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Results of Shear Studies with 241-AY-101 Sludge

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Abstract: The effects on settling rates, chemical composition, distribution of radionuclides, and particle size distribution, for a AY-101 waste tank sludge composite are tested after shearing with a tissue homogenizer.

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ABBREVIATIONS AND ACRONYMS

AY-101	Hanford Waste Tank 241-AY-101
AZ-102	Hanford Waste Tank 241-AZ-102
AT	Total alpha activity
cm	Centimeters
DL	Drainable liquid from core sample
DOE	Department of Energy
ft/s	Feet per second
g	Grams
g/mL	Grams per milliliter
GEA	gamma energy analysis
gpm	Gallons per minute
ICP/AES	Inductively coupled plasma atomic emission spectroscopy
L/min	Liters per minute
m/s	Meters per second
min.	Minutes
mL	Milliliters
PSD	Particle Size Distribution
LH	Lower half of core sample segment
rpm	revolutions per minute
TFA	Tanks Focus Area
UH	Upper half of core sample segment

1.0 INTRODUCTION AND EXECUTIVE SUMMARY

The Department of Energy's Tanks Focus Area (TFA) authorized a project to study the effect of shear on the settling properties of high-level waste sludge to support retrieval programs. A series of settling studies was conducted on a composite sample of tank 241-AY-101 (AY-101) material. Comparisons were made with duplicate samples that were sheared with a tissue homogenizer and allowed to settle. Aliquots of sheared and unsheared settled solids were submitted for chemical and radiological analyses.

The work was funded by the TFA (EM-50) under Technical Task Plan Number RLO-8-WT-41, "PHMC Pretreatment – Saltcake Dissolution", Subtask A, Prevention of Solids Formation.

1.1 SUMMARY AND CONCLUSIONS

There are five major conclusions from the study that apply to AY-101 sludge:

1. Sludge settling rates are detectably decreased after shearing of particles by means of a tissue homogenizer. A significant decrease in the settling rates was measured after 2 minutes of shearing. A smaller additional decrease in the settling rates was observed after an additional 10 minutes of shearing.

2. Sodium and Cesium appear to be present in both the liquid and solid phases of the composite sample.

3. The shearing of the solids does not appear to significantly change the distribution of the radionuclides, (^{241}Am, ^{90}Sr, Total Alpha, or other radionuclides), within the solids.

4. The mean particle diameter decreases after shearing with the tissue homogenizer and affects the settling rate in proportion to the square of the particle diameter.

5. The sonication of the unsheared particles produces a similar particle size reduction to that of shearing with a tissue homogenizer.

It is difficult to quantitatively compare the shear produced by a mixer pump installed in a double-shell tank with that produced by the tissue homogenizer in the laboratory. On a qualitative basis, the mixing pump would be expected to have less mechanical and more hydraulic shearing effect than the tissue homogenizer. Since the particle size distribution studies indicate that (for the AY-101 solids) the breaking up of particle aggregates is the main means of particle size reduction, then the hydraulic shearing of the mixing pump may well produce similar shearing effects as the tissue homogenizer. (Mechanical shear represents the shear caused by direct contact between a particle and a metal surface; hydraulic shear is caused by the particle moving between fluids traveling at different speeds.)

2.0 DESCRIPTION OF LABORATORY STUDIES

2.1 PREPARATION OF COMPOSITE SAMPLE

The composite sample was prepared in a hot cell as directed in the test procedure (Controlled Laboratory Notebook HNF-N-226 1, pp. 1-15). The test procedure specified the percent settled solids of the composite sample should be between 10% and 15% by volume. The composite sample was estimated to be 12.2 volume percent settled solids after settling by using a scale in the hot cell, however, the results of the settling tests indicate an average of 16.6 volume percent. Table 2-1 shows the summary of the sample jars used to prepare the composite sample.

Table 2-1. Tank AY-101 Core Samples Used in Composite Sample

Core	Segment	Sample Type	Jar Number	Weight Used (grams)
275	2 LH[1]	Solid	16992	16.0
275	3 UH[2]	Solid	17013	8.0
277	2 UH	Solid	15946	8.0
277	2 LH	Solid	15951	10.8
277	3	Solid	15952	8.0
275	1 DL[3]	Liquid	18608	240.8
277	1 DL	Liquid	17465	226.2

[1]LH = Lower Half of the core sample segment.
[2]UH = Upper Half of the core sample segment.
[3]DL = Drainable Liquid from the core sample segment.

2.2 SETTLING STUDIES

After preparation, the composite sample was mixed with a magnetic stirrer to ensure a uniform distribution of solids. The magnetic stirrer was placed on the minimum setting required to adequately mix the sample without causing unnecessary shearing of the particles.

While the composite was being stirred, a 2 mL sample was withdrawn for particle size distribution analysis, using a syringe with a large bore opening to which a length of plastic tubing had been attached. Approximately 2 mL of water was added to the sample vial. The same syringe was then used to sample the composite into four 100 mL graduated cylinders labeled 1AY-1, 1AY-2, 1AY-3, and 1AY-4. The first settling test (Settling Test A) was then performed. The initial settling test was terminated after 1 week. A video camera was used to record the progress of the test.

At the conclusion of the first settling test, each of the samples was separately transferred to a 150 mL beaker. The slurries from columns 1AY-1 and 1AY-2 were briefly stirred at the previous setting required to disperse the particles. Throughout this study, the stirrer/hotplate was operated at the same setting, which equates to a 2.5cm stirbar spinning at approximately 300 rpm. The samples were then returned to the graduated cylinders for the second settling test. The slurries from columns 1AY-3 and 1AY-4 were transferred to the beaker and sheared with the tissue homogenizer shown in Figure 1 (Basic Ultra-Turrax® Laboratory Disperser/Homogenizer, Model T25) for two minutes. These samples were also returned to the

graduated cylinders for the second settling test (Settling Test B) and recorded with a video camera. The second settling test was terminated after 1 week.

At the conclusion of the second test, a third settling test (Test C) was repeated after a ten minute shearing period for the slurries from columns 1AY-3 and 1AY-4 and recorded with a video camera.

At the conclusion of the third test (Test C), the settled solids from cylinders 1AY-1 and 1AY-3 were centrifuged and the weights of the centrifuged solids were determined. The centrifuged solids from 1AY-3 were then recombined with the supernatant and stirred until the solids were suspended. While suspended, a 2 mL sample was withdrawn for particle size distribution analysis, using a syringe. Approximately 2 mL of water was then added to the sample vial. The settled solids from columns 1AY-2 and 1AY-4 were divided into top and bottom samples which were submitted for fusion digests and the following analyses: ICP, AT, GEA, and ^{90}Sr.

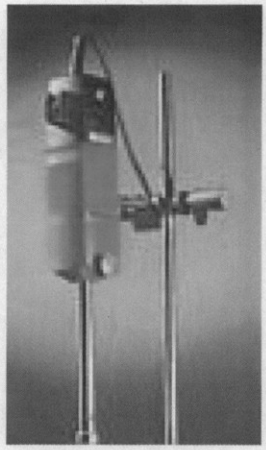

Figure 2-1. Ultra-Turrax® LaboratoryDisperser/Homogenizer

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2.3 COMPARISON TO MIXER PUMP

The Ultra-Turrax® Laboratory Disperser/Homogenizer uses rapidly rotating blades to draw the sample into the bottom of the shaft (see Figure 2-2). The action of centrifugal force then causes the sample to be discharged through slots along the perimeter of the shaft. For this study, the tissue homogenizer was operated at the minimum setting of 8,000 revolutions per minute (rpm) which equates to a blade tip speed of approximately 500 cm/s (16 ft/s).

As an example of a mixer pump, the pump installed in AZ-101 is a single-stage, centrifugal pump with a capacity of approximately 37,800 L/min (10,000 gpm) and a discharge velocity of 18.3 m/s (60 ft/s). The mixer pump operates on a similar principle as the tissue homogenizer, in that centrifugal force forces liquid to be drawn into the impeller and then out the discharge nozzle. The mixer pump has a 46 centimeter (18 inch) impeller which operates at 1,200 rpm. The blade tip speed at the impeller tip is 30 m/s (100 ft/s).

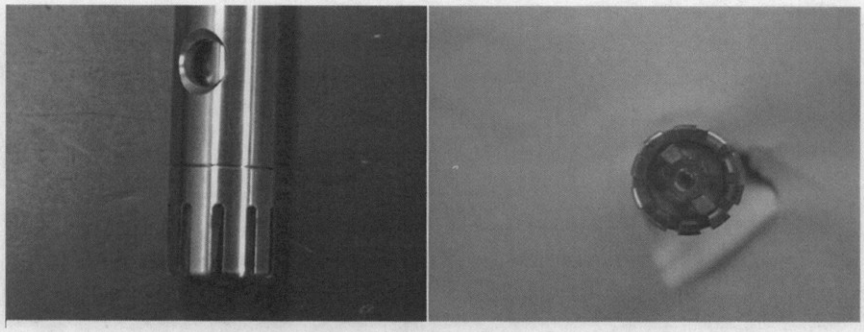


Figure 2-2. Tissue Homogenizer Shaft

The tissue homogenizer would be expected to have a greater mechanical shearing action (particle/metal surface interaction) than the mixer pump, largely because of the small distance between the rotating blades and the outer wall. In contrast to the tissue homogenizer, centrifugal pumps are specifically designed to provide a smooth path for slurry flow. One of the goals of pump designers is to extend pump life by minimizing the wear caused by particulates impacting the pump surfaces. Undoubtedly, a fraction of the particles would undergo mechanical shear on any given pass through the pump. This fraction would be expected to be quite low in comparison with the tissue homogenizer. The hydraulic (particle/liquid interaction) shear force, though, may be higher for the mixer pump than the tissue homogenizer due to the higher tip speed of the impeller blades in the mixer pump.

3.0 RESULTS OF ANALYTICAL MEASUREMENTS

3.1 SETTLING RATE MEASUREMENTS

All of the settling rate tests followed the classic sedimentation behavior pattern (Osborne 1990). To summarize the classic pattern, the initial well-mixed slurry separates into four zones. From top to bottom they are: (1) clear supernatant liquid, (2) suspended solids, (3) compressing sediment, and (4) compacted sediment. Normally (and in the current study), the only observable interface is between zones 1 and 2. The position of that interface as a function of time is recorded for all tests in Appendix A.

In the classic sedimentation test, there may or may not be an induction period during which little or no settling occurs. Then, once the zone 1/zone 2 interface develops, the interface falls at a linear rate as long as there is a zone 2 present in the cylinder. Eventually, zone 2 disappears, at which time the rate becomes non-linear until zone 3 also disappears. Then, when only clear supernatant liquid and compacted sediment (zones 1 and 4) remain, settling essentially stops.

Figure 3-1 shows the settling rate as a function of time for Test A, in which all four samples have not been sheared by the tissue homogenizer. (The four cylinders are essentially duplicate tests.) The position of the interface is recorded as Vol% Settled Solids for each cylinder. This figure shows that there was little or no induction period, the initial settling rate was nicely linear, and the reproducibility among the four cylinders was very good.

Figure 3-2 shows analogous data for Test B, in which two cylinders contain unsheared slurry and two cylinders contained slurry that had been sheared with the tissue homogenizer for 2 minutes each. The curves show a slight decrease in settling rates in the linear portion of the settling curves for the two sheared samples.

Figure 3-3 shows data for Test C, in which the two cylinders contain unsheared slurry and the two cylinders contain slurry that had been sheared with the tissue homogenizer for an additional 10 minutes each. The curves show a slight decrease in settling rates in the linear portion of the settling curves for the two sheared samples, however, the 1AY-2 unsheared sample also shows some sign that the stirring had a slowing effect on the settling rate.

