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BIOSYNTHESIS AND CHARACTERIZATION OF ZNO NANOPARTICALS BY ANNONA RETICULATA SEEDS

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ABSTRACT

Development of green nano technology is producing attention of researchers near eco- friendly biosynthesis of nano particle. Many foundations were discovered for the synthesis of ZnO nanoparticles. In this study, biosynthesis of ZnO nanoparticle was done using *Annona Reticulata* seed extract. Seed extract was mixed with Zn nitrate and we observe the change in colour from deep yellowish to white ZnO NPs. These biosynthesized ZnO NPs were characterized with the help of X-ray diffraction, Infrared spectroscopy, UV visible spectra, Dynamic light scattering and SEM. SEM micrographs reveal the globular shaped agglomerated particles. UV visible and FTIR spectroscopy confirms the bonding in extract and NPs. DLS and zeta potential indicates size and charge on nanoparticles explore new area for reactions. Thus this method can be used for rapid and eco-friendly biosynthesis of ZnO NPs.

KEYWORDS: technology, extract, color, agglomerated particles, ecofriendly.

I. INTRODUCTION

In recent, green synthesis of ZnO nanoparticles was attained by leaves extract of Ocimum Tenuiflorum plant. Oscimum Tenuiflorum also called as holy basil, tulsi, Ocimum sanctum.[1-3] The chemical constituents of Ocimum Tenuiflorum are linalool, alkaloids, ursolic acid, glycosides, carvacrol, tannins, rosmarinic acid, aromatic compound etc.[4-5] Recently Leaves extract of Ocimum Tenuiflorum plant have been utilized in the synthesis of copper nanoparticles, Gold nanoparticles, and silver nanoparticles.[6-9] Nanotechnology has now become an allied science which is most commonly used in other field of science like electronic, medicine, physics and engineering. The prominence of these materials understood when researchers found that size can affect the physiochemical properties of substance e.g. the optical properties.[10-11] A 20- nm gold, platinum, silver, and palladium NPs have characteristic red, yellowish grey, black and dark black colors, respectively.

Although nanoparticles are generally considered a discovery of modern science, have a very long history. Nanoparticles used by artisans as far back as 9 century in Mesopotamia for generating a glittering effect on the surface of pots. Spectacular effects were obtained with metal nanoparticles as color pigments in luster and glass technology.[12-14] Metallic cluster decorations of glazed ceramics showed amazing optical properties due to presence of separate silver and /or copper Nanoparticles dispersed with in the outermost layers of the glaze. Metal Nanoparticles can color glass in an extraordinary way. Gold has been used for a long time to introduce a striking a red color to glass.

The last periods have seen the appearance of nanomaterial for numerous applications in almost all the field of life, reaching from solid state lighting to biomedical applications.[13-15] Their things lie between those of wholesale material and those of atoms as they are only made up of some atoms decided in an ordered style. Such particles exhibition the size dependence and a wide spectrum of properties.

Nanomaterial's have the structural features in between of those of atoms and the bulk materials. The properties of materials with nanometer dimensions are due to their small dimensions, nanomaterials are already known to have many novel properties.

One of the most attractive and useful features of nanomaterials is their visual things. Applications based on optical things of nanomaterials comprise visual detector, Laser, sensor, imaging, phosphor, display, solar cell, photocatalysis, photoelectron chemistry and biomedicine.[16] When light strikes an object it may be transmitted, absorbed or reflected Materials varies on their ability to transmit the light usually describe as transparent, translucent or opaque. Transparent materials

are usually glass transmits the light &absorption or reflection of light take place. The material which diffuse the light are called as translucent. Opaque materials not transmit the light.

