

Biosynthesis of Silver Nanoparticles Using Zataria multiflora Extract, and Study of Their Antibacterial Effects on Negative Bacillus Bacteria Causing Urinary Tract Infection

Authors : F. Madani, M. Doudi, L. Rahimzadeh Torabi

Abstract : The irregular consumption of current antibiotics contributes to an escalation in antibiotic resistance among urinary pathogens on a global scale. The objective of this research was to investigate the process of biologically synthesized silver nanoparticles through the utilization of Zataria multiflora extract. Additionally, the study aimed to evaluate the efficacy of these synthesized nanoparticles in inhibiting the growth of multi-drug resistant negative bacillus bacteria, which commonly contribute to urinary tract infections. The botanical specimen utilized in the current research investigation was Z. multiflora, and its extract was produced employing the Soxhlet extraction technique. The study examined the green synthesis conditions of silver nanoparticles by considering three key parameters: the quantity of extract used, the concentration of silver nitrate salt, and the temperature. The particle dimensions were ascertained using the Zetasizer technique. In order to identify synthesized Silver nanoparticles TEM, XRD, and FTIR methods were used. For evaluating the antibacterial effects of nanoparticles synthesized through a biological method, different concentrations of silver nanoparticles were studied on 140 cases of Multiple drug resistance (MDR) bacteria strains Escherichia coli, Klebsiella pneumoniae, Enterobacter aerogenes, Proteus vulgaris, Citrobacter freundii, Acinetobacter humanii 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 PCR test and laboratory methods (Agar well diffusion and Microdilution methods) to assess their sensitivity to Nanoparticles. The data were subjected to analysis using the statistical software SPSS, specifically employing nonparametric Kruskal-Wallis and Mann-Whitney tests. This study yielded noteworthy findings regarding the impacts of varying concentrations of silver nitrate, different quantities of Z. multiflora extract, and levels of temperature on nanoparticles. Specifically, it was observed that an increase in the concentration of silver nitrate, extract amount, and temperature resulted in a reduction in the size of the nanoparticles synthesized. However, the impact of the aforementioned factors on the index of particle diffusion was found to be statistically non-significant. According to the transmission electron microscopy (TEM) findings, the particles exhibited predominantly spherical morphology, with a diameter spanning from 25 to 50 nanometers. Nanoparticles in the examined sample. Nanocrystals of silver. FTIR method illustrated that the spectrums of Z. multiflora and synthesized nanoparticles had clear peaks in the ranges of 1500-2000, and 3500 - 4000. 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, A. humanii 23 and 15mm, respectively. MIC was observed for all of bacteria 125 mg/ml and for A. humanii 250 mg/ml. Comparing the growth inhibitory effect of chemically synthesized the results obtained from the experiment indicated that both nanoparticles and biologically synthesized nanoparticles exhibit a notable growth inhibition effect. Specifically, the chemical method of synthesizing nanoparticles demonstrated the highest level of growth inhibition at a concentration of 62.5 mg/mL. The present study demonstrated an inhibitory effect on bacterial growth, facilitating the causative factors of urine infection and multidrug resistance (MDR).

Keywords : multiple drug resistance, negative bacillus bacteria, urine infection, Zataria multiflora

Conference Title : ICBSAATAR 2023 : International Conference on Broad-Spectrum Antibiotics, Antibiotic Therapy and Antimicrobial Resistance

Conference Location : Amsterdam, Netherlands

Conference Dates : November 06-07, 2023