Biosynthesis of Zinc Oxide Nanoparticles from Leaf Extract of *Anacardium occidentale* Linn

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SUNDAY 5TH – THURSDAY 9TH AUGUST 2018

Introduction

- ✓Heterogeneous semiconductor photocatalysts such as ZnO have received much interest among researchers due to its wide properties [Ahmed et al., 2017].
- ✓ZnO is classified as a semiconductor with a high band gap of 3.37 eV large exciton energy of 60 meV have the ability to absorb wide range of UV spectrum [Agarwal et al., 2017]
- ✓Physical and chemical methods used to synthesise ZnO nanoparticle are rather complex, generate toxic by-products. [Matinise et al., 2017]
- ✓In the light of this background, this study employed an environmentally benign and facile protocol to prepare ZnO nanoparticles.

Objectives

The aim of this study is to synthesize and characterize ZnO nanoparticles prepared via green route using zinc acetate dehydrate $(CH_3C00)_2$ $Zn.2H_2O$ and leaf extract of *Anacardium occidentale* Linn. The objectives are to:

- ✓Evaluate the effect of solution pH and calcination temperature on the morphological characteristics of the prepared ZnO nanoparticles.

- ✓Characterize the prepared ZnO nanoparticles for their morphology crystallinity and elemental composition using High Resolution Scanning Electron Microscope (HRSEM), X-ray Diffraction (XRD) and Energy Dispersive X-ray Spectroscopy (EDS)

Methodology

Sampling (*Anacardium occidentale* Linn extract)

Phytochemical constituents of *Anacardium occidentale* Linn (Polyphenolic compounds)

Synthesis of ZnO nanoparticles (*Anacardium occidentale* Linn extract + 50 cm^3 of 0.5 M Zinc Acetate dihydrate as precursor)

Variation of solution pH (2, 4, 10, 12)

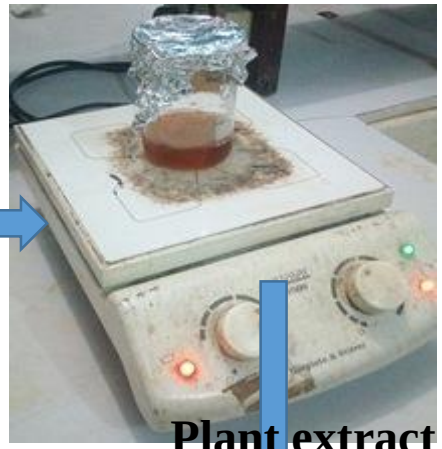
Variation of calcination temperature (400°C, 500°C, 600°C, 800°C) and holding time of 2hours)

Characterization using HRSEM, XRD and EDXS

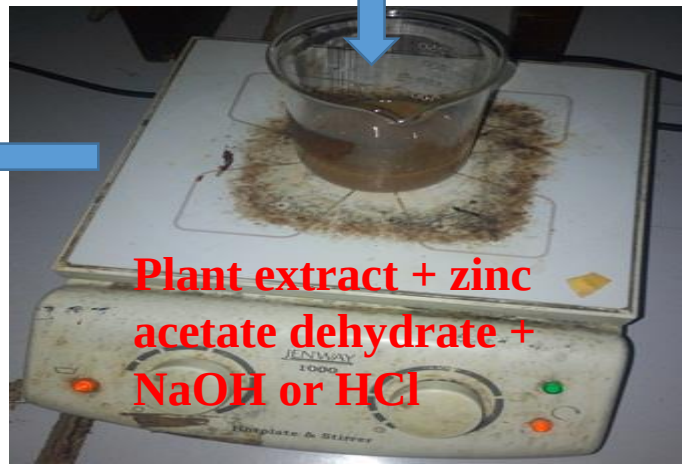
Experimental Setting

Hot extraction

Filtered plant extract used for the synthesis

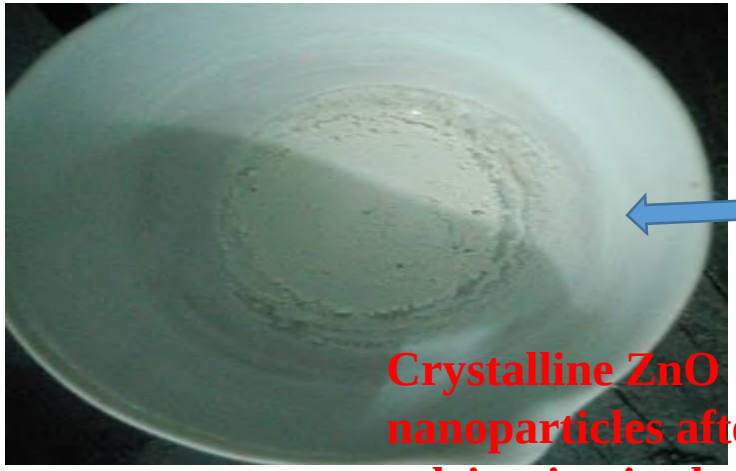


Plant extract + zinc acetate dihydrate



Plant extract + zinc acetate dehydrate + NaOH or HCl

Washed and air dried amorphous ZnO nanoparticles



Crystalline ZnO nanoparticles after calcination in the furnace

Results and Discussion

•**Table 1: Quantitative phytochemical screening of aqueous leaves extract of *Anacardium occidentale Linn***

