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Formulation and Evaluation of Sunscreen Lotion Containing Natural and Synthetic Agents

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ABSTRACT

Sunscreen is a chemical compound that helps protect you from UV rays sunburn is caused by ultraviolet B radiation but ultraviolet a may be more damaging to the skin. Sunscreen should ideally block both wavebands. The aim of this study was to develop a topical sunscreen formulation based on some fixed oils, in combination with some medical plants. Regular use of sunscreen reduces the development of actinic keratosis, squamous cell carcinoma and melanoma. Sunscreen may be organic or inorganic chemicals. Sunscreen is also known as sunblock lotion. The product absorbs or reflects the sun's ultraviolet radiation and protects the skin. The increasing incidence of skin cancers and photo-damaging effects caused by ultraviolet radiation has increased the use of screening agents, which have shown beneficial effects in reducing the symptoms. Sunscreen agents should be safe chemically inert, non-irritating non-toxic, photostable an able to provide complete protection to the skin against damage from solar radiation.

1. INTRODUCTION

A substance that helps protect the skin from the sun's harmful rays. Sunscreens reflect, absorb, and scatter both ultraviolet A and B radiation to provide protection against both types of radiation. Using lotions, creams, or gels that contain sunscreens can help protect the skin from premature aging and damage that may lead to skin cancer. [1]

Sun-block formulae must be created for repair, reduction of sunburn, sun tanning, skin melanoma, and early fine lines and wrinkles, as well as increasing the degree of sun protection factor (SPF) . Sunscreens are frequently applied to the skin to protect it from the sun's harmful rays and to reduce the risk of skin disorders caused by the sun's rays. Broad-spectrum sunscreens are now being researched to reduce the long-term effects of high UV radiation. [2]

The use of sunscreens as photo protectants has evolved significantly over the last few decades. With increasing awareness of the protection afforded by sunscreens against sunburns, skin aging and melanomas, the demand for sunscreen formulations will invariably increase, and there exists a significant opportunity for pharmaceutical industries to fulfill this demand by manufacturing quality, efficacious, safe and aesthetically appealing sunscreen formulations. [3] Sunscreen lotion is a sort of product that protects against the sun's harmful rays by containing ultraviolet radiation (UV rays), which is divided into

- UVA: longest wavelength with 320-400nm, it affects inner cells in the top of skin including dermis and causes immediate tanning and sunburn.
- UVB: Medium wavelength with 290-320nm, it affects the cells in the top layer of skin and causes delayed tanning, sunburn and blisters.
- UVC: Shortest wavelength with 100-290nm, it affects the outermost cells in the top layer of skin and causes redness, ulcers and lesions.

UV rays are absorbed by certain bioactive substances in the environment, which protects the skin from their harmful effects. Because of their safety, absence of unpleasant responses, lack of dangerous chemical components, and environmental integrity, biologically active compounds have become more popular in cosmetics formulations in recent years. Because synthetic photo-protective chemicals are more likely to be dangerous and carcinogenic,

phytoconstituents are gaining favor as major cosmetics ingredients due to their natural anti-cancerous, anti-mutagenic, and non-toxic properties.[4]

Genuine herbal elements in sunscreen are the least irritating to the skin, especially for sensitive skin, include natural components, can regenerate the skin, and give enough protection against pollution and climate changes in the atmosphere. The most often used herbs in natural sunscreen include aloe vera, vitamin E, turmeric.

Aloe vera gel has been found to protect human skin from all harmful effects of rays. Due to its anti-inflammatory, antibacterial, and wound-healing characteristics, aloe vera has long been used to treat digestive issues as well as skin injuries (burns, wounds, insect bites, and eczemas). Turmeric is produced by Curcuma Longa, the extract of curcuma longa has anti-flatulent, anti-inflammatory, anti-fungal, antiparasitic, anti-inflammatory, and anti-cancer properties. Additionally, Curcuma longa has the advantage of inhibiting apoptosis, Vitamin E is a fat-soluble antioxidant with photoprotective capabilities that is vital for human health.

Rosemary polypenols including rosmarinic acid, carnosic acid and carnosol have previously been shown to reduce the damaging effects of UV radiation and ionizing radiation.

