



FORMULATION AND EVALUATION OF BAKUCHIOL ENCAPSULATED HYDRATING GEL

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Abstract: Bakuchiol is a naturally occurring chemical that is extracted from *Psoralea corylifolia* seeds. It has gained a lot of attention lately because of its possible use as a retinol substitute in beauty products. The objective of this research was to create a hydrating gel that contains bakuchiol and assess its stability, physicochemical characteristics, and ability to provide anti-aging and moisturizing benefits. Various excipients including gelling agents, humectants, emollients, and stabilizers were selected and their concentrations were adjusted to achieve desired rheological properties and skin feel.

Physicochemical characterization of the formulated gel was performed using techniques such as rheology, viscosity measurements, pH determination, and spreadability test to ensure its suitability for topical application. In summary, this study's outcomes show that a moisturizing gel encapsulated with bakuchiol can be successfully formulated with the desired stability and physicochemical qualities. Furthermore, the effectiveness research suggests that it could be a good skincare solution for moisturizing and anti-aging needs.

Keywords: Bakuchiol oil encapsulation, skin hydration, anti-aging, anti-oxidant.

I. INTRODUCTION

The skin is an essential organ that protects the body from hazardous elements such as radiation, physical injury, and microbial invasion. Wrinkles, age spots, and other signs of aging are caused by structural and functional changes in the skin brought on by aging. Several variables, including telomere shortening, oxidative stress, inflammation, and cellular senescence, contribute to the complex process of skin aging.

BAKUCHIOL:

In recent years, the skincare industry has witnessed a growing interest in natural alternatives to traditional anti-aging ingredients like retinoids. Bakuchiol, derived from the seeds of the *Psoralea corylifolia* plant, has emerged as a promising compound due to its retinol-like effects without associated side effects such as irritation and photosensitivity.

ENCAPSULATION TECHNOLOGY AND HYDRATION:

Encapsulating bakuchiol in a hydrating gel formulation offers several advantages. Gels are lightweight, non-greasy formulations that are well-suited for delivering active ingredients like bakuchiol. Hydration is crucial for maintaining skin health and incorporating hydrating agents ensures that the formulation not only delivers bakuchiol effectively but also moisturizes the skin, enhancing its overall appearance and feel.

Formulating a bakuchiol encapsulated hydrating gel involves several considerations, including selecting appropriate gelling agents, stabilizers, and encapsulation techniques to ensure the stability and bioavailability of bakuchiol. Additionally, evaluating the performance of the gel is essential to confirm its efficacy and safety for consumer use.

This introduction sets the stage for a detailed exploration of the formulation and evaluation process of bakuchiol encapsulated hydrating gel, aiming to provide insights into its development as a potential skincare product with anti-aging benefits. By understanding the formulation and evaluating its effectiveness, researchers and skincare developers can contribute to advancing the field of natural skincare alternatives.

AIM AND OBJECTIVES:**Aim:**

To formulate and evaluate a bakuchiol encapsulated hydrating gel in order to achieve prolonged hydration and rejuvenation of skin.

Objective:

- To provide hydration to the skin by maintaining the moisture level and improve skin texture.
- To investigate the pH of the formulation.
- Developing a stable hydrogel formulation incorporating bakuchiol.
- Characterizing the physicochemical properties of the gel.
- Evaluating the safety and efficacy of the gel through dermatological testing.

II. METHODOLOGY**2.1 PROCEDURE:**

Weighed required amount of xanthum gum, agar, sodium alginate and it was added to 1,2-propanediol and mix to form a smooth slurry. Then add water and sodium chloride to form a gel. Heat 65°C and stir until the gel becomes smooth and homogenous mixture. Then add bakuchiol oil to the above mixture and mix well. Then add sodium benzoate as preservative and lavender oil as perfuming agent. stir it well until homogenous and reduce heat around 50-55°C. Pour off product in to calcium chloride solution using micropipette or syringe. Drain off calcium chloride solution and rinse thoroughly with water and then allow to drain. Put formed gel droplets into emollient carrier in final packing. The exact concentration of each formula can be found in Table 1.

2.2 INGREDIENTS:

Table no. 1 : Ingredients and their working formula

INGREDIENTS	USES	WORKING FORMULA
1,2-Propanediol	Humectant	5ml
Bakuchiol oil	Anti-ageing, anti-oxidant, skin brightening	0.3ml
Xanthum gum	Thickening agent and to enhance droplet coalescence	1g
Agar	Thickening and stabilizing agent	1g
Sodium alginate	Thickener, gelling agent and stabilizer	2g
Sodium chloride	Binding agent/ thickening agent	0.1g
Sodium benzoate	Preservative	0.4g
Lavender oil	Perfuming agent	1ml
Calcium chloride	Induce polymer chains crosslinking	4g
Mica purple powder	Colouring agent	0.3g
Isopropyl myristate	Texture enhancer and emollient	15ml
Water	solvent	q.s

2.3 EVALUATION:**2.3.1 Physical appearance:**

The color and appearance of the formulation were observed visually. The sensory experience of a cosmetic product is based on its appearance, texture, and odor, and is a measure of its quality.

2.3.2 pH measurement:

pH measurement of the gel was carried out using a digital pH meter by dipping the glass electrode completely into the gel system to cover the electrode. The measurement was carried out in triplicate and the average of the three readings was recorded. The pH of the encapsulated hydrating gel should be in the range of 4.66 to 5.91, which is close to skin pH 4.5-7.

2.3.3 Homogeneity:

The homogeneity of the prepared formulation was evaluated by visual perception.

