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Corn Silk (*Zea mays*) and Liquorice (*Glycyrrhiza glabra*): A Polyherbal Approach for Skin Brightening Emulgel – A Review

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ABSTRACT

Corn Silk (*Zea mays L*) and Liquorice (*Glycyrrhiza glabra L*) are promising plant derived materials with great potential for use in skin care and cosmetics due to the presence of many bioactive phytochemicals in them. In this review, the polyherbal emulgel of corn silk and liquorice extracts for skin brightening activity have been discussed. Corn Silk is an agricultural waste product consisting of flavonoids, phenolic acids, tannins, saponins, and polysaccharides which act as strong antioxidants and antifungal. Liquorice is a medicinal plant with glabridin, liquiritin, flavonoids and glycyrrhizin. These compounds exhibit antioxidant, anti-inflammatory and tyrosinase inhibition properties that help in reducing the production of melanin which improves skin appearance. Ethanol extraction, especially using Soxhlet extraction in the case of liquorice and appropriate extraction methods in case of corn silk, helps in the extraction of these bioactive phytoconstituents and maintains their biological properties. Phytochemical tests confirm the presence of flavonoids, phenolics, tannins, saponins, alkaloids, and glycosides which are helpful in providing therapeutic properties in topical formulations. This review further discusses skin physiology barrier and the benefits of emulgel as a topical drug delivery system. However, evidence regarding their combined application remains limited. Further research required to establish the synergistic effects, formulation stability.

Keywords: Corn silk; *Zea Mays L;* Liquorice; *Glycyrrhiza glabra;* Melanogenesis; Glabridin; Liquiritin

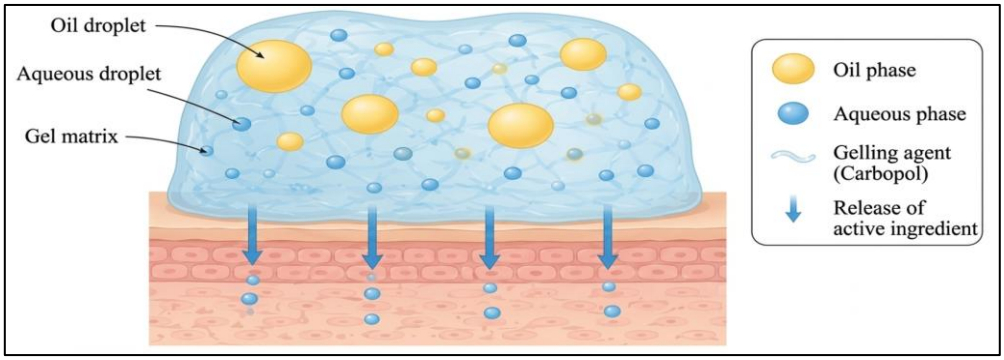
INTRODUCTION

The skin is continuously exposed to environmental such as ultraviolet (UV) radiation and oxidative stress, which can influence melanogenesis, pigmentation, and overall skin appearance. In which very rare conventional formulation for skin brightening. Nature has a great variety of bioactive compounds which are very much used for skin care. Within that corn silk (*Zea mays L.*) is a very under used agricultural by product rich in antioxidants and liquorice (*Glycyrrhiza glabra L.*) has a natural source of the skin brightening compound glabridin. Here presents a promising polyherbal approach for preparing an emulgel formulation which enhance topical delivery, improve skin contact and at the same time to produce a stable, non-greasy base for very effective skin brightening.

CONCEPT OF EMULGEL [2,3]

Emulgels are a wide range of topical preparations that allow effective delivery of active agents directly to the skin which in turn offers very good for dermatological care and treatment. Emulgel brings to the table the benefits of both emulsions and gels. They also facilitate the incorporation of hydrophobic or poorly water-soluble substances into the oil phase of an emulsion which is then incorporated into a gel base. This combination sees to improve the stability, spreadability, skin penetration and controlled release of active ingredients.

Emulgels are easy to prepare, cost-effective and do not require special equipment. They have a smooth, non-greasy texture, easy to apply and wash off and provide emollient effect.



Advantages of Emulgels

- Improve drug penetration through the skin.
- Non-greasy and easy to apply.
- Provide better drug stability and controlled release.
- Easy and cost-effective to prepare.
- Improve patient compliance and acceptance.

