FORMULATION & EVALUATION OF HERBAL CREAM CONTAINING SOLID LIPID NANOPARTICLES

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ABSTRACT:

Nano cosmetics are products that incorporate nanomaterials, which are materials with at least one dimension between 1 and 100 nm. Nanomaterial can be used to enhance performance, stability and delivery of active ingredients. Herbal nano cosmetics products combine benefits of herbal ingredients and nanotechnology. The aim of the present research work was to formulate and evaluate herbal cream containing solid lipid nanoparticles. Solid Lipid Nanoparticles have numerous benefits when incorporated in to herbal creams. It enhanced the delivery and efficacy of herbal extracts. It include benefits like increased stability, improved penetration in to the skin, prolonged release of active compounds and enhanced hydration. Cream was formulated using aqueous herbal extracts of *Nelumbo nucifera*, *Averrhoa carambola*, *Nigella sativa* and *Sphaeranthus indicus.* Method carried out to prepare O/W cream was very simple. Firstly, oil phase was prepared, the mixture of stearic acid (4%), Glyceryl Monostearate(2%) and cetyl alcohol (2%) were melted at 70 ˚C. Secondly aqueous phase was prepared, paraffin oil(8%), tween 80(2%) Triethanolamine(0.25%) and water (77.75%) heated at 70 ˚C. Then aqueous phase was added into the oil phase at 70 ˚C with continuous stirring. After that it was allowed to come at room temperature. Perfume and methyl paraben (as preservative) was added at last just before the finished product was transferred to suitable container. Mixture of SLNs extracts (4%) was added after cooling. The physical parameters such as pH, homogenecity, appearance (colour), Spreadability, ease of removal, type of smear, Acid value, Saponification Value and phenolics were determined.

Keywords: Herbal cream, Cosmetics, Solid lipid nanoparticles, Ageing, Acne.

1.INTRODUCTION [1,2,3]:

Here we have used four herbal ingredients in this cream preparation which are Kalonji, Gorakhmundi, Lotus and Kamrakh. Kalonji can help with acne, blemishes, dry skin and even improve skin tone. They are also known to have anti-ageing benefits and protect the skin from environmental damage. Gorakhmundi is used to the skin to treat acne, wounds and fungal infections. Lotus flower extract is used in skin care for both acne and ageing due to its anti-oxidant and anti-inflammatory properties. It reduces acne and also protects the skin from environmental damage and give youthful appearance by reducing wrinkles and improving skin elasticity. Kamrakh is also used for both acne and ageing due to its anti-oxidant and anti-inflammatory properties. It can help in reducing acne by controlling sebaceous secretions and promoting a clean and glowing complexation. It having vitamin C content and ability to boost collagen production can reduce wrinkles, fine lines and age spot. The aim of our cream is to protect acne, ageing and also protect the skin.

Acne, also known as acne vulgaris which is common issue especially for teenagers and adolescence according to global statistics approximately 85% of Population will suffer from skin acne at around age of 12-25 years, nearly 8% adult at age of 23-24 years old and only 3% of adult having Acne at age 35-44 years old. In youths, overweight and obesity are inversely associated with acne in a dose-dependent manner. Overweight and obesity are associated with acne in girls aged 18 and 19, but the same association was not observed in boys. Propionibacterium acne and staphylococcus epidermis were responsible for acne. Acne symptoms generally include pain, stiffness, swelling, tenderness etc. the erythema systemic symptoms which are mostly absent in acne vulgaris.

Ageing is a complex biological process which progressive accumulation of changes with time that are associated with or responsible for the ever-increasing susceptibility to disease and death which accompanies advancing age and “the sum of the deleterious free radical reactions going on continuously throughout the cells and tissues constitutes the aging process or is a major contributor to it” Free radicals and oxidative stress play an insignificant role in aging. Aging is the generated by multiple causes damage to the structures and functions of the molecules, cells, organs, *etc.*, of an organism. Main causes of aging are collagen breakdown**,** photo defense, oxidation, inflammation, glycation.

Nanotechnology is regarded as the most recent technology of 21st century and is considered as a big boon in the cosmetic industry. Nano cosmetics which utilize nanoparticles, that offered

enhanced benefits over traditional cosmetics due to increased skin penetration, controlled release of active ingredients and improved stability. Nanomaterials can carry a wide range of ingredients, both hydrophilic and hydrophobic and small size of nanoparticles allows better delivery and efficacy.

