

Freshwater Cyanobacterial Bioactive Insights: *Planktothricoides raciorskii* Compounds vs. Green Synthesized Silver Nanoparticles: Characterization, in vitro Cytotoxicity, and Antibacterial Exploration

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Abstract : Introduction: New compounds and possible uses for the bioactive substances produced by freshwater cyanobacteria are constantly being discovered through research. Certain molecules are hazardous to the environment and human health, but others have potential applications in industry, biotechnology, and pharmaceuticals. These discoveries advance our knowledge of the varied functions these microbes perform in different ecosystems. Cyanobacterial silver nanoparticles (AgNPs) have special qualities and possible therapeutic advantages, which make them very promising for a range of medicinal uses. Aim: In our study; the attention was focused on the analysis and characterization of bioactive compounds extracted from freshwater cyanobacteria *Planktothricoides raciorskii* and its comparative study on Cyanobacteria-mediated silver nanoparticles synthesized by cell-free extract of *Planktothricoides raciorskii*. Material and Methods: A variety of bioactive secondary metabolites have been extracted, purified, and identified from cyanobacterial species using column chromatography, FTIR, and GC-MS/MS chromatography techniques and evaluated for antibacterial and cytotoxic studies, where the Cyanobacterial silver nanoparticles (CSNPs) were characterized by UV-Vis spectroscopy, scanning electron microscopy (SEM), transmission electron microscopy (TEM), and Fourier transform infrared (FTIR) analysis and were further tested for antibacterial and cytotoxic efficiency. Results: The synthesis of CSNPs was confirmed through visible color change and shift of peaks at 430-445 nm by UV-Vis spectroscopy. The size of CSNPs was between 22 and 34 nm and oval-shaped which were confirmed by SEM and TEM analyses. The FTIR spectra showed a new peak at the range of 3,400-3,460 cm^{-1} compared to the control, confirming the reduction of silver nitrate. The antibacterial activity of both crude bioactive compound extract and CSNPs showed remarkable activity with Zone of inhibition against *E. coli* with 9.5mm and 10.2mm, 13mm and 14.5mm against *S. paratyphi*, 9.2mm and 9.8mm zone of inhibition against *K. pneumonia* by both crude extract and CSNPs, respectively. The cytotoxicity as evaluated by extracts of *Planktothricoides raciorskii* against MCF7-Human Breast Adenocarcinoma cell line and HepG2- Human Hepatocellular Carcinoma cell line employing MTT assay gave IC50 value of 47.18ug/ml, 110.81ug/ml against MCF7cell line and HepG2 cell line, respectively. The cytotoxic evaluation of *Planktothricoides raciorskii* CSNPs against the MCF7cell line was 43.37 ug/ml and 20.88 ug/ml against the HepG2 cell line. Our ongoing research in this field aims to uncover the full therapeutic potential of cyanobacterial silver nanoparticles and address any associated challenges.

Keywords : cyanobacteria, silvernanoparticles, pharmaceuticals, bioactive compounds, cytotoxic

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