Disadvantages of Emulgels [4,5]

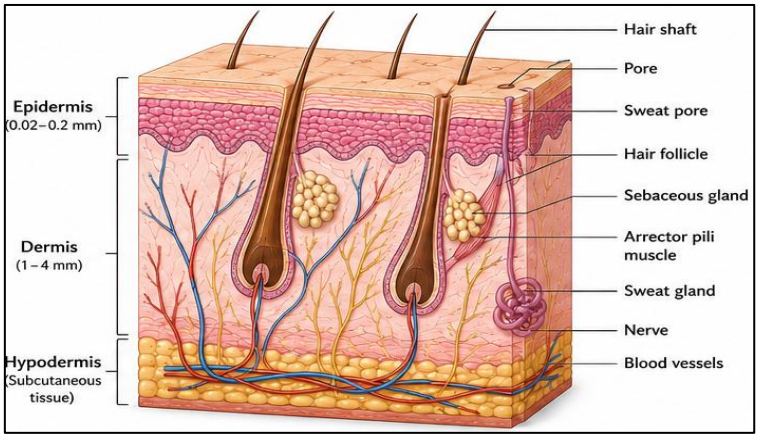
- May cause skin irritation or allergy.
- Some drugs show poor skin absorption.
- Large drug molecules penetrate poorly.
- Air bubbles may form during preparation

ANATOMY OF SKIN

The skin is the greatest organ of the human body also perform many of the body's functions. It protects from physical injury, microorganism attacks, chemical exposure, great loss of water, and also environmental factors. Also, it has a major role in temperature regulation, sensation, immune defence, and vitamin D production. Even though skin is very thin its structure does very well to keep out foreign substances. Skin also changes its thickness based on age, sex, and body part. The skin is mainly composed of three layers:

- Epidermis – the outermost layer
- Dermis – the middle connective tissue layer
- Hypodermis or subcutaneous tissue – the innermost layer

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Epidermis

The epidermis which is the outer layer of the skin acts as the main barrier between the body and the external environment. It is mainly made up of epithelial cells which does not have blood vessels. Nutrients and oxygen are supplied to the epidermis by diffusion from the blood in the underlying dermis. Keratinocytes are the main cells of the epidermis which approximately accounts to be 90-95% of epidermal cells. They are produced in the basal layer as they move toward the skin surface they go through a process of differentiation and produce keratin which is a very strong structural protein. The mature cells at the end forms the stratum corneum. The major cell types present in the epidermis include:

Keratinocytes: The major cells responsible for keratin production and skin barrier formation.

Melanocytes: which is mainly seen in the basal layer produce melanin which in turn gives us our skin colour.

Langerhans cells: they are immune cells protect the skin from foreign elements and microorganisms.

Merkel cells: which is a type of sensory cells involved in the perception of light touch.

The epidermis consists of five layers:

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

The stratum lucidum present in the thick skin that is hands and feet. The stratum corneum which is the outer layer is the main barrier to the penetration of topically applied substances. It put forth that this layer is a “brick and mortar” structure in which the corneocytes are the bricks and the intercellular lipid matrix is the mortar. This arrangement reduces water loss and also keeps out harmful substances.

For in topical formulations the stratum corneum is the primary barrier which affects drug penetration. Thus, the composition and properties of an emulgel are important for the delivery of active compounds into the skin.

Dermis

In the base of the epidermis, we find the dermis which is made up mainly of connective tissue. It gives the skin it’s mechanical strength, elasticity, and structural support. The dermis has collagen and elastic fibers, blood and lymphatic vessels, nerves, hair follicles, sweat and sebaceous glands. Collagen fibres give strength and firmness, while elastic fibres give flexibility and elasticity.

Blood vessels in the dermis feed the dermis and also the avascular epidermis. Also present are sensory nerve endings which allow for the perception of touch, pressure, pain and temperature.

The major cells present in the dermis include:

Fibroblasts play a role in the production of collagen, elastin, and elements of the extracellular matrix.

Macrophages which help in removal of cellular waste and also provide immune protection. Mast cell's role is in inflammatory and immune responses. Also, the dermis plays a part in body temperature regulation which we see via blood circulation and sweat production. For topically applied formulations the dermis is an important target area because active ingredients which pass through the epidermis may interact with dermal cells and tissue.

Hypodermis

The hypodermis, also known as the subcutaneous layer, is the deepest layer located under the dermis. It mainly consists of adipose tissue and connective tissue. This layer connects the skin of underlying structures such as muscles and bones.

