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## Formulation, characterization and evaluation of herbal under-eye cream

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### ABSTRACT

The eyes, also a focal point of facial expression, not only convey the full range of human emotion but also have a significant impact on how one is perceived in terms of health and beauty. When there is more melanin produced around the eyes than is usual, giving them a darker color, the condition is periorbital hyperpigmentation. In the present research an attempt has been made to formulate, characterize and carry out the in-vitro evaluation of an under-eye cream containing herbal extracts for lightening the dark eye contours. The plant material chosen includes aqueous extracts of *Glycyrrhizaglabra Linn.* (Yashtimadhu), *Hemidesmusindicus R.Br.* (Sariva) and *Santalum album Linn.* (Chandana). The characterization comprises of determining the physicochemical parameters which proves the genuinity of the plant material procured. The cream was assessed for its safety and stability. The aesthetic appeal of the product was also studied. The aqueous extract of the drug was examined for its anti tyrosinase activity. The under-eye cream formulation showed good aesthetic appeal, stability and safety. The anti tyrosinase activity was shown by *Glycyrrhizaglabra Linn.* (Yashtimadhu). while *Hemidesmusindicus R.Br.* (Sariva) and *Santalum album Linn.* (Chandana) showed negligible activity.

**KEY WORDS:** Periorbital hyperpigmentation, Dark eye circles, *Glycyrrhizaglabra*, *Hemidesmusindicus*, *Santalum album*.



### INTRODUCTION

To look stunning and beautiful is a natural aspiration. This increased awareness of looking good has also brought in more sensitivity to problems of the skin especially the face. Eyes are known as “The Windows of our Soul”. One of the major problems faced by people of all age groups is that of dark circles. The skin under the eye is very thin and when blood passes through the large veins close to the surface of the skin, it can create a bluish tint to the skin. The more transparent the skin is, the darker the circles appear. When there is more melanin produced around the eyes than is usual, giving them a darker color, the condition is periorbital hyperpigmentation. The causes for dark circles include fatigue, stress, excessive sun exposure, sleep deprivation, long working hours, lack of balanced diet, dehydration and medical conditions related to kidney, thyroid, and anemia.<sup>1,2</sup> Eye care products are one of the top selling cosmetics in the world. A large number of under eye creams are currently available in the market. However many common side effects reported for

these currently available under eye creams are as follows: redness, burning, itching, peeling and swelling. Several studies on cosmetic reactions have shown that the ingredients most often responsible for cosmetic allergy are fragrances.<sup>3</sup> Therefore most of the agents used to treat skin hyperpigmentation or discoloration show common adverse effects like mild irritation, increased risk of sun damage/ sensitivity and minor skin cracking as most of them contain artificial colour or perfume. Moreover several studies have shown that naturally occurring colours and perfumes are always associated with fewer or complete absence of side effects.<sup>4</sup> An attempt has been made in this present study to make use of the actives from naturally occurring traditional plant materials belonging to *Varnya (Complexion Enhancers)* category of Ayurvedic in alleviating these dark eye contours. The crude drugs chosen for treatment of dark eye circles, for the present research work from the Classical Ayurvedic texts are **Yashtimadhu** (*Glycyrrhizaglabra Linn.*), **Sariva** (*Hemidesmusindicus R.Br.*) and **Chandana** (*Santalum album Linn.*).<sup>5,6</sup>