II. EXPERIMENTAL

Raw Materials

Preparation of seed extract of Annona Reticulata: For the preparation of seed extract of Annona Reticulata first washed seeds many times with water and dried in sunlight. Seeds are crushed into fine powdered by the molten pestle. Then taking 10 grams of dried seed powder with 100 ml of distilled water in 250 ml of round bottom flask. Kept that flask for the reflux for 1 hour. Cool the mixture and filter with the whatman filter paper no. 41. Collect the filtrate into the beaker. It stored in the refrigerator for synthesis of ZnO nanoparticles. Fig. 1 shows the preparation of seed extract from Annona Reticulata seeds.

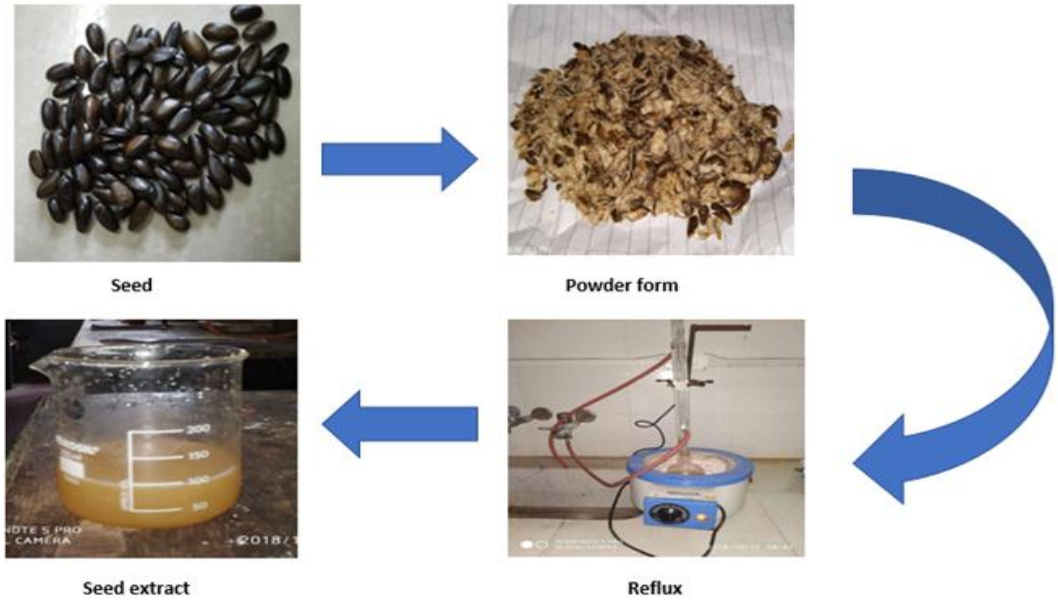

Fig 1: Preparation of seed Extract Materials.

Synthesis of Zinc Oxide

Green synthesis of ZnO nanoparticles using seed extract of Annona Reticulata: For the ZnO nanoparticle synthesis, 100 ml of seed extract of Annona Reticulata was taken in a beaker and boiled to 60 – 80^{o}C using magnetic stirrer heater. Then 5 gm of zinc nitrate was added to seed extract of Annona Reticulata, when temperature reached at 70^{o}C and boiled it to reduced deep yellow paste. This paste dried at temperature 100-130^{0}C in microwave for 1 minute. ZnO nanoparticles obtained in the form of light yellow powder. Fig. 2 shows the complete synthesis of the ZnO nanoparticles.

