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Formulation and Evaluation of Poly-Herbal Anti-Acne Cream

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Abstract:
Acne is a prevalent dermatological issue affecting individuals of all ages, often leading to diminished self-esteem and confidence. This study aims to develop an effective anti-acne cream using a polyherbal ingredient approach. The primary objective is to formulate a cream capable of controlling and inhibiting the growth of acne-causing bacteria. Herbal extracts from Symplocos racemosa (lodhra), Rubia cordifolia (madder), and Curcuma longa (turmeric) were selected for their potent antibacterial properties and additional skin benefits. These herbal components were integrated into a cream base, which also included preservatives. The formulated cream successfully passed all evaluation tests, demonstrating stability during and after stability testing, and did not cause skin irritation in the irritancy test.

Keywords: Symplocos racemosa, Rubia cordifolia, Curcuma longa, Staphylococcus aureus, anti-acne cream, antibacterial properties.

1. Introduction:

Since the ancient time humans uses herbal medicinal plants material to cure any disease or to give a satisfactory treatment against that disease. The purpose of current study is based on the medicinal properties of a plants like. Lodhra, Manjistha and turmeric.

Herbal face cream formulation development is based on some herbal plants, in combination with other medicinal plants. The herbal face cream is used to reduce skin dryness, retards aging signs and treat acne

Now-a-days herbal extracts are used in the cosmetic preparations for enhancing beauty and attractiveness. Herbal cosmetic products are divided on the basis of dosage form like- cream, powder, soaps, solutions, etc. and according to part or organ of the body to be applied for like; cosmetics for skin, hair, nail, teeth and mouth etc. Creams are semisolid emulsions intended for application to the skin or mucous membrane.

The skin is the body's first line of defence for external exposure. The signs of ageing are most visible on the skin. Although, ageing skin is not a threat to a person. Much of the premature ageing occurs as a direct or indirect result of skin's interaction with the environment andexposure to sunlight.

Acne is also a prominent skin problem, especially among teenagers, it may be caused due to bacteria such as *Propionibacteriumacnes* which block the pores present on the skin along with dust particles leading to acne.

This herbal face cream consists of various crude drugs such as lodhra (*Symplocosracemose roxb.*), Indian madder (*Rubia cordifoliaLinn.*) and turmeric (*curcuma longa linn.).* [1]

1.1 SKIN:

Body's first line of defence against damage from irritants, extremes of light, infection, pollution and temperature is skin. The skin, being the largest organ of the human body, serves as a crucial protective barrier against external elements, including harmful UV radiation. The use of vanishing creams, particularly

herbal vanishing creams, has gained popularity due to their natural composition and potential benefits. This paper aims to explore the anatomy and physiology of the skin, specifically focusing on the mechanism of penetration of herbal vanishing creams into the skin. By understanding this mechanism, we can evaluate the efficacy and safety of herbal vanishing creams for optimal skin protection.

- **Role of skin**
- Protects against physical, chemical and microbiological attacking.
- Prevents against penetration of ultra-violet rays.
- It regulates of blood pressure (BP)
- Acts as thermostat

1.2 Anatomy of Skin:

The skin covers a surface area of approximately 2sq.m. and thickness of 2.97-0.28mm.
The human skin is composed of following layers:[5]

