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Research Article

BIOSYNTHESIS AND CHARACTERIZATION OF SILVER NANOPARTICLES FROM BROILER CHICKEN *GALLUS GALLUS DOMESTICUS* (FAECAL EXCRETA)

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ABSTRACT

The present study was undertaken to evaluate the efficacy of extracts prepared from the broiler chicken faecal excreta *Gallus gallus domesticus.* The UV-Visible spectra showed an absorption wavelength 242.50 nm which corresponds to the absorbance of silver nanoparticles. The XRD pattern showed different intensity peaks in the whole of 2ɵ values ranging from 10-80^0 for the silver nanoparticles. The FTIR spectrum of synthesized silver nanoparticles showed Alkyl halides, Esters, Nitrogroups, Amides, Aldehydes, Alkenes and Phenols and Alcohols. SEM micrographs of nanoparticle obtained in the filtrate showed that AgNPs are Spherical shape. EDAX results, a peak of silver that confirmed the presence of elemental silver in the suspension. The other spectral signals such as Cl, C and O were also noticed in the EDAX spectrum.

Keywords: Biosynthesis, Characterization, Silver nanoparticles, *Gallus domesticus.*

INTRODUCTION

Nano means very small size the ranged from 10 to 100 nm (Thirumalai, 2010). Nano is a Greek word synonymous to dwarf meaning extremely small (Mukunthan *et al.*, 2011). Nanotechnology has been coined by Narino Taniguchi is researcher at the University of Tokyo, Japan (Taniguchi, 1974 and Venkataraman *et al.*, 2011). 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 and medicine (Kumar and Yadav, 2009). Nanobiotechnology is the branch of nanotechnology that deep with biological applications of nanomaterials. Nanoparticles exhibit completely new or improved properties based on specific characteristics such as size, distribution and morphology (Naiwa, 2000). Nanoparticles cover a broad area of interest including electronics, medicine, food industry, environmental applications and cosmetics (Mendoza, *et al.*, 2010). Silver nanoparticles (SNPs) are non-toxic to humans and most effective against bacteria, virus and other eukaryotic micro-organism at low concentrations and without any side effects (Jeong *et al.*, 2005). Silver nanoparticles play a significant role in the field of biology and medicine and show a strong toxicity over microorganisms (Klueh *et al.*, 2000).

MATERIALS AND METHODS

Synthesis of silver nanoparticles from faecal excreta

Aqueous faecal excreta *Gallaus gallus domesticus* was prepared by placing 10g of collected faecal excreta in a 250-ml Erlenmeyar flask and billed with 100 ml of sterile double distilled water up to 60ºC in a water bath. The crude extract was passed through Whatmann filter paper (No.1), and the filtrates (=aqueous faecal extract) were stored at 4° C and used within 3 days. Ten mil liliter of aqueous leaf extract was treated with 90 ml of prepared 1mM aqueous Ag NO_3 solution in an Erlenmeyer flask and incubated in dark at room temperature. The aqueous solution of 1mM of $AgNO_3$ was greatly reduced from $Ag+$ to Ag^0 by faecal excreta leading to change of pale yellow to dark brown resulting in synthesis of Ag NPs.

Characterization of synthesized silver nanoparticles

A UV-Vis spectrum was monitored for reaction time on Shimadzu UV- 2450, Japan at a resolution of 1 nm between 300 and 800nm. To determine the nature and size of the synthesized Ag NPs, X-ray diffraction (XRD) was performed. For this, the reacting mixture was centrifuged (20,000xg, 15 min, 40º C). The powder form of the sample

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was recovered and coated on the XRD grid, the spectra were recorded at a voltage of 40 Kev. The diffracted intensities were recorded from 10º to 90º at 2*ɵ* angles. Dried powder of the AgNPs was subjected to analyze the presence of possible functional groups for the reduction of Ag+ions resulting in formation of AgNPs using Fourier Transform Infrared (FTIR) Spectroscopy (Schimadzu, Japan). FT-IR spectra were recorded at 1 cm-1 resolution. The purified silver nanoparticles were air-dried and then subjected to SEM using a Philips scanning electron microscope equipped with an EDAX attachment. energy dispersive X-ray spectrometer(EDAX) operated at an accelerating voltage at 20 KeV.

