



Suntory Holdings Ltd., Japan, chose AGR as a partner for their sustainability strategy.



The initiative led to significant weight reductions of their 2l tea bottle

PET bottle light-weighting initiative offers energy and raw material savings

Reducing weight, increasing benefits

Founded over a century ago, Suntory Holdings Ltd, produces beverages in Japan and has more than a 20% share of the domestic market. In addition to a strong wine and spirits business, the company produces or markets a wide line-up of soft drinks, teas, juices, and bottled water. Suntory recently launched an enterprise-wide campaign to shrink its carbon footprint. Part of the sustainability strategy was aimed at light-weighting PET bottles. The benefits of this initiative range from decreased plant energy and raw material consumption to reduced carbon emissions and transportation costs.

Weight and performance targets

PET bottles have slimmed down over the past decade. By 2010, Suntory had already managed to trim 11g from its 2l tea bottle, from a weight of 55g to 44g, but the company wanted to achieve even further reductions. However, it takes considerable effort and expertise to develop a light-weighting program. The mandates of Suntory's initiative included the need to reach aggressive light-weighting targets without compromising bottle performance criteria or the extremely stringent quality standards demanded by the Japanese market. Thorough investigation of available light-weighting tools led Suntory to the Process Pilot automated blow moulder management system manufactured by AGR International.

The Process Pilot works in conjunction with AGR's PETWall Profiler material distribution measurement system to automate the management of blow moulding production. Analysing the relationship between the material distribution in the container and the blow moulder, the Process Pilot's software algorithms and thickness measurement capabilities interact with blow moulder controls. The Process Pilot simultaneously manages all aspects of blow moulder operation to maintain proper

thickness distribution during bottle production. On sensing changes in processing conditions - such as cooler than normal preforms or a draft of warm air, for instance - the Process Pilot software responds automatically to keep the blow moulder on track, making the requisite adjustments much more quickly and reliably than a human operator.

Three stages of testing

According to Japanese protocol, new measurement equipment must undergo a thorough evaluation process before commissioning and adoption. Suntory's Haruna plant, which produces tea and juice filled in PET bottles manufactured on site, was designated as the test bed for the AGR technology. The PETWall Profiler system with Process Pilot control was installed on a KHS Blowmax 18 Series III blowmoulder. Running at 18,000bph, the line is dedicated to producing newly designed, light-weighted 2l bottles. Together the two companies formulated a rigorous three-stage program to validate the new equipment. Mr. Toshiya Kobayashi, Deputy General Manager-Engineering Department at Suntory, described the testing regimen as "extensive". The first stage validated the accuracy of the system measurements. Next came testing to confirm the optimum Process Pilot settings. The third stage, over a longer term, compared bottles produced on the KHS Blowmax with

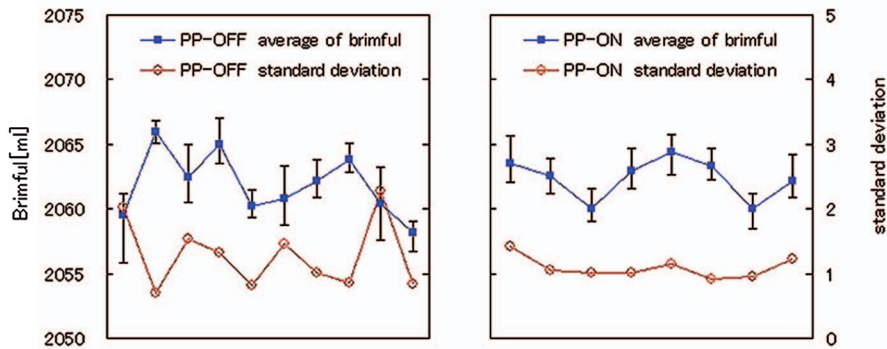


Figure 1: Brimful

To quantify the benefits of the AGR Process Pilot, Suntory gathered data over two 10-hour production periods, with and without the process control system enabled. The test showed that swings in the brimful volume were significantly reduced and the overall average standard deviation was more consistent with the Process Pilot turned on. (Courtesy of AGR International)

Process Pilot ON and OFF to quantify the benefits derived from its use.

