GREEN SYNTHESIS AND CHARACTERIZATION OF SILVER NANOPARTICLES USING PLANT EXTRACT

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ABSTRACT

In recent science , Nano technology is a burning field for the researchers. These particles can be prepared easily by different chemical ,physical, and biological approaches. The Green synthesis was done by using aqueous solution of Azadirachta indicia leaf extract and AgNo3.Silver was of a particular interest for this process due to its evocative physical and chemical properties. The Nano particles were characterized by UV –Vis spectrophotometer,FTIR, DLS,ZetaAnalysis,XRD, and SEM.Thenano particles were found have the size ranges from 160-180 nm.

Key words : Nanotechnology, Nanoparticles, Green Synthesis.

INTRODUCTION

Due to their extraordinary physicochemical properties, metallic nanoparticles (NPs) have been effectively applied in numerous fields, including health care, synthetic biology, and cellular transportation [1]. Amongst various nanoparticles, AgNPs have received particular attention due to their unique morphologies, stability, and controlled geometry [2]. AgNPs have been largely used in various electronic and sensing devices, coating materials, data packing, and molecular switches [3–5]. Apart from this, they have also been applied in the diagnosis and treatments of various diseases [6]. Particularly, AgNPs possess excellent antimicrobial activities against several microorganisms whichare known to be responsible for several infectious diseases. Due to this, they have been successfully used in different medical products, such as in coating materials of catheters for cerebrospinal fluid drainage [7–9], contact lenses [9], and other medical devices. They have also been used in bone cement [10], surgical masks, impregnated textile fabrics, nanogels, nanolotions [11–14], wound

dressings, etc. [15]. Indeed, a majority of the Ag-based products developed have been commercialized and are approved by global regulatory bodies

Nanoparticles have unique properties as a consequence of their size, distribution and morphology and, therefore, are a very important component in the rapidly developing field of nanotechonology. Silver has been known, for more than 2000 years, as a metal that exhibits good medical properties, silverbased compounds being used in numerous antimicrobial applications. Silver ions are highly toxic for microorganisms and, therefore, have multiple roles in the medical field [16]. In the majority of cases, silver participates in its nitrate form, thus inducing a strong antimicrobial effect but when silver nanoparticles (AgNPs) are used the surface area exposed to different types of microbes increases considerable [17]. AgNPs are a very important part of nanotechnology mainly because they do not induce modification on living cells and, so, are unable to cause microbial resistance. Recent studies revealed that AgNPs have the ability to attach to cell walls and alter cellular respiration. AgNPs are widely used in biology and medicine especially because of their attractive and unique physiochemical properties. Researches carried out in the late 1970s used silver particles for the treatment of orthopedic diseases caused by different infections with microorganisms and a faster bone recovery was noticed. Many other applications can be attributed to AgNPs, for example: catalysts in chemical reactions, bio-labeling, spectral selective coatings for the absorption of solar energy, food additives, textile industry etc., as it can be seen in Figure 1. Figure 1. Different applications of silver nanoparticles AgNPs can be obtained by using conventional or unconventional methods, using two different approaches: “topdown” and “bottom-up”. Although there are numerous conventional methods used to obtain AgNPs (e.g.: solution, chemical / photochemical reactions in reverse micelles, thermal decomposition of different silver compounds, electrochemical, sonochemical, radiation and microwave-assisted routes) they usually involve hazardous chemicals, low compound conversions, high energy requirements and wasteful purifications [18,19]. In recent years green chemistry and biosynthetic methods have become more attractive ways to obtain AgNPs. These unconventional methods use either biological microorganisms (e.g.: bacteria, fungi, marine algae, yeasts) or different alcoholic or aqueous plant extracts. Green synthesis has multiple advantages over classical routes: it is cost effective, eco – friendly and does not require high pressure, energy, temperature or the use of toxic chemical reagents [20].

EXPERIMENTAL TECHNIQUE

PREPERATION OF PLANT EXTRACT

From Azadirachta indicia leaves

Fresh leaves of Azadirachta indicia were collected in our place and washed several times with water to remove dust particles and then sun dried to remove the residual moisture and grinded to form powder. Then plant extract was prepared by mixing 1% of plant extract with deionized water in a 250ml of conical flask.Thenthe solution was incubated for 30 minutes and then subjected to centrifuge for 30 minutes at room temperature with 5000rpm.The supernatany was separted and filtered with filter paper with help of vaccum filter.. Then the solution was used for the reduction of silver ions to silver nano particles.