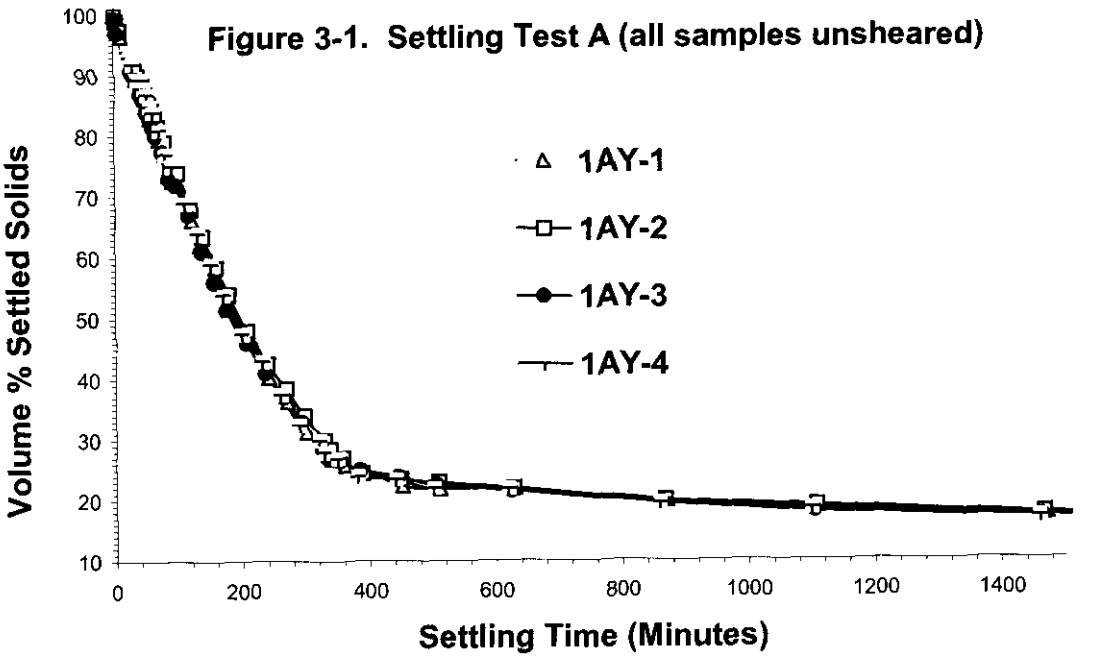


Figure 3-1. Settling Test A (all samples unsheared)
Volume % Settled Solids
Settling Time (Minutes)
1AY-1
1AY-2
1AY-3
1AY-4
100
90
80
70
60
50
40
30
20
10
0
200
400
600
800
1000
1200
1400

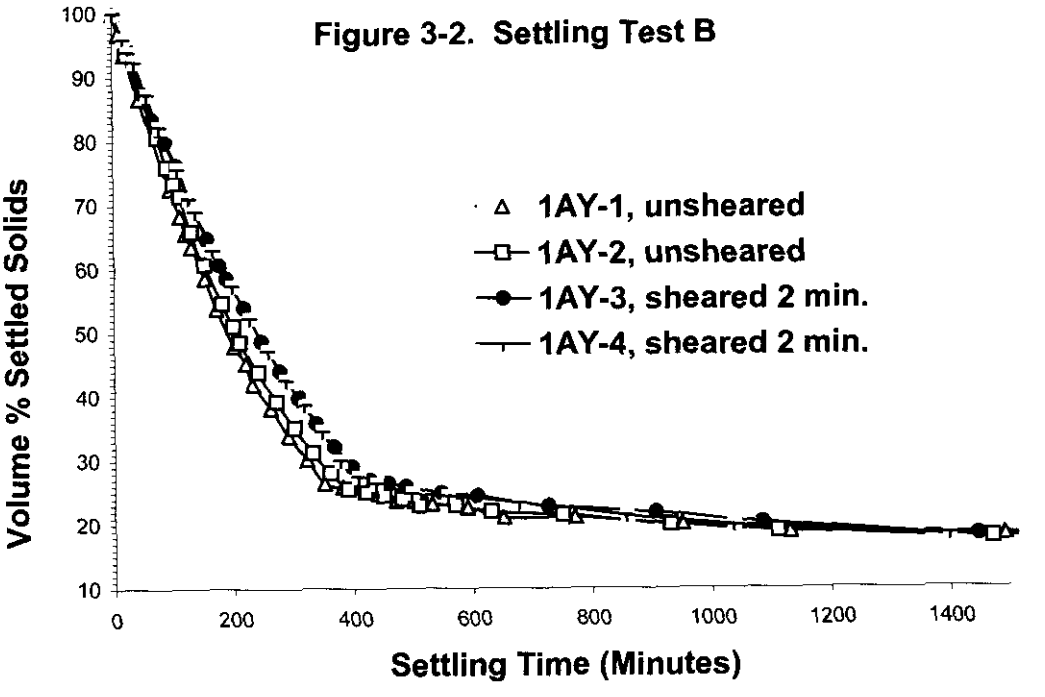
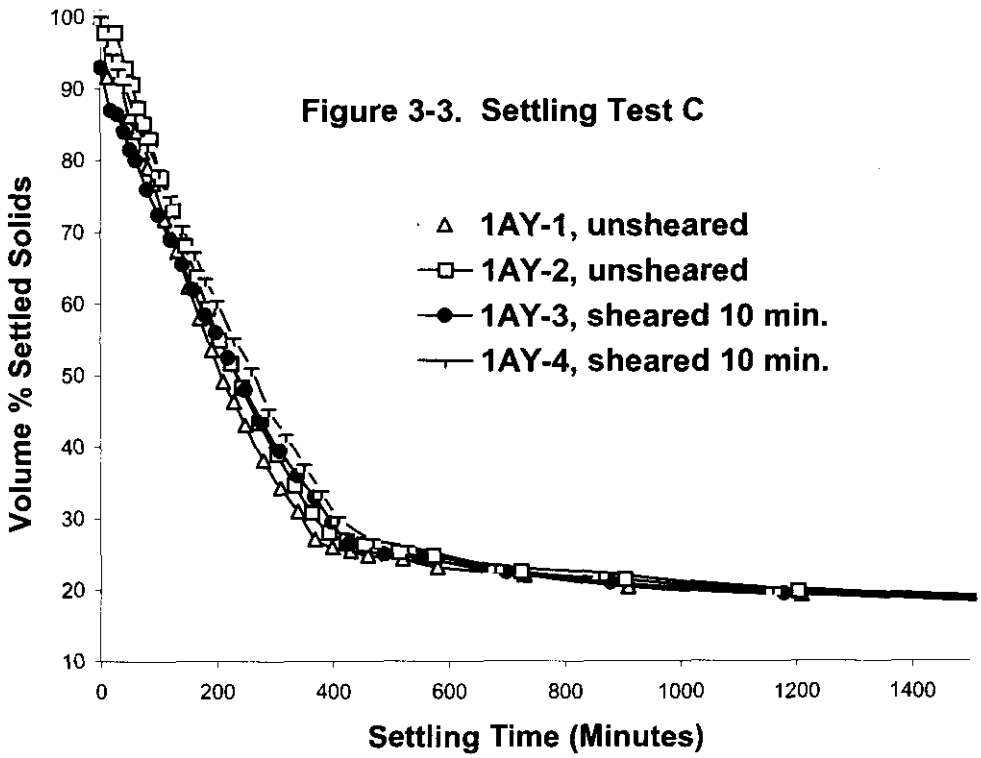


Figure 3-2. Settling Test B
Volume % Settled Solids
Settling Time (Minutes)
1AY-1, unsheared
1AY-2, unsheared
1AY-3, sheared 2 min.
1AY-4, sheared 2 min.
100
90
80
70
60
50
40
30
20
10
0
200
400
600
800
1000
1200
1400



Linear regression equations were fit to the raw volume data Volume % vs. time over the linear portions of the settling curves in Figure 3-1, 3-2 and 3-3. The slopes (rates) calculated from the regression equations are shown in Table 3-1. The effect of shear on the settling rate can also be seen by comparing the length of time needed to reach 50 volume percent settled solids. This point is within the linear portion of each settling curve, so it can be calculated from a regression equation fit to each set of data; results are shown in Table 3-1. As shown by repeated settling tests with the same sample, mixing with the stirrer/hotplate caused only a little shearing of particles or change in settling time to the unsheared sample, 1AY-1. Some decrease occurred in the unsheared sample, 1AY-2 after repeated settling tests. In contrast, shearing with the tissue homogenizer caused a significantly larger change in settling time as shown in Table 3-1.

In a prior settling study on AZ-102 sludge samples (Herting, 2000), the settling times to reach 50% settled solids for the unsheared solids were approximately 23 minutes compared to approximately 195 minutes for the AY-101 solids. Also, the effect of shearing on the AZ-102 solids was much more dramatic, going from approximately 23 minutes unsheared to 39-186 minutes sheared (approximately a 70–710% increase) compared to approximately 195 minutes unsheared to 241–265 minutes sheared (approximately a 24-36% increase) for the AY-101 solids to reach 50% settled solids.

All of the settling tests conducted in this study were performed in 100 mL graduated cylinders. In *The Settling and Compaction of Nuclear Waste Slurries* (MacLean 1999), the author evaluated the settling of tank waste simulant in several different sized vessels. The studies performed in 100 mL graduated cylinders were found to adequately represent the initial phase of rapid settling. The tests in 100 mL graduated cylinders failed to achieve the same degree of compaction observed in larger vessels.

Table 3-1. Settling Time and Rates at 50% Settled Solids.

		1AY-1	1AY-2	1AY-3	1AY-4
Test A Unsheared[1]	Settling Time to Reach 50% Settled Solids, (min.)	195	202	190	193
	Volume % Settling Rate, (Vol. %)/min.	-0.195[3]	-0.193	-0.185	-0.201
Test B Unsheared	Settling Time to Reach 50% Settled Solids, (min.)	193	206	---	---
	Volume % Settling Rate, (Vol. %)/min.	-0.208	-0.178	---	---
Test C Unsheared	Settling Time to Reach 50% Settled Solids, (min.)	211	236	---	---
	Volume % Settling Rate, (Vol. %)/min.	-0.197	-0.169	---	---
Test B Sheared[2] (2 min.)	Settling Time to Reach 50% Settled Solids, (min.)	---	---	241	243
	Volume % Settling Rate, (Vol. %)/min.	---	---	-0.159	-0.163
Test C Sheared (10 min.)	Settling Time to Reach 50% Settled Solids, (min.)	---	---	262	265
	Volume % Settling Rate, (Vol. %)/min.	---	---	-0.154	-0.150

[1]Unsheared means stirred gently with magnetic stirbar.
[2]Sheared means stirred with tissue homogenizer.
[3]Average %Error in settling rate is ~4%.

3.2 CENTIFUGED SOLIDS

After the conclusion of Test C, the unsheared column 1AY-1 and the sheared column 1AY-3 were prepared by decanting most of the supernatant from the solids and transferring the slurry with the settled solids into 50 mL centrifuge cones. The cones were then centrifuged for 30 minutes and the remaining supernatant was decanted. The volumes and weights were recorded and are shown in Table 3-2 along with the calculated densities of the centrifuged solids and supernatants.

Table 3-2. Volumes and Weights of Centrifuged Solids.

	Unsheared 1AY-1	Sheared 1AY-3
Volume of initial Sample, (mL)	27.0	32.5
Volume of Centrifuged Solids, (g)	11.0	10.0
Weight of Total Sample, (g)	34.157	40.825
Weight of Centrifuged Solids, (g)	16.617	15.906
Density of Supernatant, (g/mL)	1.10	1.11
Density of Centrifuged Solids, (g/mL)	1.51	1.59

The calculated density of the sheared sample of 1.59 g/mL implies that the smaller sheared particles pack together in a slightly more compact form upon centrifugation.

3.3 CHEMICAL COMPOSITION

Samples of settled solids were collected from the unsheared slurry (column 1AY-2 after Settling Test C) and the sheared slurry (column 1AY-4 after Settling Test C). The samples were gathered by dividing the material in each column into top and bottom portions. Prior to submitting the samples for analysis, the samples were allowed to settle and the excess supernatant liquid was removed. The samples were prepared for analysis by the fusion method, which uses nickel crucibles with the addition of potassium hydroxide. Consequently, nickel and potassium results were not reported. The other analytical results are presented in Table 3-4. All reported values are the average of duplicate results and all < values are the smallest of the duplicates.

For the sake of discussion, the analytes in Table 3-4 can be divided into two major categories (ignoring those with "less-than" values). Those analytes that are expected to exist primarily in the solid phase include Total Alpha (dominated by ^{241}Am), ^{90}Sr, Al, Cr, Fe, Mn, Si and Zr. Those analytes that are expected to exist primarily in the liquid phase include ^{137}Cs and Na. These analytes and the ratios of their concentrations in the bottom to the top, (Bottom:Top), portions of the settled solids samples are presented in Table 3-3.

Table 3-3. Ratios of Concentrations (Bottom:Top) for Settled Solids

Analyte	Ratio (Unsheared) Bottom:Top	Ratio (Sheared) Bottom:Top
Si (S)	2.7	1.7
Al (S)	2.6	1.7
Total Alpha (S)	2.3	1.6
Fe (S)	2.2	1.3
Mn (S)	2.1	1.2
^{90}Sr (S)	2.1	1.4
Cr (S)	1.8	1.4
Zr (S)	1.7[1]	1.9
Na (L)	1.3	1.3
^{137}Cs (L)	1.2	1.2
^{241}Am (S)	1.0[2]	1.5

[1] 70% Relative Percent Difference (RPD) between duplicates for bottom half.
[2] Suspect analytical result because of inconsistencies between ^{241}Am and Total Alpha results.
(S) Those analytes that are expected to exist primarily in the solid phase.
(L) Those analytes that are expected to exist primarily in the liquid phase.

