IJNRD.ORG ISSN : 2456-4184
INTERNATIONAL JOURNAL OF NOVEL RESEARCH AND DEVELOPMENT (IJNRD) | IJNRD.ORG
An International Open Access, Peer-reviewed, Refereed Journal

REVIEW ON HERBAL SUNSCREEN

Mukunjan Kumar Sah[1*],Meenakshi Kandwal[2],Shivanand M. Patil[3]

[1]Student of B.Pharm IV year,Shree Dev Bhoomi Institute of Education Science and Technology,Poundha,Dehradun,Uttarakhand

[2]Associate Professor, Shree Dev Bhoomi Institute of Education Science and Technology,Poundha,Dehradun,Uttarakhand

[3]Director, Shree Dev Bhoomi Institute of Education Science and Technology,Poundha,Dehradun,Uttarakhand

ABSTRACT

Sunscreen is a chemical that protects your skin from UV rays. Sunburn is caused by UVB radiation, however UVA radiation may be more damaging to the skin. Sunscreens protect the skin from UV radiation through absorption, scattering, and blocking. UV rays are divided by wavelength into three types: UV-A, UV-B, and UV-C. Sunburn is caused by UV-B causing damage to the epidermal layer. The active ingredient in sunscreen agents is a synthetic product that is divided into organic and inorganic filters that are used in the market. The historic use of plants in healing or cosmetics drives research and the creation of new cosmetic trends. This evaluation takes into account all critical characteristics of spices' skill as radioprotective specialists, as well as their future potential. The purpose of this study was to develop a herbal topical sunscreen formulation using different fixed oils and medicinal plants.

Keywords: sunscreen,sunburn,absorption, historic,radioprotective,medicinal plant

1.INTRODUCTION

1.1.Sunscreen :

Sunscreens are those agents which absorbs, scatter or block UV radiation.[1] It controls the deleterious effects like premature aging which can lead to sagging, wrinkling, hyperplasia associated with UV radiation. Sunscreens are available as cream- or foam-based moisturisers, sticks, powders, lotions, sprays, gels, foams, and other topicals. Sunscreen is a common addition to clothing, especially sunglasses, sun hats, special sun protection clothing, and other forms of sun protection.[2]The active ingredients used in Sunscreen preparation are divided into Organic and Inorganic filters based on the mechanism of action and chemical composition.[3]Organic filters absorb the UV radiation while Inorganic filters protect skin by scattering and reflecting UV radiation.[4]This agents are found as over-the-counter products in supermarkets and pharmacies, even it is sold by physicians in USA directly, in Italy by hospitals and in Australia by Cancer charities and Cancer control Organisation.[5]

1.2.Classification :

Sunscreen can be classified into two types sunscreen[6]

- Physical sunscreen;-Those that reflect the sunlight.
- Chemical sunscreen:-Those that absorb the uv light.

