

# Application News

## No. Q113

### Powder Property Analysis

## Particle Size Distribution Measurement of Powdered Young Leaf Blade of Barley

### ■ Introduction

Powdered barley grass is often used in health food products. At the distribution stage, it is packaged in dry powdered form, but it is normally mixed with water, milk, or other liquids, to form a suspension for actual consumption. In other words, from the time it is shipped until it is consumed, the barley grass exists in a variety of different states.

Particle size distribution is a physical property that is dependent on the dispersion status.

Given the same sample, measurement results can differ depending on how the particles are dispersed. This article describes the results obtained from measuring the particle size distribution of the same sample in which the particles were dispersed using three different dispersion methods. Note the difference in particle size distributions, depending on the dispersion conditions.

Measurements were obtained using a Shimadzu SALD-2300 laser diffraction particle size analyzer.



Wet Measurement System



Dry Measurement System

Fig. 1 SALD-2300 Laser Diffraction Particle Size Analyzer

Table 1 Measurement Conditions (wet)

Dispersant	: Purified water, Isopropanol
Dispersing Agent	: None
Dispersing Method	: Sonicated for 3 minutes in 100 W ultrasonic bath
Refractive Index	: 1.70-0.05 i

Table 2 Measurement Conditions (dry)

Injection Type	: Cyclone
Pressure	: 0.3 MPa
Refractive Index	: 1.70-0.05 i

Test Samples and Results

Purified water was used as a dispersant for measuring samples in a wet batch cell. Measurement conditions are indicated in Table 1. A dispersion solution was prepared in a 50 mL beaker as the stock solution. A portion of that solution was sampled, placed in a batch cell, and measured.

The measurement results are shown in Figure 2. Of the two particle size distributions, one was obtained following measurement immediately after dispersion, whereas measurement of the other was conducted about five minutes after dispersion. The results show that the particles were larger when measured five minutes after dispersion.

Next, samples were measured with isopropanol (IPA) used as the dispersant, but with all other conditions and procedures kept the same. Just as with the purified water dispersant, samples were sampled and measured twice at least five minutes apart. Unlike the purified water, however, there was no time-dependent variation in particles sizes, as shown in Figure 3.

These results suggest that the barley grass particles swell in water.

The same sample was then measured using a dry method. The sample was dispersed by spraying it as a dry powder in air, and then measured.

Figure 4 shows a comparison of results from the wet dispersion in purified water, wet dispersion in IPA, and dry dispersion methods. The results from dry dispersion were roughly consistent with the IPA dispersion results, except for the apparent presence of particle clusters included in the large particle region.

Presumably, these are from particles that dispersed in IPA, but did not quite disperse in air.

Based on the above results, the wet IPA method appears to be preferable for determining the original primary particle diameters, the dry method for determining the particle size distribution close to the dry powdered state with aggregations, and the wet water method for determining the distribution of particles close to their slightly swollen state when they are actually consumed.

Therefore, it is probably best to select the dispersion method, or even the measurement system, based on the state of the particles for which the particle distribution is to be measured.

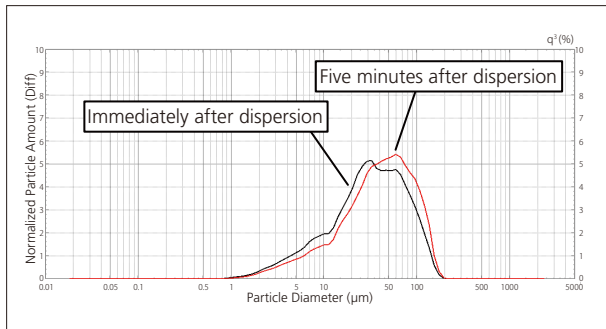


Fig. 2 Measurement Result of Barley Dispersed in Water

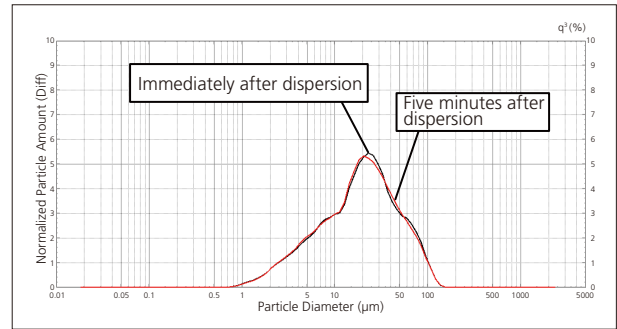


Fig. 3 Measurement Result of Barley Dispersed in Isopropanol

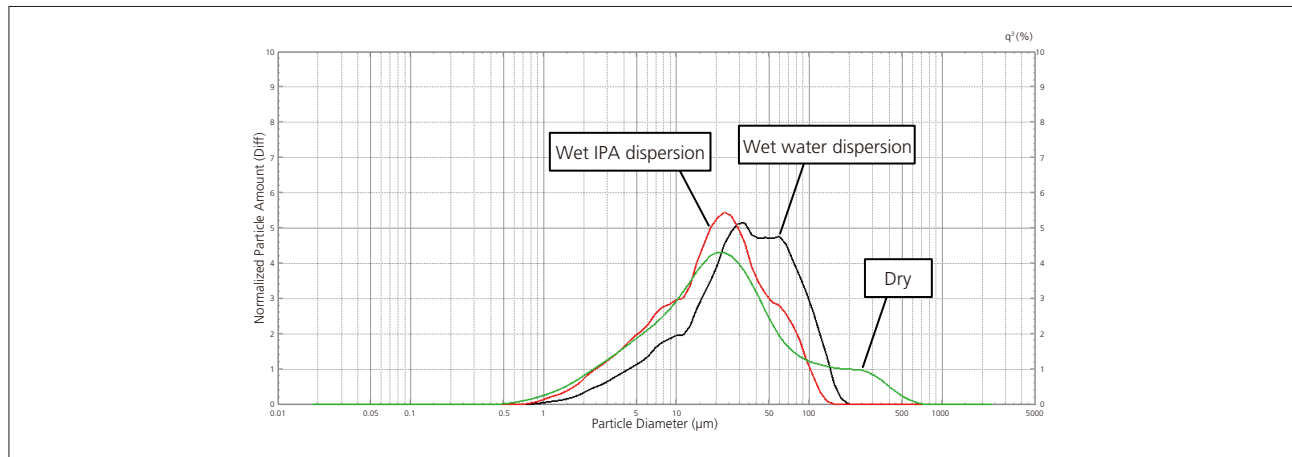


Fig. 4 Overlay Graph of Particle Size Distributions of Barley Dispersed in Different Methods

	File Name	Sample ID	Sample #	Median D (µm)	Modal D (µm)	Mean V (µm)	Std Dev	Refractive Index
1	BG-2300bc-w-0001	Barley Grass		31.408	30.617	27.723	0.428	1.60-0.05i
2	BG-2300bc-IPA-0001	Barley Grass		19.476	24.133	17.262	0.433	1.60-0.05i
3	BG-2300DS5-2001	Barley Grass		20.161	19.023	20.482	0.567	1.60-0.01i