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DEVELOPMENT AND ASSESSMENT OF A HERBAL SUNSCREEN LOTION FORMULATED WITH POMEGRANATE PEEL EXTRACT

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Abstract: *Sunscreen is a topical product that absorbs or reflects some of the sun's UV radiation on the skin to prevent excessive exposure. It can potentially prevent sunburn and reduce the harmful effects of radiation. This study aimed to develop a topical herbal sunscreen lotion formulation using pomegranate peel extract. Zinc oxide, HPMC, cetyl alcohol, and stearic acid were used in varying concentrations to prepare sunscreen lotion. A total of 10 formulations were prepared and evaluated for homogeneity, spreadability, pH, and SPF. F7 formulation containing HPMC, stearic acid, and cetyl alcohol was chosen as the optimal formulation among all other formulations with the highest SPF value of 26.4. The study findings suggest that the formulated sunscreen lotion can greatly improve and boost UV absorption properties.*

Key Words: *pomegranate peel extract, cetyl alcohol, HPMC, stearic acid.*

1. INTRODUCTION:

In recent years, the incidence of various diseases and disorders associated with solar ultraviolet radiation has increased, and it continues to grow [1]. Chronic exposure to mammalian skin by UV radiation causes a number of biological responses, including the development of erythema, edema, and formation of skin burn cells, immune suppression, DNA damage, photoaging, and melanogenesis. These changes are directly or indirectly involved in developing skin cancer [1, 2]. Although naturally human skin already has a protective system against the effects of harmful sunlight, it is not yet effective enough to overcome excessive radiation [3].

UV rays and skin

The skin being a major organ of the body covers a surface area of roughly 1.5–2.0 m2. Skin acts efficient wall to protect the internal organs of the human body from the damaging effects of ecological and xenobiotic substances. Acute or chronic contact with solar UV radiation is the most vital cause of several dermal disorders like sensitization, aging, sunburn, redness, allergy, wrinkles, dryness, tanning, immunosuppression, DNA damage, and even skin cancer [4]. The percentage of solar exposure to outdoor-working people is estimated per year to be about 10% and for indoor-working people is about 3% on a horizontal plane [5,6].

In the 1890s, the UV-light absorption capacity of acidified quinine was identified, and the same quinine's lotion, like the first sunscreen, was noted too [8]. Use of physical barriers to sunlight, like sun protective clothing, sunglasses, hats, an umbrella, shade, and possible avoidance of sunlight, can be very common options for sun protection. Many animals (e.g., elephant uses mud as a physical barrier to block the UV rays and thus sunburns [9].

Sunscreens:

Sunscreens are cosmetic products to protect skin from damage mediated by sunlight radiation. Topical sunscreen, which either absorbs or reflects radiation to protect skin from the harmful effects of radiation unable to give complete sunscreen protection to organs like eyes and lips. Oral sunscreen products or constituents are also available in the market to be consumed to avoid skin damage [10]. Countless reports suggest regular and appropriate use of sunscreen

causes a dramatic reduction in early skin aging symptoms like wrinkles, sagging, pigmentation, and sensitization [11]. Sunscreens are more popular in the form of lotions, creams, gels, sprays, sticks, and oils. In early 1940, the FDA started investigating new photo-protective molecules. This agency currently accepts the use of 30 UV filters and accepts their use in over-the-counter (OTC) cosmetic products [12]

Punica Granatum:

Pomegranate (punica granatum L.) is a fruit tree that belongs to the lythraceae family. Pomegranate peel is the non-edible part of the pomegranate fruit considered as waste; it contains high levels of phenolic compounds like punicalagins and ellagic acid that have notable photoprotective, antioxidant, and antiaging properties [7].

2. METHODOLOGY:

Preparation of pomegranate peel extract:

Fresh pomegranate fruits were collected from a local market. After the removal of seeds, the peel of all fruits was collected, washed, and dried in a hot air oven for 48 hours at 50 °C. The dried pomegranate peel was finely grounded and passed through sieve number 8. The powder was macerated with 95% ethanol for 3 days. The filtrate was dried using a hot air oven.

