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## Light-emitting diodes: As external stimulus for plant-mediated biosynthesis and biological activities of silver nanoparticles

Sumaira Anjum

Kinnaird College for Women, Pakistan.

The trend of using biological entities particularly plant extracts for nanoparticles (NPs) synthesis has expedited in recent years due to environmental safety, cost effectiveness, simplicity and sustainability of green route. Moreover, the morphology of NPs could be fine-tuned by applying abiotic factors such as LEDs which enhance the bio-reduction of precursor salt and excites phytochemicals during the green synthesis. Given this, in present study the green synthesis of AgNPs was carried out using by *Dalbergia sissoo* leaves extract under the illumination of red, green, blue, yellow and white LEDs. Phytochemical analysis revealed that *D. sissoo* was enriched with phenolic ( $23.6 \pm 0.76$  mg GAE/g DW) as well as flavonoids content ( $1.65 \pm 0.01$  mg QE/g DW) which attributed to high FRSA ( $80.84 \pm 0.87$  %). The phytochemical profile reflected upon the effective synthesis of AgNPs as alcohols and phenols were mainly involved in capping and bio-reduction revealed from FTIR analysis. Moreover, XRD analysis showed face center cubic crystalline nature of AgNPs with interesting finding that LEDs helped in reducing the size of AgNPs significantly. Y-DS-AgNPs (34.63 nm) being smallest in size as compared to control (87.35 nm). LEDs not only reduced the size of AgNPs but SEM analysis showed synthesis of non-agglomerated differently shaped AgNPs including spherical, triangular, hexagonal as compared to mixed shape control AgNPs. These green biocompatible AgNPs showed extraordinary therapeutic potential specially B-DS-AgNPs resulted in highest anti-oxidant (FRAP  $485.6 \pm 9.6$   $\mu$ M TEAC; CUPRAC  $588.1 \pm 8.4$   $\mu$ M TEAC; ABTS  $323.4 \pm 10.4$   $\mu$ M and ORAC  $469.2 \pm 11.3$   $\mu$ M TEAC), anti-glycation ( $63.3 \pm 2$  % and  $33.1 \pm 3$  % inhibition of vesper lysine-like AGEs and pentosidine-like AGEs) as well as anti-bacterial activities. While Y-DS-AgNPs effectively inhibited HepG2 cells growth (cell viability  $26.01 \pm 1.56$  %) by inducing intracellular ROS/RNS generation ( $3807.62 \pm 236.63$

relative DHR-123 fluorescence), disrupting mitochondrial membrane potential ( $1839.29 \pm 162.45$  RFU) via caspase-3 gene activation ( $419.15 \pm 106.51$  log 2-fold change) and enhanced caspase-3/7 activity ( $137.26 \pm 41.13$  RFU/mg protein). Lastly, these NPs showed mild toxicity towards brine shrimp and caused moderate hRBCs hemolysis, showing their biosafe nature which can be enhanced at lower concentrations. Here we conclude that external factors such as LEDs are effective in controlling the morphology of AgNPs which reflects upon their enhanced biological efficacy.

### Recent Publications

1. Sumaira Anjum, Mariam Hashim, Sara Asad Malik, Maha Khan, José M Lorenzo, Bilal Haider Abbasi, Christophe Hano. Recent Advances in Zinc Oxide Nanoparticles (ZnO NPs) for Cancer Diagnosis, Target Drug Delivery and Treatment. *Cancers*. 2021; 13(18): 4570
2. Amna Komal Khan, Sidra Kousar, Duangjai Ununium, Christophe Hano, Bilal Haider Abbasi, Sumaira Anjum. Nano Elicitation as an Effective and Emerging Strategy for In Vitro Production of Industrially Important Flavonoids. *Applied Sciences*. 2021; 11(4): 1694
3. Faryal Saeed, Muhammad Younas, Hina Fazal, Sadaf Mushtaq, Faiz Ur Rahman, Muzammil Shah, Sumaira Anjum, Nisar Ahmad, Mohammad Ali, Christophe Hano, Bilal Haider Abbasi. Green and chemically synthesized zinc oxide nanoparticles: effects on in-vitro seedlings and callus cultures of *Silybum marianum* and evaluation of their in-vitro activities. *Artificial cell Nanomedicine and Biotechnology*. 2021; 29(1):450-460.

### Speaker Biography

Sumaira Anjum has her expertise in synthesis and biomedical applications of Nanoparticles. She has synthesized a large variety of metallic and metal oxide nanoparticles and evaluate their activities for treatment of various diseases. She is having published many papers in International Journals regarding the Nanotechnology and Nanomedicines.

e: Sumaira.anjum@kinnaird.edu.pk