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### Research Article

# TRANSDERMAL DELIVERY OF FLUCONAZOLE MICROSPONGES: PREPARATION AND IN VITRO CHARACTERIZATION

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#### ABSTRACT

The pivotal objective of this investigation was to formulate Fluconazole microsp sponge by emulsion solvent diffusion technique in order to provide sustained release. Microsp sponge was formulated by emulsion solvent diffusion technique with varied drug-polymer ratios. Ethyl cellulose was used as release retarding material and polyvinyl alcohol was used as a surfactant. The prepared microsponges were characterized by Scanning electron microscopy, Fourier transform infrared spectroscopy, particle size analysis, and evaluated for surface morphology, drug loading, *in vitro* drug release as well. The formulated microsponges are spherical with a porous surface and 108.16µm of mean particle size. The microsponges were then incorporated into the carbopol gel. The *In vitro* drug release results showed that microsponges with 1:1.5 drug-polymer ratios were more effective to make a prolonged drug release of 74.2% at the end of 8 hours. Thus the formulated microsp sponge-based gel of fluconazole would be a hopeful choice for formal therapy for safe and effective treatment of fungal infections.

**Key Words:** Fluconazole, Microsp sponge, Ethyl cellulose, Scanning electron microscopy, particle size and *in vitro* drug release.

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## INTRODUCTION

Fluconazole is a synthetic antifungal agent belonging to the group of triazole. It is one of the commonly used antifungal agents for most kinds of fungal infections; including superficial and invasive fungal infections.<sup>1</sup> Regrettably fluconazole oral administration has limitations such as nausea, vomiting, bloating and abdominal discomfort. Alongside most of the time the parenteral administration of fluconazole led to skin rashes and itching.<sup>2</sup> For these reasons, now a day's

advance localized and transdermal delivery has gained a lot of importance.<sup>3,4</sup>

The conventional gel formulation of fluconazole causes cutaneous irritation and prolonged use led to dermal hypersensitivity. Hence, a novel system necessitates which will increase the presence of active agents either on the skin surface or within the epidermis, concurrently reducing hasty transdermal penetration. Many researchers have attempted to develop novel transdermal formulations of fluconazole. Accordingly, the objective

of our research is to formulate and evaluate fluconazole microsphere loaded carbopol gel for safe, effective and stable gel and evaluate the *in-vitro* sustained release performance. Microsphere-based delivery systems (MDS) give assurance of drug legalization on the skin surface and within the epidermis without entering into the systemic circulation in greater extent; thereby reducing systemic and local cutaneous adversities. They also offer an advantage of programmable release and are biologically safe. Additionally, this technology presents quite a lot of benefits via drug entrapment by means of better formulation flexibility, abridged side effects, improved elegance and superior stability.<sup>5-8</sup>

## MATERIALS AND METHODS

### Materials

Fluconazole was obtained as a gift sample from RMS Research labs Pvt Ltd Hyderabad. Ethyl cellulose was gifted by Yeluri formulations, Hyderabad. Polyvinyl alcohol, triethyl citrate and ethyl acetate were purchased from Emerck (India) Ltd., Mumbai. All other chemicals and solvents used are of analytical grade.

### Methods

#### Formulation of Fluconazole microsphere

Fluconazole loaded microspheres were prepared by quasi-emulsion solvent diffusion technique<sup>9</sup>. The internal phase was encompassed ethyl cellulose and triethylcitrate (TEC) both were dissolved in 10ml of ethyl acetate. TEC was used as plasticizer. This was, followed by addition of fluconazole with stirring. The internal phase was then poured into polyvinyl alcohol (PVA) solution in water, the external phase. Then the final mixture was filtered through filter paper with a pore size of 0.45  $\mu\text{m}$  to separate formed microspheres and dried at room temperature for further studies.

#### Calculation of production yield, actual drug content and entrapment efficiency

The production yield (PY) was determined by following formula accurately calculating the initial weight of the raw materials and the weight of the obtained microsphere particles. Samples of drug loaded microspheres (20 mg) were dissolved in 10 ml phosphate buffer pH 5.5 under sonication for 20 min at 25°C. The samples were filtered using 0.45  $\mu\text{m}$  membrane filter and analyzed for FLZ content spectrophotometrically using Shimadzu UV-1650 UV-VIS double beam spectrophotometer (Shimadzu, Japan) at 260 nm. The actual drug content and EE were calculated as given below.<sup>10,11</sup>

The actual drug content (%) =  $(M_{act} / M_{ms}) \times 100$

The EE (%) was calculated according to the following equation:

Entrapment efficiency =  $(M_{act} / M_{the}) \times 100$

Where  $M_{act}$  is the actual fluconazole content with weighed quantity of the microsphere,  $M_{ms}$  is the weighed quantity of powder of microspheres, and  $M_{the}$  is the theoretical amount of fluconazole in microsphere

calculated from the quantity added during preparation. All the experiments were performed in triplicate and the mean of the values was reported.

