Green synthesis of ZnO nanoparticles from *Brassia actinophylla* flower Extract and their characterization report

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Abstract:

The ZnO nanoparticles were synthesized by solution combustion method using *Brassia actinophylla* flower extract .For the green synthesized ZnO nanoparticles UV peaks were observed at 370nm and FTIR peaks were observed between 500 to 1000 cm^{-1}.The PXRD studies reports for the structure and morphology of the product. The percentage of copper and oxygen were found out in EDAX analysis. The size of nanoparticles were observed through SEM images.

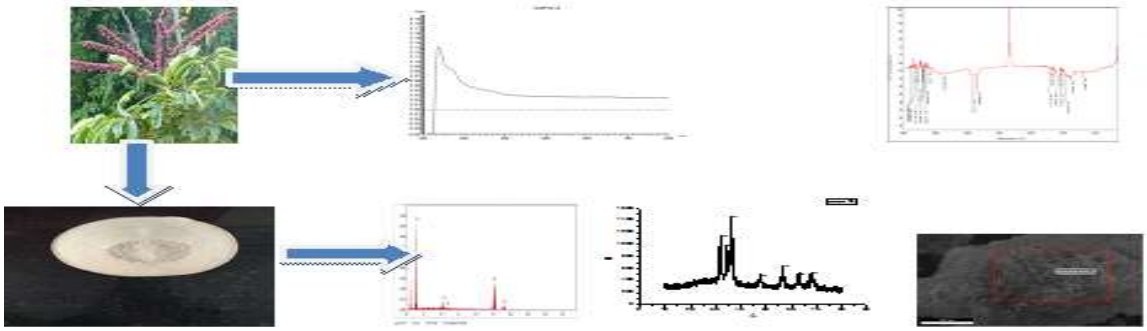
Key words:

ZnO nano particles, SEM, *Brassia actinophylla* flower extract

1.Introduction:

The ZnO nanoparticles were synthesized by different techniques hydrothermal [1],sol-gel[2],microwave aided hydrothermal [3],co-precipitation[4].The above methods need long time and sophisticated equipments. Other than physical and chemical methods metal oxide nanoparticles were synthesized by eco-friendly methods[5] and also biological methods in microorganisms[6],enzymes[7],fungus[8],plant extracts[9].In this paper ZnO NPs were synthesized using solution combustion method which is cost effective and time saving method. ZnO NPs have significant features such as high catalytic activity, semiconductors, sensors, solar cells, sensing, nano-medicine.[10,11]. Green synthesis of ZnO NPs using various plants carried out using leaf extracts of Punica granatum L and Tamarindus indica L[12],Ocimum basilicum L.var. Purpurascens,Parthenium hysterophorus L.[13],Borassus flabellifer[14]. *Brassia actinophylla* plant extracts exhibit antioxidant activities[15].They have long been used for the treatment of diabetes[16].In this paper ,ZnO NPs were synthesized using *Brassia actinophylla* flower extract and characterization was carried by UV-Visible Spectroscopy, FTIR,X-ray powder diffraction(XRD),SEM and EDAX studies.

Graphical representation:



2.Materials and Methods:

2.1Chemicals used:

Zinc Nitrate hexahydrate ($Zn(NO_3)_2.6H_2O$) ,Fischer Scientific Quali of 98% purity was purchased from Vasa Scientific Co, Avenue Road, Bangalore.

2.2Plant Collection:

The plant was collected from New Horizon College Campus, Marathalli, Bangalore and the authentication was done by Institute of Trans-Disciplinary Health Sciences and Technology, Yelahanka, Karnataka, Bangalore ,India.

Scientific classification:

Kingdom: Plantae, Order:Apiales, Family:Araliaceae, Genus:Schefflera, Species:S.actinophylla

Binomial name:Schefflera acinophylla,Synonyms:Brassia actinophylla

2.3Preparation of plant extract:

Brassia actinophylla flowers were collected and dried in the absence of sunlight, after drying it was powdered and taken for extraction process using soxhelt apparatus around 72 hours at the temperature of 45-60^{0}C.The aqueous solution was subjected to concentration using rotary flash evaporator at (40± 5 ˚C) under reduced pressure(Buchi ,Flawil,Switzerland),then sample was dried in hot air oven at 50-60^{0}C,from the dried crude extract nanoparticles were synthesized by taking little amount.