The hypodermis performs several important functions, like;

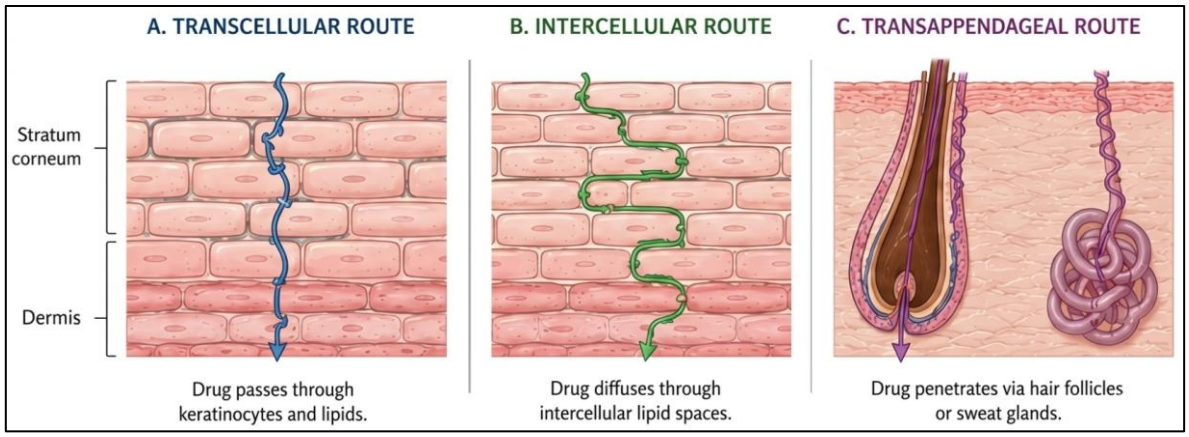
- Provide thermal protection
- Storing energy in the form of fat
- Mechanical shock absorption and buffering
- Supporting and cushioning the skin
- Allowing movement of the skin over underlying tissues

The thickness of the hypodermis varies depending on the anatomical site, age, sex and nutritional status.

PERMEATION PATHWAYS THROUGH THE SKIN [6,7]

The stratum corneum is the main barrier to the penetration of drugs and biologically active substances through the skin. There are three ways for topical drugs to penetrate the skin:

1. Transcellular pathway
2. Intercellular pathway
3. Trans appendageal pathway



Transcellular Pathway

In the transcellular pathway, the active ingredient passes through the cells of the stratum corneum i.e., through their hydrophilic parts and lipid domains. Consequently, to overcome this barrier, the drug must cross the membrane several times, penetrating through hydrophilic and lipophilic regions alternately. Thus, the transcellular pathway is most probably not the main route for delivering hydrophilic compounds into the skin due to the high number of barriers to absorption.

Intercellular Pathway

In the intercellular pathway, the active ingredient crosses the intercellular lipid membrane and the intercellular space between corneocytes. It is considered the primary route for lipophilic compounds, but it is not well understood in terms of physicochemical principles. In the case of the intercellular pathway, the drug's transfer and penetration through the skin will depend on the physicochemical properties of the substance and the characteristics of the stratum corneum. Due to the complex and twisting path, the transcellular option ensures a good opportunity for the delivery of both water and lipid-soluble phytoconstituents, making it appropriate for use with emulgel. Thus, using an emulsion as a drug delivery system seems to be a good idea for the intended purpose since it can provide penetration of both hydrophilic and lipophilic compounds.

Trans appendageal Pathway

Finally, the trans appendageal pathway includes the pores of the sweat glands, sebaceous glands, and hair follicles. It is assumed that this method is available for a limited number of substances due to the small surface area of these structures.

Potential of Corn silk & liquorice for skin brightening activity.

PLANT PROFILE

Corn silk (*Zea mays L.*) is a natural herbal material which has high levels of flavonoids, phenolics, polysaccharides and other bioactive phytoconstituents. These phytochemicals have antioxidant, anti-inflammatory, anti-microbial and skin protective action. It put forth that the bioactive elements of Zea mays L. positively play a role in the studied model which sees a reduction in the effects of oxidative stress on the skin due to the presence of antioxidant action.



Liquorice (*Glycyrrhiza glabra L.*) is a medicinal plant which contain high concentration of flavonoids, glycyrrhizin and also isolated compounds like glabridin and liquiritin. Particularly the antioxidant, anti-inflammatory and melanin inhibitory effects of its flavonoids and glycosides. Among the isolated flavonoids of liquorice, glabridin, which is a strong inhibitor of tyrosinase activity has received the most attention. The antioxidant and anti-inflammatory activity of glabridin, along with its inhibitory effect on melanogenesis will reduce hyperpigmentation and provide skin whitening and UV protection.[8]



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MATERIALS AND METHODS

Procurement of materials:

The plant material corn silk and liquorice collected from the local market. The crude liquorice was coarsely powdered using mechanical grinder and sieve using sieve 40 mesh to required uniform powder.