### Particle size analysis

Particle size analysis of prepared microspheres was carried out using particle size analyzer (Malvern Mastersizer Hydro 2000, Ver.5.54 Malvern, UK) which allows sample measurement in the range of 0.020–2000  $\mu\text{m}$  and the particle refractive index were set to 1.520. Microspheres were dispersed in double distilled water before running the sample in instrument to ensure that light scattering signal (as indicated by particle count per second) is within the sensitivity range of the instrument<sup>12</sup>.

### Fourier Transform Infrared studies

IR spectra of the pure drug, other excipients and formulations were obtained and compared. In the present study, potassium bromide (KBr) pellet method was employed. The samples were thoroughly mixed with dry powder of potassium bromide and scanned from 4000–400 $\text{cm}^{-1}$  by FT-IR spectrophotometer (Model number 02437 Shimadzu, India)<sup>13</sup>

### Scanning electron microscopy studies

The morphology and appearance of the microspheres were studied using SEM (SEM-JEOL Instrument, JSM-6360, Japan) operating at 15 KV. The samples were dusted onto double-sided tape on a metal stub and coated with gold/palladium alloy under vacuum. The obtained photograph was recorded at x500 magnification<sup>14</sup>.

### Formulation of fluconazole microsphere gel

To obtain a suitable topical formulation for application, microspheres were incorporated into a gel base. After the preliminary tests carbopol was found to be an ideal choice. 0.5 g of Carbopol 934 was uniformly dispersed in beakers containing a sufficient quantity of water and was allowed to hydrate overnight. Then it was mixed with 5 g of glycerin with methyl paraben to form a paste. Next, 95 ml of water was added slowly to paste under constant stirring, followed by the drop wise Triethanolamine addition to adjust pH to 6.5–7.5. A calculated amount of FLZ microsphere was incorporated which makes the final concentration of fluconazole in the gel is 1% w/w<sup>15</sup>.

### Evaluation of microsphere loaded carbopol gel

#### Homogeneity

The prepared gels were visually inspected for clarity, color and transparency. The prepared gels were also evaluated for the presence of any particles. Smears of gels were prepared on a glass slide and observed under the microscope for the presence of any particle or grittiness<sup>16,17</sup>.

#### pH

The pH of the prepared fluconazole loaded microsphere gel was measured using pH – meter (LI-120 Digital PH

Meter) by putting the tip of the electrode into the gel and after 2 minutes the result was recorded<sup>16, 17</sup>.

### Spreadability

A sample of 0.1g of gel was pressed between 2 slides with 500g weights and left for about 5 min where no more spreading was expected. Diameters of spread circles were measured in cm and were taken as comparative values for spreadability (diameter of the spread circle – initial diameter)<sup>16, 17</sup>.

$$S = ML/T$$

Where  $M$  = weight (in g) attached to upper slide,  $L$  = length (in cm) of glass slides, and

$T$  = time (in s) taken to separate the slides.

Wooden block-glass slide apparatus was used and by applying weight about 20 g, time for complete separation of the upper slide (movable) from a lower slide (fixed) was estimated

### Viscosity

The viscosity of fluconazole loaded microspunge carbopol gel was measured in Brookfield Viscometer, model- VL2 (Lemis Baltic) with spindle No 4<sup>16, 17</sup>.

### In vitro drug release

The *in vitro* release of gel formulations was studied using Franz diffusion cells. The cellophane membrane (0.45  $\mu$ m) previously soaked overnight in dissolution medium was mounted onto Franz diffusion cell with 15 ml receptor compartment and effective diffusion area 2.84 cm<sup>2</sup>. PBS (pH 7.4) was used as receptor medium, and system was thermostated to 37  $\pm$  1°C under constant stirring. All batches of drug microspunge gels (F1–F10) were conducted for the diffusion study. Aliquots of 1 ml volume were withdrawn at specific time intervals by maintaining sink condition. Withdrawn aliquots were then diluted using receptor medium and analyzed by a UV spectrophotometer (Shimadzu 1601, Kyoto, Japan) at 260 nm against PBS pH 7.4. To reveal the drug release mechanism and contrast, release profiles disparities among formulations, data obtained from timely drug release were used. Further, release data were analyzed by means of diverse mathematical models to know release kinetics<sup>18</sup>.

### Accelerated stability studies

According to an *in vitro* release profile F3 formulation was selected as optimized formulation and which was subjected to stability studies as per ICH. 5gm of gel was filled with collapsible aluminum tubes and kept at 5°C, 25°C/60% RH, 30°C/65% RH and 40°C/75% RH for a period of three months. The samples were withdrawn at specific time intervals (15, 30, 60 and 90 days) and evaluated for physical appearance, pH, homogeneity, spreadability, viscosity and drug release profiles<sup>19</sup>.

### Drug release kinetics

To analyze the mechanism of fluconazole release from the formulations, the *in vitro* release data were fitted into various release kinetic models. The models used are: zero order, first order, Higuchi model and Korsmeyer - Peppas. The model with the highest correlation coefficient was considered to be the best fitted model<sup>20</sup>.