RESULT AND DISCUSSION

The synthesized Ag nanoparticles was initially confirmed by visible observation of colour change. The appearance of brown colour is due to the excitation of Surface Plasmon vibration (Figure 1). These results are consistent with earlier reports on synthesis of silver nanoparticles using the faecal pellet namely *Capra aegagrus hircus,* (Karthika and Sevarkodiyone, 2015).

The UV-Visible spectra showed an absorption wavelength 242.50 nm (Figure 2.) which corresponds to the absorbance of silver nanoparticles. Green synthesized silver form *A. indica* has absorbance peaks at 241 nm (Subash and Susikumar, 2014).

The XRD pattern showed different intensity peaks in the whole of 2ɵ values ranging from $10\text{-}80^0$ for thesilver nanoparticles. The average estimated particle size of the sample was 5 nm. The size of the nanoparticles through the Scherrer equation is given by t= 0.9 $\lambda/\ \beta\ cos\theta$ where, $\lambda = 1.5A^0$, β=Full width Half Maximum (FWHM) ɵ=bragg's Angle, t=mean of the nanoparticles(Figure 3). XRD spectrum with the standard confirmed that the silver nanoparticles formed in our experiments were in the formed nanocrystals, as evidenced by the peaks at 2ɵ values 23^o, 27^o, 32.5^o, 38^o, 44^o, 65^o, and 77^o. The XRD pattern with the diffraction peaks at 28.5^o, 32.5^o, 38.5^o, 46.5^o, 55.5^o, 58^o, 62^o and 77^o corresponding to the diffraction exhibited from $10\text{-}90^0$ at range of 2θ (Manjula and Sevarkodiyone, 2015).

The FTIR spectrum of produced silver nanoparticles had many absorption bands (Figure 4; Table 1) and the absorption bands seen at 3183.29cm^{-1}, 3050.21 cm^{-1}, 1723.28 cm^{-1}, 1658.67 cm^{-1}, 1528.48 cm^{-1}, 1356.83 cm^{-1}, 1230.50 cm^{-1}, 1016.42 cm^{-1}, 0825.48 cm^{-1}, 0677.93 cm^{-1}, 0653.82 cm^{-1}, 0592.11 cm^{-1}, 0518.82 $^{cm-1}$ were assigned to the Hydrogen bonded O-H stretch of phenols and alcohols,=C-H stretch of alkenes, C=O stretch of aldehydes, C=O stretch of amides, N-H bend of amides, N=O stretch of nitrogroups, C-O stretch of esters, C-F stretch of alkyihalides, C-Cl stretch of alkylhalides, C-Br stretch of alkylhalides. The presences of active functional groups in aqueous extract of broiler chicken faecal excreta result in the swift reduction of silver ions to silver nanoparticles. Fourier transform infrared spectrometer (FTIR) analysis was carried out to determine the nature of the capping agents in each of *Amorphophallus campanulatus* (peel) (Manjula and Sevarkodiyone, 2015).

The formation of silver nanoparticles as well as their morphological dimensions in the SEM study demonstrated that the average size was from 72nm (Figure 5). Vaishnavi *et al*. (2015) reported that SEM image of *Jasminum sambac* synthesized silver nanoparticles were cluster and their size ranged from 14-17 nm.

EDAX results, a peak of silver that confirmed the presence of elemental silver in the suspension. The other spectral signals such as Cl, C and O were also noticed in the EDAX spectrum (Figure 6). This result is consistent with reports, extracts of *Glycyrrhiza glabra* (Dinesh *et al*., 2012).

Figure 1. A. Silver nitrate 1mM, B. 90 ml silver nitrate+10ml sample and C. Synthesized silver nanoparticles from broiler chicken faecal excreta.