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A formulation of a stable w/o cream containing ethanolic extracts of *Glycyrrhizaglabra* and its effects on skin pigment melanin has been described by Akhtar, Naveed et al.<sup>7</sup> Improvement of Melasma by Liquirtin extracted from *Glycyrrhizaglabra* has been reported by Amer M., et al.<sup>8</sup> Neyra O., et al has reviewed Glabrene and Isoquiritigenin as tyrosinase inhibitors from licorice roots(2003).<sup>9</sup> Fu B, Li H, Wang X, Lee FS, Cui S. have studied isolation and identification of flavonoids in licorice and their inhibitory effects on tyrosinase (2005).<sup>10</sup> U.S. patent number 5,609,875 discloses a combination of *Glycyrrhizaglabra* with  $\alpha$ - or  $\beta$ -hydroxy acids, or salts thereof for skin lightening. The Japanese patent application JP2010100554 discloses a melanin formation inhibitor containing an extract of at least one kind of plants selected from *Hemidesmus indicus*, *Nigella sativa*, *Bacopa monniera* and *Piper longum* an active ingredient for the inhibition or prevention of the occurrence of pigmentation caused by aging or sunburn. The Japanese patent number JP3107254 discloses a whitening cosmetic containing the water extract of *Santalum album* Linn. and, if necessary, further at least one selected from a group consisting of kojic acid, ascorbic acid, hydroquinone, liquirtin, and their derivatives. There is a clear need for an effective composition to address the problems associated with under eye creams and thereby provide an effective formulation using herbal actives for alleviation of dark eye contours or periorbital hyperpigmentation. The present study has an objective to formulate an under eye cream combining aqueous extracts of *Glycyrrhizaglabra* Linn.(Yashtimadhu), *Hemidesmus indicus* R.Br. (Sariva) and *Santalum album* Linn.(Chandana). The research also includes characterization of these crude drugs and their evaluation for the anti-tyrosinase activity. The cream is further evaluated for its aesthetic appeal, safety and stability.

## MATERIALS AND METHODS

The crude drugs for the present research were procured from Total Herb Solutions, Mumbai. The roots of *Glycyrrhizaglabra* Linn.(Yashtimadhu) and *Hemidesmus indicus* R.Br. (Sariva) and heartwood of *Santalum album* Linn.(Chandana) were ground into a coarse powder.

**Chemicals and Materials:** All the chemicals used for formulation and evaluation were obtained from SD fine chemicals (Mumbai).

**Characterization of the Plant Material:** The raw material standardization was carried out with reference to 'The Ayurvedic Pharmacopoeia of India.' The standardization included the physicochemical testing of the raw material.

Physicochemical testing ensures the identity and determines the quality of the crude drug samples.<sup>11-13</sup> The Physicochemical tests to be carried out on the three drugs chosen for study are as in Table 1.

**Anti tyrosinase activity of herbal extract:** The aqueous extracts of Yashtimadhu (*Glycyrrhizaglabra* Linn.), Sariva (*Hemidesmus indicus* R.Br.) and Chandana (*Santalum album* Linn.) were prepared, two test samples were prepared. In Sample I, the drugs (Yashtimadhu, Sariva and Chandana) were combined and the anti-tyrosinase activity was determined at four different concentrations – 5%, 10%, 25% and 50% using anti-tyrosinase enzyme. In Sample II, the same activity was determined in a combination of Sariva and Chandana. The activity was determined spectrophotometrically at 475nm. This experiment was carried out in triplicate and the Mean % Inhibition was determined.<sup>14-16</sup>

**Formulation of the under eye creams:** The aqueous extracts of *Glycyrrhizaglabra* Linn.(Yashtimadhu), *Hemidesmus indicus* R.Br. (Sariva) and *Santalum album* Linn.(Chandana) were prepared in different concentrations. These extracts were further incorporated into vanishing cream base. The stable cream was formed by using a 25% concentration of *Glycyrrhizaglabra* Linn. (Yashtimadhu), 25% of *Hemidesmus indicus* R.Br. (Sariva) and 10% concentration of *Santalum album* Linn. (Chandana). One of the major attributes of this preparation was that there is no colour, perfume or pearlescence added which are regular ingredients added to normal creams which result in several allergic reactions.<sup>17-20</sup> The selected cream was evaluated for physicochemical properties, aesthetic appeal and stability. The composition of the cream depicted in Table no 2. and Figure no 1. The final cream has been depicted in Figure 2 and the unstable cream in Figure 3.

**Evaluation of the under eye cream Sensory Evaluation:** Sensory evaluation involved testing the product for organoleptic properties like appearance, colour, texture, aesthetic appeal, cohesiveness, firmness, robustness, spreadability, residue left and effect on the skin.<sup>21-23</sup>

**Microbiological evaluation:** The preparation was tested for freedom from the following pathogenic microorganisms namely, *Escherichia coli*, *Staphylococcus aureus*, *Pseudomonas aeruginosa* and Fungi.<sup>21-23</sup>

**Test for E-coli:** Loopful of the cream was streaked on sterile MacConkey agar and incubated at 37 °C centigrade for 24 hours.

