

Production Control of Sugar using the CAMSIZER Digital Image Analyzer

Sugar is a basic food commodity and hence each country has a well-developed sugar industry. Monitoring a product's physical properties, like particle size distribution, is of utmost importance in maintaining consistent quality, and often determines whether the product is accepted or rejected. The use of the CAMSIZER® digital image analysis system is a useful tool to achieve production optimization in sugar manufacturing.

Summary

Size analysis in sugar manufacturing has traditionally been performed using sieve analysis. Sieving is important for quality monitoring, but performed on the final product, it provides little information about the manufacturing process. Since sieving is relatively inexpensive, the desire for a more advanced particle sizing system differs from country to country.

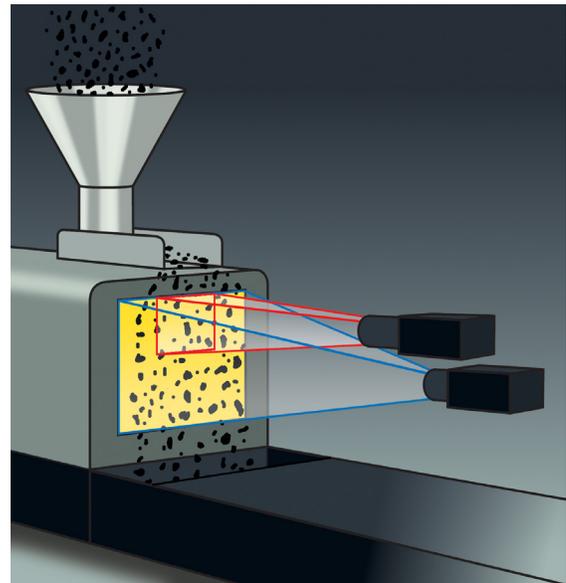
In cases where the customers require quality analysis of each sugar delivery, the number of sieve analyses per day is huge. Combined with higher labor costs, the benefits of the CAMSIZER® digital image analysis system outweigh the initial higher cost. An extension of the system also allows online analysis of the production line, in addition to final quality inspection.



CAMSIZER® Digital Image Analyzer

Measuring Principle

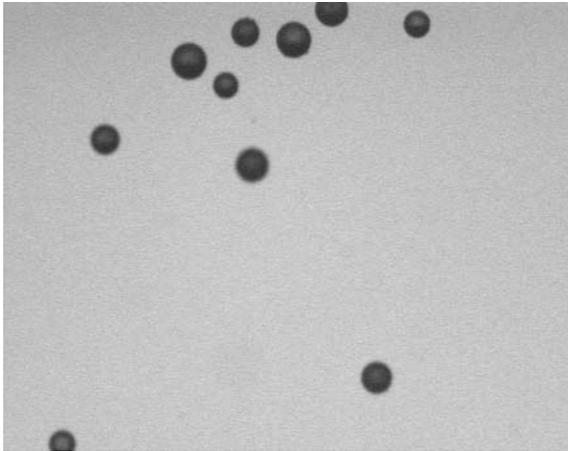
The sugar crystals are fed into the measuring chamber by a sample funnel and a vibratory feeder. The particles fall in front of a light source and produce shadows that are recorded by two high-resolution digital matrix cameras.



The software simultaneously determines the size distribution and shape of the particles. Several hundred thousand particles can be measured in a single run so that a high degree of statistical certainty is achieved in the results.

The patented two-camera technology allows a measuring range between 30 µm and 30 mm without any adjustments to the optical system. The software provides detailed shape analysis that provides a multitude of benefits, including results that closely correlate to sieve analysis.

The agreement between the CAMSIZER® results and sieve analysis is shown in the following illustration:



Measurement Requirements

The important measurement for sugar customers is the size distribution. In order to maintain continuity with historical data, the measurements are required to correlate to sieve analyses. Small differences may be tolerated, given the wide tolerance in sieving data.

