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Formulation and evaluation of posaconazole Emulgel: A novel topical drug delivery

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Abstract

The goal of this study is to create a Posaconazole emu gel that will enable the medication to permeate the skin more deeply than current preparations. Posaconazole, a triazole antifungal medication, is used to prevent severe fungal infections. When administered orally, this medication absorbs slowly. Topical pharmaceutical delivery is preferred as a therapy method because it prevents the drug's first-pass metabolism. Posaconazole emu gel is prepared using the gelling agent carbopol 934. Furthermore, oleic acid is used as an emulsifier for the oil phase, while tween 80 is used as an emulsifier for the aqueous phase, propylene glycol and Transcutol P serves as a co-surfactant and Transcutol in this formulation has used for its ability to enhance anti- fungal property, and methyl paraben and propyl paraben are employed as preservatives. TEA (Triethanolamine) was Added to adjust the pH of the emu gel to 6-6.5. All of the prepared emulgels had satisfactory physical properties. The batch F6 of the formulation demonstrates improved drug release compared to the other formulations

Keywords: Emu gel; Topical Formulation; Posaconazole; Controlled Drug Delivery System

1. Introduction

Aim and objective

- Aim:
    - To Formulate & Evaluate Posaconazole Emulgel: A Novel Topical Drug Delivery to treat serious fungal infections in immunocompromised patients
- Objective:
    - To Procure the raw material and drug
    - To Determine the lambda max of drug
    - To Construct the standard calibration curve
    - To formulate the emulgel of posaconazole
    - To Perform solubility studies
    - To Evaluate and interpret of results

Topical drug delivery refers to the application of a formulation to a specific body area, such as the ocular, rectal, nasal, vaginal, or skin, in order to increase bioavailability and reduce side effects.[1] Topical drug delivery refers to the local administration of medication for the treatment of dermatological problems that is not intended for systemic dispersion.

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Eczema and psoriasis, for example, can be treated topically. Topical medications include corticosteroids, antivirals, antifungals, antibiotics, antiseptics, local anesthetics, and antineoplastics.

1.1. Skin Structure

- **Epidermis:** The uppermost layer, which contains the stratum corneum (SC). This layer serves as the principal barrier to medication absorption. Its lipid-rich nature is critical for reducing medication penetration.
- **Dermis:** It is located beneath the epidermis and contains blood vessels, nerve endings, and connective tissues. While medications normally must pass through the epidermis to reach the dermis, the qualities of the dermis influence the drug's activity once it reaches this layer.
- **Hypodermis:** is the skin's lowest layer, made mostly of fatty tissues. Although this layer is not directly involved in medication absorption, it can influence drug distribution and retention.

1.2. Stratum Corneum

- **Barrier Function:** The stratum corneum (SC) is the epidermis' topmost layer and the major barrier to drug penetration. Its composition of keratinized cells and lipid matrix limits the flow of chemicals.
- **Hydration:** The hydration status of the stratum corneum has a substantial impact on medication absorption. Well-hydrated skin frequently exhibits enhanced permeability.

1.3. Skin pH

- **Acidic Nature:** he hydration status of the stratum corneum has a substantial impact on medication absorption. Well-hydrated skin frequently exhibits enhanced permeability.

1.4. Skin Thickness

- **Regional Variation:** collagen thickness varies by body part. For example, the skin on the palms and soles is thicker than that of the eyelids. Thicker skin typically provides a stronger barrier to drug penetration.

1.5. Blood Flow

Higher blood flow in places like the face or scalp can lead to better drug absorption compared to lower flow locations. This is because improved perfusion can help medications enter the systemic circulation more efficiently**.**

1.6. Age and Skin Condition.

- **Age**: Skin qualities vary with age. For example, aging skin tends to be thinner and drier, which may impede drug absorption.
- **Skin conditions**: such as eczema or psoriasis, might impact drug absorption due to altered skin permeability.

1.7. Skin temperature

Elevated skin temperature can improve medication permeability and diffusion through the stratum corneum, leading to better absorption.

1.8. Drug Formulation

- **Vehicle and Excipients:** The topical drug's formulation, including vehicle type (e.g. cream, gel, ointment) and excipients, impacts its skin interaction. For example, lipophilic medications may be better administered in oily bases, whereas hydrophilic pharmaceuticals may be more effective in watery formulations.

Understanding these physiological properties helps in designing topical formulations that optimize drug delivery and efficacy.

