**FORMULATION AND EVALUATION OF HERBAL SUNSCREEN LOTION FROM LIQUORICE ROOT EXTRACT**

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**Abstract:**

Cosmetics are defined as “The items with mild action on human body for the purpose of cleaning, beautifying, adding to the attractiveness, altering the appearance, or keeping or promoting the skin or hair in good condition” while functional cosmetics even after falling the cosmetics definition are designated as “Items fulfilling specific conditions like skin whitening, minimizing the appearance of lines in the face and body, protecting from the sun and sun tanning.” Sunscreens are those agents which absorbs, scatter or block UV radiation. It controls the deleterious effects like premature aging which can lead to sagging, wrinkling, hyperplasia associated with UV radiation. The use of sunscreen as photo protecting agents for UV protection is becoming very popular. A sunscreen preparation is defined as a formulation which, when applied topically, protects the treated area from sunburn. Sunscreens are used to aid the body’s natural defense mechanisms to protect against harmful UV radiation from the sun. Sunscreen Agents protect the skin from Ultraviolet (UV) rays by absorption, scattering and by blocking phenomena. Ultraviolet (UV) rays are divided into three wavelengths UV-A, UV-B and UV-C in which UV-B causes sunburn by affecting the epidermis layer. Active Ingredient of Sunscreen Agents is Synthetic Product which is divided into Organic and Inorganic filters which is used in market. Organic filters have subtypes among which Benzophenone and PABA derivative have some serious side effects, to overcome these deleterious effects. Natural Sunscreen came into existence. Natural products are efficacious as Sunscreen same as that of the product which is present in the market.

**KEYWORDS:** Sunscreen, Herbal, Liquorice, Leguminosae, UV Radiation, Glycyrrhiza glabra etc.

**INTRODUCTION:**

Sunscreens are those agents which absorbs, scatter or block UV radiation. It controls the deleterious effects like premature aging which can lead to sagging, wrinkling, hyperplasia associated with UV radiation. The use of sunscreen as photo protecting agents for UV protection is becoming very popular. A sunscreen preparation is defined as a formulation which, when applied topically, protects the treated area from sunburn. Sunscreens are used to aid the body’s natural defense mechanisms to protect against harmful UV radiation from the sun. The largest organ of the body is skin which covers 15% of the total body mass of an adult. The skin not only varies from one individual to other but it varies because of the geographical location and with respect to color, texture, thickness of the skin layers and adrenal structures like sweat glands, sebaceous glands, hair follicles.

**Structure of skin 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. Herbal sun blocker (also referred to as sunscreen, herbal suntan lotion) may be a lotion, spray or alternative topical product that helps shield the skin from the sun’s ultraviolet (UV) radiation, and that reduces sunburn and alternative skin damage, with the goal of lowering the chance of carcinoma with the assistance of herbs. However, within the use, the term suntan lotion sometimes means that the alternative of sun blocker, and instead refers to lotion designed to wash and maximize actinic ray exposure and tanning instead of blocking it. Cosmetics are defined as “The items with mild action on human body for the purpose of cleaning, beautifying, adding to the attractiveness, altering the appearance, or keeping or promoting the skin or hair in good condition” while functional cosmetics even after falling the cosmetics definition are designated as “Items fulfilling specific conditions like skin whitening, minimizing the appearance of lines in the face and body, protecting from the sun and sun tanning.”

**Classification of Sunscreen**

1. Physical Sunscreen

2. Chemical Sunscreen

**Physical sunscreen**

Physical sunscreen contains inert mineral particles that reflect UV rays like a mirror. The most common type used is ultra fine titanium dioxide (TiO²), made up of minute particles only 20- 30 mm³ in size. These products have advantages over chemical sunscreens in that they are inert substances that do not break down over time. They are far less liable to cause skin irritation, since they are in the form of insoluble particles that are not absorbed through the skin. Because of the small size of the particles, modern physical sunscreens reflect radiation in the UVB and short UVA regions better than earlier products. These products have blessings over chemical sunscreens there in their inert substances that don't break down over time. They are way less at risk of cause skin irritation, since they're within the kind of insoluble particles that don't seem to be absorbed through the skin. Owing to the little size of the particles, trendy physical sunscreens replicate radiation within the UVB and short UVA regions higher than earlier product. The SPF will be measured by applying emollient to the skin of a volunteer and measurement however long it takes before sunburn happens once exposed to a man-made daylight source. In the US, such Associate in nursing in vivo take a look at is needed by the FDA.

