
Preface

Applied environmental biotechnology is the field of environmental science and biology that involves the use of living organisms and their by-products in solving environmental problems like waste and wastewaters. It includes not only the pure biological sciences such as genetics, microbiology, biochemistry, and chemistry but also subjects from outside the sphere of biology, such as chemical engineering, bioprocess engineering, information technology, and biophysics.

Cleaning up the contamination and dealing rationally with wastes is, of course, in everybody's best interests. Considering the number of problems in the field of environmental biotechnology and microbiology, the role of bioprocesses and biosystems for environmental cleanup and control based on the utilization of microbes and their products is highlighted in this work. Environmental remediation, pollution control, detection, and monitoring are evaluated considering the achievement as well as the perspectives in the development of environmental biotechnology. Various relevant articles are chosen up to illustrate the main areas of environmental biotechnology: industrial waste water treatment, soil treatment, oil remediation, phytoremediation, microbial electroremediation, and development of biofuels dealing with microbial and process engineering aspects. The distinct role of environmental biotechnology in future is emphasized considering the opportunities to contribute new approaches and directions in remediation of a contaminated environment, minimizing waste releases, and developing pollution prevention alternatives using the end-of-pipe technology. To take advantage of these opportunities, new strategies are also analyzed and produced. These methods would improve the understanding of existing biological processes in order to increase their efficiency, productivity, flexibility, and repeatability.

The responsible use of biotechnology to get economic, social, and environmental benefits is highly attractive since the past, such as fermentation products (beer, bread) to modern technologies like genetic engineering, rDNA technology, and recombinant enzymes. All these techniques are facilitating new trends of environment monitoring. The twenty-first century has found microbiology and biotechnology as an emerging area in sustainable environmental protection. The requirement of alternative chemicals, feedstocks for fuel, and a variety of commercial products has grown dramatically in the past few decades. To reduce the dependence on foreign exchange, much research

has been focussed on environmental biotechnology to develop a sustainable society with our own ways of recovery and reusing the available resources.

An enormous amount of natural and xenobiotic compounds are added to the environment every day. By exploring and employing the untapped potential of microbes and their products, there are possibilities of not only removing toxic compounds from the environment but also the conversion and production of useful end products. Basic methodologies and processes are highlighted in this book which will help in satisfying the expectations of different level of users/readers.

This work focuses on the alarming human and environmental problems created by the modern world, and thus provides some suitable solutions to combat them by applying different forms of environmental studies. With the application of environmental biotechnology, it enhances and optimizes the conditions of existing biological systems to make their course of action much faster and efficient in order to bring about the desired outcome. Various studies (genetics, microbiology, biochemistry, chemistry) are clubbed together to find solutions to environmental problems in all phases of the environment like, air, water, and soil. The 3R philosophy of waste reduction, reuse, and recycling is a universally accepted solution for waste management. As these are end-of-pipe treatments, the best approach is developing the approach of waste prevention through cleaner production. However, even after creation of waste the best solution to deal with is through biological means, and today by applying various interdisciplines we can create various by-products from this waste and utilize them best. Treatment of the various engineering systems presented in this book will show how an engineering formulation of the subject flows naturally from the fundamental principles and theories of chemistry, microbiology, physics, and mathematics and develop a sustainable solution.

The book introduces various environmental applications, such as bioremediation, phytoremediation, microbial diversity in conservation and exploration, in-silico approach to study the regulatory mechanisms and pathways of industrially important microorganisms, biological phosphorous removal, ameliorative approaches for management of chromium phytotoxicity, sustainable production of biofuels from microalgae using a biorefinary approach, bioelectrochemical systems (BES) for microbial electroremediation, and oil spill remediation.

This book has been designed to serve as a comprehensive environmental biotechnology textbook as well as a wide-ranging reference book. The authors thank all those who have contributed significantly in understanding the different aspects of the book and submitted their reviews, and at the same time hope that it will prove of equally high value to advanced undergraduate and graduate students, research scholars, and designers of water, wastewater, and other waste treatment systems. Thanks are also due to Springer for publishing the book.

Kishangarh
Rajasthan
India

Garima Kaushik

**Applied Environmental Biotechnology: Present Scenario
and Future Trends**

Kaushik, G. (Ed.)

2015, XVI, 167 p. 29 illus., 17 illus. in color., Hardcover

ISBN: 978-81-322-2122-7