

# Formulation and Evaluation of Fluconazole Soap Strips for Dermal infections

Swati Jagdale\*, Dhaval Bhavsar, Mahesh Gattani, Swapnil Borse,  
Aniruddha Chabukswar

MAEER's Maharashtra Institute of Pharmacy, S.No. 124, MIT Campus, Paud Road,  
Kothrud, Pune-411038, MS, India

\*Corres. Author: [jagdaleswati@rediffmail.com](mailto:jagdaleswati@rediffmail.com)  
Tel. No. +91 9881478118.

**Abstract:** In present study, antifungal paper soap strips of fluconazole were prepared & evaluated for dermal infections because the presence of thick foam on the infected part causes hydration of stratum corneum for better penetration of drug. The formulation and evaluation of medicated soap strips were carried out in two phases. Phase-I studies optimization, which was carried out to study water absorption capacity using different types of papers (Whatman filter paper no. 1, 41 and 42, filter paper, bond paper and butter paper) by determining the parameters weight gain, size, shape and foam test. From these parameters best soap, concentration of liquid soap solution and papers were selected. Phase-II studies involve incorporation of drug in best soap solution and papers chosen from phase-I studies. The medicated soap strips were prepared by dipping the selected paper in drug containing soap solution. The prepared medicated paper soap strips were characterized for weight gain, foam test, drug content uniformity, FTIR, in vitro drug release studies using diffusion cell with hydrated cellophane membrane and primary skin irritation test. The microbial studies indicate drug activity by zone of inhibition against microorganisms *C.albicans*, *S.typhi*, *S.aureus*, *E.coli*, *klibsiella*, *B.subtilis*, *P.aeruginosa*, *A.niger* and *A.fumigatus* species. The obtained results for prepared medicated soap strip of fluconazole indicate that these strips are economic, convenient, gives good foam on application, uniform in drug content and not showing any skin irritation.

**Keywords:** - Dermal infections, fluconazole, thick foam, hydration of stratum corneum, medicated paper soap strips.

## INTRODUCTION

Fluconazole is an antifungal azole. It is a broad spectrum antifungal, first approved in Europe in 1988 and then in America in 1990. It was the first single dose treatment approved for vaginal candidiasis. Fluconazole is an effective agent in the treatment and prophylaxis of Candidal infection<sup>1-4</sup>. Presence of thick foam on the infected part causes hydration of stratum

corneum for better penetration of drug<sup>5-9</sup>. Topical drug delivery systems are available including medicated soaps having disadvantages like their economy, wastage, no accurate dosage, no proper foam formation etc. Hence the aim for present work was to prepare medicated soap strips which will be more effective against dermal infections.

## **MATERIALS AND METHODS**

### **Materials**

Fluconazole was obtained from Nicholas Piramal as a gift sample. Soap X & soap Y were purchased from local market. Filter paper & Whatman filter paper no. 1, 41 & 42 were from New Neeta chemicals. Butter paper & bond paper were purchased from local market.

### **Methods**

#### **1. PHASE-I**

##### **Selection of soap solution**

Two non-medicated soaps of different brands were selected and coded as X and Y. Soap solution of varied concentration (5, 10, 15, 20% w/v) were prepared. Formation of foam was avoided during solution preparation. Foam test was the criteria for selection of good soap. The soap capable of producing maximum foam was selected.

##### **Selection of paper**

Six different branded papers (Whatman filter paper no. 1, 41 and 42, filter paper, bond paper and butter paper) were selected and coded as A, B, C, D, E, and F. They were evaluated for their absorption capacity and weight gain. The paper showing maximum absorbing capacity was considered as the best paper.

##### **Formation of non medicated paper soap strips**

The paper soap strips were prepared by Dipping technique using modified disintegration apparatus and air dried overnight at  $37\pm 2^\circ\text{C}$ . For this purpose different papers were dipped one after another into the soap solution of varied concentration (5, 10, 15, 20% w/v) and air dried overnight.

##### **Evaluation of non-medicated paper soap strips**

The prepared strips were subjected for determination of size, shape, weight variation, pH and foam test by a reported standard method and an average of 20 strips was taken.

#### **2. PHASE-II**

##### **Formulation of medicated paper soap strips**

The drug was incorporated in the selected formulation which showed good absorption capacity in phase-I studies. Accurately weighed drug (2% fluconazole) was mixed with 15% soap powder and distilled water was added under constant and continuous stirring until

a uniform soap-drug solution was formed. Then paper soap strips were prepared.

