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# Formulation and Development of Moisturizing Cream Using Candlenut Oil

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**ABSTRACT:**
Xerosis (Dry skin), a common dermatological condition that is attributed to loosening of water in the stratum corneum. Nowadays, herbal moisturizers are extensively recognized over synthetic products and widely used to retain skin hydration and prevent signs of aging. Candlenut oil contains polyunsaturated fatty acids mainly, linoleic acid and alpha-linoleic acid that possess high moisturizing properties. Hence, the present investigation was undertaken to formulate and evaluate the moisturizing cream containing candlenut oil. The Fatty acid content profile of candlenut oil was evaluated using gas chromatography. It revealed the presence of 31.3% monosaturated fats, 11.4% saturated fats and 54.8% of polyunsaturated fats. In the present study, moisturizing creams (O/W emulsion) were formulated by incorporating 2%, 4% and 6% concentrations of candlenut oil. Furthermore, formulations were evaluated for its moisturizing efficacy using digital skin moisture meter on healthy female volunteers. Topical application of candlenut oil cream dose-dependently increased moisture content at 2%, 4%, and 6% concentrations as compared with base (control; without active). The highest skin moisture content was observed at 6% formulation relative to base control and hyaluronic acid base. The candlenut oil (6%) moisturizing cream was subjected to accelerated stability testing for physical appearance, colour, odour and pH. The pH was found to be 6.65. The formulation was found to be effective and stable in terms of all functional parameters. Our present findings suggest that topical moisturizing cream containing 6% Candlenut oil could be a potential herbal skin hydrating approach to ameliorate skin dryness and signs of aging.

**KEYWORDS:** Candlenut oil, Moisturizing cream, Water in oil emulsion, Skin hydration, Dry skin.

## 1. INTRODUCTION:

Dry skin, medically known as xerosis or xeroderma, is a common condition characterized by compromised skin barrier function with lack of natural moisturizing factors leading to rough, scaly, and cracked skin. This condition can be triggered by various factors, including environmental elements like cold weather, frequent bathing, and harsh soaps. Dry skin is prevalent across all age groups and affecting nearly all individuals over 60 years to some extent[1,2].

The natural skin barrier is comprised of brick and mortar model of corneocytes, embedded in a lipophilic intercellular substance and arranged in regular columns in the stratum corneum (SC). The skin barrier

function and permeability are mainly dependent on the SC integrity. During maturation and differentiation of keratinocytes, the conversion of profilaggrin to filaggrin takes place within keratinocytes in the lower stratum corneum. Filaggrin is further proteolyzed/degraded to pyrrolidine carboxylic acid, urocanic acid and free amino acids in the upper layers of the stratum corneum[3]. These key ingredients constitute the "natural moisturizing factor" (NMF), which is essential for the water-binding capacity of the corneal layer. NMF components are water-soluble, which means they are easily leached from the cells with water contact, making the skin drier[4,5,6,7]. Lack of NMF can lead to dry skin with flaking, fissuring, and cracking. Additionally, the intercellular lipid-enriched matrix, which is composed of ceramides, free fatty acids (FFAs) and cholesterol primarily prevents evaporation of water and maintains skin permeability barrier. Altered composition of intercellular lipids and decreased NMF content in the skin leads to impaired barrier function that triggers trans-epidermal water loss (TEWL) contributing to dry skin/xerosis[8].

In the epidermis, the metabolism of polyunsaturated fatty acids (PUFAs) is highly active with the exception that short-chain polyunsaturated fatty acids (PUFAs) such as α-linolenic acid (ALA) and linoleic acid (LA), that cannot be synthesized by the skin and need to be taken through dietary sources (vegetables and seed oils). Linoleic acid, is the major fatty acid present in the epidermis, and plays crucial role in regulating the integrity of the skin permeability barrier through its incorporation into ω-hydroxylated ceramides[9,10,11,12]. However, dietary deficiency of linoleic acid contributes to dry, scaly and pruritic skin condition. Combined supplementation with ALA and LA showed significant improvement in the skin associated inflammatory conditions (Atopic dermatitis, psoriasis) [13,14,15]. Moisturizers play a crucial role in maintaining the skin's lipid barrier and retaining moisture. Synthetic moisturizing creams are skincare products, typically include a combination of emollients, humectants, and occlusives are used to reduce trans epidermal water loss (TEWL) which in turn, increases skin hydration, and ameliorate xerosis. However, it is noteworthy that synthetic skincare can also include harmful ingredients like parabens, silicones, and phthalates associated with side effects [16]. Hence, the paramount therapeutic approach to treat skin dryness could be an impactful herbal cosmetic oils over synthetic versions.

One of such cosmetic oil is Candlenut oil (Kukui oil) which is derived from the nuts of Aleurites moluccanus and is widely distributed through Polynesia and Madagascar, found in Hawaii, South Asia, China, and the West Indies[17,18]. Candlenut oil is rich source of polyunsaturated fatty acids such as oleic acid, linoleic acid, linolenic acid and alpha-Linoleic acid, as well as other fatty acids such as palmitic acid and stearic acid. It is enriched with powerful antioxidants, including tocopherols and phenolic compounds. According to a study by Oyen et al. (2007), the dominant fatty acid present in candlenut oil are palmitic acid (5-9%), stearic acid (2-7%), oleic acid (11-35%), linoleic acid (34-49%), and linolenic acid (21-35%). It exhibits diverse pharmacological activities including anti-inflammatory, antioxidant, purgative, antimicrobial as well as moisturizing, emollient properties[19, 20]. It supports higher water transpiration rates than saturated oil [21] that might attributes to its feeling of silkiness instead of greasiness. The substantial benefits of candlenut oil might be due to its unique fatty acid composition that possess its potential aid to certain skin conditions (eczema, burns, psoriasis)[22]

In the light of above evidences, we propose that candlenut oil could acts as protective barrier over skin and which might decrease transepidermal water loss and retain moisture due to its occlusive or emollient properties. Hence, the present investigation was undertaken to formulate and evaluate moisturizing cream enriched with candlenut oil.

