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FORMULATION OF LIQUORICE AND CHARCOAL FACEWASH TABLET INCORPORATING INORGANIC SALT

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ABSTRACT

This study focuses on the formulation and evaluation of charcoal and liquorice-based face wash tablets, a novel approach to facewash tablet that makes the tablet faster disintegrant and promote stability using Inorganic salt. The formulation process involved selecting suitable excipients to ensure tablet stability, rapid disintegration upon contact with water, and compatibility with active ingredients. The tablets were prepared using Wet granulation method, Inorganic salt plays a crucial role in enhancing disintegration through multiple physicochemical mechanisms while maintaining formulation stability. Inorganic Salt is a natural and readily available ingredient, it functions as an effective disintegrant by promoting moisture absorption and tablet breakdown. Its inclusion accelerates tablet dispersion, allowing for quick lather formation and efficient cleansing. Inorganic Salt is highly water-soluble and creates an osmotic gradient when exposed to moisture. This gradient brings water into the tablet, causing it to swell and break tablet apart efficiently. Dissolution of salt in water is an exothermic or slightly endothermic process. The formulation is optimized for skin compatibility, balancing cleansing efficacy with hydration and mildness. Inorganic Salt ions can weaken intermolecular forces within the tablet, reducing cohesion and improving dispersibility. The optimized formulation demonstrated excellent physical stability, a pH suitable for facial skin, and effective cleansing without causing dryness or irritation. Liquorice and charcoal exhibited a synergistic effect, providing detoxification and enhanced skin tone. User acceptability studies highlighted convenience, ease of use, and skin benefits, making this innovative format a promising solution in skincare.

KEYWORD:- Face wash tablet, Liquorice, Activated charcoal, Inorganic salt, Cleansing effect, Detoxifying effect.

INTRODUCTION

Facewash tablet

The concept of facewash tablet is gaining traction as a more sustainable and travel friendly alternative to traditional liquid or gel cleansers. Facewash tablets are solid formulations of facial cleansers designed to dissolve when mixed with water. They aim to provide the same cleansing benefits as conventional facewashes removing dirt, oil, and impurities. Key advantages include reduced packaging waste, enhanced portability, and formulations with fewer preservatives.

A face wash tablet is a facial care product used to clean the skin on the face of make-up, dead skin cells, oil, grime, and other sorts of pollution. It aids in pore cleaning and the prevention of skin conditions like acne. Together with a toner and moisturizer, a face cleanser can be used as a part of skincare routine.[1]

Benefits of face wash tablet

- Helps keep skin clear and healthy & It makes the skin radiant.
- The combination of dead skin cells and excess oil can clog pores, causing acne, white heads, blacks heads and a tired appearance.
- Regular pore exfoliation prevents all of the above skin problems.
- Exfoliation accelerates the blood circulation. It helps to remove dead skin cells and helps new skin cells replace old ones.
- Removes dead skin cells, which means your skin wrinkles more slowly.

Advantages of facewash tablet

- Reduced preservatives because facewash tablet have a lower water content than facewashes. Or sometimes no preservatives.
- Enhanced portability solid form makes face wash tablet ideal for travel.[2]

- Environmental sustainability
- Cost effectiveness.

Disadvantages of facewash tablet

- Dissolution time: May take longer to dissolve and create a usable lather.
- Limited varieties: Fewer formulation options compared to traditional liquid face washes.
- Skin type specificity: May not cater to all skin types as precisely as liquid formulas.

Applications

1. Efficient elimination of contaminants, oil, and grime[3]
2. Fits a variety of skin types, including sensitive, dry, oily[4]
3. Aids in inflammation reduction and acne management[5]
4. Sustainable components
5. Mitigating inflammation and skin irritation
6. Cleaning before applying cosmetics
7. Treating skin disorders (psoriasis, eczema)

Skin

Covering the entire body the skin is the biggest organ in the human body. It help with the perceptions of touch, pressure, temperature and vibration, controls body temperature, and acts as a barrier to protect against outside influences.

Structure of skin

The largest organ in the body is the skin. The epidermis, dermis, and subcutaneous layer are its three primary layers.

Epidermis

On the outside, it is an elastic layer that regenerates continuously. It consists of the following: The primary cells of the epidermis, known as keratinocytes, are created by cell division at the base. The surface is constantly being approached by new cells. They eventually die and flatten as they migrate.

- Corneocytes: Also known as the stratum corneum or horny layer, these flattened dead keratinocytes collectively comprise the epidermis' outermost layer.
- Melanocytes: these cells create the pigment melanin, which provides skin its color and UV protection.