Phytochemical constituents	Concentration (mg/cm^3)
Total flavonoids	7.3741
Total phenols	21.4264
Total tannins	1.0854

HRSEM and EDS results of ZnO nanoparticles prepared at different pH

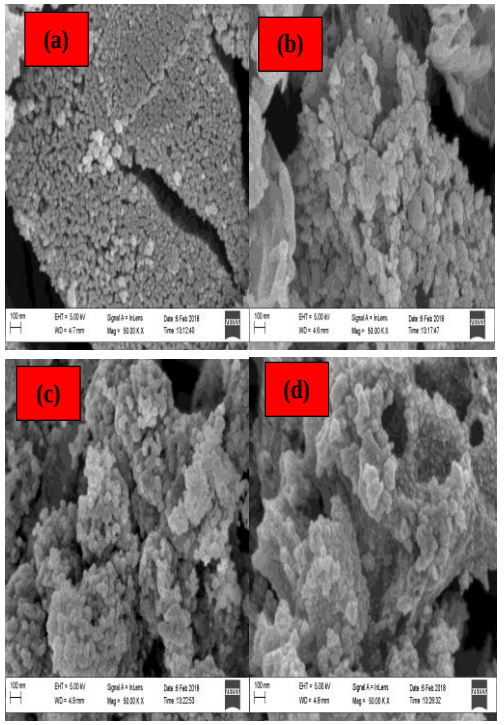


Fig. 1: HRSEM micrograph of ZnO nanoparticles prepared at (a) pH 2 (b) pH 4 (c) pH 10 (d) pH 12

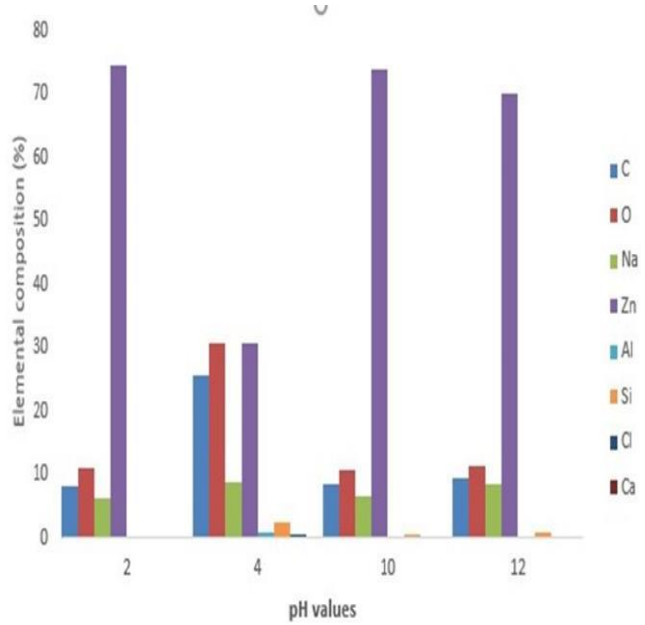


Fig. 2. EDX analysis of ZnO prepared at different pH

Fig. 1: HRSEM micrograph of ZnO nanoparticles prepared at (a) pH 2 (b) pH 4 (c) pH 10 (d) pH 12