From Acoruscalamus rhizome

Dried rhizomes of Acoruscalamus were brought in our native place and grinded to form powder.Then plant extract was prepared by mixing 1% of plant extract with deionized water in a 250ml of conical flask.Then the solution was incubated for 20 minutes and then subjected to centrifuge for 30 minutes at room temperature with 5000rpm.The supernatany was separted and filtered with filter paper with help of vaccum filter.. Then the solution was used for the reduction of silver ions to silver nano particles.

Synthesis of silver Nanoparticles

Four concentration ratios of plant and metal ions were prepared (30:1,60:1,120:1,240:1) by increasing the concentration of plant extract concentration in the solution.0.17% of 1mM$AgNO_3$ metal ion was added in the prepared plant extract.

Characterization of silver nanoparticles

UV –Vis analysis

Optical property of AgNPs was determined by UV-Vis spectrophotometer.After the addition of $AgNO_3$ to plant extract, the spectra were taken in different time intervalsupto 24 hrs between 350nm to 500nm.

FTIR Analysis

The chemical composition of the synthesized silver nanoparticles was studied by using FTIR spectrometer.

XRD Analysis

The phase variety and grain size of synthesized silver nanoparticles was determined by X –ray Diffraction spectroscopy.

SEM Analysis

The morphological features of synthesized silver nanoparticles from neam plant extract were studied by Scanning Electron Microscope.

DLS & Zeta – potential Analysis

Dynamic light scattering was employed to study the average particle size of nanoparticles.

