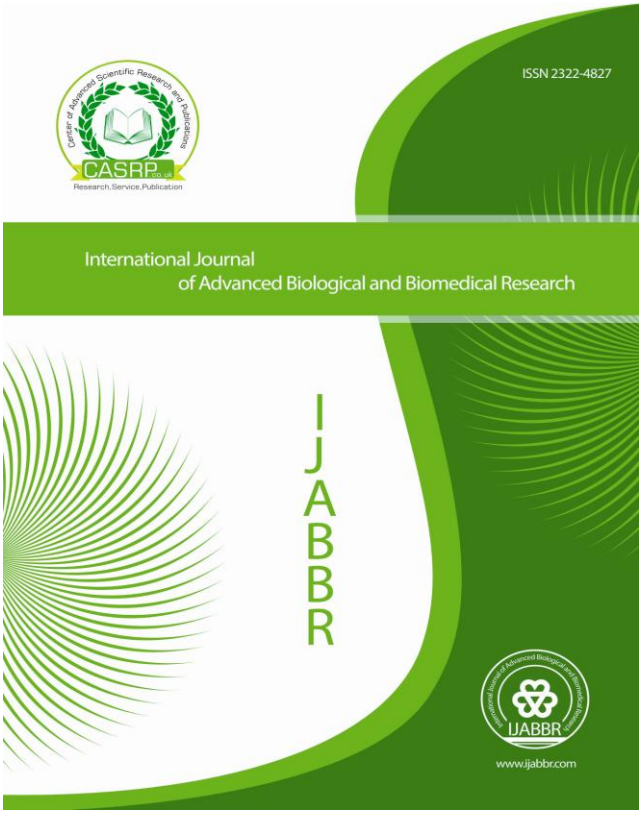

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CASRP PUBLISHER

International journal of Advanced Biological and Biomedical Research 4(1) (2016) 100–103

doi: 10.18869/IJABBR.2016.100

Original Article **Open Access**

Antimicrobial activities of gold nanoparticles against *E.coli*

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Abstract

Recently, the effects of antimicrobial activity of silver nanoparticles was considered by researcher because of Bacterial resistance to antimicrobial agents in chemical.The aim of this study was to evaluate the antimicrobial activity of the gold nanoparticles on Escherichia coli. Gold nanoparticles are chemically synthesized. Standard strain of E. coli was cultured in a nutrient broth. Minimum Inhibitory Concentration (MIC) and minimum bactericidal concentration (MBC) was determined by microdilution. The results showed that gold nanoparticles have good inhibitory effect against E.coli have been studied.

Keywords: Gold nanoparticles, E. coli, Minimum inhibitory concentration.

1. Introduction

Nowadays, nanotechnology is growing at a rapid rate due to the widespread and abundant uses in science and technology. Nanotechnology is a science that is based on nanoparticles (Kaviya et al., 2011). The nanoparticles are materials with three-dimensional structure that can vary in size from 1 to 100 nm. These materials consist of tens or hundreds of atoms or molecules in different forms, such as crystal size, spherical, needle, amorphous etc. (Harrison, 2002). Among themetal nanoparticlesproduced onlya small number of them can be usedinmedical applications. In addition to its unique properties for nanoparticles should be compatible with the human body and also to have a low toxicity. Gold nanoparticles is known as one of the most appropriate options. Gold has anti-

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Received 13 December 2015 | Accepted 12 January 2016 | Available online 19 January 2016
iThenticate screening 16 December 2015 | English editing 10 January 2016 | Quality control 16 January 2016

bacterial, anti-fungal and anti-virus effects (Kalish Waralal et al., 2010). Today, one of the important issues that are raised in the treatment of pathogens associated with drug-resistant strains in hospitals, accordingly, a lot of efforts have been made in the field of pharmacy and discover new ways to combat these pathogens. The multi-drug resistance in bacteria is high and is not responsive to drug treatment. While studies have shown that gold nanoparticles have anti bactericidal activity (Rai et al., 2009). The aim of this study is to investigate the activity of gold nanoparticles on Escherichia coli.

2. Materials and methods

2.1. Bacterial strain and condition

Bacterial strain was obtained from standard laboratory. Evaluate the antibacterial activity of the goldnano particles was investigated using strain of E.coli ATCC 25922. The typed culture of bacterial was sub-cultured on Nutrient agar (Oxoid) and stored at 4 ^{o}C until required for study.