The unsheared solids follow the expected pattern in comparing the top and bottom portions of the settled solids. The bottom portion is expected to contain somewhat less interstitial liquid than the top portion, so it should have somewhat higher concentrations of insoluble components and lower concentrations of soluble components. That is true for every one of the insoluble components listed above with a ratio (Bottom:Top) consistently ≥1.7, except for ^{241}Am with a ratio of 1.0. The soluble components also have ratios >1.0, but are significantly lower than the insoluble components, except for ^{241}Am.

The sheared solids followed the same general pattern but with lower ratios, 1.2-1.9, implying that there is more interstitial liquid in the bottom layer than in the unsheared sample. This behavior is consistent with results found for AZ-102 settling studies (Herting, 2000). The

soluble components are still lower than those for the insoluble portions as expected, but their ratios were unchanged by the shearing, remaining at 1.2-1.3.

The data imply the Al and Si solids settle more rapidly in both the unsheared and sheared slurries than the other solids and that all the solids materials settle less rapidly in the sheared slurry, (except for the ^{241}Am). Whatever property the solids have in the unsheared slurry (higher density, larger size?) that causes them to settle more rapidly is disrupted by the shearing action of the tissue homogenizer. The greatest effect of the shearing is seen on the Fe and Mn solids with the least effect seen on the Zr solids, however, some care should be taken with the Zr analyses since the relative percent differences (RPDs) for the duplicate samples are rather large. If one threw out the duplicate Zr analysis data, the ratios would be 2.1 and 1.9 which would be in line with other solids data. The data also imply that the Al and Si solids are either associated with each other or behave in a very similar manner in both settling and shearing properties. The Fe and Mn solids also behave as if they are either associated with each other or behave in a very similar manner.

Comparisons of the analytical results for the sheared and unsheared samples makes sense for the solid components from the standpoint that the sheared sample, which did not settle as well as the unsheared sample, should contain more interstitial liquid than the unsheared sample. Thus, for the bottom fractions, for example, the unsheared sample is higher in insoluble component concentrations, except for ^{241}Am and Zr. The Soluble components Na and ^{137}Cs do not fit this model since the ratios are the same in the unsheared and sheared samples and are >1.0 in both cases. This behavior implies that Na and ^{137}Cs are present at significant concentrations in the solid as well as the liquid phases. Since the solids are high in both Al and Si, the presence of aluminosilicate minerals, such as cancrinite or zeolite, in the solid phase may be possible which may contain Na and ^{137}Cs (Campbell, 1976). The behavior of the ^{241}Am (ratios 1.0 and 1.5), which would usually be expected to follow the Total Alpha (ratios 2.3 and 1.6) behavior and to be associated with the solids, does not. This behavior is inconsistent and may indicate problems with the ^{241}Am analyses.

Table 3-4. Composition of Unsheared and Sheared Settled Solids

Analyte	Unit	Unsheared Settled Solids (Top Portion)	Unsheared Settled Solids (Bottom Portion)	Sheared Settled Solids (Top Portion)	Sheared Settled Solids (Bottom Portion)
Alpha	µCi/g	3.57e+00	8.14e+00	8.83e+00	1.39e+01
Cobalt-60	µCi/g	<1.40e+00	2.99e-01	<3.09e+00	<3.46e+00
Strontium-89/90	µCi/g	7.39e+02	1.55e+03	1.93e+03	2.74e+03
Antimony-125	µCi/g	<3.61e+00	<2.99e-01	<6.89e+00	<7.65e+00
Cesium-137	µCi/g	9.88e+01	1.23e+02	1.08e+02	1.32e+02
Europium-154	µCi/g	<3.92e+00	3.82e+00	<7.77e+00	<1.01e+01
Europium-155	µCi/g	<1.46e+00	1.92e+00	<3.19e+00	<3.62e+00
Americium-241	µCi/g	6.17e+00	6.09e+00	1.37e+01	2.04e+01
Silver	µg/g	<1.98e+02	3.58e+02	2.30e+02	5.31e+02
Aluminum	µg/g	8.57e+03	2.21e+04	2.39e+04	3.95e+04
Arsenic	µg/g	<1.98e+03	<2.09e+03	<2.07e+03	<2.16e+03
Boron	µg/g	<9.92e+02	<1.05e+03	<1.03e+03	<1.08e+03
Barium	µg/g	<9.92e+02	<1.05e+03	<1.03e+03	<1.08e+03
Beryllium	µg/g	<9.92e+01	<1.05e+02	<1.03e+02	<1.08e+02
Bismuth	µg/g	<1.98e+03	<2.09e+03	<2.07e+03	<2.16e+03
Calcium	µg/g	<1.98e+03	<2.09e+03	<2.07e+03	<2.16e+03
Cadmium	µg/g	<99.2e+01	<1.05e+02	<1.03e+02	<1.08e+02
Cerium	µg/g	<1.98e+03	<2.09e+03	<2.07e+03	<2.16e+03
Cobalt	µg/g	<3.97e+02	<4.19e+02	<4.14e+02	<4.31e+02
Chromium	µg/g	5.35e+02	9.55e+02	1.05e+03	1.47e+03
Copper	µg/g	<1.98e+02	<2.09e+02	<2.07e+02	<2.16e+02
Europium	µg/g	<1.98e+03	<2.09e+03	<2.07e+03	<2.16e+03
Iron	µg/g	1.26e+04	2.82e+04	3.59e+04	4.57e+04
Lanthanum	µg/g	<9.92e+02	<1.05e+03	<1.03e+03	<1.08e+03
Lithium	µg/g	<1.98e+02	<2.09e+02	<2.07e+02	<2.16e+02
Magnesium	µg/g	<1.98e+03	<2.09e+03	<2.07e+03	<2.16e+03
Manganese	µg/g	7.26e+02	1.51e+03	2.02e+03	2.39e+03
Molybdenum	µg/g	<9.92e+02	<1.05e+03	<1.03e+03	<1.08e+03
Sodium	µg/g	5.68e+04	7.16e+04	6.16e+04	7.79e+04
Neodymium	µg/g	<1.98e+03	<2.09e+03	<2.07e+03	<2.16e+03
Phosphorus	µg/g	<3.97e+03	<4.19e+03	<4.14e+03	<4.31e+03
Lead	µg/g	<1.98e+03	<2.09e+03	<2.07e+03	<2.16e+03
Sulfur	µg/g	2.14e+03	2.18e+03	<2.07e+03	<2.16e+03
Antimony	µg/g	<1.19e+03	<1.26e+03	<1.24e+03	<1.29e+03
Selenium	µg/g	<1.98e+03	<2.09e+03	<2.07e+03	<2.16e+03
Silicon	µg/g	1.40e+03	3.77e+03	3.51e+03	5.99e+03
Samarium	µg/g	<1.98e+03	<2.09e+03	<2.07e+03	<2.16e+03
Strontium	µg/g	<198e+02	<2.09e+02	<2.07e+02	<2.16e+02
Thorium	µg/g	<1.98e+03	<2.09e+03	<2.07e+03	<2.16e+03
Titanium	µg/g	<1.98e+02	<2.09e+02	<2.07e+02	<2.16e+02
Thallium	µg/g	<3.97e+03	<4.19e+03	<4.14e+03	<4.31e+03
Uranium	µg/g	<4.96e+03	<5.24e+03	<5.17e+03	<5.39e+03
Vanadium	µg/g	<9.92e+02	<1.05e+03	<1.03e+03	<1.08e+03
Yttrium	µg/g	<1.98e+02	<2.09e+02	<2.07e+02	<2.16e+02
Zinc	µg/g	<1.98e+02	<2.09e+02	<2.07e+02	<2.16e+02
Zirconium	µg/g	7.01e+02	1.17e+03	1.19e+03	2.21e+03

3.4 PARTICLE SIZE DISTRIBUTION

A particle size sample was taken from the AY-101 composite slurry before settling and shear testing and one from the1AY-3 test after settling and shear testing. The particle size distribution (PSD) measurements were performed on the Horiba LA-910 Particle Size Analyzer.

The unsheared and sheared samples were both run in four different instrument conditions:

(1) agitator pump on setting 1,
(2) agitator pump on setting 3,
(3) after 2 minutes of sonication with agitator setting 3 and
(4) agitator pump setting 1.

The PDS data are presented in Appendix B. Both the volume-based and number-based PSD data are presented. However, since just a few large particles either present or not present have a very large influence on the volume-based PSD and very little influence on the number-based PSD, the number based PSD is much easier to interpret.

Table 3-5 shows the mean particle diameter of the unsheared and sheared samples measured with the four different instrument settings. The diameter is the average of the duplicate measurements.

Table 3-5. Effect of Shearing on Particle Diameter.

Instrumental Conditions		Unsheared	Sheared	
Agitator Pump Setting	Sonicated	Avg. Mean Particle Diameter, μm	Avg. Mean Particle Diameter, μm	% Change
1	No	1.07	0.95	-12.%
3	No	1.03	0.93	-10.%
3	Yes	0.89	0.87	-2.8%
1	Yes	0.90	0.87	-3.4%

The data show a 10-12% decrease in diameter after shearing with the tissue homogenizer. After 2 minutes of sonication, the difference is only ~3%. The agitator pump setting had little effect on the particle diameter.

What the data seem to indicate is that tissue homogenization and sonication accomplish nearly the same result. This suggests that both are breaking up agglomerated particles rather than shearing homogeneous solid particles.

To test the consistency between the observed decrease in the mean particle diameter and the decrease in the settling velocity, the following relationship for a slowly free falling particle in a liquid may be written (Perry & Green):

$$\frac{v_u}{v_s} = \frac{D_u^2}{D_s^2} \qquad \text{or solving for } v_s\text{:} \qquad v_s = \frac{v_u \times D_s^2}{D_u^2}$$

where: v_s = settling velocity of the sheared particles,
v_u = settling velocity of the unsheared particles,

D_s = mean diameter of sheared particles, and
D_u = mean diameter of unsheared particles.

Using the values determined by PSD for D_s (after Test C) and D_u (before Test A) from Table 3-5 and the value for v_u determined from the settling test from Table 3-1, then:

$$v_s = \frac{-0.195 \times 0.95^2}{1.07^2} = -0.154\ (Vol\%)/\min.$$

which is equal to the value for the settling velocity determined for the 1AY-3 sample after shearing (Test C), Table 3-1. This result clearly indicates that the AY-101 composite solids settle at a rate proportional to the square of their mean particle diameters.

4.0 ACKNOWLEDGEMENTS

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APPENDIX A

SETTLING DATA

Settling Test A
(Volume represents position of interface between clear supernatant liquid and settling solids)

		1AY-1			1AY-2			1AY-3			1AY-4		
Date	Time	Elapsed Time (min.)	Volume (mL)	Volume %	Elapsed Time (min.)	Volume (mL)	Volume %	Elapsed Time (min.)	Volume (mL)	Volume %	Elapsed Time (min.)	Volume (mL)	Volume %
8/28/01	10:31	0	100.5	100.0	---	---	---	---	---	---	---	---	---
	10:34	3	98.5	98.0	0	100.0	100.0	---	---	---	---	---	---
	10:37	6	98.0	97.5	3	99.0	99.0	0	99.5	100.0	---	---	---
	10:42	11	97.0	96.5	8	97.5	97.5	5	97.0	97.5	0	100.5	100.0
	11:04	33	90.0	89.6	30	91.5	91.5	27	90.5	91.0	22	94.0	93.5
	11:07	36	90.0	89.6	33	91.0	91.0	30	90.0	90.5	25	93.0	92.5
	11:12	41	89.5	89.1	38	90.0	90.0	35	89.5	89.9	30	92.0	91.5
	11:17	46	87.5	87.1	43	88.5	88.5	40	87.0	87.4	35	89.5	89.1
	11:22	51	85.5	85.1	48	87.0	87.0	45	86.0	86.4	40	89.5	89.1
	11:27	56	83.5	83.1	53	85.5	85.5	50	84.0	84.4	45	88.0	87.6
	11:32	61	83.0	82.6	58	84.5	84.5	55	83.0	83.4	50	87.0	86.6
	11:37	66	82.0	81.6	63	83.0	83.0	60	81.5	81.9	55	85.0	84.6
	11:42	71	80.0	79.6	68	81.5	81.5	65	80.0	80.4	60	84.0	83.6
	11:52	81	77.5	77.1	78	79.0	79.0	75	77.5	77.9	70	81.0	80.6
	12:02	91	73.0	72.6	88	74.5	74.5	85	73.0	73.4	80	77.0	76.6
	12:12	101	72.5	72.1	98	74.0	74.0	95	72.0	72.4	90	75.0	74.6
	12:32	121	66.5	66.2	118	68.0	68.0	115	67.0	67.3	110	69.0	68.7
	12:52	141	62.0	61.7	138	63.5	63.5	135	61.0	61.3	130	64.0	63.7
	13:12	161	57.0	56.7	158	58.5	58.5	155	56.0	56.3	150	59.0	58.7
	13:32	181	52.0	51.7	178	54.0	54.0	175	51.5	51.8	170	54.0	53.7
	14:02	211	47.0	46.8	208	48.0	48.0	205	46.0	46.2	200	47.5	47.3
	14:32	241	40.5	40.3	238	42.5	42.5	235	41.0	41.2	230	43.0	42.8
	15:02	271	36.5	36.3	268	38.5	38.5	265	37.0	37.2	260	37.5	37.3
	15:32	301	31.5	31.3	298	34.0	34.0	295	33.0	33.2	290	32.5	32.3
	16:02	331	29.0	28.9	328	30.0	30.0	325	28.5	28.6	320	30.0	29.9
	16:11	340	27.0	26.9	337	28.5	28.5	334	27.0	27.1	329	28.0	27.9
	16:32	361	26.0	25.9	358	27.0	27.0	355	26.5	26.6	350	27.0	26.9
	17:02	391	25.0	24.9	388	24.5	24.5	385	25.0	25.1	380	24.0	23.9
	18:02	451	22.5	22.4	448	23.5	23.5	445	24.0	24.1	440	23.5	23.4
	19:02	511	22.0	21.9	508	23.0	23.0	505	22.5	22.6	500	22.0	21.9
	21:01	630	22.0	21.9	627	22.0	22.0	624	21.5	21.6	619	22.0	21.9