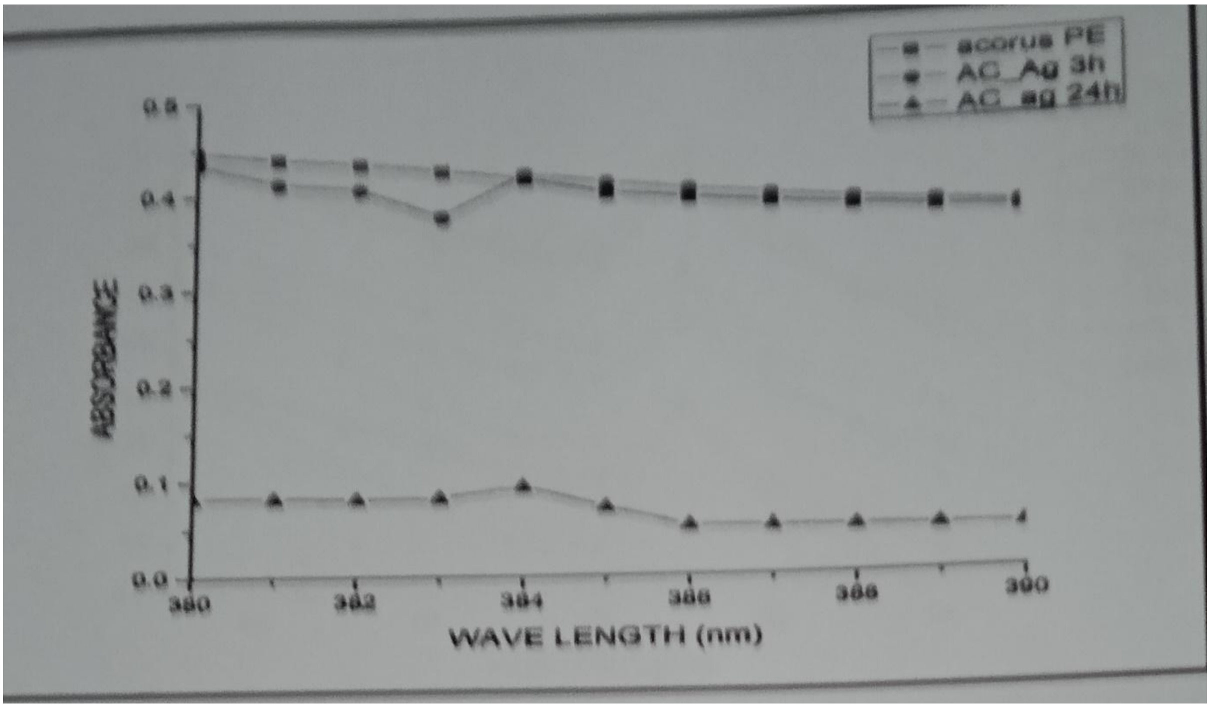
CONCLUSION

The synthesized nanoparticles were of spherical and sheet shaped and the estimated sizes were 160-180nm. From the techniques of UV-Vis spectrophotometer,SEM, DLS, Zeta Analuser, XRD, FTIR find the shape of nanoparticles. From the data of DLS it was found that the 30:1 ratio solution had sharp nanoparticles of around 5nm and some has around 180nm and had the potential of around 15.5mV.

