Application News

No.Q112

Particle Size Distribution Measurement of Chocolate

■ Introduction

There are several possible parameters for expressing the taste of a piece of chocolate. For example, it can be described in terms of taste characteristics such as sweetness or bitterness, but it is also possible to characterize chocolate in terms of its texture in the mouth, for instance, how readily it melts in the mouth. Included in such parameters is "tongue texture," for which particle size distribution provides a potential index for expressing this parameter in numeric terms. This article describes the use of a SALD-2300 laser diffraction particle size analyzer to measure the size distribution of particles in chocolate. Chocolate is a mixture of cocoa mass, which consists of ground cocoa beans mixed with milk, sugar, cocoa butter, and other ingredients. This can be considered as a mixture of various particles in fat. Consequently, the particle size distribution presumably varies depending on the dispersion conditions. In this example, isopropanol at about 45 °C was used as the dispersant.

Fig. 1 SALD-2300 Laser Diffraction Particle Size Analyzer

Table 1 Measurement Conditions

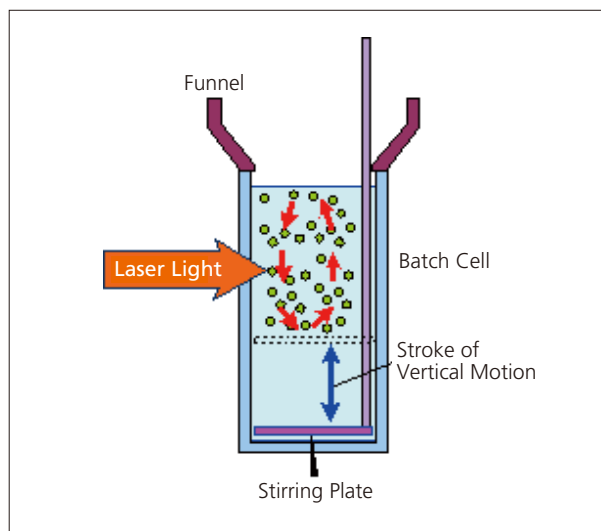|	
Dispersant	: Isopropanol (45 °C)
Dispersing Agent	: None
Dispersing Method	: Stirred using a magnetic stirrer
Refractive Index	: 1.70-0.05i

Fig. 2 Batch Cell

■ Test Samples and Results

Three kinds of chocolate were prepared as samples. Sample A was milk chocolate, B was milk chocolate from a different manufacturer, and C was chocolate removed from a chocolate chip cookie.

Each sample was cut into thin pieces with a box cutter knife and placed in a 50 mL beaker. Then 45 °C isopropanol was added to dissolve (disperse) the samples into a suspension, which was stirred for about 2 minutes with a magnetic stirrer. This suspension was used as the stock solution. Part of this stock solution was sampled and added to a batch cell filled with ambient-temperature isopropanol until the appropriate concentration was achieved. Figure 3 shows the particle size distribution results obtained from measurement of the samples as described above.

The results indicate that C contains larger particles than B and B contains larger particles than A. When the samples were actually eaten, the mouth texture of Sample A was extremely smooth, B was slightly less smooth than A, and C felt clearly grainy on the tongue. Put simply, the results indicate that an adequately smooth mouth texture can be achieved if all the particles are smaller than 50 μm in diameter. In contrast, chocolate containing particles with diameters larger than 100 μm clearly imparts a grainy sensation.

Of course, smoothness on the tongue is not the only factor that determines how good a chocolate product tastes, but this example shows how measuring the particle size distribution provides a measurement scale that can be used for evaluation.
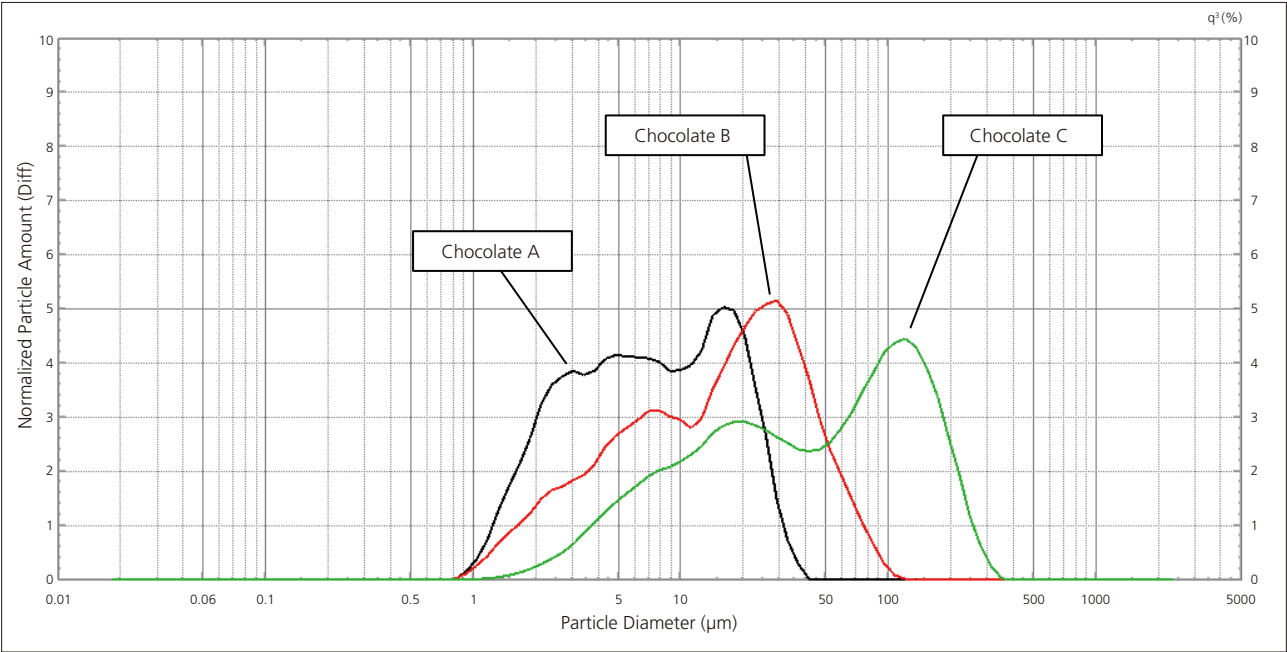
	File Name	Sample ID	Sample #	Absorbance	Refractive Index
1	A	A	bc ipa st2m	0.10	1.60-0.02i
2	B	B	bc ipa st2m	0.08	1.60-0.02i
3	C	C	bc ipa st2m	0.12	1.60-0.02i

	Median D (μm)	Modal D (μm)	Mean V (μm)	Std Dev	10 %D (μm)	50 %D (μm)	90 %D (μm)	0 %D (μm)	0 %D (μm)	0 %D (μm)	0 %D (μm)	0 %D (μm)	0 %D (μm)
1	6.969	14.994	6.771	0.377	2.049	6.969	20.764	0.000	0.000	0.000	0.000	0.000	0.000
2	15.895	30.617	13.265	0.449	2.906	15.895	45.539	0.000	0.000	0.000	0.000	0.000	0.000
3	42.862	127.664	36.861	0.534	6.351	42.862	163.880	0.000	0.000	0.000	0.000	0.000	0.000

Fig. 3 Particle Size Distributions of Several Kinds of Chocolate

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> SALD-2300

Laser Diffraction Particle Size Analyzer

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