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Application News

No. Q119

Powder Property Analysis

# Evaluation of the Size and Concentration of Particles in Beverages
## - Utilizing the qLD Method in the Beverages Field -

The minute particles within beverages hold the possibility of giving various tastes to a beverage. However, these particles may also cause trouble in production equipment. If the size and concentration of minute particles can be accurately measured and controlled, the taste of beverages can be quantitatively recognized, making it also possible to develop new products according to plan. Also, since trouble caused by residual substances in filters and tubing of production equipment can be prevented, stable production is possible, thereby suppressing production costs. Conventionally, the quantitative evaluation of the concentration of minute particles in the order of sub microns (smaller than 1 µm) up to a few dozen µm was difficult. However, by using the Aggregates Sizer™ Aggregation Analysis System for Biopharmaceuticals (referred to as Aggregates Sizer hereafter, Fig. 1), quantitative evaluation of the size and concentration of such minute particles becomes possible.

Aggregates Sizer was developed as a system to quantitatively analyze aggregate particles in biopharmaceuticals, but is also capable of quantitatively analyzing particles in beverages as well. This article introduces the results of measuring the sizes and concentrations of particles within a number of beverages using Aggregates Sizer.

S. Totoki, H. Maeda


**Fig. 1 Aggregates Sizer**

## Materials and Methods

Table 1 lists the samples and measurement method.

**Table 1 Samples and Measurement Method**

| | |
|---|---|
| Sample | : Sports drinks (powdered type, bottled type)<br>Green tea (with and without matcha, both bottled)<br>Japanese sake (pure-rice *daiginjo*, unpasteurized sake, ordinary sake) |
| Instrument | : Aggregates Sizer |
| Method | : Quantitative laser diffraction method (qLD method) |
| Measuring unit | : Batch cell (Fig. 2) |
| Analysis range | : 0.2 µm to 20 µm |
| Refractive index. | : 1.46-0.10i *1 |
| Density | : 1.37 g/cm$^3$ *1 |

*1 If the composition of particles is known, more accurate quantitative measurement is possible by using those parameters for calculations.

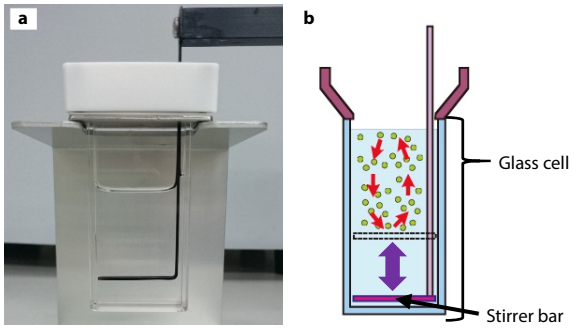


**Fig. 2 Batch Cell**
**a. Picture b. Schematic Diagram**

## Results and Discussion

The particle size distribution for each sample and graphs of the particle concentration in ranges where a peak was observed are shown in Figs. 3 to 5.

Fig. 3 shows the measurement results for a powdered sports drink dissolved in water and a bottled sports drink. With both sports drink types, a peak in particle concentration is observed in the 0.2 µm to 2 µm range. However, the powdered type also exhibits a high concentration in the range above 2 µm, indicating that particles that were not completely dissolved are remaining.

Fig. 4 shows the measurement results for two different types of bottled green tea. For the type with matcha, a high concentration of particles is detected over a wide range with a peak in the vicinity of 10 µm. For the type without matcha, particles are hardly detected, suggesting that particles are removed from the beverage during production.

Fig. 5 shows the measurement results for three different types of Japanese sake. Although Japanese sake appears to contain no particles, the results show that there are very slight amounts (less than 1 µg/mL) of particles in the range of a few µm up to a few dozen µm.

As described above, Aggregates Sizer enables quantitative comparison of the particle concentrations in beverages for different particle size ranges. Since the size and concentrations of minute particles affect the occurrence of filter clogs in production equipment as well as the taste of beverages, this is expected to be a very effective tool.

