

Microconstituents in the Environment

Occurrence, Fate, Removal and Management

Rao Y. Surampalli | Tian C. Zhang | Chih-Ming Kao
Makarand M. Ghangrekar | Puspendu Bhunia
Manaswini Behera | Prangya R. Rout



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Edited by
Rao Y. Surampalli,
Tian C. Zhang,
Chih-Ming Kao,
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and Prangya R. Rout

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Preface

Microconstituents or contaminants of emerging concern (CECs) refer to any pollutants that have not previously been detected or regulated under current environmental laws, or may cause known or suspected adverse ecological and/or human health effects even at insignificant levels. They consist of pesticides, industrial chemicals, surfactants, pharmaceutical and personal care products, cyanotoxins, nanoparticles, and flame retardants, among others, that are consistently being found in groundwater, surface water, municipal wastewater, drinking water, and food sources. The presence of CECs in treated effluents and its long-term impact are to be evaluated considering their environmental partitioning and bioaccumulation potential in the aquatic species. There is an urgent need not only to develop reliable and cost-effective methods to analyze a wide range of ECs, but also to find techno-economically feasible options for their efficient removal from different ecosystems.

This book is intended to provide the readers with an understanding of the occurrence and fate of microconstituents in the environment and possible management strategies. The main topics are organized into five core parts with subdivisions of each. Part I deals with the fundamental ideas regarding microconstituents in the environment and consists of four chapters. Chapter 1 introduces the microconstituents and explores their various classifications, properties, and sources, as well as their impact on environmental ecosystems and human health. The presence of microconstituents in environmental samples and the detection methodology are discussed in Chapter 2. The sampling protocols, quantification, and analysis of microconstituents are discussed in Chapter 3. Chapter 4 deals with the toxicity assessment, including acute and chronic toxicity and dose-responses studies. Part II covers the fate and transportation of microconstituents in various environmental domains, including mathematical transport systems of microconstituents (Chapter 5), groundwater contamination by microconstituents (Chapter 6), microconstituent transport in surface water (Chapter 7), fate and transport of microconstituents in wastewater treatment plants (Chapter 8), atmospheric transport of microconstituents (Chapter 9), and modeling microconstituents based on remote sensing and GIS techniques (Chapter 10). Part III encompasses details of the various physicochemical treatment techniques of microconstituents with five chapters. Chemical precipitation (Chapter 11), adsorption (Chapter 12), ion exchange (Chapter 13), filtration and membrane separation (Chapter 14), and

advanced oxidation (Chapter 15) are covered in this part. The removal of microconstituents via biological treatment techniques is discussed in Part IV. Aerobic biological treatment (Chapter 16), anaerobic biological treatment (Chapter 17), bioelectrochemical systems (Chapter 18), and hybrid treatment solutions (Chapter 19) are presented in this part. Finally, Part V focuses on the aspects of sustainability and environmental management, including regulatory framework (Chapter 20), laboratory to field application (Chapter 21), and sustainability outlook (Chapter 22).

We hope this book will be of interest to students, scientists, engineers, government officers, process managers, and practicing professionals. As a reference, this book will help the readers readily find the information they are looking for.

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