**Chemical Sunscreen**

Those that absorb the UV light Sunscreen agents are for external use only. The use of sunscreen as photo protecting agents for UV protection. The sunscreen formulations which when applied topically protect the treated area from sunburn sunscreen depends on ability to protect against UV induced sunburn and their chemo preventive activity. Excessive solar ultraviolet radiation is responsible for various skin damages such as sunburn, skin pigmentation premature aging and photo carcinogenesis. The main mechanism of skin damage by UV radiations is formation of Reactive Oxygen Species (ROS) that interact with proteins lipids and subsequently alter them. UVB and to a lesser extent UVA are responsible for inducing skin damages. Sunscreen should contain antioxidant agent in addition to sunblock agent to be effective in prevention of photoaging and skin cancer. Plants due to their antioxidant potential are known as attractive option to be used in Sunscreen formulation for prevention of skin damage due to solar radiation. Sunscreen is topical product that protects the skin against harmful effects of the sun.

**Classification of UV Radiation (UVR)**

Ultraviolet radiation (UVR) is part of the spectrum of electromagnetic radiation emitted by the Sun. UVR is defined as that portion of the electromagnetic spectrum between X rays and visible light, i.e., between 30–3 eV. The Sun is our primary natural source of UV radiation. Current research indicates that exposure to UV rays damages the body’s largest organ, the skin.

**UVA Radiation:** UVA radiation exposure has an initial pigment darkening effect (tanning) followed by erythema if the exposure is excessive. Atmospheric ozone absorbs very little of this part of the UV spectrum. UVA is needed by humans for the synthesis of vitamin D; however, overexposure to UVA has been associated with toughening of the skin, suppression of the immune system and cataract formation. UVA light is often called black light. Out of these three rays, only UVA and UVB types are directly harmful to our skin, damaging its surface and inner structure when in prolonged Sun exposure condition.

**UVB Radiation:** UVB radiation is typically the most destructive form of UV radiation because it has enough energy to cause photochemical damage to cellular DNA, yet not enough to be completely absorbed by the atmosphere. UVB is needed by humans for the synthesis of vitamin D; however, harmful effects can include erythema (sunburn), cataracts, and development of skin cancer.

**UVC Radiation:** UVC radiation is almost never observed in nature because it isabsorbed completely in the atmosphere, as are Far UV and Vacuum UV. Germicidal lamps are designed to emit UVC radiation because of its ability to kill bacteria. In humans, UVC is absorbed in the outer dead layers of the epidermis. Accidental overexposure to UVC can cause corneal burns, commonly termed welders’ flash and snow blindness, a severe sunburn to the face. The UVC injury usually clears up in a day or two, but it can be extremely painful.

**What is SPF?**

SPF stands for Sun Protection issue and is that the system used worldwide to work out what quantity protection a emollient provides, applied to the skin at a thickness of two mg/cm. The take a look at works out what quantity ultraviolet illumination radiation (mostly UVB) it takes to cause barely detectable sunburn on a given person with and while not emollient applied. As an example, if it takes ten minutes to burn while not a emollient and a hundred minutes to burn with a emollient, then the SPF of that sunscreen is ten (100/10). An emollient with a SPF of fifteen provides >93% protection against UVB. Protection against UVB is enhanced to ninetyseven with SPF of 30+. The distinction between a SPF fifteen and a SPF thirty emollient might not have a clear distinction in actual use because the effectiveness of a emollient has a lot of to try to to with what quantity of it’s applied, however typically it’s applied, whether the person is sweating heavily or being exposed to water. Therefore a emollient with SPF 15+ ought to give adequate protection as long because it is getting used properly