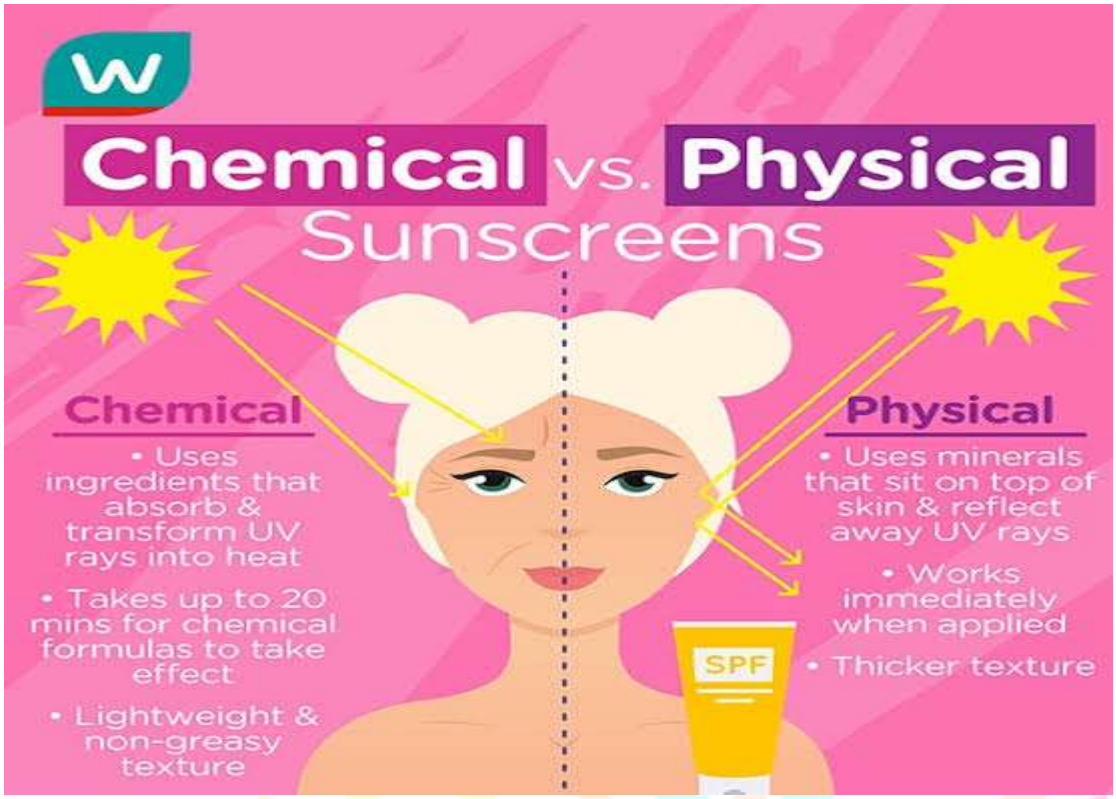

Fig.1: Difference between physical and chemical sunscreen

Classification of sunscreen agents is based on thecomposition and mechanism of action is shown inFigure1. Sunscreen agents works by different method by blocking, reflecting and scattering theUV radiation[7].

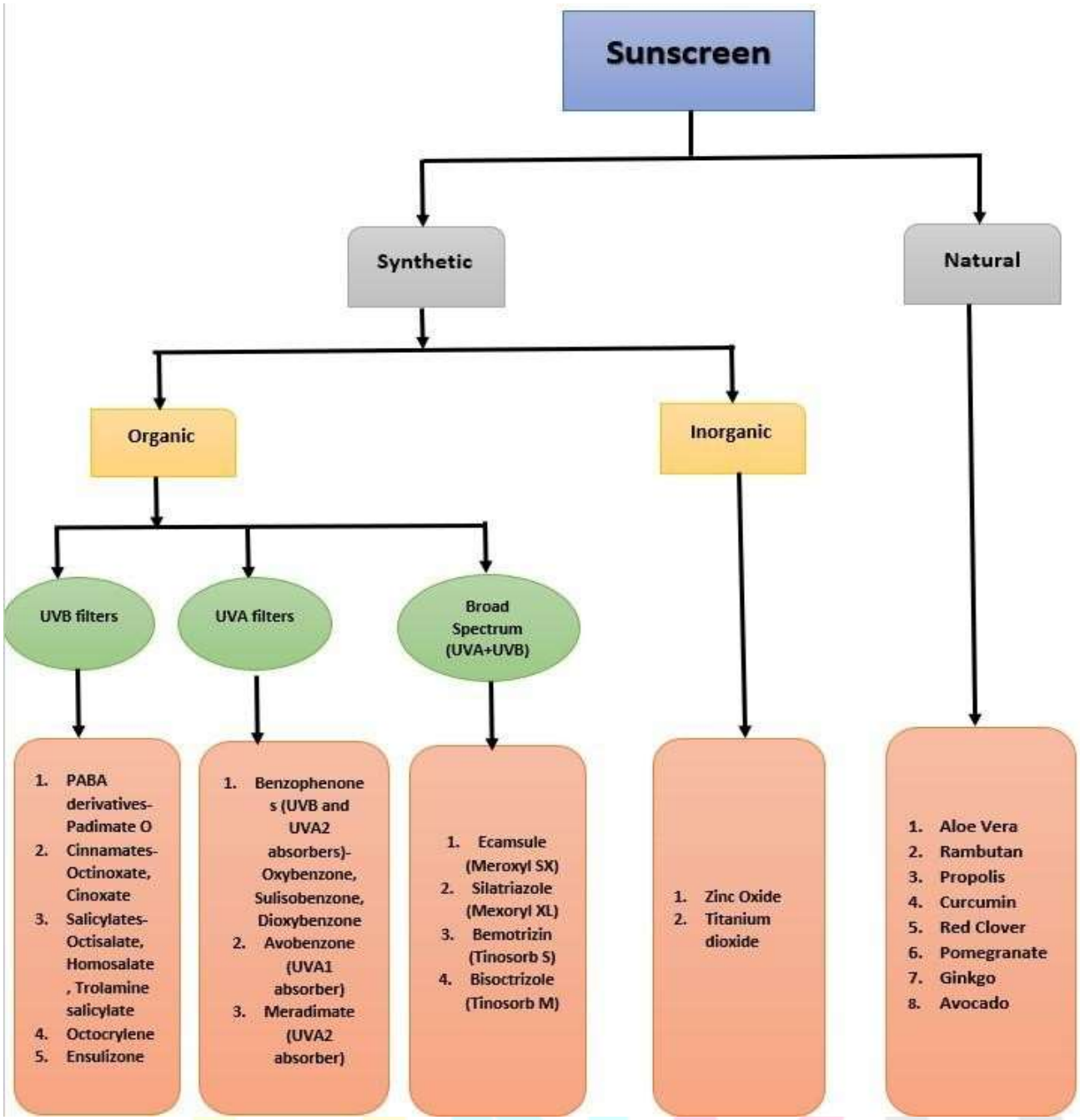

Fig.2:Classification of Sunscreen

1.3.Synthetic Sunscreen:

