Synthesis, Structural Characterization, and Preclinical Efficacy of a Novel Paclitaxel-Loaded Alginate Nanoparticle for Breast Cancer Treatment


Abstract:

The antitumor activity of a novel alginate (ALG) polymer-based particle that contained paclitaxel (PTX) was evaluated using human primary breast cancer cells. Materials and Methods. PTX was combined with ALG in a nanoparticle as a drug delivery system designed to improve breast cancer tumor cell killing. PTX-ALG nanoparticles were first synthesized by nanoemulsification polymer cross-linking methods that improved the aqueous solubility. Structural and biophysical properties of the PTX-ALG nanoparticles were then determined by transmission electron microscopy (TEM) and high performance liquid chromatography (HPLC) fluorescence. The effect on cell cycle progression and apoptosis was determined using flow cytometry. Results. PTX-ALG nanoparticles were prepared and characterized by ultraviolet (UV)/visible (VIS), HPLC fluorescence, and TEM. PTX-ALG nanoparticles demonstrated increased hydrophobicity and solubility over PTX alone. Synthetically engineered PTX-ALG nanoparticles promoted cell-cycle arrest, reduced viability, and induced apoptosis in human primary patient breast cancer cells superior to those of PTX alone. Conclusion. Taken together, our results demonstrate that PTX-ALG nanoparticles represent an innovative, nanoscale delivery system for the administration of anticancer agents that may avoid the adverse toxicities with enhanced antitumor effects to improve the treatment of breast cancer patients.

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