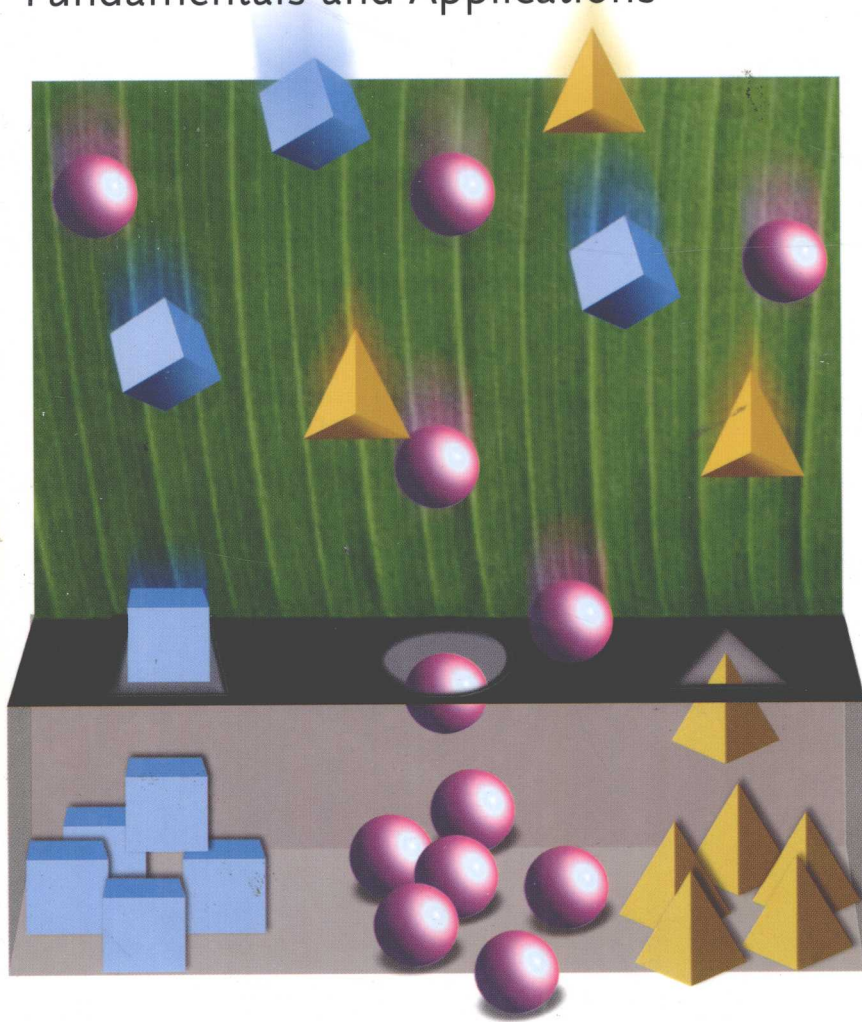


Edited by Carlos A.M. Afonso
and João G. Crespo

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Green Separation Processes

Fundamentals and Applications



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Carlos A. M. Afonso, J. G. Crespo



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Foreword

At the heart of Green Chemistry is scientific and technological innovation. This volume contains a collection of important and useful innovations that are of the type that will be essential to enduring that our next generation of products and processes are more benign to human health and the biosphere. What makes these Green Chemistry technologies different from those technologies of the past is that they integrate reduced impact on the environment as a performance criterion of the design. Rather than treating impact of the technology on biological and human systems as an afterthought to be dealt with after introduction and utilization, Green Chemistry technologies as detailed in this book ingrain the goals of sustainability at the outset of the design process.

The impact of this Green Chemistry approach is important on several levels. Certainly, the benefits to protection of the environment are the most evident and can be understood and appreciated in reviewing the many excellent examples in this volume. However, many of the other benefits may be less obvious at first on first analysis. For instance, this collection of technologies taken as a whole demonstrates that it is possible to achieve environmental and economic goals simultaneously. By using the Green Chemistry approaches presented in this book, the benefits of energy efficiency, material minimization, intrinsic hazard reduction, and waste avoidance all can be achieved. Each of these factors have direct linkages to the net profitability of the technology. Too often historically, it has been necessary to achieve these above goals in a decoupled manner that have added costs in the form of material, energy and time. In many ways this historical approach can be viewed as elegant technological “bandages” that sought to repair or make an unsustainable process more legally and socially acceptable. So even in cases where the goals were achieved, the improvements came at significant costs.

The Green Chemistry technologies that have been selected and compiled for this important collection by the editors and that have been commendably portrayed by the authors demonstrate the imperative of using Green Chemistry principles in the design framework. Through this approach and the coupling of environmental and economic goals for societal benefit, environmental protection and sustainability can become autocatalytic in our next generation of products and processes. The editors and authors of this volume have provided important contribution to the advancement of Green Chemistry that will be well utilized and built upon in the future.

Washington, D.C., May 2005

Paul T. Anastas

Preface

Chemistry has been one of the pillars of the wealth and growth of the World economy throughout the twentieth century, based on an increasing understanding of the interactions taking place on a molecular level to enable enhanced production and product quality. Chemistry is, and will certainly continue to be, a primary driver for wellbeing, growth and sustainable development in the economy during this century.

Green(er) Chemistry is the key to sustainable development as it will lead to new solutions to existing problems and will present opportunities for new processes and products by:

- securing access to competitive feedstocks, including the exploration of alternative renewable raw materials to allow a gradual shift from petroleum-based raw materials as required;
- reducing the resource intensity of chemical manufacture and use, including closing materials loops, enhancing reuse and recycling, and reducing waste and emissions;
- developing improved and new functionalities by means of new materials and new formulations based on increasing control of physical properties from the nano to the macro scale;
- increasing control over total production costs through improving materials and energy efficiency and minimizing the impact of chemicals manufacturing on the environment;
- designing engineering solutions to allow for better product quality and fast and flexible responses to market needs.

This book aims to contribute to a better understanding of the new challenges that Chemistry is facing, with a particular emphasis on the need for the development of new processes for product separation and recovery. The contributions to this book are organized into three interlinked sections: “Green Chemistry for Sustainable Development”, “New Synthetic Methodologies and the Demand for Adequate Separation Processes” and “New Developments in Separation Processes.” The chapters from the first part present the general principles and regulations that support the need for a Green(er) Chemistry for sustainable development, while the second part will introduce novel synthetic methodologies aiming to obtain higher

quality products while respecting those principles. The third part of the book presents a comprehensive discussion of new separation processes, which result from the needs and challenges discussed in the previous sections.

May 2005

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