Bulletin of Environment, Pharmacology and Life Sciences
Bull. Env. Pharmacol. Life Sci., Spl Issue [3] 2022: 126-129

Online ISSN 2277-1808
Journal's URL:http://www.bepls.com
CODEN: BEPLAD

SHORT COMMUNICATION **OPEN ACCESS**

Use Copper Nanoparticls as an Antimicrobial Therapy

Krupa Patel[1], Dhwani Upadhyay[2], Indrani Bhattacharya[2], Anjali Thakur[2], Prasad Andhare[3]*
[1-2]Parul Institute of Applied Science, Parul University, Post Limda, Waghodiya, Gujarat
[3] Biological Sciences, PDPIAS, Charotar University of Science and Technology,
Changa, Anand, Gujarat.
*Corresponding Author: Dr. Prasad Andhare;
E-Mail: prasadandhare.as@charusat.ac.in

ABSTRACT
Copper nanoparticle synthesis methods include green approaches such as plants and microbes. Copper nanoparticles have unique structural and biological properties. Nanoparticles are used in many different industries. The ability to manage particle size and, as a result, size-dependent characteristics of copper nanoparticles is likely to create additional paths of application. For the production of copper nanoparticles, biological techniques such as plant leaf extracts and microorganisms are used. Copper nanoparticles were produced at room temperature and tested for antibacterial activity using the well agar disc-diffusion technique. Use the medicinal plant Azadirachta indica (Neem) leaves to evaluate antibacterial activity against B. subtilis and E. coli. The antibacterial test on Bacillus subtilis and Escherichia coli indicated a clear inhibition zone of 27 mm and 28 mm, consecutively. Demonstrating the potential of copper nanoparticles as a therapy for infectious disorders that are caused by investigated microorganisms. As shown in this article, E. coli has slightly higher antimicrobial activity than B. subtilis.
KEYWORDS: *materials and methods , method of antimicrobial evaluation, Results and discussion.*

Received 02.08.2022 Revised 17.09.2022 Accepted 25.10.2022

INTRODUCTION

Copper is a low-cost , effective antibacterial agent with a long history of use , bacteria, yeasts and viruses are all quickly destroyed on the metallic copper surface , a process known as "contact killing". Copper has recently been registered with the US Environmental agency due to its usage as an antibacterial agent in a health care settings[1-4].

The varieties of nanoparticles have a considerable influence on nanotechnology applications. Bactericidal metal nanoparticles may be stabilised and coated on surfaces. Potentially finding use in medical equipment and devices, water treatment, and food preparation. Metal nanoparticles can be mixed with polymers to create composites in order to better use their antibacterial action. Metal nanoparticles are also employed in various fields, including catalysis and sensing [5,6]. In the most precious and imaginative ways, the environment is constructed using the most economical, smallest usable resources [7-8].

Copper is just one of those metallic elements group that are important to human health, and it is now recognized as a human-self-material [9]. The antiomicrobial effect of CuNPs against *Escherichia coli* and *Bacilus subtillis* was investigated. Copper nanoparticles were discovered to have excellent antimicrobial characteristics and significant antibacterial impact on gran-positive (*Bacullus subtilis*) and gram-negative (*Escherichia coli*) organisms. Copper nanoparticles killed *E. coli* and *B. subtilis* more effectively. CuNPs' work has focused on the environmentally sustainable production of copper nanoparticles with *Azadirachta indica* medicinal plant extract.

MATERIAL AND METHODS

PROCESS OF PREPARING SAMPLES AND PLANT EXTRACTS:

Copper nitrate solution [$Cu(NO_3)2H_2O$], muller hintor agar solution, and dimethyl sulfoxide (DMSO) were employed in the experiment as ingredients.

Leaves was collected from *Azadirachra indica*. For the preparation of plant extracts, use the medicinal plant leaves of neem (*Azadirachra indica*). The leaves of *Azadirachta indica* are cleaned with water or deionised water after making the extract to remove dust particles. It is dried in a microwave oven for around 2 minutes to eliminate the amount of moisture. A crushing device was used to crush the dried leaves and make powder. In a 500-ml conical flask containing 300 ml of distilled water, 15 g of powdered neem leaves were extracted. To eliminate the effect of daylight, the flask was then wrapped with aluminium foil and a cotton plug. This suspension was mechanically shaken for 90 minutes at 50 degrees Celsius for 1 hour on a magnetic stirrer before being allowed to cool at room temperature overnight. To get a clear solution, the prepared combination was filtered using filter paper. The solution was kept at 4 degrees Celsius for further analysis.

