Formulation And Evaluation of Poly Herbal Sunscreen

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Abstract- *The present study was designed for the preparation of sunscreen gel with different combination of herbs in it. Herbs like Neem (Azadirachta indica), Aloe vera (Aloe barbadenisis) and Beet root (Beta vulgaris), Cucumber(Khayarain) were added. These plants are well known for their therapeutic values in traditional medicine.*

Hydroalcoholic extraction of the plant parts was performed. Carbopol 940 was used as the gelling agent and the prepared gel was then evaluated for its colour, odour. pH, spreadability, phase separation, etc. UV protective study was also performed by UV- Spectrophotometer at the range of 200- 400nm. The maximum absorption for the gel and the extraction was found between 220- 300nm.

Keywords- Sunscreen gel, Azadirachta indica, Aloe barbadenisis, Beta vulgaris, Cucumber, UV protective study.

I. INTRODUCTION

Cosmetics arise from a greek word kosmeticos which means adorn. These are materials that are intended to beautify or improve the appearance of the skin. in other words cosmetics can be defined as those materials that may be applied to the skin, hair and nails for the purpose of covering, colouring, softening, cleaning, nourishing and protection Sunscreens are used as a protective agent for the skin.

These products prevent the skin from the deleterious effects of sun like sunburns and suntan. When the skin gets exposed to the sun there are both beneficial and harmful effects. When the skin gets exposed to a moderate period of time, it helps in stimulation of the blood circulation and also helps in the formation of haemoglobin. It also helps in the formation of vitamin D by activating 7- dehydrocholesterol. Sunscreen preparations help in providing protection against sunburn.

They also help in absorbing the portion of erythema on the skin caused by radiation energy of the sun, in winter high proportion of UV- radiation are reflected than in summer. The solar septum radiation of the sun is divided into five regions: UVC (from 100mm to 290nm), Ultra UVB (from 290nm to 320nm), UVA (from 320nm to 400nm), visible range or light (from 380nm to 78nm) and infrared (from 780nm to 106nm) Skin is the external barrier of the body both physical and immunological. The main function of the skin is to provide protection from dust, sunburn, microorganism, etc. It also helps in sensory reception, excretion and thermoregulation. The skin consists of three main layers such as epidermis, dermis and sebaceous gland. Epidermis is the outermost layer of the skin which helps from the UV-radiation and it acts as water proof. Various herbal and synthetic formulations are available to block the radiation of the sun and prevent from skin damages. The plant source that is used in this sunscreen gel are neem, beet root, cucumber and aloe vera.

Ideal Properties of Sunscreen Gel

- Inertness, non irritanat
- Photostability and compatibility with other ingredients
- Physical characteristics inclde low viscocity to promote good spreadabillity. Aesthetic appeal
- Small Particle Size Water proof capability.
- Appropriate solubility and non-odorous
- Functional attributes include the ability to afford protection across a wide range of wavelength and limited systemic absorption through the skin to minimize sensitization.
- The products should also be readily available, inexpensive and contaminant free. Sunscreen should absorb a broad range of UV spectrum for protecting the skin from UV rays.
- There should be no chemical breakdown which will result into decrease in efficacy
- It should have suitable properties while formulating with cosmetic base and it should penetrate the skin easily.
- It should not get removed by water For effective
- Sunscreen gel should be capable of absorbing wavelength at the range of 280-320nm They should be stable to withstand heat, light and perspiration

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) Sunscreen protects every skin type.

CLASSIFICATION OF SUNSCREEN AGENT

1) Organic UV Filter
2) Inorganic UV Filter
3) Hybrid Filter
4) Botanical Agents

Sunscreen agents are basically categorized into inorganic and organic UV filters which have specific mechanisms of action upon exposure to sunlight. Inorganic agents reflect and scatter light, while organic blockers absorb high-energy UV radiation. Recently, hybrid materials combining properties of organic and inorganic compounds have attracted the attention of scientists as a promising sunscreen agent. Remarkably, botanical agents, which contain large antioxidant compounds, can be used as inactive ingredients to protect the skin against adverse effects adverse effects.