Tomatoes have an ingredient called lycopene, which is a phytonutrient that helps protect your skin from sun damage when consumed.[5]

1.1 CLASSIFICATION OF SUNSCREEN

Sunscreens can be classified as follows

1. Based on the mode of action they can be classified as

a. Physical sunscreen: Reflect harmful rays away from skin.

Eg: zinc oxide and titanium dioxide.

b. Chemical sunscreen: Absorbs UV rays

Eg: microfine titanium dioxide, avobenzone and oxybenzone. The combination of both physical and chemical active ingredients is considered to be a best sunblock. Physical sun blocks are having scattering affect thereby results in whitening phenomenon while majority of organic chemicals used in sunscreen formulations have not been established as safe.

2. Based on application

a. Topical: They either absorb or reflect radiation to protect from harmful radiation

b. Oral: These are consumed orally to avoid skin damage. Eg: Carotenoids

Topical sunscreens are divided into two classes based on their mechanism of protection

- Organic sunscreen
- Inorganic sunscreen
- Organic Sunscreen: Organic sunscreen works by absorbing into skin and converting UV rays into heat .it is thin and ideal for everyday use allow for skincare ingredients to be added easily. Organic sunscreen actives chemical carbon based compound .it contains non mineral active ingredient.
- Inorganic sunscreen: These are particles that scatter and reflect uv rays back to the environment they act as physical barrier to indent ultraviolet and uv light. They are considered broad spectrum as they cover entire ultraviolet spectrum .the Inorganic sunscreen is also referred to as sunblock .[6]

1.2 IDEAL PROPERTIES OF SUNSCREEN

1. Must absorb a broad range of UV rays causing sunburn
2. Must be stable in the presence of sunlight
3. Should be able to provide complete protection for skin
4. Should be safe effective, chemically inert, at low concentration
5. Should not cause irritation, sensitization and toxicity
6. Should not stain Filtering
7. Activity against UVB and UVA radiation
8. Anti-oxidant and reactive oxygen species scavenging property
9. Anti-mutagenic property
10. Anticancer property
11. Booster effect

12. Safety stability of active compound[7]

1.3 MERITS OF SUNSCREEN LOTION

1. Helps to prevent sunburn and premature aging
2. Protects from the sun as soon as it is applied.
3. Lasts longer when in direct UV light.
4. Better for those with heat-activated skin[redness].
5. Offers protection against UVA and UVB rays.

1.4 DEMERITS OF SUNSCREEN LOTION

1. It is an expensive product.

2. Can create an occlusive film which results in perspiration.

3. Can be less protective if not applied accurately and generously.

4. Can cause white drips to show on the skin when sweating.

5. Sunscreen can cause stickiness in some skin types.

1.5 IMPORTANCE OF SUNSCREEN

UV radiation is essential to human health such that it helps in the intestinal absorption of calcium, phosphorous and for the production of vitamin D3. On the other hand, these radiations also harm our health by directly interacting with DNA, RNA proteins, lipids and thereby causing potential carcinogenic effects. The most efficient way to protect skin from harmful UV radiation is the topical application of any active molecule which has UV absorbing or reflecting properties. This is why the sunscreen has gained importance in the current scenario.[8]

Wearing sunscreen is one of the best — and easiest — ways to protect your skin's appearance and health at any age. Used regularly, sunscreen helps prevent sunburn, skin cancer and premature aging. To help make sunscreen a part of your daily routine, dermatologist Anna Chien addresses common concerns.

1.6 WHY WE USE SUNSCREEN?

- Too much-unprotected sun exposure leads to
- Premature skin ageing
- Sun burn
- Skin cancer

Fig No.1: Sunburn

1.7 MECHANISM OF PHOTOPROTECTION

UV rays mediated photo oxidative damage reaches the dermal capillaries via epidermis and dermis and cause depletion of enzymatic and non-enzymatic antioxidants in Stratum corneum, epidermis and dermis. Photo oxidation of pre-existing melanin and its precursors will occur which result in immediate and persistent pigment darkening.

