

Clarithromycin nanoparticles synthesis,  
characterization and enhancement of antimicrobial  
activities and dissolution rate

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By:

Muhammad Ishafq Ahmad

ID: 15005140011

SUPERVISOR:

Dr. Sammia Shahid

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Department of chemistry  
School of science  
University of management and technology, Lahore, Pakistan  
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characterization and enhancement of antimicrobial  
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MUHAMMAD ISHFAQ AHMAD

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SESSION: 2015-2017

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

## **RESEARCH COMPLETION CERTIFICATE**

Certified that the research work contained in this thesis titled, “Clarithromycin Nanoparticles Synthesis, Characterization And Enhancement Of Antimicrobial Activities And Dissolution Rate” has been carried out and completed by **Muhammad Ishfaq Ahmad, ID: 15005140011**. The quantum and the quality of the work contained in this thesis is 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 Muhammad Ishfaq Ahmad S/O Mubarik Ali ID: 15005140011**

Session **2015-2017** hereby declare that the matter printed in the thesis titled **“Clarithromycin Nanoparticles Synthesis, Characterization And Enhancement Of Antimicrobial Activities And Dissolution Rate”** 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:* \_\_\_\_\_

\_\_\_\_\_

*(Muhammad Ishfaq Ahmad)*

# DEDICATION

*To*

DEDICATE THE FRUIT OF THIS HUMBLE EFFORT TO  
HOLY PROPHET (S.A.W)  
THE GREAT SOCIAL REFORMER  
MY PARENTS AND FAMILY WHOSE PRAYER  
AND AFFECTIONS ARE THE SOURCE OF  
STRENGTH AND SIGN OF SUCCESS  
FOR MY BRIGHT FUTURE

MUHAMMAD ISHFAQ AHMAD

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**MUHAMMAD ISHFAQ AHMAD**

## **ABSTRACT**

Low solubility and bioavailability was the major concern in the past for macrolide antibiotic drugs. The solubility and dissolution rate could be enhanced by preparing nanodrugs as their surface area increases. In this research clarithromycin drug nanoparticles were prepared by using solvent-antisolvent precipitation method. The prepared drug nanoparticles were characterized by FTIR, SEM, EDX and XRD. Dissolution rate was studied by using Dissolution apparatus and High Performance Liquid Chromatography (HPLC) at different time intervals was used. The dissolution rate of nano drug showed a major enhancement as compared with the parental drug. No difference was observed in IR spectra of both parental drugs and nano drug of clarithromycin. X-Ray diffraction (XRD) showed the amorphous form of clarithromycin. The SEM images showed the nanosized particles of nanodrug. The antibacterial activities of both parental drug and nanoparticles were determined against *Staphylococcus aureus*, *E. coli*, and *Salmonella typhi* by agar well diffusion method. The nano drug showed better results as compared to the parental drug.

Key Words: Clarithromycin; High Performance Liquid Chromatography; Nanodrugs; Macrolide Antibiotics

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## NOMENCLATURE

API	:	Active pharmaceutical ingredients
SEM		Scanning Electron Microscope
TEM		Transmission Electron Microscope
XRD		X-ray Diffraction
FTIR		Fourier Transform Infrared Spectroscopy
EDX		Energy Dispersive X-Ray
CCD		charged couple device
CLA		Clarithromycin
TGA		Thermal Gravimetric Analysis
DSC		Differential Scanning Calorimetry
EP		European Pharmacopoeia
USP		United State Pharmacopoeia
DMSO		Dimethylsulfoxide
HPLC		High-Performance Liquid Chromatography
SCDM		Soya Bean Casein Digest Agar Medium
MA		Macconkey Agar

### 1.1 INTRODUCTION

#### 1.1 NANOSCALE

In our daily life different scales are used to measure the distance or length like millimeter, centimeter, meter and kilometer. Nanometer one more unit of length which is billionth part of meter ( $10^{-9}$  meter) also written as 1nm. This scale is called nano-scale. In the history of science in the world from last fifteen years, the word “Nano” got great consideration and significance for the scientists. Nanoscales have great worth in the field of nano measurement and invention of nano materials. Scientists with advance technology and research are able to produce nano particles having dimensions in nanometers.[**Allhoff *et al.*, 2010**].