ORGANIC UV FILTER

Organic blockers are classified into either UVA (anthranilates, dibenzoylmethanes, and benzophenones) or UVB filters (salicylates, cinnamates, paraaminobenzoic acid (PABA) derivatives, and camphor derivative), which play an important role in absorption activity of sunscreen. These agents show outstanding safety and aesthetic properties, including stability. nonirritant, nonvolatile, non-photosensitizing, and non-staining to human skin, compared to inorganic UV filters. Besides, they are mostly used in combination at levels currently allowed by the FDA to provide broad-spectrum absorption, as well as increased SPF values. Never the less, the combination is limited in selecting the appropriate UVA/UVB filters to avoid possible negative interactions between the combining agents. Particularly, some organic filters(e.g., PABA, PABA derivatives, and benzophenones) show considerable negative effects, including eczematous dermatitis, burning sensation, and increased risk of skin cancer. Therefore, sunscreens have recently minimized or avoided the use of these compounds to protect consumers from undesirable effect.

For example, the use of the two most popular organic filters, octinoxate(ethyl hexulmethoxy cinnarnate) and oxybenzone, has recently been restricted in Hawaii because of their negative effect on the coral reefs. Besides, some photo unstable filters (e.g., avobenzone and dibenzoylmethanes) show a number of photoreactive results in the formation of photoproducts that can absorb in different UV regions, therefore reducing their photoprotective efficacy. Particularly, these photodegradation products can come in direct contact with the skin, thus promoting phototoxic, photosensitizing, and photo allergic contact dermatitis on the skin.

INORGANIC UV FILTER

Inorganic blockers have approved to protect human skin from direct contact with sunlight by reflecting or scattering UV radiation over a broad spectra. The current agents are ZnO, TiO2, FexOy, calamine, ichthammol, talc, and red veterinary petrolatum. Although they are generally less toxic, more stable, and safer for human than those of organic ingredients, they are visible due to white pigment residues left on the skin and can stain clothes. Since the early1990s, these metal oxides have been synthesized in the form of micro and nanoscale particles (10-50 nm), which can reduce the reflection of visible light and make them appear transparent throughout the skin, resulting in enhance aesthetics over the larger size. For instance, micro-size TiO2 and ZnO have been replaced nano-size TiO2 and ZnO in sunscreen, eliminating undesired opaqueness and improve SPF value. Moreover, the main disadvantage of utilization of nanoparticles (NPs) is that sunscreens tend to block shorter wavelength from UVAII to UVB rather than long radiation (visible and UVA range). In particular, most NPs can produce ROS radicals and are small enough to penetrate into the stratum corneum, thus causing severe skin e_ects with prolonged exposure, such as photoallergic contact dermatitis and skin aging.

Therefore, in order to improve natural appearance as well as reduce side eect on the skin, these cosmetics using nanoparticles need to be controlled by numerous factors, including particles size and distribution, agglomeration and aggregation, and morphology and structure of the NPs. For examples, the utilization of TiO2 and ZnO NP-coated silicon or doped elements (A1203 and Zr) can minimize ROS production and prevent negative e_ects as mentioned above.

HYBRID UV FILTER (ORGANIC/INORGANIC)

According to the literature, hybrid materials are two half-blended materials intended tocreate desirable functionalities and properties. They are constituted of organic components(molecule or organic polymer) mixed with inorganic components (meal oxides, carbonates, phosphates, chalcogenides, and allied derivatives) at the molecular or nanoscale.

The combination creates ideal materials with a large spectrum and high chemical, electrochemical, optical. transparency, magnetic, and electronic properties Furthermore, some less toxic and biocompatible hybrid materials have been utilized as active ingredients in cosmetics due to their ability to absorb or deliver organic substances into the hair cuticle and skin layers, there by improving skin care e_ect. For instance, L'Oréal and Kerastase have introduced the Intra- CylaneTM shampoo, which contains amino functionalized organosilanes hybrid substances that not only protect against hair damage, but also create hair volume .