Accuracy validation

Because the Process Pilot control software relies on precise thickness data to operate successfully, the first step in the evaluation program was to validate the PETWall Profiler's measurement capabilities. Suntory conducted multiple tests to compare the accuracy of the on-line measurement system with traditional off-line measurements, which are typically thought to generate a higher degree of accuracy. Several sets of bottle samples were taken during production runs, and on-line measurements were recorded for individual bottles in each set. The same bottles were subsequently measured by a high accuracy laboratory device. After thorough analysis of both sets of data, Suntory concluded that the PETWall Profiler possessed the highly accurate measurement functionality necessary for its light-weighting initiative.

Blowmoulder control

The second stage of testing evaluated the Process Pilot's ability to actually control the blowmoulder to maintain desired bottle thickness distribution consistently over a period of time. This series of tests included varying oven settings, pre-blow pressure and timing, preform temperature, and oven ventilation with the Process Pilot system enabled to prove its ability to control and stabilise the process, regardless of changes in environmental conditions. Results showed that the Process Pilot system quickly responded to the various control input changes and maintained the process with little variation. Suntory

then moved into more extensive production testing. Multiple production runs were conducted, each with a different set of Process Pilot configuration settings, incrementally tightening the tolerances. From these, the ideal configuration was determined, resulting in an extremely stable process with little variation.

Confirming Process Pilot value

Utilising the blowmoulder configuration developed during the earlier tests, the third phase of tests analysed bottles produced with and without Process Pilot control to assess the effects on bottle quality and performance. Over several weeks, the physical bottle parameters - thickness distribution at critical locations, toplod, and volume - were documented for bottles produced with Process Pilot turned OFF and ON. Bottles produced with the system showed a marked improvement in the form of reduced standard deviation of sidewall thickness, increased toplod strength, and greater

consistency in brimful volume (see figures 1 and 2). The narrowed process variation window and lower standard deviation assured the company that it could continue its aggressive light-weighting program while maintaining identical package performance.

Moving forward

Commenting on the Process Pilot a few months after its deployment, Deputy General Manager Kobayashi listed "reduced process optimisation time at startup, improved bottle performances, reduced influence of operators on blowmoulder settings, and a decrease in rejected packages" as its primary benefits. Before the system was installed, bottle and preform rejects averaged about 1%/a. Reject totals were reduced by 80%. The beverage producer has also successfully reduced the bottle weight. The 44g 2l tea bottle shed an additional 7g. Its current weight is now down to just 37g, a 16% reduction. Assuming resin pricing for bottle-grade PET of \$1.00 per lb, the subsequent reduction works out at roughly \$0.015 per bottle. With Haruna's production of millions of bottles per month, the savings are considerable. Equally important, the company has made the move to lighter-weight preforms with no loss in bottle performance. Now that the first Process Pilot has been fully approved, Suntory intends to extend deployment to additional blowmoulding lines, bringing it increasingly closer to the light-weighting goals of its sustainability campaign. Further light-weighting will produce significant savings in raw material costs as well, even more so with rising PET prices.

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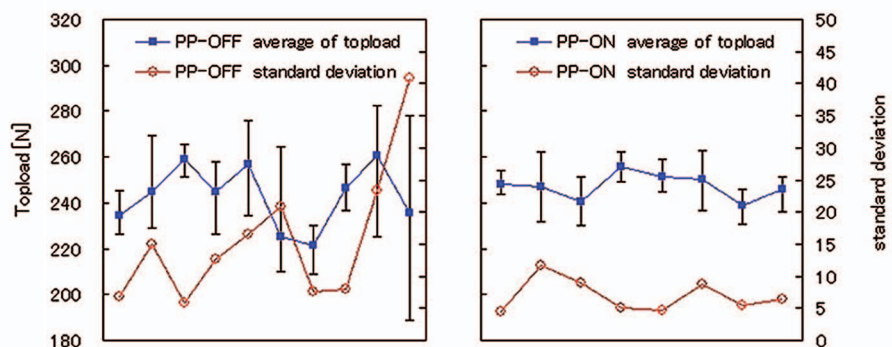


Figure 2: Topload

When the same testing scenario was repeated to measure toplod, similar results were obtained. With the Process Pilot enabled, Suntory found more consistent toplod resistance and lower overall standard deviation. (Courtesy of AGR International)