The Handbook of Environmental Chemistry

Founded by Otto Hutzinger

Volume 11

The Handbook of Environmental Chemistry

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Polymers – Opportunities and Risks I

General and Environmental Aspects

Volume Editor: Peter Eyerer

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Aims and Scope

Since 1980, *The Handbook of Environmental Chemistry* has provided sound and solid knowledge about environmental topics from a chemical perspective. Presenting a wide spectrum of viewpoints and approaches, the series now covers topics such as local and global changes of natural environment and climate; anthropogenic impact on the environment; water, air and soil pollution; remediation and waste characterization; environmental contaminants; biogeochemistry; geoecology; chemical reactions and processes; chemical and biological transformations as well as physical transport of chemicals in the environment; or environmental modeling. A particular focus of the series lies on methodological advances in environmental analytical chemistry.

Series Preface

With remarkable vision, Prof. Otto Hutzinger initiated *The Handbook of Environmental Chemistry* in 1980 and became the founding Editor-in-Chief. At that time, environmental chemistry was an emerging field, aiming at a complete description of the Earth's environment, encompassing the physical, chemical, biological, and geological transformations of chemical substances occurring on a local as well as a global scale. Environmental chemistry was intended to provide an account of the impact of man's activities on the natural environment by describing observed changes.

While a considerable amount of knowledge has been accumulated over the last three decades, as reflected in the more than 70 volumes of *The Handbook of Environmental Chemistry,* there are still many scientific and policy challenges ahead due to the complexity and interdisciplinary nature of the field. The series will therefore continue to provide compilations of current knowledge. Contributions are written by leading experts with practical experience in their fields. *The Handbook of Environmental Chemistry* grows with the increases in our scientific understanding, and provides a valuable source not only for scientists but also for environmental managers and decision-makers. Today, the series covers a broad range of environmental topics from a chemical perspective, including methodological advances in environmental analytical chemistry.

In recent years, there has been a growing tendency to include subject matter of societal relevance in the broad view of environmental chemistry. Topics include life cycle analysis, environmental management, sustainable development, and socio-economic, legal and even political problems, among others. While these topics are of great importance for the development and acceptance of *The Handbook of Environmental Chemistry,* the publisher and Editors-in-Chief have decided to keep the handbook essentially a source of information on "hard sciences" with a particular emphasis on chemistry, but also covering biology, geology, hydrology and engineering as applied to environmental sciences.

The volumes of the series are written at an advanced level, addressing the needs of both researchers and graduate students, as well as of people outside the field of "pure" chemistry, including those in industry, business, government, research establishments, and public interest groups. It would be very satisfying to see

these volumes used as a basis for graduate courses in environmental chemistry. With its high standards of scientific quality and clarity, *The Handbook of Environmental Chemistry* provides a solid basis from which scientists can share their knowledge on the different aspects of environmental problems, presenting a wide spectrum of viewpoints and approaches.

The Handbook of Environmental Chemistry is available both in print and online via www.springerlink.com/content/110354/. Articles are published online as soon as they have been approved for publication. Authors, Volume Editors and Editors-in-Chief are rewarded by the broad acceptance of *The Handbook of Environmental Chemistry* by the scientific community, from whom suggestions for new topics to the Editors-in-Chief are always very welcome.

Damià Barceló
Andrey G. Kostianoy
Editors-in-Chief

Volume Preface

Polymers have achieved tremendous success since their first industrial applications. Today the worldwide production of polymers is about 260 Mio t/a entailing a huge number of employees working not only in production but also in the processing of polymers. A success story of such magnitude must now, however, be regarded in terms of environmental issues, which was not the case until the 1970s when pollution of the environment was focused on more and more by society in different parts of the world, today playing a very important role.

Against this background the *Handbook of Environmental Chemistry* will discuss the environmental aspects of the industrial use of polymers in two volumes called *Polymers – Opportunities and Risks I: General and Environmental Aspects* and *Polymers – Opportunities and Risks II: Sustainability, Product Design and Processing*. The scope of these volumes is to take a critical view on the chances and potential of polymers, recognizing their risks in reference to environmental issues arising from their production and application.

Because of the strong engineering background of the editors, the engineering view point is predominant throughout these volumes emphasizing the fact, that the processing of polymers and the service life of polymeric parts play – besides their production – a decisive role in view of their environmental impact. The field addressed is characterized by such diversity that two single volumes are just able to relate the most important aspects.

Following this mainly engineering view point, the first volume *Polymers – Opportunities and Risks I* is dedicated to the basics of the engineering of polymers (materials, processing, design, surface, use phase, recycling, depositing) – but always in view of the environmental impact.

In the second volume *Polymers – Opportunities and Risks II*, single aspects are regarded in more detail by means of examples. Our aim was to select examples that cover a broad range of topics of interest and of course we would be happy if we have succeeded in meeting the interests of the majority of readers.

Because of the complexity of the subject and the broadness of the covered topics, the production of these volumes took far longer than expected when we planned the project. We would like to thank Springer-Verlag for their help and active cooperation and the contributing authors for their patience in waiting for the publication of

their contributions, quite a few of which are not published in their original form but were actualized in 2009. We would also like to thank Alexandra Wolf for her incredible commitment in helping with manuscript organization.

Peter Eyerer
Christof Hübner
Martin Weller
Volume Editors

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