

Summary

An instrument-to-instrument variation study was performed with 2 standards on 30 randomly selected units of the HORIBA LA-350 laser diffraction particle size analyzer. One standard was a monodisperse polystyrene latex (1.030+/-0.015µm, 4010A, Thermo Scientific). The other standard was a polydisperse particle standard (PS202, 3-30µm, Whitehouse Scientific). The average values collected from multi-instrument analysis are well within the uncertainties set out by each respective reference materials.

Analytical Test Method

The disparate nature of each sample requires separate methods to be developed for accurate, precise particle size analysis.

1. Thermo Scientific polystyrene latex 4010A, 1µm

- Fill the LA-350 with de-ionized water (Medium level).
- Activate Circulation (level 3).
- Create Refractive Index "SINGLE_PSL in water".
- Set Convergence Factor 1000, Data Acquisition Time 5000 for sampling and blanking.
- Add a few drops of the standard into the sample cup of LA-350 until the red laser transmittance % reaches 85-90%.
- After the real time distribution on the screen is stable, take 3 consecutive measurements.

2. Polydisperse Particle Standard PS202 (3-30µm)

- Fill the LA-350 with de-ionized water (Medium level).
- Activate Circulation (level 5).
- Create Refractive Index "GLASS BEADS in water".
- Set Convergence Factor 15, Data Acquisition Time 5000 for sampling and blanking and ultrasound time 5 min at power 7.
- Add the entire bottle of PS202 into the sample bath of the LA-350.
- Apply 5 minutes of internal sonication (level 7) for material de-agglomeration.
- After the ultrasonic treatment completes, take 3 consecutive measurements.

Results Summary

Thermo Scientific 4010A, 1.030 +/- 0.015 µm

| HORIBA LA-350 | Mean value, µm |
|------------------|----------------|
| Unit 1 | 1.029 |
| Unit 2 | 1.028 |
| Unit 3 | 1.028 |
| Unit 4 | 1.019 |
| Unit 5 | 1.012 |
| Unit 6 | 1.028 |
| Unit 7 | 1.028 |
| Unit 8 | 1.029 |
| Unit 9 | 1.028 |
| Unit 10 | 1.028 |
| Unit 11 | 1.028 |
| Unit 12 | 1.028 |
| Unit 13 | 1.029 |
| Unit 14 | 1.028 |
| Unit 15 | 1.028 |
| Unit 16 | 1.027 |
| Unit 17 | 1.023 |
| Unit 18 | 1.027 |
| Unit 19 | 1.028 |
| Unit 20 | 1.028 |
| Unit 21 | 1.020 |
| Unit 22 | 1.028 |
| Unit 23 | 1.028 |
| Unit 24 | 1.022 |
| Unit 25 | 1.028 |
| Unit 26 | 1.028 |
| Unit 27 | 1.028 |
| Unit 28 | 1.029 |
| Unit 29 | 1.028 |
| Unit 30 | 1.028 |
| Mean | 1.027 |
| Std. Dev. | 0.004 |
| CoV(%) | 0.37% |

Whitehouse Scientific PS202 3-30µm

| HORIBA LA-350 | Mean Diameter, µm | | |
|------------------|-------------------|------------------|------------------|
| | Percentile (D10) | Percentile (D50) | Percentile (D90) |
| Unit 1 | 9.55 | 13.90 | 18.83 |
| Unit 2 | 9.41 | 13.74 | 18.59 |
| Unit 3 | 10.16 | 14.44 | 19.49 |
| Unit 4 | 9.74 | 14.24 | 19.44 |
| Unit 5 | 9.09 | 13.32 | 18.01 |
| Unit 6 | 9.72 | 14.05 | 18.97 |
| Unit 7 | 9.36 | 13.59 | 18.32 |
| Unit 8 | 9.31 | 13.61 | 18.38 |
| Unit 9 | 10.04 | 14.08 | 18.76 |
| Unit 10 | 9.21 | 13.35 | 17.66 |
| Unit 11 | 9.25 | 13.49 | 18.24 |
| Unit 12 | 9.07 | 13.29 | 17.85 |
| Unit 13 | 9.87 | 14.23 | 19.25 |
| Unit 14 | 9.67 | 14.06 | 19.12 |
| Unit 15 | 9.86 | 14.08 | 18.89 |
| Unit 16 | 9.70 | 13.93 | 18.73 |
| Unit 17 | 9.52 | 13.77 | 18.62 |
| Unit 18 | 9.41 | 13.68 | 18.56 |
| Unit 19 | 10.38 | 14.69 | 19.37 |
| Unit 20 | 9.57 | 13.95 | 18.94 |
| Unit 21 | 9.67 | 13.88 | 18.59 |
| Unit 22 | 9.23 | 13.58 | 18.46 |
| Unit 23 | 9.66 | 14.01 | 18.99 |
| Unit 24 | 9.58 | 13.87 | 18.79 |
| Unit 25 | 9.95 | 14.08 | 18.85 |
| Unit 26 | 9.57 | 13.80 | 18.55 |
| Unit 27 | 9.39 | 13.62 | 18.28 |
| Unit 28 | 9.18 | 13.50 | 18.35 |
| Unit 29 | 9.88 | 14.07 | 18.93 |
| Unit 30 | 10.09 | 14.24 | 19.18 |
| Mean | 9.60 | 13.87 | 18.70 |
| Std. Dev. | 0.33 | 0.33 | 0.45 |
| CoV(%) | 3.44% | 2.41% | 2.41% |

| Certified Value from Whitehouse Scientific | | | |
|--|-------|-------|-------|
| Lower Limit | 8.28 | 12.57 | 18.90 |
| Upper Limit | 10.00 | 14.29 | 21.78 |

| HORIBA Specification | | | |
|----------------------|-------|-------|-------|
| min | 7.87 | 12.19 | 17.96 |
| max | 10.50 | 14.72 | 22.87 |