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FORMULATION AND EVALUATION OF POLYHERBAL UNDER EYE GEL USING *IXORA COCCINEA*, *AMARANTHUS CRUENTUS* AND *HIBISCUS ROSA-SINENSIS*

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ABSTRACT

Cosmetics are products or substances that are used on the human body to make someone look more beautiful, clean, enhance their appearance, or help them look more attractive. In this study, we focus on cosmetics made with natural ingredients, especially herbs. The study is about making and testing a special gel for the under-eye area using three plants: Ixora coccinea, Amaranthus cruentus, and Hibiscus rosa-sinensis. These plants were chosen because they have strong antioxidant properties. The under-eye area is very sensitive and needs extra care when using any beauty products. It also shows how healthy your skin is overall. When the skin is exposed to harmful free radicals in the environment, it can cause oxidative stress, which leads to problems like wrinkles, puffiness, and dark circles under the eyes. The compounds called flavonoids in these herbs work as powerful antioxidants, helping to remove free radicals and stop damage. People are choosing more cosmetics with natural ingredients because they are safer, work well, and cause fewer side effects. The gel made in this study was tested with several physical and chemical tests to check its quality and how well it holds up over time.

KEYWORD: Cosmetics, antioxidant, periorbital region, poly herbal under eye gel, free

radical scavenging assay.

INTRODUCTION

Polyherbal under-eye gels are soft, gentle creams made with natural plant extracts mixed into a light gel form. They feel light on the skin, have a cooling effect, and don't leave an oily residue, making them perfect for the delicate skin around the eyes. These products are generally easy for the skin to accept and offer many benefits while being less likely to irritate. The natural chemicals found in these gels, like flavonoids, tannins, and saponins, help protect the skin by fighting free radicals and calming inflammation. More people are choosing natural and eco-friendly beauty products, which has made herbal gels more popular.[1]

Antioxidants are important because they help the skin defend against damage from harmful molecules called free radicals. Too many free radicals can speed up the ageing process and cause redness and skin damage from the sun. Applying antioxidants directly to the skin helps remove these harmful molecules and supports the skin's natural protection. The ability of plant-based ingredients to act as antioxidants is often tested in lab experiments like DPPH radical scavenging and lipid peroxidation tests.[2]

MATERIALS AND METHODS

1. IXORA COCCINEA

Family: Rubiaceae.

This plant is known for making the skin brighter and helping with aging. It also helps the skin heal and reduces inflammation, so it is good for products around the eyes.[3]

2. AMARANTHUS CRUENTUS

Family: Amaranthaceae.

It is used for its anti-inflammatory and soothing properties. In cosmetic applications, it helps to reduce fine lines, retain skin moisture, and relieve rashes, making it suitable for under-eye care formulations.[4]

3. HIBISCUS ROSA-SINENSIS

Family: Malvaceae.

It helps to protect the skin from oxidative stress and premature ageing. It is known for its anti-inflammatory and wound-healing properties. It helps improve skin elasticity, reduce fine lines, and promote a smoother, healthier under-eye.[5]

4. ALOE VERA

Family: Asphodelaceae.

It has strong moisturising, soothing, and anti-inflammatory properties. It has been used for wound healing and skin hydration. In cosmetic formulations, it helps reduce irritation, improve skin elasticity, and maintain moisture, making it highly suitable for under-eye gel preparations.[6]

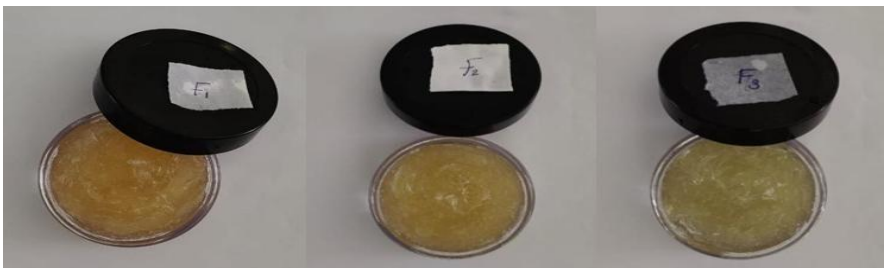
METHODOLOGY

Fresh, healthy plant materials were locally collected, dried on shade, and pulverised into coarse powder. The powdered samples of *Ixora coccinea*, *Amaranthus cruentus*, and *Hibiscus rosa-sinensis* were extracted using the Soxhlet method with ethanol as the solvent. The extraction process was continued until maximum yield was obtained, after which the extracts were concentrated and stored for further use.[7]

