The Study of Antibacterial Properties Nano-silver Colloid

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Nanotechnology has become one of the most practical technologies, because of unique physical and chemical properties of nanomaterials. In this study, antibacterial effect of silver nanoparticles with average size 45nm on Escherichia coli strain was investigated. Liquid and agar nutrient medium used for E.coli culture and different antibiotics used for Disk diffusion technique to evaluate antibiotic resistance pattern of E.coli. Antibacterial effect of 1% and 3% of silver nanoparticles evaluated via disc diffusion test. Based on this study, nano-TiO2 has efficient antibacterial effect and can be used as an antibacterial agent for different purposes.

Key words: Silver nanoparticles, E. coli, Disc diffusion.

Nanotechnology has been established as a new interdisciplinary science that refers to a field of science and engineering dedicated to materials of dimensions sizing from 1–100 nm. Nanoscience and has the facility to make available explanations to the humanity in different parts like the environment challenges viz. water management, defensible chemical manufacture etc. as well as in fields like medicine, solar energy renovation etc. Commonly, the methods used for the preparation of metal nanoparticles can be clustered into two different types Top-down or Bottom-up. Breaking a wall down into its components—the bricks, characterizes the Top-down attitude.

Silver as a disinfectant has (empirically) been used for several millennia, and implanted as salt or nano-systems (colloids) during the 1960s, primarily for wound treatment. However, comprehensive research on the antibacterial action of silver nanoparticles emerged around 2004 and rose exponentially. Nano-silver systems present several advantages that make them very interesting for a use as antimicrobial agents. Nanoparticles are now considered a viable alternative to antibiotics and seem to have a high potential to solve the problem of the emergence of bacterial multidrug resistance. In particular, silver nanoparticles have attracted much attention in the scientific field. Silver has always been used against various diseases; in the past it found use as an antiseptic and antimicrobial against Gram-positive and Gram-negative bacteria due to its low cytotoxicity. Silver nanoparticles were considered, in recent years, particularly attractive for the production of a new class of antimicrobials opening up a completely new way to combat a wide range of bacterial pathogens. Although the highly antibacterial effect of silver nanoparticles has been widely described, their mechanism of action is yet to be fully elucidated. Therefore, in this study the effect of commercially silver nanoparticles was investigated against E. coli.

EXPERIMENTAL

Silver Nanoparticles with particle size of 45 nm was purchased from US Research Nanomaterials (US-Nano). Nanoparticles was
suspended in distilled water and sonicated for 20 minutes before use. The suspension of silver nanoparticles was studied by dynamic light scattering (DLS) to confirm nano-silver colloid. Concentrations ranging from 1% and 3% were prepared. The Muller-Hinton was used to culture the bacteria and the Ampicillin and Amoxicillin antibiotics were used to study for their resistance pattern according to Disk Diffusion method. The bacteria were cultured in Muller-Hinton Medium and Antibiogram disks of 1% and 3% of silver nanoparticles were prepared according to disk diffusion test. The disks were placed over the media and incubated at 37°C for 24 hours.

### RESULTS AND DISCUSSIONS

The suspension of silver nanoparticles was studied by DLS analysis to confirm nano-silver colloid. Figure 1 shows particle-size distributions of the silver nanoparticles using dynamic light scattering (DLS). Nanoparticles exhibit strong inhibiting effects towards a broadened spectrum of bacterial strains. For testing the silver nanoparticles susceptibility of *E. coli*, we used disc diffusion assay. As it is evident from the results, cells were highly sensitive to all tested concentration of silver nanoparticles, which was also confirmed from the size of the zone of inhibition.

<table>
<thead>
<tr>
<th>Samples</th>
<th>Ampicillin</th>
<th>Amoxicillin</th>
<th>1% of silver nanoparticles</th>
<th>3% of silver nanoparticles</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diameter of zone of inhibition (mm)</td>
<td>8.5</td>
<td>6.5</td>
<td>4.5</td>
<td>7</td>
</tr>
</tbody>
</table>

**Table 1.** Disc diffusion of silver nanoparticles against *E. coli*

![Fig. 1. A particle size distribution histogram of silver nanowires](image)

Silver nanoparticles have been found to be a strong bactericidal compound, although not as much as the established antibacterial compound but can be studied for superficial application as well as for combinational therapies. Inhibition zone measurements show that by increasing the concentration of silver nanoparticles, the inhibition zone also increased (Table 1).

### CONCLUSIONS

Silver nanoparticles display inhibitory effect on the growth of *E. coli* strain which was confirmed by above parameters. Therefore, silver nanoparticles can be considered as effective antibacterial compound, but not as much as the established compound such as ampicillin. As they are eco-friendly, so the antibacterial properties of silver nanoparticles can be further explored in future on other bacterial strains, so that these nanoparticles can be used in several industrial and medical applications.

### REFERENCES


