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FORMULATION AND EVALUATION OF HERBAL SUNSCREEN

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1.INTRODUCTION

1.1 SKIN

The skin is the body's largest and primary protective organ, covering its entire external surface and serving as afirst-order physical barrier against the environment. Its functions include temperature regulation and protection against ultraviolet (UV) light, trauma, pathogens, microorganisms, and toxins

STRUCTURE OF SKIN

The skin is primarily made up of three layers. The upper layer is the epidermis, the layer below the epidermis is the dermis, and the third and deepest layer is the subcutaneous tissue.

- The epidermis, the outermost layer of skin, provides a waterproof barrier and contributes to skin tone.
- The dermis, found beneath the epidermis, contains connective tissue, hair follicles, blood vessels, lymphatic vessels, and sweat glands.
- The deeper subcutaneous tissue (hypodermis) is made of fat and connective tissue.

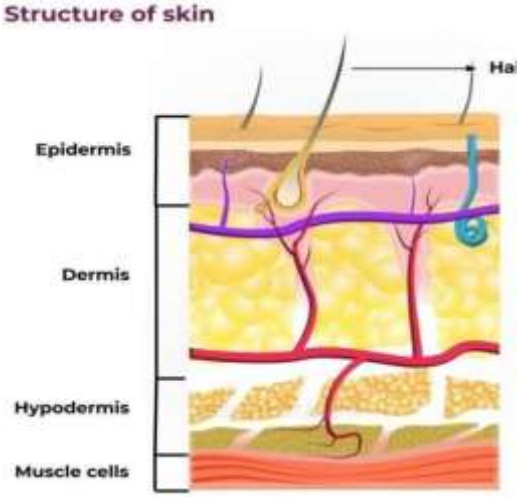

Figure 1: Image Showing Structure Of Skin

FUNCTIONS OF SKIN

1. **EPIDERMIS**

   It's a thin but durable and acts as a protective barrier between your body and the world around you. The primary function of the epidermis is to protect your body by keeping things that might be harmful out and keeping the things your body needs to function properly in.Bacteria, viruses and other infectious agents are kept out, helping prevent infections on your skin. Water and nutrients are kept in for the body to use. Body parts that are more susceptible to injury, like the soles of your feet and palms of your hands, have a thicker epidermis for even better protection.

2. **DERMIS**

   The dermis is a connective tissue layer sandwiched between the epidermis and subcutaneous tissue. The dermis is a fibrous structure composed of collagen, elastic tissue, and other extracellular components that includes vasculature, nerve endings, hair follicles, and glands. The role of the dermis is to support and protect the skin and deeper layers, assist in thermoregulation, and aid in sensation. Fibroblasts are the primary cells within the dermis, but histiocytes, mast cells, and adipocytes also play important roles in maintaining the normal structure and function of the dermis.

3. **HYPODERMIS**

   The hypo dermis allows your skin to move smoothly over the tissues and muscles underneath it. Without the hypo dermis, your skin would rub against those tissues and muscles. It also acts as a shock absorber to protect your organs, muscles and bones from harm.

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4. **MUSCLE CELLS**

Muscle tissue is composed of cells that have the special ability to shorten or contract in order to produce movement of the body parts. The tissue is highly cellular and is well supplied with blood vessels. The cells are long and slender so they are sometimes called muscle fibers, and these are usually arranged in bundles or layers that are surrounded by connective tissue

OVERVIEW OF FUNCTIONS OF SKIN

- Provides a protective barrier against mechanical, thermal and physical injury and hazardous substances.
- Prevents loss of moisture.
- Reduces harmful effects of UV radiation.
- Acts as a sensory organ (touch, detects temperature).
- Helps regulate temperature.
- An immune organ to detect infections etc.
- Production of vitamin D.

1.2ANATOMY OF SUNBURN

Sunburn is a form of radiation burn that affects living tissue, such as skin, that results from an overexposure to ultraviolet (UV) radiation, usually from the sun. Common symptoms in humans and other animals include: red or reddish skin that is hot to the touch or painful, general fatigue, and mild dizziness.

