

Preface to the First Edition

The general public worldwide has a poor opinion of chemistry. Almost every day the mass media broadcast bad news about environmental damage caused by uncontrolled industrial practices and accidents. Chemical elements or compounds are identified as being responsible for the pollution of air, water or soil, and also for the deaths of humans, animals and plants.

In such a doom-laden scenario it can be difficult to convince our colleagues and students of the benefits of chemistry. We believe that the chemistry community should adopt a new style of communication in order to promote the idea that chemistry is our best weapon to combat illness, and that chemical methods can solve pollution problems caused by the incorrect use of materials, or by the accumulation and transport of dangerous substances in inappropriate conditions. There is not bad chemistry and good chemistry: there are only bad and good uses of chemistry. The truth is that the advancement of chemistry is a good indicator of the progress of humanity. However, we must look for a new paradigm that can help to build bridges between the differing perspectives of chemists and the general public.

In our opinion 'green chemistry' now represents not only the right framework for developments in chemistry but also the best approach to informing the general public about advances in the subject. The term was first introduced in 1990 by Clive Cathcart (*Chemistry & Industry*, 1990, **21**, 684–687) and the concept was elaborated by Paul Anastas in his 12 principles. Briefly, green chemistry provides a way to predict the possible environmental downsides of chemical processes rather than solving them after the fact. It provides a series of recommendations for avoiding the deleterious side effects of chemical reactions, the use of chemical compounds and their transport, as well as a philosophy for improving the use of raw materials in order to ensure that our chemical development is sustainable. The principles

of green chemistry build on the efforts made in the past to improve chemical processes by improving the experimental conditions, but pay greater attention to the use of hazardous materials, the consumption of energy and raw materials, and the generation of residues and emissions. This is consistent with recent regulations that have come into effect in different jurisdictions relating to the registration, evaluation, authorization and restriction of chemical substances, especially the REACH norms established by the European Union.

Within the framework of green chemistry, green analytical chemistry integrates pioneering efforts to develop previously known clean methods of analysis, the search for highly efficient digestion systems for sample preparation, the minimization of analytical determinations, their automation, and the online treatment of analytical wastes. These efforts have improved the figures of merit of the methodology previously available, helped to reduce the cost of analysis and improved the speed with which analytical information can be obtained. Along with all these benefits there have been improvements in the safety of methods, both for operators and for the environment. It is therefore not surprising that green analytical chemistry is now a hot topic in the analytical literature.

Two books on green analytical chemistry have appeared in the last year: one by Mihkel Koel and Mihkel Kaljuran, published by the Royal Society of Chemistry, and one by Miguel de la Guardia and Sergio Armenta, published by Elsevier. These books help to clarify the present state of green analytical chemistry and the relationship between the relevant publications in the analytical literature. However, until now there has been no multiauthor book by specialists in the different fields of our discipline describing the various developments made in green analytical chemistry. The present book is an attempt to make such an approach to recent advances in sample preparation, miniaturization, automation and also in various analytical methods, ranging from electroanalysis to chromatography, in order to contribute to the identification of the green tools available in the literature and to disseminate the fundamentals and practices of green analytical chemistry.

We hope that this book will be useful both for readers working in the industrial field, in order to make their analytical procedures greener, and also for those who teach analytical chemistry in universities, to help them see their teaching and research activities in a new light and find ways of making our discipline more attractive to their young students.

This book has been made possible by the enthusiastic collaboration of several colleagues and good friends who have written excellent chapters on their respective fields. The editors would like to express their gratitude for the extra effort involved in this project, generously contributed by people who are continually active in the academic, entrepreneurial and research fields. During the development of this project we lost one of the authors, Professor Lucas Hernández, from the Universidad Autónoma de Madrid, an excellent scientist and a good friend. He became ill while writing his chapter and died before seeing the final version of this book. On the other hand,

Professor Lourdes Ramos, from the CSIC, became pregnant and we celebrate the arrival of her baby Lucas. So, in fact this book is also a piece of life, a human project, written by a number of analytical chemists who believe there is a better way to do their work than just thinking about the traditional figures of merit of their methods. We hope that readers will enjoy the results of our labours.

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