BOTANICAL AGENTS

Botanical agents are secondary metabolites produced by living organisms which play a crucial role in the growth and continuity of these organisms. It has been indicated that metabolites possess antioxidant and UV ray absorption abilities. Their featured properties are related to- electron systems, which are mainly found in conjugated bond structures expressed in linear chain molecules and in most of aromatic compounds containing electron resonances. Certainly, there is no denying that UV radiation can generate huge ar ROS radicals, which leads to inflammation, neutrophil infiltrate activates ni 6/31 adenine dinucleotide phosphate (NADPH) oxidase, and sebaceous gland dysfunction. accelerates skin pigmentation and dermal matrix.

In the presence of antioxidants, the ROS radicals are directly scavenged and prevented from their biological targets. As a consequence, the propagation of oxidants is limited, resulting in preventing aging.

MECHANISM OF ACTIONS

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.
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, evenit is sold by physicians in USA directly, in Italy by hospitals and in Australia by Cancer charities and Cancer control Organization.
5) The largest organ of the body is skin which covers 15% of the total body mass of an adult.
6) Integument is an outer covering of skin which is derived from the Latin word integere.
7) The skin not only varies from one individual to other but it varies because of the geographical location and with respect to colour, texture, thickness of the skin layers and adrenal structures like sweat sebaceous glands, hair follicles.
8) Skin structure consists of mainly three layers
   (a) Epidermis
   (b) Dermis
   (c) Hypodermis

their functions are different from one another It mainly protects from pathogens. UV light, chemicals and injury because of its structure made up of intricate network which acts as a barrier. It also regulates the temperature and amount of water released into the external environment.

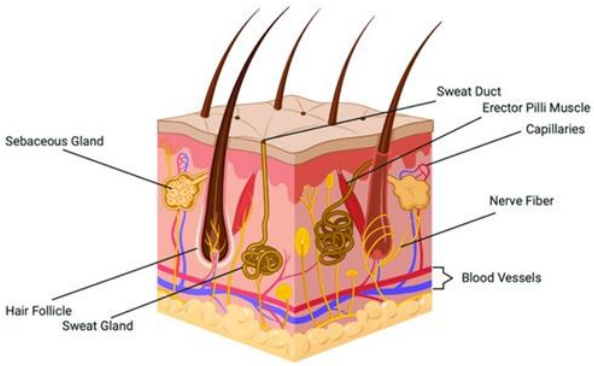
MORANGABAD

9) Sunlight is an electromagnetic radiation of continuous spectrum which is divided into three

   1. Ultra violet
   2. Visible
   3. Infrared

10) Ultraviolet (UV) radiation is further divided into three ranges

a)UV-A(320-400nm)
(b)UV-B(280-320nm)
(c) UV-C (200-280 nm)



Anatomy of skin layers and showing penetration of UVA & UVB radiation through skin :

11) Among which UV-A has highest wavelength and less energy, UV-C has high energy and shorter wavelength while UV-B remains in the mid-range.
12) Around 80-90% of UV-A and 1-10% of UV-B reach the earth's surface while UV-C gets absorbed to earth's atmosphere.
13) UV-A can penetrate to deeper layer of dermis and it can damage DNA by indirect photosensitizing reaction by production of reactive oxygen species. UV-B is reaches to epidermis layer and it is absorbed by DNA which results in molecular rearrangements forming photoproducts like cyclobutene dimers and pyrimidine (6-4) pyrimidine (6-4 photoproducts) as shown in Figure Figure 1 1 and and UV-C gets absorbed to ozone layer of earth's satosphere TRUST HUKANGAR
14) UV exposure is a main reason for age related changes such as development of skin cancer because of skin's anatomic location at external part of body. To overcome this problem Sunscreen Agents are used.

REVIEW OF LITERATURE

Dragana Borjan 2022 :-

Red beetroot is well known for its high proportion of betalains, with great potential as functional food ingredients due to their health-promoting properties.

