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FORMULATION AND EVALUATION OF TOPICAL EMULGEL LOADED WITH SERTACONAZOLE NITRATE

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ABSTRACT

Aim: The objective of the present work was to develop, characterize and evaluate the sertaconazole nitrate loaded emulgel that release the drug in controlled manner. Sertaconazole nitrate is an imidazole derivative, act as fungistatics, fungicidal, antibacterial, anti-inflammatory and antipruritic. The novel system of drug delivery offers a means of improving effectiveness of incorporated drugs. The goal of any drug delivery system is to provide a therapeutic amount of drug to the proper site in the body to achieve promptly & then maintain desire drug concentration.

Method: Gel was prepared using different polymers such as carbopol 934 and HPMC, followed by preparation of emulsions and finally mixed together. Emulgel was evaluated for physical appearance, pH, spreadability, extrudability, viscosity, swelling index, drug content, *in vitro* release study, kinetic analysis of release data, and stability study.

Results: Evaluation parameters were in acceptable range with good physical appearance and the pH in the range of 5 to 6. The results show that the with spread ability in range of 19.8 -22.5cm. Among all formulations of emulgel F4 was having high swelling index (62%). Spread ability was lies between 19.8-22.5. In vitro drug release was conducted. Stability study revealed that emulgel were stable at room temperature and must will be stored in cool and dry place.

Keywords: Sertaconazole nitrate, controlled drug release, gelling agent, Topical delivery

INTRODUCTION:

Topical drug delivery system can be defined as the application of a drug containing formulations to the skin to treat coetaneous disorder directly **[1]**. The topical drug delivery system is generally used where other routes (sublingual, oral, rectal, parental) of drug administration fails or local skin infection like a fungal infection **[2]**. The main advantage of the topical drug delivery system is by pass first metabolism **[3]**. They are avoidance of risk and inconveniences of intravenous therapy and of different condition of absorption, pH changes, the presence of enzyme, gastric emptying time **[4]**.

Emulgel: it is the combination of gel and emulsion. Both oil in water and water in oil type of emulsion used as a vehicle to deliver various drug to the skin. The presence of gelling agent in water phase converts a classical emulsion in to an emulge **[5-8]**. They should be non–toxic, non-irritating and non-allergenic **[9-11]**. They work ideally, rapidly. The activity and duration of effect should be both predictable and reproducible **[12]**. They should no pharmacological activity with in the body i.e should not bind to receptor sites **[13]**. This penetration enhancer should be appropriate for formulations in to diverse topical preparations. They should be compatible with both excipients and drugs **[14, 15]**.

Table 1: Concentration of oils for emulgel preparation [16]

Chemical	Quantity	Dosage forms
Light liquid paraffin	7.5%	Emulgel and emulsion
Isopropyl myristate	7- 7.5%	Emulgel
Isopropyl state	7-7.5%	Emulgel
Isopropyl palmitate	7-7.5%	Emulgel
Propylene glycol	7-7.5%	Emulgel

Table 2: Uses of gelling agents [16]

Gelling agents	Quantity	Dosage forms
Carbopol -940	0.5-2%	Emulgel
Carbopol-934	0.5-2%	Emulgel
HPMC-2910	0.5-2%	Emulgel
HPMC	2.5%	Emulgel
Sodium CMC	1%	Gel

Table 3: Use of penetration enhancers [17]

Penetration enhancers	Quantity	Dosage form
Oleic acid	1%	Gel
Lecithin	5%	Gel
Isopropyl myristate	5%	Gel
Linoleic acid	5%	Gel
Clove oil	5%	Gel
Menthol	5%	Gel
Cinamon	8%	Gel

MATERIAL AND METHOD:

Drug was received as a gift sample. Other ingredients such as Carbopol, tween 20, HPMC, Liquid paraffin, ethanol, cetostryl alcohol and sodium dehydrogenate phosphate was used. The gel phase was prepared by dispersing HPMC (Hydroxy propyl methyl cellulose) in water and pH was adjusted up to 6 -6.5 using triethanolamine. The oil phase of the emulsion was prepared by dissolving span 20 in Liquid paraffin and heat up to 70 - 80℃ and add cetosteryl alcohol. The aqueous phase was prepared by dissolving tween 20 in water separately. Given amount of propyl parabean was dissolved in polyethylene glycol and drug was dissolved in ethanol then all the solution was mixed properly. Heating both aqueous and oily phase up to 70℃ The oil phase was added to aqueous phase with continuous stirring until reach up to room temperature then emulsion form is formed. Finally gel phase was prepared mixing both gel and emulsion in 1:1 ratio then sertaconazole nitrate emulgel is formed.

RESULTS:

Preformulation studies:

Preformulation studies was performed and given data **(Table 5)**.

Important Peaks of Infra-red Spectrum and Data Analysis of Drug have been shown in **Figure 1**.

Construction of standard curve of Sertaconazole nitrate in methanol:distilled water (70:30) is shown in **Table 6 and Figure 2**.

1. **Physical Appearance [18]:** The prepared emulgel was inspected visually for their colour, homogeneity, grittiness and phase separation **(Table 7)**.
2. **pH [19]:** The pH measurements was done using pH paper. A small amount of different emulgel batches was kept in pH meter and pH of emulgel was recorded **(Table 8)**.
3. **Sweeling Index [20]:** One gram of prepared emulgel was taken in petridish and full with 10 ml water and sample was withdrawn at 30 minutes interval then dry sample is weight. Then dry sample is filled with fresh 10 ml distilled water then after 60 minutes sample is dry with filter paper and dry sample is weight and difference is recorded **(Table 9; Figure 3)**.

Swelling index (sw%) = [Wt - W0 / W0] × 100

4. Spreadbility [21]: The dermination of spreadability 0.5 gm of prepared emulgel was spread on glass slide of 1 cm diameter then another glass slide was placed on upper side. Increase in diameter due to gel spreading was recorded **(Table 10; Figure 4)**.

5.Viscosity [22]: The viscosity of prepared emulgel was measured by Brookfield viscometer **(Table 11; Figure 5)**.

6. DRUG CONTENT [23]: The determination of drug content 0.5 gm emulgel was dissolved in 5 ml ethanol then filter with wattman filter paper then solid residue is extracted. Then one gram filtrate solid extract is further diluted in 5 ml ethanol. All the formulated batches were analyzed by double beam UV visible spectrophotometer and absorbance was noted **(Table 12; Figure 6)**.

7. In Vitro Drug Release [24]: The drug release study was performed for emu gel using Cellophane semi permeable membrane. Sertaconazole nitrate emulgel using USP type –II dissolution apparatus in 900 ml dissolution media at 50 rpm and 37±1℃ temperature. In dissolution media phosphate buffer **(Table 13; Figure 7)**.

8. Release Kinetics (Table 14)

1) **Zero Order Kinetics (Figure 8)**
2) **First Order Kinetics (Figure 9)**
3) **Korsmeyer - Peppas model (Figure 10)**

Table 4: Composition of formulation

Sr. No.	INGREDIENTS	F 1	F 2	F 3	F 4
1.	Sertaconazole nitrate (mg)	0.5	0.5	0.5	0.5
2.	HPMC	0.5	1	-----	-----
3.	Carbopol 940	-----	----	0.5	1
4.	Liquid paraffin (ml)	5	5	5	5
5.	Cetosteryl alcohol (mg)	3	3	3	3
6.	Tween 20 (ml)	1	1	1	1
7.	Span 20(ml)	1	1	1	1
8.	Polyethylene glycol (ml)	5	5	5	5
9.	Ethanol (ml)	2.5	2.5	2.5	2.5
10.	Propyl parabean (mg)	2.5	2.5	2.5	2.5