1.8.1. Physicochemical Factors

- Partition coefficient: More the value of log p more easily will be the percutaneous absorption of the drug.
- The molecular weight (<400 Dalton).
- The degree of ionization (only unionized drugs gets absorbed well).
- Effect of vehicles:

"Several antifungal medications are available on the market in topical formulations (for example, creams, ointments, and powders for local dermatological therapy). Posaconazole, which has antifungal and antibacterial properties, is one of these antifungal agents. It is used to treat dermatophytes and other minor skin infections. An emulsion is a controlled release approach in which pharmaceutical particles contained in the internal phase pass through the external phase to the skin and are slowly absorbed. Internal phases act as drug reservoirs, gently releasing medication to the skin via the exterior phase. The hydroalcoholic gel allows for the most efficient absorption via the skin.Posaconazole (\4-[4-[4-[4-])[(3R,5R)-5(2,4difluorophenyl)-5-(1,2,4-triazol-1-ylmethyl)oxolan-3-yl]methoxy]phenyl]piperazin-1-yl]phenyl]-2-[(2S,3S)-2-hydroxypentan-3-yl]- 1,2,4-triazol-3-one Posaconazole is a triazole antifungal medication that is used to prevent serious fungal infections. It exerts It inhibits sterol 14α-demethylase, a cytochrome P-450-dependent enzyme in fungi, by attaching to its heme cofactor.

This inhibits the formation of ergosterol, a critical component of the fungal cell membrane, resulting in the accumulation of methylated sterol precursors. This inhibits fungal cell development, ultimately leading to cell death. When administered orally, this medication demonstrates limited absorption. To circumvent this, topical medication delivery is favored, as it bypasses the drug's first pass metabolism. They dispense the medicine at a predetermined rate and increase patient compliance. Taken orally, it is a less preferred choice. Gels, a newer type of dosage form, are created by encapsulating vast amounts of aqueous or hydroalcoholic liquid within a network of colloidal solid particles formed of natural or synthetic materials. The medication's duration Its bio adhesive property allows for greater contact with the skin. Emulgel combines the properties of an emulsion and a gel, resulting in a double-control release mechanism. Despite their benefits, gels have significant limits in their ability to distribute hydrophobic medicines. Emulgel was designed to address this constraint. Emulgel has been used to address the issue of stability in cosmetics and medicinal formulations. Emulgel has a number of advantages in dermatology, including being thixotropic, greaseless, readily spreadable, quickly removable, emollient, non-staining, water-disposable, having a longer shelf life, being bio-friendly, straightforward, and pleasing to the eye."[4] Emulgel are a preferable option for BCS class II drugs with low solubility and high permeability. Several elements such as gelling agents, oil, and emulsifiers affect the stability and The effectiveness of emulgel. Emulgel has various advantages, such as the incorporation of hydrophobic medicines, increased loading capacity, production feasibility and reduced preparation costs, improved stability, controlled release, etc.

2. Literature review

Table 1 Literature review of the project

Author and year of publication	Title of publication	Journal name	Key points
Dr.G.Jagadeesh et.al 2021	Formulation And Evaluation Of Microemulsion Based Gel Of Posaconazole For Topical Delivery	International Journal of Research and Developement	Skin permeation/retention properties of microemulsion have been increased by incorporating microemulsion into gel form. Compared with conventional gel as well as microemulsion
Priyanka Priyadarshini, Ayesha Syed A.N. Asha et.al 2022	Formulation and Evaluation of Nano emulgels for the Topical Drug Delivery of Posaconazole	Journal of Drug Delivery and Therapeutics	The high solubilization of POS in oleic acid was helpful to encapsulate the solubilized drug in nanosized oil droplets with high loading efficiency. improved stability with sustained drug release
Kota Padmaja, Rajeev Ranjan et.al 2023	Formulation And Characterization Posaconazole Nano emulgel by Using Natural Oils For Fungal Infections	Journal of Cardiovascular Disease Research	Natural essential oils have been shown to promote the cutaneous permeability of topical formulations, enhancing medication safety and efficacy

Sujeet Pratap singh et.al 2021	Formulation and Evaluation of Posaconazole Drug Loaded Ethosomal Gel for Antifungal Activity	International Journal Of Pharmacy & Pharmaceutical Research	ethosomes were a very promising carrier for the transdermal delivery of Posaconazole, as evidenced by higher entrapment efficiency and a better stability
Mayram Hacıo et.al 2022	Optimization of the Micellar-Based In Situ Gelling Systems Posaconazole with Quality by Design	MDPI	Poloxamer 407 is an important excipient for the development of an in situ gel with ideal properties as a thermosensitive copolymer poloxamer 188 such that the developed formulations become gel at the natural temperature of the eye
Venkata Deepti Vemuri et.al 2022	Posaconazole-amino acid cocrystals for improving solubility and oral bioavailability while maintaining antifungal activity and low *In vivo* toxicity	Journal of Drug Delivery Science and Technology	posaconazole-l-glutamine cocrystal showed higher solubility (92.42-fold) and dissolution (7.72-fold) enhancement compared to that of the parent molecule.
Ahmat ogul araman et.al2023	Preparation, optimization, and *In vitro* drug release study of microemulsions of posaconazole	Journal of Drug Delivery Science and Technology	This study aims to develop stable (MEs) as SEDDS that enhance the oral bioavailability of posaconazole

3. Material and Methods

Posaconazole IP. Carbapol 934, Oliec acid, propylene glycol, Transcutol span 80, tween 80, methyl paraben, propyl paraben, methanol, and triethanolamine were obtained. All of the solvents were analytical grade. The inclusion procedure is used to create emu gel.

