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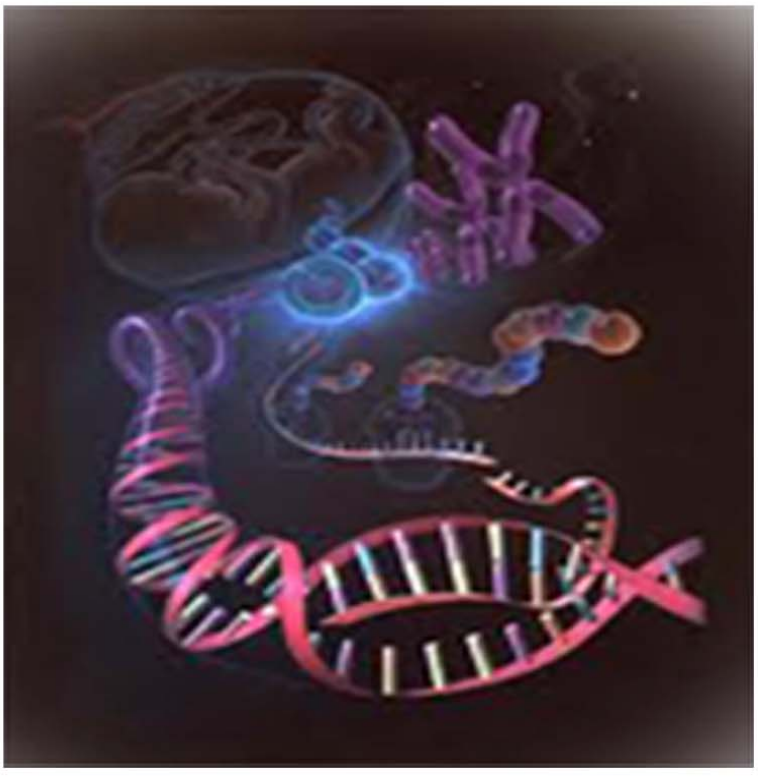

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Research Paper

BIOSYNTHESIS OF SILVER NANOPARTICLES OBTAINED FROM PLANT EXTRACTS OF *MORINGA OLEIFERA*

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Nanoparticles of noble metals such as silver have antibacterial properties; metallic nanoparticles being the most useful, from this point of view Biosynthesis of nanoparticles by plant extracts is currently under exploitation. Plant extracts are not expensive and ecofriendly and thus can be an economic and efficient alternative for the large-scale synthesis of nanoparticles. In the present report, synthesis of silver nanoparticles was achieved trough simple eco-friendly nontoxic, inexpensive, abundantly available route. The silver nanoparticles formed by reaction of biomass of aqueous extracts from plants with aqueous solutions of silver nitrate (AgNO3). The synthesized nanoparticles were confirmed by XRD and Scanning Electron Microscope (SEM)

Keywords: *Moringa oleifera*, Silver nano particles, Microwave radiation

INTRODUCTION

Nanotechnology has wide area of applications. Nanotechnology can be considered as a description of activities at the level of atoms and molecules that have applications in all fields, like electronic, magnetic, optoelectronics, biology, medicine (Kumar and Yadav, 2009; Singh *et al*., 2008; and Paknikar, 2007). The size of nanomaterials is similar to that of most biological molecules and structures; therefore, nanomaterials can be useful for both *in vivo* and *in vitro* biomedical research and applications. Nanomedicine has generated great enthusiasm in recent years due to important discoveries, especially in cancer therapy (Fierascu, 2008).

The synthesis, characterization and application of biologically synthesized nano-materials have become an important branch of nanotechnology. Many chemical routes are known to use toxic chemicals for the synthesis of the nanoparticles. The need-of-the-hour, however is to evolve procedures for nanoparticles synthesis through environmentally benign routes. Researchers in this field, therefore, have been eagerly looking at biological systems as alternative ecofriendly or nontoxic systems

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(Bunghez, 2010). Chemical synthesis methods lead to presence of some toxic chemical absorbed on the surface that may have adverse effect in the medical applications. Green synthesis provides advancement over chemical and physical method as it is cost effective, environment friendly, easily scaled up for large-scale synthesis and in this method there is no need to use high pressure, energy, temperature and toxic chemicals (M A Dubey, 2009).

The importance of bactericidal nanomaterials is due to the increased resistant strains of bacteria against most potent antibiotics. This has promoted research in the well-known activity of silver ions and silver-based compounds, including silver nanoparticles. It is known that silver is usefulness as an antimicrobial agent. Many years, silver has been used as an anti-bacterial agent by people (R Sathyavathi *et al*., 2010).