##### **Evaluation of paper soap strips**

These prepared medicated soap strips were evaluated for weight gain, foam test, pH, in vitro drug release and primary skin irritation test. Microbial studies have been done by using microorganisms like *C.albicans*, *S.typhi*, *S.aureus*, *E.coli*, *K.pneumoniae*, *P.aeruginosa*, *B.subtilis* and *A.niger* species. The % drug content is measured by using UV spectroscopy at  $\lambda_{\text{max}}$  278 nm.

##### **In vitro drug release<sup>9-12</sup>**

In vitro drug release of fluconazole from prepared soap strips was studied by using Keshary-Chien diffusion cell. Prehydrated Cellophane paper was used as a membrane in this study. The study was done by using 0.1 N HCl media. The samples were collected at the interval of 3 minutes for a period of 15 minutes. The drug content was estimated by measuring the absorbance at 278 nm.

##### **% Drug content**

The % drug content is measured by using UV spectroscopy at  $\lambda_{\text{max}}$  278 nm.

##### **Primary skin irritation test**

For this, three human volunteers were selected and the prepared soap strips were given to them and checked for irritation.

##### **Microbial study<sup>13</sup>**

Microbial study has been done using microorganisms such as *C.albicans*, *S.typhi*, *S.aureus*, *E.coli*, *klibsiella*, *B.subtilis*, *P.aeruginosa*, *A.niger* and *A.fumigatus* species. For measuring the effectiveness of an antimicrobial agent against fungi/bacteria grown in culture, the microorganism of interest was swabbed uniformly across a culture plate. Then a soap strip of 5×5 mm was placed on the surface of the agar. Then the plates were placed in incubator for 24 hrs at 30°C. The drug diffuses out from the paper soap strip into the agar. The concentration of the compound will be higher next to the strip, and will decrease gradually as distance from the strip increases.

##### **IR spectral analysis for drug-excipient interaction<sup>14</sup>**

The studies were carried out using IR method with the help of IR (Varian) spectrophotometer.

**Table 1: Formulation of fluconazole soap strips**

Sr. No.	Ingredients	Quantity taken
1	Soap Y	15 gm each
2	Fluconazole	2 gm
3	Distilled water	100 ml

**Table 2: Evaluation parameters of miconazole soap strips**

Sr. No.	Parameters	2% Miconazole soap strips
1.	Weight variation	$0.1 \pm 0.01$ gm
2.	Foam height	$17 \pm 0.02$ ml
3.	% drug content	$96 \pm 5.0$ %
4.	pH	7.0

**Table 3: Zone of inhibition obtained in microbial studies**

Sr. No.	Micro-organism	Diameter of Zone of inhibition(cm)		
		Strip A	Strip B	Strip F
1	<i>A.niger</i>	$2.9 \pm 0.1$	$2.6 \pm 0.2$	$0.0 \pm 0.2$
2	<i>A.fumigatus</i>	$2.5 \pm 0.2$	$3.3 \pm .02$	$1.4 \pm 0.1$
3	<i>C.albicans</i>	$3.3 \pm 0.2$	$3.5 \pm 0.3$	$1.1 \pm 0.2$
4	<i>B.subtilus</i>	$3.8 \pm 0.3$	$3.9 \pm 0.3$	$0.4 \pm 0.1$
5	<i>S.typhi</i>	$2.1 \pm 0.3$	$1.9 \pm 0.4$	$0.8 \pm 0.1$
6	<i>E.coli</i>	$1.8 \pm 0.1$	$2.4 \pm 0.1$	$0.8 \pm 0.1$
7	<i>S.aureus</i>	$4.0 \pm 0.4$	$3.6 \pm 0.4$	$0.0 \pm 0.1$
8	<i>P.klebsiella</i>	$2.1 \pm 0.2$	$2.6 \pm 0.2$	$1.5 \pm 0.1$
9	<i>B.aureginosa</i>	$2.3 \pm 0.1$	$2.1 \pm 0.2$	$0.6 \pm 0.1$