The objective of this. study was to investigate the influence of processing techniques such as Soxhlet, cold, ultrasound and supercritical fluid extraction on the betalains content and its antioxidant, anti- inflammatory and antihyperglycemic activities

Shradha Sahu, Shashikant Maury, 2021-

The objective of this study was to develop sunscreen cream formulations with high sun protection factor (SPF) and satisfied characteristics. The sun-and-skin interactions have controversial sides. The topical application of sunscreens (and the avoidance of extreme exposure to sun rays) is worldwide recognized as the best strategy to avoid sunburn and oedema.

Radava R. Korać, Kapil M. Khambholja 2011:-

Herbs have been used in medicines and cosmetics from centuries. Their potential to treat different skin diseases, to adorn and improve the skin appearance is well-known. As ultraviolet (UV) radiation can cause sunburns, wrinkles, lower immunity against infections, premature aging, and cancer, there is permanent need for protection from UV radiation and prevention from their side effects. Herbs and herbal preparations have a high potential due to their antioxidant activity, primarily. Antioxidants such as vitamins, flavonoids, and phenolic acids play the main role in fighting against free radical species that are the main cause of numerous negative skin changes.

DRUG PROFILE

1) BEET ROOT

FAMILY: Chenopodiaceae
KINGDOM:- Plant
SYNONYMS:-Beta vulgaris Morphological character :-
Organoleptic Properties:-

1) Shape: Globular
2) External Color :- Radish Purple
3) 3)Size: 8 cm
4) Surface: tuberculated.
5) Texture: No Hair
6) Odour:- Slight
7) Taste: strongly astringent

FIG. BEET ROOT

Biological Activity :

According to research beet contain betalain compound. This compound serves as antidote to free radical, and one of those free radical is an excessive exposure to UV light that can harm skin.

2) Aloe Vera :

TQXONOMY:-
Kingdom: Plant Order: Asparagales
Family: Asphodelaceae Genus:-Aloe
Species: Aloe vera

Fig: Aloe Vera

Biological Activity :

Effects on skin exposure to UV and gamma radiation-

Aloe vera gel has been reported to have a protective effect against damage to skin [62, 63]. Exact role is not known, but following the administration of alove vera gel, an antioxidant protein, metallothionein, is generated in the skin which scavenges hydroxyl radicals and prevents suppression of superoxide dismutase and glutathione peroxidase in the skin. Its reduces the production and release of skin keratinocyte-derived immunosuppresive cytokines such as interlukin-10 and hence prevents UV-induced suppression of delayed type hypersensitivity.

3) Neem

- Synoname: Azadirachta indica;
- Melia Azadirachta; tree
- Taxonomical Classification
- Kingdom: Plantae
- Subkingdom: Tracheobionta
- Division: Magnoliophyta
- Class: Eudicot
- Subclass: Rosidae
- Order: Sapindales
- Family: Meliaceae
- Genus: Azadirachta
- Species: A. indica

Fig : Neem

Biological Activity:-

Neem has antioxidant activity, anti-inflammatory activity as well as would healing activity. The antioxidants and fatty acids found in neem can help restore, and repair, the collagen layer beneath the skin.

CHEMICAL CONSTITUENT :

Leaves contains Nimbin, nimbolinin, nimbidine, sodium nimbinate, ascorbic acid, sitosterol, polyphenollics, flavonoids, triterpenoids, and proline. Nimbidin and Nimbolinine

Biological Activity:-

Neem has antioxidant activity, anti-inflammatory activity as well as would healing activity. The antioxidants and fatty acids found in neem can help restore, and repair, the collagen layer beneath the skin.