**Advantages of herbal sunscreen**

1. Easily available.
2. Do not provoke allergy.
3. Easy to manufacture.
4. Cheap in cost.
5. Effective with small quantity.
6. No side effect.
7. No special equipment needed for preparation.
8. Renewable resources.
9. Botanical ingredients are easily available.
10. They are inexpensive
11. Ingredients are easily available
12. Non-toxic and non-irritant
13. Be neutral
14. Be stable to heat
15. Easy to manufacture

**AN IDEAL HERBAL SUNSCREEN AGENT SHOULD HAVE FOLLOWING CHARACTERISTICS**

1. Absorb light preferentially over the range of 280mm – 320mm
2. Be stable to heat;’ light and perspiration
3. Be non-toxic, non-irritant and non-sensitizing
4. 4.Not be rapidly absorbed
5. Be rapid soluble in suitable vehicle
6. Be neutral
7. Must absorb a broad range of UV rays causing sunburn
8. Must be stable in the presence of sunlight
9. Should be able to provide complete protection for skin
10. Should not be easily washed away with water
11. Should be safe, effective, chemically inert at low concentration
12. Should not cause irritation, sensitization and toxicity
13. Capable of retaining Sunscreening property for several hours
14. Resistance to water
15. Preferably odorless, if mild odor, accepted by user.
16. Capable of retaining sunscreening property for several hours.

**MATERIAL AND METHODS:**

**MATERIALS:**

**Table 1: List of Materials**

|  |  |  |  |
| --- | --- | --- | --- |
| **Sr. No.** | **Ingredient** | **Source** | **Role** |
| 1. | Glycyrrhizin | Glycyrrhiza glabra root extract | Active Ingredient |
| 2. | Aloe Vera gel | Aloe barbadensis | Moisturizer |
| 3. | Bees Wax | Honey comb | Emulsifier |
| 4. | Rose Water | Dabur Gulabari (marketed) | Fragrance |
| 5. | Glycerine | Nimson(marketed) | Humectant |
| 6. | Distilled Water | - | Vehicle |

**PLANT PROFILE:**

Licorice, having scientific name Glycyrrhiza is of Greek origin which means “sweet wood”. Glycyrrhiza glabra is one of the most popular medicinal plants belonging to the Fabaceae family (also known as Leguminosae). Commonly, G. glabra root is employed to prepare a tea that is an excellent thirst quencher. The dried root has been described as a tooth cleanser. From the beginning of human civilization, humans used plants for food, shelter, and treatment. Before the invention of modern medicine and the unprecedented advancement of science and technology, people entirely relied on certain plants with medicinal value. The use of liquorice predates the Greek and Roman empires, having a long history of traditional medicines and folk remedies.Using licorice can be dated back to several thousand years ago. It was widely used for gastritis, peptic ulcers, respiratory infections, tremor, etc.Glycyrrhizinic acids (a flavonoid) derived from licorice have anti Helicobacter Pylori effect. Other proven effects of this plant are anti-Mutagenic, antioxidant, reducing cortisol and aldosterone effects as well as inhibition of thrombin and increasing bile .Although licorice can reduce diabetes symptoms such as polydipsia and frequent urination, but cannot reduce blood glucose.This review focuses on amalgamating experimentally isolated bioactive compounds from Glycyrrhiza glabra, their pharmacological role in combating different physiological ailments, and the potential promise of Glycyrrhiza glabra as a promising pharmaceutical product.

**Taxonomy of *Glycyrrhiza glabra-***

* Kingdom – Plantae
* Division – Angiospermae
* Class – Dicityledoneae
* Order – Rosales
* Family – Leguminosae
* Genus – Glycyrrhiza
* Species – glabra.Linn



**Fig. 1 : Liquorice shrub**



**Fig. 2 : Roots of *Glycyrrhiza glabra***

**EXCIPIENT PROFILE:**

**ALOE VERA GEL:**



**Fig. 3: Aloe vera gel**

**USES:**

* Soothes sunburn
* Moisturize the skin
* Reduces infection and acne
* Anti-aging
* Boosts healing of wounds

**BEES WAX:**

Top of Form

Beeswax is a natural wax produced by honey bees of the genus Apis. The wax is formed into scales by eight wax-producing glands in the abdominal segments of worker bees, which discard it in or at the hive.