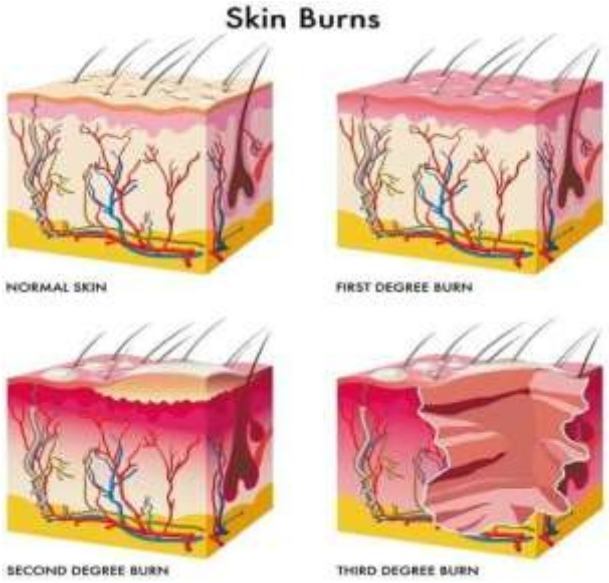

Figure 2: Image Showing Sunburn

1.3 STEPS OF SUNBURN

1. **Melanin Puts up a fight**

When you're exposed to sunlight, the melanin in your skin (pigment molecules that determine your skin color) goes on the defensive and redistributes itself. This protective mechanism isn't available to everyone equally, i.e., fair-skinned blondes. Wherever they can, UVB rays sneak in and cause instant damage to the DNA in the cells in the epidermis, the outermost layer of the skin.

2. **Blood flow ramps up**

The mounting DNA damage gets your body's attention. Blood vessels dilate in the dermis, the layer below the epidermis, to nourish that outermost layer.

3. **The pain of inflammation**

Anywhere from a few hours to 12 hours after the initial sun exposure, the "steamedlobster look," called erythema, sets in. It's the way your body is trying to respond by increasing blood flow to increase the healing, and the area gets red and swollen. The longer the skin "roasts" under the sun without sunblock, the greater and deeper is the extent of DNA damage. Heat damage can also cause first-degree burns. Most of those cells in the epidermis that suffer from DNA and heat damage begin programmed cell death, or apoptosis. But in cells deeper in the skin that can't shed or peel, such as the basal epidermal layer, enzymes repair nearly all the DNA damage. However, if some of the damage isn't repaired and those enzymes accumulate, that can lead to mutations, in turn, causing basal-cell and squamous-cell carcinomas, the two most common forms of skin cancer.

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4. **Like a blister in the sun**

In extreme sunburns, cells in the underlying dermis can be damaged as well, resulting in a second-degree burn and blistering. The body's purpose in blistering is to create a soft, liquid, protective bubble so the damaged dermal tissue underneath can heal. The fluid is made of the clear part of our blood called the plasma, and it collects between the two skin layers. Blisters can begin to rise from the skin anywhere between six and 24 hours after initial UV exposure. Blisters from sunburns are a risk factor for melanoma, the deadliest form of skin cancer.

5. **Peeling and healing**

Your body tries to compensate for all of the destroyed cells in the upper tiers of the epidermis by sending in fresh replacements. In the bottom basal layer, skin cells replicate, then move up the higher layers of skin. These cells usually live about 28 days, slowly reaching the top skin layer before they die, then shed.When sun damage accelerates this natural process, these skin cells don't get the usual time to mature and separate, and instead, stick together like a sheet of tissue. That's what causes peeling and flaking. Once it starts, peeling can last several day, serving as a "gross" reminder of the damage that's been done to your skin.

1.4 HERBAL SUNSCREEN

Now-a-days Herbal extracts are used in the cosmetic preparations for augmenting beauty and also for protective functioning and also for attractiveness.

The traditional system of medicine, evolved over centuries had been responsible for safe guarding healthcare of the world until the advent of allopathic system of medicine. As people around the world later used knowledge of modern biology and chemistry, for both discovery and treatment, but the use and growth of herbal formulations is again increasing due to increasing awareness and backing psychology of the users.

SUNTAN is a major problem arising In people who are coming in direct contact of the sun rays and their skin gets darker in color and also causing sun burn and itching and severe sunburn can lead to cancer, skin cancer.

SUNSCREEN is a substance that helps protect the skin from the sun's harmful rays

HERBAL SUNSCREEN (also known as Herbal Sunblock, Herbal Suntan Lotion) is a lotion, spray or other topical product that helps protect the skin from the sun's ultraviolet (UV) radiations, and which reduces sunburn and other skin damage problems, with the goal of lowering the risk of skin cancer with the help of herbs.