3.1. Step 1: preparation of gel using gelling agent

The gel in the formulations was made by dispersing a carbapol 934 (gelling agent) in purified water q.s with constant

stirring at a moderate speed using a mechanical stirrer, then the pH was adjusted to 6- 6.5 using triethanolamine (TEA).

3.2. Step 2: preparation of an emulsion

- Oil phase preparation: oil phase of the emulsion is prepared by dispersing the span 80 in oleic acid.
- Aqueous phase preparation: Aqueous phase of the emulsion is prepared by dispersing tween 80 into purified water.
- Posaconazole is dissolved in methanol in separate beaker.

Simultaneously, in another beaker methyl paraben and propyl paraben was dissolved in propylene glycol, similarly with Transcutol P whereas drug was dissolved in methanol and both solutions was mixed with the aqueous phase.

Mixing of phases: Both the oily and aqueous phases were separately heated at 70°C-80°C, then the oily phase was added to the aqueous phase with continuous stirring until it was cooled to room temperature. The emulsion was obtained, which is stored in a well-closed airtight container.

3.3. Formulation table (%w/w)

Table 2 Formulation table of posaconazole emulgel

Formulation	F1	F2	F3	F4	F5	F6
Posaconazole	1	1	1	1	1	1
Carbopol	0.75	0.75	1	1	1.5	1.5
Oleic acid	2	2	2	2	2	2
Span 80	0.5	0.5	0.5	0.5	0.5	0.5
Tween 80	0.8	0.8	0.8	0.8	0.8	0.8
Methanol	0.1	0.1	0.1	0.1	0.1	0.1
Transcutol P	0.25	0.5	1	1.5	2	2.5
Methyl Paraben	0.02	0.02	0.02	0.02	0.02	0.02
Propyl Paraben	0.03	0.03	0.03	0.03	0.03	0.03
Triethanolamine	Q.S	Q.S	Q.S	Q.S	Q.S	Q.S
Water	Q.S	Q.S	Q.S	Q.S	Q.S	Q.S

Formulation	F7	F8	F9	F10	F11	F12
Posaconazole	1	1	1	1	1	1
Carbopol	0.75	0.75	1	1	1.5	1.5
Oleic acid	2	2	2	2	2	2
Span 80	0.5	0.5	0.5	0.5	0.5	0.5
Tween 80	0.8	0.8	0.8	0.8	0.8	0.8
Methanol	0.1	0.1	0.1	0.1	0.1	0.1
Propylene glycol	0.25	0.5	1	1.5	2	2.5
Methyl Paraben	0.002	0.002	0.002	0.002	0.002	0.002
Propyl Paraben	0.003	0.003	0.003	0.003	0.003	0.003
Triethanolamine	Q.S	Q.S	Q.S	Q.S	Q.S	Q.S
Water	Q.S	Q.S	Q.S	Q.S	Q.S	Q.S

3.4. Pre formulation study of posaconazole

- Posaconazole pre-formulation study examined its organoleptic qualities, including color, odor, taste, crystallinity, and pH. [6]
- **Melting Point Determination**- The melting point of the Posaconazole sample was measured using a melting point equipment. "Posaconazole was placed in one end of an open capillary tube. The capillary was placed in a melting point device, and when the temperature rose, the melting point of the posaconazole powder was recorded."[6]
- **Determination of λmax By UV spectrophotom**eter - The standard stock solution was made by dissolving 10 mg of posaconazole in 40ml of methanol in a 100ml volumetric flask. The solution was sonicated for 15 minutes to produce a clear solution. The volume was marked up with methanol to get
- **Determination of λ max By UV spectrophotometer**- Standard stock solution was prepared by dissolving 10 mg of posaconazole in 40ml of methanol in a 100 ml volumetric flask. The solution was sonicated for 15 minutes to get a clear solution. Volume was mark up with methanol to Determine the stock solution's final concentration

of 100 µg/ml. The solution was pipetted into a 10ml volumetric flask and diluted with methanol to 10µg/ml. The UV-visible Spectrophotometer (Jasco, Japan model V-630) was used to scan the range of 200-400nm.