4) Cucumber

- Botanical Name: Cucumis sativus Linn.
- Local Name: Hindi- Khir
- Kingdome: Planate
- Division: Angiosperms
- Class: Eudicots.
- Order: Cucurbitales
- Family: Cucurbitaceae
- Subfamily: Cucurbitaceae
- Genus: Cucumis
- Species: C. sativus

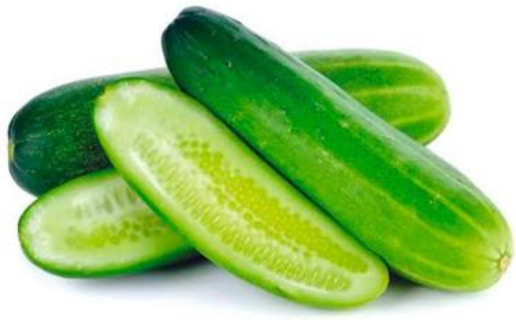


Fig : Cucumber

Biological Activity

Cucumber (Cucumissativus) extract has strongmoisturizing abilities as well as mild astringent effects. It also helps remove dead skin cells and SH tightens skin.Cucumbers soothe skin irritations, prevent waterretention and are rich in water, fiber and beneficialminerals. Cucumber also contains ascorbic acid and caffeic acid, both of which soothe skinirritations. These two acid compounds prevent water retention, which is why cucumbers applied topically are helpful for swollen eyes, burns and dermatitis.

PLAN OF WORK :-

1) Literature review
2) Selection of natural agent and chemical
3) Formulation of Poly-herbal sunscreen.
4) Evaluation of poly-herbal sunscreen
   Organoleptic evaluation
   pH
   Spreadabillity
   Washability
   Viscocity
   Homogeneity
   Consistency
   GrittinessScreening of UV protection activity.
   Swelling index study of topical gel.
5) Result & Discussion
6) Conclusion
7) Reference

MATERIALS AND METHODS

Selection of plant material The specimen for the preparation of sunscreen gel was collected from the medicinal garden and also collected from the local market. These plant material were washed, cleaned.

Extraction method Fresh beet root

The soxhelete extraction method was performed using the soxhlet apparatus in this 30% aqueous methanol,50% aqueous methanol,50% aqueous ethanol and water has been used for this extraction. A total 20g dried powder has been introduced into the tubes and 150 ml solvent are added into the flask. Extraction was carried out in three cycles for approximately 2h. The heating temperature was adjusted to the boiling point of the solvent.

Fig : Extraction of beetroot

Extraction method of aloe vera

Cutting the leaves from an aloe vera plant. Sterilizing said leaves by washing, drying the said leaves then physically removing the rind and aloins from the gel under sterile conditions, and then place the gel extract of aloe vera into the sterile container.

Fig : Extraction of aloe vera

Extraction method of neem

The soxhelete extraction method was performed using the soxhlet apparatus in this 30% aqueous methanol,50% aqueous methanol,50% aqueous ethanol and water has been used for this extraction. A total 20g dried

powder has been introduced into the tubes and 150 ml solvent are added into the flask. Extraction was carried out in three cycles for approximately 2h. The heating temperature was adjusted to the boiling point of the solvent.

Fig : Extraction Of Neem

Extraction method of cucumber :

For isolating the extract from cucumber, cucumbers were properly peeled, washed and chopped finely. The chopped material was then crushed in a grinder and the slurry obtained was passed through the muslin cloth in order to obtain the cucumber extract.

Fig : Extraction Of Cucumber

Preparation of gel :-

To a few ml of water, methyl paraben and propyl paraben were dissolved completely. Carbopol 940 was added to the paraben solution and stirred well using mechanical stir. To this glycerine and triethanolamine were added and stirred.

The extracts were added to the above mixture & stirred continuously until a uniform mixture was obtained Sodium hydroxide was used to adjust the pH between 6.8-7.

Evaluation test for sunscreen activity :- Organoleptic Evaluation

Organoleptic evaluation such as colour has been and appearance is a and odour was evaluated.

Spreadabillity

glass plates were selected. The Igm gel was spread on one side of theslide and the other slide is place on top of it like a sandwich. The slides are fixed allowing the upper slide to slip off. The gel formulation spreads smoothly on a clean even glass plate with minimum pressure without the presence of any solid or gritty particles. The spreadabillity and time required for spread has been calculated by formula ie. SWL/T

Where, S Spreadability L= length of the glass plate. W=Weight tied to upper plate.
T=Time taken for the two plates to get separated.