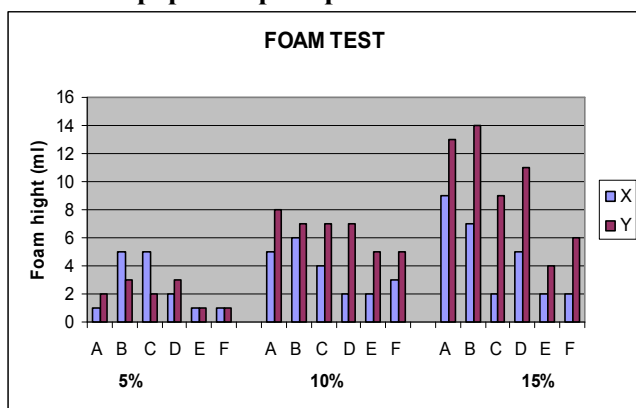
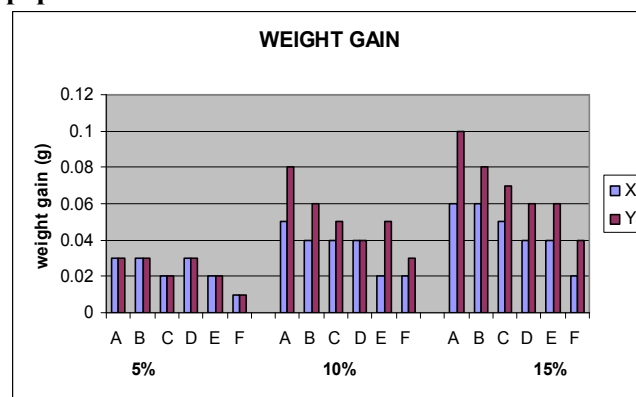
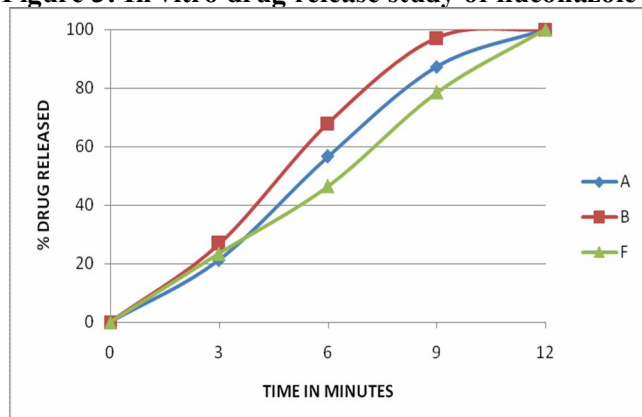
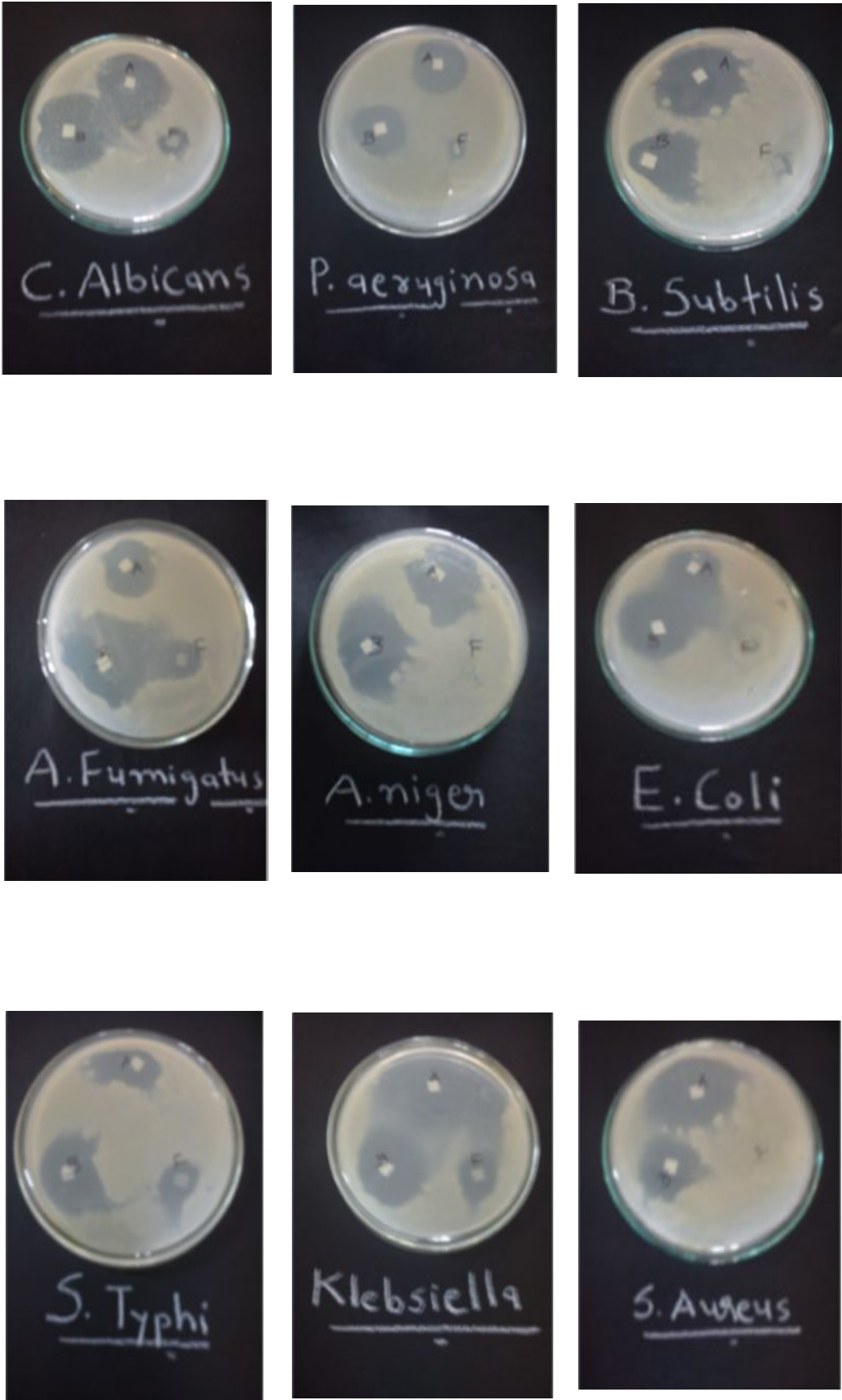
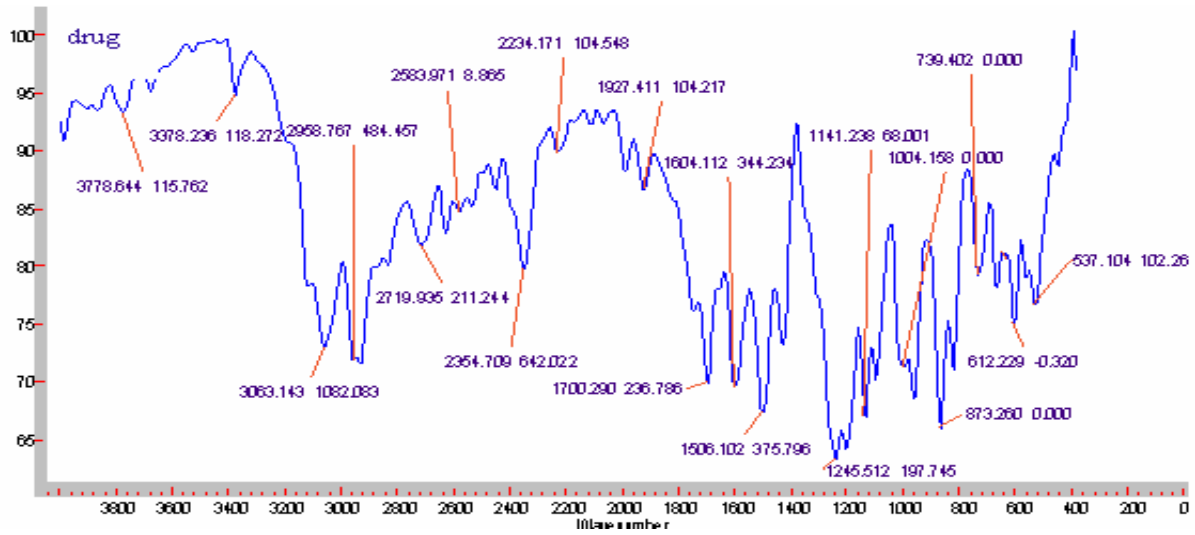
**Figure 1: Foam height produced by different non-medicated paper soap strips.****Figure 2: Weight gain of different non-medicated paper****Figure 3: In vitro drug release study of fluconazole soap strips.**