Preparation of sunscreen lotion:

The weighed quantity of pomegranate peel extract was dissolved in the required amount of water. Now the aqueous phase was heated to 70 -75 °C. An accurate quantity of cetyl alcohol, stearic acid was melted by heating up to 70-75 °C. Zinc oxide and glycerine were added to the oil phase. HPMC was added to the aqueous phase and stirred until it gets dissolved. Oil phase was added to the aqueous phase with continuous stirring. This was subjected to homogenization until a desired product was obtained. Finally, Triethanolamine was added to adjust the pH.

Table No. 1 Formulation of sunscreen lotion containing pomegranate peel extract and zinc oxide

SNO	F1	F2	F3	F4	F5	F6
Pomegranate peel extract(g)	1	1	1	1	1	1
Stearic acid(g)	4	4	4	4	4	4
Glycerine(ml)	2	2	2	2	2	2
Zinc oxide(g)	10	10	10	10	10	10
Cetylalcohol(g)	1	1.5	2	1.5	2	2.5
Rose water(ml)	2	2	2	2	2	2
Propylparaben(g)	0.002	0.002	0.002	0.002	0.002	0.002
Triethanol amine(ml)	2	2	2	2	2	2
Distilled water(ml)	50	50	50	50	50	50

Table No.2 Formulation of lotion containing pomegranate peel extract and HPMC

SNO	F7	F8	F9	F10
Pomegranate peel extract (g)	1	1	1	1
Stearic acid(g)	4	4	4	4
HPMC(g)	2	2	3	3
Cetyl alcohol(ml)	2	2	2	2
Glycerine(ml)	2	2	2	2
Rose water(ml)	2	2	2	2
Propyl paraben(g)	2	2	2	2
Triethanol amine(ml)	2	2	2	2
Water(ml)	50	50	50	50

Evaluation of sunscreen lotion:
The prepared sunscreen lotion was evaluated for colour, homogeneity, odour, washability, P^H, Spreadability, and SPF.

Homogeneity:
The formulation was tested for homogeneity by visual appearance and touch.

Determination of pH:
The pH of sunscreens was determined using a digital pH meter. One gram of the formulation was dissolved in 100 ml of distilled water. The purpose of this study was to guarantee that the pH of the produced herbal sunscreen lotion is similar to pH of skin.

Spreadability:
The spreadability of sunscreens determines their therapeutic efficiency. The appropriate amount of sunscreen was applied between two slides, and under specified load directions, the time in seconds it took for the two sides to slide off was noted by formula
S=M×L/T
Where M = weight tied to the upper slide
L = length of glass slide
T = time taken to separate the slides

SNO	Parameters	Observation
1	Color	Light brown color
2	Odor	Pleasant
3	Appearance	Good
4	Washability	Washable
5	State	Semisolid with pourable consistency
6	Texture	Smooth

Washability: This test is carried out by simply washing the applied sunscreen lotion with water

Determination of SPF :
UV-Visible spectrophotometer was used to examine the in vitro efficacy of herbal sunscreens.
A 1 percent solution (w/v) of herbal sunscreen lotions in ethanol was made by dissolving 1gm of herbal sunscreen lotions in 100 ml of ethanol. Between 280-320 nm, aliquots of each herbal sunscreen were scanned at 5 nm intervals.
SPF was calculated using the equation below. Three times each sample was analyzed
SPF = CF∑EE (λ) × I(λ) × A(λ) 320 290 (3)
Whereas, CF= Correction factor;
EE= Erythemogenic effect;
I= Intensity of solar light of wavelength.
A= Absorbance

3. RESULTS:
Determination of physical parameters
All the physical parameters were tested and reported in table 3.

Table No. 3 Physical parameters

From the observation, it has been observed that all the formulations were light brown in colour with a pleasant smell and had a smooth texture with semisolid pourable consistency.

