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Development And Evaluation Hydrogel of Luliconazole

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Abstract

Background: This study's primary goal was to create a topical drug delivery system (Hydrogel) for luconazole with the intention of lowering the dose of the active medication, enhancing patient compliance, preventing adverse effects, and boosting local onset absorption and activity. Luliconazole interacts with cytochrome P-450 enzyme 14-α sterol demethylase, which is necessary for the conversion of lanosterol to ergosterol. Because there is less ergosterol in the fungal cell membrane, these lead to a suppression of ergosterol synthesis and an increase in the fungus's cellular permeability.

Methods: The preparation of topical hydrogel formulations for liconazole involved the use of various polymers to improve viscosity and stability at varying doses. Luliconazole was created in six distinct formulations, and each one was assessed for colour, spreadability, viscosity, pH determination, drug content, in vitro drug release studies, and stability studies.

Results: The medicine, polymers, and excipients did not interact in any way, according to the results of the FT-IR investigation. The developed formulations of luconazole all exhibit conventional physical qualities that are deemed acceptable. Of all the formulations, the F5 formulation had the highest drug concentration and yield %. Better medication release is seen in F5. The best formulation, F5, with guar gum polymer was determined to have the best stability study.

Conclusion: This F5 formulation may be a more potent topical formulation for the treatment of fungal infections in the skin, according to the results of the above observation.

Keywords: Luliconazole, Hydrogel, Zeta Potential, Lanosterol, Ergosterol, Cell Membrane.

Introduction

An infinite rigid network structure that immobilises the liquid continuous phase within formulation can be created by a gel, which is a two-component, cross-linked, three-dimensional network made up of structural components strewn with a sufficient but disproportionately large amount of liquid. Often, organic macromolecules, mostly polymers, or inorganic particles make up the structural components that make up the gel network. Chemical or physical interactions are common ways in which cross connections are created. As a result, gel is classified into two categories: chemical gel systems and physical gel systems. Luliconazole interacts with cytochrome P-450 enzyme 14-α sterol demethylase, which is necessary for the conversion of lanosterol to ergosterol. These lead to a suppression of ergosterol synthesis and an increase in fungal cellular permeability because the fungal cell membrane contains less ergosterol. Since ergosterol is a crucial part of the

fungal cell membrane, blocking its synthesis increases the permeability of the cell, which allows internal contents to escape and ultimately leads to cell death.[1-6]

Classification of gels

Gels may be classified supported colloidal phases, nature of solvent used, physical nature and rheological properties.

1. Based on nature of solvent

Hydro gels (water based)

In this instance, water is present in their continuous liquid phase. For example, bentonite, cellulose derivatives, carpooler, and artificial poloxamer gel. Plastibase (low molecular weight polyethylene dissolved in oil), Olag (aerosol) gel, and metallic stearate dispersion in oils are a few examples.

Hydrogel

A hydrogel is a gel dosage form formulation that is semisolid and has an exterior apolar phase that is immobilised. The self-assembling structures of substances known as gelators cause all polymers to physically engage, immobilising the apolar phase within the voids of the 3D network structure.[7]

Xerogels

Xerogels are solid gels that have a low solvent content. These are made via freeze-drying or solvent evaporation, which leaves the gel structure behind. When they come into contact with new fluid, they swell and can potentially reconstitute. For instance, polystyrene, β1-cyclodextrin, acacia tear ribbons, and dry cellulose.[8]

2. Based on colloidal phases:

They belong to the category of inorganic (two-phase system) forces, which are responsible for the links that define the network's structure and, consequently, the gel's properties.[8]

Single-phase system these contain large organic molecules existing on the twisted strands dissolved during a continuous phase.