		1AY-1			1AY-2			1AY-3			1AY-4		
Date	Time	Elapsed Time (min.)	Volume (mL)	Volume %	Elapsed Time (min.)	Volume (mL)	Volume %	Elapsed Time (min.)	Volume (mL)	Volume %	Elapsed Time (min.)	Volume (mL)	Volume %
8/29/01	1:01	870	20.0	19.9	867	20.0	20.0	864	19.5	19.6	859	19.5	19.4
	5:01	1110	19.0	18.9	1107	19.0	19.0	1104	18.0	18.1	1099	18.5	18.4
	11:01	1470	17.5	17.4	1467	17.5	17.5	1464	17.0	17.1	1459	17.0	16.9
	13:56	1645	17.5	17.4	1642	17.0	17.0	1639	17.0	17.1	1634	17.0	16.9
	17:00	1829	17.5	17.4	1826	17.0	17.0	1823	17.0	17.1	1818	17.0	16.9
	23:00	2189	17.5	17.4	2186	17.0	17.0	2183	17.0	17.1	2178	17.0	16.9
8/30/01	8:02	2731	17.0	16.9	2728	17.0	17.0	2725	16.5	16.6	2720	16.5	16.4
	10:59	2908	17.0	16.9	2905	17.0	17.0	2902	16.5	16.6	2897	16.5	16.4
	22:58	3627	17.0	16.9	3624	17.0	17.0	3621	16.5	16.6	3616	16.0	15.9
8/31/01	10:58	4347	17.0	16.9	4344	17.0	17.0	4341	16.5	16.6	4336	16.0	15.9
9/1/01	10:56	4345	17.0	16.9	4342	17.0	17.0	4339	16.5	16.6	4334	16.0	15.9
9/2/01	10:55	5784	17.0	16.9	5781	17.0	17.0	5778	16.5	16.6	5773	16.0	15.9
9/3/01	10:53	5782	17.0	16.9	5779	17.0	17.0	5776	16.5	16.6	5771	16.0	15.9
9/4/01	9:35	7144	17.0	16.9	7141	17.0	17.0	7138	16.5	16.6	7133	16.0	15.9

Settling Test B
(Volume represents position of interface between clear supernatant liquid and settling solids)

		1AY-1			1AY-2			1AY-3			1AY-4		
Date	Time	Elapsed Time (min.)	Volume (mL)	Volume %	Elapsed Time (min.)	Volume (mL)	Volume %	Elapsed Time (min.)	Volume (mL)	Volume %	Elapsed Time (min.)	Volume (mL)	Volume %
9/4/01	10:30	0	93.0	100.0	---	---	---	---	---	---	---	---	---
	10:39	9	90.0	96.8	---	---	---	---	---	---	---	---	---
	10:50	20	87.0	93.5	---	---	---	---	---	---	---	---	---
	10:51	21	87.0	93.5	0	98.0	100.0	---	---	---	---	---	---
	11:14	44	80.5	86.6	23	92.0	93.9	0	96.5	100.0	---	---	---
	12:04	94	67.5	72.6	73	79.0	80.6	50	84.5	87.6	0	98.5	100.0
	12:21	111	63.5	68.3	90	74.5	76.0	67	80.5	83.4	17	94.5	95.9
	12:31	121	61.0	65.6	100	72.0	73.5	77	79.0	81.9	27	92.5	93.9
	12:41	131	59.0	63.4	110	70.0	71.4	87	77.0	79.8	37	91.0	92.4
	13:01	151	54.5	58.6	130	64.5	65.8	107	73.5	76.2	57	86.0	87.3
	13:21	171	50.0	53.8	150	59.5	60.7	127	68.5	71.0	77	81.0	82.2
	13:51	201	44.5	47.8	180	53.5	54.6	157	62.5	64.8	107	74.5	75.6
	14:10	220	42.0	45.2	199	50.0	51.0	176	58.5	60.6	126	70.0	71.1
	14:21	231	39.0	41.9	210	47.5	48.5	187	56.5	58.5	137	68.0	69.0
	14:51	261	35.5	38.2	240	43.0	43.9	217	52.0	53.9	167	62.0	62.9
	15:21	291	31.5	33.9	270	38.5	39.3	247	47.0	48.7	197	56.5	57.4
	15:51	321	28.0	30.1	300	34.5	35.2	277	42.5	44.0	227	51.5	52.3
	16:21	351	24.5	26.3	330	30.5	31.1	307	38.5	39.9	257	46.5	47.2
	16:51	381	24.0	25.8	360	27.5	28.1	337	34.5	35.8	287	42.0	42.6
	17:21	411	24.0	25.8	390	25.0	25.5	367	31.0	32.1	317	38.0	38.6
	17:51	441	23.0	24.7	420	24.5	25.0	397	28.0	29.0	347	34.0	34.5
	18:21	471	22.0	23.7	450	24.0	24.5	427	26.0	26.9	377	29.5	29.9
	18:51	501	22.0	23.7	480	23.5	24.0	457	25.5	26.4	407	27.0	27.4
	19:21	531	21.5	23.1	510	22.5	23.0	487	25.0	25.9	437	26.0	26.4
	20:21	591	21.0	22.6	570	22.5	23.0	547	24.0	24.9	497	24.5	24.9
	21:21	651	19.5	21.0	630	21.5	21.9	607	23.5	24.4	557	24.0	24.4
	23:21	771	19.5	21.0	750	21.0	21.4	727	22.0	22.8	677	23.0	23.4
9/5/01	2:21	951	18.5	19.9	930	19.5	19.9	907	21.0	21.8	857	21.0	21.3
	5:20	1130	17.5	18.8	1109	18.5	18.9	1086	19.5	20.2	1036	19.5	19.8
	11:20	1490	17.0	18.3	1469	17.5	17.9	1446	17.5	18.1	1396	18.0	18.3
	17:20	1850	16.0	17.2	1829	17.0	17.3	1806	17.5	18.1	1756	17.5	17.8

		1AY-1			1AY-2			1AY-3			1AY-4		
Date	Time	Elapsed Time (min.)	Volume (mL)	Volume %	Elapsed Time (min.)	Volume (mL)	Volume %	Elapsed Time (min.)	Volume (mL)	Volume %	Elapsed Time (min.)	Volume (mL)	Volume %
9/6/01	5:24	2574	16.0	17.2	2553	17.0	17.3	2530	17.0	17.6	2480	16.5	16.8
	17:23	3293	16.0	17.2	3272	17.0	17.3	3249	17.0	17.6	3199	16.5	16.8
9/7/01	5:23	4013	16.0	17.2	3992	17.0	17.3	3969	16.5	17.1	3919	16.5	16.8
	17:22	4732	16.0	17.2	4711	17.0	17.3	4688	16.5	17.1	4638	16.5	16.8
9/8/01	17:20	6170	16.0	17.2	6149	17.0	17.3	6126	16.5	17.1	6076	16.5	16.8
9/9/01	17:24	7614	16.0	17.2	7593	16.5	16.8	7570	16.5	17.1	7520	16.0	16.2
9/10/01	9:11	8561	16.0	17.2	8540	16.5	16.8	8517	16.5	17.1	8467	16.0	16.2

Settling Test C
(Volume represents position of interface between clear supernatant liquid and settling solids)

		1AY-1			1AY-2			1AY-3			1AY-4		
Date	Time	Elapsed Time (min.)	Volume (mL)	Volume %	Elapsed Time (min.)	Volume (mL)	Volume %	Elapsed Time (min.)	Volume (mL)	Volume %	Elapsed Time (min.)	Volume (mL)	Volume %
9/12/01	13:50	0	90.5	100.0	---	---	---	---	---	---	---	---	---
	13:56	6	88.5	97.8	0	91.0	100.0	---	---	---	---	---	---
	14:02	12	83.0	91.7	6	89.0	97.8	---	---	---	---	---	---
	14:21	31	83.0	91.7	25	89.0	97.8	0	93.0	100.0	---	---	---
	14:40	50	78.0	86.2	44	84.5	92.9	19	87.0	93.5	0	96.0	100.0
	14:51	61	76.0	84.0	55	82.5	90.7	30	86.5	93.0	11	93.0	96.9
	15:01	71	73.5	81.2	65	79.5	87.4	40	84.0	90.3	21	91.0	94.8
	15:11	81	71.5	79.0	75	77.5	85.2	50	81.5	87.6	31	89.0	92.7
	15:21	91	69.6	76.9	85	75.5	83.0	60	80.0	86.0	41	87.0	90.6
	15:41	111	65.0	71.8	105	70.5	77.5	80	76.0	81.7	61	83.0	86.5
	16:01	131	61.0	67.4	125	66.5	73.1	100	72.5	78.0	81	79.0	82.3
	16:21	151	56.5	62.4	145	62.0	68.1	120	69.0	74.2	101	75.5	78.6
	16:41	171	52.5	58.0	165	58.0	63.7	140	65.5	70.4	121	72.0	75.0
	17:01	191	48.5	53.6	185	54.0	59.3	160	62.0	66.7	141	68.0	70.8
	17:21	211	44.5	49.2	205	50.0	54.9	180	58.5	62.9	161	64.5	67.2
	17:40	230	42.0	46.4	224	47.0	51.6	199	56.0	60.2	180	61.0	63.5
	18:00	250	39.0	43.1	244	44.0	48.4	219	52.5	56.5	200	58.0	60.4
	18:30	280	34.5	38.1	274	39.5	43.4	249	48.0	51.6	230	53.0	55.2
	19:00	310	31.0	34.3	304	35.5	39.0	279	43.5	46.8	260	49.0	51.0
	19:30	340	28.0	30.9	334	31.5	34.6	309	39.5	42.5	290	43.5	45.3
	20:00	370	24.5	27.1	364	28.0	30.8	339	36.0	38.7	320	40.0	41.7
	20:30	400	23.5	26.0	394	25.5	28.0	369	33.0	35.5	350	36.0	37.5
	21:00	430	23.0	25.4	424	24.5	26.9	399	29.5	31.7	380	32.5	33.9
	21:30	460	22.5	24.9	454	24.0	26.4	429	26.5	28.5	410	29.0	30.2
	22:30	520	22.0	24.3	514	23.0	25.3	489	25.0	26.9	470	26.0	27.1
	23:30	580	21.0	23.2	574	22.5	24.7	549	24.5	26.3	530	25.0	26.0
9/13/01	2:00	730	20.0	22.1	724	20.5	22.5	699	22.5	24.2	680	22.5	23.4
	5:00	910	18.5	20.4	904	19.5	21.4	879	21.0	22.6	860	21.5	22.4
	10:00	1210	17.5	19.3	1204	18.0	19.8	1179	19.5	21.0	1160	19.5	20.3
	22:04	1934	16.5	18.2	1928	17.0	18.7	1903	17.5	18.8	1884	17.5	18.2
9/14/01	10:03	2653	16.0	17.7	2647	16.5	18.1	2622	17.0	18.3	2603	16.5	17.2

	22:02	3372	16.0	17.7	3366	16.5	18.1	3341	16.5	17.7	3322	16.5	17.2
9/15/01	10:02	4092	16.0	17.7	4086	16.5	18.1	4061	16.5	17.7	4042	16.5	17.2
9/16/01	10:00	5530	16.0	17.7	5524	16.5	18.1	5499	16.5	17.7	5480	16.5	17.2
9/17/01	9:22	6932	16.0	17.7	6926	16.5	18.1	6901	16.0	17.2	6882	16.0	16.7
	10:04	6974	16.0	17.7	8408	16.5	18.1	8383	16.0	17.2	8364	16.0	16.7
9/18/01	10:42	8452	16.0	17.7	8446	16.5	18.1	8421	16.0	17.2	8402	16.0	16.7
9/19/01	9:45	8395	16.0	17.7	9829	16.5	18.1	9804	16.0	17.2	9785	16.0	16.7

APPENDIX B

Particle Size Distribution Data

Fluor Hanford
P. O. Box 1000
Richland, WA 99352

FLUOR

Memorandum

To:	R. W. Warrant	T6-07	Date:	B3610-JBD-01-032 November 14, 2001
From:	James B. Duncan JBD	T6-07	Telephone:	373-1972
cc:	D. B. Bechtold	T6-07		
	W.S. Callaway	T6-07		
	L. L. Lockrem	T6-07		
	J. K. Watts	T6-50		
	W. I. Winters	T6-07		
	JBD File/LB			

Subject: PARTICLE SIZE DISTRIBUTION MEASUREMENT RESULTS: TANK 241-AY-101 SLUDGE SHEAR STUDY

This letter reports the results of particle size distribution analysis of two samples: S01T001871 and S01T001874 from tank 241-AY-101 sludge composite S01T001312. Sample S01T001871 was taken directly from the composite S01T001312. Sample S01T001874 was taken from subsample 1AY-3 which was subjected to two cycles of homogenization and settling.