## RESULTS AND DISCUSSIONS

### Formulation of Fluconazole microspunge

Quasi-emulsion solvent diffusion method was used for the preparation of fluconazole microsponges and it has the following advantages like easy, rapid, cost effective and avoiding solvent toxicity<sup>9</sup>. Ethyl acetate and water were used as internal phase and external phases for the preparation of fluconazole microsponges. The drug and polymer solubility, rate of diffusion into the internal phase, were used to provide good spherical porous microsponges Figure 1.

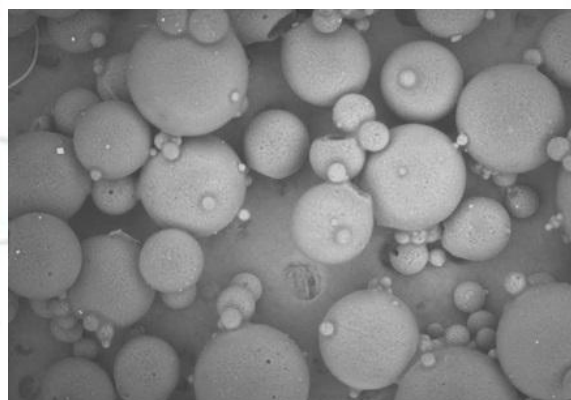


Figure 1: Scanning Electron Microscopy of Fluconazole loaded microspunge

Table 1: Composition of Fluconazole microsponges

Ingredients	Formulation batches of Fluconazole microspunge									
	F1	F2	F3	F4	F5	F6	F7	F8	F9	F10
D/P ratio	1:0.5	1:1	1:1.5	1:2	1:2.5	1:3	1:1.5	1:1.5	1:1.5	1:1.5
Ethyl Acetate (ml)	10	10	10	10	10	10	10	10	10	10
Tri ethyl citrate (ml)	1	1	1	1	1	1	1	1	1	1
PVA (% w/v)	0.75	0.75	0.75	0.75	0.75	0.75	0.45	0.6	0.9	1
Water (ml)	90	90	90	90	90	90	90	90	90	90

D/P ratio = Drug: Polymer ratio, PVA=Poly vinyl alcohol

### Fourier Transform Infrared studies

The IR spectra of pure fluconazole and formulation are shown in Figure & Table. The peak at 3120 cm<sup>-1</sup> indicate O-H stretching, 3012 cm<sup>-1</sup> for the C-H stretching, 1620 cm<sup>-1</sup> for the aromatic C=C stretching,

1597 cm<sup>-1</sup> for the N-H bending, 1354 cm<sup>-1</sup> for the C-H bending. These are the major spectral peaks of the drug. All these peaks were present in the formulations and thus this confirms that the drug did not have any interaction with the excipients. Results are shown in Figures 2, 3 & Table 2