So, basically Sunscreen is a chemical or natural compound that help in protecting you from the UV rays causing Sunburns mainly caused by Ultraviolet B radiation but Ultraviolet A radiations cause more damage to the skin, Sunscreens should ideally block both wavebands. Herbal sunscreen also known as herbal sunblock, herbal suntan lotion is a lotion, spray or other topical product that help protect the skin from the suns UV radiation and which reduce sunburn and other skin damage, Sunscreen can be classified into two types

1. Physical sunscreen
2. Chemical sunscreen

1) PHYSICAL SUNSCREEN

These types of sunscreens contain inert particles that reflect UV rays like a mirror. These have an advantage over chemical sunscreens in that these are inert substances that do not break down over time. These are far less liable to cause skin irritation, since they are in form of insoluble particles that are not absorbed through the skin.

2) CHEMICAL SUNSCREEN

These are synthetic chemical substances with the properties like=

These are powerful absorbers of UV radiations when these products absorb radiation they remain relatively these sun filters are formulated with other compounds in order to obtain highly effective products with protection factors varying from 4 to 30.

Importantly, these are often have to be applied quite frequently.

SPF

SPF is a measure of how much solar energy (UV radiation) is required to produce sunburn on protected skin (i.e., in the presence of sunscreen) relative to the amount of solar energy required to produce sunburn on unprotected skin. As the SPF value increases, sunburn protection increases.

1.5 Mechanism of photoprotection

Sunscreen act by preventing and minimizing the damaging effects of the UV. Scattering and reflection of UV energy from the skin surface mineral based on inorganic sunscreen works on this mechanism they provides coating that blocks sun rays from penetrating through the skin.

Absorption of the uv energy by converting it to heat energy thus reducing its harmful effects and reduce the depth which can penetrate the skin organic sunscreen works on this mechanism.

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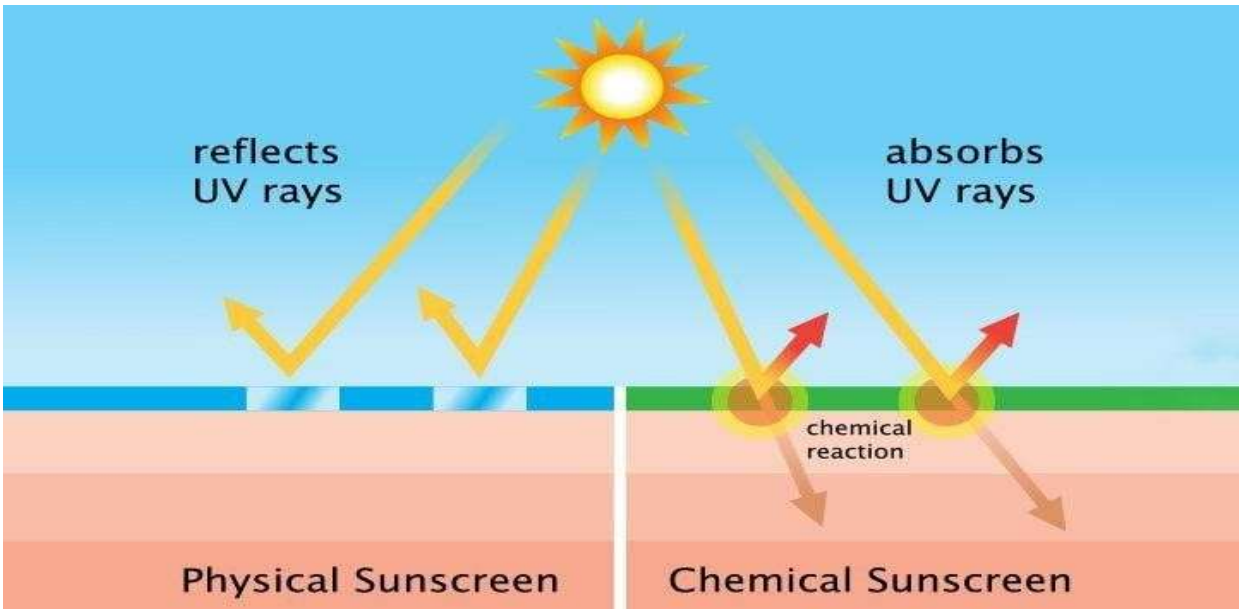

Figure 3: Image Showing Difference Betwen Physical And Chemial Susncreen

2. WORK ENVISAGED

2.1 RATIONALE OF THE STUDY

The aim of the present study was to develop herbal sunscreen that prevents sun burn and skin cancer and reduce the formation of actinic keratosis and also reduce the formation of squamous cell carcinoma and melanoma.
The main aim is to formulate a Herbal Sunscreen based on some fixed oils and some medical plants that have antibacterial and UV protection activity.
Now-a-day, increasing demand of herbal formulation than the synthetic formations due to better safety and less side effects of herbal formulations.
Herbal Sunscreen consists of various types of fixed oils and medicinal plants like Aloe Vera, Rose Water, Neem, Vitamin E, Coconut oil(used mainly as a base).