Table 5: Preformulation studies

S. No.	Parameters	Calculated data	Observed data
1.	Melting point	164-166℃	166℃
2.	PH	6	6
3.	UV range	260 nm	270 nm
4.	Colour	White or almost white powder	White
5.	Solubility	Practically insoluble in water but soluble in methanol and ethanol	Soluble

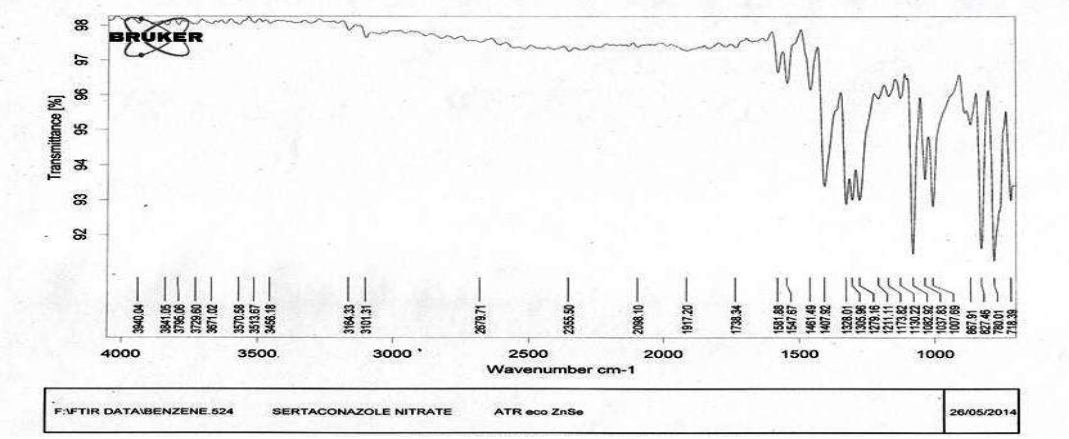

Figure 1: Important Peaks of Infra-red Spectrum and Data Analysis of Drug

Table 6: Construction of standard curve of Sertaconazole nitrate in methanol:distilled water (70:30)

S. No.	Concentration (µg/ml)	Absorbance at 260 nm
1	0	0
2	5	0.067
3	10	0.131
4	15	0.189
5	20	0.259
6	25	0.315

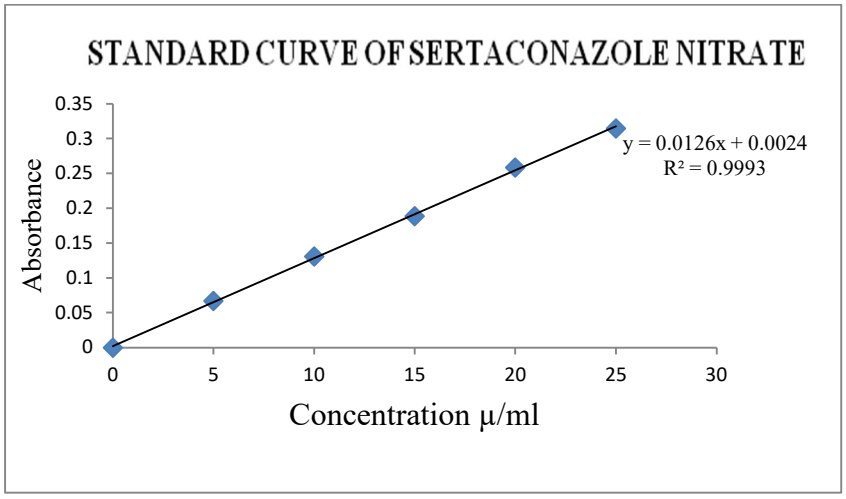

Figure 2: Standard Curve of Sertaconazole nitrate in Methanol: distilled water (70:30) at 260 nm

