Curvaceous solution to rate swing problem

problem:

HUNTSMAN Petrochemicals faced complications when analysing its 360,000 t/y paraxylene process at Wilton, UK. The reaction section of the plant was subject to rate swings, and there were questions about whether the recovery section was optimally operated. The liquid feedstocks are vaporised and superheated in two parallel heat trains before being fed into the reactor. The hot vapour from the reactor is passed back through the exchanger, where the heat is recovered. Two gas-fired heaters and two steam heat exchangers provide additional heat. The system is subject to rate swings, and the extensive heat integration made analysis of the root causes difficult. Conventional wisdom was that the level in the vaporiser shell was key, and that the levels should be run as high as possible. As a result, the vaporiser levels were frequently being adjusted to try and maintain rates.

Downstream of the reactor, paraxylene is recovered by crystallising it out of solution and separating it from the residual liquid with centrifuges. The company had recently improved control in the section to increase the equipment reliability, but the complexity of the series/parallel centrifuge arrangement made it difficult to determine how much material should be recovered in each crystallization process for optimum recovery.

solution:

Curvaceous Software's award-winning Geometric Process Control (GPC) technology shone a light in the fog. Using C:Suite visualExplorer (CVE) Huntsman was able to see all of their several hundred variables simultaneously. The entire process could now be analysed in one step, from one screen, without seeing an equation, while traditional time series and XY plots would have limited analyses to a few variables at a time, making the process awkward and cumbersome.

By highlighting the areas of the data where rates to the reactor were highest and where the vaporiser levels were highest, CVE showed within a few minutes that pushing the vaporiser levels to the maximum was not the best strategy.

The same display was used to look for other potential disturbances. It was noted that although the furnace exit temperatures were closely controlled, the temperature at the reactor exit was varying, and that these changes corresponded to the swings in rate. A little more digging showed that a dominant factor driving the reactor temperature was – to everybody's surprise – the wind speed!

Within an hour and a half, the focus had shifted from vaporiser levels to the weather. With the problem understood, the heat input into the process could now be adjusted to account for changes in ambient conditions.

The data also indicated that one of the two parallel fired heaters was operating more efficiently than the other. The unit had been re-tubed and revamped less than a year beforehand and the second was awaiting this treatment. CVE had provided conclusive evidence that this maintenance procedure was worth every penny.

That done, Curvaceous started to analyse the plant's centrifuges. The data showed that over the normal operating range, the recovery efficiency was quite flat. How the flow was biased between sets of centrifuges was less important than keeping the system steady. Again, this was a result from a few hours of analysis, which would have taken a considerable amount of time and effort using traditional time series or XY plots or computer simulation. All in all, within six hours of use, CVE had solved two major operational issues – a tremendous return on investment. Unsurprisingly, the companies continue to cooperate closely.

One-step crystallisation and granulation cuts risk, saves money

problem:

Production of active pharmaceutical ingredients can pose significant risks to operators. Moreover, like in any production process, time is money. The crystallisation, granulation and formulating stages of a pharmaceutical are particularly high-risk, creating fine powders that are easily inhaled and can be difficult to contain.

solution:

Collette, a member of Niro Pharma Systems, has developed a single pot processor for crystallizations and granulations, which eliminates the primary/secondary divide.

The API is loaded into the single-pot processor either in liquid form, or as powder and then dissolved in the appropriate solvent. (Re-)crystallization is executed using a vacuum system, supplemented with microwaves for extra energy input (or not, as required), and can be carefully controlled. When the product has been crystallized and dried, the other ingredients can be added, and wet granulation and subsequent drying is carried out in the same machine.

This process offers major benefits with regards to containment of highly toxic active ingredients, eliminating cumbersome containment measures during packaging, storage and shipment of the API. It is also less expensive.

Metal analysis without the lab

problem:

Churngold Remediation, a major contaminated land remediation contractor, was given a contract to prepare a former industrial site in the West Midlands, UK, for redevelopment. Churngold needed a quick way of assessing on site a range of metals (chromium, nickel, copper and zinc from the former electroplating works.

solution:

Churngold rented Ashtead Technology's portable x-ray fluorescence (XRF) analyser from Innov-X, a handheld unit which can easily identify on site a wide range of metallic elements in soil, solid and liquid samples.

As contaminated material was removed, the XRF analyser quickly determined which soil was too contaminated for treatment and which could be reused, thus ensuring contaminated volumes for disposal were kept to a minimum.