## 2.Materials And Methods

### 2.1 Material:

Cold pressed Candlenut oil was procured from Moksha Lifestyle Products (Amarnath Khandelwal Agencies Pvt. Ltd). Delhi.

**Figure 1. Candlenut Oil**


### 2.2 Characterization of cold pressed candlenut oil:

#### 2.2.1 Determination of Acid value:

Acid value is the number which expresses in milligrams theamount of potassium hydroxide necessary to neutralize the free fatty acidpresent in 1gm of the substance.

10 gm of the substance was dissolved in 50 ml of a mixture of equal volumes of ethanol (95%) and ether, previously neutralized with 0.1 M potassium hydroxide to a phenolphthalein solution. If the sample did not get dissolved in the cold solvent, a flax was connected with a reflux condenser and warmed slowly with frequent shaking until the sample dissolved. 1 ml of phenolphthalein was added and titrated with 0.1 M potassium hydroxide until the solution remained faintly pink after shaking for 20 seconds[23].

The acid value was calculated the from expression

Acid value = 56.1*NV/W

V= the number of ml of 0.1 M potassium hydroxide required.

N=normality of potassium hydroxide.

W=weight in grams of substance.

#### 2.2.2 Determination of Saponification value:

Saponification value is the number of milligrams of potassium hydroxide necessary to neutralize the free fatty acids and to saponify the esters present in 1 gm of substance.

2 g of sample was weighed into a 200 ml flask of borosilicate glass fitted with a reflux condenser. 25 ml of 0.5 M ethanolic potassium powder was added, along with a little pumice powder, and the solution was boiled under reflux on a water bath for 30 minutes. 1ml of phenolphthalein solution was added and titrated immediately with 0.5 M hydrochloric acid (a ml). The operation was repeated, omitting the substance (b ml)[24].

The saponification value was calculated from expression

Saponification value = 28.05(b-a)/w

Where,

W = weight in grams of the substance.
b = blank.
a = titrate value.

**2.2.3 Determination of specific gravity:**

Specific gravity or relative gravity is a dimensionless quantity that is defined as the ratio of the density of a substance to the density of water at a specified temperature and pressure.

The specific gravity of candle nut oil was evaluated using Hydrometer, according to the procedure described by Lin et al. (2018) [25,26].

**2.2.4 Determination of refractive index:**

Refractive index is the ratio of the speed of light in vacuum to the speed of light in the medium.

The refractive index was evaluated using refractometer as per the procedure described by [ASTM D – 1218 – 02][26] as depicted in Table.1

**2.3 Quantitative Analysis of Candlenut oil using Gas Chromatography**

Candlenut oil composition was analysed by Gas Chromatographic method, according to the procedure given in AOAC 969.33.

**3.Formulation and development of Moisturizing cream**

For the formulation of moisturizing cream 4 base formulations (F1, F2, F3, F4) were prepared and were evaluated for their physical appearance, pH and daylong stability. The moisturizing cream was formulated by mixing oil phase into the water (at 80 °C) phase by slow continuous stirring until the homogenous emulsion was formed. Thereafter, perfume was added when the temperature downs at 35 °C. Preservative was added in the water phase before mixing. The base that gives satisfactory texture and consistency was selected as final base (Table 3). The trial, F4 base formulation was found to be more stable than any other formulations and hence selected as moisturizing cream base. It did not reveal visible signs of physical instability such as cracking, creaming, phase inversion of the cream base at 45°C for 24 hr (Table 3) [27].

**3.1 Formulation of Candlenut oil moisturizing cream (active)**

Candlenut oil (active) was incorporated into the selected base at three different concentrations of 2% , 4% , 6% , as depicted in Table 4.

**3.2 Formulation of hyaluronic acid moisturizing cream**

On the another side a moisturizing cream was formulated by adding hyaluronic acid (6%) using F4 base ingredients, as depicted in Table 5. To compare the moisture content with Candlenut cream using skin moisture meter

**3.3 Characterization of Moisturizing cream:**

**3.3.1 Organoleptic Properties**

The properties like colour, odour and consistency were visually observed.

**3.3.2 Determination of pH**

The pH values of moisturizing cream were determined using digital pH meter, by taking 10% moisturizing cream in distilled water at room temperature 25º ± 0.2°C. The electrode was dipped into the sample and pH was recorded [28].

### 3.3.3 Determination of Washability

Formulations were applied on the skin and then ease and extend of washing with water were checked manually.

### 3.3.4 Determination of Spreadability

Spreadibility indicates the extent of area to which cream readily spreads on application to skin[29]. About 1gm of cream was weighed at the centre of the glass plate (10x10cm) and carefully another glass plate was placed over it. 2 kg weight was placed on the plate (avoid sliding of the plates). The diameter of cream in cm was measured after 30 min.