Synthetic Sunscreen contains Organic and Inorganic filters. Chemical sunscreens are physical blockers that both absorb and absorb high-energy UV radiation while reflecting or scattering low-energy UV rays. Organic chemicals, which are also used in chemical sunscreen, offer protection from a variety of UV light spectrum. By spreading the microparticles of inorganic compound on epidermis which is upper layer of skin increases the optical path of photons which results in absorption of photons in high amount by increasing the Sun Protection Factor (SPF) ultimately increases the efficacy of compound.[8,9,10]

A.Types of Organic filters:

a.Dibenzoylmethane Derivatives: This derivatives contains high absorption capacity in UV-A region but as it decomposes in presence of sunlight irradiation which will decrease the efficiency of sun protection at the time of UV exposure. Photofragmentation of this derivatives occur which will lead to formation of free radicals which will cause skin damage. [11]

b.Benzophenone Derivatives: This derivative absorb or dissipate Ultraviolet radiation mainly UV-A. Matsumoto et al., 2003 reported cytotoxic effects in this derivatives. [12]

c.Para-Aminobenzoic acid (PABA) and its derivatives: This derivative absorbs UV-B radiation. It penetrates into the deeper layer of dermis, which causes it to stay in the skin for a longer period of time. It is soluble in 70% alcohol at a concentration of 2-5%.[13] Photoallergic reactions occur due to PABA. [14]

d.Salicylate Derivatives: This derivatives weak absorbers of UV-B radiation. They are used to minimize the photodegradation of other photoprotectants. [15]

e.Benzotriazoles: Mexoryl SX is a photostable broad spectrum filter having effective sun protection ability. It lessens photoaging and photosensitivity reactions, and Mexoryl SX is a registered brand of L'Oreal. [16]

B.Inorganic filters: Inorganic filter scatter and reflect back UV rays to the external environment. It acts as a physical barrier for UV radiation.Due to its coverage of the whole UV spectrum, this filter is regarded as broad spectrum..common inorganic filter are Titanium dioxide and Zinc oxide. [17]

2. THE HUMAN SKIN

The largest organ of the body is skin which covers15% of the total body mass of an adult.[18] Integument is an outer covering of skin which is derived from the Latin word integere. [19]The skinnot only varies from one individual to other but itvaries because of the geographical location and with respect to colour, texture, thickness of the skin layers and adrenal structures like sweat glands, sebaceous glands, hair follicles.[20]Skinstructure consists of mainly three layers: (a) Epidermis, (b) Dermis, (c) Hypodermis and their functions are different from one another It mainly protects from pathogens, UV light, chemicals and injury because of its structure made up of intricatenetwork which acts as a barrier. It also regulatesthe temperature and amount of water released into the external environment.[21]

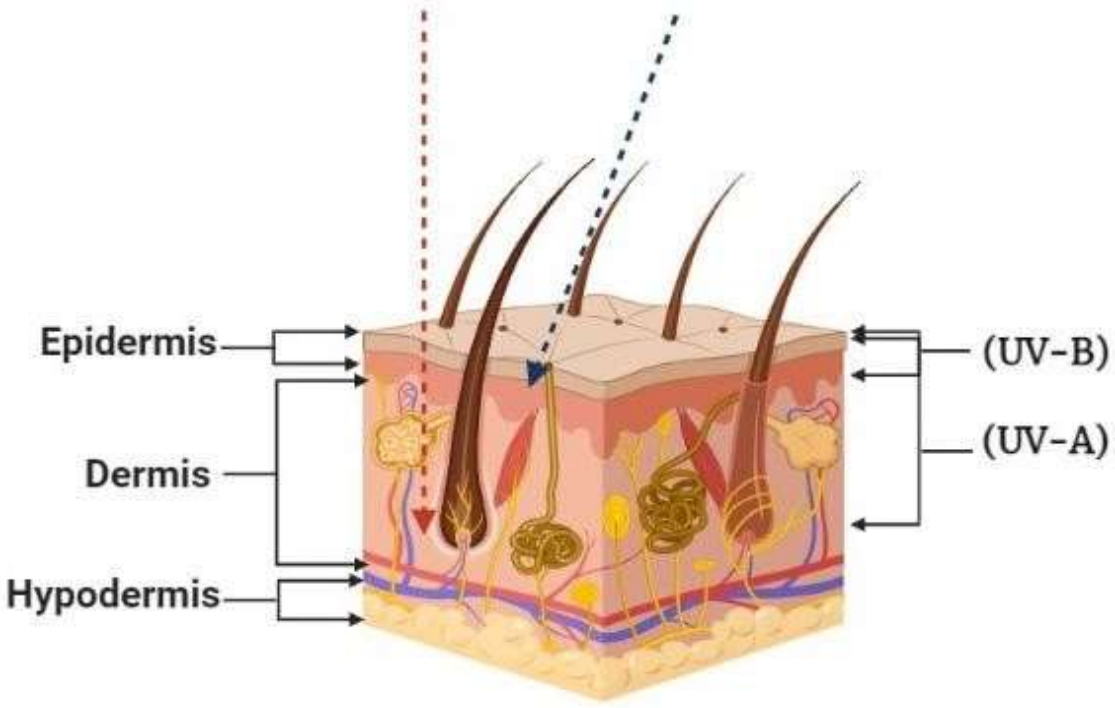

Fig.3:Anatomy of skin layers and showing penetration of UVA and UVB radiation into skin layers