2.4Synthesis of ZnO nanoparticles

To synthesize ZnO nanoparticles 0.18g of dried crude flower extract of Brassia actinophylla and stoichiometric amount of zinc nitrate hexahydrate was dissolved in 10ml of distilled water with constant stirring about 15 minutes, after mixing

the solution mixture was kept in a pre-heated muffle furnace maintained at 400± 10 ˚C for 5 to 8 minutes. The sample was taken out and the colour observed was dirty white, cooled to room temperature and stored in airtight container for further analysis[17,18].

2.5Characterization:

The UV-absorption peak of ZnO nanoparticles were measured by Shimadzu UV-2800 spectrometer. FTIR wavelength ranging from 500-4000cm^{-1} recorded through Nicolet is5 (Thermo Fisher).EDAX and XRD observed by (XPERT-3) diffractometer for phase purity and crystalline size.SEM analysis carried out through camera model VEGA3 LMU 115-0026 for the morphology determination.

3.Result and Disussion:

The ZnO Nps were synthesized using *Brassia actinophylla* flower extract by solution combustion method at the temperature of 400± 10 ˚C .The small UV-peak observed in Fig-1 near 370nm confirms the presence of ZnO nano particles. The FTIR peak observed in Fig-2 between 1000to 500cm^{-1} wavelength shows the presence of ZnO nanoparticles. The broad peak at 3398cm^{-1} responsible for O-H bond of phenols and 1656cm^{-1} responsible for C=O strectching vibration of primary amines[19].

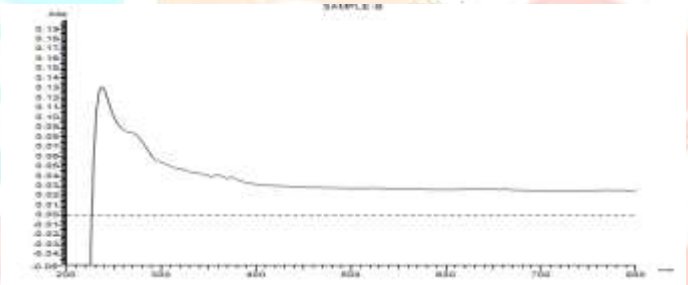


Fig-1 UV-Vis spectrum of ZnO Nps using *Brassia actinophylla* flower extract

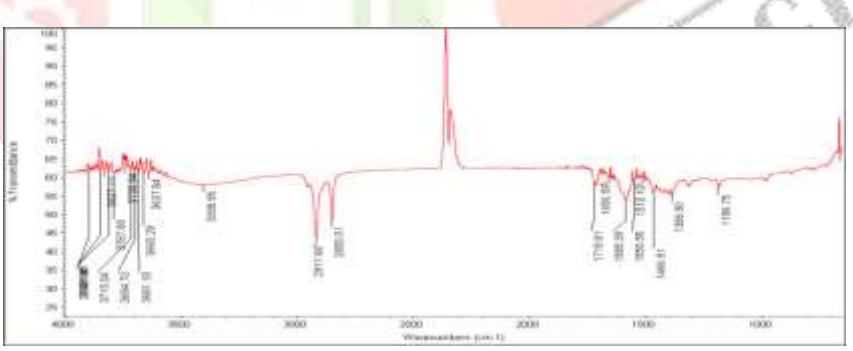


Fig-2 FTIR report of ZnO Nps using *Brassia actinophylla* flower extract

The average crystalline size of ZnO-nanoparticles were explained using Scherrer equation

D=kλ/βcosθ where, D is average crystalline size, k is the constant of 0.9 value, λ is the wavelength of X-rays used. Cuk$_\alpha$ 1.542 A^o, β is the line broadening at half the maximum intensity(FWTM) and θ is the Bragg angle. The 2θ values are 31.83,34.44,36.28,47.52,56.64,62.97,67.90 which are assigned to planes in Fig-3 of(100),(002),(101),(102),(110),(103),and (201) with reference to JCPDS 36-1451.

