INVITRO AND INVIVO STUDIES OF PLGA-PEG NANOCARRIERS CO-DELIVERING PACLITAXEL AND ANTI-PD-1 FOR ENHANCED CHEMO-IMMUNOTHERAPY

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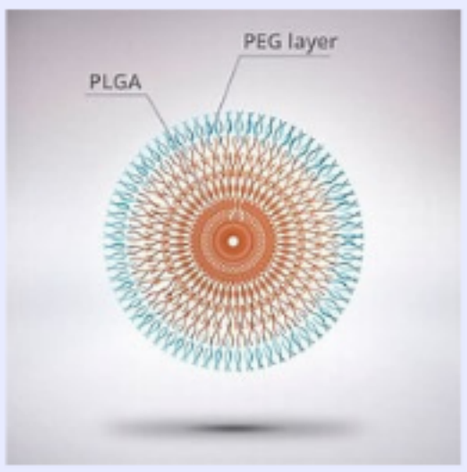
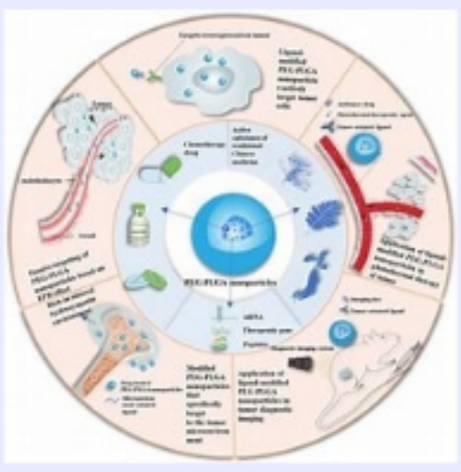
INTRODUCTION

Nanocarriers are nanoscale delivery systems designed to transport therapeutic agents directly to diseased sites with precision, thereby improving drug stability, bioavailability, and targeted release while minimizing systemic toxicity. In oncology, nanocarriers hold promise for co-delivering chemotherapeutic and immunotherapeutic agents, maximizing therapeutic synergy and reducing adverse effects compared to conventional single-drug strategies.





METHOD

PLGA–PEG nanoparticles were synthesized using a modified double emulsion solvent evaporation method, encapsulating both PTX and anti-PD-1. The system was characterized for particle size, morphology, zeta potential, encapsulation efficiency, and stability. In vitro assays assessed pH-responsive drug release, cytotoxicity in MCF-7 and B16F10 cell lines, and immunomodulatory effects through IFN-γ secretion and CD8+ T-cell activation. In vivo efficacy and safety were evaluated in a murine melanoma model.

CONCLUSION

The PLGA–PEG nanocarrier platform achieved effective co-delivery of chemotherapy and immunotherapy, producing synergistic tumor suppression and immune activation. This strategy demonstrates strong translational potential for safer and more effective cancer treatment.

- Q. Zhang et al., "Co-delivery of doxorubicin and anti–PD-1 by liposomes for combination therapy," Acta Biomater., vol. 101, pp. 534–546, 2020.
- World Health Organization, Cancer Fact Sheet, 2021.
- J. Couzin-Frankel, "Cancer immunotherapy," Science, vol. 342, no. 6165, pp. 1432–1433, 2013.

OBJECTIVE

This study aimed to design and evaluate a poly(lactic-co-glycolic acid)–polyethylene glycol (PLGA–PEG) nanocarrier system for the co-delivery of paclitaxel (PTX) and an anti-programmed cell death protein-1 (anti-PD-1) monoclonal antibody. The objective was to enhance cytotoxic and immunomodulatory effects against cancer through a synchronized chemo-immunotherapeutic approach.

RESULTS

The nanocarriers exhibited uniform spherical morphology (~152 nm, PDI 0.16), high encapsulation efficiency (87.3% PTX, 78.5% anti-PD-1), and four-week stability. pH-dependent release showed accelerated drug liberation at tumor-simulating acidic conditions (92.1% PTX, 83.5% anti-PD-1). Co-delivery nanoparticles demonstrated superior cytotoxicity compared to free drugs or single-agent nanoparticles. Immunomodulation assays revealed significantly enhanced IFN-γ secretion and CD8+ T-cell activation. In vivo, tumor volume was suppressed to ~215 mm³ versus >1,000 mm³ in controls, with no systemic toxicity or weight loss observed.