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Formulation Of Microencapsulated Gel Sunscreen

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Abstract: In the present study an attempt was made to formulate microencapsulated gel sunscreen also containing herbal extracst like tomato.The use of sunscreen lotion has gradually increased over the years, as people have become more aware of the detrimental effects of UV radiation. The presented formulation contains microencapsulated physical filters such as titanium dioxide and zinc oxide as well tomato extract protecting against UV rays. The formulation was evaluated based on pH, extrudablity, spreadability. The SPF of sunscreen was measured using a UV spectrophotometer.

Keywords: Microencapsulation, Sunscreen, SPF

Introduction:Sunscreen comes in a variety of formulations, including ointments, creams, gels, lotions, sprays, and wax sticks. Sunscreens have been used for decades to protect against UV radiation, specifically UV-A (320-400nm) and UV-B (280-320nm). Exposure to sunlight can have both beneficial and harmful effects on the human body, depending on the length and frequency of exposure to the intensity of the sunlight and the sensitivity of the individual concerned.

Microencapsulation involves encapsulating active ingredients, such as UV filters, within small particles to improve their stability and efficacy. This technique has been widely used in various industries, including cosmetics, pharmaceuticals and food. In the case of sunscreen, microencapsulation can help to protect UV filters from degradation due to exposure to heat, light and other environmental factors.

The design and development of a sunscreen gel using microencapsulation technology involves several steps, including the selection of appropriate UV filters, encapsulation materials and techniques. The formulation must also be tested for stability efficacy and safety.

HERB USED:- TOMATO

- Botanical name - Solanum Lycopericum
- Family - Solanaceae

Description

- Colour – Red
- Odour - Earthy and spicy odor
- Taste- sweet - sour
- Chief chemical constituents –lycopene
- Uses - UV protection

Experimental work

Preparation of extract of solanum lycopersicon

Solanum lycopersicum extract was prepared by using soxhlet apparatus. The tomato was dried at 121-degree celsius,after drying the tomato was ground and converted into powder form.The powder of lycopersicum was diluted with 95% ethanol and then attached to the assembly of the Soxhlet apparatus. After that,the extract was separated from ethanol using a distillation unit.

Phytochemical screening of different qualitative chemical tests

It can be performed to establish profile of ethanol and aqueous extract for its chemical composition. The following tests were performed on extracts to detect various phytoconstituents present.

Detection of carbohydrate

Molish Test

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

Detection of alkaloids

Dragondroff's test

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

Detection of protein

Biuret test

An aliquot of 2 ml filtrate is treated with one drop of 2% copper sulphate solution. To this, 1 ml ethanol (95%) is added, followed by an excess of potassium hydroxide pellets. The pink color in the ethanolic layer indicates the presence of proteins.

Detection of steroids and triterpenoid

Libermann-Burchard test

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

Detection of glycosides

Killer killani test

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

Detection of tannin

Ferric chloride solution test:-

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

Preparation of sunscreen

1. Preparation of sodium alginate drug solution

0.15gm of Sodium alginate dissolved in 30ml of distilled water in a beaker with continuous stirring for 30 minutes.Then ingredients such as titanium dioxide, zinc oxide, tween 80, coconut oil are added in appropriate quantities.

2. Preparation of enclosed beads

Prepared solution was extruded into 5% calcium chloride solution with help of syringe. The formed microbeads were kept in calcium chloride solution for 30min. The prepared microbeads were filtered and dried in hot air oven.

3. Preparation of carbopol gel base

3gm of carbopol was soaked in water for 5-6 hours and incorporated glycerine then triethanolamine were added Snadalwood oil and neem oil also added.

4. Incorporation of microbeads into gel

Prepared microbeads and tomato extract were added to gel base with continuous stirring.

Formulation table

Sr.no.	Ingredient	Quantity
1	Solanum lycopericum extract	5ml
2	Titanium dioxide	0.5gm
3	Zinc oxide	0.5gm
4	Sodium alginate	0.15gm
5	Tween 80	0.1ml
6	Triethanolamine	1ml
7	Coconut oil	0.5ml
8	Carbopol 934	3gm
9	Glycerine	5ml
10	Calcium chloride	5gm
11	Neem oil	0.5ml
12	Sandalwood oil	0.1ml
13	Distilled water	Q.S.
14	Total Weight	100gm

Evaluation Parameters

1. **Physical parameters:**

Color:The color of the formulation was manually examined and observed.
Odor: The Smell of Formulation was checked by applying preparation on hand and feel the fragrance.