- **Preparing the Calibration Curve From the stock solution**, 1, 2, 3, 4, and 5 ml were transferred to a series of calibrated 10 ml volumetric flasks, and the final volume was adjusted with methanol. The observed absorption maxima (λ max 204nm) were used for absorption analysis at concentrations ranging from 10 to 50µg/ml. The linear plot was created, and the correlation coefficient value was calculated.
- **Solubility Analysis**- Posaconazole's solubility was tested by dissolving it in various solvents, surfactants, and co-surfactants such as dichloromethane, chloroform, ethanol, methanol, ether, water oleic acid, span 40, span 60, tween 80, tween 40, PEG 600, PEG 400, and propylene glycol. Each solvent was placed in a separate test tube, then an excess amount of posaconazole was added and manually mixed.
- **FTIR spectroscopy**- Posaconazole was analysed using a Shimadzu FTIR spectrometer (Model: FTIR-8400S). Each sample was combined with potassium bromide in a 1:100 ratio and compressed to observe at a range of 4000 to 400 cm-1.

4. Result and discussion

4.1. Evaluation of emulgel posaconazole

- **Physical appearance**: The prepared Emulgel is examined visually for color, homogeneity, consistency, and phase separation. The color of the formulation was examined against a white and black background. The consistency of the emulgel was assessed by putting it to the skin.
- **pH examination**: pH examination is an important requirement, particularly for topical formulations. To simulate the skin condition, the pH of the emulgel should range from 5.8 to 6. If the pH of the created emulgel is acidic or basic, the patient may experience irritation. The pH of the created emulgel was determined using a digital pH meter and dipping the glass electrode into an emu gel. The pH of each formulation was measured in triplicate, and average results were obtained.
- **Viscosity**: A Brookfield Viscometer was used to determine the viscosity of the created Emu gel mixture. To determine viscosity, the produced Emulgel formulation was introduced to the beaker and allowed to settle for 30 minutes at 25-30°C. Adjust the spindle so that it does not touch the bottom of the jar, and rotate at a moderate speed of 100 RPM for 10 minutes. The viscosity reading was observed. [7]
- **Spread ability** is measured using apparatus that has been appropriately adapted in the laboratory and employed in the investigation. Spread ability was tested using two glass slides and a wooden block with a pulley at one end, based on gel slip and drag characteristics. A ground glass slide was mounted on this block. was subjected to pull of 50gms. If time taken for the separation of two slides is less then better the spread ability".[8]

Spread ability is calculated by using the following formula:

$$S = M \times L/T$$

Where,
S is the spread ability,
M is the weight in the pan (weight tied to the upper slide),
L = is the length moved by the glass slide
T = time taken to separate the slide completely from each

- **Drug Content Determination**: Emu gel is mixed in a suitable solvent. Filter it to obtain clear solution. Determine its absorbance using UV spectrophotometer. From the standard equation by putting the absorbance value concentration and drug content can be obtained. Drug content was calculated using the slope and the intercept obtained by linear regression analysis of standard calibration curve.

$$\text{Drug Content} = (\text{Concentration} \times \text{Dilution Factor} \times \text{Volume taken}) \times \text{Conversion Factor}.$$

- ***In-Vitro* Drug Diffusion Study**: Release of posaconazole from emulgel formulation was measured through dialysis membrane by using Franz diffusion cell. Dialysis membrane was soaked in diffusion media for overnight and then placed on support screen of diffusion cell assembly. Phosphate buffer at pH 5.5 was used as the receptor medium and 1g of gel was placed on the donor side. At predetermined time interval, 2ml of sample was withdrawn from the receptor compartment and replaced with same volume of phosphate buffer at Ph 5.5. The aliquots were analysed by UV spectrophotometer at 226nm. Stability Study: "Emul gel was packed in

aluminium collapsible tubes (5gm) and subjected to stability study at 5°C, 25°C/60% RH, 30°C/65%RH for 1 month. Samples are withdrawn at each 10days as per ICH guidelines and analysed for their physical appearance, pH, drug content, drug release profile etc.".[9]

4.2. Scan spectrum by UV- spectroscopy

- Turn on the UV-Vis spectrometer and allow the lamps to warm up for an appropriate period of time (around 20 min) to stabilize them.
- Fill the cuvettes with the solvent for the sample and make sure the outside is clean. This will serve as a blank and help account for light losses due to scattering or absorption by the solvent.
- Open the UV probe 2.33 software in the computer connected to the UV device.
- Connect the UV-Vis spectrometer to the system by pressing F4 button on it, then the device can be operated with computer.
- Press blank in spectrum mode, then press autozero and set the baseline
- Then replace one of the blanks with the lowest concentration of the standard solution.
- Then go to the spectrum mode and select the peak pick and choose the desired wavelength

Table 3 UV spectroscopy range of posaconazole drug

Sample ID	Concentration	Absorbance
2ppm	2	0.028±0.006
4ppm	4	0.165±0.019
6ppm	6	0.238±0.0112
8ppm	8	0.348±0.013
10ppm	10	0.464±0.033

