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Synthesis and Characterization of Nano Particles Using Spectroscopy

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Abstract: The much interested topic among the global chemists and researchers and a topic making a strong impact in all spheres of human life is Nanotechonology. Nano- the greek word indicating one billionth of a meter or 10^{-9} are clusters of atoms and their size from 1-100 nm. The term Nano Techonology commenced some where in the date 1959. Nano particles gained prominence and dominance because of its various applications in different fields. These Nano particles were grouped as organic nano particles and inorganic nano-particles. Nano Technology, a mushrooming field is emerging as a safe and best alternative to conventional methods.

Key wards : nano-particles,

Nano materials

The nano materials are characterited by a number of spectroscopic methods like.

UV-VIS	- Ultra Violet – Visible Spectroscopy
XRD	- X- ray Diffraction
SEM	- Scanning Electron Microscopy
TEM	- Tunneling Electron Microscopy
FTIR	- Fourier Transform Infra Red Spectrocopy
EDS	- Energetic Dispersive X-ray Spectrometer

Synthesis and Characterization of Silver nanoparticles

In a typical reaction procedure, different concentrations (2, 4, 6, 8, 10 mL) of Phyllanthus amarusleaf extract were added to 5 mM aqueous Ag acetate solution. This mixture was kept at room temperature under vigorous stirring for 1 hr. The change in color indicated synthesis of NPs. From UV-Vis analysis, we observed 6mL extract is suitable amount for formation of Ag NPs using Ag acetate and Phyllanthus amarus plant extract. In another experiment, silver reduction was carriedout by mixing different concentrations of Agacetate (205, 7.5, 10, 12.5 mM) and 6 mL Phyllanthus amarus plant extract solution without varying other conditions.

The colorless Agacetate solution turned yellow to brown or reddishyellow to deep red, indicated the formation of Ag Nps. This is shown by Figure 1. The appearance of the brown color was due to the excitation of the surfaceplasmon vibrations, typical of AgNps having λ max values which were reported earlier in the

visible range of 400 – 500 nm. The SPR absorbance was extremely was extremely sensitive to the nature, size and shape of the particles formed, their inter particledistances and the surrounding media.

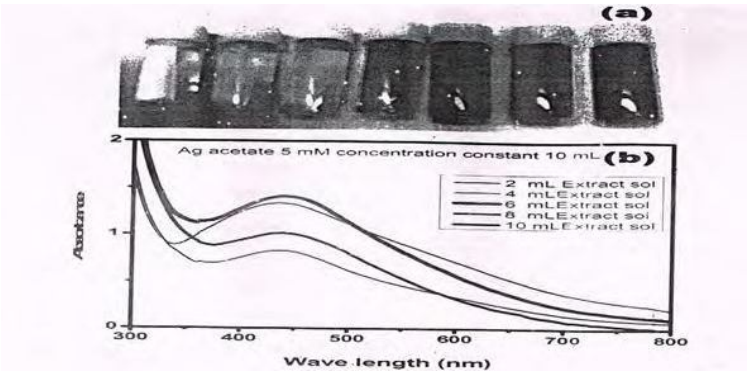

Figure 1 (a) Colors of Ag NPs with various concentrations of extract solution including Ag acetate and leaf extract (b) UV-Vis absorption spectra of AgNPs recorded as a function of amount of extract solution from 2-10 mL with fixed concentration of Ag acetate (5mM)

Figure 1 shows the UV-vis spectra of the nanoparticles obtained on varying the amount of the plant extract solution ranging from 2 – 10 mL. The particles synthesized with 2 mL plant extract solution plasmonresonalce band at 410 nm. On increasing the concentration to 6 mL λ max increased to 430 nm. The slight variations in λ max values signify changes in particle size owing to changing concentration of plant extract solution.

Figure 2 shows the UV-vis spectra of the AgNPs obtain on varying the Agacetate concentrations (2.5, 5, 7.5, 10, 12.5 mM) and 6 mL plant extract solution.