2. **Washability**:

This test involves washing applied sunscreen lotion with water.

3. **Homogeneity:**

The formulation was tested for homogeneity through visual appearance and touch.

4. Determination of pH :

The pH of sunscreens was determined using a digital pH meter. pH was measured after 1 g of the formulation was dissolved in 100 ml of distilled water for 2 hours.The goal of this study was to ensure that the pH of the produced sunscreens is comparable to the pH of the skin after 24 hours of use.

5. Determination of spreadability

Two sets of glass slides were taken. On one of the slides, 0.5 g of the sunscreen gel formulation was applied. Sunscreen gel was positioned between the two slides, forming a sandwich with gel. For 5 minutes, on the upper slide, a weight of 125 g was inserted, pressing the gel evenly between the two slides to create a thin coating.

The circle's diameter was measured as an indication of gel spreadability.

6. Determination of extrudability

The sunscreen gel was placed in a neat and clean, lacquered aluminum collapsible tube. The quantity of cream extruded was measured via the tip for the identification of extrudability.

$$\text{Extrudability} = \frac{Quantity\ of\ gel\ that\ emerged\ from\ tube}{TOtal\ amount\ of\ gel\ to\ be\ filled\ in\ tube} \times 100$$

Determination of SPF

In-vitro SPF determination (absorbance measurement) by UV-Spectrophotometer:

Weigh 1 g of all samples, transfer to a 100 mL volumetric flask, dilute to volume with ethanol, followed by ultrasonication for 5 min and then filter through cotton, rejecting the first ten mL. Transfer a 5.0 mL aliquot to 50 mL volumetric flask and dilute to volume with ethanol. Then transfer a 5.0 mL aliquot to a 25 mL volumetric flask and complete the volume with ethanol. Measure the absorptions of samples in solution in the range of 290 to 450 nm with every 5 nm increment using 1 cm quartz cell, and ethanol as a blank. Calculate SPF by Mansur equation. EE* I values are constant and given in Table no

$$\textbf{SPFspectrophotometric} = CF \times \sum_{290}^{320} EE(\lambda) \times I(\lambda) \times Abs(\lambda)$$

Whereas,

CF= Correction factor;

EE= Erythemogenic effect;

I= Intensity of solar light of wavelength;

A= Absorbance

Wavelength (λ) in nm	**EE×I (Normalized)**
290	0.0150
295	0.0817
300	0.2874
305	0.3278
310	0.1864
315	0.0839
320	0.0180

1) Phytochemical Screening Test:

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

2) Physical parameters

Sr.no.	Parameters	Result
1	Colour	Brown
2	Odour	Pleasant
3	Wash ability	Washable
4	State	Semisolid
5	Texture	Smooth
6	Homogeneity	Homogeneous

1. Determination of pH

The pH of sunscreens was determined using a digital pH meter. pH was measured after 1 gm of the formulation was dissolved in 100 ml of distilled water for 2 hours. The purpose of this study was to guarantee that the pH of the produced sunscreens is similar to the pH of the skin after 24 hours of use.
The pH of the formulation was found to be 6 which is good for skin.

2. Spreadability test

The spreadability test for the formulation was performed and the spreadability of the formulation was found out to be 6.4 cm

3. Extrudability test

The formula to find out homogeneity is as following

$$\text{Extrudability} = \frac{\text{Quantity of gel that emerged from tube}}{\text{Total amount of gel to be filled in tube}} \times 100$$

Observations
Quantity of gel that emerged from tube = 1.1
Total amount of gel filled in tube = 50

From the calculation,the extrudability of the formulation was found out to be 2.2

4. Determination of SPF

Despite being a source of life and energy, sunlight causes serious health problems such as sunburn, pigmentation, wrinkles, dermatitis, urticaria, aging, immunological suppression, and a variety of skin malignancies.
SPF is a measure of how effective sunscreens are at preventing sunburn SPF. The absolute protection efficacy of sun care products against erythemal-effective UV light was determined using in vitro transmittance measurements, which were weighted with the erythema action spectrum and the "standard" output spectrum of a UV solar simulator used for SPF testing.
The SPF of sunscreens was estimated using the equation. The aliquots were scanned between 290 and 320 nm, and the absorbance values obtained were multiplied by the corresponding EE (A) and I (λ) values. Then, their summation was taken and multiplied with the correction factor i.e. 10
SPF of the formulation was measured by instrument Jasco V-750. The SPF of formulation calculated about 18.09.