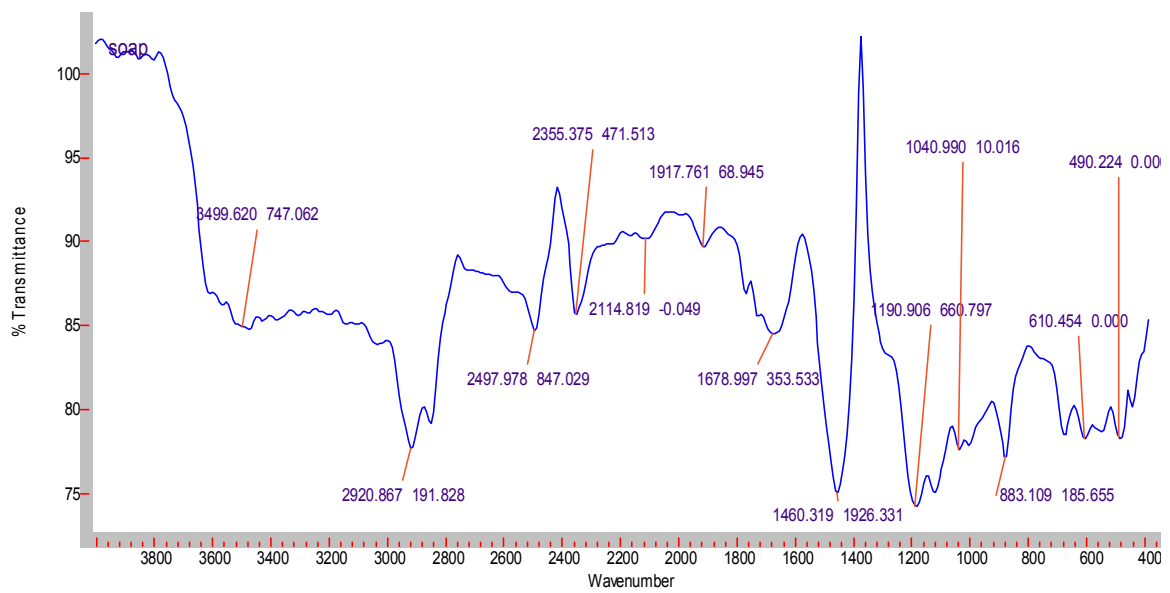
Figure 4: Zone of inhibition against various micro-organisms

