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A Comprehensive Study on Metal Nanoparticles

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ABSTRACT

The research into the properties of nanoscale particles (1-100 nm) in nanotechnology is transforming a number of fields, including healthcare and medicine. The application of nanoparticles in molecular biology, chemistry, and material science is being fueled by their special qualities, such as a high surface-to-volume ratio and their ability to interact with biological mechanisms. The synthesis, evaluation and applications of important metal nanoparticles: gold, silver, copper, zinc oxide, and iron are examined in this review, with a focus on the many applications and unique features of these materials.

Because of their simple process of functionalization, gold nanoparticles are used in imaging and drug delivery applications. Chemical reduction, physical methods like laser ablation, and biological methods using plant extracts can all be used to generate them. Medical devices and wound dressings can benefit from the remarkable antibacterial, antiviral, and antifungal characteristics of silver nanoparticles. Chemical reduction and microbiological procedures are used in their synthesis, and assays for antifungal activity and transmission electron microscopy (TEM) are applied in their evaluation.While being oxidation-prone, copper nanoparticles are used in several uses and are recognized for their mechanical and thermal qualities. They utilise physical technologies such as laser ablation and plant extracts for green synthesis. Drug delivery uses zinc oxide nanoparticleswhose production can be achieved by a number of approaches, such as physical vapor synthesis and mechanochemical processing. Green synthesis methods have grown more and more popular due to their eco-friendliness and iron nanoparticles have significant potential for both medical and environmental protection.

Key words: Nanoparticle, Metal nanoparticles, Evaluation and formulation of gold, silver, copper, zinc, iron nanoparticles.

I. INTRODUCTION

Nanotechnology is the science deals with the manufacturing of nanoscale particles, which range in size from 1 to 100 nm, using a variety of synthetic techniques, particle structure, and size modification. The ability to regulate materials at the nanoscale thanks to technology advancements is enabling a major change in medical and healthcare therapy. These days, there is an unanticipated increase in the application of nanoparticles in many fields, including molecular biology, physics, organic and inorganic chemistry, medicine, and material science. According to reports, materials' physicochemical properties will alter as they go from bulk to nanosize, and these changes can be applied to a variety of biomedical applications. Because of their high surface to volume ratio, ability to influence cellular or molecular processes, and potential to interact with these processes, nanoparticles are highly appealing for a variety of biomedical applications[1].

Nanoparticles are essential in a variety of industries due to their increased characteristics and performance advantages. Their distinct appearances are one of their most notable benefits. For example, localized surface plasmon resonance (LSPR) is a characteristic of gold and silver nanoparticles which permits them to interact with light in a way not possible for bulk materials. For applications like imaging and biosensing, where great sensitivity and resolution are essential, this makes them extremely valuable. Similarly, because of their high surface-to-volume ratio, nanoparticles have a higher chemical reactivity[1][2]. Because of this property, they function as very powerful catalysts in industrial settings, facilitating more effective and focused chemical reactions.Nanoparticles have many benefits, but they also have drawbacks, especially when it comes to environmental and health hazards. Their possible toxicity is one of the primary concerns. When breathed, consumed, or in contact with the skin,

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nanoparticles' small size and huge surface area may have unwanted health impacts. Significant obstacles also come from manufacturing and cost concerns. It can be difficult and costly to produce nanoparticles in large quantities while preserving their consistent size and characteristics. The extensive use of these technologies has been limited by their high production costs, which may also restrict their accessibility[2].

Synthesis of MNPs is regarded as an innovative field in nanobiotechnology, drawing scientific research with significant possibilities for medication administration and imaging. Because MNPs have optical features including surface plasmon resonance (SPR) and the capacity to modulate optical field, they are extremely attractive and potential candidates for biomedical applications. Because of their small size, MNPs are able to pass across physiological or biological membranes, which are typically impervious to other macromolecules[2][3].

The demand for biological synthesis of metal nanoparticles has grown significantly due to their huge potential to improve living standards. Some of these nanoparticles include gold, copper, and others. The most common metal and metal oxide nanoparticles (NPs) added to paints are silicon dioxide and titanium dioxide (TiO2), which give paints antibacterial, antifungal, and anti-algal properties. Furthermore, according to AZO NANO, nano silver NPs have antibacterial properties through the interaction of bacterial cell proteins, as well as deodorizing, hydrophobicity, and reduced toxicity. These NPs serve a huge part in cosmeceuticals, which have therapeutic effects on hair and skin and can be used to address wrinkles, dark spots, photoaging, and other issues. Cosmetics are designed with a variety of nano carriers that encapsulate the drug to be targeted and exhibit its effects[3].

