MICROWAVE IRRADIATION SYNTHESIS OF SILVER NANOPARTICLES USING LEAF AND FRUIT EXTRACT

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ABSTRACT

The immense use of Nanoparticles due to its small size and change in size affects the properties enormously. These can be synthesized by different physical, chemical and biological methods. But biological approach is more convenient, ecofriendly, low cost, less time consuming. A microwave irradiation synthesis of silver nanoparticles were carried out biological approach using extracts of Neem leaves (Azadirachta Indica) and bitter gourd (Momordica Charantia) fruit .We synthesized silver nanoparticles by mixing two different extracts along with silver nitrate solution and comparative study has been done. Structural characterization of synthesized sliver nanoparticles was performed by uv-vis and FTIR spectroscopy. The synthesized silver nanoparticles exhibit energy absorption band at 300nm-420nmfor different samples. The FTIR spectra of synthesized silver nanoparticles showed strong bands at 3400, 1500, 1350,500 cm^{-1} to identify the compounds for the reduction of silver ions to silver atoms, the functional groups present in plantfruit extract were investigated by FTIR.

Keywords:Azadirachta Indica, FTIR, Momordica Charantia, Microwave irradiation, Neem leaves, Silver Nanoparticles, Spectra.

I.INTRODUCTION

Nanotechnology is promising as a rapidly growing field with its applications in Science and technology. Silver Nanoparticles (AgNPs) are studied widely among researchers. With this keen interest of AgNPs among researchers the need for synthesis of Silver nanoparticles has increased. But the need for biosynthesis of nano particles arose as the physical and chemical processes are less convenient. Often, Chemical synthesis method leads to presence of some of toxic chemicals that adverse effect in the medical applications. This is not an issue when it comes to biosynthesis route. So, in the search of cheaper pathways for nano particles synthesis, scientists use microbial enzymes, plant and fruit extracts. With their antioxidant and reducing properties they are responsible for the reduction of silver ion to silver metal nano particles. Green synthesis provides advancement over chemical and physical method as it is cost effective, eco friendly and in this method there is no need to use high energy, temperature and toxic chemicals.[1]The main objective of this paper is to study the formation and characterization of silver nano particles by green synthesis for the further applications of it in optical sensors,

effective diagnostic techniques and also for antibacterial activities. The first time in this paper we have reported that the microwave irradiation green synthesis of silver nanoparticles by reduction of silver ions using mixed extracts of Neem leaves and Bitter Gourd fruit. The reaction process is very simple, cost effective, and rapid. The extracts mixtures of Neem leaves and Bitter gourd acted as reducing agents, stabilizing agents and also capping agents for AgNPs. Formation of silver nano particles was confirmed by SPR spectra using UV-VIS spectrometer and absorption peak is found at 300nm-425nm for various samples. The properties were characterized by UV-VIS and reducing and functional groups were characterized by FTIR.

II. EXPERIMENTAL

Typically, a plant extract-mediated bio reduction involves mixing of aqueous extract with an aqueous solution of the appropriate metal salt. The synthesis of nano particle occurs within 15 to 20 seconds in a microwave oven.

2.1 Materials

Neem leaves, Bitter Gourd, Silver Nitrate ($AgNO_3$), Distilled water.

2.2 Preparation of Plant and fruit Extract

Neem leaves extract was used to prepare silver nanoparticles on the basis of cost effectiveness, ease of availability and its medical property. Fresh leaves were collected and surface cleaned with running tap water to remove contaminated organic contents, followed by distilled water. About 20 gm of finely cut leaves were kept in a beaker containing 100 ml distilled water and boiled for 20 seconds in a microwave oven. The extract was cooled down and filtered for the further use.

Similar procedure is fallowed for Bitter gourd fruit extract. Fresh fruits were collected from the market. About 20 gm of finely cut pieces were placed in a beaker containing 100ml of water and boiled for 30 seconds and then filtered for the further use.

2.3 Green synthesis of Silver nano particles

Solution of Silver nitrate was prepared of about 500ml of 0.1mM solution. Freshly prepared 10 ml of neem leaves extract is added to the 100 ml of $AgNO_3$ solution. This set up is placed in a microwave oven and irradiated with microwaves for 70 seconds , reduction of Ag^+ to $Ag^0$was confirmed by color change of solution from colorless to brown. FIG1

Solution of Silver nitrate was prepared of about 500ml of 0.1mM solution. Freshly prepared 10 ml of bitter gourd fruit extract is added to the 100 ml of $AgNO_3$ solution. This set up is placed in a microwave oven and irradiated with microwaves for 60 seconds , reduction of Ag^+ to $Ag^0$was confirmed by color change of solution from colorless to brown. Fig1

2.4 Combination of extracts and synthesis of AgNPs

We take the different combination of plant and fruit extract for further synthesis of silver nanoparticles and to study its properties.

