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COMBINED EFFECT OF 830 NM LASER IRRADIATION AND SILVER NANOPARTICLES IN WS1 WOUNDED CELLS

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In recent years, silver nanoparticles (AgNPs) have attracted significant attention in medicinal, biomedical and pharmaceutical research owing to their valuable physicochemical and antibacterial properties. The objective of this study was to prepare, characterize and evaluate the potential of green synthesized silver nanoparticles (G-AgNPs) against human pathogenic bacteria and evaluate their cellular responses in WS1 wounded cells in combination with laser irradiation (830 nm, fluence of 5 J/cm²). When the mixture of silver nitrate solution and leaf sap extract (LSE) was exposed to direct sunlight, it yielded a rapid color change from colorless to reddish-brown, indicating the formation of G-AgNPs. Physicochemical characterization such as single particle inductively coupled plasma mass spectrometry, high resolution transmission electron microscopy and surface chemistry studies (Fourier transform infrared spectroscopy and x-ray diffraction) revealed a small size of 38±2 nm, smooth surface and existence of LSE on the G-AgNPs. G-AgNPs possessed good antibacterial activity against both *Pseudomonas aeruginosa* and *Staphylococcus aureus*. *In vitro* wound healing studies such as cell morphology, cell migration, cell proliferation, cell apoptosis and nuclear morphology studies were investigated in WS1 cells. Overall, these results suggest that the use of G-AgNPs and in combination with laser shows great potential to heal wounds in *in vitro*, and this combined therapy did not show any toxicity to the cells. Thus, the present study reveals that the novel G-AgNPs demonstrated effective antibacterial properties against both gram-negative and gram-positive bacterial strains, and G-AgNPs in combination with photobiomodulation showed excellent wound healing properties in WS1 cells.

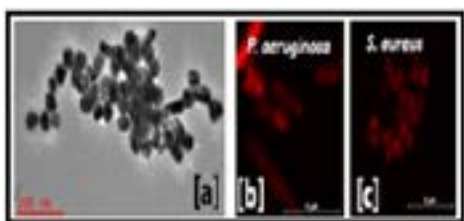


Figure 1: [a] HRTEM image of G-AgNPs, [b] and [c] confocal image of G-AgNPs treated *Pseudomonas aeruginosa* and *Staphylococcus aureus*.

Recent Publications

1. D Sathish Sundar, N N Houreld, E M Kroukamp and H Abrahamse (2017) Cellular imaging and bactericidal mechanism of green-synthesized silver nanoparticles against human pathogenic bacteria. *Journal of Photochemistry and Photobiology B: Biology* DOI: 10.1016/j.jphotobiol.2017.11.001.
2. Sathish Sundar Dhilip Kumar, Gover Antoniraj, Senthil Kumar, Shyam Mohapatra, Nicolette Houreld and Ruckmani Kandasamy (2016) Recent trends of biocompatible and biodegradable nanoparticles in drug delivery: A review. *Current Medicinal Chemistry* 23:3730-3751.
3. C Senthil Kumar, M D Raja, D Sathish Sundar, M Gover Antoniraj and K Ruckmani (2015) Hyaluronic acid co-functionalized gold nanoparticle complex for the targeted delivery of metformin in the treatment of liver cancer (HepG2 cells). *Carbohydrate Polymers* 128:63-74.
4. D Sathish Sundar, M Surianarayanan, R Vijayaraghavan, A B Mandal and D R MacFarlane (2014) Curcumin loaded poly(2-hydroxyethylmethacrylate) nanoparticles from gelled ionic liquid – *In vitro* cytotoxicity and anti-cancer in SKOV-3 cells. *European Journal of Pharmaceutical Sciences* 51:34-44.
5. D Sathish Sundar, A Mahesh, M Surianarayanan and A B Mandal (2014) Synthesis and characterization of curcumin loaded polymer/lipid based nanoparticles and evaluation of their antitumor effects on MCF-7 cells. *Biochimica et Biophysica Acta* 1840(6):1913-1922.

Emerging Trends in Materials Science and Nanotechnology

Biography

Sathish Sundar Dhilip Kumar has completed his BSc degree in Botany from Bharathidasan University, India; MSc degree in Biotechnology from Bharathidasan University, India; and PhD in Nanobiotechnology from Anna University, India. He is currently working as a Claude Leon sponsored Postdoctoral Researcher in the Laser Research Centre, Faculty of Health Sciences, University of Johannesburg, South Africa. His field of research is mainly focused on preparation and characterization of nanoparticles and their applications in

biological sciences. He has published 10 research articles including one review paper in accredited international journal with a Google scholar H-index of seven, i10-index three with the overall citations of 127 and Research Gate score of 16.90 and one book chapter. He also acted as a Reviewer for *Drug Delivery, Informa Healthcare, Process Biochemistry, Elsevier, and Pharmaceutical Biology, Taylor and Francis Online*.

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