3. Based on rheological properties:

The gels typically exhibit non-Newtonian flow characteristics. They fall into one of three categories: a) plastic gels; b) pseudoplastic gels; and c) thixotropic gels. (a) Gels made of plastic For instance, Bingham bodies and flocculated solutions of aluminium hydroxide show a plastic flow. The rheogram plot indicates the gels' yield value, over which the elastic gel deforms and starts to flow. (b) Artificial plastic gels Examples of substances that display pseudo-plastic flow include liquid tragacanth dispersion, sodium alginate, and Na carboxymethyl cellulose.[9]

4. Based on physical nature:

(A) Flexible gels Agar, pectin, guar gum, and alginates gels behave elastically. The fibrous molecules are joined at the junction by dipole attraction and hydrogen bonds, which are rather weak interactions. Such as carbapol and alginate. (b) Rigid gels: These can be made of macromolecules with a primary valence bond connecting the

framework. For instance: Si-O-Si-O bonds hold silic acid molecules together in a colloid, resulting in a polymer structure with a network of pores.

Preparation of Gels

Typically, gels are made on an industrial scale at room temperature. A small number of polymers, both synthetic and natural ones, require extra care before processing, nevertheless. Gels are also made using the techniques listed below.10–11

1. Variations in temperature
2. Dispersion
3. Chemical reaction or process

Materials and Methods

A gift sample of levicoxanide was obtained from Praise Pharma Ltd. located in Mumbai, India. The standard analytical grade was utilised for all other chemicals utilised in the formulation development process. Formulations for lolliconazole Different polymers were used to prepare hydrogel, each at a different concentration. The temperature is kept at 400C while polymers are continuously mixed in distilled water at a medium speed using a magnetic stirrer. Gels are packaged in wide-mouthed glass jars, which are then coated with aluminium foil and a screw-capped plastic top. Table 1 displays several liconazole hydrogel formulations. They were all housed in a chilly, dark room. Assessment of the physicochemical properties of the liconazole gel hydrogel that was prepared Compatibility tests between drugs and excipients using Fourier transfer infrared spectrophotometers (FTIR). The FTIR method is used to study the interactions between the medication, polymer, and excipients. Generally speaking, for a formulation to be stable, safe, and effective, the drug and excipients must get along. IR spectrum analysis was performed on both polymers and pure drugs. Peaks and patterns produced by a pure drug were compared to those produced by a polymer and drug combination.[11-15]

Results and Discussion

Drug-excipients compatibility studies

An increased percentage of polymers are employed in the infrared experiments of the clear liconazole formulation, which are carried out to determine the relationship between the drug and the polymers.

The infrared spectra of formulations with a higher percentage of polymer, as well as pure liconazole and liconazole gel, exhibit similar basic patterns and peaks. The polymer and medication did not exhibit any significant interactions.

Visual inspection: Visual determination is done to examine the physical properties and color of the developed formulation.

pH determination: All gels that were generated had pH values between 6.5 and 7.4. This is adequate to make the skin feel good and reduce the possibility of irritation when applied locally.

Spread-ability: A few key components of the study demonstrate the gel character that comes out of the tube. A test for spreadability is conducted on each formulation.

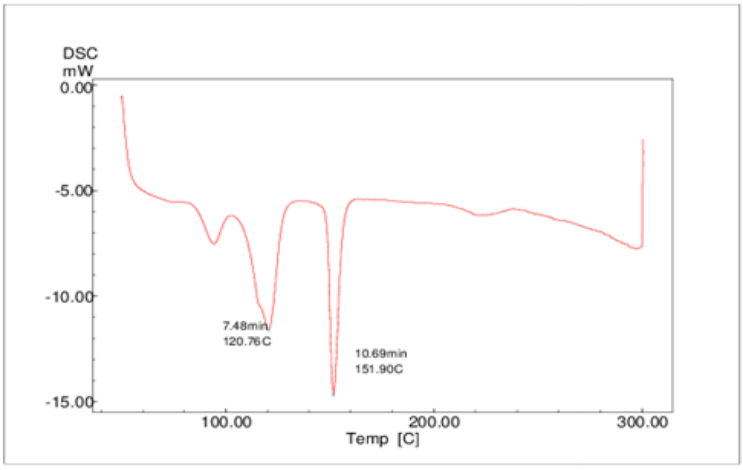
Drug content estimation: An estimate of the drug content was made for the prepared gel. The drug content shows that the substance was dispersed evenly across the gel.

Percentage yield and viscosity: The percentage yield of a topical gel containing clotrimazole ranged from 94.15% to 94.55%. It was found that the inclusion of guar gum polymer in the F5 formulation resulted in a higher percentage yield than in the other preparation.