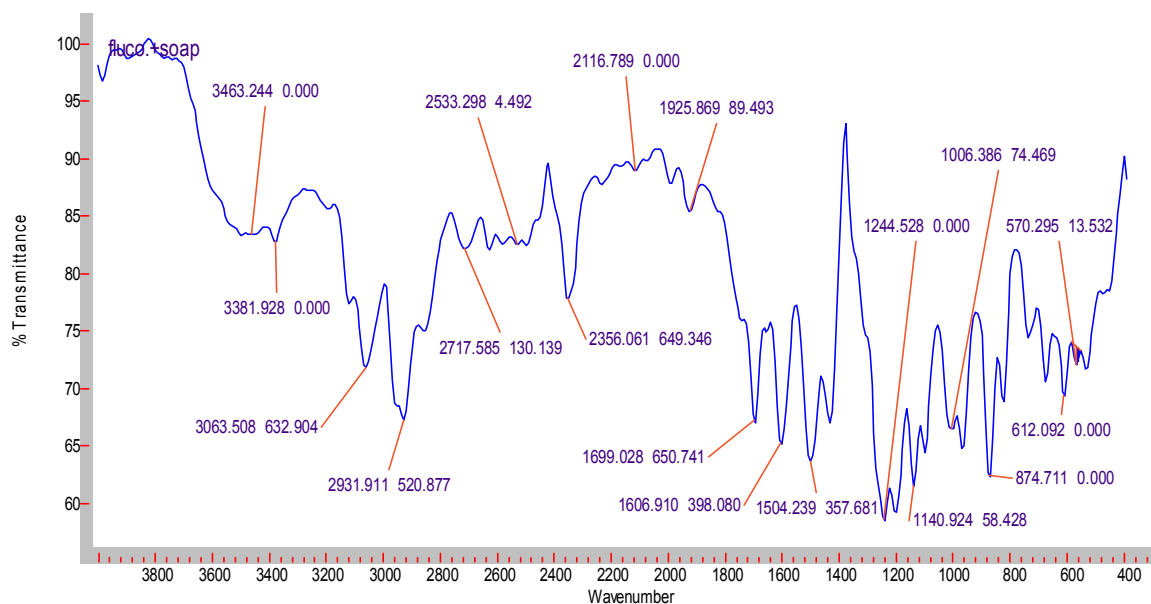


**Figure 5: IR spectral analysis of fluconazole**



**Figure 6: IR spectral analysis of soap**



**Figure 7: IR spectral analysis of mixture of fluconazole and soap**

## **RESULTS AND DISCUSSION**

### **1. Non medicated soap strips**

From the several papers studied the papers coded A, B and F found to have optimum absorption capacity. The solution of 15% Y soap was found good. All the strips have pH near about 7.0.