### 3.3.5 Determination of Total Fatty Matter

2 gm of the material was weighed into a conical flask, and then 25 ml of dilute hydrochloric acid was added to it. A reflux condenser was fitted into the flask, and the solution was boiled until it became perfectly clear. The content of the flask was poured into a 300 ml separation funnel and rinsed with 50 ml of ethyl ether in portions of 10 ml. The ether rinsing was then poured into the separation funnel. The funnel was shaken until the layers separated. The aqueous phase was separated, then shaken with 50 ml of ether twice. All the ether extracts were combined and washed with water until free of acid. The ether extract was then filtered through a filter paper containing sodium sulfate into a conical flask that had been previously dried at room temperature of 60±2°C and weighed. Then, all the ether was distilled off, and the material in the flask was dried at room temperature of 60±2°C to a constant mass[30].

The Total Fatty Matter was calculated using the following expression

Total fatty substance, % by mass= 100(M1/M2)

Where,

M1- mass in g of the residue

M2- mass in g of the material taken for the test.

### 3.3.6 Accelerated Thermal Stability

The sample of the cream was subjected to accelerated test condition and was kept at room temperature, in oven at 45℃ and in refrigerator at 4℃. The parameters like colour, odour, pH and separation if any were observed at specific interval of time[31].

a)Colour

Colour of the product was observed visually. The samples were kept inoven, fridge and room temperature and results were noted regularly at interval of 2 days and the results are depicted in Table 6.

b) Odour

Odour change was noted simply by smelling the product. The samples were kept on oven fridge and room temperatures were noted regularly at interval of days and the results are summarized in the Table 7.

c) pH-

The pH of moisturizing cream was measured using pH meter. The sampleswere kept in oven, fridge, and room temperature were noted regularly at intervals and results are depicted in Table 8.

### 3.3.7 Skin Irritancy Test

Skin irritancy test is performed to evaluate whether the product or formulation is allergic to skin or not. If the skin exhibits redness (erythema) or have any irritation like itching, inflammation it considered to be irritant. If it failed to show any effect even after applying for around 5-10 minutes, it is considered safe and nonirritant/non-allergic. An irritation test was performed on human volunteers with their consent. Five volunteers were selected, and 1.0 g of formulated cream was applied on an area of 2

square inches to the back of the hand. The volunteers were observed for any allergic reactions like, erythema, edema, or irritation[32].

**3.3.8 *In-Vivo* Evaluation of moisturizing efficacy of Candlenut oil moisturizing cream**

The comparative study of moisturizing cream containing different concentrations of candlenut oil (2%, 4%, 6%) was evaluated by Moisture meter (SK-3). To measure the moisture content, 12 female healthy volunteers with dry skin were chosen.

**Procedure:**

The patch of the volunteers skin where the testing has to be done was first cleaned with ethanol and dried with cotton, reading of the normal skin was noted ie, blank reading. Six partitions of 2cm each of skin areas under testing have been done with marker After those 6 partitions with cream of different concentrations of active has been tested. Sample (F4) was applied and gently massaged. The probe of moisture meter was kept on the applied part and reading was taken after each 15min till 120min. All the samples were tested in same manner. After each reading the probe was cleaned, for avoiding error[33].

The test was performed on inner side of arm where four squares of 2 cm each were made giving 1cm gap in between using a scale and a marker. Different formulations with (F5, F6, F7) and without active (F4) as well as HA cream (F8) was topically applied into each complete square. Then the moisture content of all the formulations was measured every 15 min post application till 2 hr, using digital skin moisture meter. Each formulation containing candlenut oil (2%, 4%, 6%) was compared with a control cream base (F4) and HA cream (6%). The readings are depicted in Table 9.

## 4.RESULT AND DISCUSSION

Candlenut oil is rich source of polyunsaturated fatty acids (omega 6 fatty acid and omega 3 fatty acid ) such as oleic acid, linoleic acid, linolenic acid and alpha-linoleic acid. The predominant fatty acid present in candlenut oil are linoleic acid (34-49%), and linolenic acid (21-35%) [34]. It exhibits moisturizing, emollient properties due to the presence of LA and ALA [35,36] which improve skin hydration and prevent the signs of aging[37].Therefore, an attempt was made to develop and characterize the herbal candlenut moisturizing cream pertaining to its protective skin barrier and occlusive or emollient properties.

**4.1 Characterization of cold pressed Candlenut Oil:**

Characterization of cold pressed Candlenut oil was carried out by determining its acid value, saponification value, specific gravity and refractive index. Acid value, saponification value, specific gravity and refractive index of candlenut oil were found to be 1.6, 187.8, 0.921, 1.469 respectively.

It was found that the values of the candlenut oil were in the standard range [38,39] so it was found to be pure and could be used in cosmetic preparation as shown in Table 1.

**4.2 Quantitative Analysis of Candlenut Oil using Gas Chromatography:**

The Fatty acid content profile of candlenut oil was evaluated using gas chromatography. It revealed the presence of 31.3% monosaturated fats, 11.4% saturated fats and 54.8% of polyunsaturated fats [20.39% omega 3 (ALA) and 34.41% omega 6 fatty acid (LA)] which was found in predominance. Our results are in accordance with earlier findings (Table 2). Yusri et al. found that fatty acid profile of candlenut oil chiefly contains about 20.39% omega 3 and 38.10% omega 6 and 26.67% omega 9 fatty acid.