PH

Ig of the gel was dissolved in 10ml of water and pH was noted using pH meter.

Viscosity

Viscosity of the gel was found out using Brookfield viscometer with L4 spindle type. To accurately measure viscosity 8mg of gel was centrifuged at 10-100rpm at 25°c

Consistency

The consistency of the product was evaluated manually.

Grittiness

The gel was spreaded on the palm to find if any gritty particles are present.

Washability:

Washability: The gel was applied on the hand and was washed by keeping the hand under running water.

Homogeneity

The prepared gel was tested for homogeneity by visual inspection after the gels have been set in the container. They were tested for their appearance and presence of any aggregates.

Screening of UV Protective Activity:

50g of the gel was taken and was dissolved in isopropanol and water at 50:50 ratio. The sample was taken in 1cm quartz cuvettes and was placed in the UV spectrophotometry and the spectrum was recorded from 400-200nm. The same nm was used to find the spectrum of the extracts.

Swelling Index Study of Topical Gel:-

Swelling of the polymer depends on the concentration of the polymer, ionic strength and the presence of water. To determine the swelling index of prepared topical gel, 1 gm of gel was taken on porous aluminum foil and then placed separately in a 50 ml beaker containing 10 ml water. Then samples were removed from beakers at different time intervals and put it on dry place for some time after it reweighed. Swelling index was calculated as follows:

Swelling Index (SW) % = [(Wt-Wo)/Wo] x 100. Where, (SW) % Equilibrium percent swelling, WtWeight of swollen gel after time 1.
Wo Original weight of gel at zero time

FORMULATION OF GEL:

S.N	Ingredient	Quantity
1	Extract of aloe vera	1gm.
2	Extract of neem	1gm
3	Extract of beet root	1gm
4	Extract of cucumber	1gm
5	Carbopol 940	2gm
6	Methyl paraben	1mg
7	Propyl paraben	1mg
8	Triethanolamine	2ml
9	Propylene glycol	2ml
10	Water	40ml

Result And Discussion

S.NO	PARAMETER	OBSERVATION
1	Organoleptic — Colour	Dark pink
	Organoleptic — Odour	Aromatic
2	Spreadabillity	14.48g.cm/sec
3	PH	6.8
4	Viscosity	1692cps
5	Consistency	Good
6	Washability	Easily washable
7	Grittiness	No gritty particles

Screening Of UV Protective Activity :

S.N	Wavelength	E.E *I
1	290	0.015
2	295	0.0817
3	300	0.2874
4	305	0.3278
5	310	0.1864
6	315	0.0839
7	320	0.0180

S.N	Absorbance.λ	C.F	E E*I	SPF
1	0.9752	10	1	9.752
2	0.8002			8.002
3	0.7857			7.857
4	0.7547			7.547
5	0.7382			7.382
6	0.7019			7.019
7	0.6925			6.925

Determination Of Swelling Index :

S.N	Time (hrs)	Weight	% Swelling
1	0	1	0
2	0.5	1.02	2
3	1	1.04	4
4	2	1.03	3
5	3	1.09	9
6	4	1.1	10
7	5	1.07	7
8	6	1.07	7
9	24	1.45	45

II. CONCLUSION

Sunscreen in the UVA range does not have good photostability whereas sunscreen in the range of UVB offers good photostability. Results of our product show that it lies in the UVB range thus confirming UV protective factor. The ingredients used in the gel are easily available and the evaluation parameters performed showed better results. The present study reveals that UV spectrometry is a acceptable, economic, reproducible and rapid method for the evaluation of herbal sunscreen. The formulation was also found to possess significant antioxidant activity which may contribute to its sunscreen activity. In addition to the above mentioned parameters the sunscreen gel was found to have good swelling capacity and homogeneity along with good spreadability and pH in the range of skin. Thus the polyherbal gel can be used topically as a sunscreen preparation.

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