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Development of a Thermoreversible Tenofovir Nano Gel

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Statement of the Problem: HIV is primarily transmitted as a sexually transmitted disease. The objective of the study is to develop a buffered thermoreversible gel containing tenofovir (TFR) loaded copolymer poly(lactic-coglycolic acid (PLGA) nanoparticles for prolonged protection against human immunodeficiency virus (HIV) sexual transmission.

Methodology & Theoretical Orientation: Optimized buffered formulation containing TFR loaded PLGA nanoparticles was in sol (solution) form at 2-8°C and converted to a gel matrix at ≥25°C. PLGA nanoparticles were prepared by two methods: (a) Solvent diffusion method and, (b) Emulsification solvent evaporation. The particle size was measured using dynamic light scattering (DLS). Morphology of the particles was analysed by scanning electron microscope (SEM). Cytotoxicity of formulation components was evaluated using 24 hr 3-(4,5-dimethylthiazol-2-yl)-5-(3-carboxymethoxyphenyl)-2-(4-sulfophenyl)-2H-tetrazolium, inner salt (MTS) assay performed on human vaginal epithelial cells (VK2/E6E7). *In vitro* release of TFR from buffered thermoreversible nano gel containing PLGA nanoparticles was performed in simulated vaginal fluid (pH ~4.2) in a temperature controlled shaker equivalent to vaginal temperature ~34°C) at 60 rpm.

Findings: The effective diameter range of nanoparticles prepared by both methods were 94.3-228 nm and 265-413 nm, respectively; micro image showed smooth and spherical shaped nanoparticles. Solvent diffusion method with a non-ionic surfactant (Triton® X-100) effectively reduced the particle size of nanoparticles but resulted in poor drug encapsulation. Emulsification solvent evaporation method resulted in improved drug encapsulation (1.43-10.78%) and drug loading values (0.25-1.18%) for nanoparticles. The formulation components were non cytotoxic from the 24 hr MTS assay performed on human vaginal epithelial cells. The formulation demonstrated a sustained drug release with a cumulative drug release of ~61% in 8 hrs and ~67.75% in 24 hrs. Drug release mechanism was diffusion controlled.

Conclusion & Significance: Both preparation methods were found efficient to prepare PLGA nanoparticles. Results demonstrated a successful development and characterization of vaginal nano gel formulation for prolonged protection against HIV sexual transmission.

Biography

Dr. Pradeep Karla currently works as an Associate Professor in the Department of Pharmaceutical Sciences. Dr. Karla completed Bachelors in Pharmacy with distinction from Nagarjuna University, India and interdisciplinary Ph.D. in Pharmaceutical Sciences from University of Missouri in Kansas City. Dr. Karla is the recipient of NIH funded KL2 grant and worked as NIH K Grant research fellow and Principal Investigator. Dr. Karla has been the recipient of AACP New Investigator Grant, Ecobiotix Industrial Grant and Bridge Research Grant. Dr. Karla was the recipient of teaching with technology award at Howard University. Dr. Karla's research on drug efflux transporters was cited as one of the eight promising research findings by American Association of Colleges of Pharmacy.

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