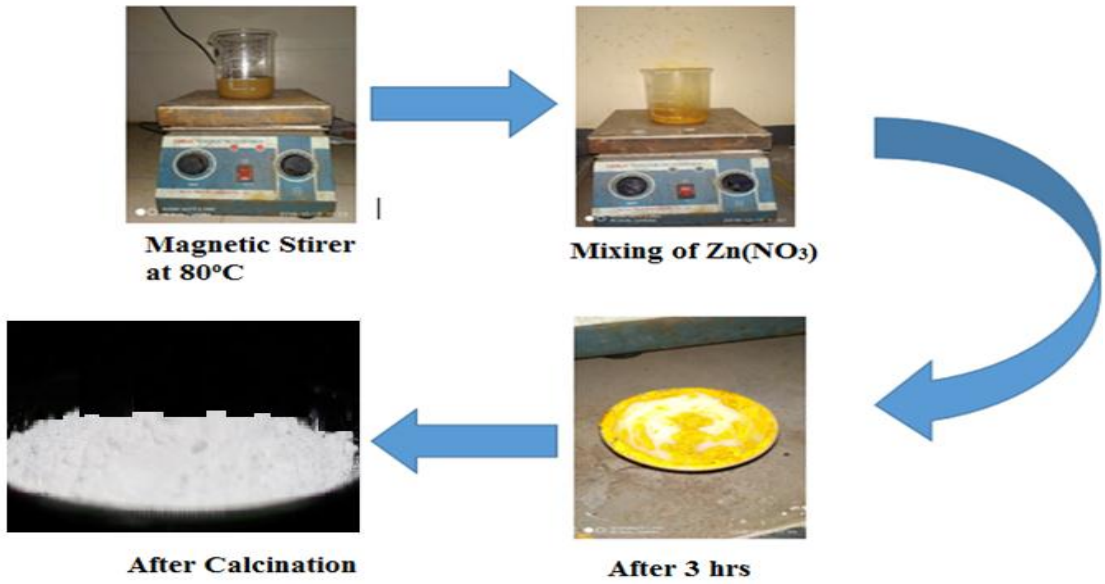

Fig 2: Synthesis of Zinc Oxide.

Characterization: Centrifugation was reinforced out at 6000 rpm by Remi R24 machine. UV–vis spectrum was verified by resources of Shimadzu UV 2450 and plotted expenditure opening place pro 9. Photoluminescence (PL) spectrum was standard at room temperature with SHIMADZU RF 5300PL spectrophotometer with quartz cuvette of 1 cm path size.

To decipher the vibrational in sequence of functional moieties, current in peels and ZnO, fourier-transform infrared (FT-IR) was accomplished with PERKIN ELMER FRONTIER 91579 in the sequence 4000–400 cm^{-1} at a decision of 4 cm^{-1}. SEM was done on JEOL JSM-7600F. Thermal analysis was performed on STARe system METTLER TOLEDO TGA (thermo gravimetric analyser) with a heat rate of 10°C/min under inert atmosphere from 30 to 1000°C.

Particle size distribution and Zeta potential measurements were done by Dynamic light scattering (DLS) measurements were achieved on a Zetasizer Nano ZS90, equipped with a red laser (633nm) and an Avalanche photodiode detector (quantum efficiency >50 %, Malvern Instruments Ltd., UK). The Malvern Dispersion Technology software (DTS) 7.10 software was used to analyze the data.

All surface-coated ZnO disturbances used to investigate the zeta potential or hydrodynamic size were distributed in deionized water in the absorption ranges of 1%, 5% and 10% individually, and were vigorously stirred at 27°C for one hour. In order to attain repeated data and improve the quantity circumstances, the zeta potential and hydrodynamic size quantities were permitted out ten times using a zeta flow cell and a DLS cuvette. The data found were spontaneously calculated from the Smoluchowski and Contin equations. The average value and scattering pattern of zeta potential and hydrodynamic size were attained. The change between the upper and lower value was less than 40 mV were recognized as results when the zeta potential supplies from the dissimilar height in cuvette were parabolic after its center and, at the same time.

Crystalline environment and phase discovery was scrutinize using X-ray powder diffraction (XRD) SHIMADZU 7000S with in commission voltage 40 kV, current 30 mA, scan speed 5° min^{-1}, monochromatised CuKα radiation (λ= 1.5406 Å) in the 2Θ range of 25°–80°C. The average nano crystaline size calculated by Debye-Scherrer equation (1).[4]

Particle Size = (0.9 x λ)/ (d cosθ) …… (1)

Where λ = 1.54060 Å (for CuKa1), d is the full width at half maximum intensity of the peak (in Rad) and Θ = 2θ/2.