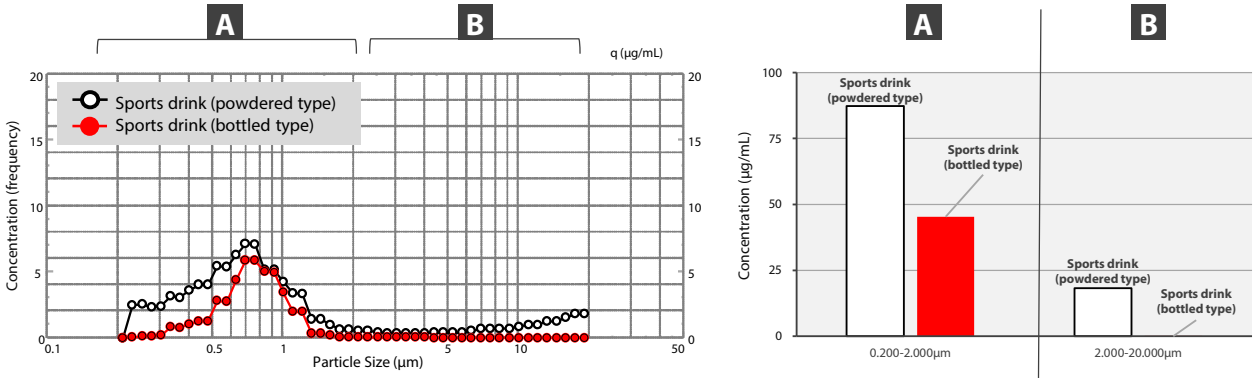


**Fig. 3 Particle Size Distribution and Concentrations of Different Particle Size Ranges in Sports Drinks**
**A: 0.2 μm to 2 μm B: 2 μm to 20 μm**
**Particles are observed in the 0.2 μm to 2 μm range for both samples, but in the range above 2 μm, particles are detected only for the powdered type.**

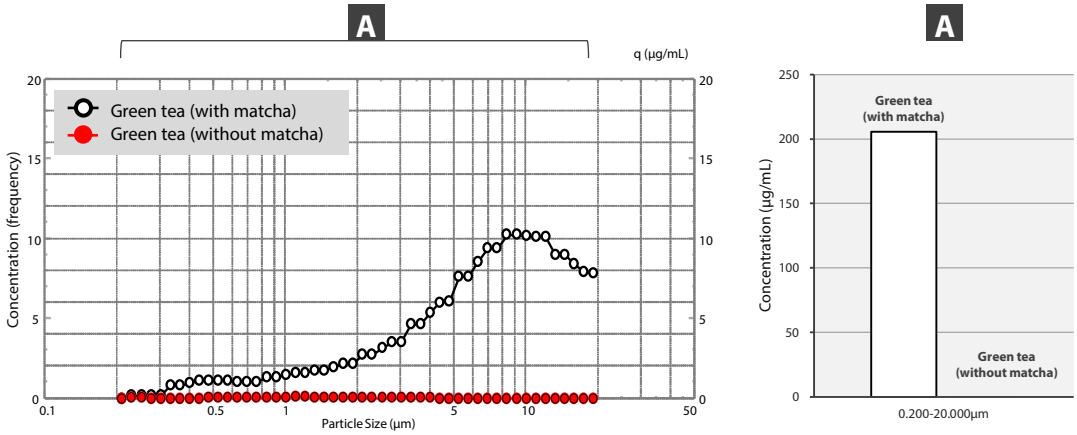


**Fig. 4 Particle Size Distribution and Concentrations of a Particle Size Range in Green Tea (Bottled)**
**A: 0.2 μm to 20 μm**
**For the type with matcha, a high concentration of particles is detected over a wide range with a peak in the vicinity of 10 μm. However, for the type without matcha, particles are hardly detected.**

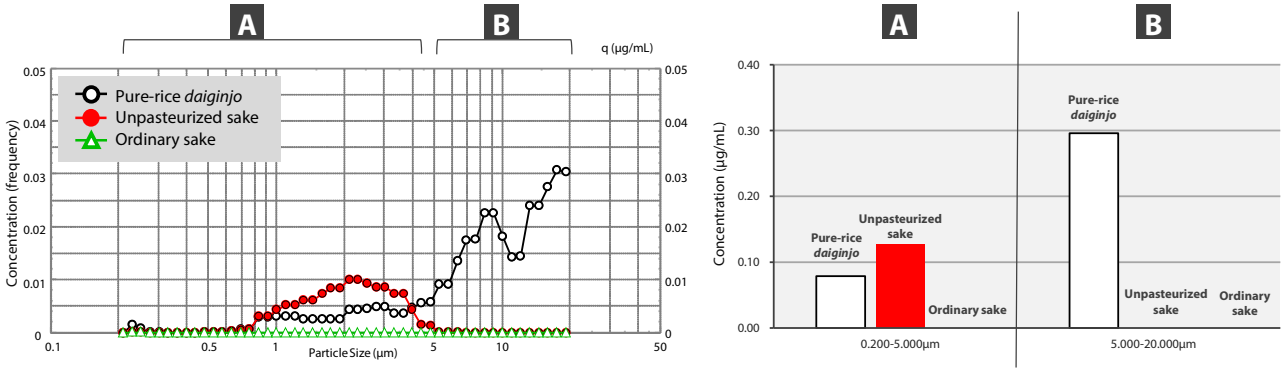


**Fig. 5 Particle Size Distribution and Concentrations of Different Particle Size Ranges in Japanese Sake**
**A: 0.2 μm to 5 μm B: 5 μm to 20 μm**
**Although Japanese sake appears to contain no particles, the results show that there are very slight amounts (less than 1 μg/mL) of particles in the range of a few μm up to a few dozen μm.**

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First Edition: Mar. 2018

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