METAL NANOPARTICLES

Metal nanoparticles are nanomaterials that made up of one element. There can be single atoms or collections of several atoms. Among the most often manufactured nanoparticles are Au, Ag,Cu, Zn,Co, Cd, Al, Ni, and Fe. Metal nanoparticles can be produced as solid nanoparticles or colloidal fluids using straightforward techniques including the hydrothermal process, microwave-assisted method, and bio-assisted method[4]. Their broad electromagnetic spectrum absorption, strong reactivity, and localized surface plasmon resonance (LSPR) are among their significant qualities. Due to their enhanced optical, optoelectrical, catalytic, antibacterial, antiviral, and cancer-fighting properties, metal nanoparticles are highly intriguing materials for a wide range of practical applications[5].

Depending on the metal, MNP can be either very toxic to bacteria or very toxic to other microorganisms, but they can be either very or non-toxic to human cells. As a result, they can be used in a variety of industries, including coating, food, and medicine. In the past ten years, research has concentrated on MNP produced by biosynthesis and certain plant extracts. These MNP show greater antibacterial capabilities with lower cytotoxicity to human cells than its counterpart made using standard methods, owing to the added antimicrobial qualities originating from the plant extracts utilized during the synthesis. The goal of ongoing research is to comprehend the various mechanisms that underlie the antibacterial activity of nanoparticles that have been biosynthesized[6].

GOLD NANOPARTICLES

Gold nanoparticles are the radiosensitizers used in medical applications such as drug delivery and cancer therapy. Because of their unique characteristics and multiple surface functions, gold nanoparticles, or AuNPs, have found widespread application in bionanotechnology.A simple process called AuNP functionalization gives a versatile platform for nanobiological elements made of oligonucleotides, proteins, and antibodies. Because of their distinctive properties and various surface functions, gold nanoparticles, or AuNPs, are finding significant application in the area of bionanotechnology. A flexible platform for nanobiological assemblies containing oligonucleotides, antibodies, and proteins is made possible by the simplicity of AuNP functionalization[6].

SYNTHESIS OF GOLD NANOPARTICLES

- **Chemical reduction**

This method which includes reduction and stabilization

1. Green method: Green chemistry offers eco-friendly and toxic-free synthesis routes. The egg shell membrane (ESM), an organic biomaterial, and Pterocarpus marsupium were utilized in an easy green biosynthetic procees to create AuNPs of a diameter of 25+7 nm.
2. Citrate reduction: This is the most widely used technique for AuNP preparation. The Frens group made several modifications that

involved reducing citrate with Au particles to produce 20 nm nanoparticles.

3. Brust- Schiffrin method: The process involves producing thermally and air-stable AuNPs with lower dispersion values through a chemical route
4. Polymer-based synthesis: The dimensions and form of AuNPs are acknowledged as crucial components in the production of colloidal Au. The intraction among the polymer and the particle influences stability and size range of AuNPs[18].

- **Physical method**

1. Electrochemical method: In order to prepare AuNPs electrochemically, a basic two-electrode cell is used, with the cathode and anode being reduced and oxidized, respectively. Because of its inexpensive cost, minimal equipment requirements, reduced processing temperature, and straightforward process management, this method has been shown to be superior to alternative approaches.
2. Method of seeding growth: AuNPs developed with sizes from 5-40nm with small dispersity. The seed to metal salt ratio modification can be used to effectively arrange the particle sizes. In the seeding step, sodium borohydrate (NaBH4) is utilized as a reducing agent and trisodium citrate as a source of OH ions. Furthermore, under UV sun radiation, AuNPs were produced on a high elevated plateau in the selected solution[19].
3. Ultraviolet-induced photochemical synthesis: Many researchers have documented that photochemistry effectively produces single crystallite AuNPs with regulated sizes by photoreduction.
4. Ultrasound aided synthesis: In the presence of 2-propanol, the Au precursor is reduced by ultrasound in this process. Citrate, disulphide, and other dendrimers are among the stabilizing agents that are employed.
5. Laser ablation synthesis: Due to size and shape, the laser ablation method has produced better outcomes in terms of precision and reproducibility. Therefore, the pulsed laser process, which necessitates continuous Au evaporation and condensation events, presents a sophisticated physical method that may be effectively used to produce AuNPs with tuneable properties. The procedure uses a laser beam with a wavelength of 532 nm to reduce HAuCl4, producing 5 nm-sized AuNPs as a result[20].