Table 7: Physical characteristics

Sr. No.	Parameter	F1	F2	F3	F4
1.	Colour	White	White	White	White
2.	Homogeneity	No	No	No	No
3.	Grittiness	None	None	None	None
4.	Phase separation	No	No	No	No

Table 8: pH of emulgel

Formulation code	PH
F1	5
F2	5
F3	6
F4	6

Table 9: Sweling Index

Formulation	Swelling Index %
F1	33
F2	46
F3	35
F4	62

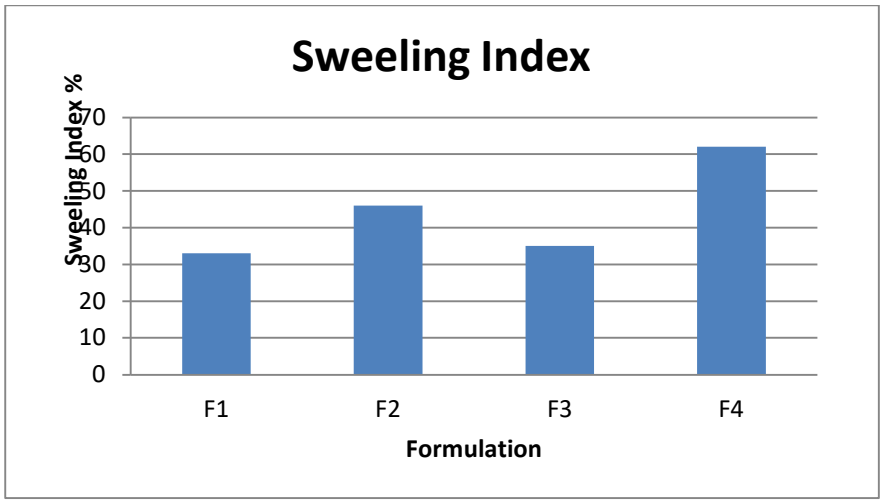

Figure 3: Swelling Index

Table 10: Spreadibility of Emulsion

Formulation	Spreadability(gm.cm/sec)
F1	19.8
F2	16.6
F3	20.4
F4	22.5

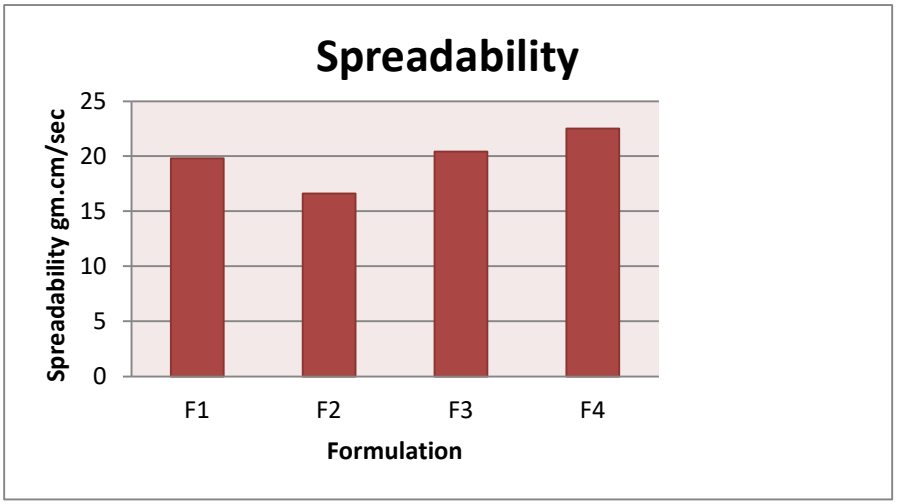

Figure 4: Spreadibility of Emulsion

Table 11: Viscosity

Formulation	Viscosity(cps) at 20 RPM
F1	9900
F2	10000
F3	12000