**Test for Staphylococcus aureus:** Loopful of the cream was streaked on sterile mannitol salt agar plate and incubated at 37 °C for 24 hours.

**Test for Pseudomonas aeruginosa:** Loopful of the cream was streaked on sterile cetrimide agar plate and incubated at 37 °C centigrade for 24 hours.

**Test for Fungi:** Loopful of the cream was streaked on sterile Sabrand's agar plate and incubated at room temperature for 2 to 3 days (48-72 hrs).

**Accelerated stability studies:** The stability of the formulation was tested on the following parameters for a period of one month.<sup>21-23</sup>

- Change in colour, fragrance, viscosity, pH, and precipitation of ingredients.
- The changes observed in different organoleptic parameters over time when stored at 4 °C, room temperature and 45 °C at 70 % relative humidity (aging).
- Sun exposure studies over a period of 3 months.
- Centrifugation of the product.

**Aging Studies:** Aging studies on the formulation at three different temperatures i.e. at 4°C, room temp and 45°C for a period of one month was conducted. The product is observed for physical changes like colour, fragrance, texture, flow, viscosity, precipitation of ingredients, coalescence and phase separation.

**Sun Exposure evaluation:** Many pharmaceutical formulations are found to be photosensitive that is showing instability on light exposure. To evaluate the photo stability of the product the sun exposure test is carried out. In this test the herbal cream was exposed to sunlight from morning 9 am. to evening 6 pm and the change in physical characteristics were observed.

**Centrifugation:** The product undergoes a lot of agitation on transportation. The centrifugation test proves that the product can sustain high levels of centrifugal force. The evaluation was carried out by placement of the herbal cream into a centrifugal machine for 35 minutes at a speed of 3750 rpm for five cycles.

## RESULTS

**Characterization of the Plant Material:** The testing of physicochemical values is a tool for crude drug standardization. The values obtained are as elaborated in Table no. 3,4 and 5. The results of physicochemical tests indicate that the plant material procured for study were genuine and of good quality.

**Anti-tyrosinase Activity:** The observations for Anti-tyrosinase testing carried out to suggest the possible mode of action of the three herbs used for study is compiled below:

The values for the anti-tyrosinase activity done on the aqueous extract containing, Yashtimadhu, Sariva and Chandana (Sample 1) has been depicted in the Table no. 6. And the activity observed with Sariva and Chandana is shown in Table no. 7. The values depicted above show that significant inhibition of tyrosinase was obtained at a 25% concentration in sample 1 (combination of all three herbs in equal proportion). Negligible tyrosinase inhibition was observed at 5% (0.00) and 10% (4.16) concentration. The anti-tyrosinase activity observed for 50% was equivalent to that showed by 25%. In accordance to the above test it can be inferred that the best result may be obtained by the use of 25% concentration. The results of anti-tyrosinase test carried out also depicts that appreciable tyrosinase inhibition was shown by Yashtimadhu (*Glycyrrhizaglabra* Linn.) in 25% concentration. It was also inferred that Sariva (*Hemidesmusindicus*R.Br ) and Chandana (*Santalum album* Linn) showed negligible anti-tyrosinase activity. In case of Sariva and Chandana the skin lightening that may be observed during the in-vivo testing is not because of its anti-tyrosinase activity, it follows a different mode of action.

### Evaluation of under eye cream

**Sensory Evaluation:** The color, odour and texture determine the appeal of the product visually. The other properties of cohesiveness, firmness, rubouts determine the staying property of the herbal cream on application. For the observations made the cream had a pleasant colour, odour and texture. The cohesiveness and firmness were found to be moderate. Spreadability was complete and residue left behind was low. Rubout for the cream was five which was acceptable. The overall aesthetic appeal of the herbal cream was found to be excellent as depicted in table no. 8.

**Microbiological Evaluation:** The preparation was tested for freedom from the following pathogenic microorganisms namely, Escherichiacoli, Staphylococcus auerus, Pseudomonas aeruginosa and Fungi. The results for the microbiological evaluation were as tabulated in Table no. 9. From the results of microbiological testing it was observed that test for Escherichiacoli, Staphylococcousaureus, Pseudomonas aeruginosa and Fungi were negative indicating freedom of the preparation from all viable microorganisms indicating a safe preparation.