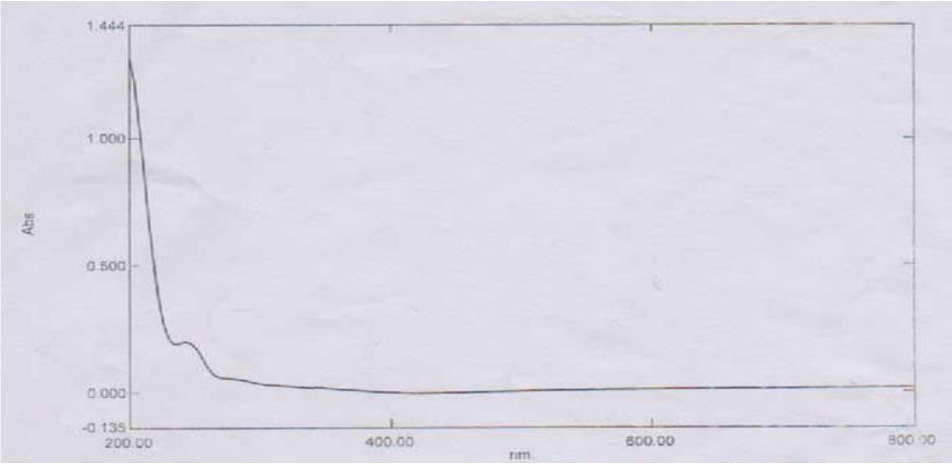

Figure 2. UV-visible absorption spectrum of silver nanoparticles synthesized using aqueous extract of broiler chicken faecal extract.

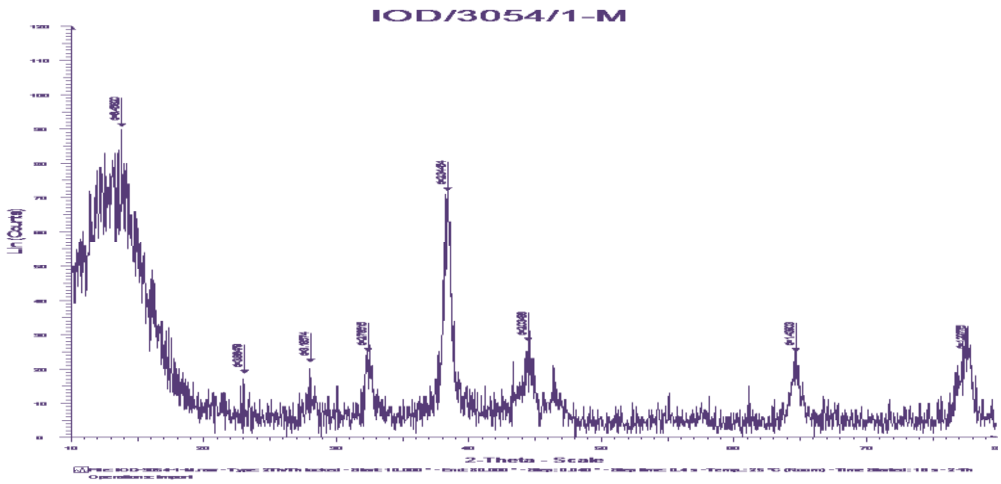

Figure 3. *XRD pa*tterns of synthesized silver nanoparticles using aqueous extract of broiler chicken faecal excreta.