EXPERIMENTAL PART OF SYNTHESIS OF SILVER NANO-PARTICLES

The extract used for reduction of Ag+ ions to Ag was prepared by taking 50g of thoroughly washed and finely cut *Moringa olifera* leaves (Figure 1) in a 500 mL flask with 250 mL of distilled water. The suspension was subjected to boiling for 5 min. Solution was then allowed to cool and was filtered. Over 10 mL of this was added 10^{-3} M aqueous solution of $AgNO_3$ and subjected to microwave irradiation for 3 min at 800 w.

Figure 1: *Moringa oleifera* Leaf

RESULTS

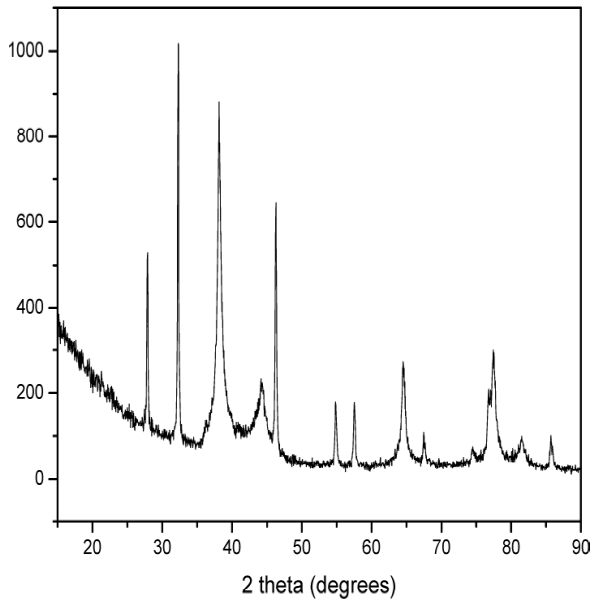
As the *Moringa olifera* extract was mixed in the aqueous solution of the silver ion complex, it started to change the color from watery to yellowish brown, and finally to green-black (Figure 2) due to reduction of silver ion which indicated formation of silver nanoparticles. Morphology, which indicates the presence of both individual and agglomerated nanoparticles as seen from SEM images in Figure 4.

DISCUSSION

Reduction of the silver ions was observed immediately when the silver nitrate solution was contacted with *Moringa oleifera* leaf extract, and the color was changed from water color to

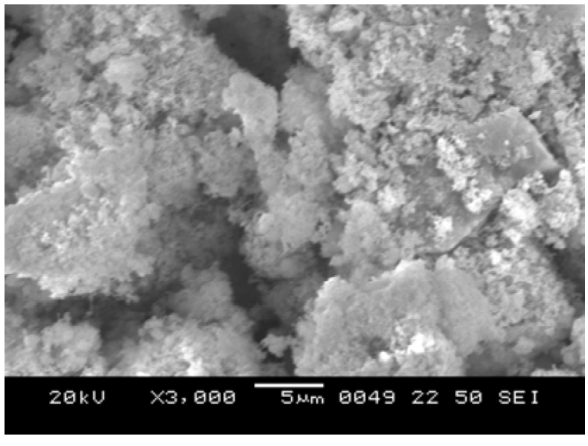
Figure 2: Colors of 10-3 M $AgNO_3$ Solution with Extract and of Silver Nanoparticles Colloid (Ag) After Irradiation

Figure 3: XRD of Silver Nanoparticles in *Moringa olifera* Leaf Extract



yellowish brown and then green-black color on irradiation, due to excitation of surface plasmon vibrations, which indicated formation of silver nanoparticles. Literature confirms that silver nanoparticles can exhibit a size-dependant characteristic surface plasmon resonance band that can be measured using ultra violet visible spectroscopy (Prabhu *et al.*, 2010). The reduction of the metal ions through leaf extracts leading to the formation of silver nanoparticles of fairly well defined dimensions. SEM analysis showed the particle size as well the structure of the nanoparticles.

Figure 4: SEM of Silver Nanoparticles



CONCLUSION

In conclusion, the bio-reduction of aqueous Ag+ ions by the plant extract of the *Moringa oleifera* leaf extract has been demonstrated. In this present study we found that this plant can be also good source for synthesis of silver nanoparticles. This green chemistry approach towards the synthesis of silver nanoparticles has many advantages such as, ease with which the process can be scaled up, economic viability, etc. Applications of such eco-friendly nanoparticles in bactericidal, wound healing and other medical and electronic applications, makes this method potentially exciting for the large-scale synthesis of other inorganic materials (nanomaterials).

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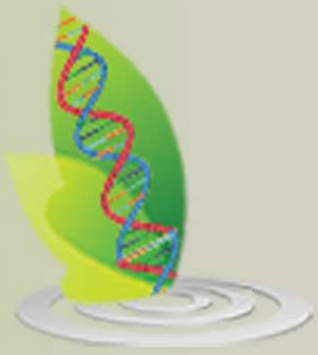

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