Another quality measurement is the percentage of aggregates in a sugar sample. Sugar crystals have a regular shape. Aggregates are a combination of single crystals fused together. The problem with the aggregates is that they tend to include also molasses, and this impurity affects the sugar quality. The amount of aggregates in the sample also gives information about the crystallization process and can be an interesting value.

The most beneficial aspect of using a more advanced analytical technique is the speed of analysis. A CAMSIZER® analysis of a standard granulated sugar sample can be performed in three minutes, allowing a much higher throughput in the laboratory and allowing faster adjustments to the manufacturing process.

Reproducibility of Automated Analysis

Another desire is to reduce the variance of the sieving results in the manufacturing group. One sugar producer conducted a round-robin test of all their plant laboratories and compared the results. The central laboratory detected differences up to 30% in one test using sieve analysis. Using a CAMSIZER® they achieved results with differences less than 5%. Due to the consistency achieved by the use of a calibration object, this reproducibility can be achieved no matter how large the number of installations.

Online Applications

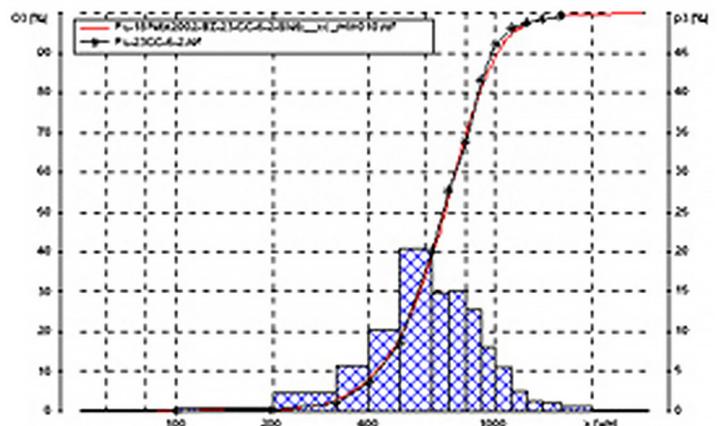
One sugar producer's bulk customers in the food industry (bakeries, beverages) required a particle size distribution for each truckload of product. The CAMSIZER® online system was installed in the filling line. During truck loading, a specially designed sampler takes representative samples for analysis. After 25 minutes, the truck leaves the filling station and receives at the gate an actual CAMSIZER® report of the loaded sugar.

CAMSIZER® Solution – Sieve Correlation

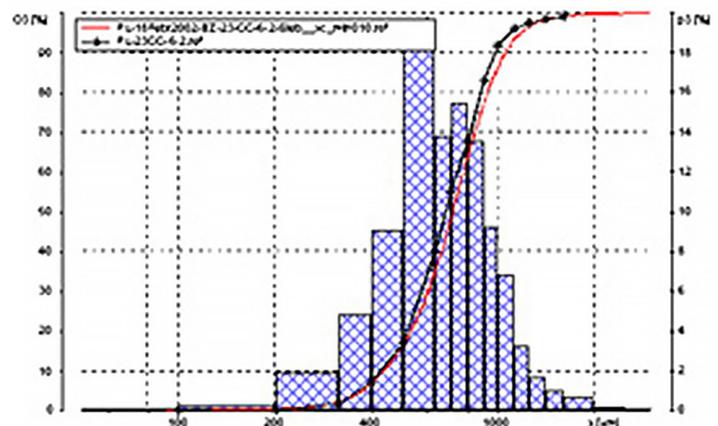
Since sugar is a natural product, a normal fitting curve would not provide optimum results, as the shape of the sugar can change very quickly during the crystallization process. The best results are achieved with a min(xc) particle definition, combined with a shape factor of 0.96.

In Figure 1, we displayed the min(xc) measurement without shape parameter. In the second figure a factor of 0.96 was set. Empirical results prove that this factor can be set for each size range. It works well for tight size ranges. For wide ranges we observe a deviation on the coarse side. The reason for that is the flatness of the bigger sugar crystals.

Graph of measurement results:
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 Task file: Fu 18Apr2002-8Z-Apr20.jg



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