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Green Synthesis and Characterization of Silver Nanoparticles by using Aloe Vera plant extract

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***Abstract*-** Silver nanoparticles are important materials have been studied extensively. Biosynthesis of silver nanoparticles from plants has an important role in biomedical science and drug discovery application. Green synthesis of silver nanoparticles is a growing research area because of their potential applications in nanomedicines. Hence, in the present study, we investigated the green synthesis of Ag Nps from silver nitrate using leaves extracts of Aloe vera. The synthesized nanoparticles were characterized by UV-Visible spectrophotometer, Fourier transform spectroscopy (FT-IR) and Zeta Potential.

***Keywords*:** Aloevera, Silver Nanoparticles, UV-Visible spectrophotometer, Fourier transform spectroscopy (FT-IR) and Zeta Potential.

I. INTRODUCTION

Medicinal plants are of great importance to the health of individual and communities. The medicinal value of the plant lies in some chemical substances that produce a definite physiological action on the human body. [1]. Today, medicinal plants play a great role in human health services worldwide. Many people in the modern world are turning to herbal medicine. For example, in USA about 25% of all prescriptions dispensed in public pharmacies in 1973 contained drugs extracted from higher plants and about 64% of the total global populations remain dependent on traditional medicine for their healthcare needs [2].

The name Aloe vera is derived from the Arabic word Alloeh meaning shining bitter substance, while vera in Latin means true. The plant Aloe vera has a history dating back to biblical times [3]. There are over 260 species of Aloe grown around the world. Only two species are grown commercially- Aloe arborescens and Aloe barbadensis Miller [4]. Aloevera is a plant that belongs to Liliaceae family that grows easily in hot and arid regions [5].

Figure.1 Aloe Vera

Nanoparticles can be broadly classified into four groups based on their composition, structures and functionalities as carbon based nanoparticles, dendrimer nanoparticles and nano-composites, metal based nanoparticles.

II. MATERIALS AND METHODS

Chemicals

All chemicals, solvents and media used in this study were of analytical grade and purchased from Merck (Pty) Ltd Mumbai, India.

Preparation of plant extract

Fresh leaves of Aloevera (Figure 1) were collected from Banasthali Vidyapith campus, and then washed several times with distilled water to remove the dust particles, impurities of any other stalks. Remove the green skin of the Aloevera leaves and cut them into small pieces. About 15 gram of finely cut aloevera leaves kept in a 500 ml beaker containing 100 ml double distilled water and boiled for 30 minute. The Aloevera leaves extract were cooled down and filtered with whatman filter paper no 1before centrifuging at 12,000 rpm for 14 minutes to remove the heavy biomaterials and extract was stored at 4^0 C for further use [6].

Synthesis of Silver Nanoparticles

0.01 M silver nitrate solution was prepared by distilled water. 10 ml of the silver nitrate solution was taken in a 200 ml glass beaker and kept in magnetic stirrer for 20 minutes at 60 ^{0} C. 1ml of the Aloevera plant extract was added drop wise in silver nitrate solution with continuous stirring. The

mixture was kept on magnetic stirrer for 20 minutes to observe colour change to indicates synthesis of silver nanoparticles. All experiments were carried out in triplicates.

III. CHARACTERIZATION OF AG NPS

UV-Visible Spectroscopy

Ultraviolet-visible spectroscopy refers to absorption spectroscopy in the UV-Vis. spectral region. The NPs were characterized in a Double beam UV-VIS Spectrophotometer (Labman Scientific Instruments). The scanning range for the samples was 300-800 nm. The double distilled water used as a blank reference.

Fourier Transform Infra-red Spectroscopy

The nanoparticles were characterized using a Fourier Transform Infrared Spectrophotometer (FTIR- BRUKER). FTIR spectra were recorded in the absorption range between 400 and 4000cm¯1.

Zeta Potential

A particle size analyzer (Malvern Zeta Potential – Model B.2590 Nano Sizer) was used to find out the size distribution of ZnO. In order to find out the particle size of sample was prepared in distilled water (1ml Ag NPs sample was diluted with 9 ml distilled water and proceed for analysis).

IV. RESULT AND DISCUSSION

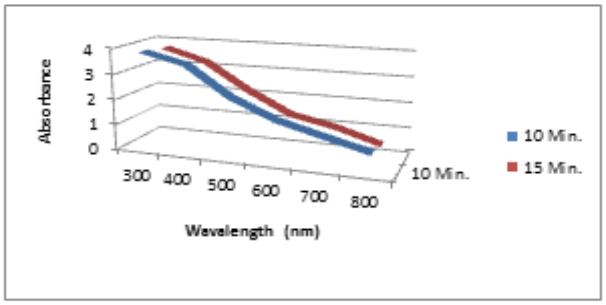

Figure. 2 UV–visible spectra of Ag NPs

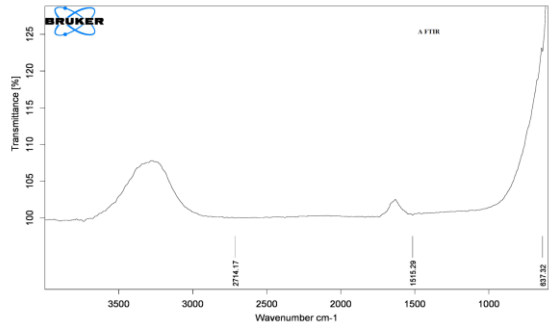

Figure 3 FTIR spectra of biosynthesized Ag NPs by using Aloevera

FTIR Analysis

Figure 3 showing FTIR Spectra of aqueous Ag NPs synthesized from Aloevera leaves extract was carried out to identify the possible biomolecules responsible for capping and stabilization of nanoparticles. Absorbance bands were observed at 2114.17 cm-1, 1515.29 cm-1 and 637.32 cm-1 which suggests that these biomolecules may have played a role in the nanoparticle synthesis.

