Case Study

Enhanced Material Transfer Control

for nearly $500,000 annual savings

About the Client: Procter & Gamble

Procter & Gamble markets 250 brands to five billion consumers in 130 countries. P&G is a leading global innovator and manufacturer of consumer products, investing nearly $2 billion annually to develop and improve its products. P&G's facilities include many liquid fruit juice manufacturing operations. This case study describes results achieved at P&G's Anaheim, California (USA) facility, where the company produces Sunny Delight orange juice, one of P&G's premium brands.

Context: The Problem

For some time, P&G's research had indicated that further reductions in manufacturing costs were required if the company was to continue to increase the profitability of its Sunny Delight brand orange juice. The company had a very good product, but they were up against tough competition from other juice manufacturers.

The engineering group knew that successful formulation of this product required the accurate mixing of several ingredients with a high level of **repeatable accuracy**. Furthermore, this accuracy had to be achieved **without compromising the speed** necessary to keep up with demand for the product. The challenge was to find a way to manufacture the product with improved control and at a faster pace while reducing manufacturing costs. To do so would require developing improvements to help this and other P&G facilities become more competitive, without substantially increasing capital investments already made in existing manufacturing lines.

The engineering group identified the batch process as the place where these goals might be achieved. If greater material transfer accuracy could be combined with increased production speed, they could:

- Reduce the buffer set-points for the more expensive materials in the formula, resulting in less waste of costly materials.
- Improve the quality and consistency of the product.

The Solution

Q.i

After investigating various advanced process control techniques commonly used in many continuous processes but not in batch processes, the engineering group decided to use model-based predictive adaptive control. P&G selected a number of sites in which to upgrade the current material transfer process, one of which was the Anaheim facility. At the time, the Anaheim facility used a multi-speed design (with two material feed speeds) to control the material transfer phase of the batch operation.

Model-based **predictive adaptive control algorithms** (PACs) were developed and implemented in the controllers for the batch system. Using the PAC technology and overlapping feeds, the material transfer control phase was redesigned as a single-speed control system. **Overlapping feed technology** makes use of scale- and flow meter-based measurements to facilitate simultaneous material additions without affecting the integrity of either material addition.

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Improved Control and Raw Material Savings

Table 1 shows the improved material transfer control achieved at the Anaheim Sunny Delight manufacturing facility. Note that this table shows improvements from only three materials out of the several used in each formulation – water, a powder, and a liquid base – from only two recipes/formulations. Other improvements were achieved, but P&G requested that only a limited data set be used in this case study.

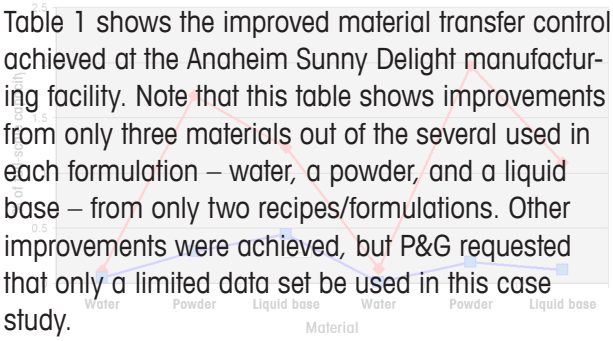

Table 1: Material Transfer Improvement Following Implementation of PAC and Single-Speed Feed Technologies

Recipe		% of full-scale capacity at 3 sigma		
		2-speed feed pre-PAC/Q.i	1-speed feed, post-PAC/Q.i	Improvement
Flavor 1	Water	< ± 0.116	< ± 0.050	**56.9%**
	Powder	< ± 1.703	< ± 0.288	**83.1%**
	Liquid base	< ± 1.231	< ± 0.448	**63.6%**
Flavor 2	Water	< ± 0.132	< ± 0.009	**93.2%**
	Powder	< ± 1.975	< ± 0.195	**90.1%**
	Liquid base	< ± 1.095	< ± 0.123	**88.7%**

Table 2: Raw Material Cost Savings after Implementation of Q.i

Recipe	Over-feed, pre-Q.i	Over-feed, post-Q.i	Cost Savings
Flavor 1	$3.47	$0.42	**87.8%**
Flavor 2	$6.34	$0.92	**85.4%**

Because the PAC technology exhibits improved control characteristics, the system can be trusted to **control to a tighter tolerance** and the formulation program can be adjusted to **reduce the set point** without the risk of adding too little material to the batch. This **saves time** otherwise wasted in trimming the batch. Table 2 clearly illustrates that, before Q.i was implemented, the larger buffer set point led to considerable waste per batch; after Q.i, the savings are substantial.

Table 3 summarizes these cost savings for the whole Anaheim facility:

Table 2: Raw Material Cost Savings after Implementation of Q.i

Average # of batches per annum per system	Average raw materials savings after PAC/Q.i implementation	Total savings over 11 systems
± 10,394	Approx. $44,074	**Approx. $484,600**

Summary of Manufacturing Benefits

Today, the Anaheim Sunny Delight manufacturing facility runs batch systems that use the PAC technology all year round. For just the three materials listed in the tables above, the savings study conducted by the P&G process improvement team for the facility identified potential savings in excess of just under half a million dollars. Even small incremental gains result in meaningful annual savings, as these savings are achieved year after year. These gains increase the manufacturing facility's profitability, and can also help to fund new process improvements.

The PAC technology behind these results has been patented and licensed by METTLER TOLEDO. It is now embedded in the new METTLER TOLEDO **IND780 Q.iMPACT** material transfer controller, and is deployed as part of the innovative METTLER TOLEDO Q.i Material Transfer Control Strategy.

About METTLER TOLEDO

METTLER TOLEDO is a leading global manufacturer of precision instruments. The company is the world's largest manufacturer and marketer of weighing instruments for use in laboratory, industrial and food retailing applications. The company also holds top-three positions in several related analytical instrument markets, and is a leading provider of automated chemistry systems used in drug and chemical compound discovery and development. In addition, the company is the world's largest manufacturer and marketer of metal detection systems used in production and packaging.

For more information on the savings the **Q.i Material Transfer Control Strategy** can deliver, please contact your local authorized distributor or sales office.

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