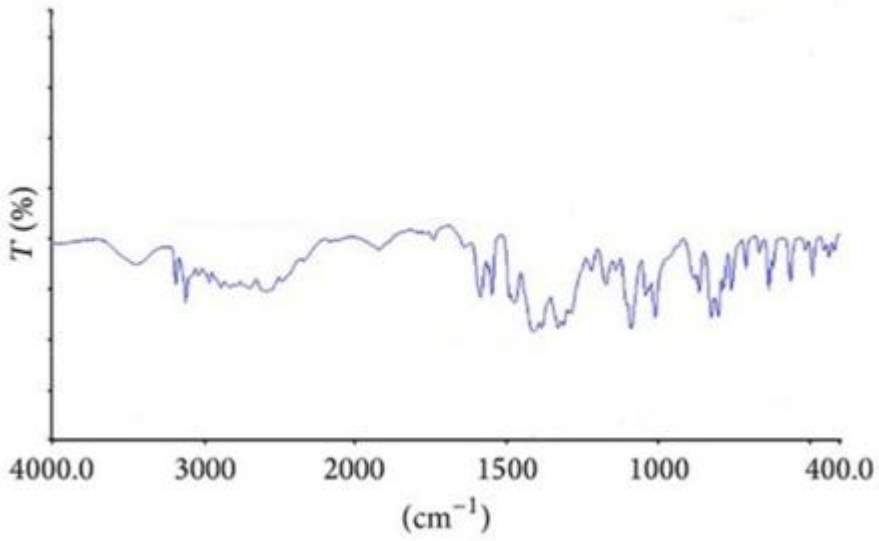
In vitro drug release: Franz diffusion cell was used to achieve the drug release profile of topical gel formulations containing luconazole. All formulations' results from the in vitro release tests are listed in Table 3, and Figure displays the statistically significant results.

Table 1: Luliconazole Formulation Table

Ingredients(Gm)	F1	F2	F3	F4	F5	F6
Luliconazole	2	2	2	2	2	2
Ethanol	5	5	5	5	5	5
Carbopol	0.5	1	1.5	-	-	-
Guar Gum	-	-	-	0.5	1	1.5
Propylene Glycol	5	5	5	5	5	5
Benzalkonium Chloride	0.5	0.5	0.5	0.5	0.5	0.5
Methyl Paraben	2	2	2	2	2	2
Propyl Paraben	0.5	0.5	0.5	0.5	0.5	0.5
Purified Water (QS)	100ml	100ml	100ml	100ml	100ml	100ml



