

Biosynthesis of silver and zinc oxide nanoparticles from *Plectranthus zeylanicus* for the development of antimicrobial formulations

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With the emergence of microbial resistance to currently employed antimicrobial agents, the recent trend is to search for novel antimicrobial substances from nature. The traditional applications of plants and plant based products as well as metals and metalloids suggest the potential of these sources for the discovery of new antimicrobial compounds with diverse chemical structures and novel mechanisms of action. Moreover, it is reasonable to hypothesize that the metal nano-preparations produced from these plant extracts could offer highly potent antimicrobial properties due to the synergistic effect of the plant extract and the metal nanoparticles. Thus the aims of the present investigation are to evaluate the antimicrobial potential of pharmacologically underexplored *Plectranthus zeylanicus* (Iruveriya), a plant claimed as an antimicrobial remedy in traditional medicine and the green synthesis of silver and zinc oxide nanoparticles as effective herbal disinfectants. The antimicrobial activity of the *n*-hexane, dichloromethane, ethyl acetate and methanol extracts of *P. zeylanicus* was determined by disc diffusion and broth microdilution methods against *Enterococcus faecalis*, *Staphylococcus aureus* and *Staphylococcus saprophyticus*. The dichloromethane extract displayed a MIC value of 31.25 µg/mL against *S. saprophyticus* and *S. aureus* while a MIC of 250 µg/mL against *E. faecalis*. Therefore this potent extract was then utilized for the green synthesis of silver and zinc oxide nanoparticles by treating with AgNO₃ and ZnSO₄ aqueous solutions respectively. The formation of metal nanoparticles was monitored by the measurement of the absorbance of the reaction mixture within the range of 200-600 nm using an ultraviolet-visible spectrophotometer at different time intervals for a period of three days. The silver nano-preparation displayed high absorbance in the range of 240-260 nm and 420- 440 nm and the absorbance of the reaction mixture increased with time. Similarly, the Zinc oxide nano-preparation has shown a high absorbance at 350-370 nm. Products of the green synthesis were evaporated in hot air oven. The scanning electron microscopy was employed to study the morphology of the nanoparticles. The antimicrobial potential of the nano-preparations will be studied in detail for the development of potent and eco-friendly herbal disinfectant/s.

Keywords: *Plectranthus zeylanicus*, Nanoparticles, Silver, Zinc oxide