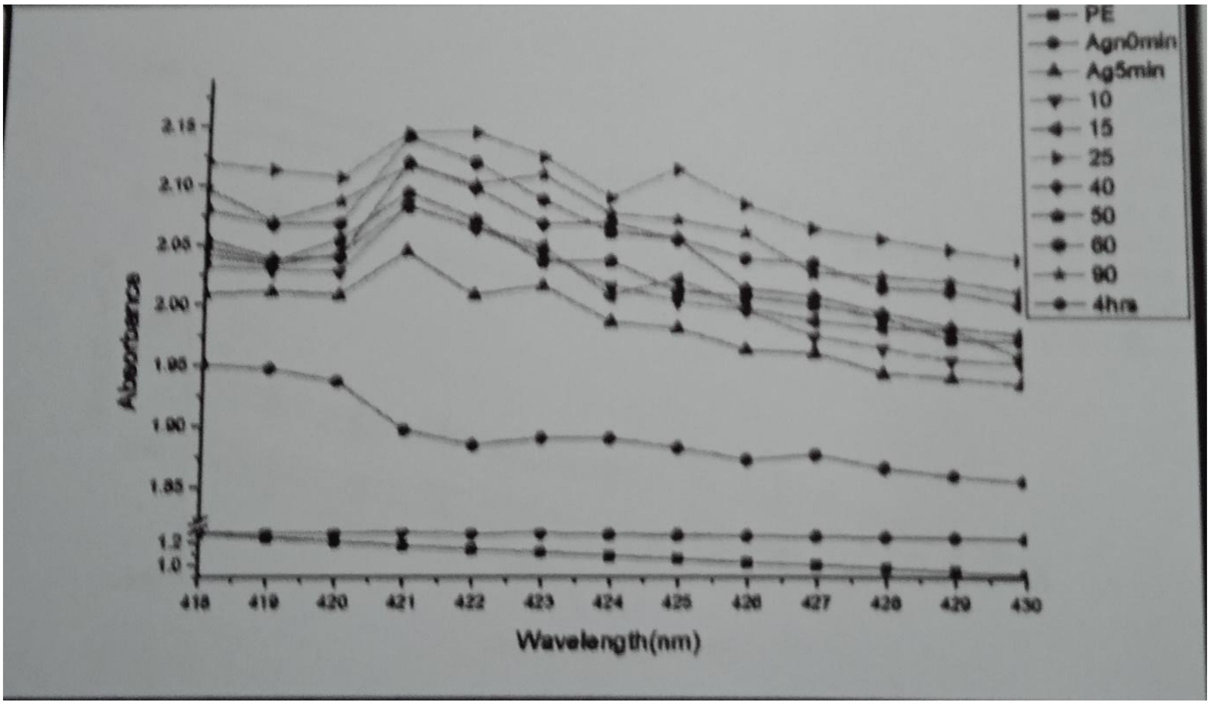
LIST OF FIGURES

PICTURE OF AZADIRACHTA INDICA LEAVES

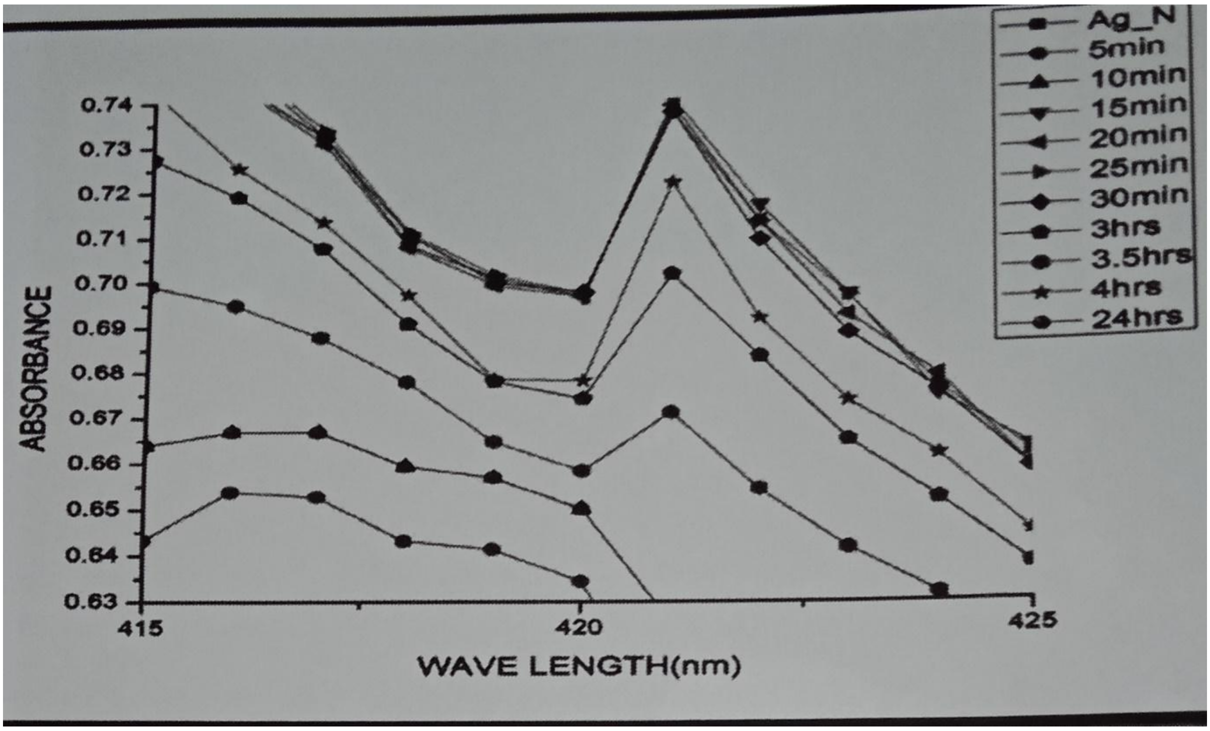

Sweet Flag (Vaikunt)