**Accelerated stability studies:** The stability of the formulation was tested on the following parameters for a period of one month.

**Aging Studies:** The observations for aging studies at different temperatures and the changes shown in the product are as indicated in Table no. 10,11,12. As observed there were no changes in the physical parameters of the cream at any of the three temperatures. This is indicative of the stability of the herbal cream to aging.

**Sun Exposure evaluation (Photosensitivity):** In this test the herbal cream was exposed to sunlight from morning 9 am. to evening 6 pm and the change in physical characteristics were observed as tabulated in Table no. 13. The observations depict that the formulation under study was highly photostable as it showed no changes in the physical characters of the formulation.

**Centrifugation:** The product undergoes a lot of agitation on transportation. The centrifugation test proves that the product can sustain high levels of centrifugal force. The observations were tabulated after placement of the herbal cream into a centrifugal machine for 35 minutes at a speed of 3750 rpm. for five cycles. The Table No. 14 illustrates the effect of centrifugation on the formulation. The observations, after five cycles of centrifugation showed no changes in the cream's properties, proving its ability to endure high transportation stresses. The stability tests proved that the cream has good shelf life and stability to withstand harsh conditions. The above testing and evaluation of the plant material has proved its authenticity. The under eye cream formulation had excellent sensory appeal, it was found to be safe as it was found to be free from microorganisms and it passed all stability testing parameters.

## DISCUSSION

In the present work an attempt has been made to not only use the natural extracts, but also to provide it with good aesthetic appeal by its incorporation into a vanishing cream base. The good appeal of the product to the consumer will lead to better utilization of the product and hence better effectiveness. *Hemidesmus indicus* contributed a beautiful pink colour to the preparation. The pleasant odour was an attribute to *Hemidesmus indicus* and *Santalum album*. The pearlescence was due to crystallization of stearic acid as small crystals after melting. As there were no artificial colour and perfume the preparation also abides by the necessary attributes of an ideal eye cream. ***The absence of these ingredients makes the present formulation more safe and non- allergenic. One***

***of the major attribute of this preparation was that there is no colour, perfume or pearlescence added which are regular ingredients added to normal creams.*** The physicochemical tests indicate all the values obtained by testing the raw materials for the present research are well within limits. The study of the total ash values obtained from all three drugs show that the drugs are of a good grade and not exhausted. It also indicates the crude drugs are free from earthy and sandy material especially in case of *Glycyrrhiza glabra* and *Hemidesmus indicus*. The extractive values are indicative of the extractability of the active principles in water and in alcohol. In the present study the water-soluble extractive values are important as the aqueous fraction is to be used for cream preparation. Except for *Santalum album*, *Glycyrrhiza glabra* and *Hemidesmus indicus* have got good water extractives as indicated by the physicochemical testing. The value for foreign matter present is indicative of the purity of the crude drug. The test for the same on *Sariva* and *Chandana* shows very low values for foreign matter, indicating a very good quality of crude drug without much adulteration. The physicochemical tests indicate the genuinity and good quality of the plant material. Anti-tyrosinase activity is a very useful tool in determining the skin lightening property. Tyrosinase is the enzyme responsible for biosynthesis of Melanin the pigment responsible for determining skin colour. Anti-tyrosinase activity determines the ability of the chosen drug in inhibition of the enzyme tyrosinase quantitatively and hence brings about skin lightening and removal of skin discolouration. The results of anti-tyrosinase test carried out depicts that appreciable tyrosinase inhibition was shown by *Yashtimadhu* (*Glycyrrhiza glabra* Linn.) in 25% concentration. The active molecule reported for this activity was Glabridin. Glabridin showed maximum activity in the lipidic media. However the in the present research the aqueous extract was used, so the probability of lightening could be also attributed to Flavanoids present in *Glycyrrhiza glabra* Linn. The probable mode of action of which was reported to be melanin dispersal.<sup>24</sup> It was also inferred that *Sariva* (*Hemidesmus indicus* R.Br ) and *Chandana* (*Santalum album* Linn) showed negligible anti-tyrosinase activity. The sensory evaluation indicates the aesthetic appeal of the formulation. Aesthetic appeal is important for a preparation intended to be applied on the face especially around the eye. This evaluation includes examining the formulation, for appearance, odour, texture, spreadability, cohesiveness, firmness of the preparation. The rubout and the residue left on application of the herbal cream were also noted. The observations of all the results obtained indicated that the product had excellent aesthetic