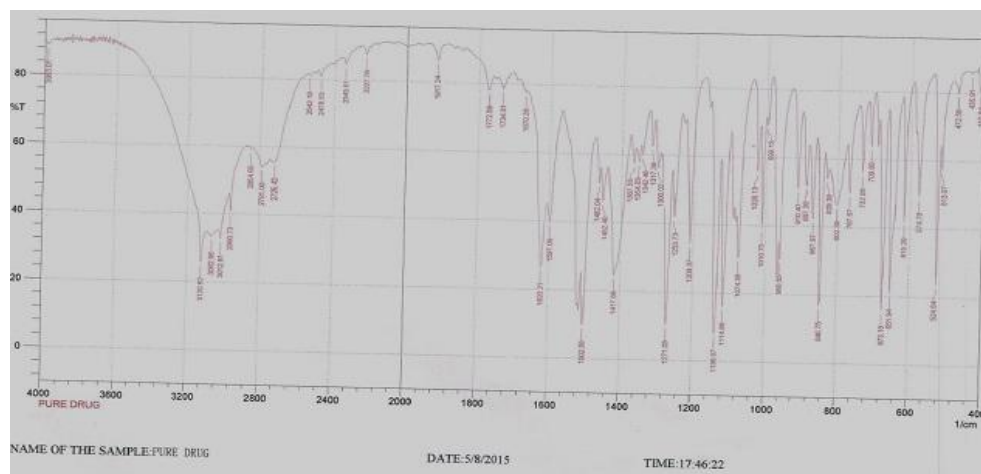


Figure 2: FT-IR Spectra of Drug

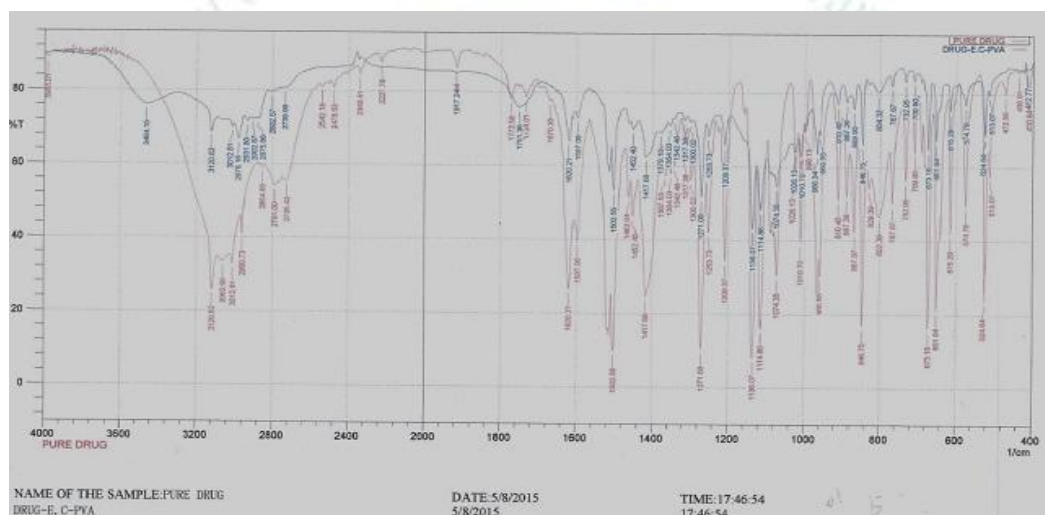


Figure 3: FT-IR Spectra of Drug +Ethyl cellulose and Poly vinyl alcoho

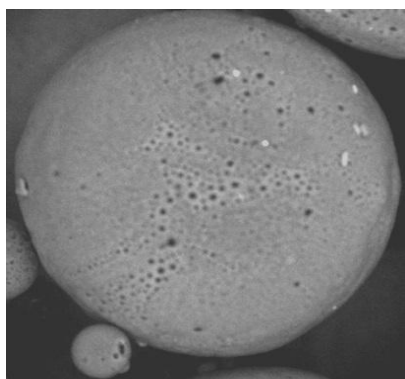
Table 2: Relevant bands of drug & physical mixture in their FT-IR Spectra

S.No	Functional group	Pure Drug	Physical Mixture	Type of vibration
1	O-H	3120.82	3120.82	Stretching
2	C-H	3012.61	3012.61	Stretching
3	C=C Ar	1620.21	1620.21	Stretching
4	N-H	1597.06	1597.06	Bending
5	C-H	1354.03	1354.03	Bending

### Scanning electron microscopy

The morphology of the prepared microsponges was studied by SEM analysis. The shape and surface characteristics of the microsponges are shown in Figure 1. The microsponges were finely spherical and uniform in shape, highly porous in nature. The pores were

created by the diffusion of solvent from surface of microsponges. The obtained SEM photograph was recorded at  $\times 500$  magnification. The captured images of microsponges are shown in Figure 4.



**Figure 4: Scanning Electron Microscopy Image of microsponge surface**

#### Production yield actual FLZ content, and entrapment efficiency (EE %)

The effect of the D/P ratio of production yield, encapsulation efficiency and drug content are shown in Table. It revealed that drug encapsulation efficiency did not attain 100%, this might be due to fewer quantity of the drug gets dissolved in either phase. The production yield of all batches of fluconazole microsponges were

ranged from 20.12% to 74.24%. The D/P ratio and PVA concentration were found to affect production yield significantly. A low production yield was noticed in a D/P ratio of 1:0.5 (F1), whereas, in D/P ratio 1:3 (F6) production yield was remarkably high i.e. 74.24%. The results indicated that higher the D/P ratio, higher the production yields. Besides this, the concentration of PVA also is equally responsible for production yield. Lower the PVA concentration, i.e. 0.45 % w/v yields less production 33.37% (F7) and as the concentration was increased to 0.9 (%w/v) the production yield was also found to be increased up to 51.64% (F8, F9). But in the case of (F10) less production yield was noticed, the reason is might be due to the presence of excessive amount of surfactant 1.0 % w/v it was responsible for more foam due to which less production yield was noticed 31.64% Rate of solvent diffusion from inner phase to outer phase took more time for formation of droplet and this might be the reason for high production yield. The encapsulation efficiencies were in the range of 64.12–91.35% as shown in Table 3. The outcome of encapsulation efficiency reflected that increasing the D/P ratios (F1-F6) led to decrease drug loadings. The results were depicted in Table 3.