Wavelength (λ) in nm	**EE×I**	**Absorbance(λ)**	**EE×I×Absorbance(λ)**
290	0.015	2.2082	0.0331
295	0.0817	2.1582	0.1763
300	0.2874	2.0144	0.5789
305	0.3278	1.7937	0.5879
310	0.1864	1.5759	0.2937
315	0.0839	1.3907	0.1166
320	0.018	1.2493	0.0224
Total	1		1.809
Multiplication with correction factor (10)			18.09

Table no.1 Result of UV spectrophotometer

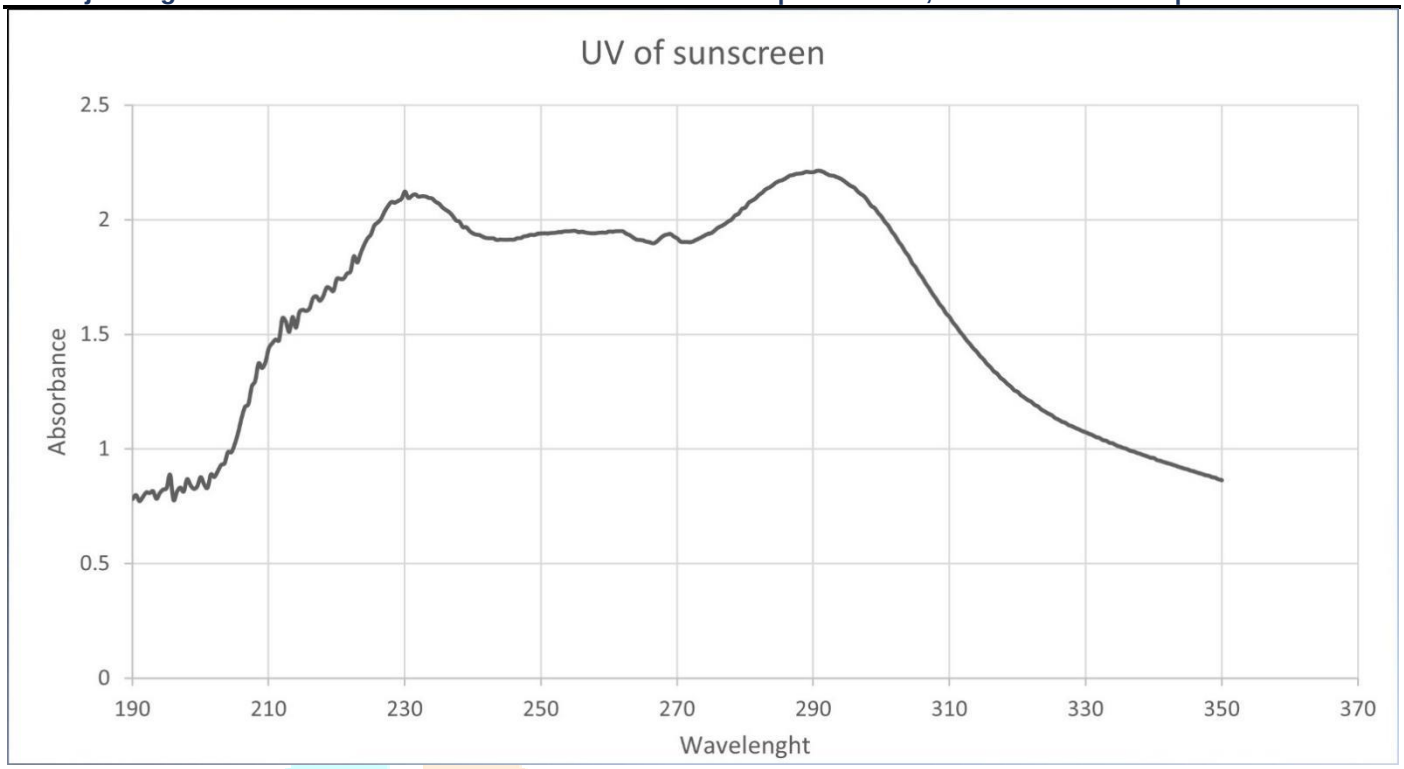

Fig.No.1 Absorbance of formulation

Conclusion

The study attempted to develop microencapsulated gel sunscreen using physical sunscreen filters such as titanium dioxide and zinc oxide with extract Solanum lycopersicum and examined their efficacy for preventing sunburn. The current study may lead to improvements in the treatment of sunburns caused by UV radiation exposure.

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