

# Pemetrexed loaded gold nanoparticles as cytotoxic and apoptosis inducers in lung cancer cells through ROS generation and mitochondrial dysfunction pathway

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## Abstract

Supramolecular nanoparticles containing peptides and drugs have recently gained recognition as an effective tumor treatment drug delivery system. A multitarget drug termed pemetrexed is effective against various cancers, including nonsmall cell lung cancer. The work aims to establish the capability of pemetrexed gold nanoparticles (PEM-AuNPs) to induce apoptosis and explore molecular changes. X-ray diffraction, Fourier-transform infrared spectroscopy, ultraviolet–visible spectroscopy, scanning electron microscope, and transmission electron microscope were used to investigate the synthesized nanoparticles. The MTT assay was utilized to investigate the anticancer properties of PEM-AuNPs at varying concentrations (50, 100, and 200  $\mu\text{M}$ ). PEM-AuNPs demonstrated a decrease in cell viability with 55.87%, 43.04%, and 25.59% for A549 cells and 54.31%, 37.40%, and 25.84% for H1299 cells at the respective concentrations. To assess apoptosis and perform morphological analysis, diverse biochemical staining techniques, including acridine orange-ethidium bromide and 4',6-diamidino-2-phenylindole nuclear staining assays, were employed. Additionally, 2',7'-dichlorofluorescein diacetate staining confirmed the induction of reactive oxygen species generation, while JC-1 staining validated the impact on the mitochondrial membrane at the  $\text{IC}_{50}$  concentration of PEM-AuNPs. Thus, the study demonstrated that the synthesized PEM-AuNPs exhibited enhanced anticancer activity against both A549 and H1299 cells.

## CONFLICTS OF INTEREST STATEMENT

The authors state that they have no competing interests.