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J Nanomed Nanotechnol 2017, 8:6 (Suppl)
DOI: 10.4172/2157-7439-C1-056

Plasmonic photothermal inactivation of Escherichia coli and Bacillus cereus using polymer coated gold nanoparticle

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The fast-growing nanotechnology provides every day new types of materials to fulfill the biomedical needs. Whereas, infections caused by pathogenic multidrug-resistant bacteria becomes one of the most worrying problems that the human health and economy suffer from. What makes the developing of new effective alternatives to classical antibiotics an urgent need? Nanotechnology has generated a novel class of photothermally sensitized agents; gold nanoparticles (AuNPs). Depending on the phenomenon of surface Plasmon resonance of noble metal nanoscale particles, new therapy has been established called Plasmonic Photothermal Therapy (PPTT). PPTT has attracted new interest in cancer therapy and also against microbes. The current research aims to assess the PPTT of AuNPs against Gram-negative *Escherichia coli* (E. coli) and Gram-positive *Bacillus cereus (B. cereus)* bacteria. Different concentrations of AuNPs capped with different polymers (polyvinyl alcohol (AuNPs -PVA) or Polyvinylpyrrolidone (AuNPs -PVP) were applied on *E. coli* and *B. cereus* in dark and under the irradiation of several doses of the light emitting diode (LED 530 nm). Results showed that the maximum antibacterial effect occurred at ten µM of AuNPs-PVP in the presence of 0.9 J/cm^2 of LED. Finally, it was concluded that PPTT with gold nanoparticles considered as an effective method for bacterial eradication as AuNPs induce hyperthermia in the surrounding environment of bacteria upon irradiation, which causes cell damage. Also, the capping material of AuNPs plays an important role in its biological effect.

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