III. RESULT AND DISCUSSION

UV-VIS Spectra

The electronic absorption spectra of ligand and the metal complexes were recorded in the range of 200-800nm with the help of UV-Visible spectrophotometer for UV Visible spectrum aq. Solution of was ZnO prepared by dissolving in requisite amount of ethanol in the ratio 1:2, 1:4, 1:6, 1:8, 1:10 .The molar extinction coefficient was calculated by using lambert's law

$A = \epsilon Cl$

Where, A=absorbance; C=concentration; l=path-length

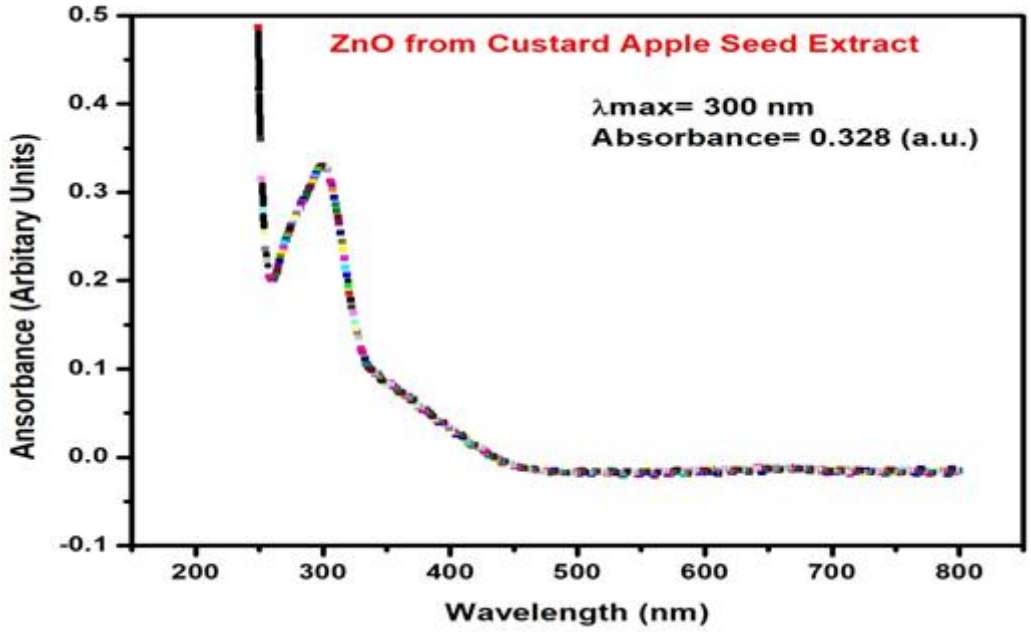

Fig 3: UV-Visible spectra.

The fig. 3 shows spectra of custard apple seed extract nanoparticles dissolved in appropriate amount of ethanol shows the absorption band at around 300nm which is maximum wavelength the sharp peak at 300nm.[11]

