Instrumental Methods of Analysis in Biotechnology

Dinesh Kumar Chatanta
Prahlad Singh Mehra

INSTRUMENTAL METHODS OF ANALYSIS IN BIOTECHNOLOGY

Instrumental Methods of Analysis in Biotechnology

Dinesh Kumar Chatanta
Associate Professor
Shoolini University of Biotechnology and Management Sciences
Solan, Himachal Pradesh

Prahlad Singh Mehra
Assistant Professor
Abhilashi College of Pharmacy
Tanda Dist., Mandi
Himachal Pradesh

I.K. International Publishing House Pvt. Ltd.

NEW DELHI • BANGALORE

Published by

I.K. International Publishing House Pvt. Ltd.
S-25, Green Park Extension
Uphaar Cinema Market
New Delhi–110 016 (India)
E-mail: info@ikinternational.com
Website: www.ikbooks.com

ISBN 978-93-81141-38-0

10 9 8 7 6 5 4 3 2 1

Published by Krishan Makhijani for I.K. International Publishing House Pvt. Ltd., S-25, Green Park Extension, Uphaar Cinema Market, New Delhi–110 016 and Printed by Rekha Printers Pvt. Ltd., Okhla Industrial Area, Phase II, New Delhi–110 020.

Dedicated to

our parents

and

teachers

FOREWORD

It is a pleasure to write the foreword of **Instrumental Methods of Analysis in Biotechnology** by Dr. Dinesh Kumar Chatanta and Prahlad Mehra, dedicated educationists and researchers of the young generation. Biotechnology is a multidisciplinary science of recent origin. The research in biotechnology is undergoing tremendous changes because of the advancement of instruments and technologies used in the analysis of biochemicals and biomolecules. With the advancement of knowledge and understanding, it is possible to make use of instrumental methods based on biochemical and other analytical properties for making an ever-increasing contribution in various fields of biotechnology and pharmaceutical sciences, viz., microbiology, biochemistry, molecular biology, medical diagnosis, pharmaceutical analysis and environmental biotechnology. This book specifically deals with the basic methodology and applications of microscopy, centrifugation, electrophoresis, chromatography, nucleic acid isolation, PCR, spectrophotometry, spectroscopy, crystallography, radioisotopy and microbial growth measurements.

This book is aimed at providing information at various levels to the undergraduate and postgraduate students in the area of biotechnology, pharmacy and other related fields of the life sciences. This book covers the syllabi of B.Sc. (Hons) Biotechnology and M.Sc. Biotechnology courses of various universities. The chapters included in this book cover basic principles, instrumentation and applications of various methodologies and techniques used in the specific analysis and measurement of the biomolecules in biotechnological and pharmaceutical applications. The contents of this book are self-explanatory and supported with illustrations. The approach of this book is very simple and presentation is very lucid so that students and researchers working in the field of biotechnology and pharmaceutical sciences understand the basic principles of instruments and methodologies used in various types of analyses.

I am sure that this book will prove to be of immense value to the readers of diverse backgrounds and fields specifically pursuing their study in the field of biotechnology, pharmacy and other related biological sciences.

Prof. T. C. Bhalla
Coordinator Biotechnology & Bioinformatics
Former Director, Institute of Integrated Himalayan Studies (IIHS)
Himachal Pradesh University, Shimla, H.P. 171005

PREFACE

Instrumental methods of analysis has importance in biotechnology and related fields, e.g., pharmaceutical science and biological science by applying various techniques and instruments in biological analysis and assay with the advancement of industrial applications and technology. This book is specifically written for the graduate and postgraduate students in biotechnology and other related biological sciences. The primary aim of this book is to provide a broad overview of methods and techniques used for the qualitative and quantitative analysis and assay of the respective biomolecules to give clear insight into the subject.

This book has been written keeping in view the importance of various techniques and instruments used in biological analysis assay and industrial applications in biotechnology.

- This book is divided into eleven chapters. This book covers the various types of microscopes including electron microscopes, centrifugation techniques used in separation of nucleic acids, proteins and immunological substances, chromatographic techniques used in the separation of biological molecules with special reference to HPLC and GC techniques.
- The other part of this book covers the techniques used for isolation and purification of nucleic acids, their amplification using various PCR techniques, separation of nucleic acids, proteins and immunogenic substances with various electrophoretic techniques.
- Next chapters in this book focus on various spectrophotometric techniques used in biochemical analysis and mass spectroscopy covers the principles and applications of Raman, infra-red spectroscopy, NMR, ESR and magnetic resonance imaging (MRI).
- The last part of this book includes radioisotopic techniques such as GM and scintillation counters and RIA, ELISA. This book also discusses the various approaches used in the determination of microbial growth with emphasis on FACS and Coulter counter techniques. This book will serve as a valuable source of information for students, teachers and researchers pursuing their study in biotechnology and other biological sciences. This is specially designed to cover the B.Sc. (Hons) Biotechnology and M.Sc. Biotechnology courses of various universities.

We express our gratitude to Prof. T.C. Bhalla, Coordinator, Biotechnology & Bioinformatics, H.P. University, Shimla for his benevolent guidance and encouragement to write this book.

We express our thanks to Dr. Duni Chand, Chairman, Department of Biotechnology, Prof. S.S. Kanwar, Dr. Wamik Azmi, Dr. Reena Gupta, Dr. Arvind Kumar Bhatt, Principal Scientific Officer, Department of Biotechnology, H.P. State Govt. for his wishes. Thanks are due to the faculty members of AILS, Mandi, namely, Divya Thakur, Shipra Sharma, Neha Tandon, Sakshi Sharma, Aakriti Guleria, Shailja Guleria, Dr. Aditya Kumar, Dr. Suresh Kumar, Dr. Altaf Khan, Pankaj Sharma, Rojila Puri, Vandana, Dr. Yogesh Walia and many others for their wishes and valuable suggestions.

