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BOOK REVIEW

Organic Chemistry Principles and Industrial Practice, by Mark M. Green and Harold A. Wittcoff, Wiley-VCH GmbH & Co. KgaA, Weinheim, 2003; ISBN 3-527-30289-1; xx + 321 pages; $39.00 paper.

In this wonderful book, Green and Wittcoff set out to expose undergraduate students, who have perhaps a semester or year of organic chemistry instruction, to selected principles of organic chemistry found in the chemical industry, especially that very large segment of the industry that converts raw materials form petroleum into useful polymers. The authors succeed admirably well in this task.

One novel aspect of this unusual book is the section following the preface entitled "Recommendations of the Experts." Here a group of distinguished chemists, including Nobel laureate Roald Hoffmann, give well-earned praise to the authors for assembling this book. Indeed, a reviewer might be tempted to simply reprint these comments and call it a day. Yet the book merits a more detailed assessment.

Readers of a certain age may recall introductory textbooks of organic chemistry that included a fair amount of material dealing with such topics as monomer synthesis and polymerization, dyes, and pigments as well as CHN analysis. One such book that this reviewer has is by C. R. Noller, *Organic Chemistry* (Saunders, Philadelphia, 2nd ed., 1958). (The 1965 edition of this text is one of the Books for Further Study and Reference.) In the 1960s, a series of textbooks were introduced that included substantial introductory material concerning the use of IR, NMR, UV-VIS and mass spectra for characterization. Not that there's anything wrong with that. Yet to keep texts to a manageable length, much of the material relating to applications and industrial practice was deleted. It is this kind of material, especially the historical aspects, that Green and Wittcoff include and develop in considerable detail at a higher level.

The book consists of ten chapters and an epilogue with the following titles: "How Petroleum is Converted into Useful Materials: Carbocations and Free Radicals are the Keys"; "Polyethylene, Polypropylene and the Principles of Stereochemistry"; "The Central Role of Electrophilic Aromatic Substitution"; "From Nucleophilic Chemistry to Crosslinking, with a Side Trip to Glycerol in the Synthesis of Commercially Important Plastics";

"The Nylon Story"; "Competition for the Best Industrial Synthesis of Methyl Methacrylate"; "Natural Rubber and Other Elastomers"; "Ethylene and Propylene: Two Very Different Kinds of Chemistry"; "The Demise of Acetaldehyde: A Story of How the Chemical Industry Evolves"; "Doing Well by Doing Good"; and "An Epilogue—The Future". Each chapter picks a topic and discusses its development in some detail. In the preface, the authors suggest that the book will be useful to students of organic chemistry and teachers at all levels. I believe that chapters 9 and 10 will be especially valuable to engineering students contemplating a career in the chemical industry (a "must read"), particularly those with managerial aspirations. The discussions of "shutdown economics" should capture the attention of such students. The need for new processes with improved economics and/or safety considerations clearly comes through to the reader. The increasing number of processes that use relatively modern organometallic chemistry is another theme that emerges. This chemistry is typically *not* taught in first year organic chemistry, and the need to learn it should not be lost on students.

The book is well produced, and the illustrations are generally clear. However, the book is not free of mistakes and typos. The methyldiethyl sulfur structure in Figure 1.1 (p. 3) either requires a positive charge or is incorrect. In Figure 1.3 (p. 7), the product of chlorination of trichloroethylene has an extra Cl atom. The right side of the plot in Figure 1.6 (p. 12) should be labeled "Homolytic." The "l" in phenol is missing in Figure 3.12 (p. 61). While the discussion of melting points of crystalline solids on p. 127 is historically accurate, it is oversimplified from a modern perspective. The structure of MTBE in Figure 6.11 (p. 149) lacks an oxygen atom "Odian" is not capitalized in Section 7.7 (p. 164). In Figure 7.7 (p. 165) the carbocation is secondary as written, not tertiary. The structure of Kevlar (Figure 7.15, p. 178) lacks the H atom on nitrogen. The structure labeled "polypropylene" (Figure 7.16, p. 180) is actually polyisobutylene. In Section 9.10 (p. 243), on line 11, "staring" should be "starting." On p. 270 (Figure 10.17), the reactions are not a "mechanism" but rather a summary of several steps. In Figure 10.24 (p. 278), "carnonate" should be "carbonate."

The Epilogue seeks to give us a glimpse of the future. The world supply of petroleum is finite and not renewable. Where will our future feedstock come from? After a discussion of the possibilities of natural gas, Green and Wittcoff mention three approaches: the functionalization of alkanes, use of immobilized enzymes, and fermentation with engineered organisms. One approach to renewable feedstocks would include the use of carbohydrates from nature. Glucose is obtained on a commercial scale from starch, and its conversion to nylon [6,6] intermediates and other bulk chemicals has been discussed by Frost and coworkers. The fat substitute olestra is

obtained by transesterification of fatty acid esters with sucrose. The chemical industry from renewable feedstocks in still in the future, but we must hope that its approach is rapid. Read this book!

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