Sunscreen act by preventing and minimizing the damaging effects of the ultraviolet sun rays following exposure to the sunscreen have been demonstrated to increase the tolerance of the skin to uv exposure. They work on two mechanisms:

Scattering and reflection of uv energy from the skin surface mineral based on inorganic sunscreen works on this mechanism they provide a coating that blocks sun rays from penetrating through the skin. [9]

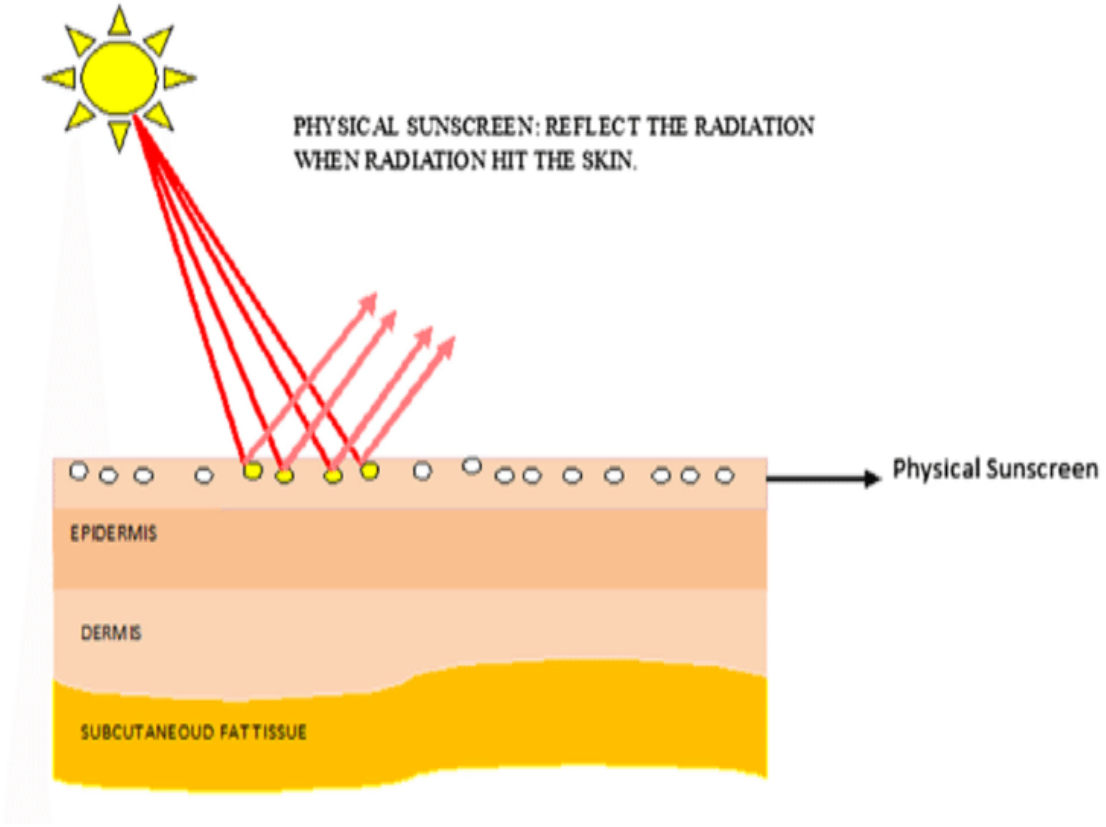

Fig no : - 02 : Mechanism of photoprotection

2. LITERATURE REVIEW

- Velasco et al. (2008) studied and investigated the development of sunscreens possessing broad spectrum anti-UV radiation effectiveness with reduced concentration of chemical UV filters; and bioactive products have been the focus of several researches due to ecological issues (sustainability), minimum ambient impact and for safe utilization.

- Ashawat et al. (2006) examines the most commonly used herbs in herbal sunscreen lotions are Aloe vera, basil, green tea, almond, olive, jojoba and cucumber.

- Tabrizi et al. (2003) Oriented to sunscreen development, the use of natural raw materials that infers UV absorption and skin protection against UVB and UVA radiation is of great interest, associated with the benefits of the products and compliance of the consumers.

- F'guyer et al. (2003) Several botanical compounds have been shown to be antimutagenic, anticarcinogenic and nontoxic and have the ability to exert striking inhibitory effects on a plethora of cellular events at various stages of carcinogenesis. Few examples include tea polyphenols, curcumin, silymarin, garlic compounds, apigenin, resveratrol, ginkgo biloba, beta-carotenoids, and ascorbic acid.