The interest of consumer towards the natural bioactive compound which has a functional Ingredient in the cosmetic product has been increased now a day due to their various health beneficial effect. Herbal cosmetic products are used to protect the skin against exogenous and endogenous harmful agents and enhance the beauty and attractiveness of skin. Herbal cosmetics are always preferred over synthetic cosmetics due to their natural composition, potential foe, fewer side effects and suitability for various skin types. These cosmetics are best choice to reduce skin disorders because they are made with plant-based ingredients.

2. **MATERIALS AND METHODS:**

2.1 **Materials**: All plants extracts were collected from Bhagvati Herbals & Healthcare private limited, Vapi. Stearic acid, Soy lecithin, Cetyl alcohol, Glyceryl Monostearate, Tween 80, Triethanolamine, Paraffin oil & methyl paraben were analytical grade reagents.

2.2.1 **Method of Preparation of Solid Lipid Nanoparticles**[4,5,6,7]: Solid Lipid Nanoparticles were prepared using microemulsion technique. Stearic acid was added into a conical flask and the flask was put into a porcelain dish filled with water and then it was put on a magnetic stirrer at 70 ˚C. After that drug extract, Tween 80 and Soy lecithin was added & stirred at 1000 RPM until it was well mixed. The prepared emulsion was diluted with ice-cold water by adding it dropwise into ice-cold water and it was stirred by using a mechanical stirrer in a cold water bath at 3000-3100 RPM for 2-3 hours. The prepared suspension was sonicated for half an hour. Sonicated suspension was centrifuged at 14500 RPM at 8˚C for 5 minutes to separate probable nanoparticles and nanoparticles were collected by using methanol and keep it drying until it was completely dry.

2.2.2 **Method of preparation of O/W Cream**[8,9] **:**

Oil phase: - Stearic acid (8 gm), Glyceryl monostearate(4 gm), Cetyl alcohol(4gm)

Aqueous phase: - Paraffin oil (8 ml), Tween 80(2 ml), Triethanolamine (0.25), Water(up to 100 ml) **Preservative**: - Methyl paraben.

Firstly, oil phase was prepared, the mixture of stearic acid (4%), Glyceryl Monostearate (2%) & cetyl alcohol (2%) were melted at 70 ˚C. After that, aqueous phase was prepared with paraffin oil (8%), tween 80(2%) Triethanolamine (0.25%) & water (77.75%) heated at 70 ˚C. Then aqueous phase was added into the oil phase at 70 ˚C with continuous stirring. Once the transfer was completed it was allowed to come at room temperature all the while being stirred. After cooling, mixture of SLNs extracts (4%) was mixed with cream. Perfume and methyl paraben (as preservative) was added at last just before the finished product was transferred to suitable container.

3. RESULT & DISCUSSION [9,10,11,12,13] :

3.1 Formulation characterization: -

3.1.1 **Physical evaluation**: Cream was evaluated for its physical appearance. Physicochemical parameters such as pH, Spreadability, acid value, saponification value etc.

Appearance: The appearance of formulation was determined by its coarseness, colour, pearlescence, thickness and segregation.

Removal: The removal of the applied formulation was done by washing it under tap water.

After feel: Formulation was applied on the skin and examined its smoothness, emolliency & amount of residue left after application.

Determination of pH: Accurately weighed 0.5 gm of the formulation was dissolved in 50.0 ml of distilled water and its pH was measured.

Type of smear: The type of smear or film formed on the skin was examined by the application of the cream on the skin.

Dye test: The scarlet red dye is mixed with cream. Place a drop of it on a microscopic slide and cover it with a coverslip and examines it under microscope. If the disperse globules appear red the ground colourless, then the cream is o/w type. The reverse condition occurs in w/o cream i.e. the disperse globules appear colourless in the red ground.

Homogenecity: Homogenecity of the formulation was examined by touch and visual appearance.