Dermis

The following are included in the inner layer-Sweat is produced by sweat glands and then transported to pores in the epidermis via sweat ducts. They have a part in controlling the temperature. The pits where hairs sprout are called hair follicles. The regulating of temperature is another function of hairs. Sebum, an oil, is produced by sebaceous glands to keep hairs free of bacteria and dust.

Subcutaneous layer

Connective tissue and fat (a excellent insulator) make up the layer underneath the dermis.

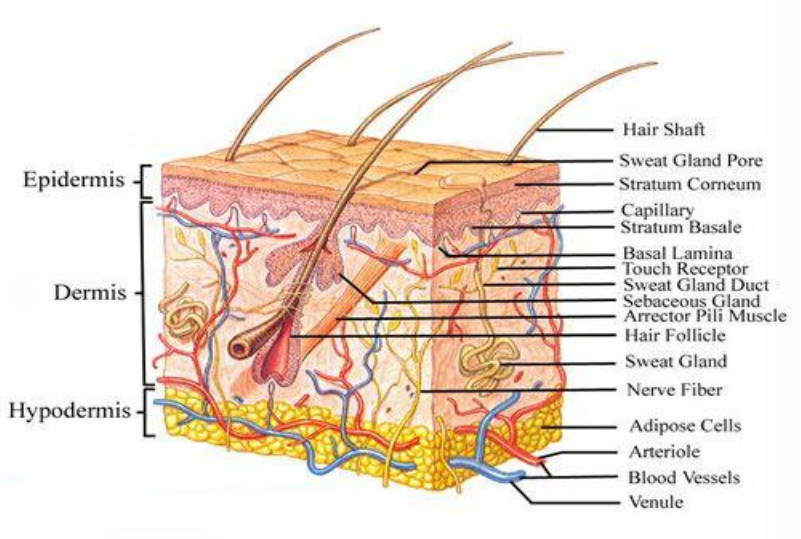

Fig. no. 1: Structure of skin.

Mechanism action of Charcoal and Liquorice on skin

Activated charcoal

Activated charcoal is known for its adsorptive properties. This means it can bind to substances on the skin's surface, such as excess oil, dirt, and impurities. It works by increasing its surface area, allowing it to trap these substances within its pores. Therefore it is thought to help with the clearing of pores.[6]

Liquorice root

Liquorice root extract contains compounds, particularly glabridin, that have skin-brightening and anti-inflammatory properties. Glabridin can inhibit tyrosinase, an enzyme involved in melanin production, which can help reduce hyperpigmentation and dark spots. It also possesses anti-inflammatory effects, which can soothe irritated skin.[7]

Formulation & Excipients

Formulation

Facewash tablet formulations represent a modern and increasingly popular approach to facial cleansing, offering several advantages over traditional liquid cleansers.

Formulation considerations

- The tablet must dissolve quickly and completely in water to create an effective cleanser.
- Many consumers prefer a foaming facewash, so formulations often include ingredients that create a rich lather.
- The formulation must be gentle and non-irritating, especially for sensitive skin.
- The process of compressing the powder into a tablet must be done in a way that creates a stable product.
- Facewash tablets represent a promising trend in skincare, combining convenience, sustainability, and effective cleansing.

Formulation & Excipients

Formulation

Facewash tablet formulations represent a modern and increasingly popular approach to facial cleansing, offering several advantages over traditional liquid cleansers.

➢ **Active pharmaceutical ingredieants**

API	Property
Liquorice	Antioxidant, Anti-inflammatory and Skin-brightening agent
Activated Charcoal	Detoxifying
Vitamin E	Antioxidant

➢ **Excipients**

Excipients	Property
Sodium starch Glycolate	Disintegrants
Sodium lauryl Sulphate	Foaming agent
Carbopol	Binder
Inroganic Salt	Disintegrant

➢ **Method of formulation**

A tablet is a small, solid dosage form of medication that is typically round or oval in shape. It is made by compressing powdered ingredients into a compact form, often with a coating that helps it dissolve in the body at the right time. Tablets are used to deliver medicine in a precise, measured dose. They can be used for a wide range of treatments, including pain relief, antibiotics, and vitamins. Some tablets are designed to dissolve quickly, while others may be made to release the medicine slowly over time.[8]

A face wash tablet is a compact, solid form of facial cleanser that is designed to be activated with water. It typically contains a blend of cleansing agents, moisturizers, and sometimes exfoliating ingredients, compressed into a tablet format for easy storage, use, and portability. When water is added, the tablet dissolves or foams to create a lather that can be used to cleanse the skin, removing dirt, oil, and impurities without disrupting the skin's natural moisture balance. Face wash tablets offer convenience as they are travel-friendly and often have a longer shelf life compared to liquid cleansers. They are increasingly popular due to their eco-friendly packaging and effective, mess-free application.[9]

Introduction to methods of tablet preparation

Tablets are solid dosage forms prepared through various methods that ensure the drug is effectively delivered to the body. The most common methods of tablet preparation include direct compression, dry granulation, and wet granulation.