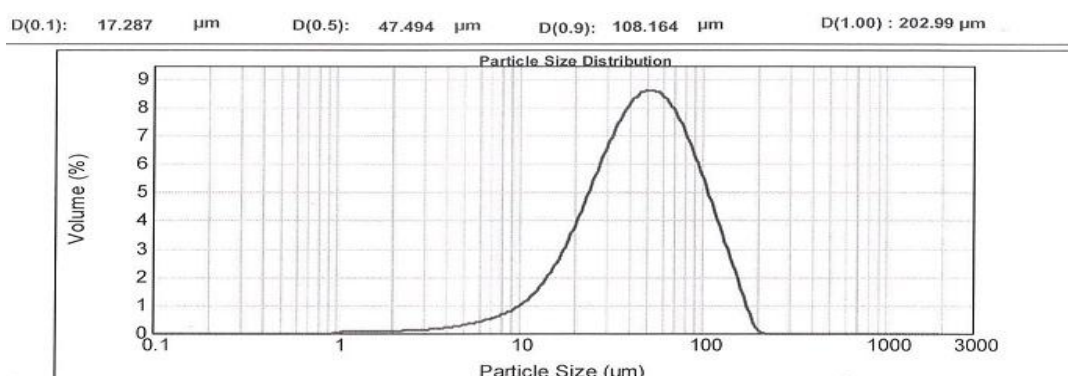
**Table 3: Actual drug content, encapsulation efficiency and production yield**

Code	D/P ratio	Theoretical drug content (%)	Actual drug content (%) $\pm$ SD	Encapsulation efficiency (%) $\pm$ SD	Production yield (%) $\pm$ SD
F1	1:0.5	75	72.58 $\pm$ 0.01	85.56 $\pm$ 0.01	32.12 $\pm$ 0.21
F2	1:1	60	58.02 $\pm$ 0.02	85.12 $\pm$ 0.02	34.60 $\pm$ 0.20
F3	1:1.5	53	50.46 $\pm$ 0.01	84.10 $\pm$ 0.03	38.40 $\pm$ 0.39
F4	1:2	41	37.23 $\pm$ 0.14	83.42 $\pm$ 0.01	40.00 $\pm$ 0.01
F5	1:2.5	36	32.16 $\pm$ 0.02	82.10 $\pm$ 0.03	45.13 $\pm$ 0.04
F6	1:3	28	30.16 $\pm$ 0.02	80.10 $\pm$ 0.03	52.24 $\pm$ 0.02
F7	1:1.5	53	49.35 $\pm$ 0.01	89.37 $\pm$ 0.21	33.37 $\pm$ 0.04
F8	1:1.5	53	49.27 $\pm$ 0.02	82.62 $\pm$ 0.01	37.52 $\pm$ 0.11
F9	1:1.5	53	49.83 $\pm$ 0.01	46.12 $\pm$ 0.02	43.31 $\pm$ 0.17
F10	1:1.5	53	51.13 $\pm$ 0.02	49.10 $\pm$ 0.01	31.64 $\pm$ 0.15

#### Particle size

The average particle size of microsponge formulations should be in the range of 5–300  $\mu$ m. The Particle size distribution of F3 formulation has been performed by laser light-scattering technique a particle size distribution map by volume of the fluconazole

microsponge was identified, which showed that the specific area surface diameter and diameter by volume of the particles were 0.19  $m^2/g$ , 30.22 $\mu$ m and 55.9  $\mu$ m respectively. The particle size distribution of d (0.1), d (0.5) and d (0.9) were 17.27  $\mu$ m, 47.49  $\mu$ m and 108.6  $\mu$ m respectively and the uniformity was 0.587. Figure 5.



**Figure 5: Particle size distribution curve of microsponges of (Optimized batch)**

## Evaluation of fluconazole microsp sponge loaded carbopol gel

### Visual inspection

The prepared fluconazole loaded microsp sponge gel formulations were inspected visually for their color, texture and appearance. All prepared formulations were White, viscous in nature with smooth texture and of good homogeneity without lumps

### pH measurement

The pH values of all prepared formulations were found in the range of 6.5–7, this is due to neutralization of formula by tri ethanol amine.

### Spreadability test

Spreadability is one of the important characteristic of topical formulations and it helps to transfer correct

dosage to the target site and make ease of application. Fluconazole microsp sponge loaded carbopol 934 forms a gel with spreadability ranges between to 2.10- 4.38 gcm/s. There was a slight decrease in spreading diameters of formulations of F4-F6; this variation was might be due to increased polymer concentration in microsp sponge.

### Viscosity measurement

The viscosity of prepared fluconazole microsp sponge gel was measured in L4 Spindle Brookefield Viscometer, model- VL2, manufacturer Lemis Baltic and was found to be in the range 25030 cPs to 47390 cPs. The results were depicted in Table 4.

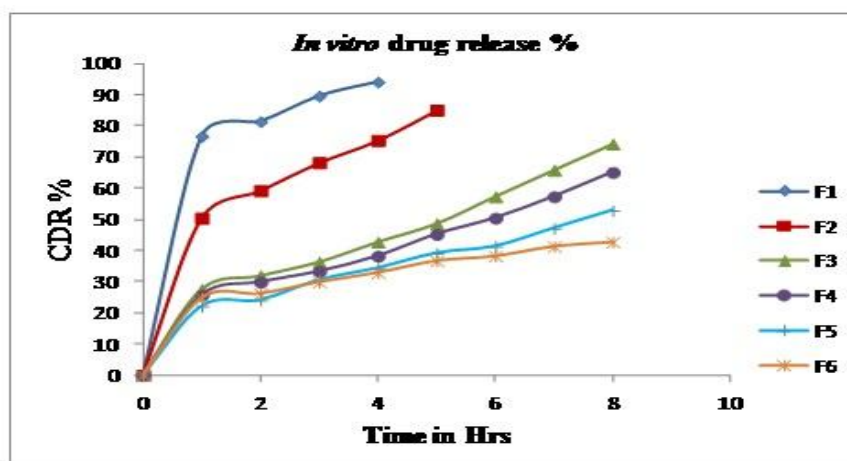
**Table 4: Physicochemical evaluation of fluconazole microsp sponge carbopol gel formulations**

