cream made of solid lipid nanoparticles and Vaseline. *Res Pharm Sci.*, 2015 Sep-Oct; 10(5): 378-87. PMID: 26752986; PMCID: PMC4691958.
- Aprilita Rina Yanti Eff1, *, Sri Teguh Rahayu1, Henny Saraswati1, Abdul Mun'im2. Formulation and Evaluation of Sunscreen Gels Containing Mangiferin Isolated from *Phaleria macrocarpa* Fruits. *Int. J. Pharm. Investigation*, 2019; 9(3): 141-145.