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Antimicrobial and Antifungal Activities of Silver Nanoparticles Biosynthesized by *Pothos scandens* and *Kaempferia galanga* Aqueous Extracts

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In order to alleviate the clinical challenges associated with antibiotic use, there is an immediate need for innovative solutions. Utilizing nanotechnology-based antimicrobials represents a promising approach to enhance the effectiveness of natural products. Ayurvedic medicine has long relied on the utilization of *Pothos scandens* (family: Araceae, common name: climbing aroid, Sinhala name: Pota Wal, Tamil name: Annaparuva) and *Kaempferia galanga* (family: Araceae, common name: aromatic ginger, Sinhala name: Inguru Piyali, Tamil name: Kacholum). Leaves, barks, and gums of *Kaempferia galanga* are used to address a variety of microbial-related ailments. The objective of this study was to biosynthesize of PS-AgNPs and KG-AgNPs and conduct *in vitro* screening for antimicrobial properties. *Pothos scandens* bark pieces (10 g) and *Kaempferia galanga* rhizome (100 mg) derived aqueous crude extracts (PSA and KGA) was prepared under sonication (44 kHz, 40 ºC, 30 min). PSA and KGA coated AgNPs (PS-AgNPs and KG-AgNPs) were biosynthesized under different conditions i.e., homogenization, magnetic stirring, exposure to UV or sun light with loading different concentrations (2.5, 5, 7.5 mg/mL). Antimicrobial properties of crude extracts, PS-AgNPs and KG-AgNPs and uncoated AgNPs (U-AgNPs) were screened *in vitro* (1 mg/per well) in triplicate, using agar well-diffusion method against standard microbial and fungal strains *Staphylococcus aureus* (ATCC 25923), *Escherichia coli* (ATCC 25922), *Pseudomonas aeruginosa* (ATCC 27853) and *Candida albicans* (ATCC 90028). Gentamicin (intravenous solution at 40 mg/mL diluted to 0.4 mg/mL), 10 µg per well was used as the positive control against microbes and fluconazole (intravenous solution at 2 mg/mL diluted to 1 mg/mL), 25 µg per well was used as the positive control against fungal cultures. AgNPs were characterized using size distribution data, polydispersity index (PDI), zeta potential, FTIR, AFM and SEM imaging. SEM and AFM imaging revealed the presence of spherical PS-AgNPs and KG-AgNPs with size ranges 50–300 nm. Inhibition zone diameter (IZD) of PS-AgNPs against *S. aureus* was 15±0.816 mm, while it was zero for PSA. IZD for KG-AgNPs against *S. aureus* was 13±0.816 mm, while it was zero for KGA. PS-AgNPs (11±0 mm) showed antimicrobial activities against *P. aeruginosa* and against KG-AgNPs (15±0.816 mm) while it was zero for both PSA and KGA. IZD for PS-AgNPs and KG-AgNPs against *C. albicans* were 14±3.741 mm and 16±1.632 mm while it was zero for both PSA and KGA. PS-AgNPs, PSA, KG-AgNPs and KGA did not exert any bioactivity against *E. coli* and U-AgNPs did not exert any bioactivity against the three microbial strains. The present study revealed that the novel PS-AgNPs and KG-AgNPs formulation is a promising antimicrobial agent against *P. aeruginosa* and *S. aureus*.

Keywords:
nanotechnology-based antimicrobials, ayurvedic medicine, biosynthesize, *Pothos scandens, Kaempferia galanga* rhizome

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