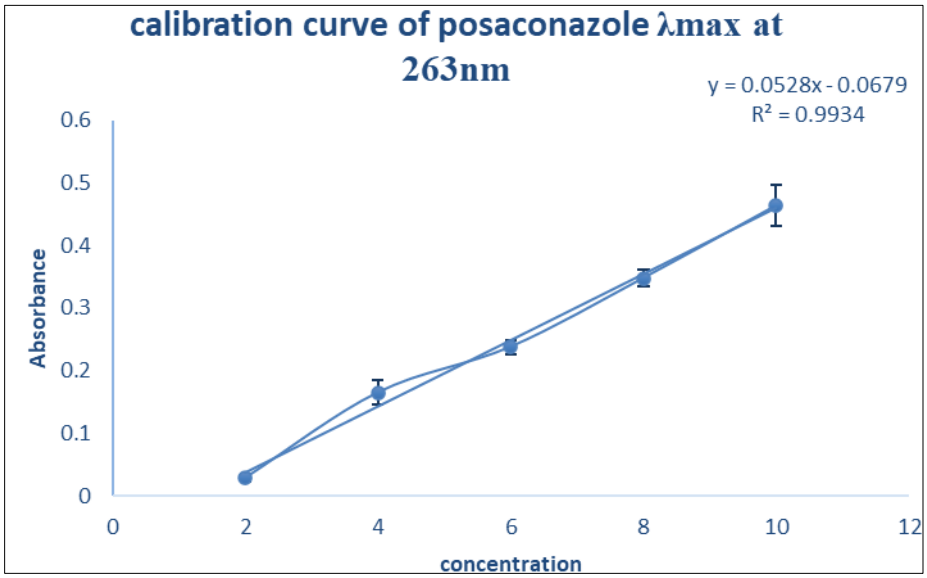

Figure 1 Calibration Curve of posaconazole at 263nm

4.3. Pre-formulation studies of drug:

- **Organoleptic properties**: The drug was studied for their organoleptic properties like colour, odour, taste, crystalline and pH observation was recorded in table 2.

Table 4 Organoleptic properties of drug

Colour	**White**
Odour	odourless
Appearance	amourphous

- **Melting point**- Melting point of drug was determined by capilary method was found to be 170.6°C (Table 5). The observed value was found to be in between the range of reported value i.e., 170°C to172°C. The observed melting point confirmed the drug as posaconazole.

Table 5 Melting point of drug

Drug	**Result**	**Reference**
Posaconazole	171.4±2	170-172
Posaconazole	170.5±2	
Posaconazole	171.3±2	

- **Solubility studies:** Different types, surfactants, solvents were selected. 500mg of each surfactants were weighed in vials in weighing balance. To this excess amount of posaconazole was added and placed in cyclomixer for 10-20min to allow solubilization of drug in, surfactants. The drug was added until it became saturated and kept 3 days for saturation. The resulting suspension was placed in a Shaking Incubator for 72 h to achieve equilibration. Thereafter, the suspension was centrifuged at 3000 rpm for 5 min. The supernatant suitably diluted with methanol and the dissolved concentration of febuxostat was determined spectrophotometrically at 260nm

Table 6 Solubility of posaconazole in different media

Solvents	**Solubility**
Oleic acid	40.8mg/ml±0.68mg/ml
Propylene glycol	36.6mg/ml±0.54mg/ml
Tween 40	28.4mg/ml±0.62mg/ml
Span 80	32.8mg/ml±0.23mg/ml
Methanol	41.1mg/ml±0.41mg/ml
Ethanol	40.3mg/ml±0.77mg/ml
PEG 600	35.0mg/ml±0.30mg/ml
Transcutol P	39.8mg/ml±0.88mg/ml

- **Ph determination**: pH determination: the pH of the produced emulgel was measured using a ph meter. The pH of the emulgel formulation was in the range of 5.7-6.3, which was regarded adequate to avoid the risk of skin irritation upon application to the skin.

Table 7 pH of posaconazole emulgel formulation

Formulation Code	**pH**
F1	6.76±0.13
F2	5.79±0.1504±0.20

F3	6.09±0.12
F4	6.20±0.11
F5	5.99±0.15
F6	6.23±0.10
F7	5.93±0.10
F8	6.09±0.12
F9	6.10±0.11
F10	5.99±0.15
F11	6.03±0.10
F12	6.3±0.10

- **Physical appearance**- emulgel preparation were thick creamy preparation with smooth homogeneous texture, the color of formulation was examined against a white and black backdrop, and the consistency of emulgel was verified by applying it to the skin.