1. The Epidermis
2. The viable Epidermis
3. A non-viable Epidermis
4. The overlying Dermis

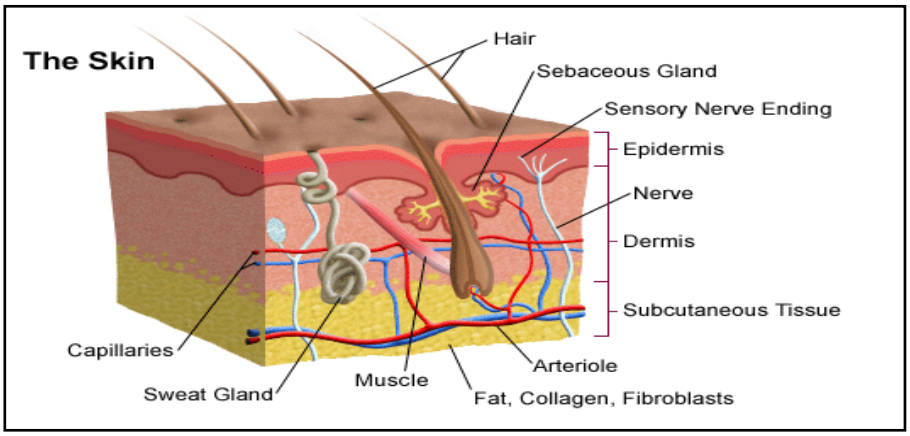

Fig.1: Anatomy of skin

I. EPIDERMIS:

Epidermis outer most layer of skin is epidermis, which is comparatively hard and thin. Keratinocytes is upper layer of epidermis. New keratinocytes hike smoothly at upper epidermis surface. They developed out of cells in inner epidermis layer known as basal layer. Thickness is 100 μm. The main resistance to diffusion and permeation through skin is subcutaneous. Five layers of epidermis are:

1. Stratum basale
2. Stratum spinosum
3. Stratum spinosum
4. Stratum lucidum
5. Stratum corneum

II.Dermis:

Dermis layer of skin is usually elastic, but is abundant in lymphatic vessels, blood channels and nerve endings. A large network of dermal pores binds the essential circulation, with extensive horizontal branching in the dermis from arterioles and venules to form plexuses and flow from capillaries to hair and sweat glands. Dermal capillaries help to extract antigens outside of clear, fluid material.

The dermis lies beneath the epidermis and provides structural support to the skin. It contains various components such as blood vessels, nerve endings, hair follicles, and sweat glands. Collagen and elastin fibres are abundant in the dermis, contributing to the skin's strength, elasticity, and hydration.

III.Hypodermis:

The hypodermis tissue supports outer layer and inner layer of skin that is dermis and epidermis. The hypodermis layer also provides shaping and contouring.The main functions are fat and energy storage, protecting the body**,** regulating body temperature**,** attaching the skin to muscle and bone, provides nutrient support and physically protection. It moves blood vessels and ending nerves to skin, and may contain organs that feel pressure. For delivery of transdermal 5 drugs (TDDS), drugs must enter through all these layers and reach essential flows, whereas in case of topical drug delivery, only diffusion through SC is required and drug must be kept in skin layers. The hypodermis, also known as the subcutaneous tissue, is the deepest layer of the skin, consisting of adipose tissue, blood vessels, and nerves. The hypodermis provides insulation, energy storage, and cushioning for the underlying structures.

Sebaceous gland:

These consist of secretory epithelial cells derived from the same tissue as the hair follicles. They secrete an oily substance, sebum, into the roots hair follicles and are present in the skin of all parts of the body except the palms of hands and the soles of feet. They are most numerous in the skin of the scalp, face, axillae and groins. In regions of transition from one type of superficial epithelium to another, such as lips, eyelids, nipple, labia minora and glans penis, there are sebaceous glands that are independent of hair follicles, secreting sebum directly onto the surface.

1.3 Mechanism of Percutaneous Absorption:

The largest barriers is *stratum corneum* which is outermost layer of epidermis. Before a topically applied drug can act either locally or systemically, it must penetrate through stratum corneum. Percutaneous absorption is defined as “penetration of substance into various layers of skin and permeation across the skin into systemic circulation”. Transport of drug to the systemic circulation is a multistep process which involves:

- solubilization within and release from the formulation.
- Partitioning into the stratum corneum
- Diffusion through the SC principally via a lipidic intracellular pathway
- Partitioning from the SC into the aqueous vial epidermis diffusion through the viable epidermis and into the upper dermis, uptake into the papillary dermis and into the microcirculation.[2]

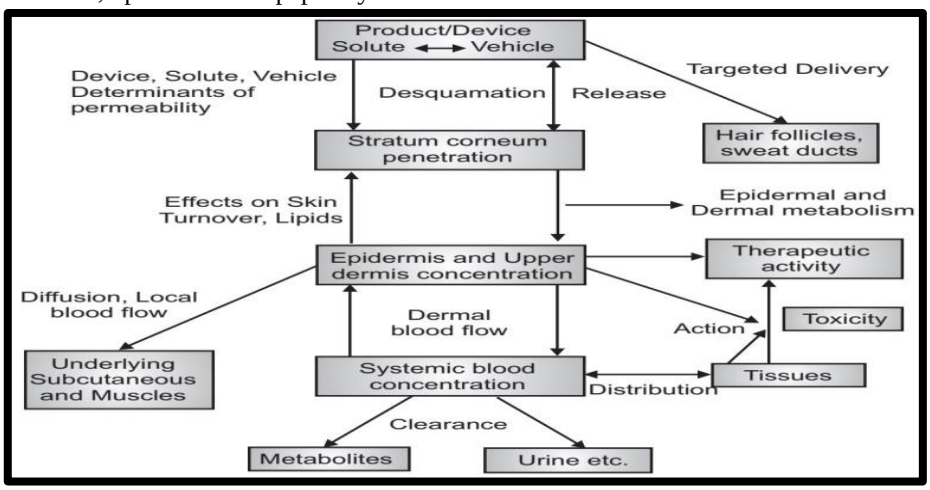

Fig.2: Schematic Representation of Percutaneous Permeation.