Table No-4 Determination of pH

SNO	Formulation	P^H
1	F1	6.75
2	F2	6.72
3	F3	6.02
4	F4	6.91
5	F5	7.02
6	F6	6.76
7	F7	6.42
8	F8	6.64

9	F9	7.01
10	F10	6.88

From the above table, it was noted that the pH of all formulations was found to be 6.5 to 7.0, identical to skin pH, which results in a lack of irritation, making the sunscreen more comfortable to use, and it is a good choice for more people.

Table no 5 Determination of SPF for formulations F1-F6

Wavelength (nm)	**EE(λ)× I(λ)**	**F1 Abs(λ) EE(λ)×I(λ) ×Abs(λ)**	**F2 Abs(λ) EE(λ)×I(λ) ×Abs(λ)**	**F3 Abs(λ) EE(λ)×I(λ) ×Abs(λ)**	**F4 Abs(λ) EE(λ)×I(λ) ×Abs(λ)**	**F5 Abs(λ) EE(λ)×I(λ)× Abs(λ)**	**F6 Abs(λ) EE(λ)×I(λ) ×Abs(λ)**
290	0.0015	0.036	0.032	0.034	0.037	0.038	0.036
295	0.0817	0.159	0.156	0.153	0.149	0.155	0.146
300	0.2874	0.679	0.659	0.657	0.648	0.646	0.661
305	0.3278	0.721	0.697	0.702	0.685	0.642	0.684
310	0.1864	0.387	0.372	0.368	0.361	0.372	0.344
315	0.0839	0.225	0.208	0.205	0.203	0.214	0.208
320	0.018	0.126	0.124	0.103	0.112	0.101	0.115
		Total:2.333	Total:2.248	Total:2.222	Total:2.195	Total:2.168	Total:2.194
		SPF:23.33	SPF:22.48	SPF:22.22	SPF:21.95	SPF:21.68	SPF:21.94

F1 formulation containing pomegranate peel extract from the above table was found to have an SPF of 23.33, which is slightly greater than all other formulations.

Table No. 6 Determination of SPF for formulations F7-F10

Wavelength (nm)	**EE(λ) ×I**	**F7 Abs(λ) EE(λ)×I(λ)×Abs(λ)**	**F8 Abs(λ) EE(λ)×I(λ)×Abs(λ)**	**F9 Abs(λ) EE(λ)×I(λ)×Abs(λ)**	**F10 Abs(λ) EE(λ)×I(λ)×Abs(λ)**
290	0.015	0.042	0.039	0.040	0.038
295	0.087	0.248	0.234	0.236	0.217
300	0.287	0.800	0.719	0.753	0.639
305	0.327	0.850	0.828	0.809	0.683
310	0.186	0.461	0.458	0.449	0.345
315	0.083	0.201	0.203	0.183	0.135
320	0.018	0.041	0.043	0.035	0.025
		Total:2.643	Total:2.524	Total:2.505	Total:2.082
		SPF:26.4	SPF:25.24	SPF:25.05	SPF:20.82

Discussion: From the above table, formulation F7 was found to have an SPF of 26.4, which is the highest among all the formulations.

4. CONCLUSION:

The current study aimed to create a stable herbal sunscreen lotion with a suitable SPF. The formulations (F1-F10) were prepared by varying the compositions and evaluated for their physical-chemical properties and SPF. The study showed that formulation F7 was found to be more stable with a high SPF value, providing a better herbal sunscreen ability. Pomegranate peel extract has been shown to absorb UVA and UVB photons, and in vitro studies suggested a strong potential as a primary active in sunscreen products. In summary, pomegranate peel extract is a promising natural photoprotective agent with both antioxidant and UV-absorbing properties and its use in herbal sunscreens may improve SPF as well as offer added skin health benefits. The findings of this study can help regulatory agencies, scientific organizations, and manufacturers set standardized standards for herbal sunscreen lotions. The study will hopefully lead to improvements in the treatment of UV radiation.

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