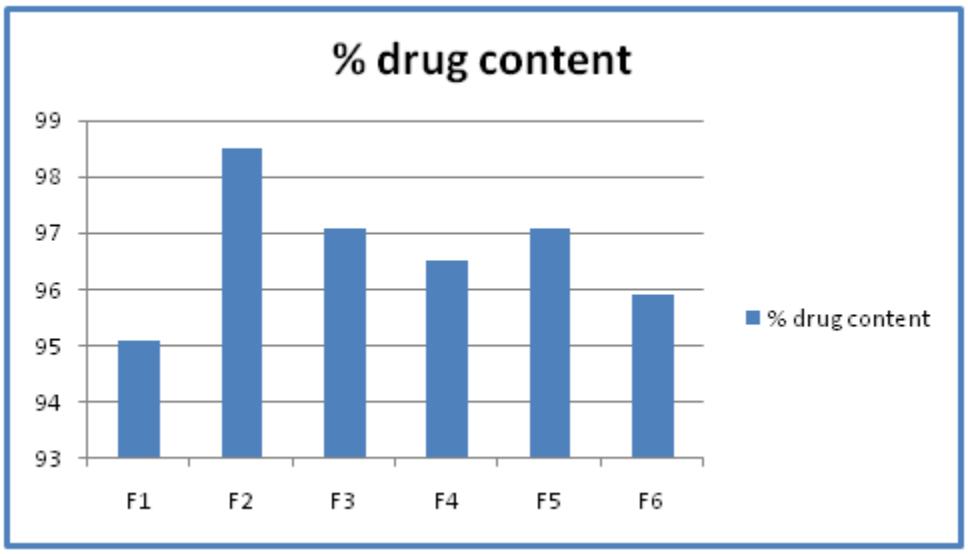
Graph 1: DSC of Luliconazole



Graph 2: IR Spectra of Luliconazole

Table 2: Characterization of formulation of Luliconazole Gel

Characterization	Formulation code					
	F1	F2	F3	F4	F5	F6
pH	7.4	7.2	6.8	7.0	7.1	6.5
Viscosity (CPS)	8811	9221	9198	9255	8854	9152
Visual Appearance	Tanslu-cent	Tanslu-cent	Tanslu-cent	Tanslu-cent	Tanslu-cent	Tanslu-cent
Gelling capacity	++	++	++	+++	++++	+++
Content uniformity	94.15 ±0.02	96.55 ±0.01	95.85 ±0.04	96.20 ±0.02	98.55 ±0.01	98.11 ±0.02



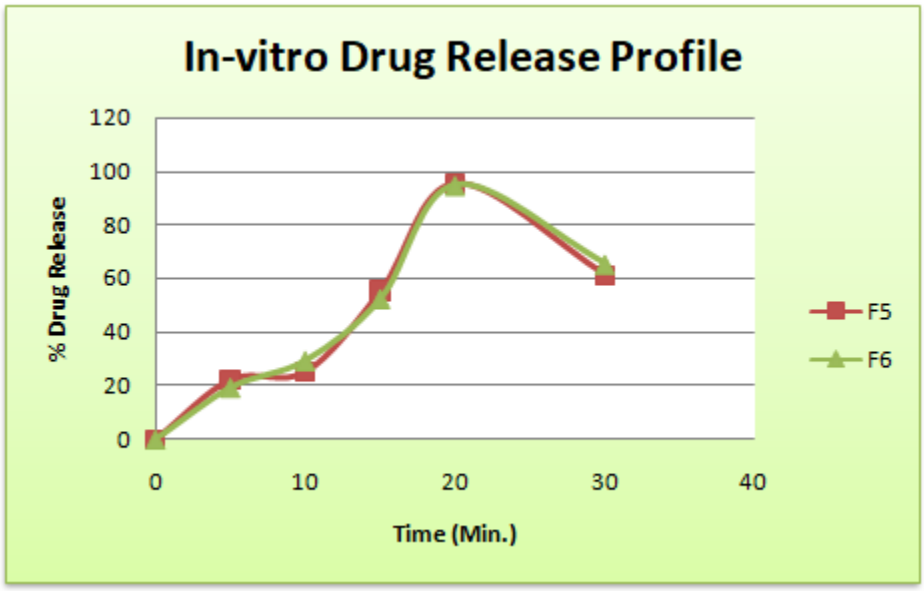
Graph 3: Drug content

Table 3: % cumulative drug release from various batches

Time (Min.)	F4	F5	F6
0	0	0	0
5	13.32	22.22	19.31
10	14.47	25.21	29.37
15	54.35	55.55	52.56
20	88.29	95.56	94.81
30	55.25	61.25	65.31

Table 4: % cumulative drug release from various batches

Time (Min.)	F1	F2	F3
0	0	0	0
5	18.44	16.23	22.34
10	26.12	25.24	21.24
15	45.22	47.23	44.28
20	74.23	80.41	81.12
30	71.21	76.16	75.15



Graph 4: Drug release profile

Discussion

Luliconazole's imidazole derivative is among the most effective medications for treating fungal infections. The topical gel preparation of luconazole used in this trial was designed to effectively absorb the medication via the skin. The physiochemical factors, including viscosity, spreadability, drug content, and in vitro drug release studies, were examined in advanced formulations of leviconacle.

Conclusion

After assessing the aforementioned data, it was determined that, of all the created formulations, our drug luconazole was successfully incorporated into the topical gel development; formulation F2 exhibits the best spreadability, drug content, viscosity, and drug release studies. It was therefore determined that our formulation would be a very safe and effective topical option for the treatment of fungal infections of the skin.

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