F4	11000

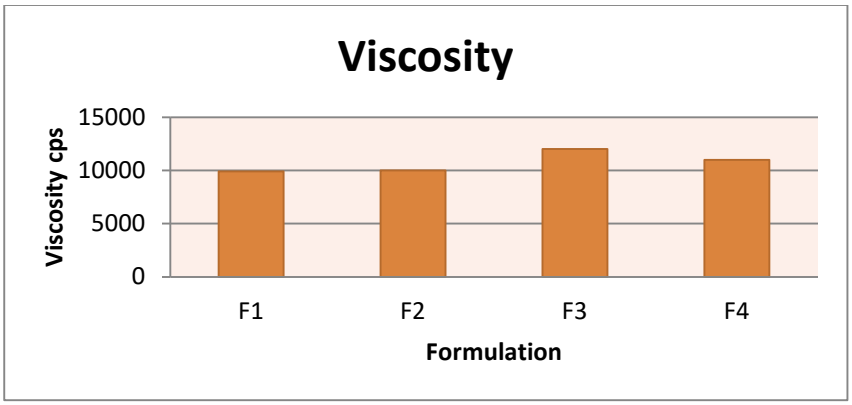

Figure 5: Viscosity

Table 12: Drug Content

Formulation	Drug content%
F1	97.95
F2	100.61
F3	98.71
F4	99.70

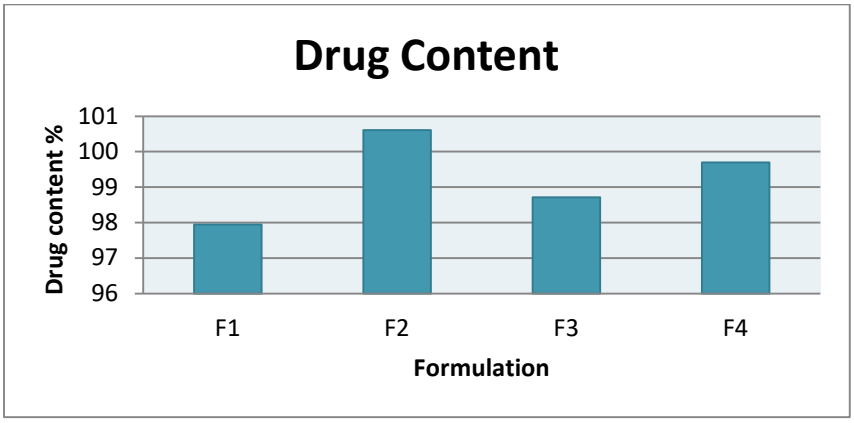

Figure 6: Drug Content

Table 13: In Vitro Drug Release

S.NO.	Time (min)	In Vitro Drug Release			
		F1	F2	F3	F4
1	30	18.81	19.97	19.23	17.47
2	60	27.65	28.53	28.30	28.45
3	90	32.44	32.53	34.30	34.52
4	120	46.12	42.49	43.48	43.24
5	180	52.45	54.62	54.74	56.75
6	240	66.89	66.67	67.1	68.67
7	300	75.87	78.56	78.45	77.41
8	360	82.24	80.21	81.44	81.56
9	420	87.34	85.89	83.45	83.78
10	480	91.23	89.28	90.23	89.54
11	540	96.86	92.56	91.67	93.89
12	600	98.69	97.47	98.86	99.28