Code	Physical appearance	pH	Spreadability	Homogeneity	Viscosity
F1	Transparent gel	6.5±0.03	4.38±0.5	Homogeneous	25,030
F2	Transparent gel	6.5±0.02	3.95±0.4	Homogeneous	29,630
F3	Transparent gel	6.8±0.01	3.31±0.3	Homogeneous	34,520
F4	Transparent gel	6.5±0.01	3.10±0.3	Homogeneous	38,630
F5	Transparent gel	6.8±0.02	2.45±0.5	Homogeneous	40,630
F6	Transparent gel	7.0±0.04	2.10±0.5	Homogeneous	47,390
F7	Transparent gel	7.0±0.03	3.30±0.6	Homogeneous	33,820
F8	Transparent gel	7.0±0.03	3.41±0.8	Homogeneous	33,620
F9	Transparent gel	6.5±0.04	3.20±0.6	Homogeneous	34,500
F10	Transparent gel	6.8±0.04	3.10±0.6	Homogeneous	34,540

### *In vitro* drug release study

The *in vitro* dissolution profile was done for fluconazole microsp sponge formulas (F1-F10). From the *in vitro* release data it was noticed that the drug release was reduced from 94.10-42.70%, this is due to D/P ratio has increased i.e. the amount of polymer available was more in each formulation. It led to thickening of the polymer matrix wall, thus lesser drug release was occurring.

94.10% of drug release was found in the highest drug release (F1) within 4Hrs, while the lowest 42.70% for F6 at the end of 8Hrs. It has been reported that by increasing the amount of PVA from batches F7 to F10, there was no significant change in the drug release pattern as compared with F3 formulation. Cumulative drug release of all batches F1–F6 and F7–F10 was shown in Figure 6, 7. According to *in vitro* release data formulation code F3 was selected as optimized batch.



**Fig 6: Dissolution profile of Fluconazole from microsp sponge (F1–F6)**

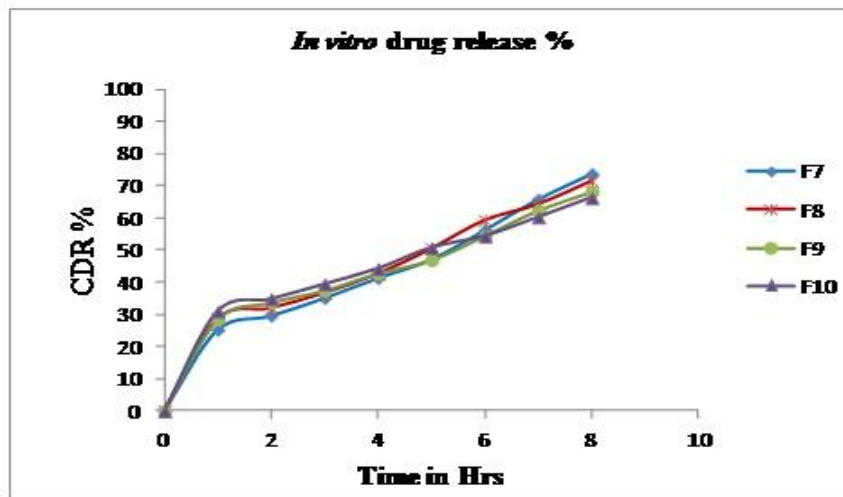


Figure 7: Dissolution profile of Fluconazole from microsponge (F7–F10)

Table 5: Physicochemical evaluation of microsponge loaded carbopol gel during stability period

F.Code	Appearance	Homogenicity	Spread ability	Viscosity	pH	% drug release
F3	White	Homogeneous	3.31	34,480	6.8±0.01	73.0±0.01

**Drug release kinetics**

The drug release kinetic data are represented in Figure 8-11. From the graphical representation it can be understood that this layer is best fit in to Zero order kinetics which had shown a regression coefficient ( $R^2$ ) of 0.9831.