- Movileanu et al. (2000) Polyphenolic compounds exhibit a wide number of parmacological properties such as antiallergic, anti-inflammatory, hepatoprotective, vasoactive, antithrombotic, antioxidant, free radical scavenging, antitumor, antibacterial and antiprotozoa due to their different in vivo action mechanism.

- Robbins (2003) Important categories of beneficial pytoconstituents include penolic acids, flavonoids, and high molecular weight polypenols.

- Movileanu et al. (2000): Baby et al. (2006).Polypenolic compounds exhibit a wide number of pharmacological properties such as anti-allergic, anti-inflammatory, hepatoprotective, vasoactive, antithrombotic, antioxidant, free radical scavenging, antitumor, antibacterial and antiprotozoal due to their different in vivo action mechanism.

- Velasco et al. (2008) Due to the structural similarities between polyphenol compounds such as flavonoids and organic UV filters, they might exert photo protection activity in addition to the antioxidant and absorbance spectrum profiles of these bioactive compounds.

3. PLAN OF WORK

1. Literature Review

2. Material and Instruments

3. Experimental method

- Sample collection
- Identification tests
- Make extraction of Curcuma longa (turmeric) powder
- Filter out the extract

4. Evaluation tests

- Physical parameter
- Determination of p^H
- Determination of Viscosity
- Spreadability
- Washability
- Homogeneity
- Stability Testing
- Determination of antioxidant activity
- Determination of SPF

Fig no. 3 : Aloevera

4. PLANT PROFILE

4.1 ALOEVERA

• Biological source- dried latex of leaves

of it also known as cape aloe .

• Family- liliaceae

• Description Colour- clear to slightly yellow

or translucent gold .

• Odour-similar like rotten garlic or onion

• Taste- Bitter

• Chemical constituents- aloe emodin

• Uses- heals burns and clears acne.[10]

4.2 TURMERIC POWDER

Fig no.4: Turmeric

• Biological source - It consists of dried rhizomes of Curcuma longa

- Family- Zingiberaceae.
- Description
- Colour - Yellow
- Odour – Aromatic
- Taste – Bitter
- Chief chemical constituents - Curcumin, Curcuminoids
- Uses -Reduce acne, Glowing skin, Lightens skin.[11]

4.3 ROSEMARY

- Biological source - Rosmarinus officinalis
- Family -Lamiaceae
- Description

Fig no.5 : Rosemary

Colour – dark green

Odour- pungent and astringent

Similar to eucalyptus or campor

- Taste – tasteless
- Chief chemical constituents –

rosmarinic acid, carnosic acid and carnosol.

Uses - reduce the damaging effects of UV

radiation and ionizing radiation.[12]

4.4 TOMATO

- Biological source -,
- Family- Solanaceae lycopersicum
- Description

Colour – Red

Odour- earthy and spicy odour

Taste- sweet - sour

Fig no. 6:Tomato

- Chief chemical constituents –lycopene
- Uses - protect skin from UV B induces potodamage.[13]

5. INGREDIENTS AND THEIR ROLE

Table no. 1. : Ingredients and their role

INGREDIENTS	ROLE OF INGREDIENTS
ROSEMARY EXTRACT	Protect from UV radiation
TURMERIC EXTRACT	Anti-Inflammatory Antioxidant
TOMATO EXTRACT	UV Protection
ALOEVERA GEL	Prevent Sunburn, Moisturise The Skin
COCONUT OIL	Moisturiser
ROSE OIL	Emollient
ROSE WATER	Fragrance
CETYL ALCOHOL	Co- Emulsifier
STEARIC ACID	Thickner
GLYCERINE	Humectant
HPMC	Stabilizer
PROPYLPARABEN	Preservative
CARBOPOL	Gelling Agent
VIT E	Antioxidant

6. AIM AND OBJECTIVE

AIM: - Formulation and evaluation of sunscreen lotion containing natural and synthetic agents.