Function of the skin :

- ✓ Storing lipids and water
- ✓ Controlling water loss by preventing water from escaping by evaporationProtecting against pathogens
- ✓ Creating sensation through nerve endings that detect temperature, pressure, touch and injury
- ✓ Providing water resistance
- ✓ protecting the skin's natural nutrients from being rinsed away

3. HERBAL SUNSCREEN[22] :

Herbal Sunscreen (called Herbal sunblock, Herbal suntan salve) is a cream, or other topical item that shields the skin from the sun's bright (UV) radiation, and which lessens burn from the sun and other skin harm, with the objective of bringing down the danger of skin disease with the assistance of herbs. None the less, in the United States, the term suntan salve for the most part implies something contrary to sunscreen, and rather alludes to cream intended to saturate and augment UV introduction and tanning instead of square it. These are ordinarily called indoor tanning moisturizers when intended for use with tanning beds or simply suntan cream whenever intended for open air use and might possibly have SPF insurance in them. The first sunscreen in the world was invented in Austraila by H.A. Milton Blake, in 1932.

3.1.Advantages of Herbal Sunscreen[23]

- Easily available
- No side effects
- No special equipment needed for preparation
- They are inexpensive
- Ingredients are easily available
- Renewable resource
- Be non toxic and non irritant
- Be neutral
- Be stable to heat
- Easy to manufacture

3.2.Disadvantages [24]

- They have a strong flavour and an unpleasant scent that are difficult to mask.
- The manufacturing process takes a long time and is difficult.
- Herbal drug have slow effects as compare to allopathic dosage form it also requires longterm therapy.

3.3Herbal Sunscreen Characteristics[25]

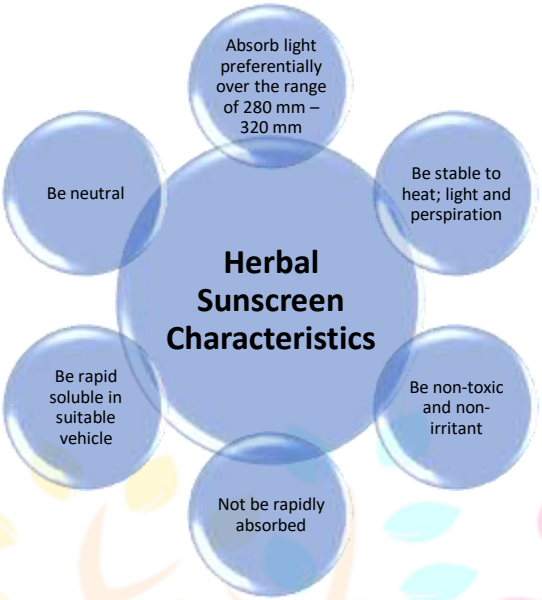

Fig.4: Herbal Sunscreen Characteristics

3.4Benefits of Herbal sunscreen[26]

- ✓ Reduce risk of skin cancer
- ✓ Protect against sunburn
- ✓ Avoid inflammation and redness
- ✓ Avoid blotchy skin and hyper-pigmentation
- ✓ Stop DNA damage
- ✓ Prevent the early onset of wrinkles and fine lines
- ✓ Lower skin cancer risk
- ✓ Shields from harmful UV rays
- ✓ Maintain the brightness of your natural complexion
- ✓ Maintain the look and texture of your skin
- ✓ Delays premature signs of aging
- ✓ Reflects UVA and UVB rays
- ✓ Works immediately when applied on the skin.