appeal. Microbiological evaluation is carried out on formulations to ensure its freedom from harmful microorganisms. The formulation under consideration is an herbal cream, to be applied on the skin around the eye. There is a possibility that the preparation may get into the eye. Moreover the preparation has to be studied for its efficacy in human volunteers with prominent dark circles. These factors make it very essential for the formulation to be free from all viable microbes. Tests carried out evaluated that the herbal cream is free of all commonly occurring pathogenic microbes like E-coli, Staphylococcus aureus, Pseudomonas aeruginosa and Fungi hence safe for use on human skin. The purpose of the present stability study is to provide information of the change in the quality of the formulation when exposed to varied environmental factors like temperature, humidity and light for different time intervals. This would help establish the shelf life of the formulation and the storage conditions recommended for the product formulated.

The aging studies showed stability of the cream to different ranges of temperature. The aging studies indicate good shelf life of the cream. Many pharmaceutical formulations are found to be photosensitive that is showing instability on light exposure. To evaluate the photo stability of the product the sun exposure test is carried out. The

results of the tests indicate good photo stability. The product undergoes a lot of agitation on transportation. The centrifugation test proves that the product can sustain high levels of centrifugal force. After the test it was concluded that the herbal cream is very stable to physical stresses. All the stability tests indicate a very stable herbal under-eye cream.

## CONCLUSION

The above research has been carried out with the aim of developing formulations containing traditional substances and studying their effectiveness in removal of the dark eye contours by in-vitro techniques. The research included characterization of plant material with reference to the Ayurvedic Pharmacopoeia of India. The study also comprised of determining the aesthetic appeal, safety and stability of the under eye formulation. The testing of plant extracts for anti tyrosinase has confirmed that there is significant lightening achieved by *Glycyrrhizaglabra* Linn. The ayurvedic literature also includes Hemidesmus indicus and Santalum album in the Varnyacategory, which is indicative that these too can bring about skin lightening, but through a different mode of action. This could be proved by conducting clinical trials with the under eye cream.

**Table 1: Physicochemical Tests**

S.NO.	TEST	CRUDE DRUG		
		Yashtimadhu	Sariva	Chandana
1.	Foreign Matter		√	√
2.	Total Ash	√	√	√
3.	Acid Insoluble Ash	√	√	√
4.	Alcohol Soluble Extractive	√	√	√
5.	Water Soluble Extractive	√	√	√
6.	Volatile Oil			√
7.	T.L.C.			√
8.	Moisture Content	√	√	√

*Yashtimadhu* :A.P.I. Part I, Vol I

*Sariva* :A.P.I. Part I, Vol I

*Chandana* : A.P.I. Part III, Vol III

**Table 2: Composition of Herbal Cream**

Ingredients	Quantity required in %
Stearic Acid	18.0
Cetyl Alcohol	0.5
Potassium Hydroxide	0.2
Sodium Hydroxide	0.16
Triethanolamine	1.2
Glycerin	10.0
Methyl Paraben	0.01
Propyl paraben	0.02
*Herbal Extracts (10%, 25% and 50%)	qs. 100

*Aqueous herbal extracts to be added in different concentrations*

**Table 3:PHYSICOCHEMICAL TESTS: Sariva(*Hemidesmusindicus R.Br.*)**

Sr no.	Physicochemical Test	Limits	Results
1	Total Ash	NMT 4%	3.8%
2	Acid Insoluble Ash	NMT 0.5%	0.29%
3	Alcohol Soluble Extractive	NLT 15%	18.3%
4	Water Soluble Extractive	NLT 13%	15%
5	Moisture Content	-	2.9%
6	Foreign Matter	NMT 2%	0.1%

**Table 4: PHYSICOCHEMICAL TESTS: Yashtimadhu(*Glycyrrhizaglabra Linn.*)**

Sr no.	Physicochemical Test	Limits	Results
1	Total Ash	NMT 10%	4.8%
2	Acid Insoluble Ash	NMT 2.5%	1.89%
3	Alcohol Soluble Extractive	NLT 10%	16.8%
4	Water Soluble Extractive	NLT 20%	22.5%
5	Moisture Content	-	5.18%