Fourier Transform Infra-Red Spectroscopy

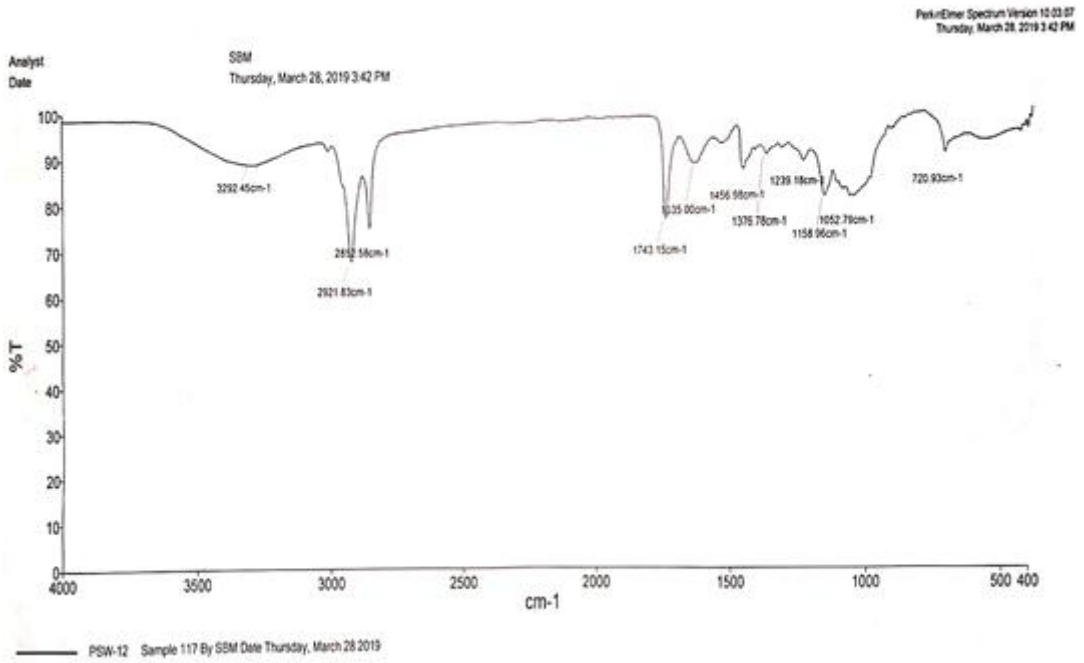

Fig 4: FTIR spectra of seed extract.

In the IR spectrum of Custard apple seed Fig. 4, the band at 2921.83cm^{-1} is due to stretching vibrations of O-H groups in H_2O, R-OH and Ar-OH and N-H stretching in amine. The C-H stretching in alkanes and O-H band in carboxylic at 2852.58cm^{-1}.The strong bond at 1743.15cm^{-1} is attributed to the C-O stretch in polyphenols and C-C stretch in ring. The bands at 1376.78cm^{-1} represent C-N stretch of amide-I in protein. Finally the C-H out of plane bending shown by weak band at 720.93cm^{-1}.

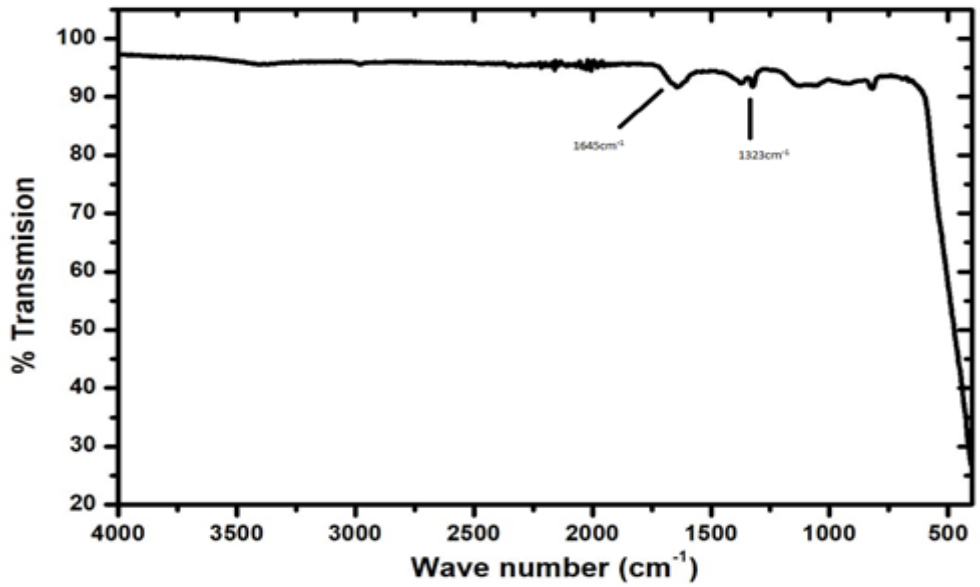

Fig 5: FTIR Spectra of ZnO NPs.