CNpS is generated in a green manner. In distilled water, a 0.2M aqueous copper nitrate [Cu (NO3)2H2O] sample was dissolved. A hundred milliliters of leaf extract were gradually mixed into 400 milliliters of 0.2M Cu (NO3)2H2O solution (1:4) while constantly stirring. The mixture was incubated overnight at 37°C. The change in colour was continually being monitored (after 30 minutes and 1 hour). The colour shift from blue to light brown shows the copper nanoparticles' formation.

METHOD OF ANTIMICROBIAL EVALUATION:

Using medicinal *Azadirachta indica* plant leaves extract, the antimicrobial effect of *B.subtilis* (grame positive) or *Escherichia coli* (grame negative) was examined using agar disc diffusion technique. Prior to testing for antimicrobial properties, the bacterial cultures that were constantly growing were inoculated over muller hintor agar (MHA)[10,11].

The antibacterial action against selected microorganisms is shown by the inhibition zone, which is measured in millimeters.

RESULT AND DISCUSSION

Copper nanoparticles have been produced by utillising *Azadirachta indica* medicinal plant extract. The technique of producing copper nanoparticles includes numerous phases. When copper ions in water were treated with medicinal neem plant leaf extract, copper nanoparticles were generated. The color changes were evaluated on a regular basis (after 30 minutes and 60 minutes). Figure 1

Depicts the formation of copper nanoparticles by showing the colour shift from blue to light brown.

An antimicrobial property of neem leaf extract was investigated using an agar disc-diffusing appproach against two bacteria (grame +ve and grame —ve), and the result was matched to the positive control (ampicllin antibiotic). This result exhibited antimicrobial activity against microorganisms (Fig.2). The outcome was compared to the negative control (DMSO). The analysis indicated antimicrobial properties against microoganisms (fig.3). Among the two types of bacteria investigated, Neem leaf extract suppresses the activity of *Bacillus subtilis* and *Escherichia coli* the most. Bacterial inhibition zones that were resistant to neem leaf extract responded effectively to neem treatment. Antibacterial effects of leaf extract against microbes have been demonstrated.

The antibacterial efficacy of CNpS against many harmful bacteria such as *Bacillus subtilis* and *Escherichia coli* was tested using an agar disc-a diffusion technique. According to the mean of the inhibition zones in millimeters around positive and negative controls, *B. subtilis* and *E.Coli* had the most antimicrobial activity, followed by leaf extract. Lower antimicrobial activity was detected against *B. subtilis* and *E. coli*, followed by ampicillin antibiotic and DMSO [Dimethyl Sulfoxide], suggesting a 10 mm and 8 mm inhibitin zone, respectively. The antibacterial test on *B. subtilis* and E. *coli* shows a good zone of inhibition of 27 and 28 mm, respectively, indicating high antimicrobial activity against the tested organisms. *E. coli* has somewhat higher antimicrobial activity than *B. subtillis*. Figures 2, 3, and 4 demonstrate this. Measuring the inhibitory zone show in table no.1.

The antibacterial impact of copper nanoparticles produce from neem leaves extract (mm).

CONCLUSION

Biologically, copper nanoparticles are generated using a biological technique. This paper provides an overview of the biological production and characterization of copper nanoparticles. Which have been proven to benefit microorganisms. Neem leaves were used to make copper nanoparticles. Copper nanoparticles exhibited considerable antibacterial efficacy against several gram-positive and gram-negative bacteria. Copper nanoparticles are available in a multitude of shapes and sizes, and they have high antibacterial characteristics. The combined action of bio-active compounds obtained from medicinal plants and CUNPs' is shown to be effective against bacteria.