- **Biological method**

1. Microbial synthesis of AuNPs: Microorganisms can be used to manufacture AuNPs since low-cost, environmentally friendly techniques are required. Enzymes like reductases, ligninases, and laccases are used in this approach to help with the nucleation and growth of AuNPs[18].Separating the soil fungus Penicillium crustosum and using extracellular proteins to prepare AuNPs is another method of Au-mediated synthesis.
2. Plant mediated synthesis of AuNPs: The use of plants in the creation of AuNPs has drawn a lot of attention because of its accessibility, affordability, and non-toxic qualities. Furthermore, Salacia chinensis phytochemicals have been used in the production of AuNPs[19].

EVALUATION OF GOLD NANOPARTICLES

- **TEM analysis**

Accurate information on the size, morphology, and shape of the produced NPs can be obtained using TEM analysis.The TEM analysis's micrographsshow the NPs' spherical shape. TEM pictures in this investigation demonstrated that the Ag and Au NPs are spherical NPs[21].

- **SEM analysis**

Scanning electron microscopy revealed that the produced nanoparticles had a roughly spherical form[21].

SILVER NANOPARTICLES

Silver metal nanoparticles, or Ag MNPs, have likely been the subject of the most research over the past ten years. They are currently being used in a wide range of industries, including fabric coatings, dental tools, biocidal coatings, photocatalysis, lithography, microelectronics, pharmaceutical drugs, wastewater treatment, wound dressing, and the food industry. Ag MNP have distinct antiviral, antifungal, and antibacterial qualities that help them combat a variety of pathogenic diseases. Moreover, multidrug-resistant bacterial strains can be targeted by using Ag MNP as nanocarriers in combination with antibiotics (amoxicillin, penicillin G, vancomycin, and erythromycin) [6].Silver has a variety of antibacterial activity modes; its use in applications is dependent upon its assemblies and compositions, such as metal, salt, or nanoparticles. The silver nanoparticle form incorporates all antibacterial effects in addition to its own modes of action,

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which include bacterial cell penetration and mechanical membrane damage, in contrast to salt and metal, which each have their own mode of action.These ions harm the cellular membrane by causing "pit" development, which results in cellular contents leaking out, essential transport systems being obstructed, proteins becoming denaturated, DNA functions being blocked, and enzymatic processes being altered. All of these effects work together to kill bacteria[8].

MECHANISM OF SILVER NANOPARTICLES(BIOSYNTHESIS)

The synthesis of AgNP by a variety of microbes shown that AgNP can be synthesized both within and outside of a cell. Proteins-enzymes on bacterial cell walls and secreted proteinsare necessary for extracellular production because they enable the reduction of Ag+ to Ag0. It was demonstrated that the extracellular synthesis of AgNP is characteristic for both Gram-negative bacteria like Klebsiella pneumoniae, Escherichia coli, and Acinetobacter calcoaceticus, as well as for the Gram-positive bacteria genus Bacillus, specifically for B. pumilus, B. persicus, and B. licheniformis, B. indicus, and B. cecembensis, as well as for Planomicrobium sp., Streptomyces sp., and Rhodococcus sp.Numerous additional microbes, including the fungus Rhizopus stolonifer, Aspergillus niger, Fusarium oxysporum, and Fusarium sp., have also had their mechanism of synthesis identified[13].

FORMULATION OF SILVER NANOPARTICLES

In order to create silver nanoparticles, AgNO3 must be reduced with citrate, using the same Frens technique that is frequently used to create gold nanoparticles. Aqua Recover was used to clean the 3-neck round bottom flask, and then deionized water was used to rinse it. The flask wascovered with an alumina fuel to prevent light. Solutions of silver nitrate (AgNO3) were heated to boiling and refluxed while being constantly stirred. Several concentrations of tri-sodium citrate solutions, ranging from 38.8 to 40 mM, were added in situ. The solution underwent a color change, going from being colorless to taking on a golden yellow tint, as part of the event that was seen.After the color change, the solution had reflux for an additional fifteen minutes. Subsequently, the heat source was deactivated, and the solution was stirred until it reached ambient temperature[8].