Table 8 Physical appearance, phase separation, Homogenicity, Consistency of all formulation

Formulation code	Colour	Phase seperation	Homogenicity	Consistency
F1	White	No	Homogenous	Creamy
F2	White	No	Homogenous	Creamy
F3	White	No	Homogenous	Creamy
F4	White	No	Homogenous	Creamy
F5	White	No	Homogenous	Creamy
F6	White	No	Homogenous	Creamy
F7	White	No	Homogenous	Creamy
F8	White	No	Homogenous	Creamy
F9	White	No	Homogenous	Creamy
F10	White	NO	Homogenous	Creamy
F11	White	No	Homogenous	Creamy
F12	White	No	Homogenous	Creamy

*Data are represented as mean ± standard deviation (SD), n=3

- **Rheological Study**-The viscosity of the produced emu gel was measured with a Brookfield viscometer (Brookfield viscometer). Viscosity was measured at 2365 cps. As the concentration of gelling agent grew, so did its viscosity.

Table 9 Viscosity of formulations in centipoise

Formulation code	Viscosity cps
F1	2151±9.01
F2	2160±4.58
F3	2190±6.50
F4	2262±7.54

F5	2287±7.93
F6	2295±5.29
F7	2321±9.01
F8	2360±4.58
F9	2150±6.50
F10	2272±7.54
F11	2283±7.93
F12	2245±5.29

- **Spreadability** : A ground glass slide approximately 20 cm in length was mounted to the table. This ground slide was treated with an excess of emu gel (about 1 g). A 500-gram weight was put on top of the two slides for 5 minutes to evacuate air and create a homogenous coating of emu gel between the slides. The top plate was then pulled by a weight of 50 g linked to the upper slide at a distance of 7 cm. The shorter the time it takes for the slides to move the necessary distance of 7 cm, the better the emu gel spreads.

Table 10 Spread ability of all formulations

Formulation	Time	Length	weight	Spreadability
F1	25	7	50	14
F2	24	7	50	15
F3	26	7	50	16
F4	21	7	50	16
F5	24	7	50	14
F6	20	7	50	17
F7	23	7	50	15
F8	22	7	50	13
F9	21	7	50	12
F10	20	7	50	15
F11	24	7	50	16
F12	22	7	50	17

- **Drug content determination**- The drug content of different emu gel formulations was measured by employing UV spectroscopy.

Table 11 % Drug content of formulations

Formulation code	% drug content
F1	34.37
F2	38.07
F3	47
F4	51.33
F5	55.61
F6	89.56

F7	67.05
F8	85.11
F9	89.59
F10	72.05
F11	85.11
F12	87.59

- ***In-vitro* drug diffusion study**: At regular intervals, 2ml of material was removed from the receptor compartment and replaced with the same volume of phosphate buffer at pH 5.5. The aliquots were examined at 226nm with a UV spectrophotometer. After 4 hours, the total amount of medicine released from the F6 batch was found to be 96.8, which is the highest percentage of drug release when compared to other emu gel formulations.

Table 12 I*nvitro* drug Diffusion study of formulation 6 &12

TIME	**F6**
5	12.91±2.56
10	24.26±2.94
15	37.45±2.01
20	45.12±3.56
25	55.25±1.73
30	62.15±2.20
1	74.23±2.20
2	86.35±2.20
3	96.16±2.20
4	96.85±2.20

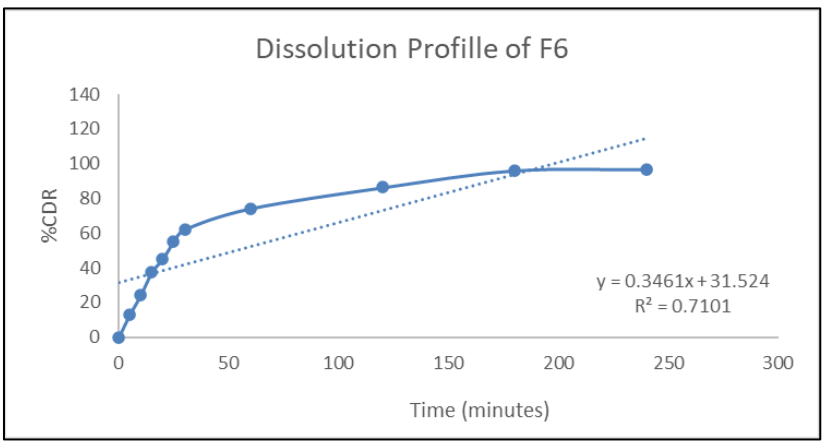

Figure 2 %CDR of formulation F6

Table 13 Drug release kinetics

Time	%CDR	Sqrt T	Log % CDR	Log T	%ARR	Log % ARR	±STD
0	0.00	0.00	0.00	0.00	100.00	2.00	
5	12.91	2.24	1.11	0.70	87.09	1.94	2.56
10	24.26	3.16	1.38	1.00	75.74	1.88	2.94
15	37.45	3.87	1.57	1.18	62.55	1.80	2.01
20	45.12	4.47	1.65	1.30	54.88	1.74	3.56
25	55.25	5.00	1.74	1.40	44.75	1.65	1.73
30	62.15	5.48	1.79	1.48	37.85	1.58	2.20
60	74.23	7.75	1.87	1.78	25.77	1.41	2.20
120	86.35	10.95	1.94	2.08	13.65	1.14	2.20
180	96.16	13.42	1.98	2.26	3.84	0.58	2.20
240	96.85	15.49	1.99	2.38	3.15	0.50	2.20