2.3.4 Spreadability test:

Two sets of glass slides of standard dimensions were taken. The encapsulated gel formulation was placed over one of the slides. The other slide was placed on the top of the gel and pressed uniformly to form a thin layer. The excess gel adhering to the slides was scrapped off. The two slides were fixed to a stand without the slightest disturbance. 20 g of weight was tied to the upper slide carefully. The time taken for the upper slide to travel the distance of 7.5 cm and separate away from the lower slide under the influence of weight was noted. Spreadability was calculated by using the following formula;

$$S = m \times l/t$$

Where, S-Spreadability, m- weight tied to upper slides, l- length of the glass slide, t- time taken in sec.

2.3.5 Viscosity:

The viscosity of gel was determined using Brookfield viscometer at 25°C with a spindle speed of the viscometer rotated at 12 rpm.

2.3.6 Stability Studies:

Formulation and development of a pharmaceutical product are not complete without proper stability analysis carried out on it to determine physical and chemical stability and thus safety of the product. The stability studies are carried out as per ICH guidelines. The samples were stored at different storage condition of temperature such as 3-5°C, 25°C RH=60% and 40°C RH=75%.

2.3.7 Washability test:

Washability test for hydrating gel was performed for evaluating how easily the gel can be removed from the skin. For determining the washability, small amount of the hydrating gel was applied to designated area of skin. Ensure the application is consistent and covers a sufficient area. Allow time to dry, this allows it to fully adhere and demonstrate its bonding properties. After the drying period, attempt to remove the gel by rinsing the area with water. Based on your observations, determine how effectively the hydrating gel washes off without leaving behind any residue.

2.3.8 Skin irritation test:

The skin irritation test for hydrating gel was performed to ensure that the product is safe and compatible with different skin types. For this apply small of product to discreet testing area of skin. Leave the gel on the skin for the recommended period, typically 24-48 hours. During this time, observe the skin closely for any signs of irritation, such as redness, itching, swelling, or burning sensations. After the observation period, if there are no adverse reactions and the skin appears normal, then the hydrating gel is likely safe for use.

III. RESULT AND DISCUSSION**3.1 RESULT:****3.1.1 Physical Appearance:**

Table no.2 : Physical appearance of the formulation

Color	Lavender
Odor	Characteristic odor
Texture	Smooth homogenous
Consistency	Slightly viscous
Homogeneity	Good

3.1.2 pH measurement:

Table no.3 : pH measurements of the formulation

Formulations	pH
F1	4.23
F2	5.24
F3	5.66

3.1.3 Spreadability:

Table no.4 : spreadability of the formulation

Formulations	Spreadability(g.cm/s)
F1	4.9
F2	5.2
F3	6.8

3.1.4 Viscosity:

Table no.5 : viscosity of the formulation

Formulation	Viscosity(cP)
F1	1941
F2	1939
F3	1937

3.1.5 Stability studies:

Table no.6 : Stability studies of formulation

Sl. No	Parameter	Suitability
1	$5 \pm 3^\circ\text{c}$	Unstable
2	$25 \pm 2^\circ\text{c}$ $60 \pm 5\% \text{RH}$	Stable
3	$40 \pm 2^\circ\text{C}$ $75 \pm 5\% \text{RH}$	Unstable

3.2 DISCUSSION:**3.2.1 Physical appearance:**

Physical appearance evaluation of bakuchiol encapsulated hydrating gel was determined. The colour was found as lavender colour. The formulation exhibits smooth texture and non-greasy and absorb well into the skin. The gel has suitable pleasant fragrance which enhance the users experience.

3.2.2 pH measurement:

Using the pH meter, the pH of each formulation was checked and it was determined to be within the acceptable range. The Ph value of F3 was found to be 5.66, which is more suitable for the skin application.

3.2.3 Spreadability:

The spreadability test for the formulations was checked and F3 was having excellent spreadability. The measured spread diameter is in the range between 5-7 cm demonstrate good physical spreadability, confirming that the gel can be applied without excessive effort.

3.2.4 Washability:

The washability evaluation test demonstrate that the product can be easily removed from the skin. This formulation exhibit excellent washability characteristics, ensuring that it can be conveniently removed without leaving any residue.

3.2.5 Stability studies:

The formulation underwent stability tests at various temperatures to test its resistance to changes in both physical and chemical properties. It proved to be stable at room temperature.

3.2.6 Skin irritation test:

The skin irritation test was performed and it was found to be non-irritant to skin. These findings confirm that the gel is safe for regular use on all skin types, including sensitive skin.

IV. SUMMARY AND CONCLUSION

The primary objective of this study was to develop and evaluate a Bakuchiol-encapsulated hydrating gel designed to deliver long-term hydration and skin rejuvenation. Bakuchiol has been scientifically proven to stimulate collagen formation, providing essential structural support to the skin, thereby retaining its firmness and suppleness. Its potent antioxidant properties effectively neutralize free radicals and exhibit anti-inflammatory characteristics. In contrast to retinol, Bakuchiol is less likely to induce side

effects such as redness or peeling, ultimately reducing the appearance of wrinkles and fine lines. Key hydrating elements such as propanediol and isopropyl myristate play a crucial role in replenishing moisture, enhancing skin barrier function, and maintaining optimal hydration levels. The gel formulation ensures a lightweight and fast-absorbing product, suitable for oily and combination skin types, delivering hydration without any heaviness or greasiness. The encapsulated Bakuchiol in the gel guarantees enhanced stability, efficacy, and controlled release of the substance. Through extensive investigation using three different formulations (F1, F2, and F3), it was concluded that F3 demonstrates exceptional spreadability, appearance, and homogeneity, and meets physical criteria such as texture, appearance, odor, color, and optimal pH. It is also best stored at room temperature for optimal results. In conclusion, this hydrating gel formulation not only effectively delivers Bakuchiol to the skin but also provides superior hydration and anti-aging benefits.

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