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RESEARCH ARTICLE

DESIGN AND DEVELOPMENT OF *O/W* NANOEMULSION FOR THE TRANSDERMAL DELIVERY OF ONDANSETRON

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Oil-in-water nanoemulsion was developed as a tool for the transdermal delivery of ondansetron, a $5HT_3$ antagonist. With an objective to select appropriate components for the formulation development, screening of oils and surfactants, co-surfactants was performed on the basis of solubility of ondansetron in oils, solibilization capacity of surfactant for different oils and nanoemulsion area of S_{mix}, respectively. Pseudo ternary phase diagrams were constructed by aqueous titration technique and various nanoemulsion formulations were developed. The developed formulations were subjected to thermodynamic stability tests. In order to evaluate the effect of nanoemulsion on skin permeation, *ex vivo* permeation of drug was performed and compared with drug solution in oil, S_{mix} and aqueous suspension. The flux of nanoemulsion formulations were in the range from 109.8-178.9 $\mu g/cm^2/h$, significantly higher ($p<0.01$) than the oil solution (control, 31.08 $\mu g/cm^2/h$), S_{mix} (14.78 $\mu g/cm^2/h$) and aqueous suspension (11.75 $\mu g/cm^2/h$). The optimized formulation was subjected to various in vitro attributes. The mean droplet size, polydispersity index, zeta potential electrical conductivity, refractive index and pH were found to be 23.70 nm, 0.27, -8.7mV, 460.17 S/cm, 1.412 and 6.2±0.219 respectively. The results of *ex vivo* permeation studies of developed nanoemulsion showed a great potential to replace oral conventional formulation and could be used for chemotherapy induced nausea and vomiting.

Key words: Nanoemulsion, Ondansetron, Ternary phase diagram, Flux, Permeability coefficient.

INTRODUCTION

Ondansetron, {1,2,3,9-tetrahydro-9-methyl-3-[(2-methyl-1*H*-imidazol-1-yl)-methyl]-4*H*-carbazol-4-one} is potent and highly selective $5HT_3$ receptor-antagonist available as an antiemetic (Currow *et al* 1997) and also indicated for the treatment and/or prophylaxis of chemotherapy- or radiotherapy- or postoperative induced emesis (Johnson *et al* 2000). The 5-HT_3 receptor antagonists are the primary drugs used to treat and prevent chemotherapy-induced nausea and vomiting (CINV) (Patel *et al* 2009). Standard regimens of ondansetron in CINV are a single dose of 8 mg by slow intravenous or intramuscular injection immediately before treatment either followed by a continuous intravenous infusion of 1 mg/h for up to 24 h, or by a further two doses of 8 mg two to four hours apart or a single dose of 32 mg given by intravenous infusion over at least 15 min. immediately before treatment. To protect against delayed emesis, these regimens are followed by oral ondansetron 8 mg twice daily or 16 mg rectally once daily, up to 5 days after the end of a course of chemotherapy.

Dosing frequency and invasive therapy of ondansetron causes great inconvenience to the cancer patients, which in turn necessitates a development a system that could maintain the therapeutic concentration of antiemetic agents safely and effectively during chemotherapy. Transdermal delivery has received increased attention in the face of growing awareness that drugs that are administered by the conventional means (tablets, capsules, parenterals) exhibit unfavorable patterns of efficacy and sometimes toxicity. Transdermal delivery could be an