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**Topic of the Research** : Biosynthesis, characterization and bioactivity of cyanobacterial Selenium nanoparticles

### Findings

In the present study, 20 cyanobacterial strains were screened for their ability to extra-cellularly synthesize SeNPs. The best-selected strain (*Arthrospira indica* SOSA-4) was further used for the optimization. Afterwards, the synthesized SeNPs were physicochemically characterized by UV spectroscopy, FTIR, XRD, Raman spectroscopy, SEM-EDX, TEM and AFM. In FTIR analysis of cell extract and SeNPs, different functional groups were found. GC-MS analysis showed 25 biochemical compounds belonging to different classes were found. XRD analysis showed amorphous nature. SEM-EDX showed spherical shape with an average size of 8.5 nm and 96 % of purity by weight. TEM and AFM analysis showed spherical shape with 9 nm and 8.7 nm of size respectively. DPPH, FRAP, SOR and ABTS assays showed significant antioxidant activities of SeNPs. The concentration-dependent manner antibacterial activity of SeNPs was observed by Disc diffusion assay, MIC study, growth curve assay and SEM analysis showed rough and wrinkled surfaces with cell distortion after SeNPs treatment. Anti-fungal activity was performed by the MIC, disc-diffusion method, growth curve and SEM against *C. albicans*, *C. glabrata* and *C. tropicalis*. The result was found in dose-dependent manner and SEM studies showed puckering and leakage of material. Anti-cancer activity by MTT assay showed significant anti-cancer activity of SeNPs against three cell lines (MCF-7, SiHa and SW480) by MTT assay, Trypan exclusion assay and FACS. Thus, it can be concluded that the synthesized *Arthrospira indica* SOSA-4 based SeNPs are biocompatible and eco-friendly so that can be used as a potential therapeutic (anti-oxidant, anti-microbial and anti-cancer) agent.