FORMULATION AND EVALUATION OF VORICONAZOLE SOAP STRIPS FOR DERMAL INFECTIONS

Surabhi Yadav¹, Devendra Kumar², Neerja Trivedi³, Vikas Kumar⁴ and Shailendra Raghav⁵

¹Department of Chemistry, Shri Venkateswaray University Gajraula, Amroha, (U. P.) India.
²Department of Pharmacology and Therapeutics, Kinge George’s Medical University U.P. Lucknow INDIA
³Department of Zoology, University of Lucknow (U. P.) India
⁴Department of Microbiology, Shri Venkateswaray University Gajraula, Amroha (U. P.) India.
⁵Department of Chemistry, K. K Degree college, Etawah (U. P) India.

ABSTRACT

In present study, voriconazole were prepared as antifungal soap strip & 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 in deferent phase. In phase-I study optimization, which was carried out to study water absorption capacity using different types of papers (Whatman filter papers 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 id control drug voriconacole and 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 of different species. The obtained results for prepared medicated soap strip of voriconazole indicate that these strips are economic, convenient, gives good foam on application, uniform in drug content and not showing any skin irritation.
Key Words: - Voriconazole, Dermal infections, thick foam.

INTRODUCTION
Voriconazole acts by inhibiting the synthesis of ergosterol in the fungal membranes and, ultimately, the growth of the microorganism. It is potent against a wide spectrum of keratitis-causative fungi, namely, the most common pathogens C. albicans, C. parapsilosis, C. tropicalis, A. fumigatus, Aspergillus flavus, and Fusarium solani, and other less common pathogens from the Paecilomyces, Histoplasma, Scedosporium, Curvularia, and Acremonium speciesis (1) Voriconazole is in a class of antifungal medications called triazoles. It works by slowing the growth of the fungi that cause infection. Voriconazole is modified from fluconazole and acquires an improving potency and spectrum (2). It can be administered via the oral and intravenous (I.V.) routes (3). Although the oral bioavailability is estimated to be 96% (4).

Presence of thick foam on the infected part causes hydration of stratum corneum for better penetration of drug (5-9). 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 as a new drug delivery for Voriconazole.

MATERIALS AND METHODS
Materials
Voriconazole was a kind gift from Cipla Ltd. (Mumbai, India). Soap X & soap Y were procured from local market shops. Filter paper & Whatman filter paper no. 1, 41 & 42 were purchased from sigma. Butter paper & bond paper were purchased from local market. Ultrapure water (18.2 M/cm) was obtained from a Milli-Q PLUS PF water purification system. All other analytical grade reagents and salts were obtained from standard commercial suppliers.

Methods
Selection of soap solution
Two non-medicated soaps of different brands were selected and coded as X and Y. Different concentration of soap solution (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 papers showing maximum absorbing capacity were 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±2°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.

Formulation of medicated paper soap strips
The drug was incorporated in the selected formulation which showed good absorption capacity in previous study. Accurately weighed drug (2% Voriconazole) 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.aeroginosa, B.subtilis and A.niger species. The % drug content is measured by using UV spectroscopy at $\lambda_{\text{max}}$ 254 nm.

In vitro drug release
In vitro drug release (9-12) of Voriconazole 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 254 nm. All release experiments were done in triplicate.
% Drug content
The % drug content is measured by using UV spectroscopy at \( \lambda \text{max} \) 254 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. Test substance was instilled directly to the skin in the right hand every 30 min for 6 h (12 treatments). Left hand served as control and were treated with distilled water. At the end of the treatment, six observations at 12 h intervals were carried out to evaluate the skin. The congestion, swelling, discharge, and redness of the skin were graded on a scale from 0 to 3, 0 to 4, 0 to 3 and 0 to 3 respectively. Irritation and opacity were graded on a scale from 0 to 4.

Microbial study
Microbial study has been done using microorganisms such as \( \text{C.albicans, S.typhi, S.aureus, E.coli, klibsiella, B.subtilis, P.aeroginosa, A.niger} \) and \( \text{A.fumigatus} \) 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 (13).

FT-IR spectral analysis for drug-excipient intraction
FT-IR spectra of freeze-dried NPs were obtained with a PerkinElmer 1600 spectrophotometer using the potassium bromide (KBr) disk technique. FT-IR spectra of Voriconazole sample loaded and their pure components were compared for evaluation drug-excipient and excipient-excipient chemical interaction (14).

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.

FT- IR spectral analysis for drug-excipient interaction
The unsubstituted peaks in IR spectra indicate that there is no interaction between drug and soap.
Figure 2: Weight gain of different non-medicated paper

Figure 3: In vitro drug release study of Voriconazole soap strips
Figure 4: Zone of inhibition against various micro-organisms (A) C. albicans, (B) P. auruginosa, (C) B. subtilish, (D) A. fumigates, (E) A. niger, (F) E. Coli, (G) S. typhi, (H) Klebsiella, (I) S. aurius
Figure 5: FT-IR spectral analysis of Voriconazole

Figure 6: FT-IR spectral analysis of mixture of Voriconazole and soa

Table -1 Formulation of Voriconazole Soap Strip

<table>
<thead>
<tr>
<th>S.n</th>
<th>Ingredients</th>
<th>Quantity use</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Soap Y</td>
<td>15 gm each</td>
</tr>
<tr>
<td>2</td>
<td>Vericonazole</td>
<td>2 gm</td>
</tr>
<tr>
<td>3</td>
<td>Distilled water</td>
<td>100 ml</td>
</tr>
</tbody>
</table>
Table -2 Evaluation parameters of miconazole soap strip

<table>
<thead>
<tr>
<th>S. N.</th>
<th>Parameters</th>
<th>2% Miconazole Soap strip</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-</td>
<td>Weight variation</td>
<td>0.1 ± 0.01 gm</td>
</tr>
<tr>
<td>2-</td>
<td>Foam height</td>
<td>17 ± 0.01 ml</td>
</tr>
<tr>
<td>3-</td>
<td>% drug content</td>
<td>95 ± 7.0 %</td>
</tr>
</tbody>
</table>

Table -3 - Zone of inhibition obtained in microbial studies

<table>
<thead>
<tr>
<th>S.N.</th>
<th>Micro-organism</th>
<th>Diameter of Zone of inhibition (cm)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Strip A</td>
</tr>
<tr>
<td>1-</td>
<td><em>A.niger</em></td>
<td>3.0 ± 0.5</td>
</tr>
<tr>
<td>2-</td>
<td><em>A.fumigatus</em></td>
<td>2.4 ± 0.3</td>
</tr>
<tr>
<td>3-</td>
<td><em>C.albicans</em></td>
<td>3.2 ± 0.3</td>
</tr>
<tr>
<td>4-</td>
<td><em>B.subtilus</em></td>
<td>3.7 ± 0.9</td>
</tr>
<tr>
<td>5-</td>
<td><em>S.typhi</em></td>
<td>2.3 ± 0.5</td>
</tr>
<tr>
<td>6-</td>
<td><em>E.coli</em></td>
<td>2.1 ± 0.2</td>
</tr>
<tr>
<td>7-</td>
<td><em>S.aureus</em></td>
<td>3.9 ± 0.4</td>
</tr>
<tr>
<td>8-</td>
<td><em>P.klebsiella</em></td>
<td>2.3 ± 0.2</td>
</tr>
<tr>
<td>9-</td>
<td><em>B.aureginosa</em></td>
<td>2.3 ± 0.1</td>
</tr>
</tbody>
</table>

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.

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