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GELS: INTRODUCTION, PREPARATION AND EVALUATION PARAMETERS

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ABSTRACT

Topical gels have a number of advantages over other traditional dosing forms. Gels are both less harmful and more effective than other forms of administration. Because topical gels are applied directly to the skin, they are the greatest choice for treating local infections and skin issues. Topical gels have drawn a lot of attention in recent years because scientists working in industry, research and development, education, and professional fields are interested in the subject. Topical gels deliver action directly to the target area. Because gels are made up of two phases, they have a greater penetration power. A complete analysis of gel, its properties, advantages, limitations, and evaluation parameters was conducted in this paper.

KEYWORDS: Topical gel, properties of gel, advantages, Disadvantages and Evaluation parameter.

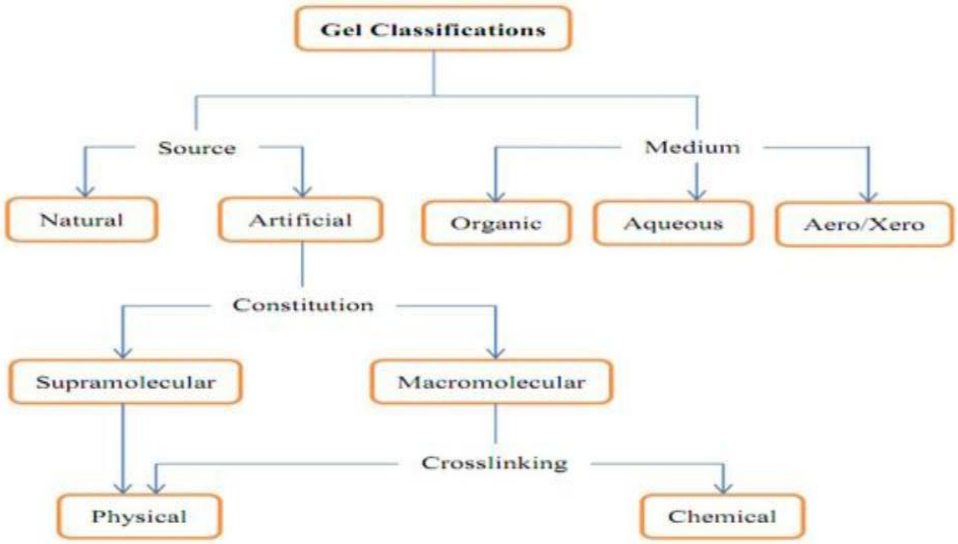
INTRODUCTION

Gelatin is the source of the word gel. Gelu is a Latin word that means "to freeze, congeal, or frost." Gels are semisolid systems in which colloidal particles interact with a liquid carrier (either physically or covalently). The term "gel" refers to a liquid setting on non-flowing solid or semisolid materials.[1]

Gels have the appearance of solid materials but are fluid and squishy. Natural or manufactured gels are classed by their source; hydrogels and organogels are classified by the liquid medium in the polymer network; and chemical and physical gels are classified by their cross linking.[2]

Gels are a semisolid dosage form made up of minute inorganic particles and big organic molecules contained in a fluid, according to the USP.[3]

Classification of gels



Gels are divided as

- **On the basis of colloidal phase**

1. **Single phase gels**

   In single phase gels in which macromolecules are evenly divided throughout a fluid with no visible barrier among dispersed macromolecules and fluid.[4]

2. **Double phase gels**

   In these phase gel mass contains floccules of minor distinct particles referred as magma.[4]

- **On the basis of continuous phase**

1. **Hydrogels**

It is a network of hydrophilic polymer chains or a colloidal gel in which water serves as the dispersion medium. They are natural or manufactured polymeric networks that are highly absorbent.[2] In 1960, Wichterle and Lim coined the word "hydrogel." Physical hydrogels, also known as reversible hydrogels, are hydrogels made up of physical crosslinks. They have a three-dimensional hydrophilic polymer network that expands in water and can hold a large amount of water.[5]

2. **Organogels**

It's a thermoplastic that's non-crystalline and non-greasy. Solid material made up of a liquid organic phase encased in a three-dimensionally interconnected network. Organogels are

dispersion gels that contain oil or non-polar liquids as a dispersion medium.[6]

3. Xerogels

Vehicles have been removed from gels, leaving a polymer network or polymer film. It has a high porosity and a large surface area, as well as a very small pore size (1-10nm).

On the basis of rheological properties

(I) Plastic gel

Bingham bodies, flocculated suspensions of Aluminum hydroxide are the example of plastic flow.

