

# ANALYSIS OF IN VITRO GENOTOXICITY OF VARIOUS SIZE AND SHAPE GOLD NANOPARTICLES IN HUMAN HEPATOMA CELL LINE (HepG2)

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Gold nanoparticles possess unique physical and chemical properties that can be modified for specific applications in various fields — from biotechnology to medicine [1]. They are especially promising in the development of therapeutic treatments and drug delivery systems [2].

However, as their use in medicine, science, and industry continues to grow, it becomes increasingly important to thoroughly assess the potential impact of nanoparticles on human health and the environment, with particular attention to their safety.

To determine the potential negative effects of gold nanoparticles in a human hepatoma cell line (HepG2), we assessed their cytotoxicity using a mixture of acridine orange and ethidium bromide. Genotoxicity was studied using alkaline and enzyme-modified comet assays. Gold nanospheres of 5 nm and 40 nm did not induce cytotoxic effects in HepG2 cells, indicating maintained cell viability. In contrast, exposure to 10 nm gold nanorods reduced cell viability by 76–98%, indicating cytotoxicity. Overall, treatment with 5 nm and 40 nm gold nanospheres did not significantly alter DNA damage levels in HepG2 cells, although a statistically significant reduction in DNA damage was observed at 2 µg/mL for 5 nm nanospheres and at 1.5–2 µg/mL for 40 nm nanospheres.

Overall, the results indicate that gold nanoparticle cytotoxicity depends on particle shape, with gold nanospheres demonstrating better biocompatibility than nanorods, making them promising for biomedical use and underscoring the need for further investigation of gold nanorod toxicity.

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[1] M. A. Beach et al., "Polymeric nanoparticles for drug delivery," *Chemical Reviews*, vol. 124, no. 9, pp. 5505–5616, Apr. 2024, doi: 10.1021/acs.chemrev.3c00705.

[2] D. Mundekkad and W. C. Cho, "Nanoparticles in clinical translation for cancer therapy," *International Journal of Molecular Sciences*, vol. 23, no. 3, p. 1685, Feb. 2022, doi: 10.3390/ijms23031685.