**4.3 Formulation and Development of Moisturizing Cream:**

In the present study, initially, four base formulation trials (F1, F2, F3 and F4) were formulated and were evaluated for their physical appearance, pH and daylong stability. The trial F4, base formulation was

found to be more stable than any other formulations after keeping it at 45°C for 24 hr, and had a pH value of 5.6 which was close to the skin pH [40]. Moreover, the physical appearance of F4 base cream was more appealing in terms of colour, odour, texture and consistency. Hence, F4 base was selected for formulating moisturizing cream containing candlenut oil at 2%, 4% and 6% concentrations.

Previous finding revealed antioxidant effects of topical formulation of candlenut oil lotion at 6% [41]. Therefore, in present study 2%, 4% and 6% candlenut oil (active) concentrations were selected for preparation of moisturizing cream (F5, F6, and F7) and the finished products were subjected to various quality tests including, organoleptic Properties, pH, washability, spreadability, total fatty matter, skin irritancy, accelerated thermal stability and evaluation of *in-vivo* moisturizing effects.

**4.4 Characterization of Candlenut moisturizing cream:**

**4.4.1 Organoleptic Properties:**

The formulated candlenut moisturizing creams were evaluated for colour, odour, and texture and consistency. The results of organoleptic evaluations are summarized in Table 6

Colour and Appearance: The colour and appearance of the formulation were observed visually. The formulations were white, odourless, light weight with a smooth texture and semi-solid with smooth consistency.

Odour: The Odour of the formulation was pleasant/characteristic.

Consistency: It was found to be semi-solid with smooth consistency and were acceptable.

All the formulations exhibited pleasant organoleptic characteristics.

**4.4.2 Determination of pH:**

The pH of a moisturizing cream is an important factor that can impact its effectiveness and skin compatibility. An optimal pH helps maintain the skin's natural acidic mantle, which is crucial for proper barrier function and skin health[42]. The pH of all the formulations with active were found to be between 6.5±0.185 to 6.9±0.158 that is within the range. Although alkaline, this pH is typical of creams containing borax and acceptable by the ISI standards.

**4.4.3 Determination of Washability:**

The washability of the cream was manually examined following the application of several formulations on the skin, and the degree and simplicity of water washing was assessed. The washability test was passed by the cream.The washability of the developed cream was found to be 9sec. Good washability is demonstrated when the applied cream is easily removed from the area of application, leaving a non-greasy skin[43].

**4.4.4 Determination of Spreadability:**

Spreadability was determined to check the extent of area to which cream is spread. Spreadability is the net result of a combination of rheological contributions, not just viscosity alone. Structural and viscoelastic characteristics that describe the rigidity, strength, and relative contributions of elastic and viscous behavior also play a major role in imparting spreading properties[44]. Here glass plates were used to check the spreadability and some weight was kept on it for around half an hour. The cream passed the spreadability test which was found to be 9.2 cm as evident in the Fig 2.

**4.4.5 Determination of Total Fatty Matter:**

The total fatty matter content in moisturizing cream is a crucial parameter that determines the quality and performance of the product. Higher TFM content is associated with better moisture delivery to the

skin, which helps prevent dryness and maintain healthy skin [45]. Total fatty matter of moisturizing cream % by mass was found to be 38%.

**4.4.6 Accelerated Thermal Stability:**

The purpose of accelerated stability studies is to ensure that the cosmetic product maintains its intended physical, chemical and microbiological quality, as well as functionality and aesthetics when stored under appropriate conditions[46]**.**

The moisturizing cream with 6% of candlenut oil was evaluated for the accelerated stability testing at different conditions and following changes were observed for month in which stability was checked twice in a week. The color, odor and pH of the product were found to be stable. The formulation of moisturizing cream was found to be effective in terms of all functional parameters.

**Colour:** Slight change in oven and fridge temperature was observed for all samples and the colour of the product remains stable as evident from the Table 7.

**Odour:** Slight change in oven and fridge temperature was observed for all samples and the odour of the product was stable shown in Table 8.

**pH:** The pH of the product was found to be stable within the range of 6-7. Slightly change at all the temperature was observed and the pH of the product was found to be stable shown in Table 8.

**4.4.7 Skin Irritancy Test:**

Skin irritancy test is performed to evaluate whether the product or formulation is allergic to skin or not. If the skin exhibits redness (erythema) or have any irritation like itching, inflammation it is found to be irritant. If it does not show any effect even after applying for around 5-10 minutes, it is considered safe and nonirritant/non-allergic [47]. The formulated candlenut oil moisturizing cream was found to be non-irritant after applying for around 10 minutes. In the present study, application of F4, F5 and F6 formulations containing candlenut oil (2%, 4% and 6%) failed to produce any redness, irritation or inflammation on the skin and hence considered safe and non-irritant.

**4.4.8 *In-Vivo* evaluation of moisturizing efficacy of candlenut oil moisturizing cream:**

Digital skin moisture meter (SK-3) was used to determine the moisturizing efficacy of candlenut oil moisturizing cream with different concentrations. Twelve female healthy volunteers (n=12) with dry skin were selected. None of the volunteers had applied any cosmetic cream two week prior to the study. Initially, a reading of normal skin (blank reading; negative control) by was noted by applying probe of digital skin moisture meter (SK-3) on skin. To each volunteer the moisturizing creams with active (candlenut oil at 2%, 4%, 6% concentrations) and without active (Control) and HA cream were applied on demarcated square areas of forearm in a uniform layer (shown in fig 3) and the products were gently massaged into the stratum corneum. The probe of moisture meter was kept on the applied square part and reading was taken after each 15 minutes till 120 minutes (shown in fig 4, fig 5 and Table 10). All measurements were performed in controlled conditions of relative humidity (45%±2%) and temperature (220±20).