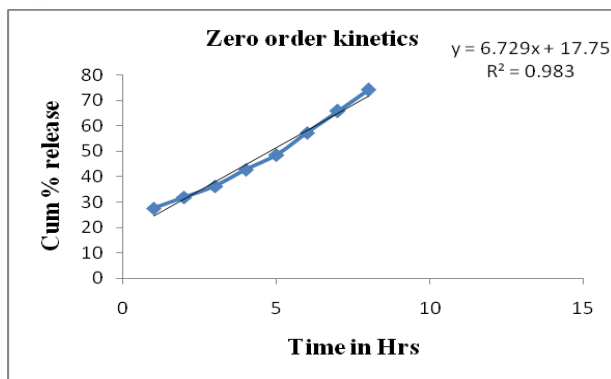


Figure 8: Zero order kinetic model

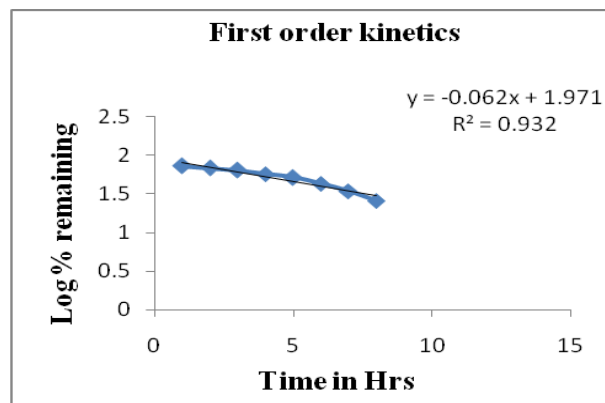


Figure 9: First order kinetics model

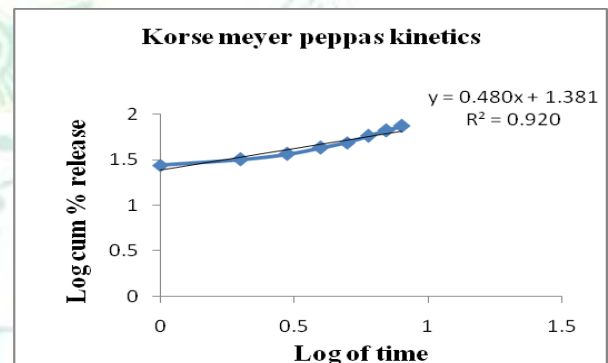


Figure 10: Korse meyer peppas kinetic model

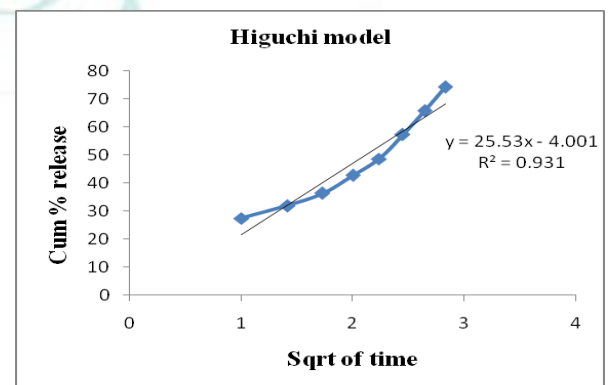


Figure 11: Higuchi kinetic model

The results of the in vitro release data of this layer were fitted to the Korsemeyer-Peppas equation to analyze the release pattern of the drug from the polymeric system. The value of “n” was found to be more than 0.89, indicating the drug release follows super case II transport.

### Stability study

During stability studies, formulation was found to be a White, homogenous, smooth and no changes in pH. It was also noticed that there were no changes in spreadability but slight changes in viscosity and drug release. Therefore, drug degradation was not observed. From that above data it has been proved that the formulation was stable over the period of 3 months. The results were shown in Figure 12.

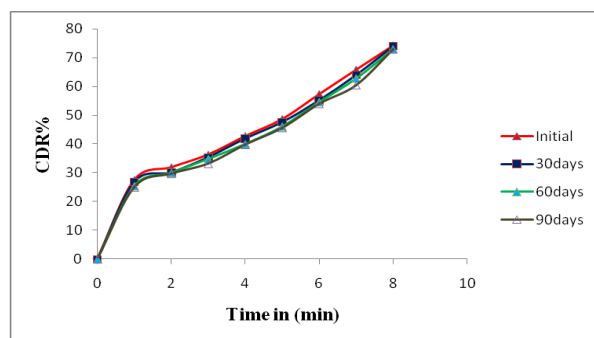


Figure 12. Drug release profile of microsphere gel during stability study

### Effect of formulation variables

#### Effect of external phase

The concentration of emulsifier plays a vital role in the preparation of microspheres. The minimum concentration of emulsifier required to formation of uniform and stable microspheres was found to be 0.75% w/v of external phase. Almost, similar encapsulation efficiency was noticed formulation code F1-F6. When the concentration of emulsifier was decreased from 0.75% to 0.45% (F7) production yield, encapsulation efficiency and drug content were increased and the formed microspheres were collapsed after 3 days figure 13 & table 6. Whereas irregular microspheres were formed in the concentration of 0.6% w/v of emulsifier figure 14 & table 6. When the concentration of emulsifier was increased to 0.9% and 1% w/v F9 & F10 resulted in the more foam formation and it drastically affects production yield, encapsulation efficiency and drug release behavior.