EVALUATION OF SILVER NANOPARTICLES

- **Transmission Electron Microscopy(TEM)**

Transmission electron microscopy was used to examine the silver's size and structure. A fraction of the diluted solution was then placed onto a grid coated with carbon after the silver samples had first been diluted with distilled water. After a minute of undisturbed standing, the solution was blotted (using filter paper) to remove any remaining particles from the grid. Before imaging, the grids were left in the grid box for two hours to dry[12][13].

- **Antifungal activity**

The proliferation of fungal cells in the presence of mycotoxins was evaluated using the antibiogram technique. A fungus medium was equally distributed across 96 well microplates on Petri dishes using agarized Czapek Dox media to inoculate them. Following that, the plates were incubated for a full day at 37ºC. The samples underwent several measurements, all of which were carried out at 37 oC while being continuously shaken in between. At 30-minute intervals, data was collected. By comparing the last data point on the growth curve to a control value, survival was ascertained[12].

- **Particle size study**

Following synthesis, solutions were evaluated by measurements of mean size of particles diameter and polydispersity indices utilising photon correlation spectroscopy. The granulometric distribution and size of the colloidal silver nanoparticles have been collected and evaluated in terms of the number of particles and the occupied volume. According to the data in the study, the diameters of the particles ranged from 5 to 50 nm[14].

COPPER NANOPARTICLE

Copper nanoparticles (CuNPs) have attracted widespread attention due to their mechanical, electrical, magnetic, and thermal features[10].They have been applied to surgical tool coatings, heat transfer systems, and water treatment.Utilizing copper has the benefit of being inexpensive and widely accessible, making the production of CuNPs economical. During preparation, copper changes into CuO and Cu2O and then back to Cu2+, which makes it difficult to

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continue synthesizing CuNPs in an ambient environment[7].

FORMULATION OF COPPER NANOPARTICLES

- **Green synthesis**

Because the method for producing metallic nanoparticles is secure, green synthesis is a popular choice. It employs plant and microbe (fungus, bacteria) compounds as an agent of reduction. The advantages include using less toxic materials, being less expensive than chemical synthesis, simpler, faster, and more sustainable. Because it is more difficult to preserve cell cultures, it is preferable to use plant extracts rather than microorganisms to create nanoparticles [9]. Additionally, it makes the difficult task of maintaining cell cultures simpler and is suitable for producing large-scale nanoparticle production.

Given that nanoparticles are used in medicine and are thought to be the next big thing in the fight against diseases, there is a greater need than before to obtain them via environmentally friendly means[9].Excellent antibacterial, anticancer, antidiabetic, anti-inflammatory, and antioxidant effects can be observed in the nanoparticles made from plants. The synthesis method to generate copper nanoparticles can be used to a variety of plant species, and the resulting nanoparticles show unique antibacterial properties[11].

- **Physical method**

The two methods for physical synthesis techniques are laser ablation and evaporation-condensation. When compared to chemical synthesis, physical synthesis generates nanoparticles with an uniform distribution and no solvent contamination. Evaporation-condensation is an energy-intensive and costly method which involves enhancing the operating temperature to enable to create very small nanomaterials (6.2–21.5 nm and 1.23–1.88 nm)[16].

EVALUATION OF COPPER NANOPARTICLES

Surface Plasmon Analysis (SPR) shows the formation of copper nanoparticles in the wavelength range of 200-800 nm. Shape, size, and bandwidth can be evaluated by UV-visible spectroscopy, SEM, and TEM; the crystal lattice structure may be determined using XRD; and the presence of a functional group on the surface of nanoparticles determined by FTIR analysis[15].

- **UV- Visible Spectrophotometry**

This spectrophotometric method is often used for measuring various transparent fluids. UV-vis spectrometers analyze the concentration of the absorbing components based on the different absorption features of the analyte. The absorption spectra can be modified by the analyte's varied reactions with the surrounding solution throughout time, as is the case with NPs. UV-vis spectroscopy. uses the fundamentals of the Beer-Lambert Law—which describes how light is absorbed and transmitted—to calculate the concentration of particulates. This method is sensitive to changes in the size, pH, and refractive index of the NPs because these changes are caused by changes in the interaction time with the solvent[16].