OBJECTIVE:

- To develop sunscreen formulation using herbal ingredients
- To perform physicochemical characterization
- To achieve maximum stability of formulation
- To achieve maximum UV protecting effect
- To develop various formulation
- To inhibit the transmission of UV radiation into the skin
- To reduce the risk of squamous cell and melanoma skin cancer
- To diminish the degree of baseline pigmentation

7. MATERIAL AND METHODS

- CHEMICALS AND REAGENTS

- **Table no. 2. : Chemicals and reagents**

Sr. NO.	CHEMICALS
1.	Ethanol
2.	Stearic acid
3.	Cetyl alcohol
4.	Triethanol amine
5.	Hydroxyl propyl methyl cellulose
6.	Glycerine
7.	Propyl Paraben
8.	Carbopol 940
9.	Rose water
10.	Rose Oil
11.	Coconut oil
12.	Vitamin E
13.	n-propyl alcohol
14.	Distilled water
15.	Conc. Sulphuric Acid
16.	DragonDroff's Reagent
17.	Ferric Chloride
18.	Molish Reagent
19.	Ninhydrine
20.	Silica gel

The various chemicals used throughout the experimental work are summarized.

Table no 3: Instruments

- **INSTRUMENTS**

Sr. no.	INSTRUMENTS	BRAND NAME
1.	Analytical balance	Contech
2.	Digital pH meter	Systronics digital pH meter 345
3.	Brook field Viscometer	DV-I, LV-I spindle, USA
4.	Digital autoclave	ASI-254
5.	UV spectrophotometer	UV 1700, Shimadzu, Japan

8. EXPERIMENTAL WORK

8.1 Plant material

The plant material used in the formulation was collected from the medicinal garden of MIBP Gondia.

8.2 Method of preparation

- **Preparation of crude extract of Curcuma longa**

The dried rhizomes of Curcuma longa (Zingiberaceae) were finely ground and separately passed through sieve no. 80. Each powder (500 g) was macerated for 3 days with 95 % ethanol and filtered**.**

- **Preparation of crude extract of rosemary**

Rosemary extract was prepared by using Soxhlet apparatus. rosemary leaves kept with water for 72 hrs. Extraction was dried and stored in dessicator for further use.[14]

➢ **Preparation of crude extract of solanum lycopersicum(tomato)**

Lycopersicum extract was prepared by using Soxhlet apparatus .Tomato was dried at 121 degree Celsius , after drying the tomato get grinded and converted into the powder form .

The powder of lycopersicum get diluted with 95% ethanol and then attached to the assembly of Soxhlet apparatus. After that the extract was dried in desiccator for further use.

8.3 Phytochemical screening of different qualitative chemical tests

It can be performed for establishing profile of ethanol and aqueous extract for its chemical composition. The following tests were performed on extracts to detect various phytoconstituents present in them.[15]

1. Detection of carbohydrate

Molish Test

To 2 ml of filtrate, two drops of alcoholic solution of alpa naphthol are added, the mixture is shaken well and 1 ml of concentrated sulphuric acid is added slowly along the sides of the tube and allowed to stand. A violet ring indicates the presence of carbohydrates.

2. Detection of alkaloids

Dragondroff's test

To a few ml of filtrate, 1 or 2 ml of Dragondroff's reagent is added. A prominent yellow precipitate indicates the test as positive.

3. Detection of saponin

- **Foam test**

The extract (50 mg) is diluted with distilled water and made up 20ml. the suspension is shaken in graduated cylinder for 15 min, A 2 cm layer of foam indicates the presence of saponins.

4. Detection of protein

- **Biuret test**

An aliquot of 2 ml filtrate is treated with one drop of 2% copper sulpate solution. To this, 1ml ethanol (95%) is added, followed by an excess of potassium hydroxide pellets. Pink colour in the ethanolic layer indicates the presence of proteins.[16]

5. Detection of steroids and triterpenoid

- **Libermann-Burchard test**

The extract (50mg) is dissolved in 2ml acetic anhydride. To this, one or two drops of concentrated sulphuric acid are added slowly along the sides of the test tube. An array of colour changes shows the presence of phytosterols.

6. Detection of glycosides

- **Killer killani test**

To the test solution few drops of ferric chloride solution and concentrated sulphuric acid was added. A brown ring between the layers indicate presence of glycoside. [17]

- **Baljet test**

Sodium picrate was added to the test solution. Appearance of yellow to orange colour indicate presence of glycoside.