The carboxylic acid polysaccharide, polyphenols, amino acid and proteins shows strong IR spectrum in fig. 5, it can be 1645cm^{-1}and 1325cm^{-1} observed that custard apple seed extract in. The immersion bands of these biomolecules, two new peaks looking at and in the IR spectrum of the ZnO NPs are the characteristic peaks of ZnO molecules.

It may be decided that the presence of upper percentage of phenolic group of molecules are liable for the reduction progression and the amino acids and amide linkages in protein are accountable for the equilibrium of the ZnO nanoparticles.

X Ray Diffraction Spectra

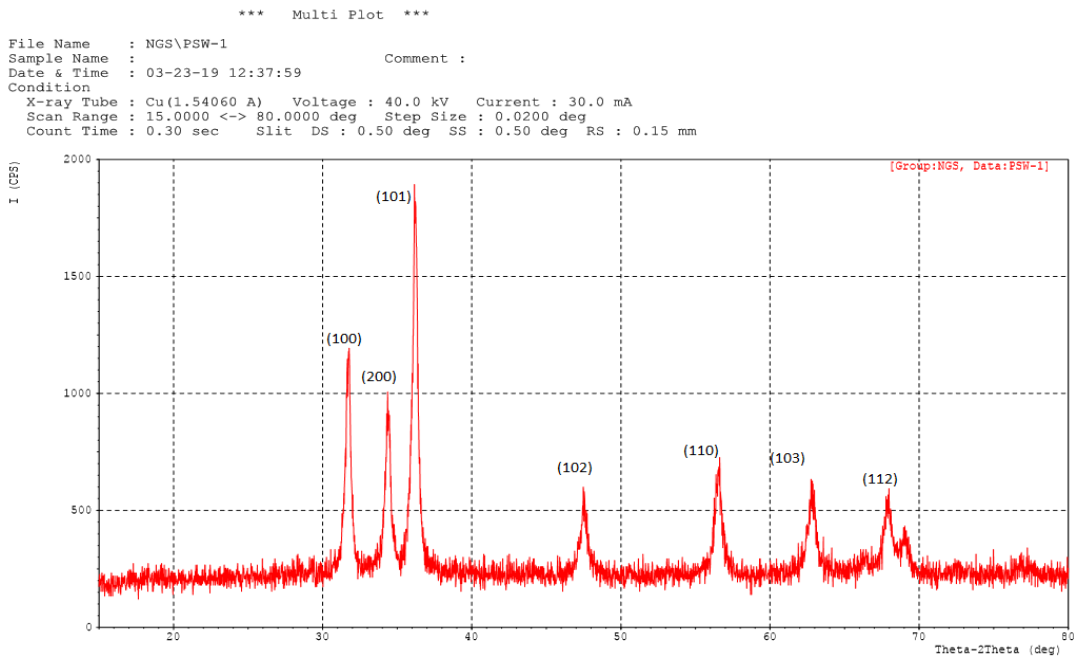

Fig 6: XRD Spectrum.

The XRD spectrogram of ZnO nano-particles synthesized with Zinc acetate is shown in Figure 6. According to the spectrogram of the crystal structure, the well defined peaks typical of ZnO in the crystal structure of Zinc oxide are clearly noticed. This is in compliance with the reports The peaks are in well defined shape and form. This clearly indicates the crystallinity of the synthesized nano-particles. According to Jenkin et al 1996, the particle size affects the effect on broadening of the peaks in the XRD spectrogram. From the Scherer's equation the mean crystallite size of the sample was estimated from the full width at half maximum (FWHM) of the diffraction peak.