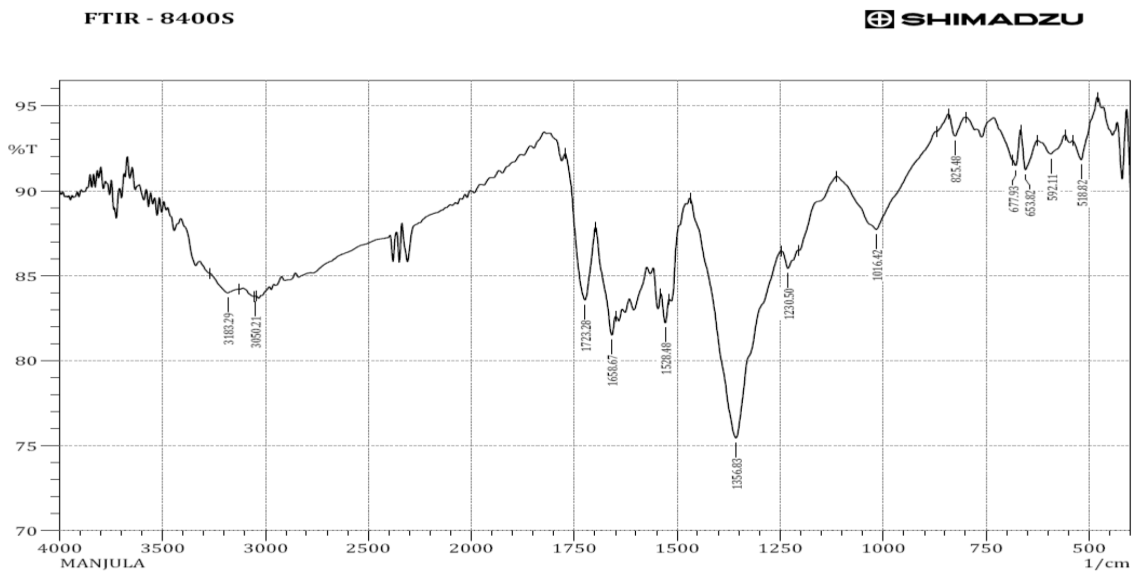

Figure 4. FTIR spectrum of silver nanoparticles synthesized using aqueous extract of broiler chicken faecal excreta.

