SYNTHESIS, CHARACTERIZATION, OPTICAL AND ANTIBACTERIAL PROPERTIES OF Ni-DOPED ZnO NANO-PARTICLES

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SYNTHESIS, CHARACTERIZATION, OPTICAL AND ANTIBACTERIAL PROPERTIES OF Ni-DOPED ZnO NANO-PARTICLES

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In the name of Allah, The most Compassionate,

The most merciful

He gave the wisdom unto whom he will and unto whom wisdom is given he truly hath received abundant good but none remember except men of understanding.

(2:-Al Baqarah 269)

SAYING OF OUR BELLOVED

HOLY PROPHET HAZRAT MUHAMMAD

(PBUH)

Knowledge of God is my capital,

Enthusiasm is my horse,

Science is my weapon,

Struggle is my manner and

My pleasure is my prayer.

DECLARATION

I **Mudassar Sher** S/O **Sher Muhammad** ID: 13001140010

Session 2013-2015 hereby declare that the matter printed in the thesis titled "Synthesis, characterization, optical and antibacterial properties of Ni-doped ZnO nano-particles" is my own work and has not been printed, published and submitted as research work, thesis or publication in any form in any University, Research institution etc. in Pakistan or Abroad.

Dated: _____ _____

(Mudassar Sher)

RESEARCH COMPLETION CERTIFICATE

Certified that the research work contained in this thesis titled, "Synthesis, characterization, optical and antibacterial properties of Ni-doped ZnO nano-particles" has been carried out and completed by Mudassar Sher, **ID:** 13001140010. The quantum and the quality of the work contained in this thesis is adequate for the award of Degree of MS/M.Phil.

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DEDICATION

Affectionately dedicated to my teachers, family, friends and especially to my mother, wife and to my son Muhammad Arham along with my daughter Dua Fatima. Due to whom Prayers and Cooperation I am able to reach this status.

ACKNOWLEDGEMENT

In the name of Allah who is most beneficent, most powerful and most merciful, who guides us in darkness and alights, our life with happiness after each trouble and difficulty, all the thanks for almighty Allah, who is the entire source for knowledge for equipping His humble creature with mental facility.

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I express deep sense of gratitude to my (late) father Sher Muhammad loving mother, wife, son and daughter.

Mudassar Sher

I.D. 13001140010

ABSTRACT

The importance of nano-particles is increasing day by day due to their potential utility in biomedicines, solar cells and in nano-composite materials. Further the effect of doping to enhance the properties of nano-particles is also under research in current period all over the world. In this work, co-precipitation and solvo-thermal methods were employed and both methods successfully yield Ni-doped zinc oxide nano-particles. We also synthesized un-doped zinc oxide nano-particles via solvo-thermal method. All prepared nano-particles were characterized through X-ray diffraction studies. To validate nickel doping in zinc oxide nano-particles Energy Dispersive X-ray analysis were further employed and Energy Dispersive X-ray results confirmed desired doping in all samples. Scanning Electron Microscopy analysis was performed to study shape and morphology of all prepared nano-particles samples. The results of all above mentioned characterization methods confirmed successful preparation of Ni-doped zinc oxide nano-particles through both preparation methods. All synthesized sampled were also employed to check their antibacterial activity. In Antibacterial study, zones of inhibition have been calculated against *Gram* positive (*Bacillus Subtilis)* and *Gram* negative (*Escherichia coli)* bacterial species. Different molar concentrations of Ni-doped zinc oxide nano-particles were checked through ager well diffusion method. The results showed that antibacterial activity is directly proportional to concentration of Ni-doped zinc oxide nano-particles Furthermore *Gram* positive bacteria are found generally more affected with synthesized nano-particles as compared with *Gram* negative bacteria. The effective antibacterial activity has shown by all prepared Ni-doped zinc oxide samples favor their use as antibacterial agent. Band gap analysis was performed to check optical activity for all samples. It was noted that doped sample shown enhanced optical character when compared with un-doped samples.

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Abbreviations	Name
M_1	Co-precipitation method product dried in air.
M_2	Co-precipitation method product dried in Vacuum.
M_3	Solvo-thermal method product obtained after four hours of calcinations.
M_2	Solvo-thermal method product obtained after six hours of calcinations.
M_A	0.1M Solution of Ni-Doped zinc oxide nano-particles.
M_B	0.75M Solution of Ni-Doped zinc oxide nano-particles.
M_C	0.5M Solution of Ni-Doped zinc oxide nano-particles.
M_D	1.0M Solution of Ni-Doped zinc oxide nano-particles.