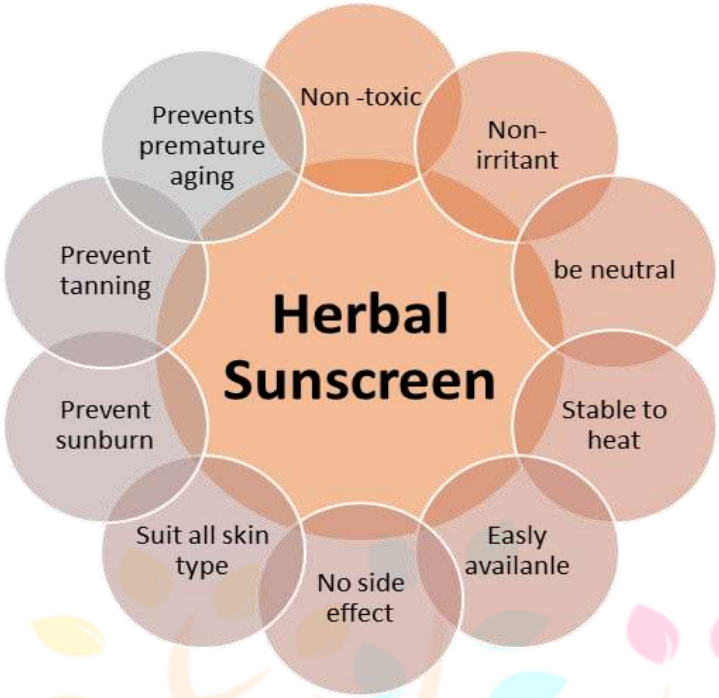

Fig.5: Herbal Sunscreen Benefits

4.What is SPF ?

SPF is a measure of the amount of solar energy required to produce a sunburn on protected skin compared to the amount of solar energy required to produce a sunburn on unprotected skin. As the SPF value increases, the resistance to sunburn increases.[27]

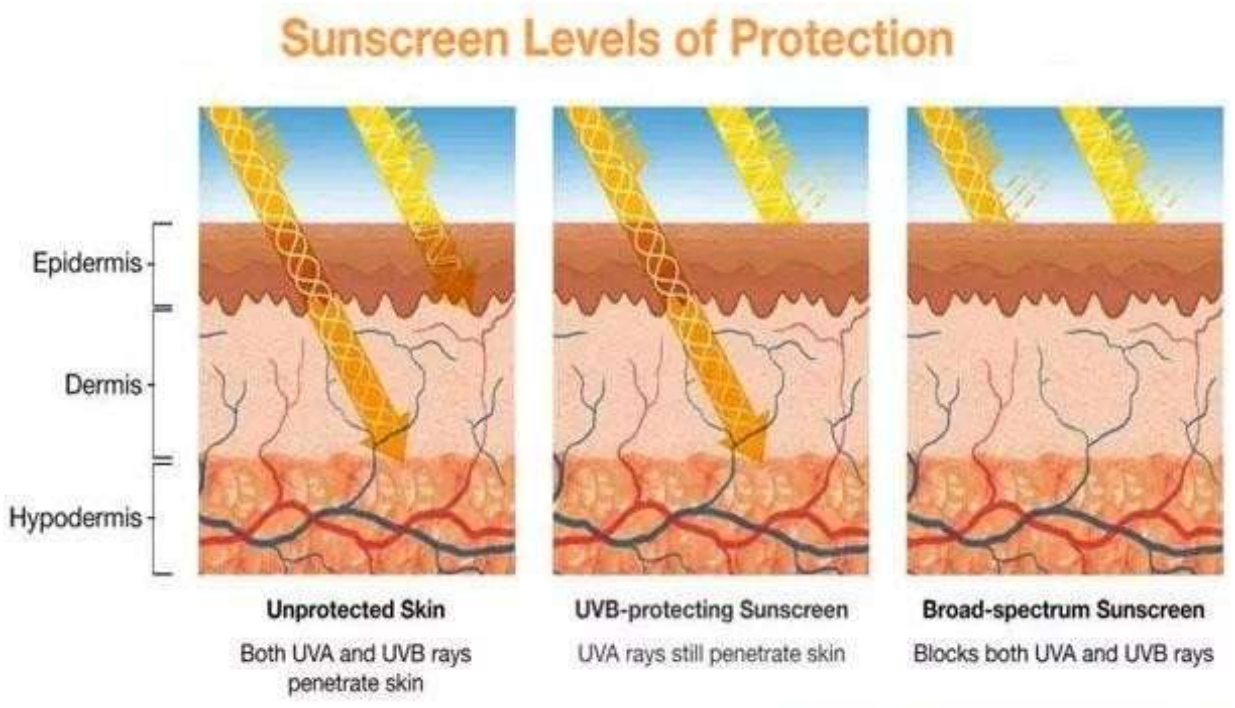

Fig.6: Sunscreen levels of protection.

