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“FORMULATION OF SUNSCREEN WITH SYNERGISTIC EFFICACY ON SPF”

Miss. Ware Renuka Bhanudas

Prof.BAGWAN L.R.

Dr. HINGANE L.D.

ADITYA PHARMACY COLLEGE, BEED 431122

ABSTRACT

The objective of this study was to develop sunscreen cream formulations with high sun protection factor (SPF) and satisfied characteristics. The association of sunrays with skin damage have been known since medieval times. The description of the electromagnetic spectrum facilitated the identification of the UV light spectrum as being responsible for skin damage resulting from prolonged skin exposure. Sunscreens have been used since ancient civilizations with various measures to limit exposure to sun exposure being employed. Awareness of the risks associated with sun rays has been increasing in the last century, then as a result, the science, technologies and formulation have advanced significantly.

The sunscreen is prepared using water phase that includes distilled water as a main solvent, glycerine as a moisturizer, Arabic gum as a thickener, and citric acid as a preservative. The sunscreen lotions were prepared using three different compositions F1, F2 and F3 and evaluated for their stability, safety and SPF. Results showed that the sunscreen lotions were non-mutagenic, non-irritant, stable and possess SPF for normal skin.

INTRODUCTION

Sunscreen, also known as sunblock or sun cream, is a photoprotective topical product for the skin that absorbs or reflects some of the sun's ultraviolet (UV) radiation and thus helps protect against sunburn and most importantly prevent skin cancer. Anti-oxidants and Vitamin A Derivatives. Many sunscreens use botanicals capable of anti-oxidant activity to, in theory at least, mop up some free radicals caused by sun damage. Some studies reported the addition of antioxidant vitamins and botanicals like caffeine or echinacea to formulations have reduced sun damage (40). Vitamin A derivatives such as retinols are common in “anti-aging” cosmetics and sometimes used in sunscreens. Some research shows such vitamin A additives may actually speed the development of tumors and lesions on sun-exposed skin as UV rays can break down antioxidants, forming harmful by-products (41).

ADVANTAGES

1. Sunscreen protects your skin and reduces your risk of developing skin cancer and skin precancers.
2. Sunscreen protects every skin type.
3. If you have a darker complexion, the melanin in your skin offers some protection from sunburns, but you still need to protect your skin from those harmful ultraviolet rays.
4. No special equipment needed for preparation.
5. Renewable resources.
6. Botanical ingredients are easily available(5,6,7)

INGREDIENTS AND USES:-

Sr.no	Ingredient	Uses
1.	Titanium Dioxide	Protecting agent
2.	Avobenzone	Protection from sunrays
3.	Zinc oxide	Protect UVA and UVB
4.	Octisalate	Help to filter UVB rays
5.	Oxybenzone	Protect from sun burn
6.	Homosalate	Protect from UV rays
7.	Citric Acid	Preservative
8.	Beeswax	Emulsifier and thickener
9.	Stearic Acid	Thickener
10.	Glycerine	Humectant
11.	Triglycerine oil	Emollient
12.	Water	Solvent vehicle
13.	Cetearyl Alcohol, PEG40, Castor oil, Sodium cetearyl Sulphate	Emulsifier
14.	Decyl Oleate, Propyl Parabean, methyl Parabean	Preservative, Emollient
15.	Disodium EDTA	Chelating
16.	Sodium Hydroxide	Buffer Agent
17.	Perfume	Flavouring Agent

EVALUATION PARAMETERS

Evaluation Methods

In 1934, Friedrich Ellinger determined the minimal erythral dose from protected and unprotected skin by evaluating the protective efficacy of sunscreens using mercury lamp radiation on both forearms and expressed a coefficient of protection that decreased in value to the extent that protection increased. In 1956, Rudolf Schulze proposed ‘Schulze Factor’ which been used for decades in European Countries, as a reference in the evaluation of sunscreens. Schulze Factor is exposure time required for the induction of erythema on sunscreen protected and unprotected skin by incremental doses of sunlight like radiation emitted from lamps.

Sun Protection factor

The SPF evaluation procedure was carried out according to the 1994 COLIPA recommendations concern modification to existing method of which the main points are itemised below

- Definition and measured of the solar simulator radiation
- Volunteer selection based on phototype, possibly using a colorimetric method
- Simultaneous determination of the minimal erythral dose on protected and unprotected sites, using a 1.25 geometrical progression
- Standardized application of the amount of test product, in terms of quantity

UVB sunburn protection factor

Grading system for SPF;

- .Low SPF 2 – 15
- .Medium SPF 15 – 30
- .High SPF 30 – 50
- .Highest SPF > 50

UVA PROTECTION INDICES:

Boots star rating for sunscreen	
Ratio of UVA: UVB absorbance	Boots for rating
Before irradiation	After irradiation