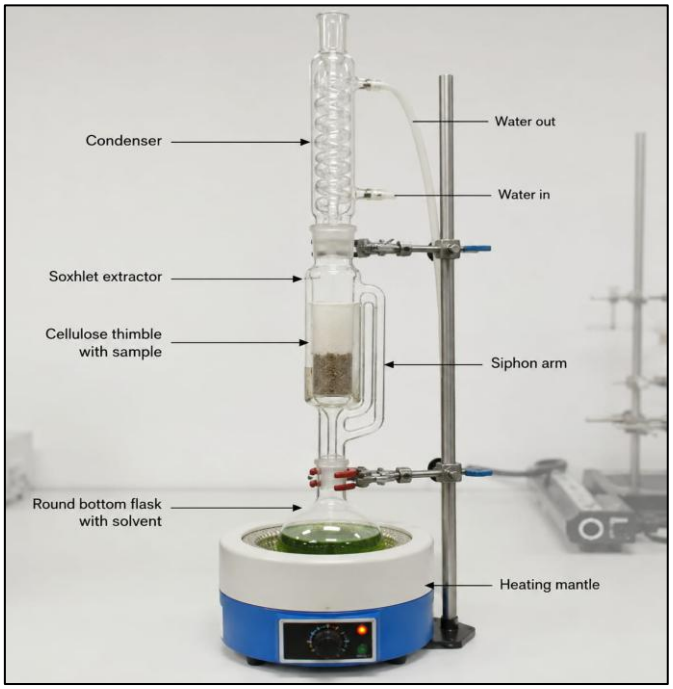
EXTRACTION

Maceration: Coarsely powdered corn silk was weighed and dipped in ethanol in a conical flak which is wrapped with aluminium foil to prevent vaporisation then allowed to stand at room temperature. It is kept for about 72hrs with occasional stirring and the extract was filtered using filter paper. The extract was collected in china dish and was evaporated to collect the residue.[9]



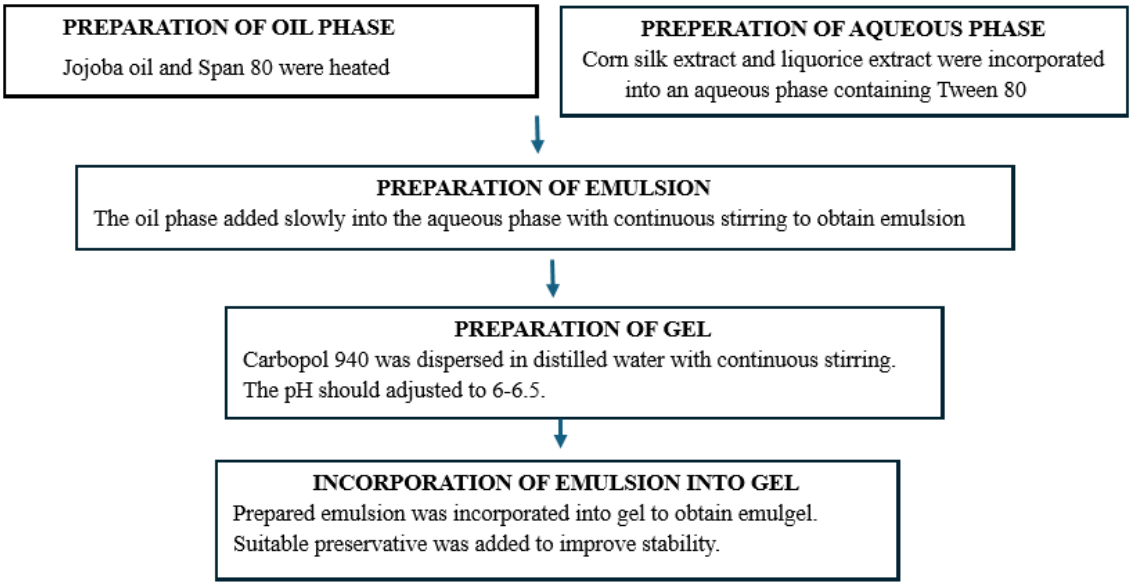
Soxhlet extraction: This is a laboratory apparatus invented in 1879 by Frans Von Soxhlet. The Soxhlet extractor divided into three parts,

- Round bottom flask
- Thimble/ extraction chamber
- Reflux condenser



For the experiment coarsely powdered liquorice was weighed and wrapped in filter paper and placed in the thimble and inserted into Soxhlet extractor, the reflux condenser which has been connected to water pumping system connected to the thimble. 70% ethanol was added to the round bottom flask and heated under controlled conditions using heating mantle. The solvent when heated rise to the distillation arm, condenses and percolate through the sample, the extraction process continues until solvent in the thimble become clear and the extract collected which is concentrated and stored in air tight container.[10]