Table 6: Effect of external phase

Code	PVA Concentration in (mg)	Production yield (%) $\pm$ SD	Encapsulation efficiency (%) $\pm$ SD	% CDR $\pm$ SD
F3	0.75	38.40 $\pm$ 0.39	84.10 $\pm$ 0.03	74.2 $\pm$ 0.46
F7	0.45	77.61 $\pm$ 0.02	89.37 $\pm$ 0.21	73.7 $\pm$ 0.29
F8	0.60	37.52 $\pm$ 0.11	82.62 $\pm$ 0.01	71.4 $\pm$ 0.23
F9	0.90	23.31 $\pm$ 0.17	46.12 $\pm$ 0.02	68.1 $\pm$ 0.27
F10	1.00	21.64 $\pm$ 0.15	49.10 $\pm$ 0.01	66.2 $\pm$ 0.32

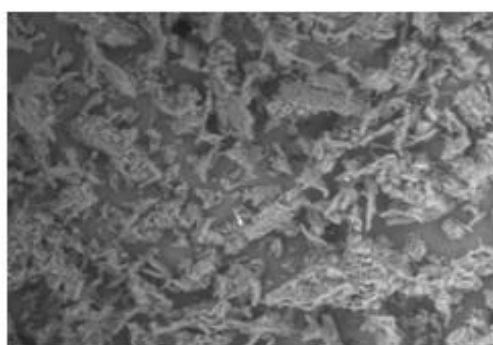
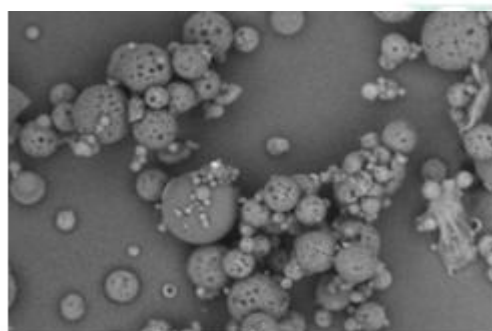


Figure 13: Microspheres at 0.45% concentration of PVA

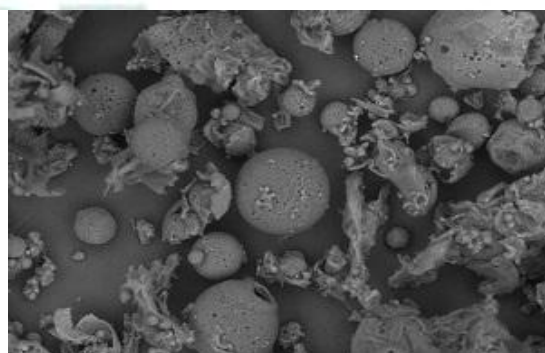


Figure 14: Formation of irregular microsphere using 0.6% concentration of PVA

#### Effect of D/P ratio

Increase in D/P ratio has been found to result an increase in production yield; while drug content, encapsulation efficiency and percent drug release were found to be decreased Table 7. The reason behind that is as D/P ratio went on increasing, the polymer amount available for each microsphere to encapsulate the drug was more, thus rising polymer matrix wall thickness which led to an extended diffusion path and ultimately to lesser drug release



Table 7: Effect of D/P ratio

Code	D/P ratio	Production yield (%) $\pm$ SD	Drug content (%) $\pm$ SD	Encapsulation efficiency (%) $\pm$ SD	% CDR $\pm$ SD
F1	1:0.5	32.12 $\pm$ 0.21	72.58 $\pm$ 0.01	85.56 $\pm$ 0.01	94.1 $\pm$ 0.01
F2	1:1	34.60 $\pm$ 0.20	58.02 $\pm$ 0.02	85.12 $\pm$ 0.02	85.1 $\pm$ 0.01
F3	1:1.5	38.40 $\pm$ 0.39	50.46 $\pm$ 0.01	84.10 $\pm$ 0.03	74.2 $\pm$ 0.02
F4	1:2	40.00 $\pm$ 0.01	37.23 $\pm$ 0.14	83.42 $\pm$ 0.01	65.1 $\pm$ 0.01
F5	1:2.5	45.13 $\pm$ 0.04	32.16 $\pm$ 0.02	82.10 $\pm$ 0.03	52.8 $\pm$ 0.03
F6	1:3	52.24 $\pm$ 0.02	30.16 $\pm$ 0.02	80.10 $\pm$ 0.03	42.7 $\pm$ 0.02

## CONCLUSION

Microsponge-based novel delivery system has been developed to provide once a day sustained release medication for topical delivery of fluconazole. The method adopted was quasi-emulsion solvent diffusion; found to be simple, reproducible and rapid. Formed microsponges were spherical shape, have high porosity. Different drug-polymer ratio reflected good particle size, drug content and encapsulation efficiency. Microsponge-based gel showed viscous and homogenizes preparation and *in vitro* drug release reflected highest regression value for zero order release model. Microsponge formulated with 1:1.5 drug-polymer ratios were found more efficient to give an extended drug release 74.20% at the end of 8h. Gel containing microsponges prepared in this study was found to be promising as new-novel delivery system offering prolonged release of fluconazole in treating fungal infections.

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