Thanks are due to Prof. P.K. Khosla, Honb'le Vice Chancellor, Shoolini University of Biotechnology & Management Sciences, Solan and Prof. S.C. Tewari, Dean Academic Affairs and Prof. D.R. Sharma, Dean Faculty of Biotechnology, Shoolini University for their blessings, support and encouragement to take up this manuscript.

We acknowledge the help rendered by faculty members of Abhilashi College of Pharmacy, Mandi, namely, Mr. Murugamani (Principal), Bhupendra Singh Tomar, Mrs. Geetanjali Tomar, Deepak Awasthi, Ravi Shankar Yadav, Manjir Sharma Katki, Ananya Rajkumari, Amit Kumar Roy, Deepti Sharma, Thakra Ram Chaudhary, Preeti Aneja, Kapil Verma and Lishu.

We also express our thanks to Dr. R.K. Abhilashi, Chairman Abhilashi Education Society, Dr. Narender Sharma, Chairman, DDM Group of Institution, Amb, Dist. Una, H.P. Prof. Divya Juyal, SGRRITS Dehradun, Dr. Shon Roy Chaudhary and Dr Jaya Bandopadhyay WBUT Kolkata; Mr Yogendra Singh, Q.A. and Q.C. Head, Alembic Pharmaceuticals Baddi; Asst. Prof. Laxmi SGRRITS Dehradun, Asst. Prof. Sumit Durgapal HIPR Dehradun, Asst. Prof. Prakash Kumar, Anand Engineering College Agra, U.P., Asst. Prof. Mohit Mehta, Head DDM College of Pharmacy, Una.

Dr. Virender Singh, Head Life Science, Himachal Institute of Life Science, Paonta Sahib; Dr. U.D. Sankhian, Coordinator Biotechnology, Govt. P.G. College, Mandi, Dr. Aswani Tapwal, Scientist-C, Rain Forest Research Institute, Jorhat, Dr. Shashi Bhushan, and Dr. R.C. Kasana, Scientist-C, IHBT, Palampur. Prof. J.S. Virdi, Department of Microbiology and Pathology, University of Delhi, South Campus; Prof. C.K. Shirkot, UHF, Nauni, Prof. S.S. Kanwar, Chairman, Department of Microbiology, CSK-HPKV, Palampur, Prof. M.K. Gupta, CSK HPKV, Palampur, Mr. Rajesh Sharma, Asst. Prof., Shoolini University, Dr. Pankaj Kumar Tyagi, Asst. Prof., Meerut Institute of Engineering & Technology, Meerut; Dr. Manvender Singh Gehlot, Asst. Prof., Maharishi Dayanand University, Rohtak. Prof. G.S. Chauhan, Department of Chemistry, HP University, Shimla, Prof. T.R. Sharma, Rice Genome Centre, IARI, New Delhi. Dr. Dharam Singh, Distinguished Post Doctoral Fellow, Taiwan. Prof. H.S. Baniyal, Prof. D.C. Gautam, Prof. M.K. Seth, Prof. D.C. Kalia, Prof. Anand Sagar, Department of Bioscience, HP University, Shimla. Dr. Virender Santvan, Institute of Integrated Himalayan Studies, H.P. University, Shimla.

We are especially thankful to Dr. Savitri, Assistant Professor, AILS for her association to start this project. However, her contribution to the present skeleton of this book could not be left unnoticed. So we are again thankful to her from core of our heart for her critical and starting input in this manuscript.

Dr. Chatanta is also thankful to his beloved wife Mrs. Rachna Verma, Assistant Professor, SILB, Solan for her critical suggestions and constant support during the course of compilation of this manuscript.

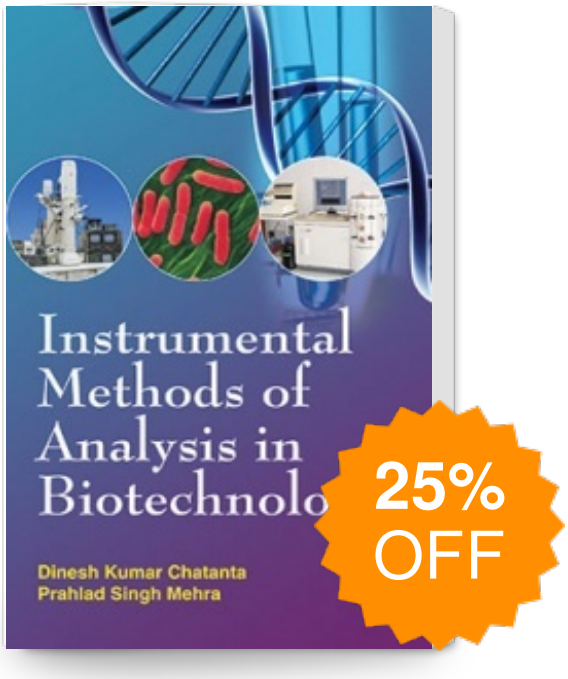
Comments, suggestions and constructive criticism of this book towards improvement of future edition of this book in the interest of readers are heartily welcomed.

Dinesh Kumar Chatanta
E-mail: chatantadk@yahoo.com

Prahlad Singh Mehra
E-mail: prahlad17@gmail.com

CONTENTS

Instrumental Methods of Analysis in Biotechnology



Publisher : IK International

ISBN : 9789381141380

Author : Dinesh Kumar Chatanta And Prahlad Singh Mehra