7. Detection of tannin

Ferric chloride solution test:-

To 1ml of the extract, ferric chloride solution was added. Appearance of green colour indicates the presence of tannins. [18]

8.4 Preparation of sunscreen lotion

Table no. 4. : List of Ingredients

- **Ingredients:**

INGREDIENTS	FORMULA 1	FORMULA 2	FORMULA 3
ROSEMARY EXTRACT	1gm	2gm	3gm
TURMERIC EXTRACT	0.5gm	1gm	1.5gm
TOMATO EXTRACT	1.5gm	2gm	2.5gm
ALOEVERA GEL	5gm	5gm	5gm
COCONUT OIL	2ml	2ml	2ml
ROSE OIL	1ml	1ml	1ml
ROSE WATER	3ml	3ml	3ml
CETYL ALCOHOL	2gm	2gm	2gm
STEARIC ACID	4gm	4gm	4gm
GLYCERINE	2ml	2ml	2ml
HPMC	3gm	3gm	3gm
PROPYL PARABEN	19gm	19gm	19gm
CARBOPOL	2gm	2gm	2gm
VIT- E	1ml	1ml	1ml
Total	50 gm		

- **Preparation Method:-**

1. Prepare aloevera gel and add little amount of carbapol in it and heat it to form a gel.

2.Weigh an accurate quantity of cetyl alocohol , stearic acid , glycerine , HPMC , propyl paraben, mix it well and melt it.[19]

3. In a beaker add 1g of triethanolamine and accurate quantity of water. Heat it upto 80-85 degree Celsius.

4. Transfer aloevera extract in mortar and pestle.[20]

5. Add rosemary extract, turmeric extract, tomato extract, and triturate all the chemicals with continuous mixing.

6. Transfer it in a suitable container and label it properly.[21]

9. EVALUATION OF SUNSCREEN

9.1 Physical parameters:

Colour: The colour of formulation was checked manually and observed.

Odour: The Smell of Formulation was checked by applying preparation on hand and feel the fragrance.

Appearance: Visually checked the appearance of the formulation.[22]

9.2 Determination of pH :

The pH of sunscreens was determined using a digital pH meter. pH was measured after 1 g of the formulation was dissolved in 100 ml of newly prepared distilled water for 2 hours. The purpose of this study was to guarantee that the pH of the produced herbal sunscreens is similar to the pH of the skin after 24 hours of use. The results were triple-checked, and S.D. was recorded.[22]

9.3 Determination of Viscosity:

The Brookfield viscometer was used to test viscosity, with the proper number of spindles selected. A 50 ml beaker was used to hold 50 g of preparation until the spindle groove was dipped and the rpm was set. Sunscreen viscosity was measured at 5, 10, 20, 50, and 100 rpm. The viscosity was computed using the factor obtained from the reading.[23]

9.4 Spreadability: The spreadability of sunscreens determined their therapeutic efficiency. The appropriate amount of sunscreen was applied between two slides, and under specified load directions, and the two sides took the time in seconds to slide off. Spreadability was defined as the amount of time it took to separate two slides in less time.

The formula for calculating it is:

$$S = M \times L / t$$

Where, M = weight tied to the upper slide

L = length of glass slide

T = time taken to separate the slides[24]

9.5 Washability: This test is carried out by simply washing applied sunscreen lotion with water.[25]

9.6 Homogeneity: The formulation was tested for homogeneity by visual appearance and touch. [26]

9.7 Irritancy Test: Mark an area (one sq. cm) on the left hand dorsal surface. The lotion was applied to the specified area and time was noted. Irritancy, erythema, edema was checked if any for regular interval up to 24 hrs and reported. [27]

9.8 Stability Testing: Stability testing of prepared formulation was conducted at room temp, studied for 7 days . And then the formulation was studied at 45 ±1°C for 20 days . The formulation was kept both at room and elevated temperature and observed on 0^{th} , 5^{th} , 10^{th} , 15^{th} and 20^{th} day for all the evaluation parameters. [28]

9.9 In vitro Antioxidant Activity Determination:

In different vials, 1 ml of varying concentrations of herbal sunscreens and ascorbic acid as standard were taken. 5 mL of DPP methanolic solution was added to this, shaken thoroughly, and incubated at 370C for 20 minutes. At 516 nm, the absorbance was measured against methanol as a blank. The DPP absorbance was used as a control. [29]

The following formula was used to compute the percentage of antiradical activity:

$$\% \, Anti - radical activity = \frac{Control\ absorbance - Sample\ absorbance}{Control\ Absorbance} \times 100$$

