

PEGylated Curcumin with Gold Nanoparticles: Antimicrobial Agent Evaluation

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Extended Abstract

Curcumin is a polyphenol derived from the *Curcuma Longa* plant. Curcumin exhibits a variety of therapeutic properties, including antioxidant, analgesic, anti-inflammatory, anticancer and antiseptic activities [1].

Curcumin acts as photosensitizer in photodynamic therapy (PDT), which is an alternative way to kill pathogenic microorganisms [2]. The use of gold nanoparticles (AuNPs) as the vehicle for curcumin delivery increases photodynamic ability [3]. Therefore, the present study aim is to investigate the effect of the photodynamic action of LED-activated curcumin gold nanoparticles, on cell viability of *Staphylococcus aureus*, *Staphylococcus aureus* (*Sa*), *Staphylococcus epidermidis* (*Se*), *Pseudomonas aeruginosa* (*Pa*), *Escherichia coli* (*Ec*), *Citrobacter freundii* (*Cf*) and *Klebsiella pneumoniae* (*Kp*).

To prepare Curcumin gold nanoparticles (Curc:AuNPs) solutions, 3.2 mg of H₂AuCl₄ was mixed with 1.5 mg Curcumin and Polyethylene glycol (PEG) in Milli-Q water. This solution was exposed to light from a mercury metal halide lamp. The resulting solutions were characterized by UV-Vis and transmission electron microscopy (TEM). The in vitro antibacterial activity of Curc:AuNPs was evaluated against *Sa*, *Se*, *Pa*, *Ec*, *Cf* and *Kp* using the minimum inhibitory concentration (MIC) test. The effects of exposure to yellow LED light with ~38 J/cm² fluence and variations in the Curc:AuNPs concentrations (50, 75 and 100% dilutions) were studied.

The presence of a surface plasmon resonance band at ~520 nm indicated the formation of spherical gold nanoparticles. In the presence of PEG, the solution color changed some minutes after the mixing of reagents, and solution size homogeneity was improved with the mercury metal halide lamp illumination. TEM analyses showed ~17±2 nm nanoparticles. The results indicate that PDT with curcumin gold nanoparticles strongly inhibits the development of Gram positive and Gram negative bacteria. This study revealed antibacterial probability of inhibition >80% with 32 mM of Curc:AuNPs and light against *Sa*, *Se*, *Cf* and *Kp* strains after 18 hours of incubation. NOVA/Tukey's tests were conducted to compare groups curcumin/Curc:AuNPs, with and without photodynamic excitation.

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References

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