FIGURE 1: Copper nanoparticles

TABLE 1: Inhibition zone of tested extract [in mm]

Name of test organisms	Copper nanoparticles	Antibiotic/DMSO
Bacillus subtilis	27 mm	Ampicillin antibiotic (10 mm)
Escherichia coli [E.coli]	28 mm	Di-methyl Sulfoxide (8 mm)

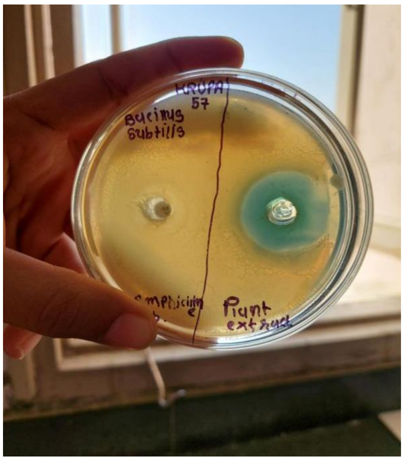

FIGURE 2: Inhibition zone against *Bacillus subtilis*.

FIGURE 3: Inhibition zone against *Escherichia coli*.

FIGURE 4: Zone of inhibition against *E.coli* & *Bacillus subtilis*

ACKNOWLEDGMENT

The author would like to express his gratitude to the department of microbiology at parul institute of applied sciences (Parul University) for providing all of the laboratory facilities required for this work. The author would like to express his gratitude to the lab department for their cooperation during the project development.

CONFLICT OF INTREST

The authors notify that they do not have any conflicts of interest.

REFERENCES

1. Das, B., & Patra, S. (2017). Antimicrobials: Meeting the challenges of antibiotic Resistance through nanotechnology. for A.T. In A. Ficai & A. Grumezescu (Eds.), Nano-structures for antimicrobial therapy: Nanostructures in therapeutic medicine series (pp. 1–22).Elsevier.
2. Flemming CA and Trevors J T. (1989). Copper toxicity and chemistry in the environment: A review. Water, Air, and Soil Pollution 44: 143-158.
3. P. Kaur, R. Thakur, and A. Chaudhury, (2016). "Biogenesis of copper nanoantimicrobial activity against opportunistic pathogens," Green particles using peel extract of *Punica granatum* and their Chemistry Letters and Reviews, vol. 9, no. 1, pp. 33–38.
4. G. Gregor, R. Christopher, S. Marc, (2011).Appl. Environ. Microb. 77 1541.
5. Vaseashta A, Dimova-Malinovska D (2005). Nanostructured and nanoscale devices, sensors and detectors. Sci. Technol. Adv. Mater. 6: 312 18. http:// dx.doi.org /10.1016/j.stam.
6. Raveh A, Zukerman I, Shneck R, Avni R, Fried I (2007). Thermal stability of nanostructured superhard coatings: a review. Surf. Coat. Technol. 201:6136–42.http: // dx.doi.org /10.1016 / j. surfcoat. 2006.08.131.\
7. R. Manimaran, K. Palaniradja, N. Alagumurthi, S. Sendhilnathan and J. Hussain. (2013). Preparation and characterization of copper oxide nanofluid for heat transfer applications. Appl. Nanosci. 4, 163
8. S. Jeong, K. Woo, D. Kim, S. Lim, J. S. Kim, H. Shin, Y. Xia and J. Moon, (2008). Controlling the thickness of the surface oxide layer on Cu nanoparticles for the fabrication of conductive structures by ink-jet printing. Adv. Funct. Mater. 18, 679.
9. Borkow, G. and Gavia, J. (2005) Copper as a biocidal tool. Curr Med Chem 12, 2163–2175.
10. S.Manandhar, S. Luitel, and R. K. Dahal, (2019). "In vitro antimicrobial activity of some medicinal plants against human pathogenic bacteria," Journal of Tropical Medicine, vol. 2019, Article ID 1895340.
11. M.Balouiri, M. Sadiki, and S. K. Ibnsouda, (2016). "Methods for in vitro evaluating antimicrobial activity: a review," Journal of Pharmaceutical Analysis, vol. 6, no. 2, pp. 71–79.

CITATION OF THIS ARTICLE

K Patel, D Upadhyay, I Bhattacharya, A Thakur, P Andhare. Use Copper Nanoparticls as an Antimicrobial Therapy. Bull. Env.Pharmacol. Life Sci., Vol Spl Issue [3] 2022: 126-129