In the present investigation, topical application of candlenut oil cream dose-dependently increased in the moisture content at the concentration of 2%, 4%, and 6% as compared with base (control) without active base control and HA base creams. The highest skin moisture content values were observed at 6% formulation at 120 min relative to control. Hence, moisturizing cream with 6% of candlenut oil was selected as a final product.

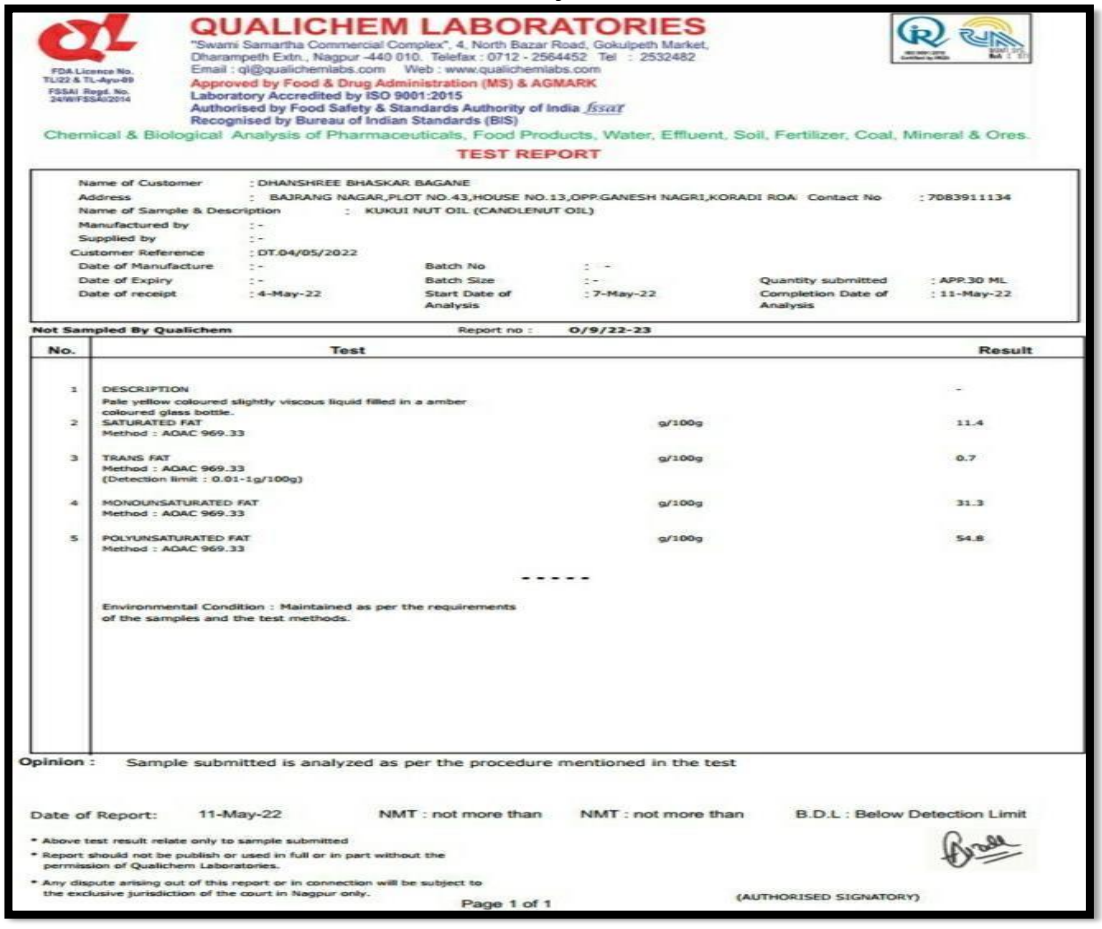
## CONCLUSION

The current study revealed the effective formulation of moisturising cream containing candlenut oil at different concentration of 2 %, 4% and 6 %. The candlenut moisturising cream exhibited excellent properties in terms organoleptic Properties, pH, washability, spreadability, total fatty matter, skin irritancy, accelerated thermal stability and *in-vivo* moisturizing effect. The topical application of moisturizing cream with 6% of candlenut oil revealed maximum moisturising effect compare to base control. We suggest topical moisturizing cream containing 6% Candlenut oil could be a potential herbal skin hydrating approach to ameliorate skin dryness and signs of aging by virtue of its emollient properties and protective skin barrier function.

**Table 1: Physiochemical testing of Candlenut Oil.**

| Sr. No. | Name of test | Standard range | Obtained value |
|---|---|---|---|
| 1. | Acid value | 1.4 - 2.5 | 1.6 |
| 2. | Saponification value | 185 – 195 | 187.8 |
| 3. | Specific gravity | 0.901 -0.935 | 0.921 |
| 4. | Refractive index | 1.466 - 1.470 | 1.469 |

**Table 2: Qualitative evaluation of Candlenut oil fatty acid composition using Gas chromatography analysis.**



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Chemical & Biological Analysis of Pharmaceuticals, Food Products, Water, Effluent, Soil, Fertilizer, Coal, Mineral & Ores.