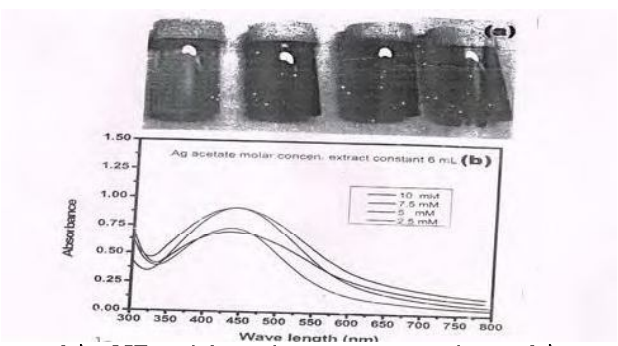

Figure 2 (a) colors of Ag NPs with various concentrations of Ag acetate (b) UV-Vis absorption spectra of AgNPs recorded as a function of Ag acetate concentration with fixed amount extract solution 6mL

As the concentration of Agacetate increased, the intensity of the colour also increased from yellow to deep red figure 2. The surface plasmonpeak for AgNPs became distinct with increasing concentration of Agacetate Figure 2. The Plasmon bands are broad with an absorption tail in the longer wavelengths as concentration of Agacetate increases which indicated enhancement in size of particles9. However, the color intensity also increased as it dependedupon size of AgNPs. In order to get control growth and samller particle size, we have used 5mM Agacetate and 6 mL aqueous Phyllanthus amarus extract for the further study reaction were carried out under the above mentioned condition.

On examining XRD pattern Figure 3 of silver nanoparticles, the prominent peaks at 20 = 38.13, 44.21, 64.47, 77.37, represents the (111), (200), (220), (311) and (222) Bragg's reflections of the face-centered cubic structure of silver respectively.

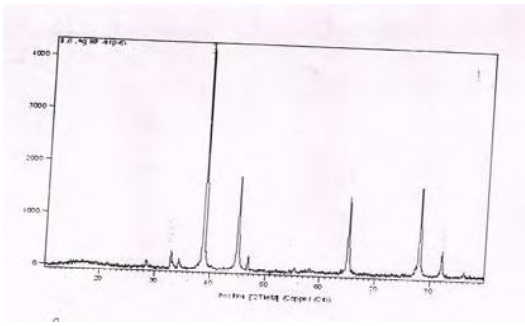

Figure 3 XRD pattern of Ag NPs synthesized using phyllanthus Amarus leaf extract.

SEM images Figure 4 of the samples obtained from the colloidal Ag solutions prepared at room temperature confirms the existence of very small and uniformly spherical nano particles.

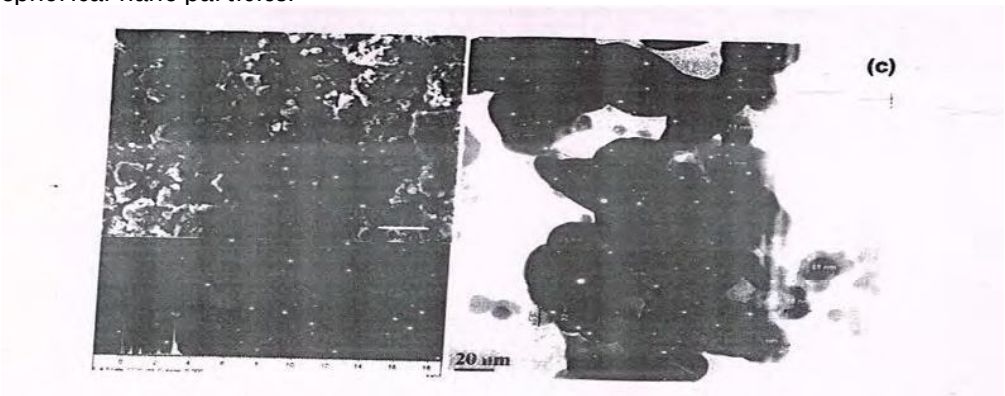

Figure 4 SEM image (b) TEM image of Ag NPs synthesized using phyllanthus Amarus leaf extract.

From the SEM images it can be observed that larger particles of Ag NPs are formed due to aggregation of nano particles which might be induced by the

evaporation of solvent during sample preparation. This could have contributed for the variation in a particle size. The elemental composition of powdered sampled was determined using SEM (JEOL-JSM 6610 LV) equipped with an EDAX (OXFORD) detector. The energy dispersive X-ray analysis (EDAX) shown in Figure 4.5 (b) revealed the strong signal in the silver region and confirmed the formation of AgNPs. Metallic silver nanocrystals generally show typical optical peak approximately at 2.983 ke V due to surface Plasmon resonance. A transmission electron microscope was employed to analyze the size and shape of the formed nano particles. From the Figure 4 it can be inferred that silver nano particles were largely uniform with narrow size distribution. TEM image of silver nano particles illustrates that they are in spherical shape an average size of about 25 nm.

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