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

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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.

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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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Thankfully, by the grace of almighty Allah, I had support of a number of people who provided assistance and encouragement in the completion of this research project, which was not less than a daunting task for me. This acknowledgment is not simply an expression of my formal duty, but all the emotional association I have with the person who helped me during in pulling what looking impossible.

I deem it as my utmost pleasure to avail this opportunity to express deep sense of obligation to my supervisor, **Associate Prof. Dr. Sammia Shahid,** Chairperson School of Science, Department of Chemistry University of Management and Technology Lahore, whose illustrious advice, intellectual stimulation, encouraging attitude, invaluable suggestions and inspiring attitude which made it very easy for me to undertake this work throughout the course of this research work. He was an immense course of encouragement for me in completing this study. I have learned from her to grow in to positive organized, responsible well-mannered.

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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. I NTRODUCTION

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 moreunit 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].**