For gel preparation, Carbopol 940 was dispersed in distilled water and allowed to hydrate completely. Humectants were added, followed by the gradual incorporation of the herbal extracts with continuous stirring. The pH was adjusted to a skin and lacrimal fluid compatible range using triethanolamine. The final formulation was homogenised and transferred into sterilised containers for further evaluation studies.[8]

INGREDIENTS	**F1**	**F2**	**F3**
IXORA COCCINEA	2.7g	1.5g	0.9g
AMARANTHUS CRUENTUS	0.9g	1.5g	2.7g
HIBISCUS ROSA-SINENSIS	0.9g	1.5g	0.9g
ALOE VERA	1.5g	1.5g	1.5g
CARBAPOL 940	0.3g	0.3g	0.3g
PROPYLENE GLYCOL	0.9 ml	0.9 ml	0.9 ml
GLYCERIN	0.6 ml	0.6 ml	0.6 ml
TRIETHANOLAMINE	0.2 ml	0.2 ml	0.2 ml
PURIFIED WATER	22 ml	22 ml	22 ml

EVALUATION



1. ORGANOLEPTIC EVALUATION

The under-eye gel was assessed for colour, odour, texture, and consistency using visual and touch-based observations.

2. PHYSICAL EVALUATION

a. pH: The pH was checked using a digital pH meter. The meter was first set up by testing it against standard buffer solutions at different pH levels. Then, 0.5 grams of the gel was placed in 50 milliliters of purified water.

b. Viscosity test: The viscosity of the herbal gel was measured using a Brooke field viscometer. The test was done at a room temperature of 25°C, with spindle number 62 rotating at a speed of 0.6 revolutions per minute.

c. Spreadability: Approximately 1 gram of the gel was placed between two glass slides.

A 100-gram weight was placed on top, then removed to leave a 20-gram weight. After the gel spread, its diameter was measured. The spreadability was calculated using the formula $S = (\pi d^2)/4$, where d is the average diameter of the spread gel.

d. Washability: A small amount of the gel was applied to a glass slide and then washed off with water.

e. Homogeneity: Homogeneity was checked by looking at the gel and by touching it.[9]

3. MICROBIOLOGICAL STUDIES

The under eye gel was evaluated for microbial contamination by culturing the sample on agar plates. After 24–48 hours of incubation, microbial colonies were counted, and acceptable limits confirmed the product's safety for use.[10]

4. CHEMICAL TESTING

a. Test for Flavonoids: Add a few drops of 10% sodium hydroxide solution to the extract. Then add dil. HCl.

b. Test for Tannins and phenols: Add a few drops of 5% ferric chloride solution or potassium dichromate solution to the extract.[11]

5. DPPH ASSAY

For the DPPH assay, the ascorbic acid was used as a reference standard. The ascorbic acid stock solution was prepared in distilled water (1 mg/ ml; w/v). A 60 µM solution of DPPH in methanol was freshly prepared, and 200 µl of this solution was mixed with 50 µl of the test sample at various concentrations. The plates were kept in the dark at room temperature for 15

minutes, and the decrease in absorbance was measured at 515 nm. Control was prepared with DPPH solution only, without any extract or ascorbic acid. 95% methanol was used as a blank.[12]

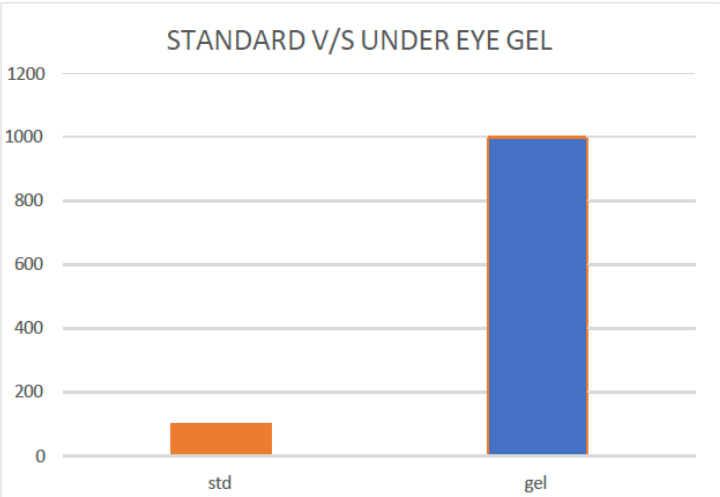
$$\textbf{Percentage inhibition} = \frac{\textbf{Absorbance of Control - Absorbance of test}}{\textbf{Absorbance of control}} \times 100$$