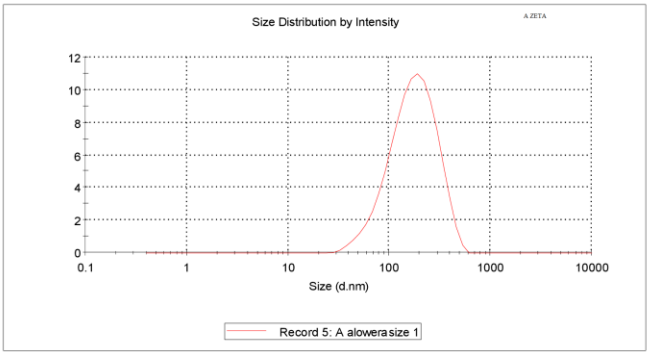

Figure. 4 Particle size distributions of synthesized Ag NPs using Aloevera leaves extract (0.01M) **(A)** Zeta sizer **(B)** Zeta potential

System

Temperature	25	**Duration Used (s)**	70
Count Rate (kcps)	209.7	**Measurement Position (mm)**	4.65

Results

Z-Average (d.nm)	**152.3**
Pdi	**0.258**

	Size(d.nm)	**%Intensity**	**St. Dev(d.nm)**
Peak1	191.5	100.00	94.86
Peak2	0	0	0
Peak3	0	0	0

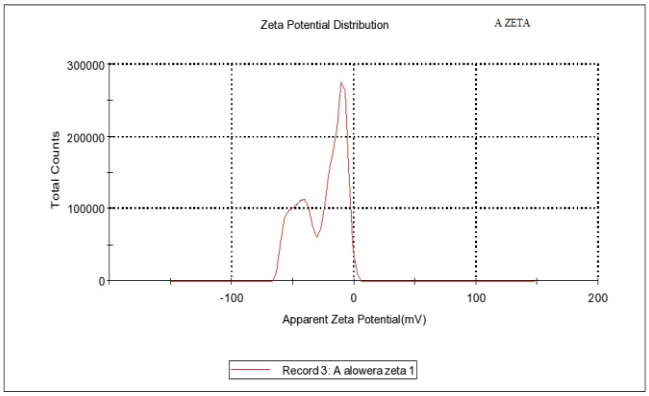

Figure.5

System

Temperature	25	**Zeta Runs**	12
Count Rate (kcps)	195.5	**Measurement Position (mm)**	2.00

Results

Zeta Pontential (mV)	**-25.5**	**Conductivity(mS/cm)**	0.0743
Zeta Deviation(mV)	17.5		

	Size(d.nm)	**%Intensity**	**St. Dev(d.nm)**
Peak1	-13.6	62.2	7.59
Peak2	-45.3	37.8	8.75
Peak3	0.00	0.00	0.000

Zeta size and zeta potential analyser shows that the zeta size range of the Z-Average (d.nm) 152.3, Pdi 0.258 and zeta potential range of the Zeta Pontential (mV) -25.5, Zeta Deviation(mV) 17.5 (Figure- 3).

V. APPLICATIONS OF SILVER NANOPARTICLES (Ag NPs) IN PHARMACEUTICS, MEDICINE, AND DENTISTRY-

Pharmaceutics and Medicines

Treatment of dermatitis; inhibition of HIV-1 replication, Treatment of ulcerative colitis & acne, Antimicrobial effects against infectious organisms. Remote laser light-induced opening of microcapsules, Silver-dendrimer nanocomposite for cell labeling, Molecular imaging of cancer cells, Enhanced Raman Scattering (SERS) spectroscopy, Detection of viral structures (SERS & Silver nanorods), Coating of hospital textile (surgical gowns, face mask), Additive in bone cement, Implantable material using clay-layers with starchstabilized Ag NPs, Orthopedic stocking, Hydrogel for wound dressing.

Dentistry

Additive in polymerizable dental materials Patent, Silver-loaded SiO2 nanocomposite resin filler (Dental resin composite), Polyethylene tubes filled with fibrin sponge embedded with Ag NPs dispersion

VI. CONCLUSIONS

In the present study, it has been observed that the leaves extract of Aloevera is a good source for the synthesis of Ag NPs by a green approach. Ag NPs synthesized by the present method are of spherical shape. FTIR provided information about functional groups, which participates in the synthesis of silver nanoparticles. The Ag NPs were characterized by UV-Visible spectrophotometer, Fourier transform spectroscopy and Zeta Potential.

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