INSTRUMENTATION

The particle size distribution (PSD) measurements were performed using the Horiba LA-910 Particle Size Analyzer located in Hood 2 of Room 1F, 222-S Laboratory. The LA-910 is a light-scattering type of instrument, which determines the PSD of an ensemble of particles by evaluating the pattern of light scattering generated by the particle ensemble. The instrument is configured to measure particles with volume equivalent diameters ranging from 0.02 μm to 1020 μm.

All samples were measured using the Horiba "Flow Cell" configuration. The flow-through configuration consists of a sample loop from the sample reservoir (with adjustable agitator), adjustable speed peristaltic pump, and flow through sample cell, with return to the sample reservoir. Tygon tubing was used to transport the sample.

MEASUREMENTS

The PSD measurements were made October 4, 2001. Filtered reagent grade water was used as the dispersing liquid for all sample measurements. The measurements were made at laboratory ambient temperature, ~ 25 C.

The PSD measurement sequence was made as follows:

1. Reagent grade water (170 mL) was transferred to the sample reservoir.
2. The peristaltic pump was started at setting 3 (388 mL/min) to eliminate air in the sample loop, when the measure screen was blank, the pump was increased to setting 6 (840 mL/min); all runs were carried out at this pump setting.
3. The sample was sparged with a polypropylene transfer pipette (2 mm tip ID) to ensure mixing.
4. The agitator was turned to setting 1.
5. The sample was sparged just prior to being added drop-wise into the sample reservoir until the percent transmission was judged acceptable.
6. After completion of the measurement cycle, the file was named and saved.
7. With the same sample in the reservoir, the agitator was adjusted to setting 3. After a wait period of 10 seconds for sample dispersion throughout the flow loop, the measurement cycle was begun.
8. Upon completion of the measurement cycle, the file was named and saved.
9. With the same 2 minutes, the sonication was turned off following a wait period of 10 seconds, and then the measurement cycle was begun (agitator setting 3).
10. After completion of the measurement cycle, the file was named and saved.
11. The agitator was set at 1 with a wait period of 10 seconds, and then the measurement cycle was activated.
12. After completion of the measurement cycle, the file was named and saved.
13. The sample was then flushed into a receiving vessel.
14. The flow cell and loop were washed with reagent grade water and the baseline reestablished.
15. The next sample was introduced and the sequence repeated.

The measurement sequence was repeated with a "duplicate" sample from the original sample vial.

All PSD measurement runs were made with 100 data samplings resulting in a total measurement time of approximately 2 minutes.

SAMPLES

All measured samples were taken from tank 241-AY-101 sludge shear study samples S01T001871 and S01T001874. Sample S01T001871 was a direct sub sample from tank 241-AY-101 TFA composite S01T001312 while sample S01T001874 had undergone two shear and settling cycles.

Sample identification information is provided in Table 1.

TABLE 1. Sample Identification Information

SAMPLE	LAB ID #	PSD RUN # / FILE NAME
AY-101 Sludge TFA Composite S01T001312	S01T001871 (Primary)	11004193
		11004194
		11004195
		11004196
	S01T001871 (Duplicate)	11004197
		11004198
		11004199
		11004200
AY-101 Sludge TFA Composite S01T001312 1AY-3 (Homogenized)	S01T001874 (Primary)	11004201
		11004202
		11004203
		11004204
	S01T001874 (Duplicate)	11004205
		11004206
		11004207
		11004208

Initial observations of the samples immediately prior to and during the withdrawal of the primary PSD measurement aliquot are presented in Table 2; both samples were similar in appearance and texture.

TABLE 2. Initial Sample Observations

SAMPLE	LAB ID #	OBSERVATIONS
AY-101 Sludge TFA Composite S01T001312	S01T001871	Dark brown in appearance, ~ 1.5 mL solids with ~ 5mL liquid cover. The material was smooth, no grit and no clumps observed.
AY-101 Sludge TFA Composite S01T0013121 AY-3 (Homogenized)	S01T001874	Dark brown in appearance, ~ 1.5 mL solids with ~ 5mL liquid cover. The material was smooth, no grit and no clumps observed.

RESULTS

The Horiba LA-910 directly generates spherical volume equivalent particle diameters from analysis of light-scattering patterns. The particle volume based distribution data should be considered the primary results. Instrument software allows the PSD data to be presented as a number (of particles counted) based distribution. This is accomplished by a machine algorithm, which multiplies the frequency value assigned to each volume based PSD bin by the reciprocal of

the (volume equivalent diameter)^3. Re-normalizing the resulting distribution then follows. At customer request, both the volume based and the number based PSD data are presented.

PSD VOLUME DISTRIBUTION VERSUS NUMBER DISTRIBUTION

PSD distributions are predicated on spherical particles. Machine algorithms will incorporate shape factors as a function of scattering parameters. However, the reported volume or number diameter is that of an equivalent sphere.

For the PSD volume distribution (if density is known this then becomes the mass distribution), the mean volume is expressed as:

$$\bar{d}_v = ((\sum n_i d_i^3)/\sum n_i)^{1/3} \quad (1)$$

where n_i is the number of particles in group i having midpoint diameter d_i .

The arithmetic mean is expressed as:

$$\bar{d} = \sum n_i d_i / \sum n_i \quad (2)$$

Using the Horbia LA-910, the measurement is performed by n number of detectors. The resulting distribution is obtained using:

$$g(N) = \sum_{i=1}^{n} K(n,d_i) f(d_i) \Delta d \quad (3)$$

where $g(N)$ = output of nth detector
$K(n,d_i)$ = response coefficient of nth detector
$f(d_i)$ = particle size distribution
d_i = *ith* representative radius
Δd = particle size segment number

The particle size distribution d_i is calculated from the relationship between the output of the detector and the response function of the detector; $f(d_i)$ is calculated on the basis of volume.

To recalculate the volume distribution to a number distribution, equation 4 applies:

$$\bar{d}_n = (f(d_i)/d_i^3)/\sum_{i=1}^{m}(f(d_i)/d_i^3) \quad (4)$$

where $f(d_i)$ is the frequency distribution of d_i.

For a discrete example, consider two particles--one is measured at 200 μm and has a frequency of 6.19 and the other is measured at 1.98 μm with a frequency of 1.33; then the recalculation to the number distribution from the volume distribution will be:

$6.19/(200)^3 = 7.7E-07$ (a very small number which is truncated by the Horbia LA-910 algorithm during renormalization.)

$1.33/(1.98)^3 = 0.17$ (a number that will be included in the recalculated distribution.

After the Horbia algorithm recalculates, truncates, and renormalizes the number distribution from the volume distribution, the larger volume particles do not appear in the number distribution due to the smaller number assigned in the renormalized distribution.

Hence both distributions are correct. If the concern is around particles entering a clean room, then the number distribution is needed, as one particle will/may cause a defect. If, however, the concern is around pumping material, then the volume distribution is needed (correlated to density) to allow appropriate hydraulic and pump calculations to be made. Furthermore, if the concern is around catalyst research, then a surface distribution would be of interest. Therefore, the intended use of the data will drive the distribution presentation.

DATA

Table 3 presents the measured volume and number based mean, volume equivalent, particle diameters for S01T001871 and S01T001874 for both the primary and duplicate runs. The data is graphically presented in Figures 1 and 2.

The percentages, on a particulate volume basis, of particles in each sample with measured (spherical) volume equivalent diameters less than a set of seven, preset; percentage values are presented in Table 4 and displayed graphically in Figure 3.

The data presented in Table 5 and Figure 4 are the percent undersize recalculated on a number of number basis.

The instrument generated PSD histograms, percent undersize curves, and original (79 channel) PSD data tables are presented in Attachments 1 and 2. Attachment 1 contains the volume distribution while Attachment 2 contains the recalculated number distribution.

TABLE 3. Mean, volume equivalent, particle diameters of samples from tank 241-AY-101

Sample	File ID	Distribution Base			
		Volume		Number	
		Mean Diameter (μm)	Std. Dev. (μm)	Mean Diameter (μm)	Std. Dev. (μm)
S01T001871					
S01T0001871	11004193	41.21	57.10	1.08	0.80
	11004194	48.09	59.18	1.02	0.76
	11004195	27.20	37.81	0.89	0.59
	11004196	26.23	37.41	0.90	0.59
	S01T001871 Duplicate Runs				
	11004197	20.26	34.46	1.05	0.76
	11004198	70.17	82.65	1.04	0.76
	11004199	30.35	39.83	0.89	0.58
	11004200	12.87	15.77	0.89	0.57
S01T0001874					
S01T0001874	11004201	6.95	6.00	0.94	0.53
	11004202	70.25	81.25	0.93	0.52
	11004203	72.31	79.00	0.86	0.47
	11004204	74.10	81.40	0.86	0.46
	S01T0001874 Duplicate Runs				
	11004205	6.50	5.48	0.95	0.53
	11004206	6.71	5.70	0.93	0.51
	11004207	66.35	83.82	0.87	0.46
	11004208	69.23	81.51	0.87	0.46

FIGURE 1. Mean particle diameters of volume based particle size distributions for samples from tank 241-AY-101. Vertical lines within the bars locate the mean diameters (μm). Bar widths represent ± one standard deviation (truncated at 0 where required). Data key: Sample # - pump speed / agitation setting / ultrasound time (min) / delay time (sec).