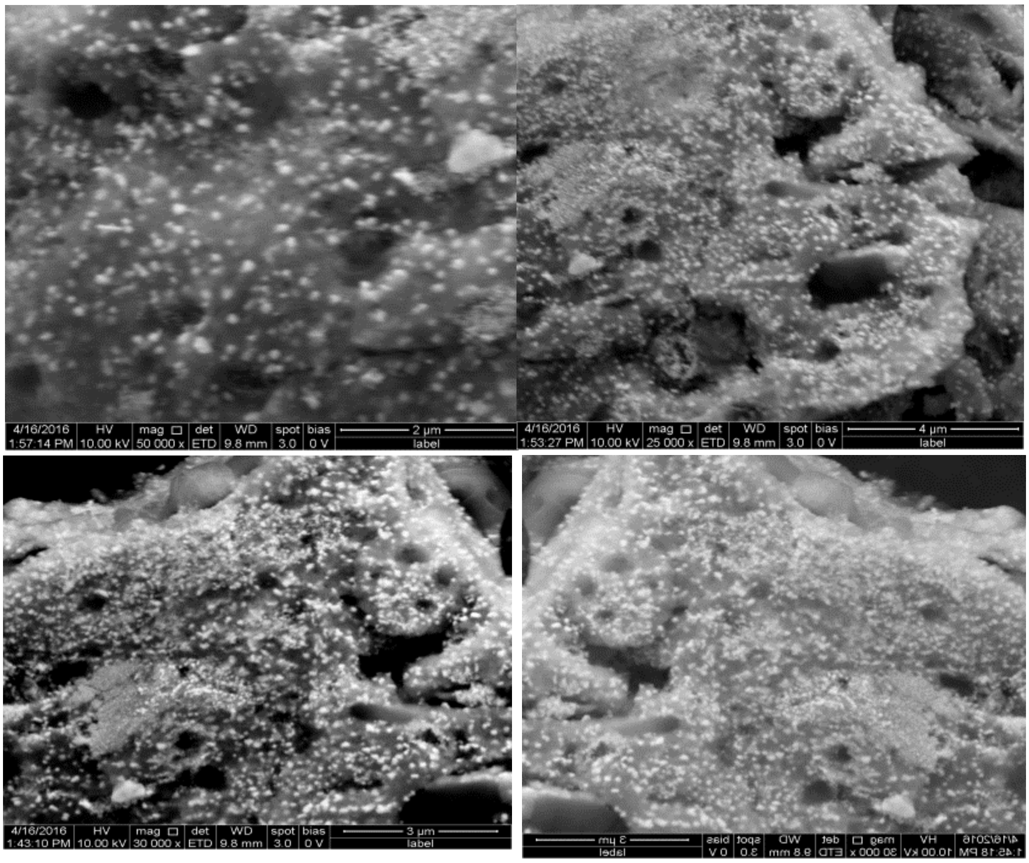

Figure 5. SEM image of synthesized silver nanopaticles at different magnification: (A) 10kv ×25,000; (B) 10kv × 30,000;(C) 10kv ×30,000; (D)10kv × 50,000.

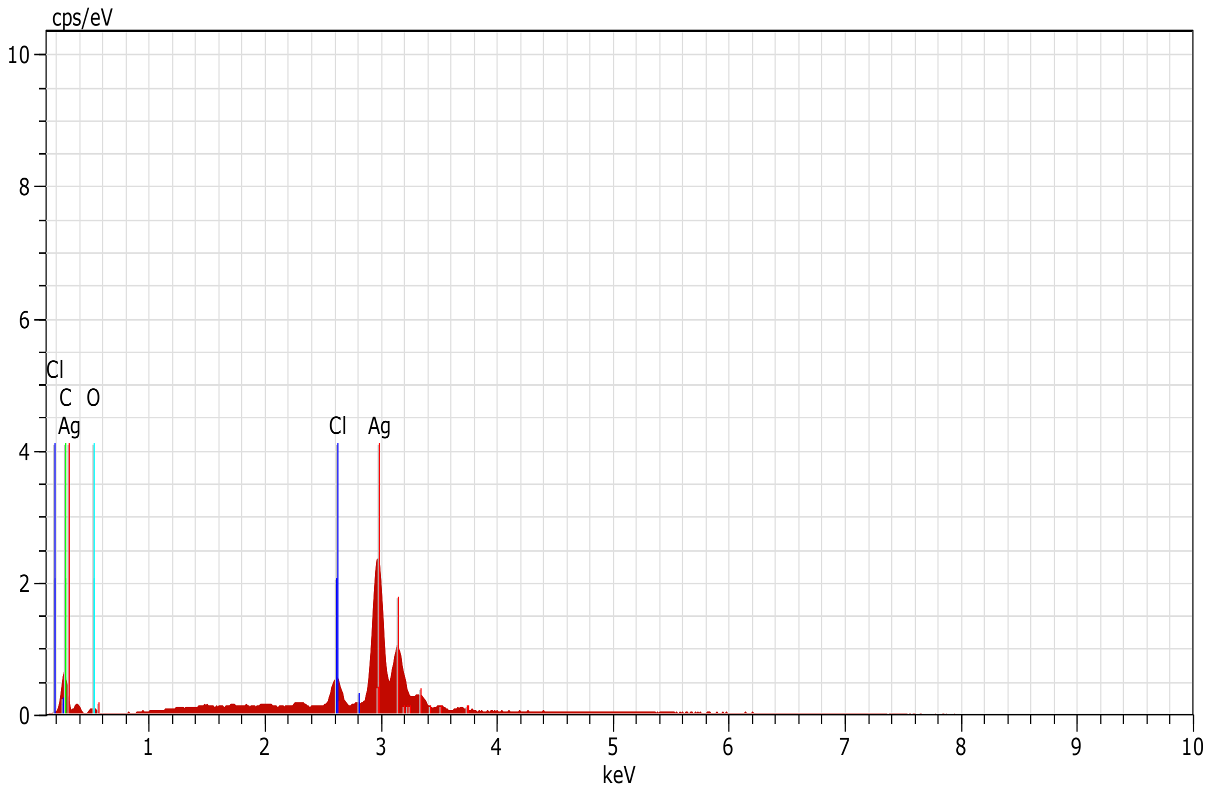

Figure 6.EDAX Spectrum of synthesized silver nanoparticles using aqueous extract of broiler chicken faecal excreta.

Table 1. Functional groups in synthesized silver nanoparticles revealed by FTIR.

