Nanochemistry and biotechnology
Bactericidal activity of silver nanoparticles synthesized from black elder fruit extract

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A green synthesis is an eco-friendly and inexpensive approach to generate silver nanoparticles (AgNPs). A number of approaches has been utilized for biogenic AgNPs synthesis from different biological materials. Among these, extracts from plants proved to be promising compared to other biogenic materials. AgNPs acquire unique properties to gain access into microbial cells and they show higher antibacterial potency than antibiotics. Therefore, they have been intensively studied to fight bacteria and represent a promising tool against antibiotic-resistant bacteria. In this study, we demonstrated a synthesis of AgNPs form black elder (*Sambucus nigra* L.) fruit extract (bio-AgNPs) and their bactericidal activity to five bacteria species (*Bacillus subtilis*, *B. thuringiensis*, *Pseudomonas aeruginosa*, *Mycobacterium smegmatis,* and *Micrococcus luteus*). The Kirby-Bauer's disk diffusion method was used for quantifying the ability to inhibit bacterial growth and to estimate minimum inhibitory concentration (MIC). In negative control, distilled water and fruit extract were applied and in positive control, $AgNO_3$ and AgNPs prepared by chemical reduction method (trisodium citrate) were included (chem-AgNPs). Dose-dependent (32, 64, 128, 256 and 512ppm) bioassays showed an inhibitory effect potency against all bacteria, but it varied among species, Ag sources and concentrations. The effect increased with increasing concentrations. Bio-AgNPs and $AgNO_3$ showed inhibitory effects for all bacteria and concentrations. Chem-AgNPs had no effect to *B. subtilis* and *M. smegmatis* and their activity was usually lower ($P<0.05$) than bio-AgNPs or $AgNO_3$. Inhibition of growth by bio-AgNPs was higher ($P<0.05$) (*P. aeruginosa* and *M. luteus*), or lower ($P<0.05$) (*M. smegmatis* and *B. thuringiensis*) than $AgNO_3$. MIC ranged from 4.70 to 46.94ppm. In case of *P. aeruginosa* and *M. luteus*, MIC was lowest for bio-AgNPs (17.44 and 15.91ppm, resp.) and for *B. subtilis*, *M. smegmatis* and *B. thuringiensis* it was lowest for $AgNO_3$ (8.12, 8.14 and 4.70ppm, resp.).