

Surfactant assisted synthesis of nanocrystalline zno & mno powders and their bioactivites



By: Naila Nazeer

ID: 15005140015

SUPERVISOR:

Dr. Sammia Shahid

DEPARTMENT OF CHEMISTRY
SCHOOL OF SCIENCE
UNIVERSITY OF MANAGEMENT AND TECHNOLOGY,
LAHORE, PAKISTAN
2017

Surfactant assisted synthesis of nanocrystalline zno & mno powders and their bioactivites

Submitted to University of Management and Technology Lahore

In partial fulfillment of the requirements

For the award of degree of

MS. CHEMISTRY

BY

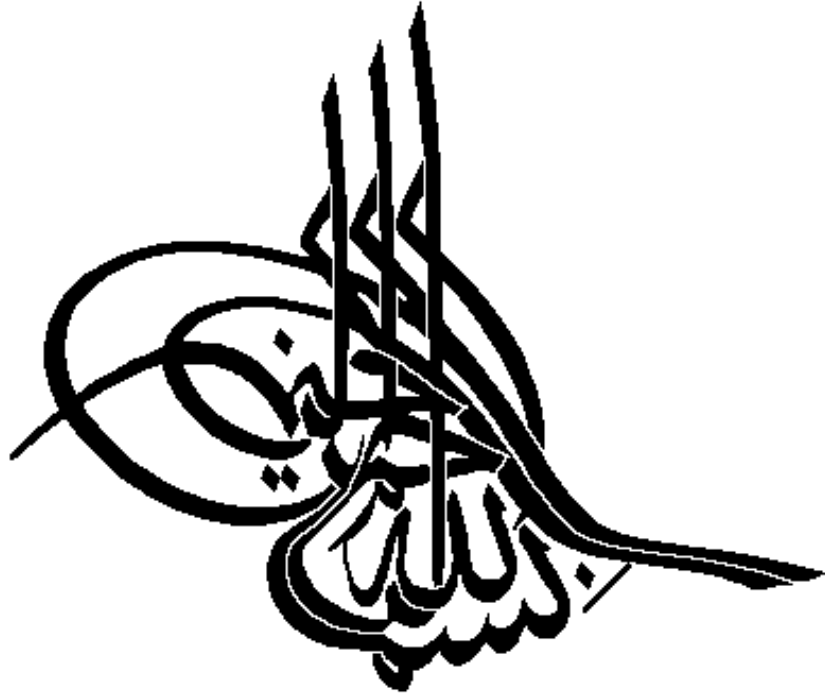
NAILA NAZEER

ID

1	5	0	0	5	1	4	0	0	1	5
---	---	---	---	---	---	---	---	---	---	---

SESSION: 2015-2017

DEPARTMENT OF CHEMISTRY
SCHOOL OF SCIENCE
UNIVERSITY OF MANAGEMENT AND TECHNOLOGY,
LAHORE, PAKISTAN



In the name of

Allah,

The most Compassionate,

The most merciful

RESEARCH COMPLETION CERTIFICATE

Certified that the research work contained in this thesis titled, **“Surfactant Assisted Synthesis of Nanocrystalline ZnO & MnO powders and their bioactivities”** *has* been carried out and completed by, **ID: 15005140015.**

The quantum and the quality of the work contained in this thesis are adequate for the award of Degree of MS/M.Phil.

Supervisor

External Examiner

Chairperson
Dr Sammia Shahid
Associate Professor
Department of Chemistry,
UMT, Lahore.

Dean
Dr Muhammad Azhar Iqbal
Professor
School of Science,
UMT, Lahore.

DECLARATION

I am Naila Nazeer D/O Nazeer -Ud- Din ID: 15005140015
Session **2015-2017** hereby declare that the matter printed in the thesis
titled **“Surfactant assisted synthesis of nanocrystalline ZnO & MnO
powders and their bioactivities”** 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: _____

(Naila Nazeer)

DEDICATION

***This thesis is dedicated to God for giving me the grace,
courage, and strength to complete it.***

***I dedicate this thesis to my beloved parents and respected
teachers whose affection, encouragement, and prays make
me able to get such success and honor.***

***I also dedicate this thesis to my brother and sister who giving
me permanent support to reach achievements.***

ACKNOWLEDGEMENT

First of all I am grateful to ALLAH who in every moment of life with me and helped me in every difficult time, whatever I am today is just because Him.

I am especially thankful to my supervisor Dr. Sammia shahid for giving me the opportunity to work in her research group and for providing me support, encouragement, guidance and cooperation.

I would like to thank my dear parents and family members for their endless love, prayers, support and continuous encouragement.

Last but not least, I would like to thank my all friends for supporting me and encouraging me during the hard time of my studies.

Naila Nazeer

CONTENTS

ACKNOWLEDGEMENTS	IV
TABLE OF CONTENTS	V
LIST OF TABLES.....	VII
LIST OF FIGURES.....	VIII
ABSTRACT	IX
1 INTRODUCTION	1-12
NANOTECHNOLOGY	1-3
ZINC OXIDE NANOPARTICLES	3
APPLICATIONS OF ZINC OXIDE NANOPARTICLES	3-4
MANGANESE OXIDE NANOPARTICLES.....	5
APPLICATIONS OF MANGANESE OXIDE NANOPARTICLES.....	5-6
ANTIMICROBIAL ACTIVITY	6-7
PHOTOCATALYTIC ACTIVITY	7
ANTIOXIDANT ACTIVITY	8
CHARACTERIZATION OF NANOPARTICLES.....	9
UV-VISIBLE SPECTROPHOTOMETER	9-10
X -RAY DIFFRACTION (XRD)	10
SCANNING ELECTRON MICROSCOPY (SEM)	11
1.8 AIMS AND OBJECTIVES.....	12
2 LITERATURE REVIEW	13-20
3 MATERIALS AND METHODS	21-27
CHEMICALS.....	21
GLASSWARE	22
INSTRUMENT	22
SURFACTANT ASSISTED SYNTHESIS OF NANOPARTICLES	23
DIFFERENT ANTIOXIDANT ACTIVITIES	23
DPPH FREE RADICAL SCAVENGING ACTIVITY	23
TOTAL ANTIOXIDANT ACTIVITY BY PHOSPHOMOLYBDENUM	24
TOTAL PHENOLIC CONTENTS	24
FERRIC REDUCING ANTIOXIDANT POWER (FRAP).....	25

