Particle Size and Shape Analysis of Chocolate Samples

Introduction

Measuring the particle size and shape of chocolate and cacao is critical. It relates directly to the quality of the product; processing develops not only the chocolate flavor, but texture as well. The particle size gives a whole range of flavor, mouthfeel and textural properties to the chocolate. Finer particle sizes require more fat, because more surface area is available. Therefore, it will be a smoother, creamier product as a result, and also more expensive; more time and effort are put into making the product.

The refining and grinding time will determine particle size and shape.
If the particle size is too small, the chocolate will feel sticky in the mouth. Typically, the particle size of chocolate is about 18 microns. The human taste papillas are about 30 microns apart, cacao particles approaching this size will result in a sandy feeling in the mouth.

Moreover, processing doesn't only result in a finer particle size, but it may also round out some of the rough edges, giving the chocolate a smoother mouthfeel. It will also affect its flow characteristics.

The Solution

With the Ankersmid CIS-100 both particle size and shape can be measured and quantified. The laser channel employs the Time-Of-Transition (TOT) technique and measures particle size distribution of chocolate and cacao. The TOT principle is independent of optical properties; hence the difference in optical properties between sugar, fats and cacao doesn't affect the measurement.
The video channel used CCD camera technology to perform Dynamic Shape Analysis.

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Instrument and Configuration

1. Particle Size Analyzer Ankersmid CIS-100S.
2. Flow Cell Module ACM-104A.
3. Liquid Flow Controller LFC-101.
4. Lens B100 (in measurement range 2-600 μ).
5. Lens CW, DW (for shape analysis).

Sample preparation:

The chocolate & cacao samples were prepared for analysis by heating the solid samples and suspending a small amount of each sample in 500 ml of sun-flower oil. The suspension was mixed for 5 minutes.

The cacao powder samples were prepared for analysis by suspending a small amount of each sample in 500 ml of sun-flower oil. The suspension was mixed for 5 minutes and than was placed in an ultrasonic bath for 10-15 minutes. Than it was mixed again for about one minute.

Procedure:

A certain amount of each suspension was placed in the reservoir of the LFC-101 and pumped through the ACM-104A cell and recycled back to the reservoir in a continuous flow manner.
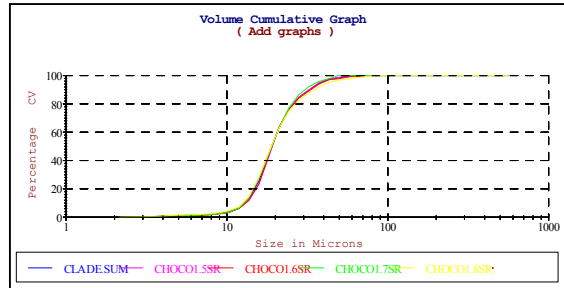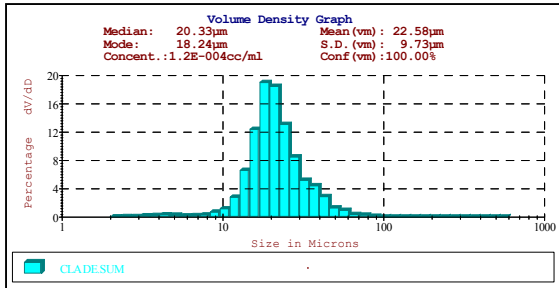
Laser Channel: Every sample was measured in the Laser Channel using the repetitive mode 3 times (runs) to illustrate the reproducibility of the results. Each set of three runs has been summed up.