Table 14 % ARR of the Formulation F6

Time (min)	%ARR
0	100.00
5	87.09
10	75.74
15	62.55
20	54.88
25	44.75
30	37.85
60	25.77
120	13.65
180	3.84
240	3.15

Table 15 % ARR of the Formulation F12

Time	Log %ARR
0	2.00
5	1.94
10	1.88
15	1.80
20	1.74
25	1.65
30	1.58

60	1.41
120	1.14
180	0.58
240	0.50

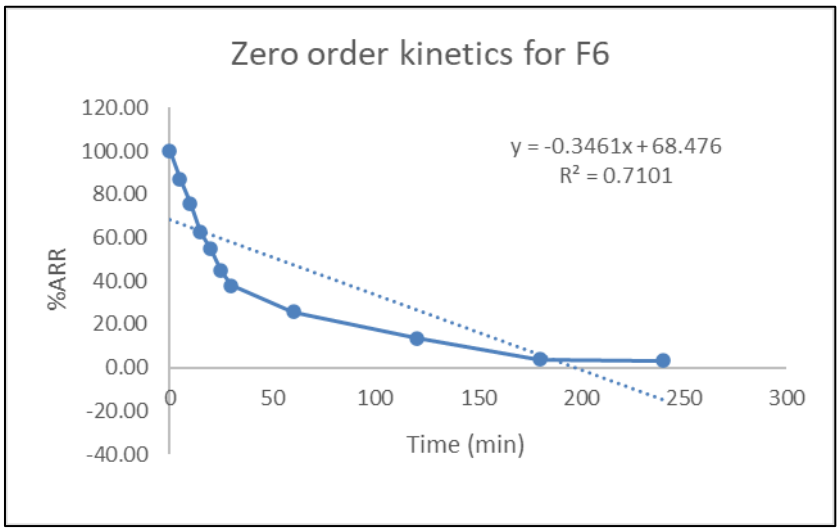

Figure 3 Zero order kinetics for F6 of prepared emulgel

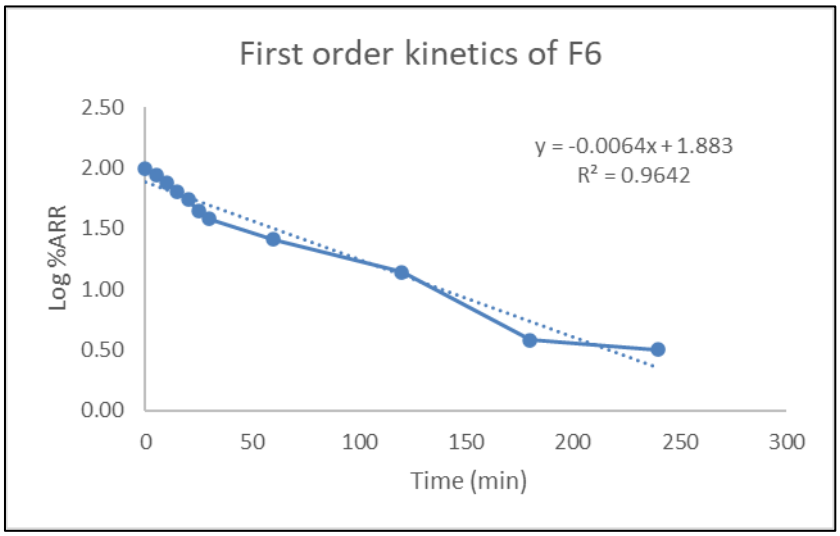

Figure 4 First order kinetics for 6 of prepared emulgel

Table 16 % CDR of the Formulation F6

Sqrt T	%CDR
0.00	0.00
2.24	12.91
3.16	24.26
3.87	37.45
4.47	45.12
5.00	55.25
5.48	62.15
7.75	74.23
10.95	86.35
13.42	96.16
15.49	96.85