2.2. Minimum inhibitory concentration (MIC) and minimum bactericidal concentration (MBC) of gold nanoparticles

The broth microdilution method was used to determine MIC and MBC. All tests were performed in Mueller Hinton broth supplemented with Tween 80 at a final concentration of 0.5% (v/ v). Briefly, serial doubling dilutions of the extract were prepared in a 96-well microtiter plate ranged from 6.25 ppm to 100 ppm. To each well, 10 µl of indicator and 10 µl of Mueller Hinton Broth were added. Finally, 10 µl of bacterial suspension (10^6 CFU/ml) was added to each well to achieve a concentration of 10^4 CFU/ml. The plates were wrapped loosely with cling film to ensure that the bacteria did not get dehydrated. The plates were prepared in triplicates, and then they were placed in an incubator at 37°C for 18–24 hours. The color change was then assessed visually. The lowest concentration at which the color change occurred was taken as the MIC value. The average of 3 values was calculated providing the MIC values for the tested extract. The MIC is defined as the lowest concentration of the extract at which the microorganism does not demonstrate the visible growth. The microorganism growth was indicated by turbidity. The MBC was defined as the lowest concentration of the gold nanoparticles at which the incubated microorganism was completely killed.

3. Results and discussion

The result of gold nanoparticles showed the MIC and MBC against E.coli was 12.5 and 25 ppm (Fig 1).

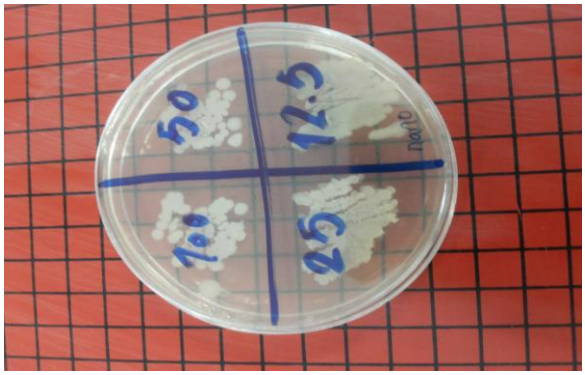

Fig. 1. The shape of the bacteria invarious concentrations of nanoparticles.

The use of nanotechnology in medicine can fix this problem in the future to help mankind. Because nanoparticles, is the foundation of nanotechnology, so their use in medicine, has opened new prospects in the fight against pathogenic bacteria (Chen et al., 2010; Grace et al., 2007). Hernandez and colleagues study the antimicrobial effects of silver nanoparticles, zinc oxide and gold produced by chemical reduction showed on Streptococcus mutans (Hernández-Sierra et al., 2008). Yoon and colleagues in a study in 2007 showed that B. subtilis is more susceptible to silver nanoparticles than E. coli (Yoon et al., 2007). Nada and colleagues in a study in 2009 showed that silver nanoparticles on Gram-positive bacteria have better performance (Nada et al., 2009). The

study of Mubarak Ali, the results showed that the leaf extract of menthol is very good bioreductant for the synthesis of silver and gold nanoparticles and synthesized nanoparticles active against clinically isolated human pathogens, *Staphylococcus aureus* and *Escherichia coli* (Mubarak Ali et al., 2011).

The study of Nirmala and Pandian, in vitro antibacterial activities of drugs capped Au nanoparticles (Au@drugs) were investigated against various strains of Gram positive and Gram negative organisms viz. *Staphylococcus aureus*, *Micrococcus luteus*, *E. Coli* and *Pseudomonas aeruginosa*. Our results suggest that gold nanoparticles could act as an effective drug carrier in drug delivery system (Nirmala and Pandian, 2007). The study of Juan Francisco Hernández-Sierra,the result showed an average MIC of 4.86 ± 2.71 µg/mL and MBC of 6.25 µg/mL; for zinc the MIC was 500 ± 306.18 µg/mL and MBC of 500 µg/mL; the gold nanoparticles demonstrated an effect only at an initial concentration of 197 µg/mL. We established a higher antimicrobial effect against *S. mutans* of silver nanoparticles at lower concentrations than gold or zinc, which would allow achieving important clinical effects with a reduced toxicity (Juan Francisco Hernández-Sierra et al., 2008).

Aknowledgements

This study was supported by Department of fisheries, Hamoun International Wetland Research Institute, University of Zabol, Zabol, Iran.

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How to cite this article: Rigi, M., 2016. Antimicrobial activities of gold nanoparticles against *E.coli*. International journal of Advanced Biological and Biomedical Research, 4(1), 100-103.