BIOSCIENCES BIOTECHNOLOGY RESEARCH ASIA, December 2016. Vol. **13**(4), 2003-2005

The Study of Antibacterial Properties Nano-silver Colloid

Roya Rashidi* and Hamid Reza Ghorbani

Department of Chemical Engineering, Qaemshahr Branch,
Islamic Azad University, Qaemshahr, Iran

http://dx.doi.org/10.13005/bbra/2356

(Received: 27 October 2016; accepted: 06 November 2016)

Nanotechnology has become one of the most practical technologies, because of uniquephysical and chemical properties of nanomaterials.In this study, antibacterial effect of silver nanoparticles with average size 45nm on *Escherichia coli* strain wasinvestigated.Liquid and agar nutrient medium used for E.coli cultureand 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 discdiffusion test.Based on this study, nano-TiO2 has efficient antibacterial effect and can beused 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[1]. 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[2].

Silver as a disin-fectant has (empirically) been used for several millennia[3, 4], and implanted as salt or nano-systems (colloids) during the 1960s, primarily for wound treatment[5]. However, comprehensive research on the antibacterial action ofsilver nanoparticles emerged around 2004 and rose exponentially.Nano-silver systems present several advantages that makethem very interesting for a use as antimicrobial agents.Nanoparticles are now considered a viable alternative to antibiotics and seem to have a high potentialto solve the problem of the emergence of bacterial multidrug resistance[6]. In particular, silvernanoparticles have attracted much attention in the scientific field[7,8]. Silver has alwaysbeen used against various diseases; in the past it found use as an antiseptic and antimicrobial againstGram-positive and Gram-negative bacteria due to its low cytotoxicity[9]. Silver nanoparticles wereconsidered, in recent years, particularly attractive for the production of a new class ofantimicrobials[10] 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, theirmechanism of action is yet to be fully elucidated.Therefore, in this study theeffect of commercially silver nanoparticles was investigated against *E.coli*.

EXPERIMENTAL

Silver Nanoparticles with particle size of 45 nmwas purchased from US Research Nanomaterials (US-Nano). Nanoparticles was

* To whom all correspondence should be addressed.
E-mail: Roya70roya@yahoo.com

suspended in distilled water and sonicated for 20minutes before use. The suspension of silver nanoparticles was studied by dynamic light scattering (DLS) to confirm nano-silver colloid. Concentrations rangingfrom 1% and3% were prepared.The Muller-Hinton was used to culture thebacteria and the AmpicillinandAmoxicillin antibiotics were used to study for their resistancepattern according to Disk Diffusionmethod.The Bacteria were cultured in Muller-HintonMedium and Antibiogram disks of 1% and 3% ofsilver nanopartilces were prepared according todisk diffusion test. The diskswere placed over the media and incubated at37°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 susceptibilities of *E. coli,* we used disc diffusion assay. As it is evidence from theresults,cells were highly sensitive to all tested concentration of silver nanoparticles, which was also confirmed from thesize of the zone of inhibition.

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

Samples	Ampicillin	Amoxicillin	1% of silver nanopartilces	3% of silver nanopartilces
Diameter of zone of inhibition (mm)	8.5	6.5	4.5	7

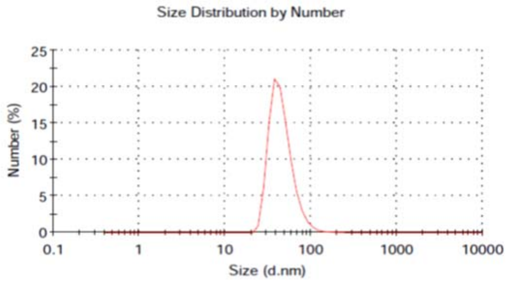

Fig. 1. A particle size distribution histogram of silver nanowires

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

CONCLUSIONS

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

REFERENCES

1. Hutchison, J.E., *Greener nanoscience: a proactive approach to advancing applications and reducing implications of nanotechnology.* ACS nano, 2008. 2(3): PubMed p. 395-402.
2. Singh, P.P. and C. Bhakat, Green synthesis of silver nanoparticles and silver nanoparticles from leaves and bark of Ficuscarica for nanotechnological applications. *Int. J. Sci. Res. Pub,* 2012; **2**(5): PubMed p. 1-4.
3. Xu GC, et al. Nanocomposite. Beijing: ChemicalIndustry Press, 2002.
4. Renugadevi, K. and R.V. Aswini, Microwave irradiation assisted synthesis of silver nanoparticle using Azadirachtaindica leaf extract as a reducing agent and in vitro evaluation of its antibacterial and anticancer activity. *Int J Nanomat Bio,* 2012; **2**: 5-10.
5. Sungkaworn T, Triampo W, nalakarn P, TriampoD, tang IM, Lenbury Y, et al. The effects of Tio2nanoparticles on tumor cells colonies: fractaldimension and morphological properties, *Int J biomed Sci* 2007; **2**(1): 67-74.
6. Guzmán, M.G., J. Dille, and S. Godet, Synthesis

of silver nanoparticles by chemical reduction method and their antibacterial activity. *Int J Chem Biomol Eng*, 2009; **2**(3): 104-111.

7. Mazur, M., Synthesis of silver nanoparticles by chemical reduction method and their antibacterial activity. 2004.
8. Fedlheim,D.L. and C.A. Foss, Metal nanoparticles: synthesis, characterization, and applications. 2001: CRC Press.
9. Khaydarov, R.A., et al., Electrochemical method for the synthesis of silver nanoparticles.*Journal of Nanoparticle Research*, 2009; **11**(5): 1193-1200.
10. Pacioni, N.L., et al., Synthetic Routes for the Preparation of Silver Nanoparticles, in *Silver Nanoparticle Applications.* 2015, Springer. 13-46.