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Application News

No. Q116

Powder Property Analysis

The Assessment of Dissolution Process of Powdered Sports Drink by Continuous Measurement Function of SALD Series

Various sports drinks are available on the market today. These sports drinks can be broadly categorized into those sold in liquid form, such as in plastic bottles, and those in powder form to be used after dissolving them. Of these two, powder form is easy to carry, and the concentration can be easily adjusted for the purpose of sugar level control. Such powdered sports drinks must also dissolve quickly even at room temperature.

In this research, taking a powdered sports drink as a sample, we measured the particle size distribution in the dry state, and the change in particle size distribution as the sample dissolves after being added to water, using the SALD series laser diffraction particle size analyzer.

The SALD series is effective in the analysis of dissolution that occurs within a short period of time since continuous measurement at as short as 1 sec intervals is possible with the simple optical system which consists of a single light source. The size of residual particles that affect the texture and smoothness of the drink can also be measured. This information can be utilized in the development and quality control of other powder form foods and pharmaceuticals.

H. Maeda, T. Kinoshita

Materials and Methods

A commercially available powdered sports drink was used as a sample. The SALD-2300 laser diffraction particle size analyzer (Fig. 1) was used for measurement.

Dry measurement was performed by placing the sample in a vial using a dispensing spoon and setting the vial on the stage. Wet measurement was performed by adding the sample to a sample bath and starting measurement immediately. Details such as the options used and parameter settings are given in Table 1.

Results and Discussion

Fig. 2 shows the particle size distribution of a powdered sports drink measured using the DS5 cyclone injection type dry measurement unit, overlaid with the particle size distribution of the sample immediately after being supplied to the MS23 sampler, on a single graph. The graph indicates that the particle size at start in wet measurement is nearly the same as that in dry measurement.

Fig. 3 shows the change of particle size distribution due to dissolution after supplying the sample into water. Particle size distribution curves are indicated per the elapsed time, of immediately after supply (0 sec), and 4 sec, 8 sec, 16 sec, 32 sec, and 64 sec after supply.

Fig. 1 SALD-2300 Laser Diffraction Particle Size Analyzer

Table 1 Measurement Conditions

Dry Measurement		
(Hardware)	Measurement unit	DS5 cyclone injection type dry measurement unit
	Injection nozzle	Dispersion nozzle (middle size ϕ3.0)
	Sample suction type	Cyclone type
	Vial	Standard
(Software)	Averaging count	64
	Particle size distribution measurement	Manual
	Elevator speed	10
	Dispersion pressure	0.5 MPa
Wet Measurement		
(Hardware)	Measurement unit	MS23 sampler
(Software)	Averaging count	64
	Particle size distribution measurement (measurement interval)	Continuous measurement function 4 sec
	Pump speed	7

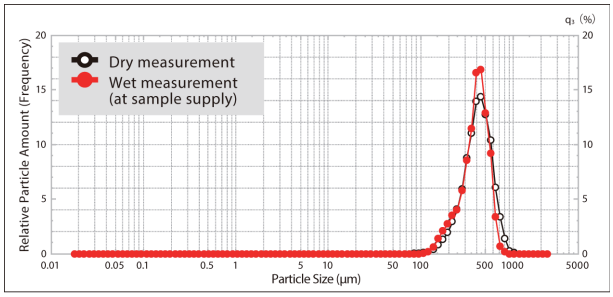

Fig. 2 Particle Size Distribution in Dry Measurement and in Wet Measurement at Start

