Advanced Agrochemicals, Bio-pesticides & Fertilizers

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Preface

Agriculture, as the backbone of food security and economic stability, is undergoing a transformative phase driven by technological advancements and sustainable practices. The growing global population, climate variability, and the need for eco-friendly solutions demand a rethinking of conventional pest management and soil fertility strategies. Advanced Agrochemicals, Bio-pesticides & Fertilizers has been designed to provide a comprehensive overview of modern developments in agrochemical science, integrating traditional approaches with innovative techniques in biological control, biotechnology, and environmentally responsible farming inputs.

This book encompasses a wide spectrum of topics, beginning with the fundamentals of agrochemicals and extending to advanced biopesticides, biofertilizers, and novel pest control methods. Special emphasis is placed on sustainable solutions such as chemosterilants, pheromones, insect growth regulators, and botanicals, along with critical insights into the environmental and health impacts of pesticide use. The chapters also explore the role of biotechnology in pest management, the utility of baits, and the science behind moulting hormones and chitin synthesis inhibitors.

By bringing together theoretical knowledge, applied research, and practical case studies, this volume aims to serve students, researchers, agricultural scientists, and industry professionals who are seeking in-depth, updated, and holistic perspectives on crop protection and soil nutrition management. The authors hope this work will inspire innovative, safe, and sustainable agricultural practices for a healthier planet.

Acknowledgement

No endeavor reaches its fullest potential without the support, guidance, and goodwill of many individuals. We take this opportunity to extend our heartfelt appreciation to all who played a vital role in bringing this book's vision to life.

Above all, we express our profound gratitude to the late Dr. Ravindra G. Deshmukh, former Principal of K. G. K. College, Karjat, Maharashtra, India, whose inspiration first kindled our research interest. His persistent encouragement, invaluable guidance, and motivating presence empowered us to undertake and complete this work. We shall cherish his vision and blessings forever.

We are equally indebted to Prof. R. S. Lokhande, Director, School of Basic Sciences, Jaipur National University, Jaipur, India, for his steadfast support and encouragement. Our sincere thanks are also due to Dr. Sharad Sankhe, Vice Principal at S S & L S Patkar College of Arts & Science and V P Varde College of Commerce & Economics, Goregaon, Mumbai, for his insightful suggestions and motivation, and to Dr. Arun K. Kadu, Assistant Professor, Department of Chemistry, University of Mumbai, Maharashtra, for his scholarly guidance. We extend our appreciation to Dr. Prashant Kamble, Assistant Professor of Chemistry, Patkar Varde College, Mumbai, Maharashtra, India, and Dr. Pradeep Shimpi, Head & Associate Professor, Department of Chemistry, BNN College, Bhiwandi, India, for their expert advice and encouragement. Our thanks also go to Dr. Ganga Gore, Assistant Professor, Department of Chemistry, Dapoli Urban Bank College, Dapoli, Maharashtra, for their continued support and contributions.

Finally, we warmly acknowledge the unwavering encouragement of our dear friends and colleagues, Dr. Vinay Singh, Dr. Gajanan Upadhye from the Department of Chemistry, Konkan Gyanpeeth Karjat College, Karjat, Raigad, Maharashtra, India, whose camaraderie and motivation have always inspired us to strive for excellence in our field.

About the Authors

Dr. Raj Ramdas Badekar, born on March 21, 1985, in Raigad, Maharashtra, India, is a highly accomplished chemist and academician. He completed his undergraduate and postgraduate studies at the University of Mumbai, followed by a Ph.D. in Chemistry from Jaipur National University in 2016. Throughout his academic career, he has served as a co-supervisor at Jaipur National University and Pacific University, Udaipur, successfully mentoring 12 Ph.D. scholars to completion.

Dr. Badekar has an impressive research portfolio, with more than 50 publications in reputed national and international journals and 24 presentations at various conferences. His professional background spans both academia and industry, including four years of teaching and over ten years of industrial experience across multiple sectors. Presently, he is the proprietor of RIVA Industries, where he continues to lead advancements and innovation in the field of chemistry.

Prof. Dr. Kalpana Patankar-Jain is an accomplished academician and researcher with an illustrious career spanning over three decades in the field of chemistry. She earned her B.Sc. in Chemistry from B. N. Bandodkar College, Thane, in 1986, followed by an M.Sc. in Analytical Chemistry from the University Department of Chemistry in 1988. She was awarded her Ph.D. in Chemistry by Jaipur National University in 2013.

With a distinguished record of 30 publications in national and international journals and authorship of 16 books with ISBNs, Prof. Dr. Patankar-Jain has made significant scholarly contributions to chemical sciences. She has served as a resource person for numerous colleges and universities, sharing her expertise in analytical chemistry and higher education.

Her academic influence extends to curriculum development, having served as a Member of the Board of Studies at the University of Mumbai, CKT College (Panvel), Sapre Pitre College (Devrukh), and Somaiya College (Vidyavihar). At BNN College, Bhiwandi, she held multiple leadership roles,

including Professor, Head of the Department of Chemistry, and Vice Principal, dedicating 34 years of service to the institution.

On 29 April 2023, Prof. Dr. Patankar-Jain was appointed Principal of the Royal College of Arts, Science, and Commerce, Mira Road, Maharashtra, where she continues to lead with distinction. Her remarkable career has been recognized with nine prestigious awards, underscoring her dedication to academic excellence, research innovation, and leadership in higher education.