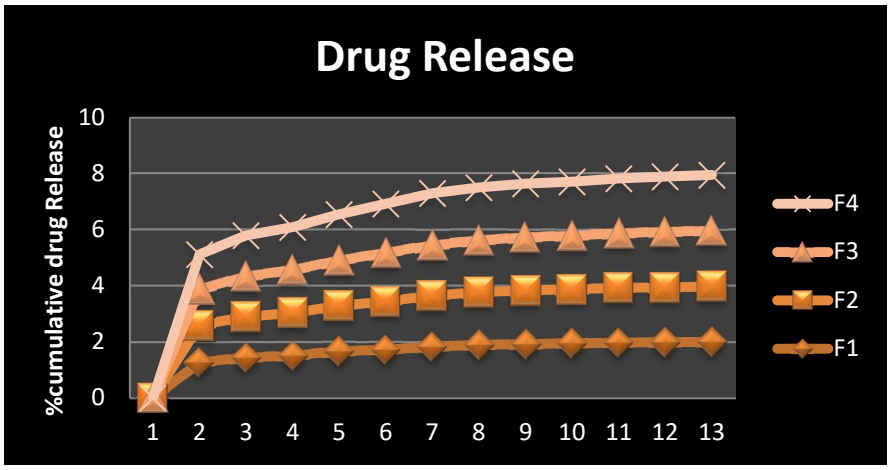

Figure 7: In Vitro Drug Release

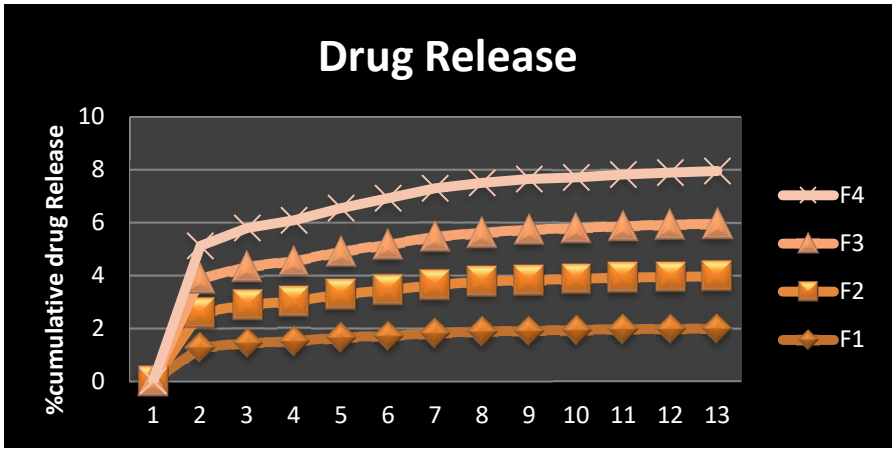

Figure 8: Zero Order Kinetics

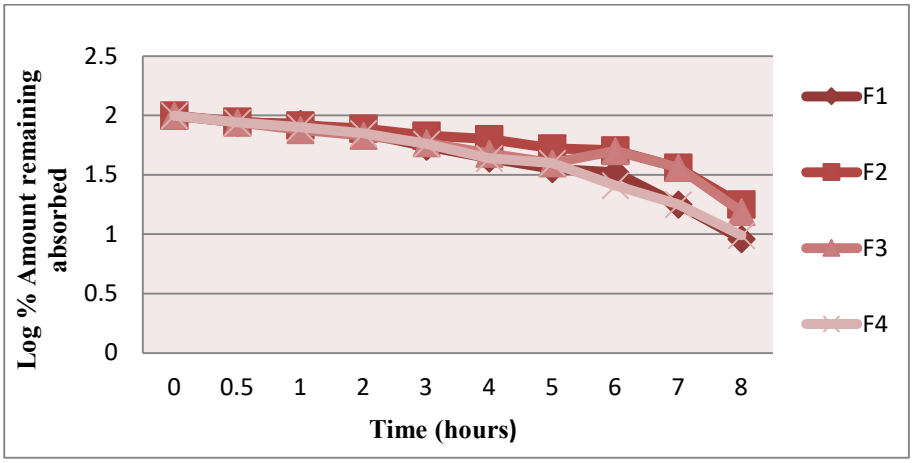

Figure 9: First Order Kinetics

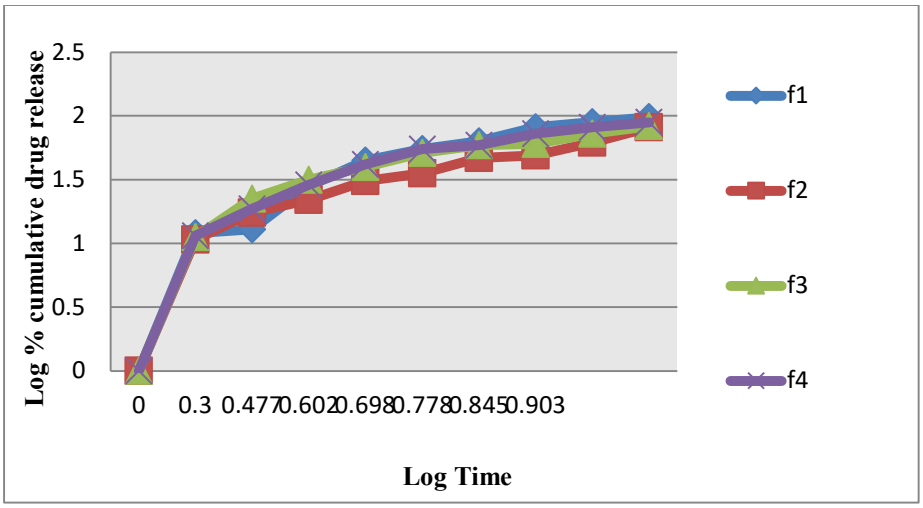

Figure 10: Korsmeyer - Peppas model

Table 14: Release Kinetics

Formulation	Zero order	First order	Higuchi model	Hixson model	Best Fit Model
	R^2	R^2	R^2	R^2	
F1	0.967	0.898	0.967	0.929	Higuchi
F2	0.962	0.923	0.966	0.923	Higuchi
F3	0.958	0.845	0.959	0.919	First Order
F4	0.961	0.853	0.970	0.921	Higuchi

Table 15: Stability studies of emulgel

Sr. No.	Days	% drug remaining 27±2℃	%drug remaining 37±2℃
1.	0	100±0	100±0
2.	30	99.9±.003	99.4±.041
3.	45	98±.027	98±.036
4.	90	97.6±.012	97.1±.02

F1 F2 F3 F4

Figure 11: Different formulation batches of emulgel

CONCLUSION:

In this work an attempt was made to formulate and evaluate for emulgel of sertaconazole nitrate by emulsion –gel method. Preformulation studies like solubility, melting point and UV analysis of sertaconazole nitrate were complied with IP standards. All the polymer and drug used were of pharmaceutical grade. FTIR spectra revealed that there was no interaction between polymer and drug. All the polymer used were compatible with drug. The