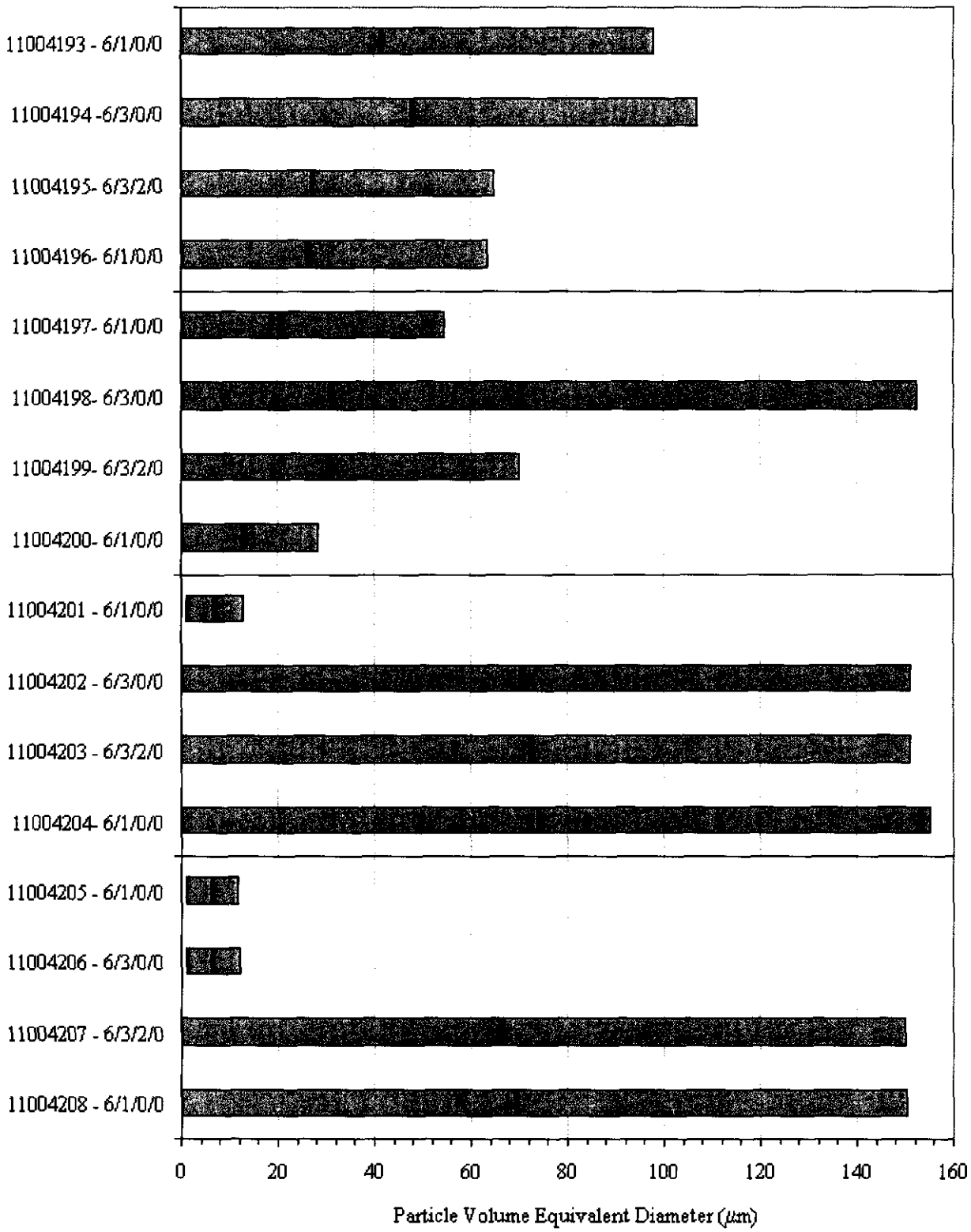

11004193 - 6/1/0/0
11004194 -6/3/0/0
11004195- 6/3/2/0
11004196- 6/1/0/0
11004197- 6/1/0/0
11004198- 6/3/0/0
11004199- 6/3/2/0
11004200- 6/1/0/0
11004201 - 6/1/0/0
11004202 - 6/3/0/0
11004203 - 6/3/2/0
11004204- 6/1/0/0
11004205 - 6/1/0/0
11004206 - 6/3/0/0
11004207 - 6/3/2/0
11004208 - 6/1/0/0
0
20
40
60
80
100
120
140
160
Particle Volume Equivalent Diameter (μm)

FIGURE 2. Mean particle diameters of number based particle size distributions for samples from tank 241-AY-101. Vertical lines within the bars locate the mean diameters (μm). Bar widths represent ± one standard deviation (truncated at 0 where required). Data key: Sample # - pump speed / agitation setting / ultrasound time (min) / delay time (sec).

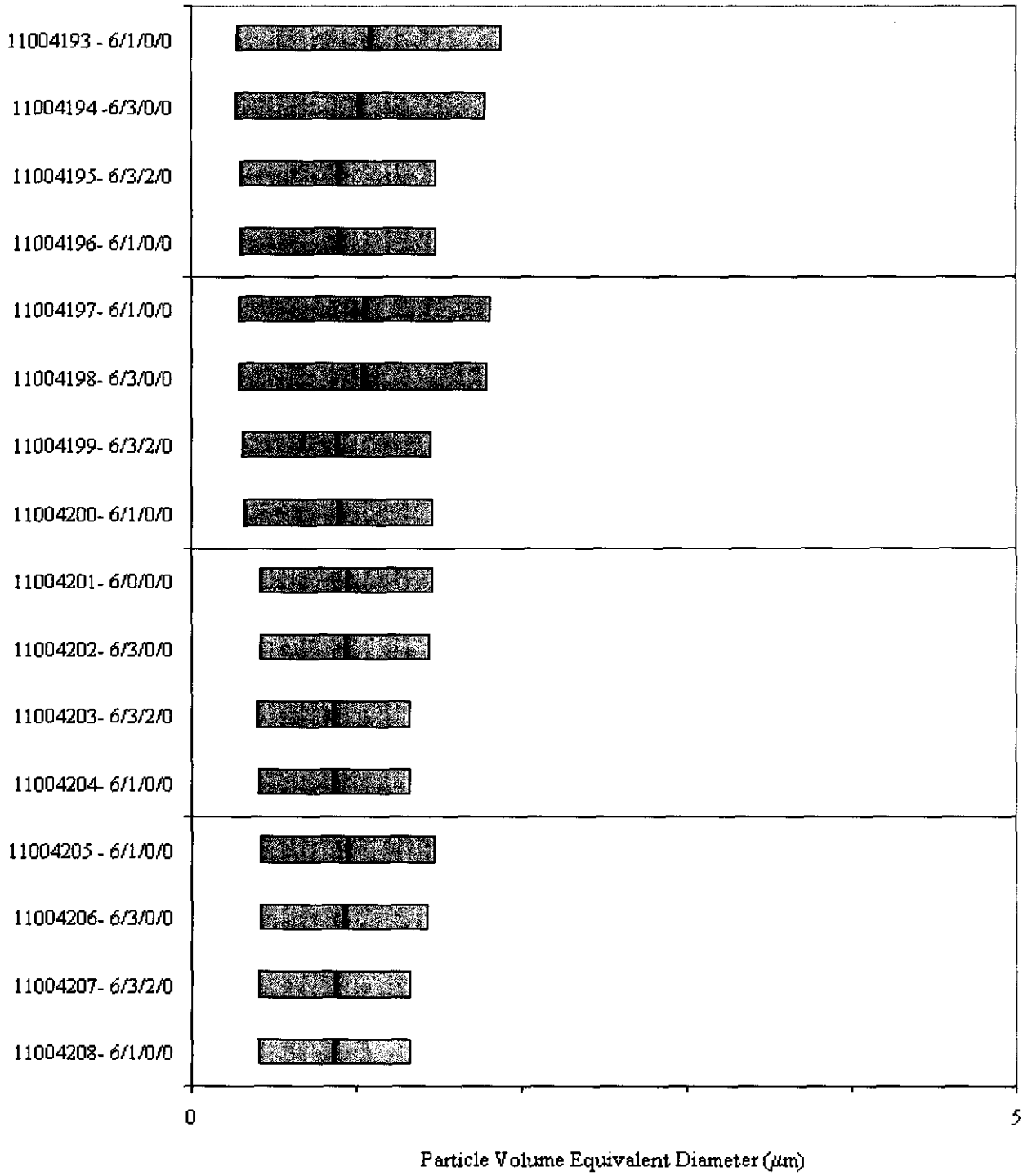


TABLE 4. Percentages of particles in samples from AY-101 with diameters (μm) less than the indicated value. Derived from particulate based, cumulative, percent undersize distribution data.

Sample #	Per Cent Distribution Based on the Spherical Volume of Partilces						
	1.0%	5.0%	25.0%	50.0%	75.0%	95.0%	99.0%
	Diameters Less Than (μm)						
S01T0001871							
11004193	0.79	1.18	6.01	12.85	56.85	162.98	227.53
11004194	0.77	1.17	6.63	14.93	90.26	165.13	227.25
11004195	0.66	0.91	4.79	11.41	26.87	115.84	159.42
11004196	0.65	0.90	4.57	10.86	23.33	115.22	156.17
S01T0001871 Duplicate Run							
11004197	0.74	1.05	4.44	9.75	17.15	105.95	175.39
11004198	0.78	1.22	7.44	19.51	126.96	227.25	329.91
11004199	0.65	0.90	4.84	11.84	37.39	119.69	154.94
11004200	0.63	0.85	3.21	8.91	15.45	42.52	85.11
S01T0001874							
11004201	0.64	0.82	1.54	5.50	10.72	18.66	24.83
11004202	0.68	0.90	4.07	13.75	142.20	214.80	276.28
11004203	0.63	0.84	4.30	15.82	140.81	208.52	268.00
11004204	0.63	0.84	4.01	14.49	145.10	213.51	271.64
S01T0001874 Duplicate Run							
11004205	0.64	0.82	1.51	5.22	10.06	17.05	22.49
11004206	0.63	0.80	1.47	5.43	10.42	17.70	22.28
11004207	0.62	0.82	2.88	11.19	143.55	220.30	281.64
11004208	0.62	0.83	3.38	12.42	142.48	214.10	273.85

TABLE 4. Percentages of particles in samples from AY-101 with diameters (μm) less than the indicated value. Derived from particulate based, cumulative, percent undersize distribution data.

Sample #	Per Cent Distribution Based on the Spherical Volume of Particles						
	1.0%	5.0%	25.0%	50.0%	75.0%	95.0%	99.0%
	Diameters Less Than (μm)						
S01T0001871							
11004193	0.79	1.18	6.01	12.85	56.85	162.98	227.53
11004194	0.77	1.17	6.63	14.93	90.26	165.13	227.25
11004195	0.66	0.91	4.79	11.41	26.87	115.84	159.42
11004196	0.65	0.90	4.57	10.86	23.33	115.22	156.17
S01T0001871 Duplicate Run							
11004197	0.74	1.05	4.44	9.75	17.15	105.95	175.39
11004198	0.78	1.22	7.44	19.51	126.96	227.25	329.91
11004199	0.65	0.90	4.84	11.84	37.39	119.69	154.94
11004200	0.63	0.85	3.21	8.91	15.45	42.52	85.11
S01T0001874							
11004201	0.64	0.82	1.54	5.50	10.72	18.66	24.83
11004202	0.68	0.90	4.07	13.75	142.20	214.80	276.28
11004203	0.63	0.84	4.30	15.82	140.81	208.52	268.00
11004204	0.63	0.84	4.01	14.49	145.10	213.51	271.64
S01T0001874 Duplicate Run							
11004205	0.64	0.82	1.51	5.22	10.06	17.05	22.49
11004206	0.63	0.80	1.47	5.43	10.42	17.70	22.28
11004207	0.62	0.82	2.88	11.19	143.55	220.30	281.64
11004208	0.62	0.83	3.38	12.42	142.48	214.10	273.85

FIGURE 3. Percentages of particles in samples from AY-101 with diameters (μm) within the indicated values. Derived from volume based, cumulative, percent undersize, distribution data. Vertical lines within middle light gray bars locate the median particle diameters.