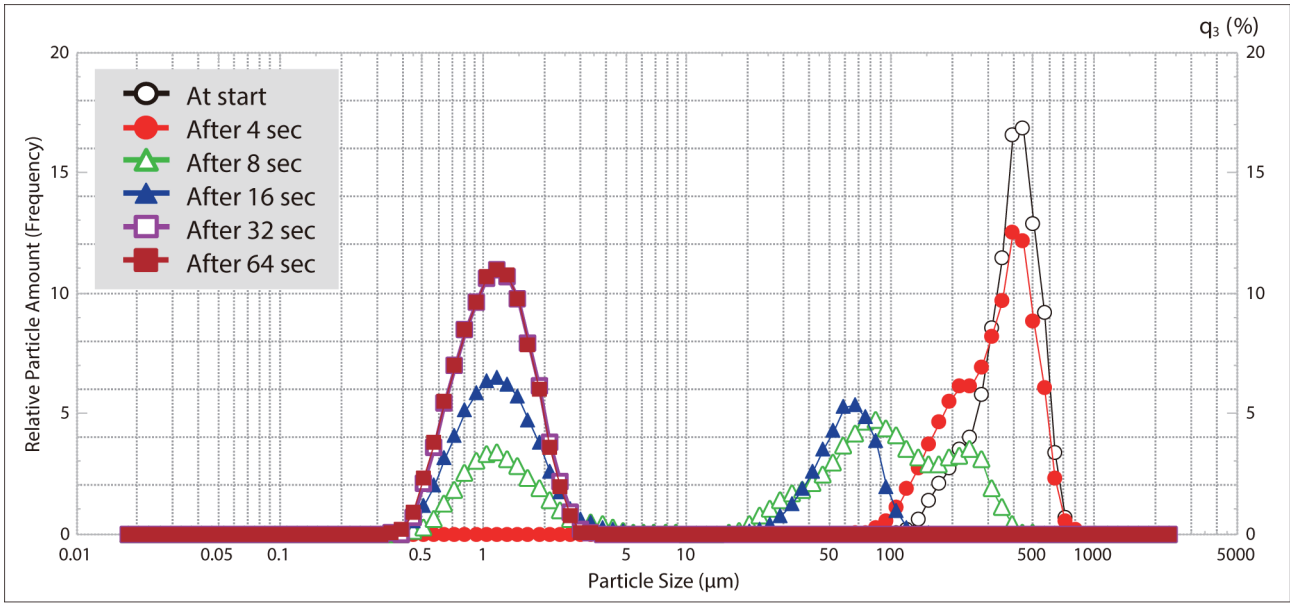

Fig. 3 Particle Size Distribution in Dissolution Process

The laser diffraction particle size analyzer irradiates sample particles in a liquid or in the air with a laser beam, measures the scattered light intensity distribution, and converts it into particle size distributions. Fig. 4 is a graph showing the change of the light intensity distributions from which the particle size distributions shown in Fig. 3 were converted. Since initially there are many large particles that have not dissolved, the scattered light intensity distribution is high at the small sensor element numbers. However, the scattered light in this area rapidly weakens as time elapses. This indicates a gradual transition from a highly turbid state to a clear state.

Fig. 5 shows the changes of D10, D50, and D90 in 4 sec intervals from immediately after supplying the sample into water, until 64 seconds elapse. By the time 24 seconds elapse, change due to dissolution is nearly finished, and the particle size distribution thereafter is constant.

In the case of this sample, not all particles are completely dissolved, and we can see that particles slightly larger than 1 µm are remaining at the end. Sports drinks of this type are slightly turbid even after dissolution in water is complete, indicating that it contains fine particles.

Through this research, we were able to observe the change in particle size distributions in dissolution process which completes as fast as within 30 seconds, demonstrating that the continuous measurement function of the SALD series is effective for such measurements.

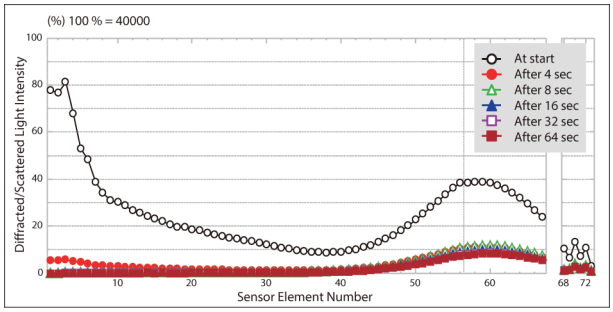

Fig. 4 Scattered Light Intensity Distribution in Dissolution Process

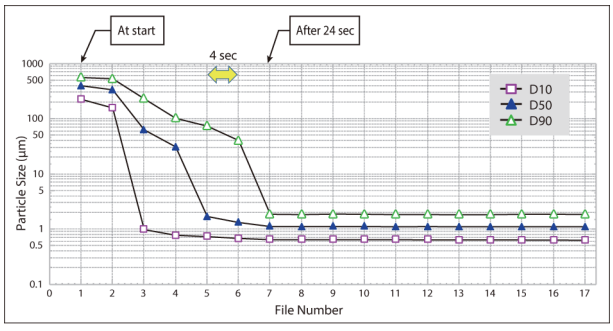

Fig. 5 Changes of D10, D50, and D90 in Dissolution Process

First Edition: Jul. 2017

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