Tube extrudability: Extrudability was based upon the quantity of cream extruded from tube on application of certain load. Extrudability is better when more quantity was extruded. The sample was filled in to a clean, lacquered aluminium collapsible, one-ounce tube with 5 nm opening. It was then placed in between two glass slides and clamped. When constant load of 1 kg cream was put on the slides and already weighed cream as extrude through the tip than extruded cream was collected and weighed. Calculate the percentage of cream extruded.

Primary skin irritation test: The site of the test was cleaned with surgical spirit. Then cream was applied on the test area. Erythema and edema was observed on test site for 24 hr, 48 hr and 72hr after application. The purpose of this test was to evaluate the irritation which was produced on the skin. If cream does not cause any erythema and edema which means the prepared formulation was non-irritant on the skin.

Acid Value: 2 gm sample was accurately weighed and dissolve it in 50 ml mixture of ethanol(95%v/v) and ether (1:1) which was previously neutralized with 0.1 mm potassium hydroxide solution. The flask was connected with reflux condenser and warmed slowly with frequent shaking until sample was dissolved. After that 1 ml of phenolphthalein solution was added and titrated with 0. KOH until solution remained faint pink after shaking it for 30 sec. The acid value was calculated from expression given below.

$$\text{Acid value} = 5.61N/W$$

Where, N=ml of KOH required, W= weight of sample in gm.

Saponification value: weight 2 gm of sample accurately and refluxed it with 25 ml of 0.5 N alcoholic KOH for 30 mins. After that cooled it and allowed it to come at room temperature and 1ml of phenolphthalein solution was added and titrated it with 0.5 N HCL(a ml). Carry out the blank titration without substance under examination. Calculate the saponification value from the expression given below.

$$\text{Saponification value} = 28.05(b-a)/w$$

Where, w=weight of the sample in gm.

3.1.2 **Estimation of total phenolic content** [14,15] : Estimation of phenolics was done by Folin-Ciocalteu method.

Method: To 1 ml of methanolic extract, 0.1 ml of folin ciocalteu reagent & 0.9 ml of water were added in to 10 ml volumetric flask and allow it to stand for 5 mins in dark. After that 1

ml of 7% w/v sodium carbonate and 0.4 ml water were added at the end of this and allow it to stand in dark for 30 mins for stabilization of blue colour formed. The absorbance was measured at 765 nm after using methanol as a blank.

The Percentage of total phenolics was calculated from calibration curve of Gallic acid by using same procedure. The data for total phenolic contents of formulation were expressed as mg of gallic acid equivalent weight (GAE)/ 100 g of dry mass. This was done in triplates.

Table 1: Physicochemical evaluation of cream

Parameter	**Result**
Appearance	Creamish brown
Homogeneity	Good
Removal	Easy
After feel	Emollient
Type of smear	Continuous
pH	6.04
Acid value	8.41
Saponification value	214.925
Phenolic content	0.013%
Primary skin irritation test	Nil

3.1.3 **Texture analysis of cream**: Texture analysis was done by QTS Brookfield texture analyser. Texture analyser is an instrument that measures the response of a sample to compression. Quantifying extrudability is important to determine the ease of removaland application of creams. In forward extrusion the sample is forced through an orifice in sample container. To push or force something out of something it requires extrudability. In the test force is applying to a product so it flows direct to an outlet and in the form of one or more holes that are in present in test cell. The sample or formulation is compressed until the structure of the sample is suspended and it release through these outlets. The peak or maximum force is taken as a measurement for firmness/hardness. For the consistency, are under the curve is taken as a measurement. When product gives the high value that means firmer the sample. while sample contains more consistency or thickness it gives high value. Maximum peak in the positive area shows the maximum sample firmness. In the graph positive area shows total forces required to extrude (consistency). Peak load of cream was 467 gm & higher the value the firmer is the sample.

