

Plumbagin functionalized silver nanoparticles for potential antimicrobial

applications

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Plumbago indica L. called “Rathnitul” in Sinhala is a medicinal plant belonging to the family Plumbaginaceae that is extensively used in the traditional system of medicine in Sri Lanka. Plumbagin is a naturally occurring hydroxynaphthoquinone which is predominantly found in the roots of *Plumbago indica* L. Plumbagin has been proven to possess remarkable pharmacological properties which include antimicrobial, anticancer, anti-inflammatory, antioxidant, and antiparasitic properties. However, high volatility, poor oxidative stability, poor bioavailability, less target specificity and high toxicity of plumbagin have limited its use in therapeutic applications. In recent years, enormous attention has been drawn towards the functionalization of natural products. Thus, the functionalization of plumbagin with an appropriate nanomaterial is a promising strategy to overcome the problems associated with plumbagin when used alone, and to enhance the therapeutic potential of plumbagin in its use for therapeutic applications. Silver nanoparticles (AgNPs) have garnered significant interest of the scientific community for synthesis of “hybrid drug molecules” as they act as good nanocarriers of the drugs leading to targeted drug delivery. Furthermore, the unique physical, chemical, optical and biological properties of AgNPs have made them excellent candidates in biomedical applications as antimicrobial and anticancer agents.

Here, we report a preliminary study conducted to synthesize plumbagin functionalized AgNPs to be used in antimicrobial applications. In this study plumbagin was extracted from the roots of *Plumbago indica* and crude plumbagin was purified by recrystallization.¹ The identity and purity of plumbagin were confirmed by GC/MS, FT-IR and UV-Vis spectra. AgNPs were synthesized by reduction of silver nitrate with hydroxylamine hydrochloride following the Leopold-Lendl method.² Synthesized AgNPs gave rise to the characteristic surface

plasmon resonance (SPR) absorption peak at 410 nm in the UV-Vis spectrum. Vortex mixing of AgNPs with plumbagin in 1: 2×10⁵ molar ratio at 1600 rpm for 2 hours at room temperature led to the successful functionalization of AgNPs with plumbagin, resulting a significant difference in the UV-Vis and FT-IR spectra. Since both materials possess notable antimicrobial properties, an enhanced antimicrobial potential is expected from plumbagin functionalized AgNPs due to the synergistic effect. Investigation of the antimicrobial potential of plumbagin functionalized AgNPs is currently in progress.

Keywords

Plumbagin, Silver nanoparticles, Functionalization, Antimicrobial