Organic Process Research & Development

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Editorial

I have recently been involved as an expert witness in some patent cases, and it has been a surprise to me on how wide a variation there can be in two chemist's views about the meaning of certain, simple (in chemical terms) words. This got me thinking about the word "yield", and how this means different things to different people. When we read the literature, or someone's experimental notebook, we usually see a yield which is a weight, followed by a percentage reflecting the efficiency of the conversion of starting material to product. However, in most publications, this yield is not usually corrected for quality of starting material, quality of product, sulphated ash or ROI, residual solvent, etc.; therefore, this is what we might call an uncorrected yield—in the UK we call this the "as is " yield! This is satisfactory for many purposes, for example, in discovery chemistry or the academic world, but not really appropriate for process chemistry and definitely not for manufacturing, where much more accurate data for costing is required. When I was involved with manufacturing many years ago, there was always a footnote on the process working directions on how the yield was calculated.

For the chemical engineer, who has traditionally been brought up with continuous processes, where the conversion to products may be low, and there will, of course, be a recycle loop, the basis of the yield has always been on the amount of starting material consumed. For batch processes, this is not always appropriate if there is no possibility of recycle, and thus in practice for batch and semi-batch processes, the yield is based on 100% conversion, even if there is residual material unreacted.

When we do not isolate an intermediate (e.g. during the telescoping of processes) our yield may be based on an in-process analytical methodology, hopefully referred to a reference standard, but nevertheless, there still may be errors (e.g., in sampling). For the chemist and engineer involved in late-stage process development and manufacturing, particularly where the cost of manufacture is critical, then space−time-yield (sometimes called volume efficiency, volume yield or productivity) measured in kg/L/h or similar units, may be the most important measure of success. Often this relates to the productivity of the work-up, where volumes and times can increase markedly, rather than the reaction "phase".

The reason for these musings—as always with editorials—is to prompt further discussion of issues. Are we in our OPR&D articles sufficiently clear in our description of yield? Is there enough mention of analytical methods used to determine yield? Should we ask for space−time-yield to be recorded as well as the assayed yield? Correspondence is welcomed on these and other issues relevant to process R & D. I look forward to your emails (to sciup@scientificupdate.co.uk).

P.S.

As a footnote to this editorial, I would like to inform you of the next two "Special Feature Sections" that we are planning to publish in future issues of OPR&D, these are summarised below. We would welcome anyone who has expertise in these areas to either contribute manuscripts for publication or volunteer to review articles that are submitted. Please contact me at the usual address for more information or to volunteer your support.

special feature section	scheduled publication date	deadline for submission of manuscripts
Continuous Processes/ Process Intensification	issue 6, 2001 (Nov/Dec)	June 2001
Industrial Biocatalysis	issue 2, 2002 (Mar/Apr)	September 2001

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