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

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**ABSTRACT**

Doxorubicin (DOX) is an anthracycline antineoplastic agents, which interacts with DNA and shows sever toxicity due to its lack of specificity. The cytotoxic effect of zinc oxide nanoparticles (ZnO NPs) is mainly concerned in changing the cytoskeleton and nucleoskeleton of proteins and/or producing reactive oxygen species (ROS) in cells exposed to ZnO NPs. The green synthesis of ZnO NPs from plant extracts has been recently employed as a simple, eco-friendly, safe, and cost- and time-effective approach with higher stability and reproducibility. *Phoenix dactylifera,* due to its chemical component (tannins, phenolic acid, and carotenoids), was employed in the preparation of ZnO NPs. The main objective of this study is to greenly synthesize ZnO NPs conjugated with DOX (DOX-ZnO NPS) and loaded into various types of gel preparations (hydrogel and oleogel). *P.dactylifera* solution extract was mixed with 0.6M zinc acetate at 1:1 v/v ratio to prepare ZnO NPs. The prepared NPs was characterized by UV-vis spectroscopy, particles size, PDI, and zeta potential. The maximum wavelength of ZnO NPs was detected at 360 nm. Dialysis method was used to determine the effect of ZnO NPs on enhancing DOX release. The cumulative amount of DOX was calculated via UV-vis spectroscopy at 480 nm after 48 h. Spherical nanoparticles of size range 15.35–28.74 nm and -22mV zeta potential was obtained. The rheological results showed that both gel formulations exhibited a pseudoplastic (shear-thinning) flow and viscoelastic behavior. The *in vitro* release studies showed that ZnO NPs enhanced the release of DOX, where the amount of DOX released from DOX-ZnO NPs hydrogel and oloegel was higher than that of DOX-hydrogel and oleogel. In addition, DOX-ZnO NPs hydrogel showed a faster release that DOX-ZnO NPs oleogel. Therefore, an eco-friendly and low-cost greenly synthesized ZnO NPs were successfully developed, conjugated with DOX, and loaded into hydrogels and oleogels for dermal delivery.