Formulation of Nanostructured lipid Carrier Based Topical Drug Delivery of Antifungal Drug

Submitted By

Ramani Avkashkumar Dhirubhai

Supervised By

Dr. Deepa H. Patel

M.Pharm, Ph.D.

Reader

Parul Institute of Pharmacy and Research

Limda, Vadodara.

Abstract

Bifonazole is imidazole ring containing drug having low solubility and poor permeability through biological barrier. It exerts potent broad-spectrum fungicidal activity by inhibiting cell membrane formation. The purpose of present investigation was to improve the infectious condition by incorporating the drug in form of nano lipid carrier as hydrogel dosage form for improvement in permeability and side effects such as burning and itching. Drug-excipients incompatibility study was performed using Fourier transform infrared spectroscopy. Nano lipid carrier of bifonazole was successfully prepared using high speed homogenization method followed by sonication of dispersion. Optimization of formulation parameter was done by Box Behnken Design (BBD) using Design Expert software. Nano lipid carriers of bifonazole were evaluated for particle size, poly dispersive index, zeta potential and percent drug entrapment. Nano lipid carriers were incorporated to structured vehicle such as hydroxy propyl methyl cellulose K 100 M to form hydrogel and evaluated for viscosity, spreadability, pH, drug content. I*n-vitro* drug release and ex vivo skin permeation study was performed using dialysis bag and rat skin respectively. Skin irritancy was performed on wistar albino rats to observe erythema and edema. Antifungal activity was performed cup-plate method using candida albican. Drug and excipients were found to be compatible to each other which were confirmed by Fourier transform infrared spectroscopy study. Nano lipid carriers were successfully prepared using high speed homogenization method followed by sonication of

dispersion using stearic acid (150 mg), oleic acid (300 mg), tween 80 (125 mg) at the speed of 10,000 RPM for 20 minutes. Particle size, zeta potential and percent drug entrapment of optimized batch of nano lipid carriers were found to be 178.0±0.012 nm, -3.18±0.091 mv and 97.66±0.089 % respectively. Viscosity, spreadability, pH and drug content of nano lipid carrier based hydrogel were found to be 38107.5 ± 0.0147 cps, 1.59 ± 0.001 gm.cm.sec^{-1}, 6.6 ± 0.003 and 92.07 ± 0.46 % respectively. *In vitro* drug release, *ex vivo* skin permeation of optimized batch of nano lipid carrier based hydrogel and marketed formulation were found to be 87.1±0.063 % and 76.13±0.73 and 80.88±0.091% and 61.64±0.02 % respectively after 24 hrs. Skin irritation of nano lipid carrier based hydrogel was found less compare to marketed formulation. Zone of inhibition of nano lipid carrier based hydrogel was found more than marketed formulation in anti-fungal activity study. Stability study shows nano lipid carrier containing bifonazole was stable at accelerated condition. The present study demonstrated that, a nano lipid carrier based hydrogel is suitable for skin fungal infections and hold great potential for treating diseases that require topical drug delivery.

Keywords: Bifonazole; Skin infections; Nano lipid carrier; Nano lipid carrier based hydrogel, Box Behnken Design; High speed homogenization method.