Direct compression, the ingredients are compressed directly into tablets without the need for granulation. This method is faster and cost-effective, particularly for drugs that are stable in powdered form.

Dry granulation involves compressing a powder mixture into larger particles, or granules, which are then compressed into tablets. This method is used for drugs that are sensitive to moisture.

Wet granulation, on the other hand, involves using a liquid to form granules, which are then dried before being compressed into tablets. Wet granulation is ideal for drugs that have poor flow properties or require better stability.

Wet granulation method in detail

Wet granulation is one of the most widely used methods in tablet preparation, particularly for drugs that have poor flow properties or require improved content uniformity. This process involves combining the active pharmaceutical ingredient (API) and excipients with a liquid binder to form granules, which are then dried and compressed into tablets.

Procedure of Facewash tablet

Granulation

Granulation is a process used in the pharmaceutical, chemical, and food industries to form granules or small,

compact aggregates of a powder or fine material. The process involves the binding of smaller particles together into larger, more manageable particles or granules. These granules are used to improve the flow properties, content uniformity, and compressibility of the material for tablet manufacturing or other applications.

In the wet granulation process, a liquid binder is added to the powder mixture, causing the particles to adhere to each other and form granules. These granules are then dried and, if necessary, sieved to ensure uniformity in size before being used in the production of tablets, capsules, or other dosage forms.[10]

We used wet granulation method for the preparation of the facewash tablet. Which is new approach in facewash tablet.

Flow of the process:

1. Weighing and Sifting of Raw Materials
2. Preparation of Binder Solution
3. Mixing of Dry Ingredients
4. Addition of binder solution
5. Granulation
6. Drying
7. Sizing (Sieving)
8. Lubrication
9. Compression (Tablet Formation)
10. Packaging

1. Weighing and Sifting of raw materials

Weighing and sifting of raw materials is a crucial initial step in the wet granulation or pharmaceutical manufacturing process. It ensures that all ingredients are present in the correct proportions and that the materials are properly prepared for further processing, which leads to uniformity and consistency in the final product.

The sifting process in the pharmaceutical industry is one of the core processes. It handles granules, pellets, active pharmaceutical ingredients, etc in the pharmaceutical industry. It boosts product integrity and quality while avoiding contamination risk. It has a role in fulfilling strict regulatory compliance in various industries.[11]

2. Preparation of binder solution

Preparation of the binder solution is a critical step in the wet granulation process, where a liquid binder is used to hold the powder particles together, forming granules. The binder solution helps improve the flow, compressibility, and uniformity of the granules, which are essential for the quality of the final product.

A Solution Binder refers to a binder added to tablet formulations in a pre-prepared solvent (water or alcohol) to manipulate flow property and compressibility. It helps in enhancing the wettability of poorly soluble drugs by spreading over particle surfaces, but an excess concentration can negatively impact tablet disintegration and dissolution rate.[12]

Examples: Starch-based binders (e.g., gelatinized starch) Polyvinylpyrrolidone (PVP) Cellulose derivatives (e.g., hydroxypropyl cellulose) Natural gums (e.g., gum arabic, guar gum) Sugars.

3. Mixing of dry ingredients

Mixing of dry ingredients is a crucial step in the wet granulation process that ensures the even distribution of all solid ingredients (such as the active pharmaceutical ingredients [API] and excipients) before the addition of the binder solution. Proper mixing is essential for the uniformity, consistency, and performance of the final product, particularly in pharmaceutical tablet.

A mortar and pestle is a traditional and simple tool used for grinding, crushing, and mixing substances. It consists of two main parts:

1. Mortar: A deep, bowl-shaped vessel made of materials like stone, ceramic, or wood. It holds the substances being ground or mixed.
2. Pestle: A club-shaped tool, typically made of the same material as the mortar, used to grind or crush the substances by applying pressure.