### **2. Medicated soap strips**

The medicated soap strips found uniform in drug content, weight variation was found to be in the range and foam produced was ranging from 15 to 18 ml. The 15% soap solutions gave best results for foam, weight gain, pH and uniformity of soap distribution as shown in figure 1 and 2.

### **In vitro drug release**

In vitro drug release studies show the 100% drug released within 10 minutes as shown in figure 3.

### **Primary skin irritation test**

Primary skin irritation test showed none of the medicated soap strip produces irritation.

### **Microbial study**

Microbial study has been done using microorganisms such as *C.albicans*, *S.typhi*, *S.aureus*, *E.coli*, *klibsiella*, *B.subtilis*, *P.aeroginosa*, *A.niger* and *A.fumigatus* species. It gave zone of inhibition against all of the microorganisms. The diameters of zone of inhibition obtained in microbial testing by different strips against various micro-organisms are given in table 3.

### **IR spectral analysis for drug-excipient interaction**

The unsubstituted peaks in IR spectra indicate that there is no interaction between drug and soap.

### **CONCLUSION:**

From the prepared medicated soap strips, the strips of paper encoded B (Whatman filter paper no. 41) shows the best results as compared to other selected papers. The medicated soap strips show excellent release within 10 minutes indicating good efficiency and penetration. The prepared medicated soap strips are convenient to use and new type of dosage form for dermal infections such as candidiasis, aspergillus. It is useful the patients of all ages and sex.

**REFERENCES**

- 1) Beale JM, Block JH. "Wilson and Gisvold's Textbook of organic, medicinal and pharmaceutical chemistry", Wolters Kluwer (India) Pvt. Ltd: New Delhi, 12<sup>th</sup> ed., 2011; pp:203.
- 2) Tripathi KD. "Essentials of medical pharmacology", Jaypee Brothers Medical Publishers: New Delhi, 6<sup>th</sup> ed., 2008; pp:763.
- 3) Barar FSK. "Essentials of Pharmacotherapeutics", S. Chand and company Ltd: New Delhi, 5<sup>th</sup> ed., 2009; pp:505.
- 4) <http://en.wikipedia.org/wiki/fluconazole>.
- 5) Banker GS, Rhodes CT. "Modern Pharmaceutics", Marcel Dekker Inc: New York, 4<sup>th</sup> ed., 2002; pp:190.
- 6) Montagna W. "The structure and function of skin", Academic Press: New York, 3<sup>rd</sup> ed., 1974; pp:10.
- 7) Misra AN. Transdermal Drug Delivery In: Jain NK editors. "Controlled and novel drug delivery", CBS publishers and Distributors: New Delhi, 1<sup>st</sup> ed., 1997; pp:100-127.
- 8) Indian Standard "Shampoo, Soap based-specification" (first revision). IS7669-1990: Bureau of Indian standards.1996; NO-AnnexaB-2; pp:2-4.
- 9) Rao KP, Patil AB, Reddy H, Sagre P. "Design of ketoconazole soap strips for dermal infections", The Pharma Review, 2008; 133-136.
- 10) Carr MM, Pryce DM, Ive FA. "Treatment of seborrhoeic dermatitis with ketoconazole: Response of seborrhoeic dermatitis of scalp to topical ketoconazole", Br J Dermatol., 1987; 116; 2: 213-16.
- 11) Farr PM, Shuster S. "Treatment of seborrhoeic dermatitis with topical ketoconazole", Lancet., 1984; 2: 1271-72.
- 12) Green CA, Farr PM, Shuster S. "Treatment of seborrhoeic dermatitis of the face, scalp and trunk to topical ketoconazole Response of seborrhoeic dermatitis of the face, scalp and trunk to topical ketoconazole", Br J Dermatol., 1987; 116: 217-21.
- 13) Kokare CR. "Pharmaceutical microbiology principles and applications", Nirali Prakashan; Pune, 2008; pp:19.4-19.5.
- 14) Indian Pharmacopoeia, Controller Publications: Delhi, vol. I, 2010; pp:333.

\*\*\*\*\*