World Academy of Science, Engineering and Technology
International Journal of Bioengineering and Life Sciences
Vol:18, No:09, 2024

Biosynthesis of Silver Nanoparticles Using Zataria multiflora Extract, and Study of Antibacterial Effects on UTI Bacteria (MDR)

Authors : Mohammad Hossein Pazandeh, Monir Doudi, Sona Rostampour Yasouri

Abstract : Irregular consumption of current antibiotic makes increases of antibiotic resistance between urin pathogens on all worlds. This study selected based on this great community problem. The aim of this study was the biosynthesis of silver nanoparticles from Zataria multiflora extract and then to investigate its antibacterial effect on gram-negative bacilli common in Urinary Tract Infections (UTI) and MDR. The plant used in the present research was Zataria multiflora whose extract was prepared through Soxhlet extraction method. Green synthesis condition of silver nanoparticles was investigated in terms of three parameters including the extract amount, concentration of silver nitrate salt, and temperature. The seizes of nanoparticles were determined by Zetasizer. In order to identify synthesized silver nanoparticles Transmission Electron Microscopy (TEM) and X-ray Diffraction (XRD) methods were used. For evaluating the antibacterial effects of nanoparticles synthesized through biological method different concentrations of silver nanoparticles were studied on 140 cases of Muliple Drug Resistance (MDR) bacteria strains Escherichia coli, Klebsiella pneumoniae, Enterobacter aerogenes, Proteus vulgaris,Citrobacter freundii, Acinetobacter bumanii and Pseudomonas aeruginosa, (each genus of bacteria, 20 samples), which all were MDR and cause urinary tract infections , for identification of bacteria were used of Polymerase Chain Reaction (PCR) test and laboratory methods (Agar well diffusion and Microdilution methods) to assess their sensitivity to Nanoparticles. The data were analyzed using SPSS software by nonparametric Kruskal-Wallis and Mann-Whitney tests. Significant results were found about the effects of silver nitrate concentration, different amounts of Zataria multiflora extract, and temperature on nanoparticles; that is, by increasing the concentration of silver nitrate, extract amount, and temperature, the sizes of synthesized nanoparticles declined. However, the effect of above mentioned factors on particles diffusion index was not significant. Based on the TEM results, particles were mainly spherical shape with a diameter range of 25 to 50 nm. The results of XRD Analysis indicated the formation of Nanostructures and Nanocrystals of silver.. The obtained results of antibacterial effects of different concentrations of silver nanoparticles on according to agar well diffusion and microdilution method, biologically synthesized nanoparticles showed 1000 mg /ml highest and lowest mean inhibition zone diameter in E.coli , Acinetobacter bumanii 23 and 15mm, respectively. MIC was observed for all of bacteria 125mg/ml and for Acinetobacter bumanii 250mg/ml.Comparing the growth inhibitory effect of chemically synthesized Nanoparticles and biologically synthesized Nanoparticles showed that in the chemical method the highest growth inhibition belonged to the concentration of 62.5 mg /ml. The inhibitory effect on the growth all of bacteria causes of urine infection and MDR was observed and by increasing silver ion concentration in Nanoparticles, antibacterial activity increased. Generally, the biological synthesis can be considered an efficient way not only in making Nanoparticles but also for having anti-bacterial properties. It is more biocompatible and may be possess less toxicity than the Nanoparticles synthesized chemically.

Keywords : biosynthesis, MDR bacteria, silver nanoparticles, UTI
Conference Title : ICBID 2024 : International Conference on Bacteriology and Infectious Diseases
Conference Location : Toronto, Canada
Conference Dates : September 19-20, 2024