4. Addition of binder solution

Addition of the binder solution is a key step in the wet granulation process, where a liquid binder (prepared earlier) is added to the dry powder mixture to form granules. The binder helps the powder particles to adhere to each other, ensuring the formation of uniform and cohesive granules that are suitable for subsequent processing, such as tablet compression or capsule filling.

- Improve the flowability of the powder mixture.
- Enhance the compressibility of the granules, making them easier to form into tablets or capsules.
- Ensure uniform distribution of the active pharmaceutical ingredient (API) within the granules, contributing to uniform dosing in the final product.

5. Granulation

Granulation is the process of forming a material (usually a powder or mixture of powders) into granules or agglomerates, which are larger particles with improved properties. In the pharmaceutical industry, granulation is a critical step in preparing a powder mixture for tablet production because it improves the powder's flowability, uniformity, and compressibility. Granules produced through this process are easier to handle, less dusty, and more suitable for tableting than fine powders.

6. Drying[13]

Drying is the process of removing moisture or water content from a material to prevent spoilage, reduce weight, or prepare the material for further processing or storage. Drying can be achieved through different methods, depending on the material being dried, the desired final product, and the required efficiency.

Shade drying: Drying in the shade to avoid heat damage. Often used for herbs and flowers that are sensitive to sunlight.

7. Sizing (sieving)

Ensures that the material has a consistent particle size distribution. This is important for processing, packaging, and ensuring quality control. It removes oversized particles (lumps or large aggregates) and fines (very small particles), which may not perform well in subsequent processes like mixing, tableting, or capsule filling. Sieves are selected based on the required particle size range. Sieves are made from mesh materials like stainless steel, with different mesh sizes that define the opening through which particles pass.

8. Lubrication

In the pharmaceutical industry, lubrication refers to the addition of a lubricant to the granules or powders before tableting or capsule filling. The main purpose is to reduce friction between the powder and the machinery, such as tablet punches, die surfaces, and capsule filling equipment. This helps improve the efficiency of manufacturing, prevents sticking or clumping, and ensures smooth operation of equipment.

Lubricants prevent the powdered mixture (granules) from sticking to the tablet press punches, dies, and other equipment during the compression process. This ensures smooth ejection of tablets and reduces the need for frequent cleaning of the machinery.[14]

9. Compression (Tablet formation)[15]

Compression (Tablet Formation) is a critical process in the pharmaceutical industry, where granules or powders are transformed into solid tablets through a mechanical process involving pressure.

Tablet compression equipment

1. Single-Punch tablet press

- Suitable for small-scale production or laboratory use.
- Consists of a single die, and the tablet is compressed by a single punch.

2. **Rotary tablet press**

- Used for large-scale tablet production.
- The rotary press features multiple die stations and punches that rotate in a circular motion, producing tablets at a faster rate.

Process of tablet compression

The tablet compression process typically occurs in several stages, including

1. Preparation of Granules:
2. Die Filling
3. Compression Stage
4. Ejection

10. Packaging

Packaging in the pharmaceutical industry refers to the process of enclosing pharmaceutical products, Packaging not only serves as a protective barrier but also plays a crucial role in maintaining the stability, efficacy, and safety of the product. Additionally, it provides vital information such as dosage instructions, expiration dates, and batch numbers.

Preformulation study on powder

Preformulation studies support lead identification throughout the drug discovery phase in addition to aiding formulation development. To become a therapeutic molecule, a novel chemical entity must have the best biopharmaceutical qualities. 'Drug ability' is not necessarily implied by the mere presence of potency and selectivity. Preformulation studies aid in determining a molecule's "drug ability." Preformulation can therefore be

Sr. No	Test	Specification	Observation
1	Colour	Black	Black
2	Odour	Sweet	Sweet
3	pH	4.5 to 6.5 (ideal for skin compatibility)	5.5
4	Angle of Repose	Angle of repose: ≤ 30°	29
5	Carr’s index	Carr's Index: ≤ 15% (Good flowability)	14.5
6	Hausner’s Ratio		0.82
7	Partical size distribution	90% of particles should pass through 100-200 µm sieve	Passes

1	Physical evalution	Visual Inspection	Tablet should be uniform in size, shape, color, and texture	Passes
2	Weight variation Test	Weighing using an analytical balance	Variation: ± 5% of the average tablet weight.	Passes
3	Friability Test	Friability Test (USP <1216>)	≤ 1% weight loss	0.51

4	Thickness	Vernier Caliper	±5% deviation from the average thickness	4mm
5	Hardness	Pfizer tester	5 - 10 kg	4kg
6	Foamability	Cylinder Shake Test	Minimum foam height: 150 mm (15 cm) after 1-minute standing time	Passes
7	Washability	Manual Skin Wash Test	easily washable within 30 seconds of rinsing	Passes
8	Irritancy Test	Patch Test	no irritation	Passes
9	Disintegration	Disintegration Test (USP <701>)	≤ 10 minutes	8 min
10	pH of Aqueous Solution	pH Meter	4.5 - 6.5	5.7

➢ **Physical evaluation**

1. **Foamability** - Drop the tablet into a 250 ml measuring cylinder that has been partly filled with water. Place your palm over the cylinder and shake it for a few minutes. Calculate how much foam is created.