<0.6	<0.56	No star
>0.6	>0.57	3
>0.8	>0.76	4
>0.9	>0.86	5

In-vitro methods:**1) In vitro SPF determination by UV -Spectro photometer:-**

Normalized product function used in the calculation of SPF

Wavelength in nm	EE x l (normalized)
290	0.0150
295	0.0817
300	0.2874
305	0.3278
310	0.1864
325	0.0839
320	0.0180
	Total 1

2) In vitro determination of SPF by UV 2000S UV Transmittance Analyser:-

Where, λ is the absorbance at wavelength and results of broad spectrum rating method of United States should be predicted as follows

$\lambda < 340$	Level of protection
$340 < \lambda < 370$ nm	UVA/UVB
$\lambda > 370$ nm	More(broad spectrum)

IN – VIVO METHODS:




Human volunteers are irradiated with a UVA light source (320-400nm) and skin changes, yielding in a immediate or persistent pigment darkening or tanning are observed after desired time

Pigmentation	Erythema
0=No response	0=No response
0.5=Equivocal response	0.5=Equivocal response
1.0=Unambiguous dark grey or brown pigmentation	1.0=Unambiguous erythema
1.5=well define dark grey or brown pigmentation with sharp borders	1.5=well defined erythema with sharp borders
2.0=Deep pigmentation	2.0=Bright erythema

Formulation Consideration :

Name		by	
 <p>Neutrogena</p>	Water, Homosalate, Ethylhexyl Salicylate, Benzophenone-3, Octocrylene, Butyl Methoxydibenzoylmethane, Silica, Styrene/Acrylates Copolymer, Potassium Cetyl, Phosphate, Beeswax, Glyceryl Stearate, PEG-100 Stearate, Cetyl Dimethicone, Caprylyl Methicone, Dimethicone, Ethylhexylglycerin, Behenyl Alcohol, Sodium Polyacrylate, Xanthan Gum, Dimethicone/PEG-10/15 Crosspolymer, Acrylates/C12-22 Alkyl Methacrylate Copolymer, Fragrance, Disodium EDTA, Ethylhexyl Stearate, BHT, Trideceth-6, Polyaminopropyl Biguanide, Methylisothiazolinone, Diethylhexyl 2, 6 Naphthalate.	Johnson & Johnson Pvt , Ltd	It's a SPF 50 Sunscreen. It block the 98% UVB radiation . Helioplex technology which offers powerful protection against sun damage while leaving a weightlessly invisible feeling on your skin . It is most effective and long time action

<p>2</p>	<p>Cetaphil</p> 	<p>Ethylhexyl Methoxycinnamate, BisEthylhexyloxyphenol, Methoxyphenyl Triazine, Diethylamino Hydroxybenzoyl Hexyl Benzoate, Ethylhexyl Triazone, Methylene-Bis-Benzotriazolyl, Tetramethylbutylphenol.</p>	<p>Encube Ethicals Pvt , Ltd</p>	<p>It's is SPF 30 Sunscreen it blocks the 97% of UVB radiation. All type of skin are use . It has a medium SPF</p>
<p>3</p>	<p>Mancode</p> 	<p>Aloe Vera, Calendula , Gotukola , seawood</p>	<p>A.V Cosmo Lifestyle , Pvt , Ltd .</p>	<p>It's a herbal Sunscreen cream with the SPF 15+ . The SPF 15 blocks about 93% of UVB radiation but it has short time to protect from Sun</p>
<p>4</p>	<p>Mamaearth</p> 	<p>Aloe Vera , Raspberry , Glycerine</p>	<p>Honasa Consumer Private Limited</p>	<p>It is a natural Sunscreen with the SPF 50 sun protection and PA+++ Protection. It has block the 98% of UVB radiation. It is not to skin damage because it has natural ingredients are use</p>

5	Camellia , Red Raspberry 	Camellia and Red Raspberry Sunscreen (Certified Natural Sunscreen)	Juicy Chemistry Private Limited	It is purely natural Sunscreen not to harmful the skin but it has low protection of sun
6	Minimalist 	Tinosrbs , Uvinul A plus , Uvinul T 150 , Titanium Dioxide , Silymarin	Uprising Science , Pvt , Ltd .	It has higher the SPF value. It contains SPF 60 it is damaged to sensitive skin
7	PhytoRx Uv Defence Sunblock Spf 100 (Lotus Professional) 	Green Tea Extract	Lotus Professional	It contains the SPF 100 protection with the green tea extract but it is harmful for sensitive skin. But it has 100% protection from sun [5,6,7]

CONCLUSION:

The use of sunscreens is an important component to sunprotection. Regular and appropriate use is associated with a decreased risk of various skin complications and cancers as a result of UV radiation exposure. In addition, patients need to be reminded not to solely rely on the use of sunscreen. Thus it can be concluded that there is great market potential for sunscreen chemicals either synthetic or natural or in combination due to awareness of protection from hazardous UVA as well as UVB rays.

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