Development and Characterization of Anticancer Model Drug Conjugated to Biosynthesized Zinc Oxide Nanoparticles Loaded into Different Topical Skin Formulation

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Abstract

The objective of this study was to synthesize zinc oxide nanoparticles (ZnO NPs) by green method using the root hair extract of *Phoenix dactylifera*. ZnO NPs were functionalized with polyethylene glycol (PEG) and doxorubicin (DOX) and loaded into various topical gel dosage forms (hydrogel, oleogel, and bigel) for skin cancer treatment. ZnO NPs were prepared using 0.6M zinc acetate dihydrate and the root hair extract solution at 1:1 ratio. The average size, polydispersity index, and zeta potential of ZnO NPs were 22.57 ± 4.79nm, 0.53 ± 0.02, and -19.23 ± 1.4mV, respectively. Gels loaded with all types of ZnO NPs exhibited pseudoplastic flow with viscoelastic properties. The *in vitro* release studies revealed that ZnO NPs enhanced DOX release from all gel types. In addition, PEGylated ZnO NPs showed a dramatic enhancement in DOX release compared to ZnO NPs. After three months of storage at room temperature, gels were physically stable, maintaining their rheological properties. Therefore, the greenly synthesized ZnO NPs,

PEGylated, and conjugated with DOX, loaded into different gel-based formulations potentially enhanced the release of DOX, turning out to be a promising drug delivery system in skin cancer treatment.

Keywords: Zinc oxide nanoparticles, Green synthesis, PEGylated ZnO NPs, Doxorubicin HCl, Hydrogel, Oleogel, Bigel.