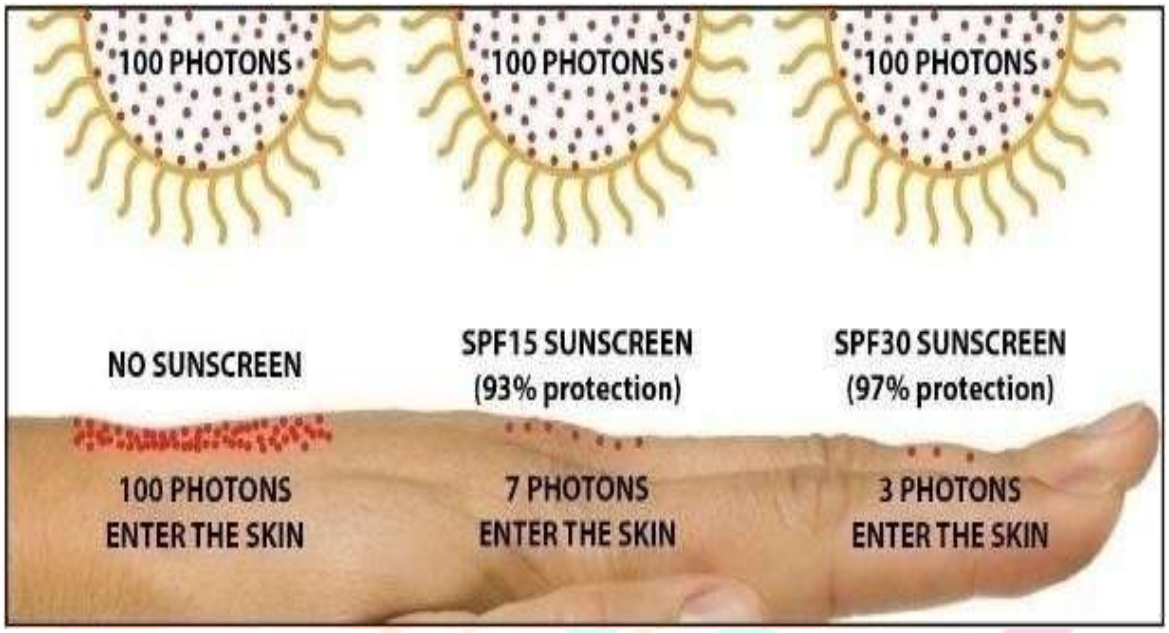

Fig.7: Photons Absorbed per SPF.

5.PLANT HAVING SUNSCREEN ACTIVITY

Table No. 1 : List of some plants and their Phytoconstituents having sunscreen activity[28--34]

PLANT NAME	PLANT PART	TYPE OF COMPOUND	MAJOR CONSTITUENTS	MAIN EFFECT
Fragaria anagassa	Fruits	Anthocyanins Hydrolysable Tannins	Pelargonidin	Antioxidant, Anti inflammatory
Vaccinium myrtillus	Fruits	Polyphenols	n.r	ROS formation stimulated by UV A is Reduced
Punicagranatum	Fruits, peel	Anthocyanidins, Hydrolysable Tannins	Delphinidin Cyanidin Pelargonidin	Synergistic Photoprotective activity in nano-structured lipid carrier
Phyllanthus emblica	Fruit	Polyphenols Flavonoid	Phyllembin VitaminC Minerals Amino acids	Free radical scavenging action against UV radiation penetration
Solanum lycopersicum	Fruit	Carotene	Lycopene Vitamin A, C, E Anthocyanin	Protection against neurodegenerative disease Antioxidant
Culticum reflexum	Leaves	Phenolic compounds Flavanols	Rutin Kaemferol Quercitin	Antioxidant,Freeradical scavenger
Pimenta Psuedocaryophyllus	Leaves	Flavonoids Polyphenols	n.r	Inhibit UV radiation induced inflammation and oxidative stress

Portulaca oleracea	Leaves	Carotenoids Betaxanthins	Omega 3 fatty acid Eicosapentanoic acid	Anti-mutagenic Antioxidant
Glycine max	Seeds	Soy isoflavone	Genistein	Antioxidant, Reduces photodamage and transepidermal water loss
Moringa oleifera	Seeds	Lipid fraction	n.r	UV absorber
Pongamia glabra	Seeds	n.r	Pongamol Karanjin	UV absorber
Vitis vinifera	Seeds	Polyphenols	Flavan 3-ol derivatives Catechin Oligomeric proanthocyanidins	Free radical scavenging effect Reducing oxidative stress and apoptosis

6.MARKETED FORMULATION OF HERBAL SUNSCREEN[35]

Table 2: Marketed formulation of various herbal sunscreen.

Product name	Photo	SPF Reported	Key Ingredient
Mama earth		SPF 50 PA+++	Carrot seed and turmeric
Lotus		SPF 40 PA+++	Birch
Patanjali		SPF 30	Coconut oil Turmeric Aloe vera

Biotique		SPF 50+	Sandalwood honey
Forest Essential		SPF 30	Aloe vera Yashad bhasma Mukta pishti
Kama Ayurveda		SPF 21	Nutmeg Ginger lime
Organic harvest		SPF 60	Olive oil, Tamarind seed extract, and Clay minerals
St. Botanica VitaminC sunscreen		SPF 30 PA+++	Vitamin C, Vitamin E, Borage oil, Lemon peel oil, Licorice extract, and Saffron extract

7.EVALUATION OF HERBAL SUNSCREEN:

i. **P^H of cream**- Firstly pH meter was calibrated using standard buffer. Then take 0.5mg of sunscreen cream in a beaker and add 50ml of distilled water to it, mix well and test the pH of cream using pH meter.