**Table 5: PHYSICOCHEMICAL TESTS: Chandana(*SantalumalbumLinn.*)**

Sr no.	Physicochemical Test	Limits	Results
1	Total Ash	NMT 1%	0.32
2	Acid Insoluble Ash	NMT 0.2%	0.1%
3	Alcohol Soluble Extractive	NLT 8%	11.2%
4	Water Soluble Extractive	NLT 1%	2.2%
5	Foreign matter	NMT 1%	0%

**Table 6:Results for Anti-tyrosinase test on Sample one**

Conc.	Expt. 1	Expt. 2	Expt. 3	Mean inhibition(tyrosinase) %
5%	0.00	0.00	0.00	0.00
10%	4.99	5.92	1.58	4.16
<b>25%</b>	<b>26.80</b>	<b>35.21</b>	<b>29.36</b>	<b>30.46</b>
50%	27.68	34.92	28.46	30.35

*Sample 1: Extract containing Yashtimadhu, Sariva and Chandana*

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**Table 7: Results for Anti-tyrosinase test on Sample two**

Conc.	Expt. 1	Expt. 2	Expt. 3	Mean % inhibition
5%	0.00	0.00	0.00	0.00
10%	0.00	0.00	0.00	0.00
<b>25%</b>	<b>3.96</b>	<b>3.58</b>	<b>5.69</b>	<b>4.41</b>
50%	4.37	3.31	2.98	3.55

*Sample 2: Extract containing Sariva and Chandana*

**Table 8: Sensory Evaluation of Herbal Cream**

Sr. no.	Name of the test	Specification	Observation
1	Colour	Pinkish Brown	Pinkish Brown
2	Odour	Pleasant	Pleasant
3	Texture	Smooth, Slippery, Pearlescent	Smooth, Slippery, Pearlescent
4	Aesthetic appeal	Excellent/Good/Satisfactory	Excellent
5	Cohesiveness	High/Moderate/Low	Moderate
6	Firmness	High/Moderate/Low	Moderate
7	Rub outs	Average 7-8 rubouts	Average 5 rub outs
8	Spreadability	Complete/Moderate/Low	Complete
9	Residue left	Low	Low

**Table 9: Microbiological Evaluation of Herbal Cream**

Sr. no.	Name of the Test	Result
1	E-coli	Negative
2	Fungi	Negative
3	Total Plate Count	Negative
4	Staphylococcus Aurous	Negative
5	Pseudomonas Aeroginosa	Negative

**Table 10: Aging Studies at Temperature : 4° Celsius**

Parameters	Day 1	Day 3	Day 7	Day 14	Day 21	Day 28	Day 30
Colour	Pinkish Brown	Pinkish Brown	Pinkish Brown	Pinkish Brown	Pinkish Brown	Pinkish Brown	Pinkish Brown
Fragrance	Herbal/ Original	Herbal/ Original	Herbal/ Original	Herbal/ Original	Herbal/ Original	Herbal/ Original	Herbal/ Original
Texture	Smooth	Smooth	Smooth	Smooth	Smooth	Smooth	Smooth
Flow	Highly Viscous	Highly Viscous	Highly Viscous	Highly Viscous	Highly Viscous	Highly Viscous	Highly Viscous
pH (25)	7.5	7.5	7.5	7.5	7.5	7.5	7.5
Viscosity (25)	32,000	32,500	32,500	32,500	32,500	32,500	32,500
Precipitation of ingredients	N	N	N	N	N	N	N
Coalescence of emulsion	N	N	N	N	N	N	N
Phase separation	N	N	N	N	N	N	N

N- No Change

Viscosity- in Cps at 25° Celsius, by Brooks field viscometer using spindle 64 at 6rpm