Debye Scherers's equation: d= K λ /β cosθ

where θ is the Bragg angle, λ is the wavelength of the X ray used, β is the breadth of the pure profile in radians on 20 scale, and k is a constant approximately equal to unity and diffraction both to the crystalline shape and to the way in which 0 is defined. The best possible value of k has been estimated as (0.89110) = 0.9x 1.54/ (0.2603) x 0.950 = 5.6048 A°

Particles synthesized using Zinc nitrate with water is shown in Figure. In the Figure, These peaks are indexed as (100), (200), (101), (102), (110), (103) diffraction lattice planes respectively. Ported for ZnO which suggests the formation of ZnO nanoparticle exhibit peaks similar to those are The XRD pattern for ZnO nanoparticles obtained with water medium shows much sharper peaks.

Dynamic Light Scattering

Table 1: DLS specification.

Sample Name	T	Z-Ave	PDI	ZP	Mob	Cond
	°C	d.nm		Mv	µmcm/Vs	mS/cm
PSW 1	25	1498	0.219	5.9	0.4625	0.412
PSW 2	25	1588	0.213	7.19	0.5638	0.422
PSW 3	25	1772	0.287	7.81	0.6122	0.429

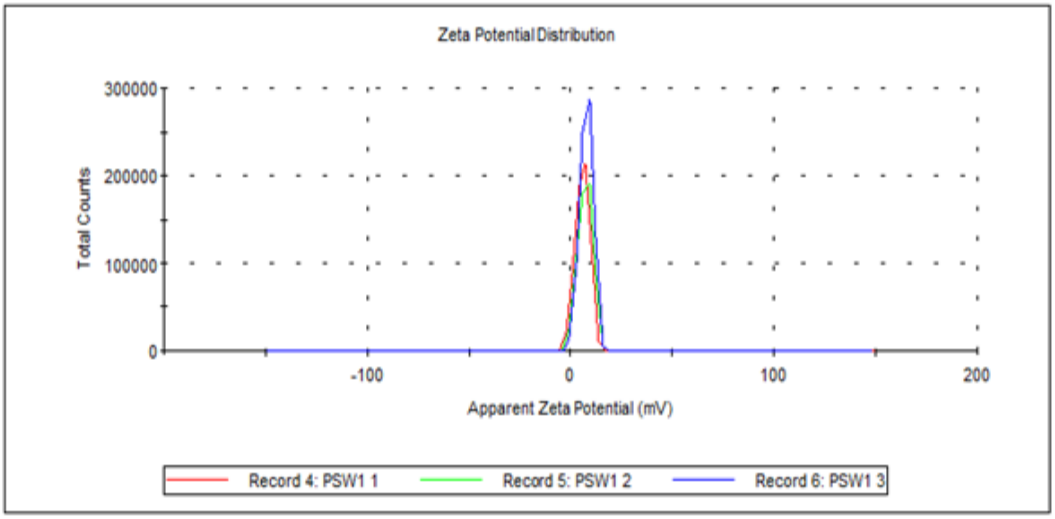

Fig 7: DLS of ZnO NPs.

DLS results shown in fig. 7, indicates the particles size distribution (PSD) conforming the presence of Nano sized zinc oxide and has average NPs size is 1620nm. This is hydrodynamic size of NPs. All the values of mobility, conductivity PDI and Z-ave are shown in table 1. Average value of PDI is 0.239 indicate with highly homogeneous monodispersed standards of NPs. Wurtzite-type ZnO nanoparticles are recognized to have positive surface charges in the as equipped state. Zeta potential quantity was carried out at least three times for each sample and the standard deviation values for all the four samples were below +7 mV signifying high colloidal stability for the coated ZnO nanoparticles in deionized water.

Scanning Electron Microscope (SEM)

SEM analysis is done to visualize shape and size of nanoparticles .scanning electron microscope was used to determine the shape of ZnO NPs. SEM image in fig.8, showed in different magnification ranges which clearly demonstrated the presence of spherical shaped nanoparticles with mean average diameter of 70nm formation of irregular spherical ZnO NPs, and change of the morphology of the nanoparticles. This SEM Image indicates irregular morphology. Some particles in the range of 70-85nm from fig 8 shows the formation of spherical ZnO nanoparticles and changes of the small granular size of ZnO NPs are formed.