ii. **Viscosity**- viscosity of the cream is evaluated using Brook field viscometer at 100rpm using spindle number 7.

iii. **Dye test**- By using scarlet red dye we perform this test. In this test, add the dye to the cream and mix well, then take a drop of cream and place it on glass slide & cover it with cover slip. Now observe under a microscope, if the dispersed particles show red colour and the ground colourless then this type of emulsion is known as o/w type emulsion. If, the dispersed particles are colourless and the ground is red colour then this emulsion is called as w/o type emulsion.

iv. **Homogeneity**- homogenicity of the cream is evaluated by visual appearance and touch.[36]

v. **Appearance-** It is judged by the colour, roughness and pearlscence of the cream.

vi. **After feel**: The quantity of residue left after applying a certain amount of cream was measured, together with its emolliency and slipperiness.

vii. **Types of smear**- After application on the skin, the type of film or smear formed is observed.

viii. **Removal**- Ease of removal of cream is checked.

ix. **Irritancy test**- Select an area on the skin (dorsal surface of hand is preferred) and apply the specific amount of cream on the selected area and check for irritancy at regular periods for 24 hours.[37]

8. CONCLUSION

It can be concluded that there is great market potential for sunscreen chemicals either synthetic natural in combination due to awareness of protection fromhazardous of Ultraviolet rays damages the skin function in which UV-B affects the upper layer of skin causing Sunburn, to treat this skin disease Sunscreen agents are used. Although the synthetic products used in formulations are beneficial, they also have negative side effects include genotoxicity, cytotoxicity, and endometriosis. To overcome this problem Natural Products are used as a Sunscreen which has minimal side effects and it is efficacious as Synthetic Product. The developing customer familiarity with the risks of the sun has impacted the beautifiers business and the sun care section specifically.

9. REFERENCES

1. Yadav HK, Kasina S, Raizaday A. Sunscreens. InNanobiomaterials in Galenic Formulations and Cosmetics 2016 Jan 1 (pp. 201-230). William Andrew Publishing.

2. Manam D, Kiran V. Role of Nanoscience and Bionanotechnology in Energy, Environment, and Lifesciences. Amelioration of Environment and Biological Sciences with Technology. 2021 Sep 12.

3.Mancebo SE, Hu JY, Wang SQ. Sunscreens: a review of health benefits, regulations, and controversies. Dermatologic clinics. 2014 Jul 1;32(3):427-38.

4. Smijs T, Pavel S. A Case Study: Nano-sized titanium dioxide in sunscreens. InNanoengineering 2015 Jan 1 (pp. 375-423). Elsevier.

5. Diffey BL. Sunscreens: use and misuse. InComprehensive series in photosciences 2001 Jan 1 (Vol. 3, pp. 521-534). Elsevier.

6. DeBuys HV, Levy SB, Murray JC, Madey DL, Pinnell SR. Modern approaches to photoprotection. Dermatologic clinics. 2000 Oct 1;18(4):577-90.

7Diffey BL, Grice J. The influence of sunscreen type on photoprotection. British Journal of Dermatology. 1997 Jul 1;137(1):103-5.

8. Latha MS, Martis J, Shobha V, Shinde RS, Bangera S, Krishnankutty B, Bellary S, Varughese S, Rao P, Kumar BN. Sunscreening agents: a review. The Journal of clinical and aesthetic dermatology. 2013 Jan;6(1):16.

9. Lademann J, Schanzer S, Jacobi U, Schaefer H, Pflu¨ cker F, Driller H, Beck J, Meinke M, Roggan A, Sterry W. Synergy effects between organic and inorganic UV filters in sunscreens. Journal of biomedical optics. 2005 Jan 1;10(1):014008-.

10. Vergou T, Patzelt A, Richter H, Schanzer S, Zastrow L, Golz K, Doucet O, Antoniou C, Sterry W, Lademann J. Transfer of ultraviolet photon energy into fluorescent light in the visible path represents a new and efficient protection mechanism of sunscreens. Journal of Biomedical Optics. 2011 Oct 3;16(10):105001-.

11. Scalia S, Mezzena M. Incorporation in lipid microparticles of the UVA filter, butyl methoxydibenzoylmethane combined with the UVB filter, octocrylene: effect on photostability. AAPS PharmSciTech. 2009 Jun;10:384-90.

12. Suzuki T, Kitamura S, Khota R, Sugihara K, Fujimoto N, Ohta S. Estrogenic and antiandrogenic activities of 17 benzophenone derivatives used as UV stabilizers and sunscreens. Toxicology and applied pharmacology. 2005 Feb 15;203(1):9-17.

13. Bhattacharjee DE, Preethi S, Patil AB, Jain VI. A comparison of natural and synthetic sunscreen agents: a review. International Journal of Pharmaceutical Research. 2021 Jan;13(01):3494-505.