TEST REPORT

Name of Customer : DHANSHREE BHASKAR BAGANE
Address : BAJRANG NAGAR,PLOT NO.43,HOUSE NO.13,OPP.GANESH NAGRI,KORADI ROA Contact No : 7083911134
Name of Sample & Description : KUKUI NUT OIL (CANDLENUT OIL)
Manufactured by : -
Supplied by : -
Customer Reference : DT.04/05/2022
Date of Manufacture : - Batch No : -
Date of Expiry : - Batch Size : - Quantity submitted : APP.30 ML
Date of receipt : 4-May-22 Start Date of Analysis : 7-May-22 Completion Date of Analysis : 11-May-22

Not Sampled By Qualichem Report no : Q/9/22-23

| No. | Test | | Result |
|---|---|---|---|
| 1 | DESCRIPTION<br>Pale yellow coloured slightly viscous liquid filled in a amber coloured glass bottle. | | - |
| 2 | SATURATED FAT<br>Method : AOAC 969.33 | g/100g | 11.4 |
| 3 | TRANS FAT<br>Method : AOAC 969.33<br>(Detection limit : 0.01-1g/100g) | g/100g | 0.7 |
| 4 | MONOUNSATURATED FAT<br>Method : AOAC 969.33 | g/100g | 31.3 |
| 5 | POLYUNSATURATED FAT<br>Method : AOAC 969.33 | g/100g | 54.8 |

- - - - -

Environmental Condition : Maintained as per the requirements of the samples and the test methods.

Opinion : Sample submitted is analyzed as per the procedure mentioned in the test

Date of Report: 11-May-22 NMT : not more than NMT : not more than B.D.L : Below Detection Limit

* Above test result relate only to sample submitted
* Report should not be publish or used in full or in part without the permission of Qualichem Laboratories.
* Any dispute arising out of this report or in connection will be subject to the exclusive jurisdiction of the court in Nagpur only.

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**Table 3: Formulation of cream base**

| **Ingredients** | **Quantity for 100 grams** | | | |
|---|---|---|---|---|
| Phase A (oil phase) | F1 | F2 | F3 | F4 |
| Stearic acid | 8 | 8 | 8 | 8 |
| Cetyl alcohol | 4 | 5 | 6 | 7 |
| Cetostearyl Alcohol | 2 | 2 | 2 | 2 |
| Lanolin | 2 | 2 | 2 | 2 |
| Mineral oil | 1 | 1 | 1 | 1 |
| Methyl paraben | 0.25 | 0.25 | 0.25 | 0.25 |
| Phase B (water phase) | | | | |
| Glycerin | 5 | 5 | 5 | 5 |
| Propylene glycol | 2 | 2 | 2 | 2 |
| Triethanolamine | 2.5 | 2.5 | 2.5 | 2.5 |
| Propyl paraben | 0.25 | 0.25 | 0.25 | 0.25 |
| Water | Upto100 ml | Upto 100ml | Upto 100ml | Upto 100ml |

**Table 4: Formulation of moisturizing creams with candlenut oil (active) at 2% , 4% , 6% concentration.**

| **Ingredient** | **Quantity for 100 gm** | | |
|---|---|---|---|
| **Phase A (Oil)** | F5 | F6 | F7 |
| Stearic acid | 8 | 8 | 8 |
| Cetyl alcohol | 5 | 6 | 7 |
| Cetostearyl Alcohol | 2 | 2 | 2 |
| Lanolin | 2 | 2 | 2 |
| Mineral oil | 8 | 8 | 8 |
| **Candlenut oil** | **2** | **4** | **6** |
| Propyl paraben | 0.25 | 0.25 | 0.25 |
| **Phase B (Water)** | | | |
| Propylene glycol | 2 | 2 | 2 |
| Glycerine | 5 | 5 | 5 |
| Triethanolamine | 2.5 | 2.5 | 2.5 |
| Water | Upto 100ml | Upto 100ml | Upto 100ml |
| Methyl paraben | 0.25 | 0.25 | 0.25 |
| Perfume | Q.S | Q.S | Q.S |

**Table 5: Formulation of Cream with Hyaluronic acid.**

| Sr. No. | Ingredients | Quantity for 100% |
|---|---|---|
| **1.** | Stearic acid | 8 |
| **2.** | Cetyl alcohol | 7 |
| **3.** | Cetostearyl Alcohol | 2 |
| **4.** | Lanolin | 2 |
| **5.** | Mineral oil | 8 |
| **6.** | Propyl paraben | 0.25 |
| **7.** | Propylene glycol | 2 |
| **8.** | Glycerine | 5 |
| **9.** | Triethanolamine | 2.5 |
| **10.** | Water | Upto 100ml |
| **11.** | Methyl paraben | 0.25 |
| **12.** | Perfume | Q.S |
| **13.** | Hyaluronic acid | 6% |

**Table 6: Organoleptic properties**

| Parameter | Observation |
|---|---|
| **Colour** | **White** |
| **Odour** | **Odourless** |
| **Consistency** | **Semi-Solid** |