PHOTOCATALYTIC DEGRADATION OF DYE	25
ANTIMICROBIAL ACTIVITY	26
ORGANISMS USED FOR ANTIBACTERIAL ACTIVITY	26
SAMPLE PREPARATION.....	26
PREPARATION OF NUTRIENT BROTH	27
PREPARATION OF INOCULUM.....	27
3.8 PREPARATION OF PETRI DISHES	27
4 RESULTS AND DISCUSSION	28-44
X- RAY DIFFRACTION (XRD) ANALYSIS	28
CALCULATION OF GRAIN SIXE BY XRD DATA OF ZINC OXIDE NPs ..	29
CALCULATION OF GRAIN SIXE BY XRD DATA OF MnO NPs.....	30
SCANNING ELECTRON MICROSCOPY	31-32
DETERMINATION OF ANTIMICROBIAL ACTIVITY.....	34-36
DETERMINATION OF PHOTOCATALYTIC DEGRADATION OF DYE.....	37-38
4.5 ANTIOXIDANT ACTIVITY	39
DETERMINATION OF DPPH FREE RADICAL SCAVENGING ASSAY	39-40
DETERMINATION OF TOTAL PHENOLIC CONTENTS	41
DETERMINATION OF FERRIC REDUCING POWER (FRAP)	41-42
DETERMINATION OF TOTAL ANTIOXIDANT BY PHOSPHOMOLYBDENUM.....	42-43
4.5.5 CONCLUSION	44
5 REFERENCES	45-55

List of tables

Table 4.1.1 XRD data of ZnO Nanoparticles	28
Table 4.2.1 XRD data of MnO Nanoparticles	29
Table 4.3.1 Zone of inhibition of ZnO NPs	36
Table 4.3.2 Zone of inhibition of ZnO NPs	36
Table 4.5.1.1 IC50 value for ZnO & MnO NPs	39
Table 4.5.1.2 Free radical scavenging activity of ZnO nanoparticles	40
Table 4.5.1.3 Free radical scavenging activity of MnO nanoparticles	40
Table 4.5.2.1 Total phenolics in ZnO & MnO nanoparticles	41
Table 4.5.3.1 Iron reducing power of ZnO & MnO NPs	42
Table 4.5.4.1 Total antioxidant in ZnO & MnO NPs	43

List of figures

Fig. 1 Types of metal nanoparticles and their applications in biotechnology	2
Fig. 4.1.1 XRD Spectra of ZnO NPs	28
Fig. 4.1.2 XRD Spectra of MnO nanoparticles	29
Fig. 4.2.1 SEM image of Zinc Oxide Nanoparticles	31
Fig. 4.2.2 SEM image of Zinc Oxide Nanoparticles	32
Fig. 4.2.3 SEM image of Manganese Oxide Nanoparticles	32
Fig. 4.2.4 SEM image of Manganese Oxide Nanoparticles	33
Fig. 4.2.5 SEM image of Manganese Oxide Nanoparticles	33
Fig. 4.3.1 Antibacterial activity of ZnO NPs	35
Fig. 4.4.1 Absorption spectra of ZnO nanoparticles	38
Fig. 4.4.1 Absorption spectra of MnO nanoparticles	38

ABSTRACT

Zinc oxide and manganese oxide nanoparticles were synthesized by chemical method using poly ethylene glycol (PEG) as a surfactant, zinc sulphate ($\text{ZnSO}_4 \cdot 7 \text{H}_2\text{O}$) & manganese sulphate ($\text{MnSO}_4 \cdot \text{H}_2\text{O}$) as a precursor molecules. Different characterization techniques were used for the determination of size and morphology of synthesized nanoparticles such as X-ray diffraction photometer (XRD) and Transmission electron microscopy (TEM). All the results confirmed that the surface of nanoparticles have sufficient compatibility with surfactant. These nanoparticles were tested for its antimicrobial activity against various bacterial strains. The nanoparticles were also used for the removal of toxic organic pollutants such as dye Methylene Blue under UV irradiation. The different operational parameters such as the initial concentration of the dye, weight of the photo catalyst, and pH on the photo catalytic degradation of the dye were investigated. Results proved that both nanoparticles act as very good catalyst for the effective degradation of Methylene Blue in the presence of sunlight. The as synthesized nanoparticles were also found to inhibit the activity of 1, 1-Diphenyl-2 picrylhydrazyl (DPPH) free radicals effectively. This research work revealed a simple and fast method for the preparation of ZnO & MnO nanoparticles with no need for expensive materials or complicated treatments.

1. INTRODUCTION

Nanotechnology

Nanoscale, materials exhibit multiple properties such as visual, electronic, and magnetic properties that diverge extremely from their bulk materials. A characteristic example is gold, yellow noble metal which in the loose form is a non-magnetic. The main characteristics of nanostructured materials allow them to find possible applications in many new and promising fields such as nanofabrication, nanocatalysts, and nanodevices (Wang, 2009).