Batch Management at Aroma & Fine Chemicals Ltd

"Effective management of batch processes is fundamental to our business. We recognised that one of the most important aspects of batch manufacturing is the ability to analyse cycle times in detail, and also to investigate other process variables on a batch by batch basis. With some of our plant being controlled manually, it is also important to have the ability to analyse batch histories to look for opportunities for performance improvement.

The e4C consultancy conducted an extensive review of the various batch monitoring products available from a wide range of suppliers and confirmed our view that the market is lacking in this area. It was also beneficial to have access to the views of an independent experienced batch control specialist."

Milton Crofts, Aroma & Fine Chemicals Ltd

Aroma & Fine Chemicals Ltd operates several production plants at its facility in Widnes, Cheshire. Most of the production is of speciality organic chemicals for the fragrance and related industries. With most production based on batch reactors, effective batch management is critical to optimum business performance. Some parts of the process are highly automated whilst others rely heavily on operator actions. In particular, batch cycle times are acknowledged to be a critical key performance indicator in understanding and improving productivity.

The e4C programme provided assistance to the company in two ways:

- Identifying available technology for analysing batch cycle times and highlighting opportunities for reducing slippages
- Identifying available systems which formalise operations on manually controlled batch plants and provide the framework for subsequent analysis

The Manufacturing Process

As is the case with virtually all similar factories, batch production at the Aroma & Fine Chemicals facility tend to comprise several operations within the same vessel—known to chemical engineers as "Unit Operations". For example a typical process could have the following steps:

1. Check that the reactor is empty, clean and dry with all outlet valves closed
2. Charge with pre-determined quantities of reactants
3. Heat the reactor and reflux
4. Cool
5. Drain

There is therefore a "hierarchy" by which a batch process can be described; a batch comprises a number of processes, each occurring in a separate vessel, A process in a vessel typically comprises several operations. And operations may have details such as temperature readings or material addition quantities. This structure is very well understood in the process control industry and is defined as the S88 standard.

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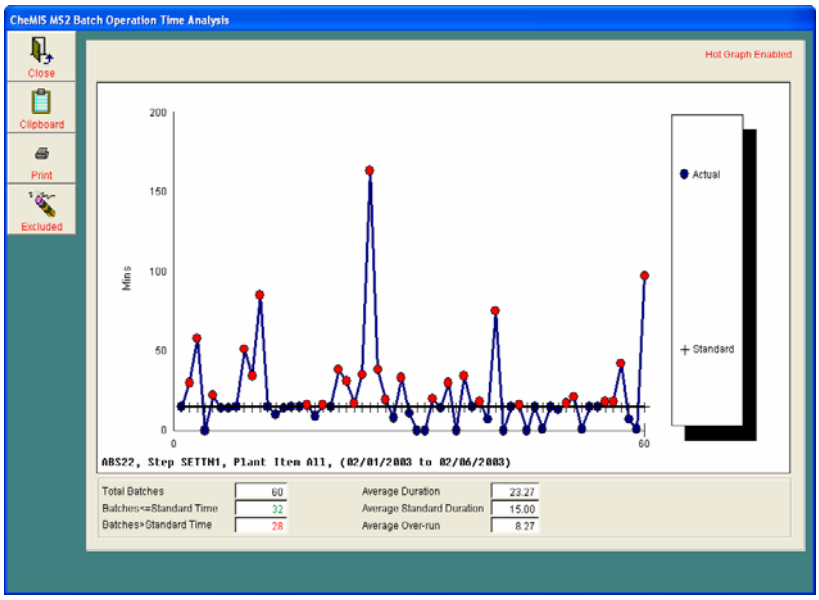
The Consultancy Project

The first task which was undertaken by the e4C project was to identify existing systems. This involved developing an understanding of both the automated and manually controlled batch processes and the methods currently employed to manage them.



An example production management system display, showing batch to batch variability

The critical key performance indicators were then agreed. Timeliness is one of the most important. Batch time is a function of the time taken to complete each operation, plus the time lost between operations. It is an issue of fundamental importance throughout the batch processing industries. Hence, it was agreed that any potential solution must be able to "drill down" not only to the overall batch time but also to individual operations within the batch. It was also recognised that comparison with a theoretical time was required; and furthermore that the theoretical time was not necessarily a constant for a given product, but could be a quantity-dependent variable.

It was then possible to develop the overall requirements for the systems needed to provide batch performance analysis and manual batch management. As specialists in the field of chemical process control, the e4C consultancy possessed a comprehensive database of companies able to provide these systems. A survey was conducted of 84 batch control and management system suppliers and interviews held with a short list of six potential suppliers.

Conclusions

Despite involving 84 possible suppliers, there is a very limited availability of batch performance measurement systems. Several vendors could provide such functionality as part of a complete control system, but very few systems are available which could be applied to existing automated batch control systems. Those which are available tended to provide only part of the required functionality; for instance identifying inter-operation slack time. Similarly, very few companies have developed manual batch management systems, although two were investigated in depth they both lacked certain aspects which were considered very important.

Consequently, the e4C project concluded with the development of an overview specification, provided to Aroma Fine Chemicals, which identified the requirements for both systems and can now be used in discussions with systems developers.

The consultancy provider was AJM Consulting Services Ltd, www.ajm.co.uk

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