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Surface chemistry driven selective anticancer potential of functional silver nanoparticles toward lung cancer cells

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Highlights

- Curcumin and isonicotinic acid hydrazide surface functionalized silver (Ag) nanoparticles are synthesized.
- Functional Ag nanoparticles exhibit anticancer potential by apoptosis, and antioxidant ability toward fibroblasts.
- Involvement of mitochondria in exerting ROS-mediated apoptosis is revealed for enhanced anti-cancerous efficacy.
- The study has potential to open new avenues for tailor-made surface chemistry driven nanomedicine development.

Abstract

Decades of nanomedicine research has demonstrated the importance of physicochemical properties to tightly regulate cytotoxicity of nanoparticles. Wherein, the tailor-made surface corona of nanoparticles may dictate nano-bio interfacial interactions toward therapeutic benefits without any significant nanotoxicity. Therefore, in the current research, selective anticancer effects originating from the specific surface chemistry of silver nanoparticles (AgNPs) is demonstrated employing lung cells. The AgNPs are synthesized by bioactive curcumin (Cur) to form a stable corona around AgNPs, and further surface functionalized with an antibiotic isonicotinic acid hydrazide (INH, isoniazid). These NPs were subjected to various structural and spectroscopy analysis for deeper understanding of the surface chemistry, followed by the anticancer potential assessment on LK-2 lung cancer cells. The higher production of reactive oxygen species (ROS) was responsible for therapeutic effects on LK-2 cells. The TUNEL and apoptotic dye studies revealed and confirmed the role of apoptosis in the ROS-mediated selective death of lung cancer cells over human foetus lung diploid fibroblasts (WI-38). Furthermore, the involvement of mitochondria in mediating the effects of AgNP's toxicity is demonstrated. The study provides a deeper understanding regarding the mechanism of anti-cancer actions of the formulated functional AgNPs, and it has potential to open new avenues for tailor-made surfaces chemistry driven nanomedicine development.

Graphical Abstract