**Table 7:- Change in colour**

| Sr.No | Time | Change in colour | | |
|---|---|---|---|---|
| | | Room temperature (27±2℃ ) | Fridge Temperature (4℃ ) | Oven temperature (50±2℃) |
| 1. | 1 | OC | OC | OC |
| 2. | 3 | OC | OC | OC |
| 3. | 5 | OC | OC | OC |
| 4. | 7 | OC | OC | OC |
| 5. | 9 | OC | OC | OC |
| 6. | 11 | OC | OC | OC |
| 7. | 13 | OC | OC | OC |
| 8. | 15 | OC | OC | OC |
| 9. | 17 | OC | OC | OC |
| 10. | 19 | OC | OC | OC |

| | | | | |
|---|---|---|---|---|
| 11. | 21 | OC | OC | OC |
| 12. | 23 | OC | OC | OC |
| 13. | 25 | OC | OC | OC |
| 14. | 27 | OC | OC | OC |
| 15. | 29 | SOCC | OC | SOCC |
| 16. | 31 | SOCC | SOCC | SOCC |

**Abbreviations :** OC- Original colour
SOCC- Slight original colour change

**Table 8 :- Change in odour**

| Sr.No | Time | Change in odour | | |
|---|---|---|---|---|
| | | Room temperature (27±2℃ ) | Fridge Temperature (4℃ ) | Oven temperature (50±2℃) |
| 1. | 1 | OC | OC | OC |
| 2. | 3 | OC | OC | OC |
| 3. | 5 | OC | OC | OC |
| 4. | 7 | OC | OC | OC |
| 5. | 9 | OC | OC | OC |
| 6. | 11 | OC | OC | OC |
| 7. | 13 | OC | OC | OC |
| 8. | 15 | OC | OC | OC |
| 9. | 17 | OC | OC | OC |
| 10. | 19 | OC | OC | OC |
| 11. | 21 | OC | OC | OC |
| 12. | 23 | OC | OC | OC |
| 13. | 25 | OC | OC | OC |
| 14. | 27 | OC | OC | OC |
| 15. | 29 | SOCC | SOCC | SOCC |
| 16. | 31 | SOCC | SOCC | SOCC |

**Abbreviations:** OO- Original odour
SOOC- Slight original odour change

**Table 9 :- Change in pH**

| Sr.No | Time | Change in pH | | |
|---|---|---|---|---|
| | | Room temperature (27±2℃ ) | Fridge Temperature (4℃ ) | Oven temperature (50±2℃) |
| 1. | 1 | 6.39 | 6.39 | 6.39 |
| 2. | 3 | 6.35 | 6.38 | 6.35 |

| | | | | |
|---|---|---|---|---|
| 3. | 5 | 6.41 | 6.42 | 6.36 |
| 4. | 7 | 6.43 | 6.42 | 6.44 |
| 5. | 9 | 6.46 | 6.43 | 6.44 |
| 6. | 11 | 6.49 | 6.43 | 6.50 |
| 7. | 14 | 6.52 | 6.47 | 6.52 |
| 8. | 17 | 6.55 | 6.49 | 6.56 |
| 9. | 20 | 6.56 | 6.50 | 6.57 |
| 10. | 23 | 6.57 | 6.50 | 6.59 |
| 11. | 26 | 6.62 | 6.53 | 6.63 |
| 12. | 28 | 6.63 | 6.53 | 6.65 |
| 13. | 31 | 6.65 | 6.54 | 6.66 |