**USES:**

* Humectant
* Emollient
* Emulsifier, Occlusive



**Fig. 4: Bees Wax**

**ROSE WATER:**

**USES:**

* Tightens the skin
* Anti-aging
* Provide hydration
* Pleasant fragrance



**Fig. 5: Rose water**

**GLYCERINE:**

**USES:**

* Lubricant
* Provides smoothness
* Act as a humectant



**Fig. 6: Glycerine**

**DISTILLED WATER:** As a vehicle to make-up the final volume of formulation.

**PHYTOCHEMICAL INVESTIGATION:**

**Table 2: Phytochemical investigation test of Glycyrrhiza glabra**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Sr. No** | **Test** | **Procedure** | **Inference (Indicating**  **Positive Test)** | **Reference** |
| 1. | **Test for alkaloid** | Extracts are treated with dilute Hydrochloric (HCL) acid and filtered. |  |  |
|  | Mayer’s test | Filtrates + few drops of Mayer’s reagent (Potassium Mercuric Iodide). | Presence of brownish / reddish ppt indicates presence of alkaloid. | [51] |
|  | Dragendroff’s test | Filtrates + Dragendroff’s reagent (solution of Potassium Bismuth Iodide | Presence of red color ppt indicate presence of alkaloid | [51] |
|  | Wagner’s test | Filtrates + few drops of Wagner’s reagent | Presences of brownish / reddish ppt indicate positive results for alkaloid. | [52] |
|  | Hager’s test | Filtrates + Hager’s reagent (saturated picric acid solution). | Formation of yellow color ppt | [51] |
| 2. | **Test for glycosides** | Extracts are hydrolyzed with dil. HCl, and then used for  detection of glycosides |  | [51] |
|  | Modified Borntrager’s Test | Extract + ferric chloride solution boil for 5min, cooled and add equal volume of benzene + benzene layer is separated which is further treated with ammonia solution. | Presence of rose-pink colour in ammoniacal layer indicate positive test. | [53] |
|  | Lugal’s Test | Extracts + sodium nitroprusside in pyridine + 10% sodium hydroxide. | Initial pink color converted in to blood red color indicates the presence of cardiac glycosides. | [54] |

**Collection and Authentication of selected herbal drug:**

I have collected the fresh roots of *Glycyrrhiza glabra* available in local market. The selected herbal drug *Glycyrrhiza glabra* belonging to family Leguminosae was carefully examined and botanically identified, authenticated by Dr. Sayyad I.G. ( Head, Department of Botony, SAJVPM`s S.K. Gandhi College, Kada, Tal. Ashti, Dist. Beed, MH, India-414202.

. **Fig. 7: Powdered roots of Glycyrrhiza glabra**

**METHODOLOGY:**

1. First, I have bought fresh roots of *Glycyrrhiza glabra* available in market.
2. Then cleaned these roots and allowed to dry at shade for about 3-4 days.
3. After drying roots were powdered as a coarse powder.
4. Then extraction of active constituent i.e. *Glycyrrhinitic Acid* was performed by using suitable extraction method known as Maceration.

**Extraction:**

Extraction is the separation of medicinally active component from its parent source using a selective solvent by using suitable standard procedure. A lot of extraction methods have been employed to extract glycyrrhizin from liquorice which includes:

•Analytical •Solvent based (dipping/percolation/ maceration) •Soxhlet, etc.

**Maceration Method:**

Maceration or dipping method involves soaking of powdered liquorice roots in a stoppered container with desired solvent such as ethanol.

This process intends to break the cell wall of plant cells to release the desired phytochemicals in the extraction solvent. The solvent used was ethanol and water (30:70 v/v) for 80 gm. of Liquorice root extract. The process is continued for about 60min so that glycyrrhizin gets dissolved in the solvent.