(II) Pseudo plastic gel

Liquid dispersion of tragacanth, sodium alginate, Na CMC, etc. are the best example of pseudo plastic gel.[3]

On the basis of physical nature

(i) Elastic gel

They are elastic gels made up of alginates, agar, guar gum, and pectin. Weak links, such as dipole attraction and hydrogen bonds, connect fibrous particles at their point of contact.

(ii) Rigid gel

It can be found in macromolecules where the frame work is linked by a primary valence bond.[4]

1.3.2 Properties of gel

- The gelling agent should be non-toxic and suitable for pharmaceutical and cosmetic applications.
- To prevent microbial attack, an antimicrobial agent must be present.
- The gel has to be sterile.
- The gel should not be sticky.[3]
- It possesses solid-state mechanical characteristics.
- High degree of adhesion between the dispersed phase and the aqueous medium, ensuring that gels remain uniform upon standing and do not settle readily.[4]

Advantages of gels

- They are easy to create with active substances and have a non-greasy application.
- Non-toxic and easily washable.

- Long-term stability
- By passing via the digestive system, undesired side effects are avoided.
- It is simple to disseminate.
- Retention of the skin
- It has a calming effect on the skin.

Disadvantages of gels

- There was a chance of having an allergic reaction.
- Gels have a slower onset impact.
- The gel's additives may irritate the skin.
- Reactions at the application location must be observed.
- Temperature, humidity, and other environmental conditions may have an influence on effectiveness.
- Some medications are difficult to absorb through the skin.

Materials use for preparation of gels

1) Aqueous material: Commonly used agents e.g. water, alcohol.
2) Gelling agent: The thickness of the formulation is increased by using a gel forming agent. This is where carbopol 934, carbapol 940, and hydroxyl propyl methyl cellulose (HPMC) come in handy.
3) Preservatives: e.g. Propyl paraben, methyl paraben, benzoic acid, benzyl alcohol etc.
4) Humectant: e.g. Glycerine, Propylene glycol.
5) Antioxidant: e.g. Butylated Hydroxy Toulene (BHT), Ascorbyl palmitate, Butylated hydroxyanisole (BHA).
6) Buffer: e.g. Triethanolamine.

Evaluation parameters of gels

pH

A digital pH metre is used to determine pH. To measure pH, the pH electrode was initially immersed in the gel formulation until the readings stopped fluctuating and a continuous reading was achieved.

Viscosity

Viscosity of a gel is determined by the Brookfield Viscometer DVII model. Firstly the T-Bar spindle is put into the gel and rotated at a speed of 10rpm with the help of spindle. The

temperature was maintained and the reading was noted down.

Spreadability

To determine spreadability, two glass slides were taken first. The first glass slide was marked with a 1cm circle, and 0.5 gm of gel sample was placed in the center of that circle, followed by the placement of a second glass slide of similar size on top of the first glass slide. An additional 200gm of weight was placed on top of the upper slide for around 5 minutes, and the diameter of the gel placed within the center circle increased owing to spreading.[7]

Percentage yield

It is calculated by weighing the empty container in which the gel formulation was stored first, then the container with the gel formulation. After substracting the empty container from the gel formulation, the practical yield is obtained. The formula was then used to calculate the percentage yield.

Percentage yield = Practical yield / theoretical yield X 100

Drug content

5g of each gel formulation was weighed and placed in a 250ml volumetric flask containing 10ml ethyl alcohol, where it was agitated for 30 minutes. The amount was increased to 100 millilitres. The produced gel formulation solution was then filtered. 1 mL of the above solution was diluted in alcohol to make 10 mL. UV spectrophotometry at 300nm was used to determine the solution's absorbance. Then the following formula was used to compute the drug content:

Drug content = Sample Absorbance / Standard Absorbance X 100

Swelling index

To determine the swelling index of a prepared topical gel, firstly weighed 2gm of prepared gel is dispersed into a 100ml measuring cylinder then add 20ml of water into the measuring cylinder containing gel after some time the gel is settle down then close the stopper of measuring cylinder and keep it side for 24 hrs. for complete swelling after 24 hrs. gel absorb water and swell. The volume occupied by the gel in the measuring cylinder get increased. Then swelling index was calculated by the given formula;

Swelling index = $W_t - [W_o / W_o] X\ 100$

CONCLUSION

Gels are a semisolid structure in general. Gels are becoming more popular since they are more stable and can give regulated release compared to other semisolid preparations such as creams, ointments, pastes, and so on. The gel formulation may have higher absorption properties and boost the drug's bioavailability.

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