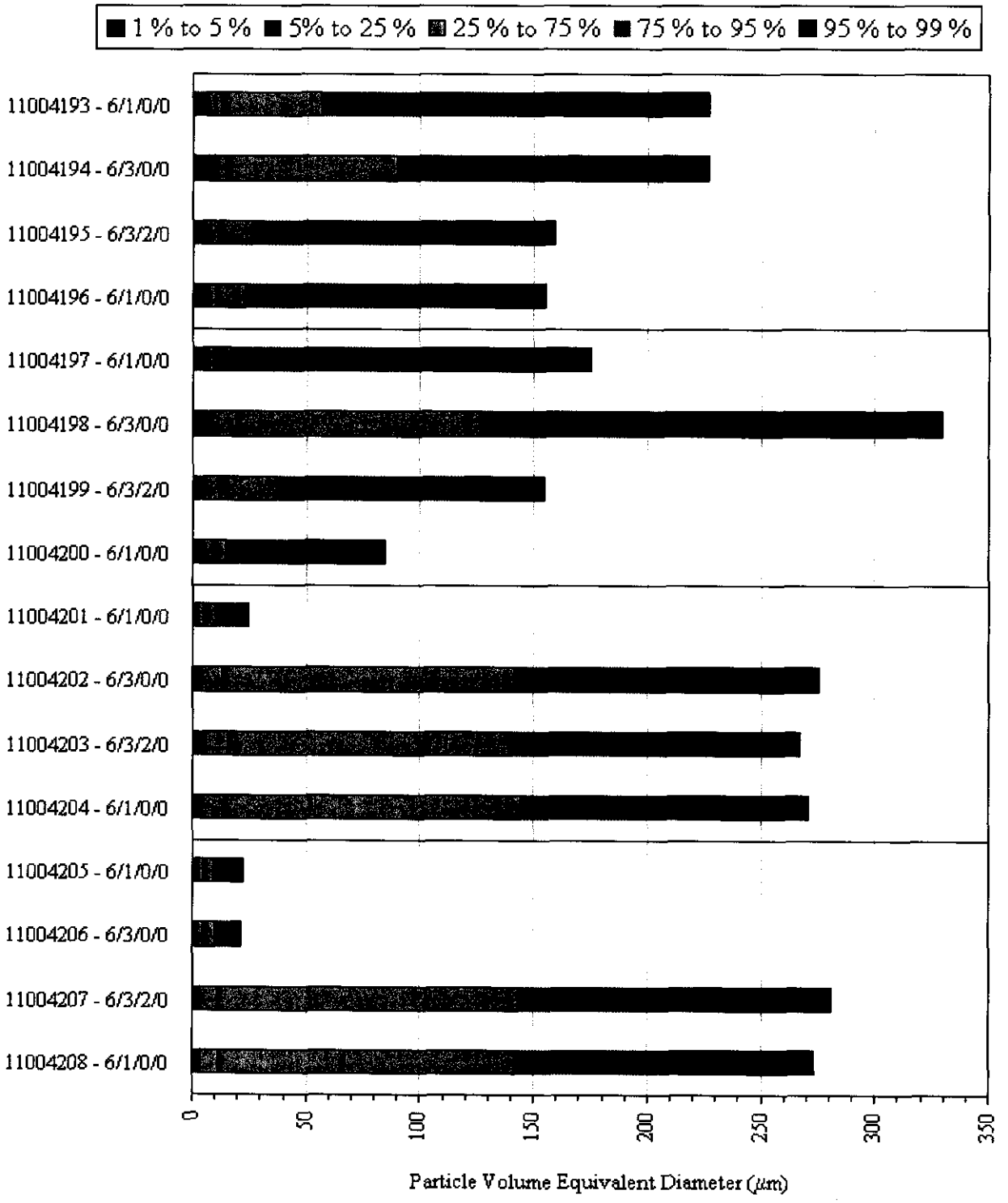
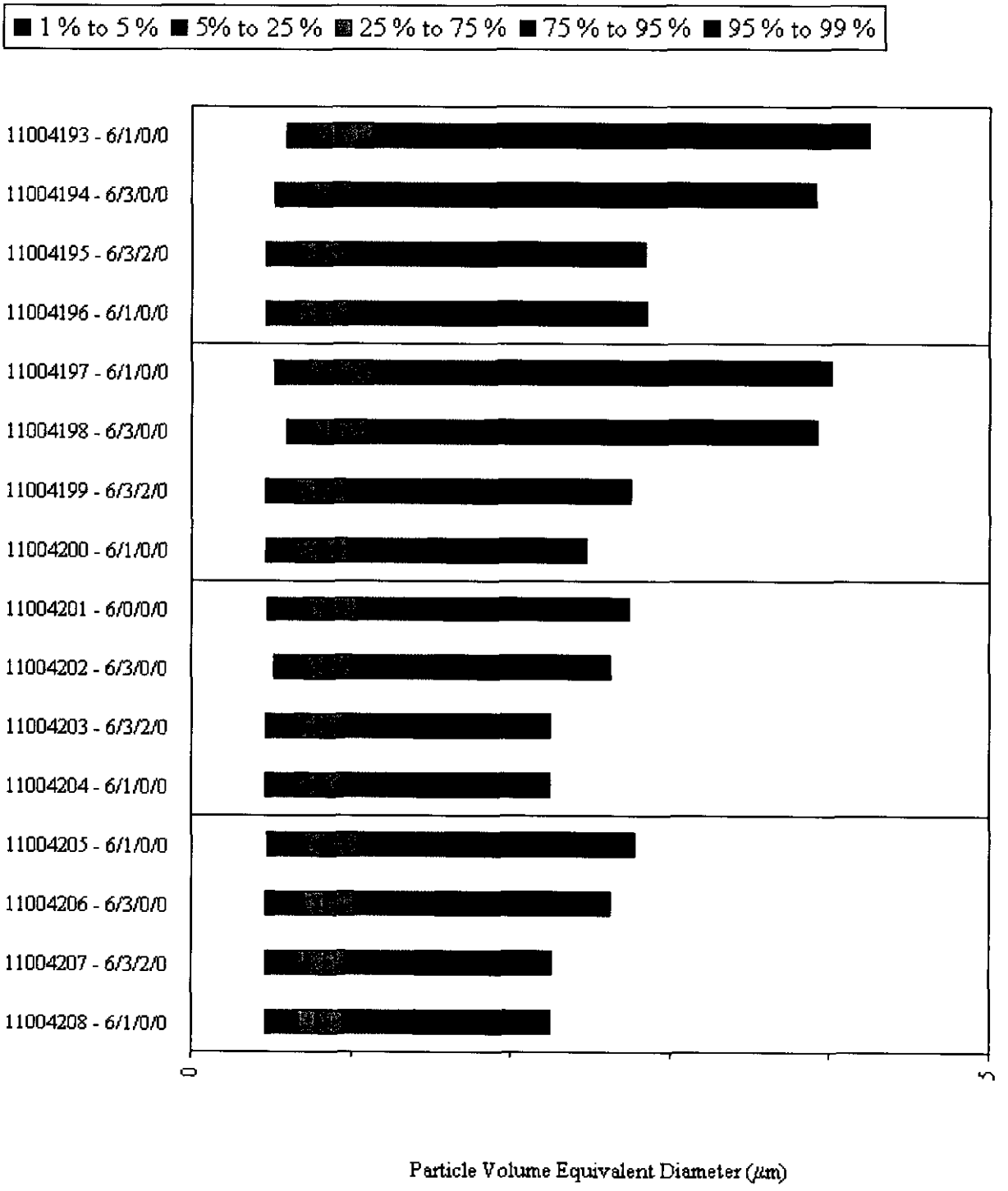


TABLE 5. Percentages of particles in samples from AY-101 with diameters (μm) less than the indicated values. Derived from number based, cumulative percent undersize distribution data.

Sample #	Per Cent Distribution Based on the number of Particles						
	1.0%	5.0%	25.0%	50.0%	75.0%	95.0%	99.0%
	Diameters Less Than (μm)						
S01T0001871							
11004193	0.59	0.62	0.76	0.91	1.14	1.96	4.25
11004194	0.52	0.57	0.72	0.87	1.01	1.83	3.92
11004195	0.46	0.50	0.65	0.79	0.98	1.49	2.85
11004196	0.46	0.50	0.65	0.79	0.98	1.49	2.86
S01T0001871 Duplicate Run							
11004197	0.52	0.58	0.73	0.89	1.13	1.91	4.02
11004198	0.59	0.62	0.74	0.88	1.10	1.84	3.93
11004199	0.46	0.50	0.65	0.79	0.97	1.47	2.76
11004200	0.46	0.51	0.65	0.80	0.98	1.48	2.48
S01T0001874							
11004201	0.47	0.53	0.70	0.85	1.05	1.58	2.75
11004202	0.52	0.56	0.70	0.84	1.02	1.52	2.64
11004203	0.46	0.51	0.65	0.79	0.96	1.39	2.26
11004204	0.46	0.51	0.65	0.79	0.96	1.39	2.26
S01T0001874 Duplicate Run							
11004205	0.47	0.53	0.70	0.85	1.05	1.60	2.79
11004206	0.46	0.53	0.69	0.84	1.03	1.53	2.63
11004207	0.46	0.51	0.66	0.72	0.97	1.40	2.27
11004208	0.46	0.51	0.65	0.79	0.96	1.39	2.26

FIGURE 4. Percentages of particles in samples from tank 241-AY-101 with diameters (μm) within the indicated values. Derived from number based, cumulative, percent undersize, distribution data. Vertical lines within middle light gray bars locate the median particle diameters.



QUALITY CONTROL

The tank 241-AY-101 samples were run in one shift. There were two standards run, one at the beginning of the shift and one at the end of the shift.

The first standard consisted of an NIST traceable, monodisperse, polymer microsphere. The standard was obtained from Duke Scientific Corporation (Palo Alto, California). The certified particle diameter for the standard was 200 nm ± 6nm. The Horiba LA-910 indicated a diameter of 188 nm ± 16 nm.

The standard ran at the end of the shift was a polydisperse quartz powder, BCR-69. This standard (also obtained from Duke Scientific) was prepared and certified by the Commission of the European Communities, Community Bureau of Reference (BCR). The BCR-69 has particles ranging from 12 to 90 μm with a calculated mean of 51.55 μm and a standard deviation of 20.4. The Horiba LA-910 response indicated a mean of 51.58 μm and a standard deviation of 22.20.

CONCLUSION

The samples that were submitted for particle size analysis had been sitting dormant for 4 to 7 weeks before commencement of particle size determination. During this time the potential for re-agglomeration by the sample that was submitted to high shear (tissue grinder) is quite possible. A possibility of re-agglomeration is through perikinetic flocculation (particle contact through Brownian motion). If the settling velocities indicated a substantial difference between the homogenized and non-homogenized samples and PSD analysis did not indicate as significant differences, then re-agglomeration should not be excluded as a possible explanation of settling versus PSD differences.

Therefore, the particles, agglomerates, or aggregates in the samples measured may have undergone significant changes in size during the initial sampling, storage, or processing before PSD measurements were performed. The particle size distributions of the analyzed sample may not, therefore, accurately represent the original *in-situ* distribution of particle sizes. The estimated weight of the particulate solids in the measured PSD specimens is no more than a few milligrams. Given this small specimen size, the quantitative accuracy (and repeatability) of the PSD measurements, particularly for samples with broad distributions including significant quantities of larger and/or high-density particles, should be critically evaluated.

If you have any questions concerning this letter report or the PSD measurements of the tank 241-AY-101 samples, please feel free to contact me at 373-1972.

JBD:lda

Attachments (2)

B3610-JBD-01-032

ATTACHMENT 1

Horiba LA-910 Generated Volume Distribution

Consisting of 16 pages,
Including cover page

HORIBA LA-910

for Windows(TM) Ver.1.20j Oct/05/'01 12:23

Laser scattering particle size distribution analyzer

PARTICLE SIZE MEASUREMENT DATA

ID# : 011004-193 13:33
Filename : 11004193
Sample : S01T001871

Material : AY101
Source : Wade W Samples
Lot Numbe :

Condition
T%(He-Ne) : 87.6% Dist.Form : Std. Sampling times : 100
(LAMP) : 86.8% R.R.Index : 1.16-0.00i ( )

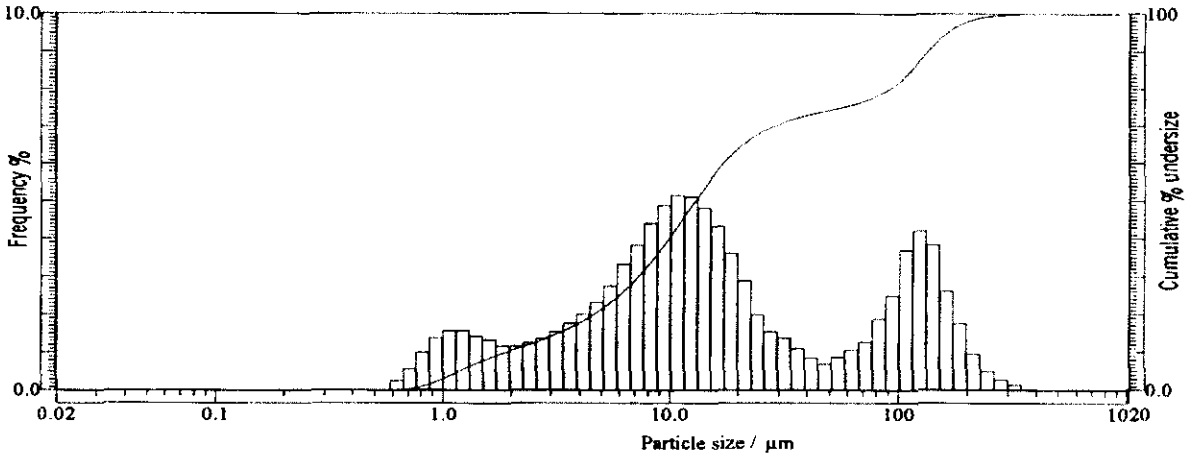
Agitation : 1 Circultn : 6 U.sonic : OFF(120)

Format
Dist.base : Volume Scaling : Auto Axis : LogX - LinearY

Data
Median : 12.854μm SP.Area : 10487cm²/cm³ S.D. : 57.104μm
Mode : 10.838μm Mean : 41.210μm
C.V. : 138.57%

Span : (D 10.0-D 90.0) / D50 = 10.255

Dia. on %(5.0%) : 1.175μm % on Dia.(0.100μm) : 0.0%
Dia. on %(25.0%) : 6.011μm % on Dia.(1.000μm) : 3.1%
Dia. on %(50.0%) : 12.854μm % on Dia.(10.000μm) : 40.5%
Dia. on %(75.0%) : 56.848μm % on Dia.(100.000μm) : 81.7%
Dia. on %(95.0%) : 162.982μm % on Dia.(1000.000μm) : 100.0%