- **XRD (X ray diffraction)**

By using constructive and destructive interference produced by the atoms in the lattice, this method for identifying crystal lattice structure resolves molecules at the atomic level. The crystal structure's diffracted pattern of constructive interference is determined by the reflection angle, θ, and the separation between atoms,ThisleadstoBragg'sequation:

$n\lambda=2d\sin$

Since XRD gives an average of the total crystal volume, peak broadening can be attributed to fine crystal structure. Therefore, the Debye-Scherrer equation can be used to determine the crystal line size D. $D=K\lambda/\cos\theta$[17].

ZINC OXIDE NANOPARTICLES

Zinc oxide nanoparticles (ZnO NPs) are one of the important metal oxide nanoparticles with substantial uses in various sectors and research institutes. Various methods of synthesis have been utilized in the manufacturing of ZnO.One common inorganic substance used in many daily applications is zinc oxide (ZnO)[20]. ZnO is utilized as a food additive and is presently classified by the Food and Drug Administration as a generally regarded as safe (GRAS) chemical.These offer a viable method for drug delivery in diabetes, cancer, and inflammatory treatments[21].

SYNTHESIS OF ZINC OXIDE NANOPARTICLES

- **Mechanochemical Processing**:

MCP is a cutting-edge technique that produces materials at the nanoscale and allows for the fabrication of separated nanoparticles. The

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technique has been extensively used to create a wide range of nanoparticles, such as ZnS, CdS, ZnO, SiO_2, and CeO_2.Through ball-powder collisions and a chemical exchange reaction, the precursors zinc chloride ($ZnCl_2$) and sodium carbonate (Na_2CO_3) are simultaneously ground in a ball mill to create zinc carbonate ($ZnCO_3$) and sodium chloride (NaCl). The ball mill functions as a low-temperature chemical reactor in which local heat and pressure at nanoscale contact surfaces drive the reaction process. An innocuous diluent called NaCl is added to the precursors. The result is regarded as a nanocomposite, where the matrix phase is NaCl[21].

- **Physical Vapor Synthesis**:

In the PVS process, a solid precursor is treated with plasma arc energy to produce high-temperature vapor[27].When the precursor is injected into the plasma, the plasma arc supplies the energy required to start processes that result in supersaturation and particle nucleation. This usually breaks them down completely into atoms, which can then expand via a nozzle, mix with a cool gas, or react to produce particles when cooled[22].

- **Physical method**:

In this procedure, stable and well-defined nanoparticles are formed by attracting tiny particles using physical forces. Amorphous crystallization, physical fragmentation, the colloidal dispersion process, and vapor condensation are a few examples. The most common physical methods to produce ZnO nanoparticles include the plasma process, laser ablation, and thermal evaporation.According to earlier research, the laser ablation process has certain special advantages since it makes it possible to produce ZnO NPs with a limited distribution of size, shape, and purity[23][24].

EVALUATION OF ZINC OXIDE NANOPARTICLES

SEM analysis was used to determine the structure of ZnO NPs using gold coating. ImageJ software version 1.53t was used to examine the size of the particles. Using a UV-visible spectrophotometer, the optical absorption spectra of ZnO NPs were captured between 200 and 600 nm. XRD was used to measure the diffraction patterns at a rate of 1°/min at two angles ranging from 20 to 80°. 40 kV and 40 mA were used to run the Cu-K radiation[24][25]. Scherrer's physical formula was utilized to determine the crystallite size, and it was found that the diffraction peak maximum was recorded at the 101 plane: D is the whole width at half the maximum of the peak, the X-ray wavelength, and the crystallite size, and it equals $0.94\ \lambda/\beta\cos\theta$. Using FTIR at room temperature and frequencies of 400–4,000 cm-1, functional groups and compound classes of papaya extract and synthetic ZnO NPs were discovered[26][27].

IRON NANOPARTICLES

Compared with traditional absorbents, iron nanoparticles not only have higher specific surface area, but also can oxidise and reduce multiple pollutants. In order to clear up both inorganic and organic contaminants from polluted water, soil, and sediments, iron nanoparticles have been used. Many revised iron nanoparticles were created through extensive research in order to improve reaction efficiency as well as overcome the initial faults of oxidation or aggregation. They are non-toxic. FeNPs are highly magnetic, have a large surface area, strongly electrical and thermal conductivity, and excellent dimensional stability. When FeNPs comes in contact with either water or air, they can oxidize quickly and produce free Fe ions. FeNPs have multiple uses, but their use for medication administration is the most clear [31].

FORMULATION OF IRON NANOPARTICLE

There are various methods to manufacture iron oxide magnetic nanoparticles (NPs) with the right chemistry of the surface, includes dry processes, wet chemical processes, and microbiological methods [32].