1.4 Acne:

- **Causes of Acne**: Acne is caused by overactive sebaceous glands, dead skin cells clogging pores, and bacteria. Hormones, diet, and certain medications can influence acne development. Bacteria live in the pores present on the face, which multiply when excess secretion oil from oil glands occur, which causes inflammation and redness.
- **Treatment Options**: Treatments include topical agents (benzoyl peroxide, retinoids), oral antibiotics, contraceptive pills, and isotretinoin capsules. It's important to use treatments correctly for effectiveness.
- **Impact on Well-being**: Acne can significantly affect mood and self-esteem, with severe cases linked to suicidal behaviour. It's crucial to seek support and discuss feelings with a doctor.
- **Self-Care Tips**: Avoid picking at spots, use non-comedogenic makeup, and consider dietary impacts. Consult a doctor before making significant dietary changes.

2. Aim:

▶ Formulation and evaluation of Poly-herbal anti-acne cream.

3. Objective:

1. To formulate poly-herbal anti-acne cream.
2. To evaluate the formulation for its anti-microbial activity.
3. To prepare a cream with good anti-acne activity.

4. Importance of investigation:

1. In current scenario the traditional herbal remedies are widely used globally.
2. Potential health benefits: Herbal ingredients, such as botanical extracts have been known to possess various health benefits. Incorporating these ingredients into face cream could offer additional skincare benefits, such as anti-dryness, anti-acne, smoothness and anti-aging properties, which may contribute to overall skin health.
3. The herbal remedies are harmless alternative for the treatment of patients and it has less side effect.
4. Increasing demand for natural products. There is a growing consumer preference for natural and organic products, including vanishing cream. Developing an herbal face cream aligns with this demand and provides an opportunity to tap into a lucrative market.
5. Easy accessibility of herbal extracts and powder such as turmeric.

5. Why Should Consider Natural Medicine:

1. Little or no harmful side effects. Pharmaceutical drugs often cause adverse reaction in the patient that them, and the worst part about it is that companies that manufactures these drugs often do so without being aware of them.
2. Herbal medicines utilize the body's natural healing process for treating condition The ingredients used are those which are regularly produced in the body.
3. It is cost –effective. It is not uncommon for even generic pharmaceutical drug to cost hundreds of dollars.
4. A natural medicine is widely understood to increase the body's ability towards of the diseases. Increased immunity and an overall healthier state of being can easily be achieved with continue treatment.[3][4]

7. Plan of work:`

Phase 1-

1. Collection of crude drugs.
2. Extraction of crude drugs.
3. Phyto-chemical screening of extracts.

Phase 2-

Formulation of face cream.

Phase 3-
Evaluation of formulated face cream.

8. Materials and methods:

8.1 Collection of plant materials-

All the plants were purchased in powder form. They were from Apoorva Ayurved Shop, Near Mahalakshmi temple, Nehru chowk, Gadhinglaj, Pin- 416502, Subdistrict- Gadhinglaj, District- Kolhapur.

I. Lodhra-

Synonyms: Rodhra, sabara lodhra.
Biological Source: It Consist of the barkof Plant *Symplocos racemosa Roxb*.
Family: Symplocaceae.
Chemical Constituents: loturine, loturidine, Colloturine, Flavonoids, tannins.
uses:All the phytoconstituents like flavanoids and glycosides are responsible for the health benefits. Lodhra is used in the system of Ayurvedic medicine for managing wounds, hemorrhage various illnesses, acne, pimples, and conjunctivitis, among other eye conditions.

