BMGI
Unlocking Potential Delivering Results

CASE STUDY | Combating Contamination

A biotech company manufactures amino acids and other solutions for delivery to pharmaceutical companies, which uses these inputs in larger drug-manufacturing operations. The problem for this company was substantial contamination rates at the end of long-lead production batches, each of which was unrecoverable at a cost of $150,000 per batch.

The company performed several failure analyses, including a standard root cause and corrective action procedure and the Kepner-Tregoe method - but no assignable causes could be identified. Therefore, the manufacturer turned to TRIZ, specifically to its predictive nature within the structure of the classic Plan Do Study Act quality framework.

The steps were as follows:

Plan: Define the problem statement.

The company was growing amino acids in a multi-step reactor process for ultimate delivery to their pharmaceutical customers. Frequently, contaminates were found in the batch at the end of the manufacturing process.

Do: Identify necessary and sufficient conditions for the mode of failure.

Using Substance Field Modeling, several possible contamination "entry ports" were identified (like valve pumps for adding amino acids, nutrients or stabilizers). Since the reactor system is closed (or controlled), these entry ports were determined to be the only possible pathway for contaminants to enter the system.

Study: Study the system to identify conditions present during failure, and eliminate potential causes until mode is verified.

Each condition for contamination was evaluated over the processing of many amino acid batches, and only normal trace quantities of bacteria were identified, so no introduction of assignable contamination was verified. But batches were still failing due to measured contamination levels at the end of the process.

With all the entry points in the closed system ruled out as contamination pathways, the company had no choice but to posit that, maybe, employees were responsible for sabotaging the batches. Given their FDA-approved quality system and other failure detection methods did not reveal the cause of contamination, the company considered installing cameras to monitor employee behavior.
Prior to this, however, the cumulative effects of the system were analyzed using Substance Field Modeling (SFM). This is a natural progression in TRIZ of first considering the additive (independent) dynamics of a system first, then considering the cumulative (interdependent) dynamics next.

Act: Assign cause and create cause and corrective action.

In biological terms, the previous work pointed to the idea of a "bacterial quorum," whereby trace contaminants from different parts of a system can combine and interact to create an overall contamination level that is greater than the sum of its parts. After further testing and evaluation using SFM, it was discovered that trace contaminants were, in fact, interacting to produce a quorum adequate enough to destabilize the batch.

Bacterial counts were taken before introduction for each component entry point, and a continuous bacterial monitoring system was established in real-time for the entire process. After two or three low-bacteria count components were added, the bacterial level escalated rapidly to the point of failure. While each step of the process functioned without flaw, interaction inside the reactor was causing the failure. Corrective actions were tested and installed, and the problem was solved.

This case study was excerpted with permission from Insourcing Innovation, an Auerbach Publications book, the lead author of which is BMGI's CEO David Silverstein.

BMGI

BMGI enables companies throughout the world to identify and solve their most important business problems, with a strong emphasis on sustainable results. During its long history, BMGI has developed solutions for a broad spectrum of businesses across many industries, driving the success of process-improvement, design and innovation initiatives. Just a few of BMGI's clients are General Dynamics, TNT Express, Avis Budget Group, China Chemical, Graphic Packaging, Siemens, Hitachi and Philips Electronics. For more information, please visit the BMGI website at ***www.bmgi.com***