•**Green synthesis**

The therapeutic properties of plant materials, their accessible availability, and a dependable, sustainable, and environmentally friendly technique for synthesizing nanoparticles have made the green production of iron nanoparticles an intriguing field of study[31]. Biological materials including plants and microbes are thought to be less expensive and environmentally friendly than physical and chemical production. Biological extracts have been used to produce iron nanoparticles with a variety of sizes and morphologies. Because they include a variety of metabolites and biomolecules, microbial (fungi, algae, bacteria, etc.) and extracts from plants have been used in the environmentally friendly synthesis of iron nanoparticles[33].

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•Physical methods:
These are elaborate procedures which suffer from the inability to control the size of particles in the nanometer range.

•Chemical methods:
These are straightforward, tractable, and effective procedures that allow one to control the NPs' size, structure, and even shape. By adding a base for the reaction of Fe2+ and Fe3+, oxides of iron can be synthesized. The form of salt employed, the ratio of Fe2+ to Fe3+, pH level, and the ionic strength all affect the form, composition, and size of iron nanoparticles (NPs) that are created chemically[34].

EVALUATION OF IRON NANOPARTICLE
•Particle size and zeta potential
The uncoated iron oxide nanoparticles' mean particle size was 65.95±5 nm, which is similar to other results that have been published. The mean particle size rose to 220.2±12 nm and 295.3±19 nm, respectively, after coating with folic acid and chitosan.. The obtained particle sizes of the coated iron oxide nanoparticles are larger than that reported previously for either folic acid-coated or chitosan-coated iron oxide nanoparticles. The particle size distribution of all samples showed unimodal patterns. The iron oxide nanoparticles which were uncoated, coated by folic acid, and coated in chitosan have average zeta potentials of -25.6±3 mV, -10.9±1.9 mV, and -0.668±0.1 mV, respectively.. Similar results were reported previously. The zeta potentials of chitosan-coated iron oxide nanoparticles and folic acid-coated iron oxide nanoparticles are higher than that of uncoated iron oxide nanoparticles due to the highly positive charge of chitosan and folic acid[32].

•XRD Analysis
XRD patterns of the prepared iron oxide nanoparticles showed the six characteristic peaks of iron oxide at 2θ values of 30.1, 35.5, 43.3, 53.7, 57 and 62.8. Similar results have been previously Reported. Sharp peaks also suggest that the iron oxide nanoparticles have good crystallized structure. Peak widening was consistent with the small particle sizes of the nanoparticles[32].

•UV-Vis absorption spectroscope
The observed UV band, originated primarily from the absorption and scattering of light by iron oxide nanoparticles.

ABBREVIATION
NP: Nanoparticles, AgNPs: silver nanoparticles, CuNPs: copper nanoparticles, ZnONPs: zinc oxide nanoparticles, FeNPs: iron nanoparticles, LSPR: localized surface plasmon resonance, SPR: Surface plasmon resonance, MNP: Metal nanoparticles, ESM: egg shell membrane, TEM: transmission electron microscopy, SEM: scanning electron microscopy, XRD: X-ray diffraction, FTIR: Fourier-transform infrared.

II. CONCLUSION
Insummary, it provide some glimpses of some simpler nanoparticles that are beingcurrently studied and modified for their potential application for medicine. In this,we collected different types of metal containing nanoparticles.Metal nanoparticlesuch as silver which posses many unique properties which include various applications are medicine, cosmetics, electronics. Silver nanoparticles have high surface area and reactivity, antimicrobial and anti-inflammatory properties make them useful in medicinal field. Gold nanoparticles which used in various field such as medicine, electronics, etc..Like silver nanoparticles it have unique property such as high surface area, conductivity, biocompactibility, which make them useful for application like drug delivery and imaging.Copper nanoparticles have improved efficiency insolar cells, feul cells, and catalysis as well as detecting biomolecule and treating disease.Like other nanoparticles zinc nanoparticle have unique properties such as antimicrobial activity, anti-inflammatory properties and ability to improve wound healing which make them effective tool for developing new drugs or treatment. Iron nanoparticles which showvarious potential activities such as superparamagnetism,biocompatibility and high surface area, which make them applicable for target drug delivery, magnetic resonance imaging and water purification. In this review, it included evaluation and formulation of some of the metal nanoparticle

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