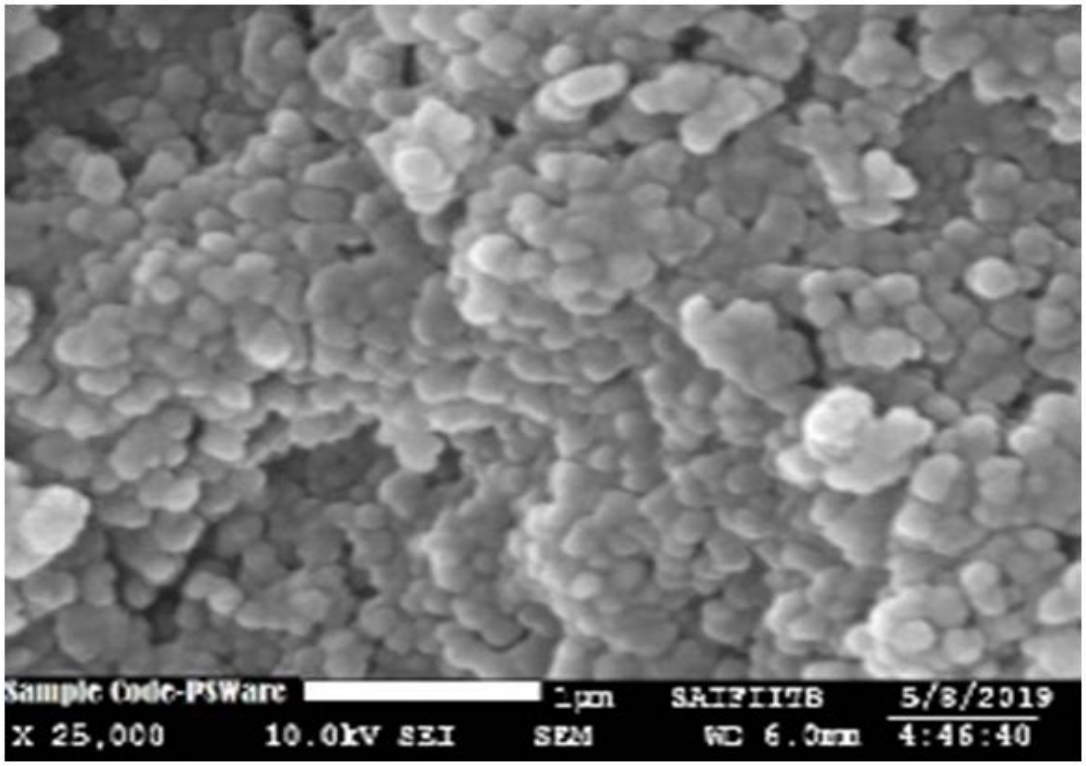

Fig 8: SEM of ZnO NPs.

IV. CONCLUSION

The modernization of nanomaterials in the food wrapper science has brought many changes in food preservation, storage, distribution and consumption. In this work, we have eco-friendly, green and facile approach for the synthesis of ZnO nanoparticles using Annona Reticulata seed extract and Zinc nitrate as a pre cursor. XRD shows the hexagonal wurtzite structure of ZnO NPs. SEM shows 70 nm sized ZnO NPs. UV and FTIR Spectroscopy technique confirms the synthesis of ZnO NPs. Easy availability of these custard apple seeds makes this method an extremely attractive option to produce ZnO nanoparticles. Also DLS indicate average NPs size is 1620nm and zeta potential has value +7 mV. All the results shows that consistent size-controlled and charge-controlled ZnO nanoparticles were industrialized for use in biological assays of nanomaterials. The surface charges in water suspension of ZnO NPs were fruitfully controlled as highly positive charged which may coat numbers of organic molecules for further research work.

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