Testing criteria/parameters

Test type : Compression

Trigger point : 5 g

Target value : 20 mm

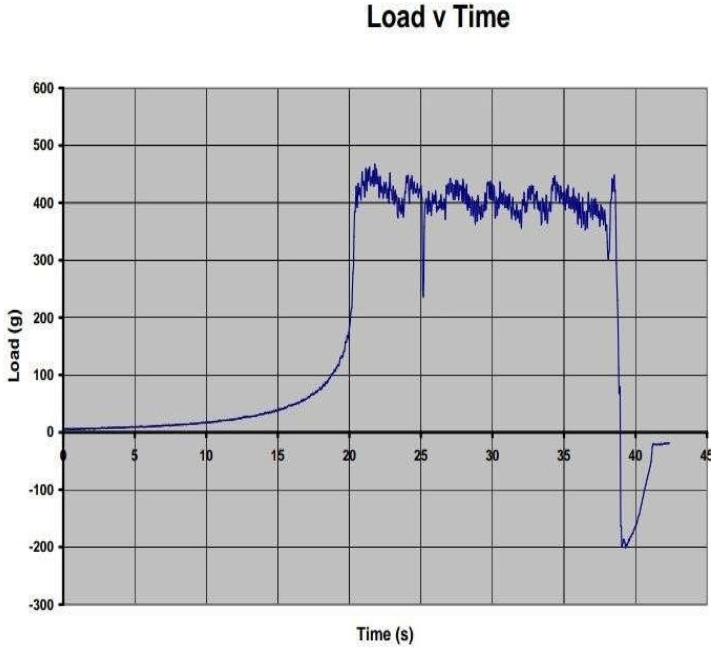
No. of cycle : 1

Hold time : 0 sec

Recovery time : 0 sec

TPB support span: 0 mm

Fig 1: Cream strength curve



3.1.4 **Stability study of formulation**: Cream preparation was kept at room temperature condition 45±2 ºC and humidity at 75%±5% RH for a period of 3 months.

Instrumentation:

Equipment Name: GMP-SC227L

Equipment Id: AIC-LMCP/INST/006

Equipment Make: Kesar Control Systems

Stability study was carried out and physicochemical parameters were checked. There were negligible changes noted in the parameters measured. The optimized formulation was subjected to accelerated stability studies for 90 days at 45±2°C and 75%±5% relative humidity. The formulations were evaluated for the parameters such as colour, appearance, pH, Spreadability, drug content, Acid value, Saponification value, Phenolic content etc. There were negligible changes noted in the parameters measured.

Table 3: Stability of Acid value, Saponification value & Phenolic content

Days	Acid Value	Saponification Value	Phenolic Content
0	8.4	214.925	0.013%
30	8.9	242.975	0.015%
60	8.1	214.925	0.013%
90	8.6	200.9	0.011%

Table 4: Stability studies of formulation

Day	Temperature	Formulations	Parameter			
			Colour	pH	After Feel	Homogeneity
0	RT	Cream	NCC	6.02	E	G
	40ºC ±2º C 75 RH±2RH	Cream	NCC	6.03	E	G
30	RT	Cream	NCC	6.04	E	G
	40ºC ±2º C 75 RH±2RH	Cream	NCC	6.03	E	G
60	RT	Cream	NCC	6.02	E	G
	40ºC ±2º C 75 RH±2RH	Cream	NCC	6.04	E	G
90	RT	Cream	NCC	6.03	E	G
	40ºC ±2º C 75 RH±2RH	Cream	NCC	6.02	E	G

NCC: Not change in colour, E: Emollient, G: Good

4. SUMMARY AND CONCLUSION:

The results showed that the solid lipid nanoparticles of all herbal extracts were successfully incorporated into cream for topical application on skin. It can be concluded that on combining the extracts of *Nelumbo nucifera*, *Averrhoa carambola*, *Nigella sativa* and *Sphaeranthus indicus* give multipurpose effects such as skin whitening, anti ageing and anti acne effects on skin. The results of our study, experimental work, and the evaluation tests show that the formulation containing SLNs of herbal extracts is a very effective and safe antiaging and anti-acne cream that can be easily used topically. In present study our aim is to develop an Herbal face cream which would be natural. We have formulated an Herbal face cream by using plant extracts which are commonly used traditionally. All the ingredients used to Formulate Herbal cream are safer and their use can greatly reduce the skin aging, acne and skin elasticity. These studies suggest that composition of extracts and base of cream is stable and safe; it may produce synergistic action without side effects as this cream comprising of many natural substances.

ACKNOWLEDGEMENT

The Authors are grateful to the Department of Pharmacognosy, L.M.College of Pharmacy, Ahmedabad, Gujarat for providing the facilities to carry out the work.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

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