DOI 10.1515/gps-2013-0077 — Green Process Synth 2013; 2: 529–530

Book review

Right first time in fine-chemical process scale-up

Lum(Bert)us A. Hulshof
Scientific Update LLP, 2013
Hardcover, XII, 483 pp.
Price: £99.50
ISBN 978-0-9533994-1-3

Growing competition in fine chemicals industry demands products to reach the market faster, which means scale-up of fine chemical process must be quicker by ensuring that everything goes right at the first attempt, which is not usually the case.

Right first time in fine chemical scale-up has been written by Dr. Bert Hulshof, who has 35 years of experience of working in process R&D for fine-chemical industries. Since 1995, he is a part-time professor of Applied Organic Synthesis at Eindhoven University of Technology, The Netherlands. This book aims to guide how to get scale-up of fine chemical processes right in first time and faster without facing the surprises, and how to bridge the gap between chemist and chemical engineers.

Chapter 1 rightly sets "the scene" for readers to understand the fine chemical processes and the need for right and fast scale-up of them. It also clarifies contribution needed from chemists, chemical engineers and analytical chemists by summarizing all the important topics dealt by these disciplines. It has also highlighted the importance of understanding reaction thermochemistry, kinetics and reactor engineering by nicely explaining thermal runaway in exothermic reactions.

Chapter 2 discusses the challenges faced in the fine chemical process development. It convincingly explains with examples, the communication gap between chemist and chemical engineers arising from their different languages and points out the importance of making right choices in process development. To get information for maximum parameters by performing minimum number of experiments, tools used such as design of experiments is briefly introduced. This chapter also briefly explains various aspects and available options of high throughput experimentation. Advanced trends engaged in fine chemical industry such as micro-reactor technology, continuous processing and microwave heating are reviewed with their future implications.

Various challenges faced in process scale-up are listed in Chapter 3. This includes the state of the art as well as practical and relevant information for both equipment and homogeneous/heterogeneous systems. This chapter contains a very useful list of scale effects, and addresses issues such as robustness in process scale-up, defining scale-up rules, and product isolation. Issues related to mixing and heat transfer are the showstoppers in process scale-up and therefore a great deal of information and practical guidelines can be found in this chapter.

In Chapter 4, 240 historic examples of surprises in fine chemical process scale-up are exposed, which makes this book unique and relevant to real-life applications. These examples provide an excellent basis for learning and getting insight into the real industrial practice of fine chemical processes.

Chapter 5 answers the question how to deal with the scale-up surprises and solutions to them. This chapter gives evaluation of those 240 examples and explains how these surprises could have been avoided. All the examples are grouped according to commonly occurring surprises, i.e., hidden regularities (as ALICE knowledge base). All of these hidden regularities are again sub-divided, which gives an even more clear correlation and picture. This chapter also contains information of 240 examples assembled according to type of chemical reactions/chemical compound, and company/institute name, which makes it easy for the reader to browse through them.

Chapter 6 tries to answer the question 'could the surprises in scale-up have been avoided' and comes up with a very useful methodology in the form of "check list" for fine chemical process scale-up. This check list is divided into various categories related to fine chemical process development and scale-up, having indication of involved disciplines and their order of responsibility. The check-list answers the question of how chemist and chemical engineer can collaborate in process scale-up.

This book convinces that it is of the utmost importance to be right at first time in scaling up the process plant to make sure that the product reaches the market in time. For this, chemist and chemical engineer must work in close collaboration from the beginning of the project. The author has shared his extensive experience and learning in the form of 240 real life industrial examples of scale-up issues and useful check list. These will be an invaluable guide for

chemist and process engineers, beginners as well as experienced, to avoid the surprises in scale-up and to be right at first time in scale-up of fine chemical processes. One more interesting feature of the book, is the bulleted text in the sections, which highlights very relevant and crucial information. Using the suggested strategies, it has shown the possibility to go to full scale plant without intermediate pilot plant runs, without any significant difficulties. However, the book can be sometimes heavy to read, because of the repetition of the information, which might be welcome and required for some readers as a reminder and to strengthen major missions, while it might be not for others. In the printing of this book, unexpectedly some text is in faint color, this sometimes misleads to perceive that information as important.

This book is essential reading for chemists, and chemical (process) engineers, working not only in fine chemical industry but also in all types of chemical industries. This book will be of value to those, who are working in process R & D as well as in production. It can be a good addition to the libraries of process industries.

Bhaskar Patil
Department of Chemical Engineering and Chemistry
Eindhoven University of Technology
Den Dolech 2
Eindhoven 5612 AZ
The Netherlands
E-mail: B.S.Patil@tue.nl