RESULT AND DISCUSSION

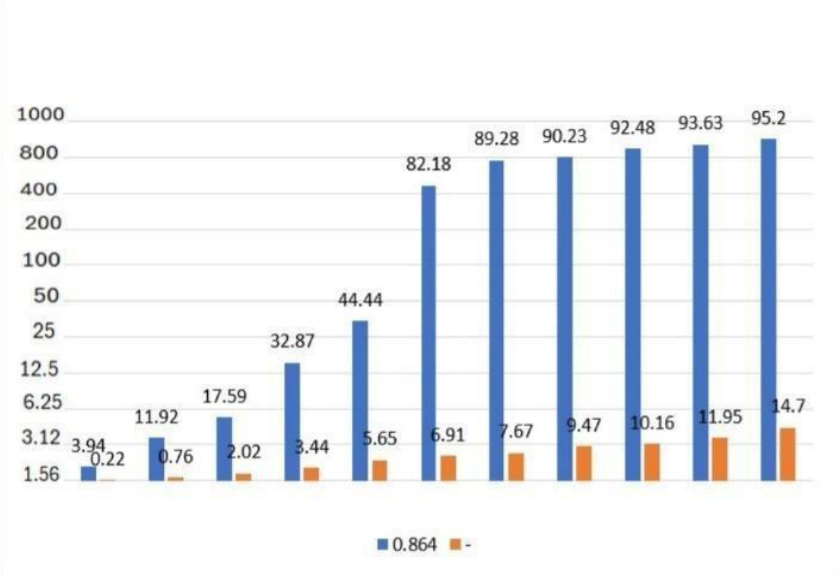
CATEGORY	PARAMETER	F1	F2	F3
Organoleptic	Colour	Light brown	Yellowish brown	Yellowish green
	Odour	Pleasant	Pleasant	Pleasant
	Texture	Smooth	Smooth	Smooth
	Consistency	Good	Good	Good
Physicochemical	pH	6.38	6.70	6.73
	Viscosity (cps)	40440	41160	43340
	Spreadability	23.758	30.190	43.196
	Washability	Easily washable	Easily washable	Easily washable
	Homogenity	Homogenous	homogenous	Homogenous
Microbiological Studies	Microbial load	Within a safe limit	Within a safe limit	Within a safe limit
Chemical Testing	Alkaloids	Absent	Absent	Absent
	Carbohydrates	Absent	Absent	Absent
	Saponins	Absent	Absent	Absent
	Flavonoids	Present	Present	Present
	Tannins & Phenols	Present	Present	Present
	Glycosides	Absent	Absent	Absent
DPPH Assay(standard)	Ascorbic acid IC_{50}	-	-	26.81µg/l
DPPH Assay (sample)	Under eye gel IC_{50}	-	-	1000µg/l

DPPH ASSAY

INHIBITION CONCENTRATION OF STANDARD AND SAMPLE



COMPARISON OF THE PERCENTAGE INHIBITION OF THE STANDARD V/S UNDER EYE GEL



DISCUSSION

This study looked at making and testing a polyherbal under-eye gel made from Ixora coccinea, Amaranthus cruentus, and Hibiscus rosa-sinensis. Among the different versions made, F3 had a smooth and even texture and was stable. The pH levels were between 6.38 and 6.73, and F3 was chosen as the best option because its pH was very close to that of tears, making it safe and suitable for the under-eye area. The gel was easy to spread and wash off, which made it comfortable to use.

A phytochemical test showed that it contained flavonoids, tannins, and phenolic compounds. Microbiological tests confirmed that it was free from harmful bacteria and other microbes. When tested for antioxidant activity using the DPPH method, it showed a strong ability to remove free radicals, and this effect increased with higher concentration. Overall, the polyherbal under-eye gel had good stability and showed promising antioxidant properties**.**

CONCLUSION

This study was designed to create and test a polyherbal gel for the under-eye area, made with extracts from Amaranthus cruentus, Ixora coccinea, and Hibiscus rosa-sinensis. These plants were chosen because they have strong antioxidant properties and can help protect the skin, which may reduce dark circles, swelling, and early signs of aging around the eyes. The plant materials were extracted using a Soxhlet method to get concentrated extracts, which were then used to make a gel with the best possible formula for testing and evaluation.

The finished gel was tested for several physical and chemical properties, like its appearance, pH level, how thick it was, how easily it spread, and whether it was free from harmful microbes. The results showed that the gel had a smooth, even texture, a pH that was safe for the sensitive under-eye skin, and good spreading ability. The absence of microbes confirmed that the gel was safe and of high quality.

To check the antioxidant power of the gel, the DPPH free radical scavenging test was used, which showed that the gel had strong antioxidant activity. This is likely due to the presence of active compounds like flavonoids and phenolic acids in the plant extracts, which are known to fight oxidative damage. In summary, the developed polyherbal under-eye gel was stable, safe, and potentially effective, but more clinical studies are needed to fully confirm its effectiveness and long-term safety.

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