Packaging material- In tubes and in glass jars

**Table 11: Aging Studies at Temperature : 45° Celsius and 70% Relative humidity**

Parameters	Day 1	Day 3	Day 7	Day 14	Day 21	Day 28	Day 30
Colour	Pinkish Brown	Pinkish Brown	Pinkish Brown	Pinkish Brown	Pinkish Brown	Pinkish Brown	Pinkish Brown
Fragrance	Herbal/ Original	Herbal/ Original	Herbal/ Original	Herbal/ Original	Herbal/ Original	Herbal/ Original	Herbal/ Original
Texture	Smooth	Smooth	Smooth	Smooth	Smooth	Smooth	Smooth
Flow	Highly Viscous	Highly Viscous	Highly Viscous	Highly Viscous	Highly Viscous	Highly Viscous	Highly Viscous
pH (25)	7.5	7.5	7.5	7.5	7.5	7.5	7.5
Viscosity (25)	32,000	32,500	32,500	32,500	32,500	32,500	32,500
Precipitation of ingredients	N	N	N	N	N	N	N
Coalescence of emulsion	N	N	N	N	N	N	N
Phase separation	N	N	N	N	N	N	N

N- No Change

Viscosity- in Cps at 25° Celsius, by Brooks field viscometer using spindle 64 at 6rpm

Packaging material- In tubes and in glass jars.



**Table 12: Aging Studies at Temperature : Ambient degree Celsius (Room temperature)**

Parameters	Day 1	Day 3	Day 7	Day 14	Day 21	Day 28	Day 30
Colour	Pinkish Brown	Pinkish Brown	Pinkish Brown	Pinkish Brown	Pinkish Brown	Pinkish Brown	Pinkish Brown
Fragrance	Herbal/ Original	Herbal/ Original	Herbal/ Original	Herbal/ Original	Herbal/ Original	Herbal/ Original	Herbal/ Original
Texture	Smooth	Smooth	Smooth	Smooth	Smooth	Smooth	Smooth
Flow	Highly Viscous	Highly Viscous	Highly Viscous	Highly Viscous	Highly Viscous	Highly Viscous	Highly Viscous
pH (25)	7.5	7.5	7.5	7.5	7.5	7.5	7.5
Viscosity (25)	32,000	32,500	32,500	32,500	32,500	32,500	32,500
Precipitation of ingredients	N	N	N	N	N	N	N
Coalescence of emulsion	N	N	N	N	N	N	N
Phase separation	N	N	N	N	N	N	N

N- No Change; Viscosity- in Cps at 25° Celsius, by Brooks field viscometer using spindle 64 at 6rpm  
Packaging material- in tubes and in glass jars

**Table 13: Sun Exposure Evaluation**

Parameters	Day 1	Day 3	Day 7	Day 14	Day 21	Day 28	Day 30
Colour	Pinkish Brown	Pinkish Brown	Pinkish Brown	Pinkish Brown	Pinkish Brown	Pinkish Brown	Pinkish Brown
Fragrance	Herbal/ Original	Herbal/ Original	Herbal/ Original	Herbal/ Original	Herbal/ Original	Herbal/ Original	Herbal/ Original
Texture	Smooth	Smooth	Smooth	Smooth	Smooth	Smooth	Smooth
Flow	Highly Viscous	Highly Viscous	Highly Viscous	Highly Viscous	Highly Viscous	Highly Viscous	Highly Viscous
pH (25)	7.5	7.5	7.5	7.5	7.5	7.5	7.5
Viscosity (25)	32,000	32,500	32,500	32,500	32,500	32,500	32,500
Precipitation of ingredients	N	N	N	N	N	N	N
Coalescence of emulsion	N	N	N	N	N	N	N
Phase separation	N	N	N	N	N	N	N

N- No Change

Viscosity- in Cps at 25° Celsius, by Brooks field viscometer using spindle 64 at 6 rpm.

Sun Exposure- In Sun Light from 9 am to 6pm

Packaging material- In tubes and in glass jars

**Table 14: Evaluation of Cream after Centrifugation**

Parameters	After 5 cycles
Colour	Pinkish Brown
Fragrance	Herbal/Original
Texture	Smooth
Flow	Highly Viscous
pH (25)	7.5
Viscosity (25)	32,000
Precipitation of ingredients	N
Coalescence of emulsion	N
Phase separation	N

N- No Change; Centrifugation- for 35 minutes at 3750 rpm



**Figure 1: Cream Preparation in process**



**Figure 2: Final cream**



**Figure 3: Cream containing 50% herbal extracts showing instability**

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