9.10 Determination of SPF:

A UV Visible spectrophotometer was used to examine the in-vitro efficacy of herbal sunscreens. A 0.10 percent solution (w/v) of herbal sunscreen lotions in ethanol was made by dissolving 0.050 g of herbal sunscreen lotions in 50.0 ml of ethanol. Between 290 and 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. [30]

$$SPF = CF\sum EE(\lambda) \times I(\lambda) \times A(\lambda)\ 320\ 290\ (3)$$

Whereas,

CF= Correction factor;

EE= Erythemogenic effect;

I= Intensity of solar light of wavelength;

A= Absorbance

10. RESULT

10.1 Phytochemical Screening Test:

Table no. 5: Phytochemical screening test

Sr no	PHYTOCHEMICAL TESTS	Rosemary officinalis	Curcuma longa	Solanum lycopersicum
1	Test for carbohydrate Molish test:-	+ve	+ve	-ve
2	Detection of alkaloids Dragondroff's test	+ve	+ve	+ve
3	Detection of saponin Foam test	+ve	+ve	+ve
4	Detection of protein Biuret test	+ve	+ve	+ve
5	Detection of steroids and triterpenoid Libermann-Burchard test	+ve	+ve	+ve
6	Detection of glycosides Killer killani test	+ve	-ve	+ve
7.	Detection of tannin Ferric chloride solution test	+ve	+ve	+ve

10.2 DETERMINATION OF PHYSICAL PARAMETERS

Table no. 6: Physical Parameters

Sr.No.	Parameters	F1	F2	F3
1.	Colour	Yellow	Light Yellow	Whitish Yellow
2.	Odour	Rose like	Rose like	Rose like
3.	Appearance	Good	Good	Great
4	Washability	Washable	Washable	Washable
5	State	Semisolid	Semisolid	Semisolid
6	Texture	Smooth	Smooth	Smooth

Discussion: from the above observation, we can conclude that F3 has all the ideal physical characteristics.

10.3 DETERMINATION OF p^H

Table no. 7: Determination of p^H

Sr. no.	Days	BF1	BF2	BF3
1.	Initial days	6.76	7.1	7
2.	7days	6.44	6.9	7.1
3.	15 days	6.34	6.8	6.9

Discussion:-The p^H test was performed for base formulation for 15 days . The p^H of the cream was found to be in the range of 6.9 to 7.1which is good for skin p^H of all formulations of cream were shown p^H nearer to skin required, but p^H formulation.f1, f2, f3 show variation in p^H restored for long period of time formulation f3 shows stable pH.

10.4 DETERMINATION OF VISCOSITY

Table no. 8: Determination of Viscosity

Sr. no.	Days	F1 (CP)	F2(CP)	F3(CP)
1	Initial day	8751	1478	1094
2	7 days	8551	1470	1092
3	15 days	8455	1455	1093

Discussion:-Viscosity tests were performed for formulations for 15 days. From the observation formulation F1 and F2 had slightly high viscosity and it is found that the F3 had appropriate viscosity like cream.

10.5 SPREADABILITY TEST

Table no. 9 : Spreadability Test

Washability Parameters	Formulations		
	F1	F2	F3
Spreadability	24.47 ±0.4	22.35±0.5	26.33±0.3

Discussion: From the above observation, the formulation F3 shows desired spreadability than F1 and F2.

10.6 IRRITANCY TEST

Table No. 10: Irritancy Test

Formulation	Irritant effect	Erythema	Edema
F1	NIL	NIL	NIL
F2	NIL	NIL	NIL
F3	NIL	NIL	NIL

Discussion: All the formulation show no redness, edema, inflammation, and irritation during studies . These formulation are safe to use for skin.

10.7 STABILITY TESTING

Table no. 11: Stability testing

Parameters	Formulations		
	F1	F2	F3
Thermal stability	No oil separation	oil separation	no oil separation

Discussion: From the above observation, the formulation F1 and F3 ha no oil separation but F2 shows oil separation.

10.8 ANTIOXIDANT CAPACITY

Table no. 12: Antioxidant Capacity

PM Assay	Absorbance at 295nm		
	F1	F2	F3
100	0.143±0.01	0.123±0.02	0.362±0.02
200	0.333±0.04	0.314±0.03	0.753±0.05
300	1.234±0.05	0.223±0.03	1.124±0.03

Discussion: From the above observation, the F3 formulation shows good antioxidant capacity in the formulation.

