Acta Scientific Biotechnology (ASBT)

Volume 1 Issue 2 February 2020

Editorial

Gold Nanoparticles: Chemistry and Antimicrobial Potentials

Debajit Borah*

Department of Biotechnology, The Assam Royal Global University, India

***Corresponding Author:** Debajit Borah, Department of Biotechnology, The Assam Royal Global University, India.

Received: December 30, 2019

Published: January 01, 2020

Gold nanoparticles (Au NPs) are inert in nature just as metallic gold whose atomic weight is 79 kDa. Au NPs owing to its chemical, physical and optical properties with a rich history since ancient times and an intense future in the field of biological and chemical sciences quenching the solution for medicinal problems as catalyst, cell markers, drug delivery tools etc. [1].

Gold nanoparticles appear in ruby red color due to a phenomenon called Surface Plasmon Resonance, which was first explained by Mie by solving Maxwell equations [2]. The surface plasmon resonance is due to the resonance of incoming light with the surface electrons of nanoparticles that reflects light at the visible spectrum of wavelength of around 520 nm. The surface plasmon resonance is not effective in nanoparticles of size less than 2 nm due to the quantum size effect [3]. Gold nanoparticles of different shapes such as spherical, oblong, rod etc., can be synthesized by altering the method of preparation and parameters. Concentrations of reagents, temperature, pH, pressure, time of reaction are some of the important parameters, which need to be controlled for the synthesis of gold nanoparticles [4].

Gold nanoparticles are exploited for their unique optical, physical and chemical properties for regulation of gene, conjugating, loading, unloading, imaging, sensing and transporting the biologicals and pharmaceuticals [5]. The biocompatibility and high potential gold nanoparticles (Au NPs) have attracted much more attention as they are inert and non-toxic and secondly due to their ease of synthesis; mono-disperse nanoparticles can be formed with core sizes ranging from 1 to 100 nm [3]. Moreover, their photo-physical properties could trigger drug release at remote place [3]. Interaction of Au NPs with thiols, provides an effective and selective means of controlled intracellular release [3]. Thus Au NPs in biology and medicine plays an important role due to its strong scattering, absorption, tunable surface plasmon resonance (SPR), easy surface functionalization, facile synthesis methods, and low toxicity.

The rise of multidrug resistant (MDR) Gram-negative pathogens is a significant clinical problem. Apart from the acquisition of acquired resistance traits, such as transposons and plasmids encoding proteins that inactivate antibiotics, many of these organisms have increased resistance resulting from mutations by altering the expression of antibiotic resistant genes present in the bacteria [6]. One of the major contributors to intrinsic resistance in Gram-negative bacteria is the efflux pump of the Resistance-Nodulation-Division (RND) family efflux in Gram-negative bacteria, which extrude a broad spectrum of antibiotics and biocides [7]. Such resistance against antibiotics and also their ability to form biofim makes it very difficult to eradicate infectious diseases [8]. In a biofilm, self-formed extracellular matrix which is popularly known as slime encapsulates the bacterial cells. This slime consists of proteins, polysaccharides and a large amount of water. The slime has elastic characteristics, hence as a consequence is resistant to fluid flow [9]. During stress condition, cells can be released from the extracellular matrix and can revert back to their planktonic form can adhere to another surface and forms a new biofilm [9]. Among the most effective ways to prevent biofilm formation is to interfere with the adhesion of planktonic cells on the surface, which is a crucial step of colonization [10]. Therefore, antimicrobial research with the help of nanoparticles is under progress to find effective solution for biofilm reduction. In short, the antimicrobial potential of Au NPs is enormous and is yet to be explored largely in various directions.

Bibliography

1. Giljohann DA., *et al*. "Gold Nanoparticles for Biology and Medicine". *Angewandte Chemie* 49 (2010): 3280-3294.
2. Haiss W., *et al*. "Determination of Size and Concentration of Gold Nanoparticles from UV-Vis Spectra". *Annals of Chemistry* 79 (2007): 4215-4221.
3. Ghosh S., *et al*. "Gnidia glauca flower extract mediated synthesis of gold nanoparticles and evaluation of its chemocatalytic potential". *Journal of Nanobiotechnology* 10 (2012): 17.
4. Das SK and Marsili E. "Bioinspired Metal Nanoparticle: Synthesis, Properties and Application". Nanomaterials. InTech (2011).
5. Rosi NL., *et al*. "Oligonucleotide-Modified Gold Nanoparticles for Intracellular Gene Regulation". *Science* (2016): 1027-1030.
6. Nikaido H and Pages JM. "Broad-specificity efflux pumps and their role in multidrug resistance of Gram-negative bacteria". *FEMS Microbiology Review* (2012): 340-363.
7. Opperman TJ and Nguyen ST. "Recent advances toward a molecular mechanism of efflux pump inhibition". *Frontiers in Microbiology* 6 (2015): 421.

8. Ce´ sar de la Fuente-Nu´ n˜ ez., *et al.* "Bacterial biofilm development as a multicellular adaptation: antibiotic resistance and new therapeutic strategies". *Current Opinion in Microbiology* 16 (2013): 580-589.

9. Harrison JJ., *et al*. "High-throughput metal susceptibility testing of microbial biofilms". *BMC Microbiology* 5 (2005): 53.

10. Kostakioti M., *et al*. "Bacterial Biofilms: Development, Dispersal, and Therapeutic Strategies in the Dawn of the Post-antibiotic Era". *Cold Spring Harbor Perspectives in Medicine* 3 (2013): a010306.