**Process Chemistry in the Pharmaceutical Industry, Vol. 2: Challenges in Ever-Changing Climates**; edited by Kumar Gadamasetti and Tamim Braish, CRC Press: Boca Raton, **2007**, hardcover, 520 pp., $259.95, ISBN: 978-0-849-39051-7

Process Chemistry in the Pharmaceutical Industry, Vol. 2, is the follow up to Gadamasetti's first volume, published in 1999. The first volume offered an interesting mix of case studies and technical reviews, and the second volume continues this tradition. The volume starts with an introduction and overview of the book, followed by Gadamasetti's thoughts on emerging trends in process chemistry, recent changes, and the future of the discipline. It then moves into many case studies and discussion pieces, many coming from the top pharmaceutical companies in the world. Many of the case studies are very good, particularly the ones which discuss honestly the problems encountered, incorrect assumptions made and lessons learned. Highlights include: the development of smoking cessation aid Varenicline, which involved challenging chemistry for scale up, including benzynes and osmium tetroxide oxidations; anti-cancer drug Sutent, which experienced surprising complications when scaling up apparently simple reactions; the successes and failures of the rapid process development and scale up of Robalzotan; and the preparation of endothelin antagonists using a particularly elegant crystallization driven dynamic kinetic resolution. Some case studies disappoint a little, as they include unnecessary experimental procedures, chemistry which seems quite dated, or are hampered by text errors and mislabeled schemes.

There are a number of interesting contributions covering a range of specialist chemistries, many of which are of high quality. Highlights include (in no particular order): reviews of chemical approaches to various classes of chiral amines and unnatural amino acids; a fascinating discussion on efforts towards truly efficient organic reactions in water, using water compatible Lewis acids, Lewis or Brønsted acid surfactant catalysts and asymmetric variants; interesting applications of N-heterocyclic carbenes; biocatalytic approaches to various pharma intermediates, including the powerful applications of aminotransferases, ketoreductases, and direct enzymatic hydroxylation; an excellent discussion on the development of robust crystallizations, an increasingly important and well understood area, giving recommendations for best practices, potential pitfalls, and other guidelines. The section on microwave technology in process optimization gives a good introduction to microwave assisted organic synthesis, including guidelines for moving reactions from conventional to microwave heating. However, the case studies of process optimization seem to be small scale syntheses (rather than kilo or pilot plant processes). Some other sections don't quite make the grade, and can seem out of place in a book which focuses on process chemistry.

Analytical approaches to process development are well represented, with an excellent discussion of reaction progress kinetic analysis, a potentially powerful and practical approach to gain understanding of reactions, in support of optimization and scale up. The applications of in situ IR are discussed in a series of four chapters, starting with a short introduction to the area, followed by three case studies in which IR was essential to understand, develop and control a process. These include optimization of a complex organometallic tandem asymmetric homologation–homoaldol process en route to indinavir; discussion of a one-pot preparation of the sitagliptin skeleton; and the development of a methylenation using dimethyltitanocene, including discussion of the implementation of online IR monitoring in a 500 gal pilot plant reactor. This is followed by an interesting and more general discussion on the use of Process Analytical Technology in manufacturing environments, including regulatory aspects and the paradigm shift of moving to continuous monitoring of reactions.

Two well-written chapters discuss biological macromolecules, which are increasingly important commercially, but which are unfamiliar to many process chemists. The first discusses PEGylation of proteins, and the second covers process development considerations for therapeutic monoclonal antibodies in mammalian cell culture. The volume wraps up with two chapters discussing outsourcing of R&D and manufacturing. The first mainly covers outsourcing to China and the important role of agents in sourcing materials and services, although it would have been more balanced to also consider the situation in India. The second is a very interesting discussion of the multitude of considerations when sourcing materials in China and India, covering everything from IP to EHS regulations. If these two sections had been combined into a single contribution, it would perhaps have given a more rounded story.

The book includes a collection of colored plates to add visual clarity to some chapters. Although some of these are truly helpful (e.g. crystal structures), others seem unnecessary and add little other than cost to the book. Overall, the book gives a balanced mix of interesting case studies and useful discussion sections, some of which cover areas less frequented by the traditional process chemist. In general, the quality of the contributions is high, and the book holds together well. Anyone wanting to learn more about the challenges and broad variety of disciplines involved in process development would benefit from reading this, and there is plenty for the more experienced process chemist too. Sadly, the cost of the book will keep it out of the hands of many individual buyers, although it is hoped that companies involved in PRD will make this a welcome addition to their library.

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