S.No.	Absorption (cm^{-1})	Class of compounds	Bond
1	0518.82	Alkyl halides	C-Br stretch
2	0592.11	Alkyl halides	C-Br stretch
3	0653.82	Alkyl halides	C-Br stretch
4	0677.93	Alkyl halides	C-Br stretch
5	0825.48	Alkyl halides	C-Cl stretch
6	1016.42	Alkyl halides	C-F stretch
7	1230.50	Esters	C-O stretch
8	1356.83	Nitrogroups	N=O stretch
9	1528.48	Amides	N-H bend
10	1658.67	Amides	C=O stretch
11	1723.28	Aldehydes	C=O stretch
12	3050.21	Alkenes	=C-H stretch
13	3183.29	Phenols and Alcohols	Hydrogen bonded O-H stretch

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REFERENCES

Dinesh, S., Karthikeyan, S., and Arumugam, P., 2012. Biosynthesis of silver nanoparticles from *Glycyrrhiza glabra* root extract. *Archives. App. Sci. Res.*, 4(1),178-187.

Jeong, S.H., S.Y. Yeo and S.C. Yi, 2005. The effect of filler particle size on the antibacterial properties of compounded polymer/ silver fibers. *J. Mat. Sci*., 40: 5407-5411.

Karthika, R. and Sevarkodiyone, S.P., 2015. Synthesis of silver nanoparticles using aqueous extract goat faecal pellets. *Int. J. Curr. Sci. Res.*, 1(1), 1-7.

Klueh, U.V., Wagner, S.K., Johnson, A. and Bryers, J.D., 2000. Efficacy of silvercoated fabric to prevent bacterial colonization and subsequent devicebased biofilm formation. *J. Biomed. Mater. Res.,* 53(6), 621-631.

Kumar, V. and Yadav, S.K., 2009. Plant-mediated synthesis of silver and gold nanoparticles and their applications. *J. Chem. Technol. Biotech.*, 84(2), 151-157.

Manjula, P. and Sevarkodiyone, S.P., 2016. Biosynthesis and characterization of silver nanoparticles from peel of *Amorphophallus campanulatus* (Yam). *Int. J. Zool. Appl. Biosci.*, 1(1), 57-62.

Mendoza, K.C., McLane, V.D., Kim, S. and Griffin, J.D., 2010. Invitro application of gold nanoprobes in live neurons for phenotypical classification, connectivity assessment, and electrophysiological recording. *Brain. Res.*, 1325, 19-27.

Mukunthan, K.S., Elumalai, E.K., Patel, T.N. and Murthy, V.R., 2011. *Catharanthus roses*, A natural sources of silver nanoparticles. *Asian Pac. J. Trop. Biomed*., 1, 270-274.

Naiwa, H.S., 2000. Hand Book of Nanostructural Materials and Nanotechnology. Academic Press, New York. 1-5.

Subash, N. and Sasikumar, C., 2014. Eco friendly synthesis of silver nanoparticles from leaf extract of *Azadirachta indica* and *Phyllanthus emblica*. *Int. J. Adv. Res.*, 2(7), 986-990.

Taniguchi, N., 1974. Japan Society of precision Engineering *Proc. Intl. Conf. Prod. Eng. Tolcyo.*, 11, 18-23.

Thirumalai, A., 2010. Stable silver nanoparticle synthesizing methods and its applications. *J. Biosci. Res.*, 1, 259-270.

Vaishnavi, B., Ganesan, Rajagopal, T. and Ponmanickam, P., 2015. Evaluation of bactericidal and fungicidal properties of silver nanoparticles fabricated using *Jasminum sambac* (L.) *Biotech. Biochem.*, 10(1), 22-31.

Venkataraman, D., Kalimuthu, K., Sureshbabu, R. and Sangiliyandi, G., 2011. An insight into the bacterial biogenesis of silver nanoparticles. In: M. Rai and N. Duran (eds.) Metal Nanoparticles in Microbiology. pp. Springer, New York, pp. 173-214.