prepared sertaconazole nitrate emulgel formulation were evaluated for drug content, *in vitro* drug release studies and release kinetics. The pharmacokinetic models reveals that the mechanisms of drug release for emulgel formulations was Higuchi model. By the drug release studies of the formulations F4 was concluded that the release profile was sustained and was in controlled fashion. All of four formulations of emulgel F3, F4 batches was 6. They are lies in normal ph skin. Drug content is measured by double beam UV spectrophotometer at 260 nm. Formulations F2 batches shows 100% drug content which indicate uniform drug dispersion in emulgel. Swelling index is related to the variation of water uptake nature and chain strength of polymer. F4 formulation batches was high swelling index with carbopol 940 as gelling agent. Emulsion system provides solubilization of hydrophobic drug. This imparts in enhancing availability of drug in the formulations. In the present study, four different formulations (F1-F4) of sertaconazole nitrate emulgel were prepared using various polymeric combination with a view for the sustained delivery of drug over at time period of 10 hours. Analysis of dissolution profiles (R^2 values) shows that drug release from matrix followed first order kinetics. Analysis of dissolution profile on the basis of Higuchi model suggest that drug release was basically Fickian diffusion controlled (Higuchi diffusion).Stability studies revealed that the Formulation F4 was stable after keeping 37℃/ 75% RH for three months. All the results showed that the prepared emulgel seems to be a potential candidate for topical sustained release of the drug.

