SPECIAL FEATURE SECTION: PROCESS INTENSIFICATION/CONTINUOUS PROCESSING IN THE FINE CHEMICALS ARENA

Editorial

Organic chemists have traditionally carried out chemical reactions in batch—or semibatch—mode, whereas chemical engineers have been educated to think in terms of continuous processes, particularly for large-scale manufacture. In the fine chemicals industry, where low-volume production is coupled to high-value products, manufacture has traditionally been batch or semi-batch, but chemical engineers are trying to change this. By designing new reactors made from novel materials, miniature production vessels can be fabricated which allow fast continuous processes to be operated efficiently in the laboratory. Instead of scaling up these processes, the idea is to "number up"—that is, just have more reactors, side by side, when additional material is required. Scale-up is no longer an issue.

These microreactors have been widely evaluated, particularly in Germany (see, for example, the excellent book *Microreactors* by Ehrfeld, Hessel, and Löwe, Wiley VCH, 2000, reviewed in *Org. Process Res. Dev.* **2001**, *5*, 89), and also in other parts of Europe and in the U.S.A. Some of the papers which follow show how these reactors may benefit certain types of reactions.

This is just one example of how the idea of continuous processing can be used to advantage. The review by Neal Anderson which follows summarises the literature on the use of continuous reactions for fine chemical synthesis in the laboratory and beyond. This excellent review shows the potential of continuous processing and emphasises that equipment does not have to be particularly sophisticated or expensive to achieve good results—it is more an attitude of mind. The conservative organic chemist must be prepared to think continuous from an early development stage—at least for fast reactions where mixing may be a problem on scale-up.

A recent symposium—part of the RSC annual congress in Birmingham in July−August, 2001 (see *Speciality Chemicals* **2001**, *September*, p 30 for brief abstracts)—was devoted to novel technologies in process R&D, and several speakers focused on process intensification and continuous processes—we hope to publish some of these talks/papers in future editions of *Org. Process Res. Dev.* In September the latest in a series of symposia devoted to process intensification was organised by BHR group "Better Processes for Better Products", and the proceedings are available for purchase from twheeler@bhrgroup.com (see http://www.bhrgroup.com).

Thus, it is clear that the subject is "hotting up". There is even a Process Intensification Network in the UK which meets regularly.

Process intensification or continuous processing lends itself to hazardous processing where the inventory of toxic or explosive chemical can be kept to a minimum. Examples include thiophosgene (see Grayson, *Org. Process. Res. Dev.* **1997**, *1*, 240) and diazomethane (see Proceedings, Scale Up of Chemical Processes, Jersey, 2000, p 383).

Some of the papers which follow in this special edition will address the synthesis of much more complex, although less hazardous, materials and show how the use of continuous processing has improved yield or quality, compared to those for batch methods.

Some of the papers submitted for this special issue did not make the deadline and will appear in subsequent issues. Also received were others which I felt did not encompass the theme of the special issue, and these excellent papers will appear in the journal in the standard section.

I thank all the contributors to this special issue, the referees for fast but critical reviews, and finally Dinesh Gala of Schering Plough for coordinating and for conceiving the initial idea for this issue.

Trevor Laird
Editor

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