Dr. Melwin Diego D'Souza (b. 25th September 1991) is currently serving as an Assistant Professor of Chemistry at St. Joseph Vaz College, Cortalim, Goa. He holds a Ph.D. in Chemistry with specialization in Analytical Chemistry from Jaipur National University, along with an M.Sc. (Physical Chemistry) from Goa University, and a B.Ed. in Mathematics and Science from Pune University.

With teaching experience spanning schools, universities, and now higher education, Dr. D'Souza has been actively engaged in both academic and research pursuits. His research interests include analytical method development, transition metal complexes, biodegradable polymers, and medicinal chemistry. He has published five international research papers in reputed journals such as RASAYAN Journal of Chemistry, Asian Journal of Organic and Medicinal Chemistry, Journal of Chemical Reviews, and Asian Journal of Chemistry.

Apart from teaching and research, he contributes to academic governance as an external examiner and paper setter for Goa University. He is also actively involved in community service as the Secretary of the Arambol Biodiversity Management Committee (BMC). Dr. D'Souza has participated in and presented at several national and international conferences, workshops, and certificate programs, further enhancing his academic and professional profile.

Prof. Dr. Yogita Shinde, M.Sc., Ph.D., is an accomplished academician and researcher in the field of chemistry, currently serving as Professor in the Department of Chemistry at K.C. College, Churchgate, Mumbai. She earned her B.Sc. in Microbiology from R. N. Ruia College in 1993, followed by an M.Sc. in Analytical and Medicinal Chemistry from SNDT University in 1995. She completed her Ph.D. in Inorganic Chemistry from the University of Mumbai in 1999.

Since joining K.C. College in July 2005, Dr. Shinde has made significant contributions to research, teaching, and academic leadership. She is a recognized research guide in Analytical Chemistry for the University of Mumbai, JJT University (Rajasthan), and HSNC University (Mumbai). She has published 20 research papers in reputed national and international journals and completed a Minor Research Project under the UGC scheme. Currently, she guides five Ph.D. scholars, with additional candidates in the admission process, and has mentored numerous postgraduate and undergraduate research projects, including guiding five undergraduate students under the Science Honors Programme (SHP) over the past seven years.

Dr. Shinde has authored reference books for undergraduate students and played a pivotal role as Departmental Coordinator for the DBT Star Scheme at K.C. College. She has coordinated M.Sc. Part I and II programs across all branches for the past four years and served as a Member of Syllabus Revision Committees for various institutions, including the University of Mumbai and HSNC University. Notably, she was Chairperson for M.Sc. Analytical Chemistry at the University of Mumbai from 2019 to 2023, and has contributed extensively as a paper setter and moderator for postgraduate analytical chemistry examinations across several prominent colleges.

Her research interests span Environmental Chemistry, Analytical Chemistry, Food Chemistry, and Cosmetic Chemistry. She has been an active Member of the Board of Studies (BOS) in Chemistry at HSNC University for the past four years, consistently working towards advancing curriculum development and promoting high-quality research in chemical sciences.

Dr. Sunil Shripat Yadav is a distinguished academician and researcher, presently serving as Assistant Professor of Chemistry and Coordinator of Research & Development at Fr. Conceicao Rodrigues College of Engineering, Bandra West, Mumbai. His research expertise spans applied chemistry and innovative materials, with a focus on sustainable technological solutions.

Dr. Yadav has published over seven research papers in reputed peer-reviewed journals and conference proceedings, contributing valuable insights to the scientific community. He is also the inventor of a design and innovation patent titled “A Method for Obtaining Silver Nanoparticles from Metallic Silver-Containing Waste” (Application No. 1649/MUM/2012 A; published 31 August 2012), demonstrating his commitment to environmentally responsible innovations.

In addition to his academic and research achievements, Dr. Yadav is an active member of the Indian Society for Technical Education (ISTE), reflecting his dedication to advancing engineering and technical education. Through his teaching, research, and professional engagement, he continues to inspire and guide the next generation of scientists and engineers.

Table of Contents

ABOUT THE AUTHORS

Dr. Raj Ramdas Badekar
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ABOUT THE BOOK

Advanced Agrochemicals, Bio-pesticides & Fertilizers is a comprehensive reference guide covering fifteen well-structured chapters that address both the scientific principles and practical applications of modern agrochemical technology. Beginning with an introduction to Agrochemicals (Chapter 1), the book progresses to specialized topics such as Non-Insect Pests (Chapter 2) and various Pest Control strategies (Chapter 3). Chapters 4 and 5 detail Biological Pest Control and Chemosterilants, while Chapter 6 examines Pheromones, Attractants, and Repellents as eco-friendly pest management tools.

The discussion on the Effects of Pesticides (Chapter 7) provides critical perspectives on environmental and health implications. Cutting-edge approaches are presented in Biotechnology in Pest Management (Chapter 8), along with nature-based alternatives like Botanicals and Biopesticides (Chapter 9). Practical methods such as Baits (Chapter 10) and Insect Growth Regulators (Chapter 11) are thoroughly explained, followed by specialized chapters on Chitin Synthesis Inhibitors and Juvenile Hormone Analogs (Chapter 12) and Moulting Hormones: Ecdysone and Ecdysterone (Chapter 13).

In the latter part, the book addresses plant nutrition with chapters on Fluid Fertilizers (Chapter 14) and Biofertilizers: A Comprehensive Study (Chapter 15), emphasizing their role in sustainable agriculture. This text serves as an indispensable resource for those involved in agricultural sciences, pest management, environmental biology, and related industries, offering both foundational knowledge and advanced insights into sustainable crop production systems.

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