14. Waters AJ, Sandhu DR, Lowe G, Ferguson J. Photocontact allergy to PABA in sunscreens: the need for continued vigilance. Contact Dermatitis. 2009 Mar 1;60(3):172-3.

15. Kullavanijaya P, Lim HW. Photoprotection. Journal of the American Academy of Dermatology. 2005 Jun 1;52(6):937-58.

16. Guenther L, Lynde CW, Zip C. Mexoryl: Broad-spectrum ultraviolet a photoprotection. Journal of Cutaneous Medicine and Surgery. 2006 May;10(3_suppl):S22-5.

17. Geoffrey K, Mwangi AN, Maru SM. Sunscreen products: Rationale for use, formulation development and regulatory considerations. Saudi Pharmaceutical Journal. 2019 Nov 1;27(7):1009-18.

18. Kolarsick PA, Kolarsick MA, Goodwin C. Anatomy and physiology of the skin. Journal of the Dermatology Nurses' Association. 2011 Jul 1;3(4):203-13.

19. Donglikar MM, Deore SL. Development and evaluation of herbal sunscreen. Pharmacognosy Journal. 2017;9(1).

20. Gaboriau HP, Murakami CS. Skin anatomy and flap physiology. Otolaryngologic Clinics of North America. 2001 Jun 1;34(3):555-69.

21. Kumler WD, Daniels TC. Sunscreen compounds. Journal of the American Pharmaceutical Association. 1948 Nov;37(11):474-6.

22. Sahu RK, Roy A, Kushwah P, Khare M, Mudotiya R. Formulation and development of whitening polyherbal face cream. Research Journal of Topical and Cosmetic Sciences. 2012;3(1):23-7.

23. Mishra AK, Mishra A, Chattopadhyay P. Herbal cosmeceuticals for photoprotection from ultraviolet B radiation: a review. Tropical Journal of Pharmaceutical Research. 2011;10(3).

24. Yusuf N, Irby C, Katiyar SK, Elmets CA. Photoprotective effects of green tea polyphenols. Photodermatology, photoimmunology & photomedicine. 2007 Feb;23(1):48-56.

25. Sahu RK, Roy A, Dwivedi J, Jha AK. Promotion and computation of inhibitory effect on tyrosinase activity of herbal cream by incorporating indigenous medicinal plants. Pakistan Journal of Biological Sciences: PJBS. 2014 Jan 1;17(1):146-50.

26. Shahriar M, Akhter S, Hossain MI, Haque MA, Bhuiyan MA. Evaluation of in vitro antioxidant activity of bark extracts of Terminalia arjuna. Journal of Medicinal Plants Research. 2012 Oct 10;6(39):5286-98.

27.Levy SB. How high the SPF? Arch Dermatol. 1995; 131(12):1463-4.

28. Buso P, Radice M, Baldisserotto A, Manfredini S, Vertuani S. Guidelines for the development of herbal-based sunscreen. InHerbal medicine 2017 Dec 20. IntechOpen.

29. Meydan İ, Kizil G, Demir H, Ceken Toptanci B, Kizil M. In vitro DNA damage, protein oxidation protective activity and antioxidant potentials of almond fruit (Amygdalus trichamygdalus) parts (hull and drupe) using soxhlet ethanol extraction. Advances in Traditional Medicine. 2020 Dec;20:571-9.

30. Bhargava V. Medicinal uses and pharmacological properties of Crocus sativus Linn (Saffron). Int J Pharm Pharm Sci. 2011;3(3):22-6.

31. Karakaya S, Yılmaz N. Lycopene content and antioxidant activity of fresh and processed tomatoes and in vitro bioavailability of lycopene. Journal of the Science of Food and Agriculture. 2007 Sep;87(12):2342-7.

32. Maske PP, Lokapure SG, Nimbalkar D, Malavi S, D'souza JI. In vitro determination of sun protection factor and chemical stability of Rosa kordesii extract gel. Journal of Pharmacy Research. 2013 Jun 1;7(6):520-4.

33. Khelker T, Haque N, Agrawal A. Ultraviolet Protection potential of Curcuma longa L. and Citrus sinensis (L.) Osbeck. Research Journal of Pharmacy and Technology. 2017;10(12):4282-4.

34. Svobodová A, Psotová J, Walterová D. Natural phenolics in the prevention of UV-induced skin damage. A review. Biomed Pap Med Fac Univ Palacky Olomouc Czech Repub. 2003 Dec 1;147(2):137-45.

35. Pachpawar NG, Mahajan UN, Kharwade RS. Formulation and evaluation of sun protective topical preparation. Int Res J Pharm. 2018;9(2):27-32.

36. Netto MPharm G, Jose J. Development, characterization, and evaluation of sunscreen cream containing solid lipid nanoparticles of silymarin. Journal of cosmetic dermatology. 2018 Dec;17(6):1073-83.

37. Moloney FJ, Collins S, Murphy GM. Sunscreens: safety, efficacy and appropriate use. American journal of clinical dermatology. 2002 Apr;3:185-91.