Conflict of Interest: There is no conflict of interest.

REFERENCES:

[1] Single V, Saini S, Joshi B; Emulgel: Emulgel: A new platform for topical drug delivery, IJPBS; 3(1) P. 50-56, 2006.

[2] Jain NK, Progress in controlled and novel drug delivery systems, 1st edition, New Delhi, CBS Publishers and Distributors: P.-100-27,2012.

[3] Aulton ME, Pharmaceutics and Science of dosage form design, 2nd edition Chhurchil Livingstone, Elestone: Eleseveir, 501-22, 2007.

[4] Swarfrick J, Encyclopedia of pharmaceutical technology, 3rd, Vol-1, Informa healthcare, p.-1311-23, 2007.

[5] Asish Dev, Reachodankar, Shelke OM, Emulgels: A novel approach topical drug delivery system,

pharmaceutical and biological evaluations; 2(4), 64-75, 2015

[6] Kute SB, Saudagar RB, Emulsifified gel a novel approach for delivery of hydrophobic drugs: An overview, Journal of advance pharmacy and Education, 3(4), p. 368-75.

[7] Potnis V,Khot M, Formulation of gellified emulsion of Clotrimazole using essential oil from Lavenduk aungustifolia, Miller, World J Pharm Sci, 2(10), P. 1316-22, 2012.

[8] Eswaraiah S, Swetha K, Emulgel: Review on novel approach to topical drug delivery, Asian J. Pharm. Res. 4(1), 2014.

[9] Shaik Sultana, Rekha MS, A Novel surrogate approach to topical drug delivery system, Indo American Journal of pharm Research, 2014, 4(11), 5250-5263.

[10] Mortazavi SA, Aboofazeli R, An investigation in to the effect of various penetration enhancers absorption of Piroxicam, Iranian J Pharm Res. 2, 135-140, 2003.

[11] Kumar L, Verma R, *Invitro* evaluation of topical prepared emulgel using natural polymer, Int J. Pharm Sci. vol-2, 58-63, 2010.

[12] Jacob SW, Francone CA, Sructure and function of man, WB Saunders Co. Philadelphia, 55-60, 1970.

[13] Panwar SW, Gujar S, Emulgel: A Review, Asian Journal of pharmacy and sciences,1(3), 333-43, 2011.

[14] Curr. AEB, Transdermal drug delivery penetration enhancement techniques healthcare, Drug Deli. 2005, (2), p23-33

[15] DJ or Jevice J, Michniak B, Pharm Sci Tech, 2003, (4), 2003.

[16] Hardenia A, Jayronia and Jain S, Emulgel: An emergent tool in topical drug delivery, IJPSR, 5(5), 1653-70, 2014.

[17] Cecv V, Mazagareanu S, Rther M: preclinical characterization of NSAIDS in ultra deformable carriers or conventional topical gels, Int J Pharm, 48, p. 159-72, 2008.

[18] Subhmanyan CVS, Text book of physical pharmaceutics, 2nd edition, New Delhi: Vallabh Prakashan, 2009.

[19] Burhate S, Potdar M, Nerker P, International Journal of Pharmaceutics Research and Development: 1-7, 2, 2010.

[20] Kumar L, Verma R, International Journal of drug delivery,2010, 2, p. 58.

[21] Raw M, Sukre G, Journal of Pharmaceutics, 2013, available at http://dx.doi.org/ 10.1155/2013/501082.

[22] Jain A, Gautam S, Gupta Y, Pellagia Research library, 2010, 1, p. 221-31.

[23] Patel A, Ray S, Thakur RS. In vitro evaluation and optimization of controlled release floating drug delivery system of metformin chloride. DARU 2006:14(2): 57-64.

[24] Costa P, Lobo JMS. Modelling and comparison of dissolution profiles. Eur J Pharm Sci 2001.