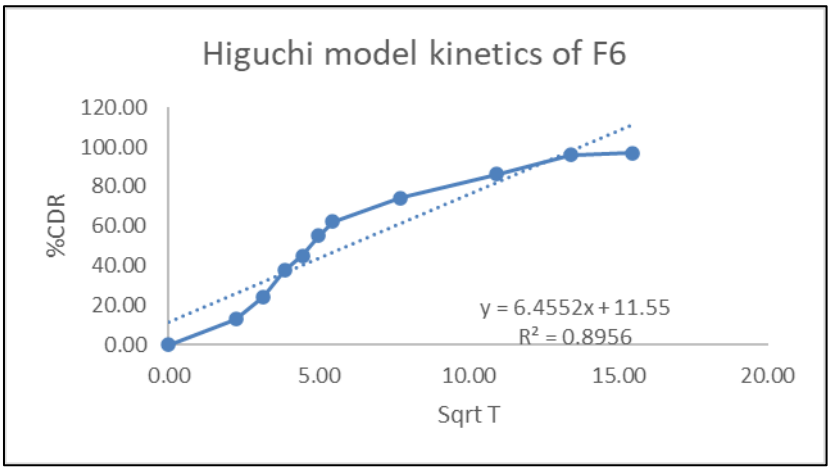

Figure 5 Higuchi model of kinetics

Table 17 Higuchi model of Formulation F6

Log T	Log % CDR
0.00	0.00
0.70	1.11
1.00	1.38
1.18	1.57
1.30	1.65
1.40	1.74
1.48	1.79
1.78	1.87
2.08	1.94

2.26	1.98
2.38	1.99

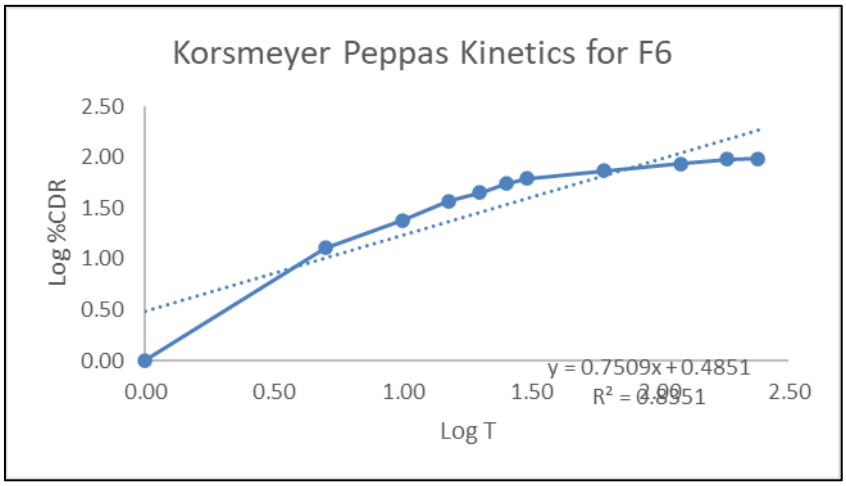

Figure 9 Korsmeyer peppas kinetics for f6

Discussion: F6 was found to indicate first-order release, with a regression value of 0.964. It was also observed that the drug was released via diffusion, having a regression value of 0.895 in Higuchi's Kinetics.

4.4. Stability studies

The stability studies data was represented in Table . All the prepared emulgel formulations were found to be stable upon storage for three months, no change was observed in their physical appearance, clarity, pH, viscosity, spreadability and Drug content, in vitro release studies

Table 18 Stability studies of F6 emulgel formulation-physical evaluation

Time period	homogenecity	ph	Spreadability	viscosity	Drug content
before	Good	6.23±0.10	17	2295±5.29	89.56±4.29
After	Good	6.12±0.11	17	2190±4.21	87.47±5.13

Table 19 Stability studies of F6 emulgel formulation-drug release

TIME	Before storage	After storage
5	12.91±2.56	11.61±1.04
10	24.26±2.94	22.61±1.74
15	37.45±2.01	35.42±2.74
20	45.12±3.56	43.21±2.08
25	55.25±1.73	51.24±1.96
30	62.15±2.20	61.24±4.18
1	74.23±2.20	70.24±4.18
2	86.35±2.20	85.24±4.18

3	96.16±2.20	93.24±4.18
4	96.85±2.20	94.24±4.18

5. Conclusion

Topical medicine distribution will become more common in the coming years as a means of increasing patient compliance. Emu gel's capacity to improve spreadability, adhesion, viscosity, and extrusion has contributed to its increased popularity among consumers. They will also be used to load hydrophobic pharmaceuticals into water-soluble gel bases for long-term stability purposes. A posaconazole topical emu gel was created and tested using a variety of physiochemical tests, including appearance, texture, spreadability, pH, drug content, and in vitro drug release.The formulation containing transcutol has shown best % cdr and due to its property of enhancing the anti-fungal property of the drug In vitro drug release and drug content of the test formulation were measured to get insight into the rate and duration of emulgel drug release. In vitro testing reveals a maximal release of 96.85 percent over 4 hours, while optimum (F6) The formulations had a drug content of 89.59. Posaconazole-containing emulgels demonstrated significant antifungal effectiveness. To summarize, an emulgel containing posaconazole can be administered as a topical antifungal medicine

Compliance with ethical standards

Disclosure of conflict of interest

No conflict of interest to be disclosed.

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