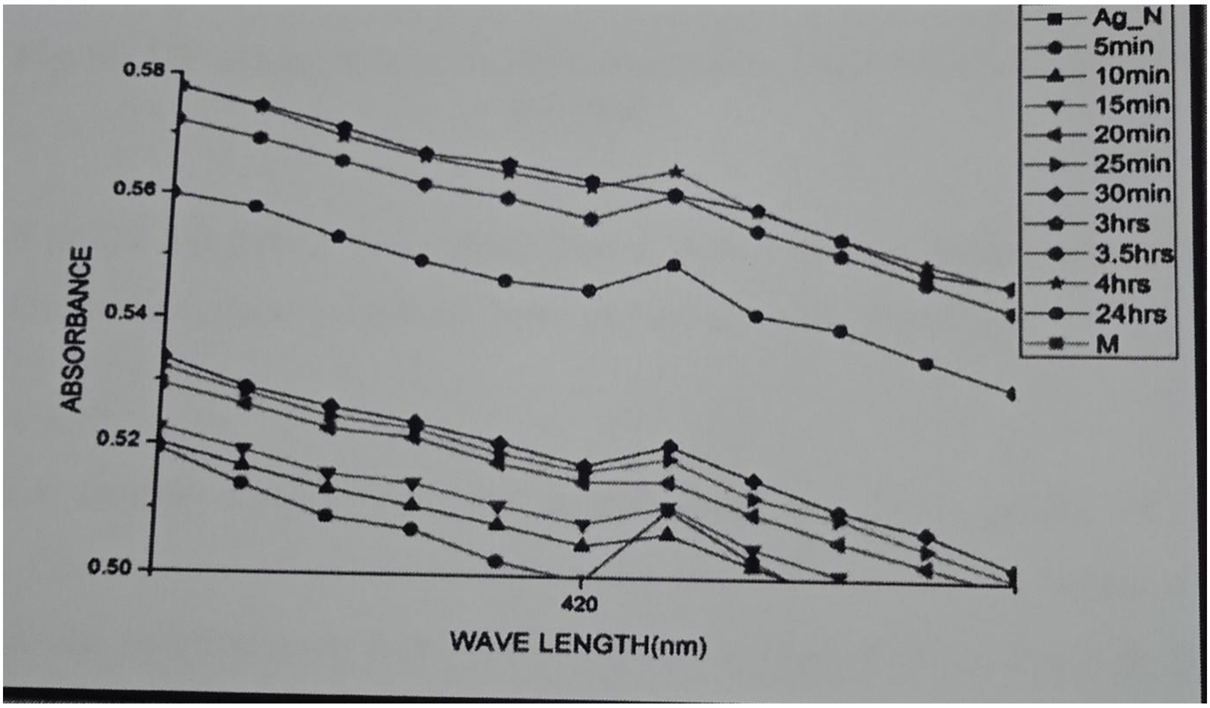
UV- VIS SPECTRA OF ACOROUS CALAMUS AT DIFFERENT TIME INTERVAL



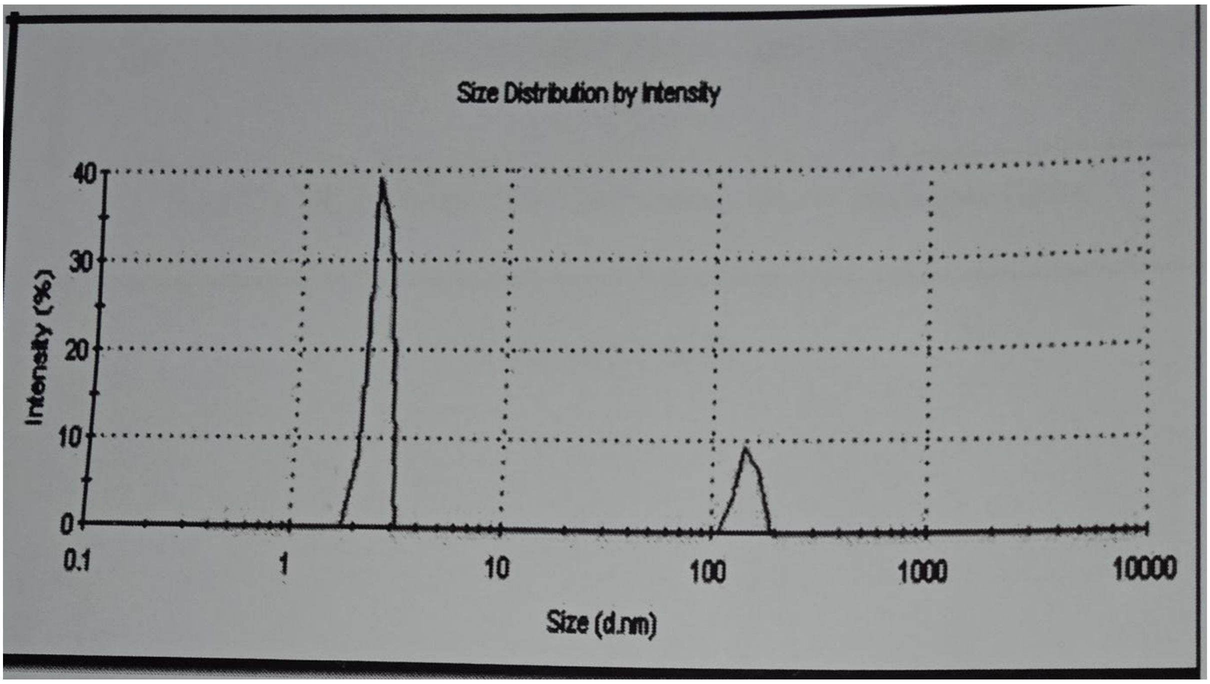
UV- VIS SPECTRA OFAZADIRACHTA INDICA 30:1 RATIO AT DIFFERNET TIME INTERVAL AT DIFFERENT TIME INTERVAL