**Fig. 8: Maceration of Liquorice root powder**

**FORMULATION OF HERBAL SUNSCREEN LOTION:**

Dissolve borax in rose water at 70°C on water bath. Melt the Bees wax with mineral oil. Keep the temperature of about 70°C. Pour borax solution into molten wax at the same temperature with constant stirring. Stir the mass constantly when temperature drops to about 45°C. Then slowly add liquorice extract followed by aloe vera gel and glycerine with constant stirring make up the final volume with the help of distilled waterPour the formulation in narrow mouth container and label it.

**EVALUATION OF HERBAL SUNSCREEN LOTION:**

1. **Organoleptic Properties**

The appearance and colour are included in the organoleptic property. Appearance i.e. colour, odour is visually inspected. [22]

1. **Sun Protection Factor**

Sun protection factor (SPF) was measured with a UV-2000S transmittance analyser. The cream was placed on the polymethyl methacrylate plates were tested. Lotion base without UV- absorbing agents was used for blank scan. Three samples’ plates were prepared was kept in dark for 15 minutes for curing. Then the plates were scanned at three different locations and the SPF value was recorded. [23]

1. **Determination of Viscosity**

Viscosity of herbal sunscreen lotion determined by Ostwald Viscometer.

1. **Determination of pH**

The pH of herbal 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 recorded.

1. **Extrudability Study**

The extrudability of herbal sunscreens was determined in this study by calculating the percentage of formulation extruded from the collapsible tube Based on the weight in grams necessary to extrude at least 0.5 cm of gel ribbon in 10 seconds.[43] After that, the extrudability was estimated using the formula.

**Formula: Extrudability = Applied weight to extrude gel from tube (gm) / Area (cm²)**

1. **Spreadability**

The spreadability of herbal sunscreens determined their therapeutic efficiency. The appropriate amount of herbal 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. [28]

The formula for calculating it is:

**S=M\*L/t**

Where,

M = weight tied to upper slide

L = length of glass slide

t = time taken to separate the slides

1. **Skin Irritation**

The prepared formulation of herbal sunscreen lotion taken in small amount and gently applied on the dorsal side of hand then wait for about 5-6 minutes, if any irritation to skin surface occurs.[30]

**RESULTS AND DISCUSSION:**

**Phytochemical investigation test of Glycyrrhiza glabra**

The phytochemical analysis of the ethanolic root extract of Glycyrrhiza glabra, also known as licorice, revealed the presence of various secondary metabolites. The tests conducted included Mayer’s, Dragendorff’s, Wagner’s, and Hager’s tests for alkaloids, and Modified Borntrager’s and Lugol’s tests for glycosides.

For alkaloids, Mayer’s and Dragendorff’s tests both produced red precipitates, indicating a strong positive (++), confirming the presence of alkaloids in the extract. Conversely, Wagner’s and Hager’s tests did not yield any precipitate or color change, resulting in negative (--) results for these particular alkaloids.

In the case of glycosides, the Modified Borntrager’s test showed a rose-pink color in the ammoniacal layer, suggesting a positive result (++). Similarly, Lugol’s test indicated a transition from an initial pink color to blood red, also confirming the presence of glycosides (++).

These results collectively suggest that *Glycyrrhiza glabra’s ethanolic root extract* contains significant amounts of alkaloids and glycosides, as evidenced by the positive reactions in specific tests tailored to detect these compounds.

**Table 3.: Results of Phytochemical Tests for Glycyrrhiza glabra ethanolic root extract**

|  |  |  |  |
| --- | --- | --- | --- |
| **Secondary Metabolites** | **Name of Test** | **Observation** | **Result** |
| **Alkaloids** | Mayer`s Test | Red ppt | **++** |
| Dragondroff s Test | Red ppt | **++** |
| Wagner`s Test | No red ppt | **\_ \_** |
| Hager`s Test | No yellow colour formation | **\_ \_** |
| **Glycosides** | Modified Borntrager`s Test | Rose pink colour in ammonical layer | **++** |
| Lugol`s Test | Initial pink colour converted to blood red colour | **++** |

**Where, ++ indicates presence of the required constituent and - - sing shows absence of the constituent.**



**Fig.9: Phytochemical tests for *Glycyrrhiza glabra* ethanolic root extract**

**Formulation of Herbal Sunscreen Lotion**

The data presented in Table 4 outlines the formulations for three variations of an herbal sunscreen lotion, each with a total volume of 20 ml. The ingredients used across all three formulations include Liquorice root extract (Glycyrrhizin), Aloe Vera gel, beeswax, borax, rose water, glycerine, and distilled water (Q.S. stands for quantity sufficient to make up the total volume).

