Handbook of Green Chemistry

Edited by Paul T. Anastas

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Green Processes

Volume 7: Green Synthesis

Volume Editor:
Chao-Jun Li

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Paul T. Anastas joined Yale University as Professor and serves as the Director of the Center for Green Chemistry and Green Engineering there. From 2004–2006, Paul was the Director of the Green Chemistry Institute in Washington, D.C. Until June 2004 he served as Assistant Director for Environment at the White House Office of Science and Technology Policy where his responsibilities included a wide range of environmental science issues including furthering international public-private cooperation in areas of Science for Sustainability such as Green Chemistry. In 1991, he established the industry-governmentuniversity partnership Green Chemistry Program, which was expanded to include basic research, and the Presidential Green Chemistry Challenge Awards. He has published and edited several books in the field of Green Chemistry and developed the 12 Principles of Green Chemistry.

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Chao-Jun Li (FRSC, UK) received his PhD at McGill University (1992) and was an NSERC Postdoctoral Fellow at Stanford University (1992–1994). He was an Assistant Professor (1994), Associate Professor (1998) and Full Professor (2000–2003) at Tulane University, where he received a NSF CAREER Award (1998) in organic synthesis and the 2001 US Presidential Green Chemistry Challenge Award (Academic). In 2003, he became a Canada Research Chair (Tier I) in Organic/Green Chemistry and a Professor of Chemistry at McGill University in Canada. He serves as the Co-Chair of the Canadian Green Chemistry and Engineering Network, the Director of CFI Infrastructure for Green Chemistry and Green Chemicals, and Co-Director the FQRNT Center for Green Chemistry and

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Preface

Ever since the synthesis of urea by Friedrich Wöhler near two centuries ago, organic synthesis has become the foundation of modern medicines for human health, produced new agrochemicals to boost world food supply, created various synthetic fibers for daily usages, and bestowed a colorful enchantment through synthetic dyes. In spite of these great achievements, the general features of organic syntheses have been, by and large, unchanged over a century: e.g., non-renewable feedstock, batch reactor, and refluxing. In addition, classical organic syntheses often produce stoichiometric amount of waste, use organic solvents and sometimes dangerous reagents, require extensive protection-deprotection of functional groups, need prefunctionalized starting materials, and involve multi-step operations, which resulted in low efficiency in resource utilization and led to various concerns due to waste generations. While, in the past, the primary goal of organic syntheses is " to get the target product", the sustainability of chemical synthesis becomes a more and more important issue. This volume of Green Syntheses illustrated some examples to address this issue ranging from starting materials, reaction design, choice of solvent, energy input, to reactor design. The chapter by Trost describes the general principle of greener synthesis; the chapter by Behr shows examples of using renewable feedstocks for making chemical products; the chapter by Horvath describes the use of alternative solvents for organic synthesis; the chapters by Zhu, Hoffman and Watts describe methods of reducing synthetic steps by running multi-component reactions, avoiding protecting groups, and in flow respectively; the chapters by Ackermann and Li show examples of direct conversion of C–H bonds; the chapters by Varma and Yoshida presents alternative energy input in chemical reactions through light and electricity; the chapters by Tao and Akiyama give examples of using enzymes and organo catalysts for synthetic purposes; and finally the chapter by Andraos uses computation methods to evaluate the relative efficiency of different synthetic routes. We hope that these examples will provide food-for-thought for further innovations in developing greener syntheses.

Montreal, April 2012 C-J Li

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