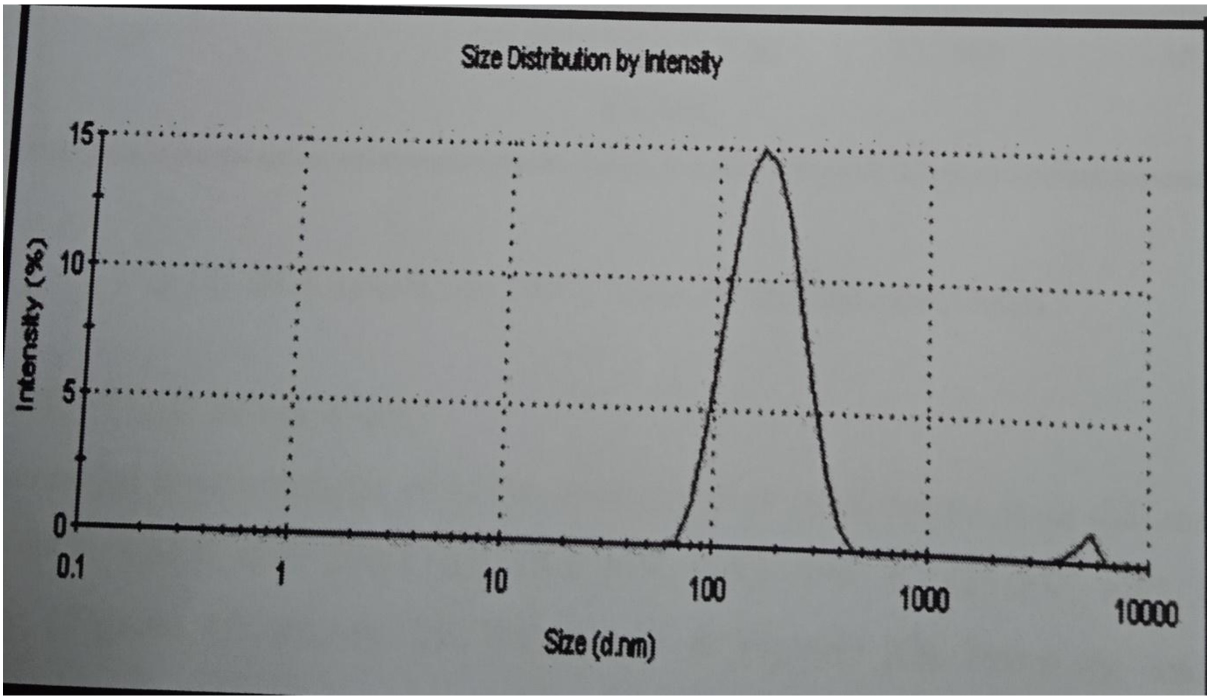
UV- VIS SPECTRA OFAZADIRACHTA INDICA 60:1 RATIO AT DIFFERNET TIME INTERVAL AT DIFFERENT TIME INTERVAL