Video Channel: Every sample was measured using WShape Analysis software. The macro included removal of out of focus particles.
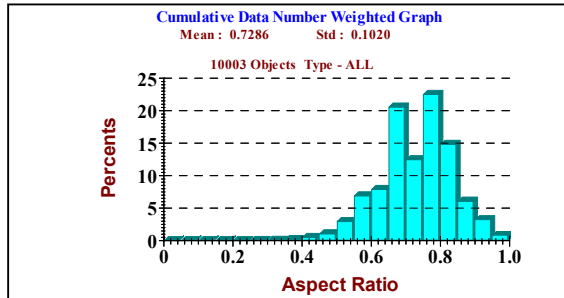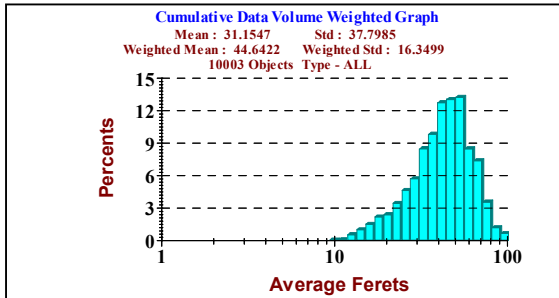
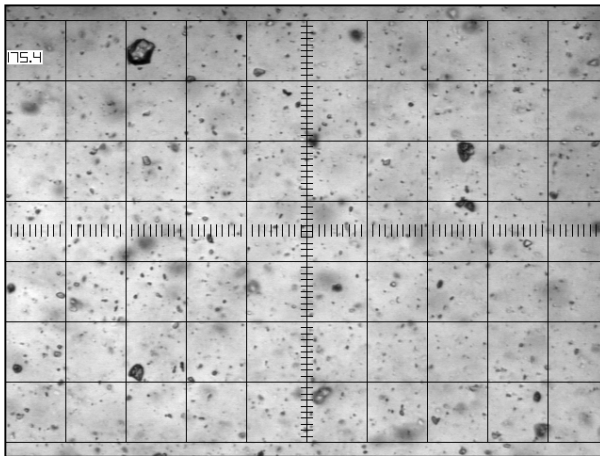Ankersmid B.V. De Wetering 25-27   4906 CT Oosterhout, the Netherlands   Phone: (31)-162-45 1800   Fax.: (31)-162-45 4163
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Results

Particle Size Results using the Laser Channel:

Volume Density Graph
Median: 20.33µm Mean(vm): 22.58µm
Mode: 18.24µm S.D. (vm): 9.73µm
Concent.:1.2E-004cc/ml Conf (vm):100.00%

Volume Cumulative Graph
(Add graphs)

Shape results using the Video channel:

Cumulative Data Volume Weighted Graph
Mean : 31.1547 Std : 37.7985
Weighted Mean : 44.6422 Weighted Std : 16.3499
10003 Objects Type - ALL

Cumulative Data Number Weighted Graph
Mean : 0.7286 Std : 0.1020
10003 Objects Type - ALL

Video images:
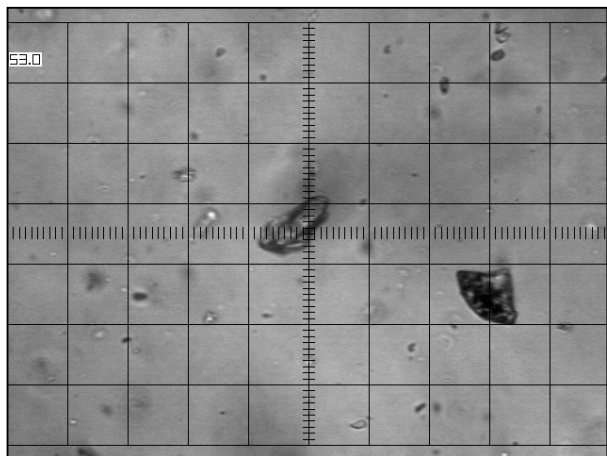
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Conclusion:

The Ankersmid CIS-100 is a powerful tool to characterize size and shape of chocolate and cacao products. The measurement is direct and not influenced by optical properties. Therefore, a difference in refractive and absorption indexes doesn't affect the results as in laser diffraction instruments. Moreover, measurements can be performed using any medium including sunflower oil.

With the video channel, the particles can be characterised on shape to obtain information about the sphericity.