In Formulation I, the lotion contains 7 ml of Liquorice root extract, 5 ml of Aloe Vera gel, 1 gm of beeswax, 0.5 gm of borax, 2 ml of rose water, and 2 ml of glycerine. Distilled water is added to reach the total volume of 20 ml.

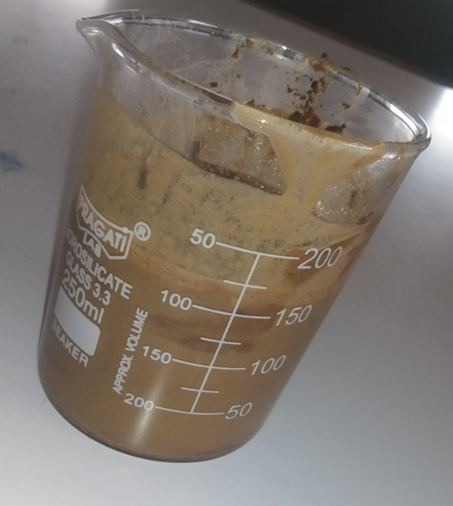
Formulation II has a slightly lower quantity of Liquorice root extract at 6 ml but maintains the same 5 ml of Aloe Vera gel as in Formulation I. It includes a higher amount of beeswax at 1.5 gm and borax at 1 gm. This formulation uses only 1 ml of rose water but increases glycerine to 3 ml. Again, distilled water is added to complete the 20 ml volume.

Formulation III increases the Liquorice root extract to 8 ml but reduces Aloe Vera gel to 4 ml. The amount of beeswax returns to 1 gm, and borax is consistent with Formulation I at 0.5 gm. Rose water remains at 2 ml, similar to Formulation I, but glycerine is reduced to 1 ml. Distilled water is used to make up the remaining volume to 20 ml.

These variations in the formulations reflect different balances of the active ingredients and excipients, which can influence the texture, consistency, and potentially the efficacy of the sunscreen lotion. Each formulation is tailored to achieve a specific combination of properties desired in the final product.

**Table 4: Formulation Table for Herbal Sunscreen Lotion**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Sr. No.** | **Ingredients** | **Formulation I (20ml)** | **Formulation II (20ml)** | **Formulation III (20ml)** |
| 1 | Liquorice root extract (Glycyrrhizin) | 7 ml | 6 ml | 8 ml |
| 2 | Aloe Vera gel | 5 ml | 5 ml | 4 ml |
| 3 | Bees wax | 1 gm | 1.5 gm | 1 gm |
| 4 | Borax | 0.5 gm | 1 gm | 0.5 gm |
| 5 | Rose water | 2 ml | 1 ml | 2 ml |
| 6 | Glycyrine | 2 ml | 3 ml | 1 ml |
| 7 | Distilled water | Q.S. | Q.S. | Q.S. |

** **

**Fig.10: Maceration of liquorice root powder**

**Evaluation of Herbal Sunscreen Lotion**

The data in Table 5 presents the evaluation results for three formulations of herbal sunscreen lotion containing *Glycyrrhiza glabra (liquorice)* ethanolic root extract. Each formulation has been assessed based on several parameters: appearance, color, consistency, texture, irritation potential, spreadability, extrudability, pH, viscosity, and Sun Protection Factor (SPF) by UV analysis.

Formulation I is characterized by a smooth and transparent appearance with a pale-yellow color. It has good consistency and a smooth texture. This formulation does not cause any irritation and exhibits excellent spreadability and extrudability. The pH is slightly alkaline at 7.3, and it has a viscosity of 21408 centipoise (cP). The SPF value, indicating its effectiveness in blocking UV rays, is notably high at 33.