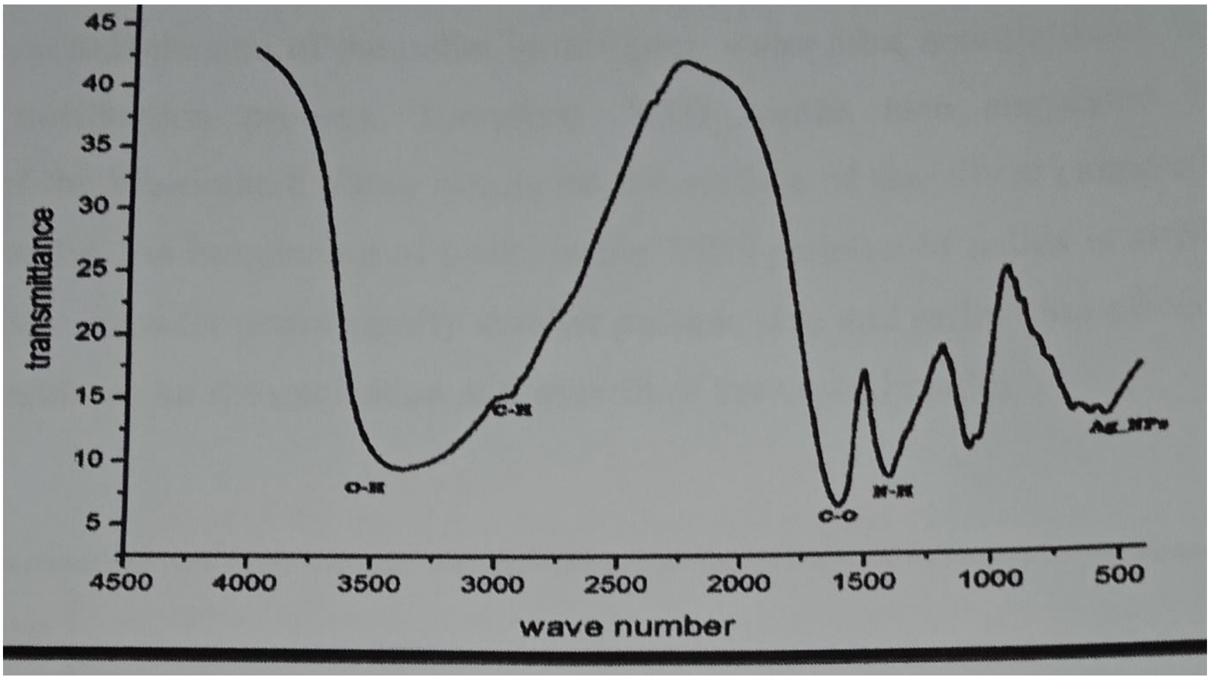
UV- VIS SPECTRA OFAZADIRACHTA INDICA 120:1 RATIO AT DIFFERNET TIME INTERVAL AT DIFFERENT TIME INTERVAL



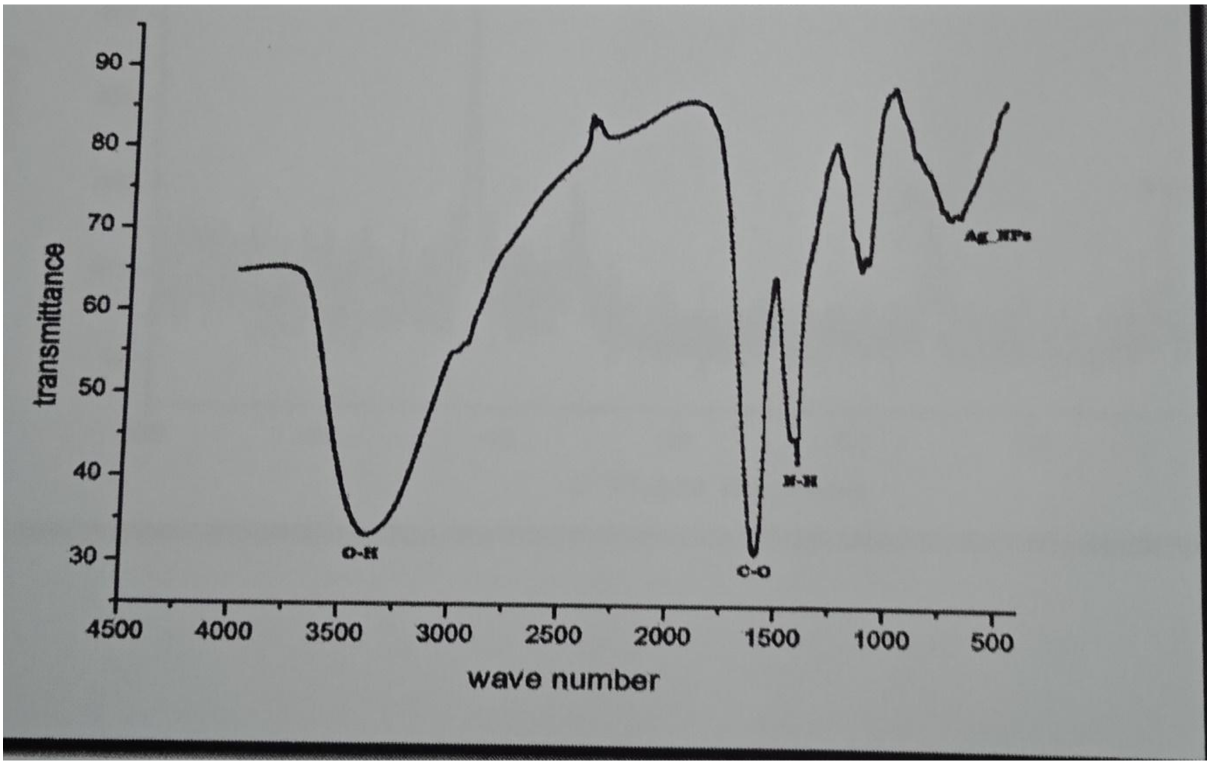
DLS RESULT FOR 30:1 RATIO SILVER NANOPARTICLES