METHOD OF PREPERATION [11]



EVALUATION [12]

i) Physical Appearance

The physical appearance of the emulgel formulation was analyzed based on color, homogeneity, texture, and appearance of the formulation. Homogeneity and texture were determined by rubbing the preparation between fingers.

ii) pH Measurement

For the determination of pH, a digital pH meter was used. Emulgel was dissolved in 10 ml of distilled water. Around 0.5 g of emulgel was used for this experiment.

iii) Viscosity

The viscosity of the formulation was determined using a Brookfield viscometer at 50 rpm with 1 g of the test sample. These readings were taken thrice, and the average value was calculated.

iv) Spread ability

Spreadability was calculated by measuring the diameter of the spread emulgel when 0.5 g of the emulgel was placed between two petri dishes and pressure of 50 g was applied to it for 5 minutes.

v) Determination of antifungal activity [13]

• Agar well diffusion method:

The antifungal activity of the emulgels were determined using agar well diffusion method. The specific amount of the fungal suspension (yeast) was added to the sterilized sabouraud's agar medium and mixed thoroughly. 20 ml of the above-mentioned medium was taken aseptically in petri plate and kept until it becomes solidified. The wells are formed in the agar plates using a

sterile cork borer. The prepared wells are filled with antifungal emulgel formulations. These plates were incubated at 18-24℃ for 72 hours.

vii) In vitro antioxidant activity

- FRAP (ferric reducing antioxidant power) Assay [14]

Preparation of Phosphate Buffer (pH 6.6)

Prepare 1 L of 0.2 M Phosphate Buffer (pH 6.6) by dissolving 27.60 g of Sodium dihydrogen phosphate monohydrate in 900 ml of water and adjusting the pH to 6.6 using 10M NaOH. Finally make it to the volume of 1000 ml using distilled water.

Procedure

Stock solutions of formulations were prepared, and this stock solution was Serially diluted separately to get different concentrations.

To 1ml of the sample solution, add 2.5 ml of 0.2 M Phosphate Buffer (pH 6.6), mix well and then add 2.5 ml of 1% ferrocyanide solution. Incubate in the dark for 20 min in a water bath at 50°C. Shake the reaction mixture and add 2.5 ml of 10 % trichloroacetic acid. Mix the contents thoroughly and take 2.5 ml of the reaction mixture and then add 2.5 ml of distilled water and then finally 0.5 ml of 0.1% ferric chloride. Blue color develops and absorbance is measured at 700 nm. Ascorbic acid is used as a standard, and distilled water as a blank.

- **DPPH Assay**

Determination of 1,1-Diphenyl-2-Picrylhydrazyl (DPPH) Free Radical Scavenging Activity

Sample Preparation

The formulation samples were weighed approximately in 0.01 ml and then dissolved in ethanol. The prepared sample solution was filtered using the Whatman filter paper and diluted to a final volume of 10 ml in the volumetric flask.

Standard Solution Preparation

10 mg of ascorbic acid was weighed and dissolved in 10 ml of ethanol. From this solution, 2.5 ml was taken and diluted to 25 ml in ethanol to make the stock solution. This stock solution was then diluted serially to get concentrations of the standard.

Procedure

Taken 3ml of 0.004% ethanolic solution of DPPH and added 0.5ml of sample solution. The solution was incubated for 30 minutes in the dark. At 517nm, DPPH show its absorbance and a comparison was made between the absorbance of the sample and the absorbance of the standard. Blank used is ethanol, the control is DPPH solution.

The percentage inhibition was calculated by the equation

$$\text{DPPH radical scavenging activity [\%]} = [(A_{\text{control}} - A_{\text{test}})/A_{\text{control}}] \, 100$$

A_{control}- absorbance of the control solution

A_{test}-absorbance of the test solution

CONCLUSION

The review article concentrates on the development of a polyherbal emulgel comprising extracts of corn silk and liquorice using Carbopol 940 as the gelling agent for skin brightening activity. The review article emphasizes Soxhlet extraction technique using ethanol as a highly effective and reliable means for isolation of phytochemicals whereas maceration is described as a simple and cost-effective means of extraction of active compounds from corn silk that can withstand minimal temperature and thus appropriate for heat-sensitive compounds. The bioactive components present in the extracts can act to reduce oxidative stress and melanin

formation. Thus, a synergistic natural way for developing skin brightening preparations can be provided by the use of extracts of corn silk and liquorice. However, more research needs to be done in order to validate its efficacy, stability and safety.

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