2.2 OBJECTIVES OF THE STUDY

Herbal sunscreen demand and hype is increasing day by day in UV protection or preventing sunburns, Herbal sunscreens not only provide suitable moisture to the skin but also reduce redness of the skin, heals skin irritation and is suitable for all skin types.

- Natural Goodness of the skin
- Prevents and heals the burns
- Improve skin elasticity
- Reduce redness caused due to dryness or itching
- Improve moisture retention
- Improve skin barrier
- To discuss the use of various herbal ingredients used in the formulation of herbal sunscreen.
- To identify the good combination of herbs for maximum effects.
- To study the formulation and evaluation of herbal sunscreen.

3. PLAN OF WORK

An attempt is made to formulate and evaluate herbal sunscreen from aloe vera, coconut oil, rose water, Neem and vitamin E capsules.

□ **Collection of all required materials** □ **Preparation of herbal sunscreen** □ **Organoleptic evaluation**

1. Color
2. Odour
3. Physical state

□ **Physical evaluation of herbal sunscreen**

The physio-chemical evaluation test was carried out as per standard method

1. pH value
2. Homogenecity
3. Removal

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4. Skin irritation test
5. After feel
6. Type of smear
7. Spreadabilty

4. HERBAL DRUG PROFILE

1. Aloe Vera

Biological source- It is derived from leaf pulp of plant *Aloe barbadensis miller.*
Family- Liliaceac
Part used- Leaves
Geographical location- India, Africa and other arid areas.
Active constituents- Vitamin A, C, E, B12, Lupenol, Salicylic Acid
Uses- Maintains skin moisture, Stops sunburn, Blocks the UVA and UVB rays.

Figure 4: Aloevera

2. Neem

Biological source- Whole plant of *Azadirachta Indica.*
Family- Meliaceae
Part used- Leaves
Geographical location- Mostly found in Assam in India.
Active constituents- Azadirachtin, Nimbin, Nimbolinin
Uses- Antiinflammatory, Anti-pollutant

Figure 5: Neem

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3. Coconut oil
Biological source- Oil is derived from dried fruits of *Cocos nucifera L*
Family- Aceraceae
Part used- Fruit
Geographical location- Southern India
Active constituents- Fatty acid, capric acid, lauric acid.
Uses- keeps the skin smooth, Prevents premature ageing of the skin, Provides moisture to the skin.

Figure 6: Coconut Oil

4. Rose water
Biological source- Sepals and petals of plant *RosaDamascena.*
Family- Rosaceae
Part Used- Rose petals
Geographical Location- Asia, North America, Europe and Northwest Africa.
Active Constituents- Vitamin B, beta-damascone, beta-damascenone
Uses- Increase effectiveness of SPF, Lightens the skin pigmentation, Removes oil and dirt from the skin.

Figure 7: Rose Water

5. Vitamin E capsules
Source- Market
Part used- Capsule's inside part
Active Constituents- Vitamin E
Uses- Provides extra protection against acute UVB damage and protect against cell mutation caused by sun and pollution exposure also it helps to cleanse the skin.

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Figure 8: Vitamin E Capsules

6. Beeswax

Biological source- Produce in the bee's hive by honeybees, *Apis mellifera*
Family- Apidae **Part used-** Wax
Active constituents- Myricin, myricyl alcohal
Uses- Provide a suitable solid base and also gives sunscreen a waterproofing power.

Figure 9: Bees Wax

5. MATERIAL AND METHOD

Collection of plant part

For the preparation of herbal sunscreen, various plant materials were collected e.gAloe Vera, Rose Water, Neem, Vitamin E capsules, Coconut oil.

Processing of herbs

Neem leaves were air dried under shade and were converted into powder with the help of mortar and pestle. The dried powder was packed in an air tight container.

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Figure 10: Showing Dried Neem Leaves

Figure 11: Powder Form Of Neem Leaves

Extraction of herbs

- Extraction of leaves of plant Neem, was done by decoction method.
- 50 gm of Neem leaf powder was mixed with 500 ml of distilled water and boiled for about 30 min. The boiled solution was filtered using Whatman No. 1 filter paper and clear aqueous leaf extract was obtained.

Figure 12: Showing Neem Extract

Formulation of Cream Base

A simple cream base was formed using Beeswax and white soft paraffin for the incorporation of herbal ingredients.