2.4.1 Different ratios of extracts (Bitter gourd 6ml + neem leaves 4ml+ 100mland (Bitter gourd 4ml+ neem leaves 6ml + 100ml $AgNO_3$ solution)

2.4.2 Synthesis

These different combinations were kept in a microwave oven for 70 seconds and color change was observed from colorless to brown. Fig1

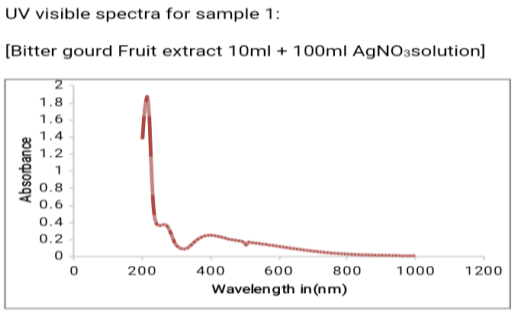
Fig1

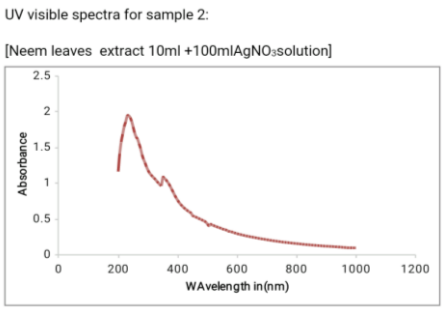
III.CHARACTERIZATION OF SILVER NANOPARTICLES

UV-Vis spectra analysis has been done after 24 hours of preparation, 1ml of sample was pipette out into a test tube and analyzed at a room temperature. The FTIR spectra recorded to analyze functional group, stabilizing and capping agent.

3.1 Visual observation of UV-VIS spectra

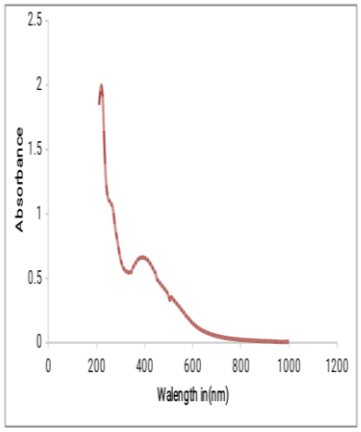
In all experiments addition of plant extracts of Neem leaves and fruit extracts of bitter gourd into the beakers containing aq. Solutions of $AgNO_3$ led to change im color of the solution from colorless to brown within reaction duration due to excitation of surface Plasmon resonance in AgNPs. On the addition of different combination of extracts to aq solution of AgNO3 keeping its concentration constant.The color of solution is changed from brown to dark brown. .Finally colloidal brown solution indicating the formation of AgNPs. from UV-vis graphs its clrarly shown the absorbance peak are found at 300nm to425nm which tells us the formation of nanoparticles by comparing with previous reports.





UV visible spectra for sample 3:

[Bitter gourd Fruit extract 6ml + neem leaves extract 4ml + 100ml $AgNO_3$ solution]



10nm. UV visible spectra for sample 4:

[Bitter gourd Fruit Extract 4ml + Neem leaves Extract 6ml + 100mlAgNO3 solution]

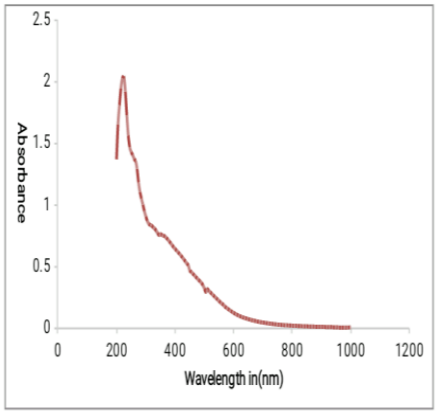


Fig2

IV.FTIR ANALYSIS

FTIR analysis measurement were carried out to identify the bio molecules for capping and stabilizing agents of a metal nano particles synthesized. The FTIR spectrum shows (Fig3)a band between 3400-3500cm^{-1} corresponds to O-H stretching H- bonded alcohols and phenols. The peak around 1500-1600cm^{-1} corresponds to C-H bonds. The peak around 1350-1450 cm^{-1} showed the bond stretch for N-h. Therefore the synthesized nano particles were surrounded by proteins and metabolites such as terpenoids etc. From the analysis of FTIR studies are confirmed that carbonyl groups from amino acid residues and proteins has a strong ability to bind the metal (i.e. capping of AgNPs) to prevent agglomeration and stabilize them. This suggests that biological molecules could perform dual role of formation and stabilization of AgNPs.

FTIF analysis

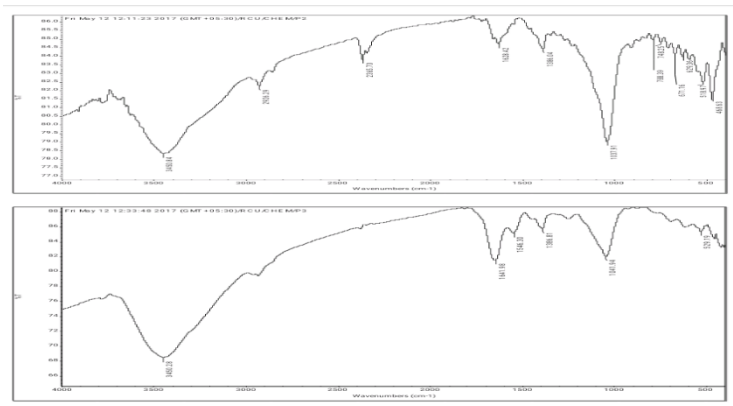


Fig3

V. CONCLUSION

Silver nano particles have been synthesized by reducing silver ions with an aq. Extracts of neem and bitter gourd fruit. The silver nano particles have been characterized by UV-VIS and FTIR spectra. From FTIR it is confirmed that bio molecules could possibly performed dual functions of formation and capping agent of AgNPs.. The XRD and SEM analysis of these samples may be studied in the future for the extension of its applications in optical sensors, neem leaves and bitter gourds are known to be medicinal plants and silver is also anti bacterial agent so we may extend this work to study antibacterial property. .Due small size of AgNPs we may use it in medical diagnostic techniques. Due to surface Plasmon activation of silver nano particles we may use it as a sensors.[4]

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