Fig.3: Lodhra

II. Indian Madder-

Synonyms: Vikasa, Samanga.
Biological Source: Indian Madder consist of dried roots of *Rubia cordifoliaLinn*.
Family: Rubiaceae.
Chemical Constituents: The various chemical constituents present in Manjistha arequinones, iridoids, oleananes triterpenoid, bicyclic hexapeptides, anthraquinones.
Uses:The anti-bacterial, antioxidant, and anti-inflammatory activities of Manjistha are beneficial for the skin. The extract obtained from manjistha is helpful in managing acne causing bacteria and reducing inflammations caused due to other skin diseases. [12]

Fig.4: Manjistha

III. Turmeric-

Synonyms: Indian Saffron, haldi, curcuma.

Biological Source: It Consist of dried or fresh rhizome of *curcuma longa linn.*

Family: zingiberaceae.

Chemical Constituents:Volatile oil, starch, curcumin, Demethoxy curcumin.

Uses:Turmeric and its extract is mainly used to improve skin appearance, treat acne and other skin conditions.[10][14]

Fig .5: Turmeric

8.2. List of equipment's and glassware's used-

SR. NO.	NAMES
1	Weighing balance
2	pH meter
3	Sonicator
4	Mechanical stirrer
5	Hot air oven.

Table No.1: List of equipment.

8.3 Extraction procedures:

Lodhra:

The 50gm powder of *Symplocos racemose*was extracted by soxhlation for 72 hours using 95% ethanol as a solvent, the residue was filtered and evaporated using water bath and stored in closed container in dark place.

Indian Madder:

Similarly, 50gm powder of *Rubia cordifolia* was also extracted using 95% ethanol as solvent by soxhlation, filtered, dried and stored in packed container.

Turmeric:

The powder of *Curcuma longa* was extracted by maceration. For this, 50gm powder was taken and macerated in 150 ml of 95% ethanol for 1 week with daily shaking. After a week, the contents were filtered and evaporated to obtain the curcumin. It was collected and stored in closed container.[13]

9. Preliminary physiochemical screening Test:

I. Test for Alkaloids:

Mayers test: The extract was added to Mayers reagent. A yellow cream precipitate formation indicates the presence of alkaloids.

II. Test for Carbohydrates:

Molisch test: 2-3 drops of Molisch reagent were added to sample, then conc. Sulphuric acid was added from side of test tube, formation of purple ring at the junction suggests presence of carbohydrates.

III. Test for Phenolic compounds:

Ferric chloride test; small amount of ferric chloride solution was added to the sample extract, sodium hydroxide was added to this until brown ppt. was formed which suggests presence of phenols.

IV. Test for Flavonoids:

Lead acetate test: 1ml extract was dissolved in 10% lead acetate solution, formation of yellow ppt. indicates presence of flavonoids.

V. Test for Saponins:

Froth test: The extract was added to 10ml of water and shake for 10 minutes, formation of foam which persists for more than 2 minutes show presence of saponins.

VI. Test for Glycosides:

Legals test: dissolve extract in solution of pyridine and nitroprusside and add 10% NaOH to it, pink coloured solution is formed.

9.1 Physiochemical screening Test Results-

SR. NO.	Phytoconstituent	Test	Turmeric	Lodhra	Indian Madder
1.	Alkaloids	Mayer's test	+	+	+
2.	Carbohydrate	Molisch test	+	-	+
3.	Phenolics	Ferric chloride test	+	+	+
4.	Flavonoids	Lead acetate test	-	+	+
5.	Saponins	Froth test	+	+	-
6.	Glycosides	Legal's test	+	-	+

Table No.2: Preliminary Physiochemical screening.

10. Procedure for cream formulation:

10.1 .Oil phase-

Beeswax and propylene glycol along with turmeric extract were placed in the first beaker and then heated in a water bath for uniform mixing. After a few minutes, an oil phase formation took place

10.2. Water phase-

In a second beaker, lodhra extract andmadder extract was placed with distilled water, white soft paraffin (Vaseline), glycerine, zinc oxide, and sodium benzoate and heated on water bath to obtain a mixture.

10.3. Mixing-

The oil phase was then added to the aqueous phase, with continuous stirring until a semisolid mass was achieved.[5][6]

SR. NO.	INGREDIENTS	F1	F2
1.	Lodhra extract	0.60 gm	1 gm
2.	Indian Madder extract	0..50 gm	0.50 gm
3.	Turmeric extract	1 gm	0.60 gm
4.	Bees wax	3.2gm	3.2gm
5.	White soft paraffin	9 ml	8 ml
6.	Methyl paraben	1 gm	1.5gm

7.	Distilled water	q.s.	q.s.
9.	Glycerine	1 ml	2 ml
10.	Propylene glycol	1 ml	1 ml
11.	Zinc oxide	0,7gm	0.7 gm
12.	Sodium benzoate	0.1gm	0.1 gm

Table No.3: Formulation table for cream.