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Formulation of Herbal Sunscreen

- All the dried and fresh herbs were weighed accurately.
- Then the Freshly extracted Neem extract was mixed with the Aloe Vera Gel.
- Then this aqueous mixture was added to the prepared oil base having coconut oil, bees wax and glycerin.
- Then Rose water was added in the above mixture.
- All the ingredients were mixed using Spatula and then Vitamin E was mixed and placed aside.

Figure 13: Formulated Herbal Sunscreen

Table No. 1- Herbal Sunscreen Formualtion

Sr. No.	Ingredients	Quantity used (per 25 gm)
1	Aloe vera	5gm
2	Neem	2gm
3	Rose water	2.3ml
4	Coconut oil	2ml
5	Vitamin E	2gm
6	Beeswax	3.2gm
7	Glycerin	1ml
8	White soft Paraffin	9 ml

Evaulation of Herbal Sunscreen

The formulated herbal sunscreen was evaluated by organoleptic evaluation and physical evaluation.

1.Organoleptic Property

Colour, Skin irritation, odour, physical state, solubility were determined manually.

2.Physical evaluation

The physiochemical evaluation was carried out with respect to pH value, homogeneity, Removal, Skin irritation test, After Feel, Type of smear, Spreadabilty were carried out as per standard methods.

A. pH value pH value of the herbal sunscreen was determined using pH meter.

B. Homogeneity

Homogeneity was measured by pressing a small quantity of formulated herbal sunscreen between the thumb and the index finger.

C. Removal

Removal test generally refers to how easy the formulated sunscreen can be removed from the skin, sunscreen cream was applied on the skin and washed the applied part with tap water

D. Skin irritation test

Applied to the skin and exposed to the sunlight for 5 minutes to check for any skin irritation.

E. After Feel

After feel test basically includes, if the formulated herbal sunscreen feels heavy or light after application on the skin. Emolliency, slipperiness, and amount of residue left after the application of fixed amount of cream was checked.

F.Type of Smear

After application of sunscreen, the type of film or smear formed on the skin were checked.

G. Spreadabilty

The formulated sunscreen's Spreadabilty was check, an ideal cream should spread easily without too much drag and should not produce greater friction in the rubbing process.

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6. RESULT

Herbal sunscreen is one of the most well known and trust able product for skin care. Herbal sunscreen not only protect the skin from harmful UV radiations from sun and environment but also provide nourishment to the skin. It provides numerous vitamins and and nutrients required to the skin for proper functioning and also provide moisturizing effects. The herbal sunscreen was prepared from the ingredients mentioned above and was subjected to many Organoleptic and Physical evaluations to ensure safety of the formulation. The evaluation parameters were Color, Odour, Skin Irritation, pH value, Removal , physical state, homogeneity, After feel, Spreadabilty etc.

Preparation of Herbal Sunscreen

The herbal sunscreen was prepared using the formula given below-

Table No.2- Herbal Sunscreen Formulation

Sr. No.	Ingredients	Quantity used (every 25gm contains)
1	Aloe vera	5gm
2	Neem	2gm
3	Rose Water	2.3ml
4	Coconut Oil	2ml
5	Vitamin E	2gm
6	Beeswax	3.2gm
7	Glycerin	1ml
8	White Soft Paraffin	9ml

Evaluation of Herbal Sunscreen

1.Organoleptic evaluation-

Different parameters were studied such as- color, odour, physical state, solubility-

Table No. 3- Organoleptic Evaluation

Sr. No.	Test	Result
1.	Colour	White
2.	Physical State	Semisolid with mild greasy nature
3.	Odour	Characteristic
4.	Solubility	Soluble in non-polar solvent

2.Physical Evaluation

The physiochemical evaluation was carried out with respect to pH value, homogeneity, Removal, Skin irritation test, After Feel, Type of smear, Spreadabilty

Table No.4- Evaluation Tests Of Herbal Sunscreen

Sr. No.	Evaluation Test	Result
1.	pH value	6.5
2.	Homogenity	Even surface, smooth hand feel
3.	Removal	2-3 splashes of water with rubbing
4.	Skin Irritation	No irritation was felt
5.	After feel	Slight slippery
6.	Type of smear	Transparent
7.	Spreadabilty	Easily spreadable

CONCLUSION

Overall the formulated herbal sunscreen provides protection to the skin from the harmful UV rays and also many more skin benefits which enhance the skin naturally.

Coconut oil and vitamin E also provides some extra benefits to the skin.

The finished product passes all the evaluation tests.

In conclusion, Herbal sunscreen is beneficial to protect skin from problems like sunburn and skin cancer.

Herbal sunscreen is an alternative source from hazardous chemical products.

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