Formulation II has a smooth but opaque appearance, with a yellow color. It is noted to have poor consistency but a very smooth texture. This formulation causes slight irritation upon application. Its spreadability is rated as good, but its extrudability is only fair. The pH is 7.1, slightly lower than Formulation I, and its viscosity is 21540 cP. The SPF value for this formulation is 29, which is slightly lower than that of Formulation I.

Formulation III has a slightly rough and opaque appearance, with a pale-yellow color. It maintains good consistency, but the texture is rough. This formulation does not cause irritation. It has fair spreadability and good extrudability. The pH is 7.2, which is between the values of Formulation I and II. This formulation has the highest viscosity at 23200 cP but the lowest SPF value of 21.35.

Overall, Formulation I stand out with its superior SPF value, excellent spreadability and extrudability, and non-irritating nature, making it potentially the most effective and user-friendly among the three. Formulation II, despite having a good SPF, suffers from poor consistency and slight irritation. Formulation III, while non-irritating and having good extrudability, has the lowest SPF and a rough texture, which might affect user preference.

**Table 5: Evaluation of Herbal Sunscreen Lotion of Glycyrrhiza glabra ethanolic root extract**

|  |  |  |  |
| --- | --- | --- | --- |
| **Parameters** | **Formulation I** | **Formulation II** | **Formulation III** |
| **Appearance** | Smooth, Transparent | Smooth, Opaque | Slightly rough, Opaque |
| **Colour** | Pale Yellow | Yellow | Pale Yellow |
| **Consistency** | Good | Poor | Good |
| **Texture** | Smooth | Very Smooth | Rough |
| **Irritation** | No | Slightly Irritate | No |
| **Spreadability** | Excellent | Good | Fair |
| **Extrudability** | Excellent | Fair | Good |
| **pH** | 7.3 | 7.1 | 7.2 |
| **Viscosity** | 21408cP | 21540cP | 23200cP |
| **SPF by UV** | 33 | 29 | 21.35 |

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**CONFLICT OF INTEREST:**

We declare that we have no conflict of interest.

**CONCLUSION**

Nature, as the ultimate chemist, offers potential solutions to many human diseases. The limitations and side effects of synthetic drugs have renewed interest in herbal medicine. Recently, herbal remedies have regained popularity.

Reearch indicates that sunblock usage is linked to intentional tanning behavior, suggesting sunscreens are often used to avoid sunburn while tanning. A recent study aimed to develop a stable herbal sunscreen with a suitable SPF. Aloe vera gel-based sunscreens (F1 and F2) showed stability, good antioxidant activity, and high SPF values (33.43 and 33.50). They were also non-mutagenic, indicating potential for improved sunburn treatment. UV Spectroscopy was effective for assessing herbal sunscreens, aiding standardization by regulatory bodies.

The study focused on creating a herbal sunscreen using liquorice root extract and evaluating its effectiveness against sunburn. Phytochemical analysis of Glycyrrhiza glabra (licorice) root extract revealed significant alkaloids and glycosides. Various formulations combined liquorice root extract, Aloe Vera gel, beeswax, borax, rose water, glycerine, and distilled water to achieve desired properties.

**Three formulations were tested:**

**Formulation I:** Smooth, transparent, pale yellow, excellent spreadability and extrudability, pH 7.3, viscosity 21408 cP, SPF 33, and no irritation.

**Formulation II:** Smooth, opaque, yellow, poor consistency, very smooth texture, slight irritation, pH 7.1, viscosity 21540 cP, SPF 29.

**Formulation III:** Slightly rough, opaque, pale yellow, good consistency, rough texture, no irritation, pH 7.2, viscosity 23200 cP, SPF 21.35.

Formulation I emerged as the most effective and user-friendly, with the highest SPF, excellent spreadability, extrudability, and no irritation. Formulation II had a good SPF but poor consistency and slight irritation. Formulation III, despite being non-irritating, had the lowest SPF and a rough texture.

In conclusion, natural sunscreens can be more advantageous than synthetic ones, which can cause side effects like endometriosis, cytotoxicity, and genotoxicity. Natural products provide effective sun protection with minimal side effects, making them a preferable alternative.

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