Fig.6: Formulated cream.

11. Evaluation of cream:

The evaluation of herbal cream was done as follows-

11.1 Physical Evaluation Parameters:

The herbal cream formulations were evaluated for physical parameters including colour, odour, consistency, and state of the formulation and results are shown in Table No.3

a) Colour: The colour of formulation was observed by visual examination.

b) Odour: The odour of cream was found to becharacteristics.

c) Appearance: The appearance of the formulations was examined by visual method.

d) Consistency: The consistency of the formulations was evaluated by rubbing the formulations between two fingers.

e) pH: The pH of the formulated herbal creams was checked on a calibrated, digital pH meter. The cream was dissolved in ethanol and kept aside for some time and the pH was checked.

f) After application: Emollience, residue left and slipperiness of cream after fixed time was checked.

g) Spreadability: The spreadability was expressed in terms of time in seconds taken by two slides to slip off from the cream, placed in between the slides, under certain load. Lesser the time taken for separation of the two slides better the spreadability. Then a weight or certain load was placed on the upper slide so that the cream between the two slides was pressed uniformly to form a thin layer. The spreadability was calculated using following formula-[11]

Spread ability = m x l/t

Where,

m= Standard weight which is tied to or placed over the upper slide (10 g)

l= length of a glass slide (7.5 cm)

t= time taken in seconds (6sec for F1) (8sec for F2)

Results are mentioned in table No.4.

h) Washability: The ease of removal was checked by washing with water after fixed time interval.

i) Stability testing- Stability testing was done at 50^0 for 24hrs in hot air oven.

j) Irritancy test: Mark an area (1sq.cm) on the left-hand dorsal surface. The cream was applied to the specified area and time was noted. Irritancy, erythema, oedema, was checked if any for regular intervals up to 24 hours and repeated.[7]

11.2 Anti-microbial activity-

Anti- microbial activity of formulated cream was evaluated on *Staphylococcus aureus*[8][9].Agar disk-diffusion method was used for antimicrobial activity. Muller-Hinton agar was used as a nutrient media for this experiment.

As a standard, marketed formulation of clindamycin was used as it offers a wide range of anti-bacterial effect.

The blank solution of DMSO was used as control.

Dilutions for the sample was made as following-

1gm sample was dissolves in 10ml of Dimethyl sulfoxide (DMSO), which is equal to 0.10gm per 1 ml. From above stock solution 0.10and 0.15 ml of solution was precisely pipetted out and was added to 100 ml DMSO separately to obtain concentrations of 100 µg/ml and 150 µg/ml final solutions.

12. Results and Discussion:

The formulation and evaluation of anti-acne cream was carried and the results of the experiment indicates that the F1 formulation had better parameter results as mentioned in the table below-

SR. NO.	TEST	F1	F2
1.	Colour	Yellowish brown	Dark brown
2.	Odour	Aromatic	Aromatic
3.	Appearance	Smooth	Smooth
4.	Consistency	Good	Good
5.	pH	7.05	7.95
6.	After application	Emollience	Emollience
7.	Spreadability	12.5	9.35
8.	Washability	Easy to wash	Easy to wash
9.	Stability testing	No change	No change

Table No.4: Evaluation results.

SR. NO.	PARAMETER	F1	F2
1.	Irritation	No	No
2.	Redness	No	No
3.	Swelling	No	No

Table No.5: Irritancy test.

The results of anti-microbial testing also suggest that the F1 formulations zone of inhibition was larger than the F2 formulations zone of inhibition as shown below:

Image. 7: Standard

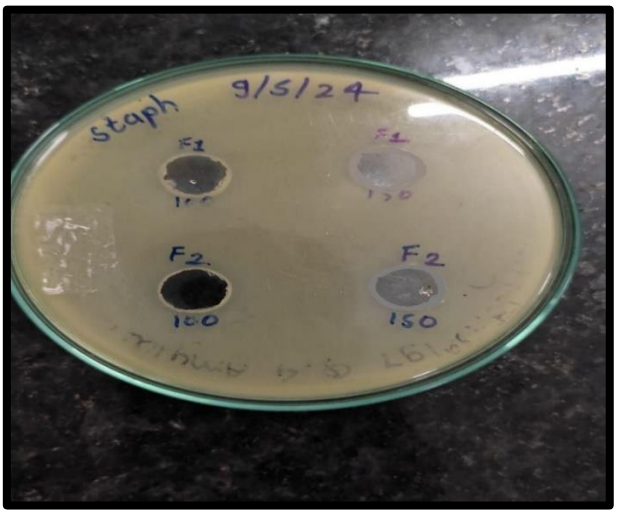

Image. 8: Sample (F1 and F2)

