Contribution ID: **80** Type: **Oral Presentation**

Evaluation of the Phototoxic effect of Chemically Synthesized Silver Nanoparticles on Breast Cancer Cells

Thursday 10 July 2025 10:50 (20 minutes)

Silver nanoparticles (AgNPs) have attracted considerable interest in cancer therapy, whereby their cytotoxicity is largely associated with the production of reactive oxygen species (ROS), as well as interfering with cancer cell energy metabolism and multidrug resistance. Other than their inherent cytotoxic potential, AgNPs have advanced significantly as carriers for drug delivery, improving the stability and targeting efficiency and cancer diagnosis. Further, the ability of AgNPs to convert absorbed light into heat, thus effectively inducing localized hyperthermia to selectively target and destroy cancer cells attributed to their photothermal efficacy. This study investigates the cytotoxic and phototoxic efficacy of chemically synthesized AgNPs in the MCF-7 breast cancer cell line. The AgNPs were synthesized via chemical reduction and characterized using ultraviolet-visible spectroscopy, Zetasizer, and dynamic light scattering. MTT assay was conducted to evaluate the cell viability percentage with or without light irradiation at 5 J/cm2 with 405 nm blue light Diode Laser. Furthermore, the AgNPs-induced cell death was visualized with Bright Field Microscopy. The photothermal induced temperature increase of AgNP solution was measured with a Thermal Camera.

The UV-Vis spectra confirmed the formation of AgNPs with a characteristic surface plasmon resonance (SPR) band between 300 nm and 600 nm, with a maximum absorption peak observed at 402 nm. Further physicochemical analysis revealed an average hydrodynamic diameter of 119.3 dnm, a zeta potential of −30.8 mV, and a polydispersity index (PDI) of 0.269 at pH 7.65, indicating suitable size distribution, surface charge, and colloidal stability under physiological conditions. A dose-dependent cytotoxic response was observed across treated groups. At 5 µg/mL, MCF-7 cells exhibited 64.4% viability in the absence of irradiation, while exposure to 405 nm laser resulted in a reduced viability of 50.1%, demonstrating enhanced cytotoxicity following photoactivation. Without AgNP treatment, laser exposure alone produced a negligible ~1℃ temperature increase. In contrast, AgNP-treated samples displayed a 3℃ increase over 120 seconds of irradiation, confirming the nanoparticles' photothermal conversion capability. The observed enhancement in cytotoxicity upon irradiation suggests a localized hyperthermic effect accompanied by plasmon-mediated generation of ROS. These findings support the contribution of both photothermal and photodynamic processes to the overall phototoxic efficacy of the AgNPs.

These results collectively demonstrate that AgNPs facilitate enhanced cancer cell death through the integration of photothermal and photodynamic mechanisms, supporting their potential application as photoresponsive agents in targeted cancer therapy.

Apply for student award at which level:

MSc

Consent on use of personal information: Abstract Submission

Yes, I ACCEPT

Primary author: BAIDOO, Isaac (University of Johannesburg)

Co-authors: Prof. GEORGE, Blassan P (University of Johannesburg); Dr SARBADIKHARY, Paromita (University of Johannesburg)

Presenter: BAIDOO, Isaac (University of Johannesburg)

Session Classification: Photonics

Track Classification: Track C - Photonics