How to Cite:
Mohamed, R. S., & Hadi, S. J. (2022). Green synthesis of Arthrospira platensis silver nanoparticles tested activity on Staphylococcus aureus bacteria. *International Journal of Health Sciences*, *6*(S6), 2266–2269. https://doi.org/10.53730/ijhs.v6nS6.10476

Green synthesis of Arthrospira platensis silver nanoparticles tested activity on Staphylococcus aureus bacteria

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***Abstract*---**This study aimed to nitrate silver using A. platensis and evaluate their antimicrobial activity. Determine the best concentration of 10 mmol and the best incubation time of 18 h and change the color of the reaction mixture from yellow to reddish brown. Characterization of bio-nanoparticles was achieved using scanning electron microscopy, X-ray diffraction and atomic force microscopy. Scanning electron microscopy (SEM) was used to detect the size, shape, and distribution of nanoparticles. Atomic force microscopy (AFM) was used to obtain the 3D structure, average diameter and silver nanoparticles of 2.07 A.platensism. According to the characterization of silver with A. platensis nanoparticles by these techniques. Biosynthetic silver particles showed antibacterial activity in the bacteria of the current study. The largest inhibition area for silver nanoparticles of S. aureus had a size of 6.7 mm of Arthrospira platensis. The results demonstrated that there was good antibacterial activity against S. aureus.

***Keywords*---**green synthesis, arthrospira platensis, silver nanoparticles, antibacterial, staphylococcus aureus.

Introduction

Arthrospira platensis is a blue-green bacterium that grows best in alkaline environments (Badri *et al.*, 2015). It consists of Unbranched cylindrical trichomes arranged in a left-handed helix giving the species its common name (spirulina) and it has been characters us a fast gliding with no visible flagellum, (Charpy *et al.*,2012)**.** *A.platensis* has been isolated mainly from alkaline, brackish and saline waters in tropical and semitropical regions (Castenholz 2001). One of the striking

lakes facts about soda is that, despite apparently what might appear unfavourable conditions, these environments are extremely productive because of high ambient temperatures, high light irradiance and unlimited supply of CO_2 (Komárek *etal.*, 2014). *A.platensis* a is rich in a group of vitamins known as (B12) thiamine (B1) cobalamin, (B3), cyanocobalamin (B6), (B2) (Riboflavin Nicotinamide vitamin C, D, And A, as well as significant amounts of fatty ALA) , Stearidonic acid (SDA), acids such as linolenic acid (GLA) and linolenic acid) Eicosapentaenoic acid (EPA), and Docosahexaenoic acid(DHA), Tryptophan, Phenylalanine,(Beta-carotene, Zeaxanthin , Tocopherols and Phenolic acids (Palombo,2011). An Indian study by (Saranraj and Sivasakthi ,2014) Booty is made from *A.platensis* rich proteins (60-70%),which contains protein on its own combination of amino acids higher than soybean protein, and that makes it one of the best and most important in the plant world and possibly it is used for human nutrition when grown in clean water and under. Organized conditions animal feed is made of microalgae that falls in to it (Kolenbrander *et al.*, 2004) used as a food agent because of its high carbohydrates, high - nutritional value containing essential fatty acids and carotenoids quality protein, complex vitamins, vitamin E and copper manganese, magnesium, Iron, selenium and zinc producing a very large number of secondary activities that carry out their normal activities cyanotoxins such as hepatotoxins, neurotoxins, Cytotoxins, Cutaneous Toxins and Toxic Irritant (Batiha et al.,2020).

Materials and Methods

Preparation of *Arthrospira platensis* samples

A. platensis is obtained from the University of Technology, Environmental Center, Baghdad, then mixing 5 g of the powder of *A. platensis* with 250 ml of 99% ethanol, depended methods of Ali 2012). Nanoscale collection and preparation of samples study Depending of (Gupta *et al.*, 2014) methods were taken Part of the dry nanomaterials, silver nitrate salts and copper sulfate it was received. In a separate, dark place at a moderate temperature in the laboratory, they are stored in plastic containers covered with silicone until use. Distilled water is used to extract two substances; *A.platensis* considered Distilled water is one of the best solvents for extracting chemical compounds. Use a concentration of 25g each of *A.nigrum* and *A.platensis* with the use of 500ml of distilled water. Physical characteristics of biogenic nanoparticles were characterized by SEM, EDS, AFM and XRD.

Antimicrobial activity of silver nanoparticles

Biosynthesized by samples study nanoparticles were examined for their antimicrobial activity against different types of pathogenic bacteria isolated and diagnosed by Al- Ameen laboratory in Al- Najaf Al-Ashraf city**.**

Results and Discussion

Biosynthesis of silver nanoparticles using *A.platensis* optimal condition to product

Green synthesis and characterization of *A.platensis* of silver nanoparticles In the current study, the synthesized were characterized by color alteration. The change in color of the mixture to redish brown occurred immediately after 24 hours of incubation in dark room.

Characterization of biogenic silver
SEM analysis4.5.3.X-ray diffraction

The results showed well-dispersed nanoparticles and homogenous with diameter of (5,10) nm for silver nanoparticles in *A.platensis* with variable shapes most of them present in spherical form. XRD of silver nanoparticles that are biosynthesized from *A.platensis* depending on size detection of nanoparticle by XRD, the efficient isolates for biosynthesis of nanoparticle was *A .platensis* due to their producing silver nanoparticle with smallest size 16nm. According to the results of characterization of nanoparticles by SEM it was observed difference in the ability of the plant for biosynthesis of silver nanoparticles. Scanning electron microscope was used to determine the shape and size of biogenic nanoparticles, experimental results displayed well dispersed nanoparticles for the *A.platensis* biosynthesized silver nanoparticle with (10nm) with variable shapes most of them present in spherical form produce related with (Aliand Saleh, 2012).

Antimicrobial activity of nanomaterial's

Silver nanoparticles fabricated by *A.platensis* inhibition *S.aereus* by zone 15.6 the AgNPs biosynthesized using *A.platensis* consider more active against microorganisms this difference was possibly attributed to the difference of the peptidoglycan layer of the bacterial cell between G+ve ,While in the Gram positive the cell envelope consists of lipoteichoic acid containing thick peptidoglycan layer and cell membrane (Kimura *et al.*,2017) deformation and structural changes in the cell wall, in the membrane and in the nucleic acids of bacterial cells. Silver ion interact with a number of electron donor functional groups such as phosphates thiols, hydroxyls, indoles and imidazoles. The AgNPs also damage membranes and induce the release of reactive oxygen species (ROS), forming free radicals with a powerful bactericidal action (Wagener *et al.,* 2014).

Conclusion

The results demonstrated that there was good antibacterial activity against *S. aureus*.

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