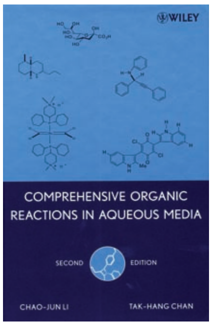
Comprehensive Organic Reactions in Aqueous Media



2nd ed. By *Chao-Jun Li* and *Tak-Hang Chan*. John Wiley & Sons, Hoboken 2007. 417 pp., hardcover \$ 125.00.—ISBN 978-0-471-76129-7

Water is the solvent of life on earth, but its use by organic chemists has been much more limited. Over the past several decades there has been an increasing interest in the use of water as a solvent for organic synthesis. Water is an attractive solvent because it is inexpensive, nontoxic, nonflammable, and has a high heat capacity. These properties are in contrast to those of the more common organic solvents, which tend to be more expensive, toxic in many cases, often highly flammable, and derived from nonrenewable carbon sources.

Much of the interest in water as a solvent stems from the movement towards "green" or environmentally sustainable chemistry. Replacing organic solvents by water can potentially improve the environmental impact of a chemical process. Of course, the fate of the resulting contaminated waste water must be considered in assessing the "green-ness" of an aqueous-phase process. Water also offers other potential benefits in synthetic processes. The properties of water can often lead to improved, or even completely altered, reactivity in comparison with traditional organic solvents. For example, the water-avoiding properties of some species can lead to an acceleration of reactions with negative volumes of activation, which is often referred to as the hydrophobic effect. In the field of homogeneous metal-catalyzed reactions, the use of an aqueous solvent can play an important role in simplifying the recovery of the catalyst from the product stream. A water-soluble catalyst becomes concentrated in the aqueous phase of a water/organic biphasic system, allowing the catalyst to be easily separated from the hydrophobic product.

A decade ago, Chao-Jun Li and Tak-Hang Chan published *Organic Reactions in Aqueous Media*, which served as a comprehensive review of the then relatively small field of aqueous-phase organic reactions. In the decade that followed, there has been an ever growing interest in this field. The authors' first edition served as an introduction and handy reference source for those entering the area. With the second edition, *Comprehensive Organic Reactions in Water*, the authors provide a much needed update to reflect the current state of the subject. In just over 400 pages, they offer a truly comprehensive look at the current state of the art in aqueous-phase organic chemistry, by providing key examples and references to nearly every type of reaction that has been successfully demonstrated in water. A particular strength of this book is that it includes examples of both classical and modern synthetic methods. Thus, hydration of alkenes can be found in the same chapter as a discussion of olefin metathesis catalysts.

The book is divided into twelve chapters, increased from eight in the first edition. The first chapter provides the reader with a short introduction to the advantages of using water as a solvent, the properties of water, and how these properties can affect organic reactions. The key features that are discussed are the hydrophobic effect and salt effects observed in aqueous solvents. The properties of supercritical and near-supercritical water are also discussed.

Each of the Chapters 3–11 is devoted to a specific functional group. The chapter is then further organized according to reaction classes, with a number of different reaction examples provided in each section. The lone exception is Chapter 12, which focuses on pericyclic reactions. This organization based on functional groups is a departure from the first edition, in which each chapter focused on a reaction type rather than a functional group. As a result, the new edition allows the reader to easily explore the range of reactivity for a given functional group. However, if one is interested in a specific class of reaction, one must often look within several different chapters. For example, the Heck reaction is discussed in both Chapter 3 (alkenes) and Chapter 6 (organic halides).

This book will serve as an excellent overview of the field of organic reactions in aqueous solvents, both for people who are already active in the area and for those who wish to enter it. The book is clearly written and well referenced. The table of contents allows readers to easily find key reaction types. The graphics are clear and are present in sufficient numbers to clearly demonstrate the chemistry being discussed. It is unfortunate that the structure of Grubb's water-soluble metathesis catalyst is drawn incorrectly, both on the cover and on page 62, but hopefully this oversight can be fixed in future printings.

This book is highly recommended for students and researchers with an interest in aqueous-phase methods of synthesis. As a consequence of the breadth of material covered, no individual reaction is covered in great detail, but the book serves as an excellent introduction and source of leading references for any class of reaction that might be carried out in water. Given the significant growth in this field over the past decade, this is an important update of a classic monograph.

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