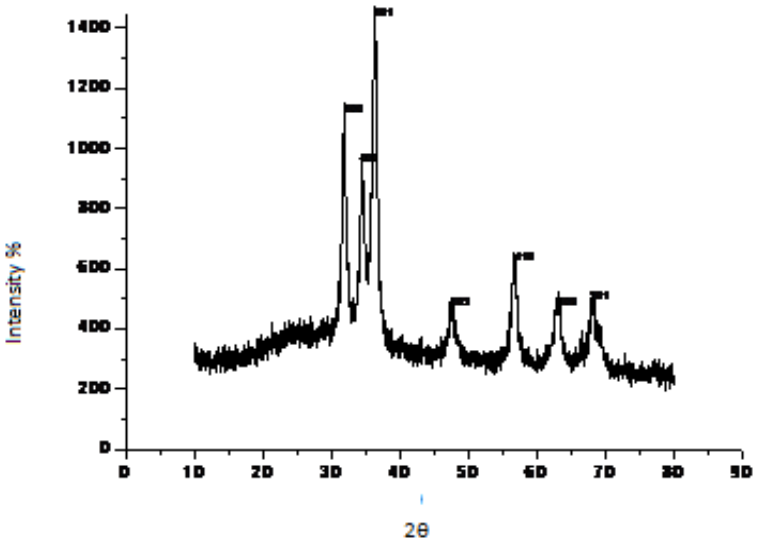
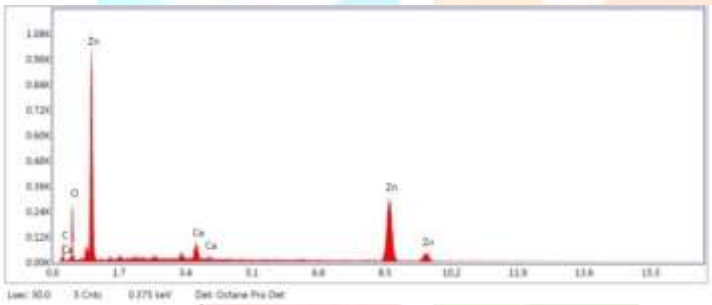


Fig-3 XRD pattern of ZnO Nps using *Brassia actinophylla* flower extract

The EDAX report reveals the presence of zinc and oxygen at the weight percentage of 49.89% and 27.09% in Fig-4.The small amount of carbon and calcium also present. The SEM patterns were indexed as hexagonal(Wurtzite structure)in Fig-5a,5b.The SEM report was focused for pertiular area in Fig-5b and the size was found to be 20µm.



Element	Weight %	Atomic %
CK	20.05	39.75
O K	27.09	40.32
CaK	2.97	1.76
ZnK	49.89	18.17

Fig-4 EDAX spectrum of ZnO Nps using *Brassia actinophylla* flower extract

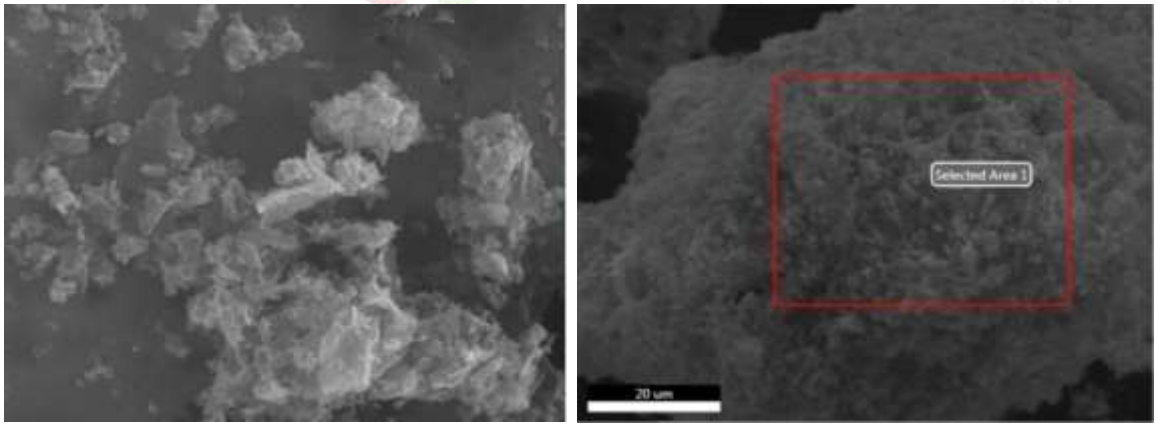


Fig-5a SEM image Fig-5b SEMimage

Fig-5a,5b SEM images of Zno Nps using *Brassia actinophylla* flower extract

4.Conclusion:

The green synthesis of ZnO Nps were successfully synthesized using *Brassia actinophyllla* flower extract.UV,FTIR,PXRD,SEM,EDAX analysis confirms the presence of ZnO Nps.The wurtzite structure of ZnO Nps were confirmed by PXRD pattern.The small sharp peak at 370nm observed through UV-Visible absorption spectroscopy reveals the presence of ZnO Nps.FTIR peaks observed between1000 to500cm^{-1} indicates the presence ZnO Nps.EDAX report shows the percentage of zinc and oxygen present in the sample.The average size of the SEM images of ZnO Nps were in the range of 14-20nm.These green synthesized ZnO Nps have various applications in the field of pharmacy,wound healing,polymer composites,Antibacterial and anticancer activities.

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