Results and Discussion

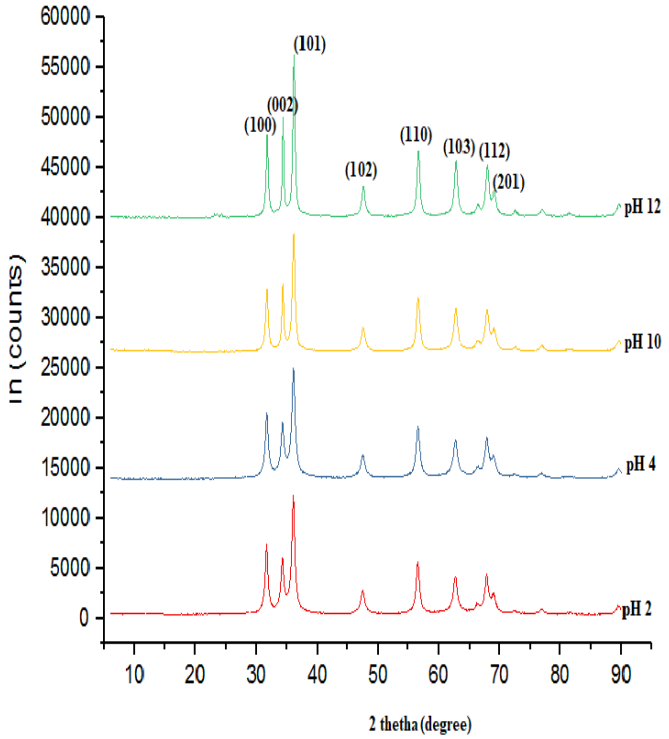


Fig. 3. XRD pattern of ZnO synthesised at different pH

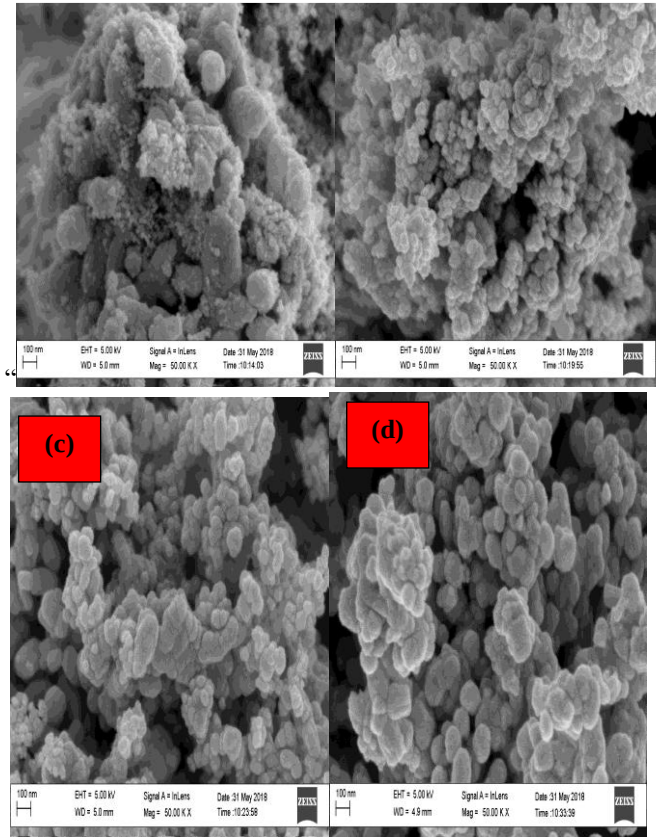


Fig. 4: HRSEM images of ZnO nanoparticles prepared at (a) 400° (b) 500° (c) 600° (d) 800°C

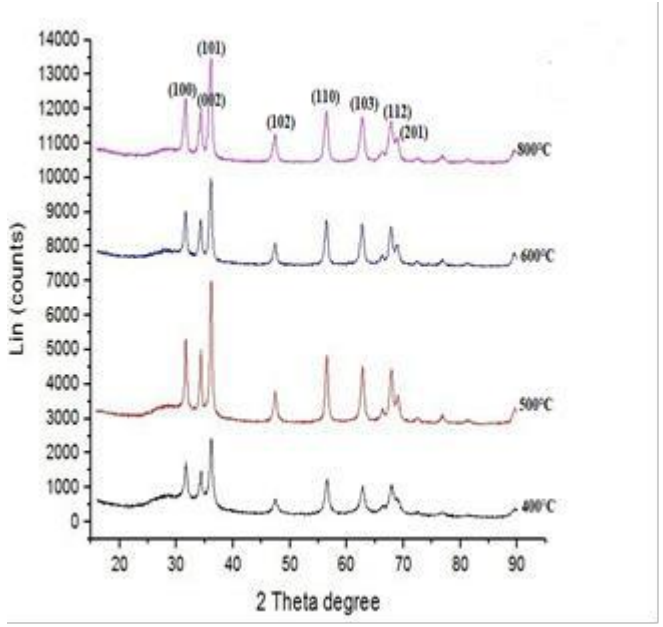


Fig. 5. XRD pattern of ZnO nanoparticles at different calcination temperatures

Conclusions & Recommendations

✓ZnO nanoparticles have been successfully synthesized via green method using *Anacardium occidentale Linn* leaf extract as reducing and capping agent.

✓The synthesized ZnO nanoparticles was characterized using HRSEM, XRD and EDS and the optimal synthesis condition to achieve pure hexagonal wurtzite of controlled size and shape were pH 10 and calcination temperature of 500°C.

References

Agarwal, H., Kumar, S.V. and Rajeshkumar, K.A (2017). A review on green synthesis of zinc oxide nanoparticles – An eco-friendly approach. *Resource – Efficient Technologies*, 000, 1-8

Ahmed, M.T., Abd-Elhamid, M.I, Sarhan, A, and Hassan, A. (2017). Characteristic and thermal stimulated depolarization current of poly (vinyl chloride-co-vinyl acetateco-2-hydroxy propyl acrylate) ZnO nanocomposite. *Global Journal Physics*, 5: 585-594

Matinise, N., Fuku, X. G., Kaviyarasu, K., Mayedwa, N., and Maaza M. (2017). ZnO nanoparticles via *Moringa oleifera* green synthesis: Physical properties mechanism of formation. *Applied Surface Science,* 406: 339–347

Acknowledgements

The authors acknowledged the support received from the Director of STEP-B, Federal University of Technology, Minna, Nigeria for providing the chemicals used for the synthesis of ZnO nanoparticles.