# Multifunctional Nanovehicles for Combined 5-Fluorouracil and Gold Nanoparticles Based on the Nanoprecipitation Method

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Abstract

To facilitate the administration of combined 5-Fluorouracil (5-FU) and gold nanoparticles (for photothermal treatment purposes), we developed 5-FU-gold poly (lactide-co-glycolic acid) (5-FU-Au- PLGA) nanovehicles, via the nanoprecipitation method. The gold nanoparticles were incorporated inside the 5-FU-PLGA carriers using a roller mixer. Morphological analysis using atomic force microscopy (AFM), scanning electron microscopy (SEM) and transmission electron microscopy (TEM), indicated uniform, singly separated spherical nanoparticles (NPs). Drug content, recovery and entrapment in the NPs were approximated using UV-spectrophotometer data. Approximately 26% of nanoparticles were recovered after drying. The percentage of total drug content was about 30%, and the percentage of drug entrapment reached 57%. Electrostatic Force Microscopy images confirmed the presence of gold inside the drug-loaded nanoparticles. We speculate that the 20-nm gold particles were able to diffuse, after 12 hours of mixing (using the roller mixer), into the PLGA matrix through the 100-nm pores (observed by SEM) without affecting the integrity of the drug delivery vehicle. These synthesized nanoparticles show promise as multimodal vehicles in the delivery of chemotherapeutic agents.

**Keywords**: Drug Delivery, 5-Fluorouracil, PLGA, Nanoprecipitation Method, Gold Nanoparticles.

Key points in the research paper:

1. We developed multifunctional nanovehicles for combined chemotherapy and photothermal treatment, based on a biodegradable and biocompitable polymer.
2. A synergistic effect of the chemotherapy induced by 5- fluorouracil coupled with the hyperthermia induced by the gold nanoparticles have the potential to increase the efficacy of these newly synthesized PLGA nanocarriers and may allow for decreasing the amount of the 5-FU administered to patient which in turn would reduce its cytotoxicity and side effects.
3. We have examined the feasibility of using this novel drug delivery system in vitro. To our knowledge, we are the first group to use EFM to study metallic nanoparticles incorporation inside polymer carriers. Additionally, while previous researchers have reported the deposition of gold on the surface of PLGA nanocarriers, here we show the presence of gold nanoparticles inside the PLGA matrix.