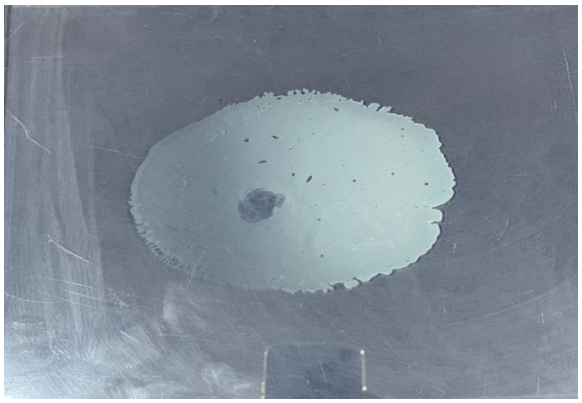

**Fig 2: Spreadability**

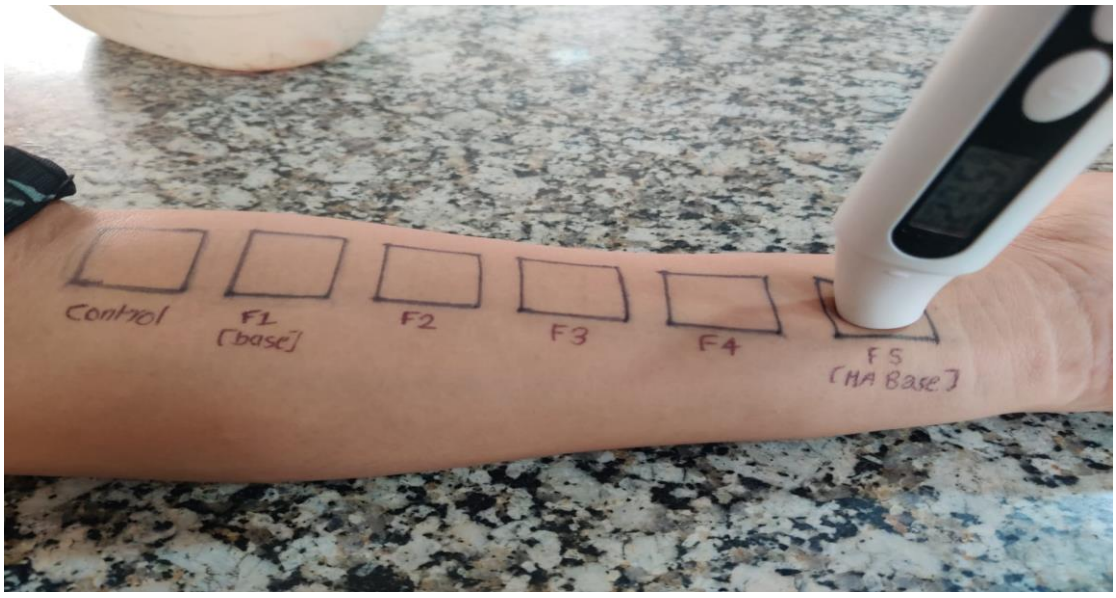


**Fig.3: Detection of moisture content on female volunteer skin by Moisture meter.**

**Table 10 :-Evaluation of moisturizing efficacy on dry skin by moisture meter.**

| Time(min) | Control (without active) | | Average value (with active) | | | Hyaluronic acid (Base) |
|---|---|---|---|---|---|---|
| | Blank (skin hydration) | [F1] Control (Without active) | [F2] 2% | [F3] 4% | [F4] 6% | [F5] 6% |
| 15 min | 9.02 | 11.2 | 30.1 | 40.2 | 55.21 | 52.4 |
| 30 min | 9.96 | 11.50 | 31.52 | 41.39 | 56.55 | 52.6 |
| 45 min | 10.32 | 12.32 | 32.73 | 42.54 | 57.69 | 53.7 |
| 60 min | 10.89 | 13.54 | 33.24 | 44.20 | 60.78 | 54 |
| 75 min | 11.05 | 14.22 | 34.47 | 46.72 | 64.80 | 55.9 |
| 90 min | 11.95 | 15.48 | 35.66 | 48.18 | 66.82 | 56.1 |
| 105 min | 12.86 | 16.36 | 36.98 | 49.4 | 67.84 | 57.7 |
| 120 min | 13.00 | 17.02 | 37.25 | 50.20 | 65.91 | 59 |

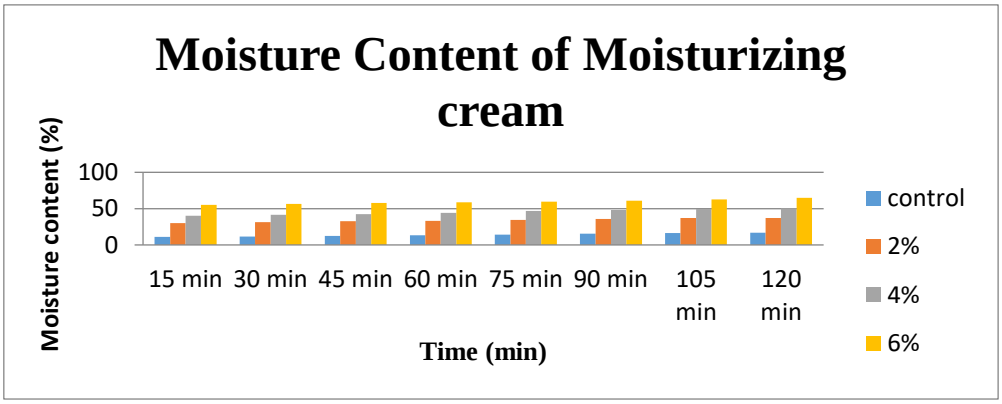


**Fig 4: Graphical representation of Moisture content of Moisturizing cream.**

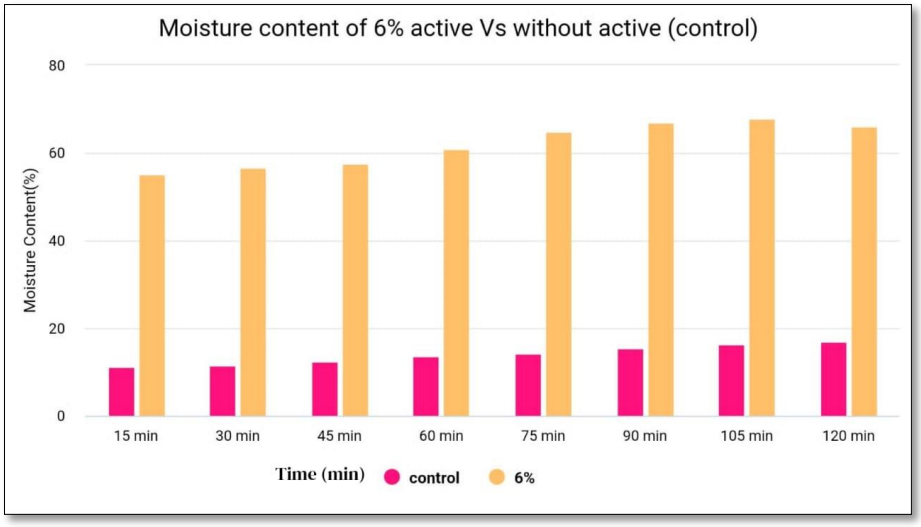


**Fig 5 :- The graphical representation of Moisture content of moisturizing cream of candlenut oil (active) the difference between 6% of active Vs Control (Without active)**

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