10.9 HOMOGENEITY

Table no. 13: Homogeneity

Sr. No.	Batch	Homogeneity
1	F1	Homogenous
2	F2	Homogenous
3	F3	Homogenous

Discussion: All the formulation produce uniform distribution of extract in lotion.

10.10 DETERMINATION OF SPF

Table no. 14: Determination of SPF

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)	
290	0.015	1.843	0.02764	3.2733	0.49099	2.995	0.0449
295	0.0817	1.448	0.1183	3.4743	0.28385	4.739	0.3872
300	0.2874	0.837	0.2405	0.9246	0.266099	1.735	0.4997
305	0.3278	1.423	0.4665	1.0413	0.34133	2.964	0.9716
310	0.01864	0.872	0.1625	3.1486	0.58689	1.925	0.3588
315	0.0837	1.205	0.1009	2.8856	0.023961	1.975	0.1653
320	0.018	1.294	0.0233	3.0563	0.054946	2.839	0.0511
		TOTAL:- 1.139		TOTAL:- 1.606		TOTAL:- 2.4786	
		SPF :- 11.39		SPF :-16.06		SPF:-24.786	

Discussion: From the above observation and calculation it was found that the formulation F3 had highest SPF than the F1 and F2.

11. DISCUSSION:

The Most apparent acute benefit of currently available sunscreen is the prevention of sunburn from UVR exposure. This effect has been suggested to be both a benefit and a potential and concern. The obvious benefit is the prevention of sun burn that may reduce the risk of non-melanoma and perhaps melanoma skin cancers because severity and frequency of sun burn.

The study attempted to develop herbal sunscreen cream using extract of rosemary and examined their efficacy for preventing sun burn. The purposed UV spectropotometric method is simple, rapid uses low-cost reagent and can be used for in vitro determination of SPF values in many cosmetic formulation. It can perform both during production process, on final product. In recent years, natural compounds or bioactive products have gained

considerable attention as a UV protective agent due to the presumable safe utilizations, ecological issues and minimum side effects besides their antioxidant activity.

Plant extracts, due to containing wide range of phenolic acids, flavonoids and high molecular weight polyphenols usually cover the full range of UV wavelengths. The phytochemical investigation of Rosmarinus officinalis revealed the presence of flavonoids, tannins, phenolics, pytosterols, glycosides, saponins etc. However the phytochemical studies of Solanum lycopersicum revealed the presence of flavonoids, triterpenoids, carotenoids, phenolics etc. The result showed strong-to-moderate absorption of UV radiation along the whole range and this ability may be due to the presence of flavonoids.

12. CONCLUSION:

The study attempted to develop sunscreen lotion using extracts of Rosmarinus officinalis, Curcuma longa and Solanum lycopersicum and examined their efficacy for preventing sunburn. It can be stated that the current study will hopefully lead to improvements in the treatment of sunburns produced by UV radiation exposure.

The study also demonstrates that UV Spectroscopy is the most efficient, acceptable, and repeatable approach for determining the performance of herbal sunscreens. The formulations F1,F2 and F3 were prepared by varying the composition and evaluated for their physical-chemical properties and SPF.

The Study showed that Formulation F3 was found to be more stable with high SPF value, Proving a better sunscreen lotion. The use of sunscreen is an important component to sun protection. Regular and appropriate use is associate with a decreased risk of various skin complication and cancers as result of radiation exposure. In addition patient 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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of information in every aspect.

14. SUMMARY

Promoting sunscreen use is an integral part of prevention programs aimed at reducing UV radiation induced skin damage and skin cancers. Protection against both UVA and UVB advocated. The used spectrophotometric method, to calculate SPF is an inexpensive and easy to apply. 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 between 290-400nm.In this research sunscreen lotion containing ethanolic extract of flower of Rosmarinus officinalisand S. lycopersicum evaluated by UV spectrophotometry.

From the result obtained in the study we can positively conclude that R.officinalis sunscreens have significant UV absorbing property. It will also help in broadening the UV protection ability of the conventional sunscreen formulation. The present work focus on the scientific amount of herbal in cosmetic. Active constituents extracted from herbals have a potent UV shielding effect.

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