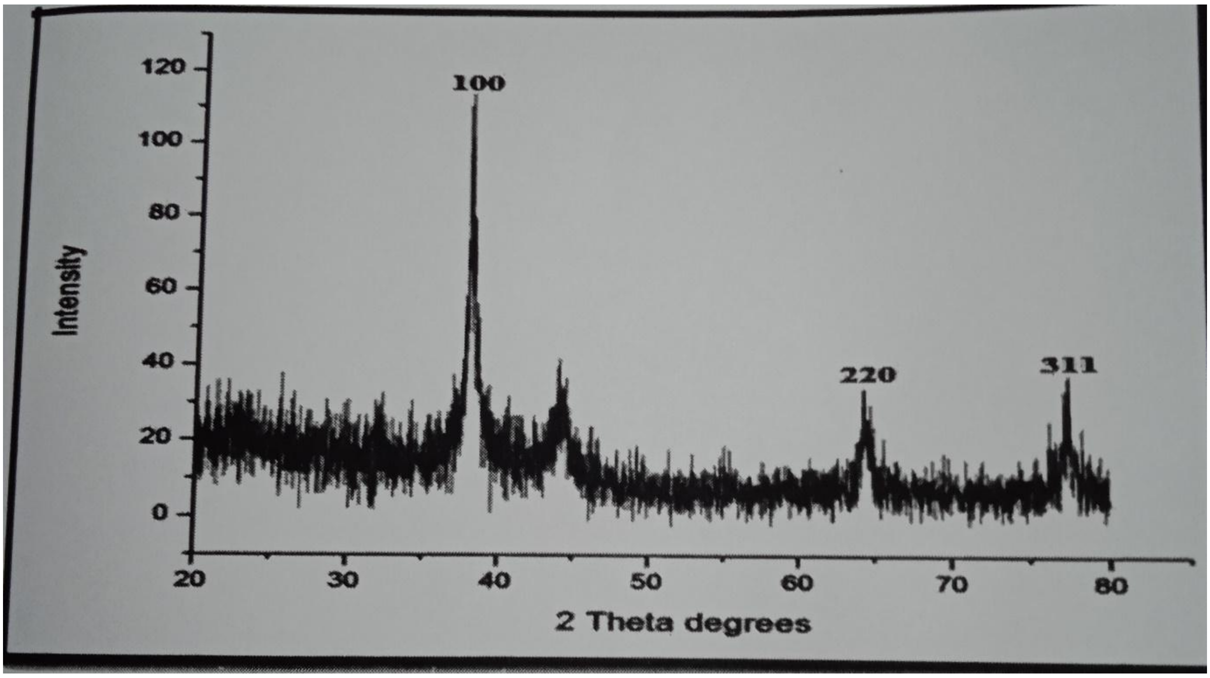
DLS RESULT FOR 60:1 RATIO SILVER NANOPARTICLES



FT-IR RESULT FOR 60:1 RATIO SILVER NANOPARTICLES.



FT-IR RESULT FOR 120:1 RATIO SILVER NANOPARTICLES



XRD RESULT FOR 60:1 RATIO SILVER NANOPARTICLES.

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