13. Conclusion:

The formulation of polyherbal anti-acne cream was concluded a success as it showed desired anti-microbial effect along with other evaluation parameters which were concluded to be satisfactory regarding to the overall effect and results.

The formulation and evaluation polyherbal anti-acne cream was done successfully. The formulated creams (F1 and F2) showed good anti-bacterial activity and inhibited the growth of bacterium of *Staphylococcusaureus* strain. The Minimum Inhibitory Concentration (MIC) of both formulations was expected to be between 100 and 150 µg/ml as the 100 µg/ml concentration does not showed any effect.

The stability testing of both formulations was also successful and no significant changes were observed. The irritancy test was passed, while the area showed slight redness after application, it was concluded that it maybe because of the Indian madder extract which is also used as a dye in industry.

Other tests were also carried out successfully and were passed by both F1 and F2 formulations. The extraction of active constituents was carried out before formulation was done according to the standard processes including soxhlation and maceration and the yields were as expected.

Overall formulation F1 was considered better than F2 due to good spreadability value and pH than the F2 formulation.

References:

[1] Matangi, Surya Prabha, et al. (2014). "Formulation and evaluation of anti-aging polyherbal cream."
[2] Mishra, Abhay Prakash, et al. (2014). "Formulation and evaluation of herbal antioxidant face cream of Nardostachys jatamansi collected from Indian Himalayan region."
[3] Banjare, Laxmi, and Pranita Kashyap (2014). "Formulation and Evaluation of Herbal Multipurpose Cream."
[4] Pandey, Sonika, et al. (2014). "Development and evaluation of antimicrobial herbal cosmetic preparation."
[5] Babu, Raja, et al. (2022). "Formulation and Evaluation of Polyherbal Cream."
[6] Satpute, K. L., and T. M. Kalyankar. "Development and evaluation of herbal cream for the treatment of acne." Journal of Pharmacognosy and Phytochemistry 8.3 (2019): 2618-2624.
[7] Yamini, K., and T. Onesimus. "Preparation and evaluation of herbal anti-acne gel." Int J Pharm Bio Sci 4.2 (2013): 956-960.
[8] Sekar, Mahendran, and Fouzia Halim. "Formulation and evaluation of natural anti-acne cream containing Syzygium samarangense fruits extract." Annual Research & Review in Biology 17.3 (2017): 1-7.

[9] Mullaicharam, A., and F. A. Elhad. "Evaluation of anti-acne property of poly herbal formulation." Journal of Biomedical and Pharmaceutical Research 1.3 (2012): 28-35.
[10] Koli, Dhanashri Sanjay, et al. "Formulation & evaluation of herbal anti-acne face wash." World J. Pharm. Pharm. Sci 5.6 (2016): 2001-200.
[11] Ghotkar, Mayur N., et al. "Formulation and Evaluation of Herbal Facewash for Acne." Asian Journal of Pharmaceutical Analysis 8.4 (2018): 183-185.
[12] Choudhari, Nishigandha & Dudhe, Anshu & Tatte, Sanika & Zile, Tanvi & Nandeshwar, Yugal & Dhawale, Tanushri & Nashine, Akash. (2023). Formulation and evaluation of anti-acne face cream. World Journal of Advanced Research and Reviews. 19. 1181-1188. 10.30574/wjarr.2023.19.1.1419
[13] Slaček, Gal & Kotnik, Petra & Osmić, Azra & Postružnik, Vesna & Knez, Željko & Finšgar, Matjaž & Marevci, Maša. (2023). The Extraction Process, Separation, and Identification of Curcuminoids from Turmeric Curcuma longa. Foods. 12. 4000. 10.3390/foods12214000.
[14] VENKATACHALAM, DHANAPAL & Thavamani, Samuel & Varghese, Vincy. (2019). REVIEW ON HERBAL COSMETICS IN SKIN CARE Corresponding author: PROF DHANAPAL VENKATACHALAM. 10.5281/zenodo.2537599..