Fig. No. 2: Foamability test.

Fig. No. 3: Foamability index.

2. Disintegration test[16]

The disintegration test for a facewash tablet is used to assess how the tablet breaks down or dissolves when in contact with water. This test is essential for ensuring that the tablet will release its active ingredients effectively when used.

Acceptance criteria

The acceptance criteria for the disintegration test of a facewash tablet are typically as follows:

- **Complete disintegration time:** The tablet should disintegrate within **15-30 minutes** of being immersed in the testing medium, though this time may vary depending on the formulation.
- **No visible residue:** After the test, there should be no intact solid residue, and the solution should be clear or as per specifications (i.e., no undissolved chunks or tablets).
- **Consistency:** A batch of tablets should exhibit similar disintegration times across different tablets.

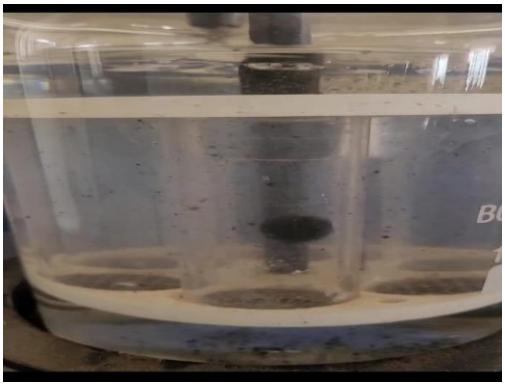

Fig. no. 4: Disintegration test.

➢ RESULT AND DISCUSSION

The facewash tablet was successfully formulated using liquorice and charcoal with the incorporation of inorganic salts through the wet granulation method. The final tablets were found to be uniform in shape, size, and texture. They dissolved easily in water and formed a smooth, foamy solution suitable for facial cleansing.

The combination of liquorice and charcoal provided effective cleansing and skin-brightening properties, while the inorganic salts enhanced the stability and cleansing efficiency of the tablet. This innovative approach demonstrated that it is possible to create a compact, travel-friendly, and eco-friendly alternative to conventional liquid facewash products.

Fig. no. 5: Facewash Tablet Incorporating Liquorice, Activated Charcoal and Inorganic Salt.

➢ CONCLUSION

The successful formulation of a facewash tablet incorporating liquorice, activated charcoal, and inorganic salts introduces an innovative and multifunctional approach to skincare. This project highlights the powerful combination of liquorice for its anti-inflammatory and brightening effects, and activated charcoal for its deep-cleansing and detoxifying properties—creating a strong foundation for effective facial cleansing.

A key novelty in this formulation is the inclusion of inorganic salts, which serve dual functions. Not only do they contribute to skin mineral balance and enhance cleansing efficiency, but they also play a critical role in improving the tablet's disintegration. By facilitating faster breakdown upon contact with water, the inorganic salts ensure quicker activation and ease of use—making the tablet both effective and convenient.

The solid tablet format provides additional benefits such as portability, accurate dosing, longer shelf life, and reduced environmental impact due to minimal packaging and preservation needs.

In conclusion, this innovative formulation offers a unique, eco-friendly, and skin-beneficial alternative to conventional facewash products. It sets the stage for further exploration into tablet-based skincare and paves the way for scalable commercial development.

➢ ACKNOWLEDGEMENT

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Firstly, I am deeply thankful to my project guide Hritik S. Dashwant, for their constant guidance, encouragement, and valuable insights, which were instrumental in shaping the direction of this research.

This project represents an innovative approach in the cosmetic formulation field, where inorganic salts were explored as an alternative to conventional disintegrants. Their incorporation not only contributed to the tablet's effectiveness but also enhanced the formulation's stability and eco-friendliness. The combination of liquorice and activated charcoal further enriched the product with natural cleansing and soothing properties, aligning with the growing demand for sustainable skincare solutions.

I also extend my thanks to the faculty members, laboratory staff, and my peers for their continuous support and collaboration throughout the experimental phase.

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