The Optimization of Nanoparticle-Based Drug Delivery of Melittin in a Colloidal Suspension as a Selective Method to Target HIV Structural Antigen p24

Sathish, Sanjeev-Kumar

The HIV-1 strand of the human immunodeficiency virus is an evasive retrovirus due to its ability to invade a cell and use the outer membrane to multiply and invade other cells. The p24 capsid protein that protects the RNA plays an important structural role in transporting the multiplied virus as it leaves the phospholipid bilayer. Previous studies have shown that melittin, a peptide found in bee venom, has the ability to selectively target p24 and other primary structural components of HIV that are found on the cell surface during replication. This research will investigate if melittin, introduced via a Fe3O4-Citric acid nanocarrier (CA-NP), will act to target HIV p24, thus inhibiting replication of the virus. First, CA-NPs were synthesized according to Racuciu, et al., with minor modification. Following confirmation of CA coating and NP size via FTIR and SEM, 130mg CA-NPs were immersed in 250µl of 2-10µM melittin (in 0.1M KCl) for 12hours peptide loading. Following centrifugation, the solid melittin-CA-NPs were re-suspended in di-water for use on simulated HIV-cell phospholipid bilayers (cpbs), created using an electroformation chamber (3Hz, 2Vp-p). To simulate HIV-cell targeting, 5ul melittin-CA-NPs were introduced to cpbs composed of 1,2-dioleoyl-sn-glycero-3-phosphocholine (DOPC) and p24. Using p24 selective ELISA at 450nm, results demonstrate that the introduction of 0.05µM melittin caused a 20% decline in p24 expression (8.51ng/ml to 6.89ng/ml), while "normal" cpbs containing only DOPC were unaffected. These results highlight the success of CA-NP as a nanocarrier for melittin, which in turn was selective in disrupting HIV replication.

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First Award of $5,000