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# Study of Metal Oxide Nanoparticles on the Bacterial Growth

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ABSTRACT

Applications of nanoparticles are expanded to various fields. Development of nanomaterials help mankind to move towards a bright future.They offer more precise methods of addressing the problems of mankind. The present study was made to see the effect of some metallic oxide nanoparticles on the growth of bacteria as these particles affect the growth and multiplication of bacteria and in environment they behave ecofriendly.

**Key words:** nanoparticles, antimicrobial property.

Nano refers to any parameter when it is expressed as a measure of $10^{-9}$ times of SI units. Existence of nanoparticles and their applications are expanded to various fields. When the significances of the nanoparticles were discovered, their applications also increased. A nanoparicle is defined as a small object behaving as a whole unit in terms of its transport and properties. Nanoparticles have greater scientific applications as they are effectively a bridge between bulk materials and atomic or molecular structures. Nanoparticles have a very high surface area to volume ratio. This ratio is responsible from tremendous driving force for diffusion especially at elevated temperatures. Nanoparticles show a number of special properties relative to bulk material. Nanoparticles have unexpected visible properties due to nanosize which confines their electrons and produce quantum effects. Increased relative surface area and quantum effects, these factors can change properties such as reactivity, strength and electrical characteristics. Nanoparticles have a much greater surface area per unit mass compared with larger particles[4].

Some metals have extremely potent antimicrobial properties. Present study was made to see the effect of some metal oxide nanoparticles on the growth of bacterium – *Azotobactor* sp. as these nanometallic particles inhibit multiplication and growth of those bacteria and fungi which cause infection, odour, itchiness and sores.

Nutrient Agar media were prepared. With the help of stock solution, various solutions with 10 & 20 ppm conc. of nano-metallic particles (copper, zinc & silver oxide) were prepared.

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Table-1. Effect of Metal-oxide nanoparticles on the Bacterial growth (*Azotobactor* sp.)

| S. No. | Metal oxide nanoparticle type | Concentration of nanoparticle solution | Number of colonies developed |
|---|---|---|---|
| 1 | Cu | 0 | 125 ± 12 |
| | | 10 | 52 ± 12 |
| | | 20 | 18 ± 07 |
| 2 | Zn | 0 | 125 ± 12 |
| | | 10 | 68 ± 09 |
| | | 20 | 18 ± 03 |
| 3 | Ag | 0 | 125 ± 12 |
| | | 10 | 38 ± 09 |
| | | 20 | 12 ± 05 |

One ml of metallic nanoparticles solution with each concentration was spread on the plated medium.

*Azotobactor* sp. were isolated from field soil and then *Azotobactor* solution were streaked on the plates. Each set were prepared with three replicates. One set without nano-particles solution was taken as control. After 48 hrs. of incubation at 37°C, number of colonies were counted in each set.

Unique size dependent properties of nanomaterials make them superior and indispensable in many areas. The results with application of nano-metallic materials shows reduced number of colonies of bacterium. As the concentration of copper, zinc and silver nanometal solution increased, more inhibition of bacterium took place and number of colonies noted less. The silver solution shows most effective antimicrobial properties.

In the field of medicine application of nanocrystalline metallic particles are very important because these particles act as antimicrobial agents. Nanosilver, when in contact with bacteria and fungus adversely affect cellular metabolism and inhibit cell growth. The nano silver suppresses respiration, basal metabolism of electron transfer system and transport of substrate in the microbial cell membrane[1].

Silver particles were proposed to posses antifungal, antinflammatory, antiangiogenic and antispermeability activities. Gold nanoparticles have also applications in the field of biology, medicine and environment[3]. The interaction of nanoparticles with nucleic acids and proteins are very high due to presence of active functional groups on the surface. Many metal ions appear to kill microbes instantly by blocking the respiratory enzyme system as well as altering microbe DNA and the cell wall, while having

no toxic effects on human cell.

The technique will be an emerging discipline as these nanoparticles may be used as smart drugs for various therapies[2]. Metal nanopalrticles grow to harmless clumps of metals. After glomeration they changes into metal particles which are harmless and behave ecofriendly.

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