Size(μm)	Freq(%)	Und(%)	Size(μm)	Freq(%)	Und(%)	Size(μm)	Freq(%)	Und(%)
1019.5	0.00	100.00	26.11	2.00	68.79	0.669	0.25	0.25
890.1	0.00	100.00	22.80	2.88	66.79	0.584	0.00	0.00
777.1	0.00	100.00	19.90	3.62	63.91	0.510	0.00	0.00
678.5	0.00	100.00	17.38	4.33	60.29	0.445	0.00	0.00
592.4	0.00	100.00	15.17	4.83	55.96	0.389	0.00	0.00
517.2	0.00	100.00	13.25	5.11	51.13	0.339	0.00	0.00
451.6	0.00	100.00	11.56	5.16	46.02	0.296	0.00	0.00
394.2	0.00	100.00	10.10	4.88	40.87	0.259	0.00	0.00
344.2	0.16	100.00	8.816	4.42	35.98	0.226	0.00	0.00
300.5	0.28	99.84	7.697	3.83	31.56	0.197	0.00	0.00
262.4	0.51	99.56	6.720	3.33	27.73	0.172	0.00	0.00
229.1	0.96	99.05	5.867	2.74	24.40	0.150	0.00	0.00
200.0	1.76	98.09	5.122	2.31	21.66	0.131	0.00	0.00
174.6	2.62	96.33	4.472	2.01	19.35	0.115	0.00	0.00
152.5	3.84	93.71	3.905	1.76	17.35	0.100	0.00	0.00
133.1	4.22	89.87	3.409	1.55	15.58	0.087	0.00	0.00
116.2	3.70	85.65	2.976	1.37	14.04	0.076	0.00	0.00
101.5	2.48	81.95	2.599	1.25	12.67	0.067	0.00	0.00
88.58	1.89	79.47	2.269	1.15	11.42	0.058	0.00	0.00
77.34	1.27	77.58	1.981	1.18	10.27	0.051	0.00	0.00
67.52	1.07	76.31	1.729	1.34	9.09	0.044	0.00	0.00
58.95	0.89	75.24	1.510	1.42	7.75	0.039	0.00	0.00
51.47	0.70	74.35	1.318	1.56	6.33	0.034	0.00	0.00
44.94	0.85	73.65	1.151	1.57	4.77	0.029	0.00	0.00
39.23	1.10	72.80	1.005	1.38	3.19	0.026	0.00	0.00
34.25	1.38	71.70	0.877	1.00	1.81	0.022	0.00	0.00
29.91	1.53	70.32	0.766	0.56	0.81			

HORIBA LA-910

for Windows(TM) Ver.1.20j Oct/05/'01 12:25

Laser scattering particle size distribution analyzer

PARTICLE SIZE MEASUREMENT DATA

ID# : 011004-194 13:38
Filename : 11004194
Sample : S01T001871

Material : AY101
Source : Wade W Samples
Lot Numbe :

Condition
T%(He-Ne) : 87.6% Dist.Form : Std. Sampling times : 100
(LAMP) : 86.8% R.R.Index : 1.16-0.00i ( )

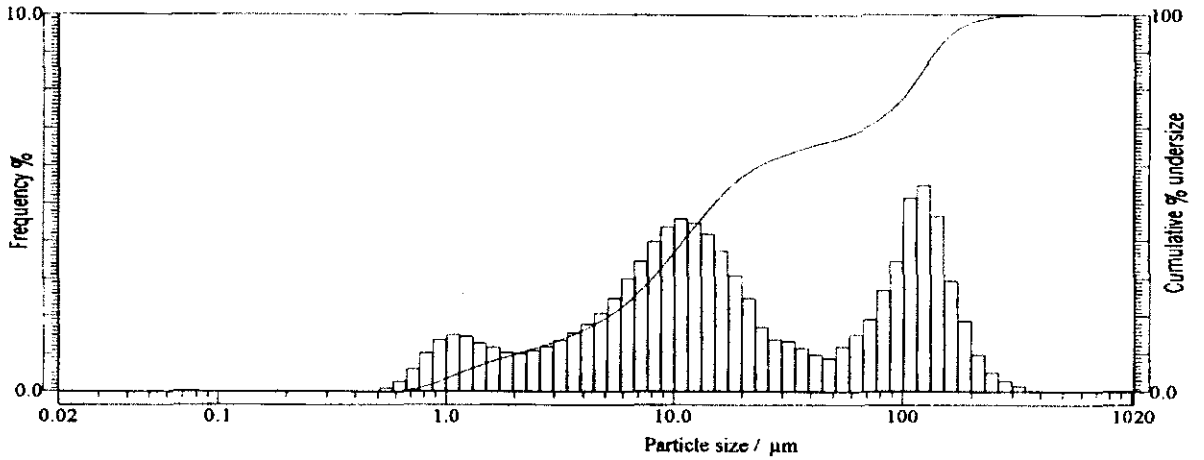
Agitation : 3 Circultn : 6 U.sonic : OFF(120)

Format
Dist.base : Volume Scaling : Auto Axis : LogX - LinearY

Data
Median : 14.934μm SP.Area : 9862cm²/cm³ S.D. : 59.175μm
Mode : 123.615μm Mean : 48.092μm
C.V. : 123.05%

Span : (D 10.0-D 90.0) / D50 = 9.144

Dia. on %(5.0%) : 1.170μm % on Dia.(0.100μm) : 0.0%
Dia. on %(25.0%) : 6.632μm % on Dia.(1.000μm) : 3.3%
Dia. on %(50.0%) : 14.934μm % on Dia.(10.000μm) : 36.9%
Dia. on %(75.0%) : 90.261μm % on Dia.(100.000μm) : 77.6%
Dia. on %(95.0%) : 165.136μm % on Dia.(1000.000μm) : 100.0%



Size(μm)	Freq(%)	Und(%)	Size(μm)	Freq(%)	Und(%)	Size(μm)	Freq(%)	Und(%)
1019.5	0.00	100.00	26.11	1.70	61.52	0.669	0.27	0.37
890.1	0.00	100.00	22.80	2.47	59.81	0.584	0.10	0.10
777.1	0.00	100.00	19.90	3.10	57.34	0.510	0.00	0.00
678.5	0.00	100.00	17.38	3.75	54.24	0.445	0.00	0.00
592.4	0.00	100.00	15.17	4.22	50.49	0.389	0.00	0.00
517.2	0.00	100.00	13.25	4.51	46.27	0.339	0.00	0.00
451.6	0.00	100.00	11.56	4.60	41.76	0.296	0.00	0.00
394.2	0.00	100.00	10.10	4.39	37.16	0.259	0.00	0.00
344.2	0.16	100.00	8.816	4.00	32.77	0.226	0.00	0.00
300.5	0.28	99.84	7.697	3.48	28.77	0.197	0.00	0.00
262.4	0.51	99.56	6.720	3.02	25.29	0.172	0.00	0.00
229.1	0.98	99.06	5.867	2.48	22.27	0.150	0.00	0.00
200.0	1.87	98.08	5.122	2.07	19.79	0.131	0.00	0.00
174.6	2.94	96.21	4.472	1.79	17.72	0.115	0.00	0.00
152.5	4.66	93.27	3.905	1.56	15.93	0.100	0.00	0.00
133.1	5.49	88.61	3.409	1.35	14.37	0.087	0.00	0.00
116.2	5.15	83.12	2.976	1.18	13.02	0.076	0.00	0.00
101.5	3.45	77.97	2.599	1.08	11.84	0.067	0.00	0.00
88.58	2.70	74.52	2.269	1.00	10.76	0.058	0.00	0.00
77.34	1.90	71.82	1.981	1.03	9.76	0.051	0.00	0.00
67.52	1.51	69.92	1.729	1.18	8.73	0.044	0.00	0.00
58.95	1.19	68.41	1.510	1.28	7.55	0.039	0.00	0.00
51.47	0.88	67.22	1.318	1.45	6.27	0.034	0.00	0.00
44.94	0.97	66.34	1.151	1.50	4.83	0.029	0.00	0.00
39.23	1.15	65.37	1.005	1.36	3.33	0.026	0.00	0.00
34.25	1.33	64.22	0.877	1.01	1.97	0.022	0.00	0.00
29.91	1.37	62.89	0.766	0.59	0.96			

HORIBA LA-910

for Windows(TM) Ver.1.20j Oct/05/'01 12:25

Laser scattering particle size distribution analyzer

PARTICLE SIZE MEASUREMENT DATA

ID# : 011004-195 13:44
Filename : 11004195
Sample : S01T001871

Material : AY101
Source : Wade W Samples
Lot Numbe :

Condition
T%(He-Ne) : 87.1% Dist.Form: Std. Sampling times : 100
(LAMP) : 85.3% R.R.Index : 1.16-0.00i ( )

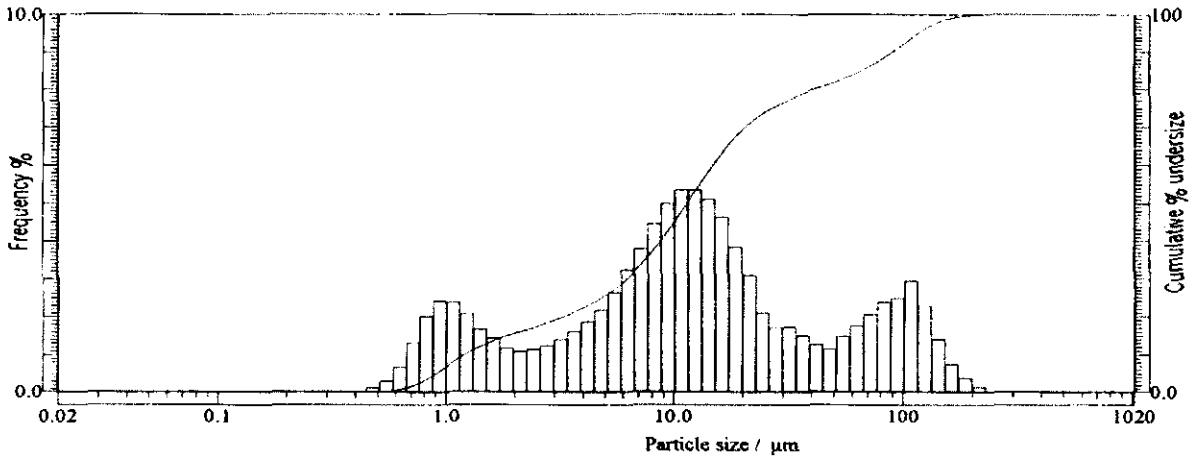
Agitation : 3 Circultn : 6 U.sonic : ON(120)

Format
Dist.base : Volume Scaling : Auto Axis : LogX - LinearY

Data
Median : 11.411μm SP.Area : 14130cm²/cm³ S.D. : 37.806μm
Mode : 12.340μm Mean : 27.202μm
C.V. : 138.98%

Span : (D 10.0-D 90.0) / D50 = 7.808

Dia. on %(5.0%) : 0.907μm % on Dia.(0.100μm) : 0.0%
Dia. on %(25.0%) : 4.787μm % on Dia.(1.000μm) : 6.7%
Dia. on %(50.0%) : 11.411μm % on Dia.(10.000μm) : 44.8%
Dia. on %(75.0%) : 26.869μm % on Dia.(100.000μm) : 91.9%
Dia. on %(95.0%) : 115.844μm % on Dia.(1000.000μm) : 100.0%



Size(μm)	Freq(%)	Und(%)	Size(μm)	Freq(%)	Und(%)	Size(μm)	Freq(%)	Und(%)
1019.5	0.00	100.00	26.11	2.10	74.64	0.669	0.67	1.09
890.1	0.00	100.00	22.80	3.09	72.54	0.584	0.29	0.42
777.1	0.00	100.00	19.90	3.83	69.45	0.510	0.12	0.12
678.5	0.00	100.00	17.38	4.63	65.62	0.445	0.00	0.00
592.4	0.00	100.00	15.17	5.11	60.99	0.389	0.00	0.00
517.2	0.00	100.00	13.25	5.35	55.88	0.339	0.00	0.00
451.6	0.00	100.00	11.56	5.35	50.53	0.296	0.00	0.00
394.2	0.00	100.00	10.10	4.99	45.18	0.259	0.00	0.00
344.2	0.00	100.00	8.816	4.45	40.19	0.226	0.00	0.00
300.5	0.00	100.00	7.697	3.79	35.74	0.197	0.00	0.00
262.4	0.00	100.00	6.720	3.24	31.94	0.172	0.00	0.00
229.1	0.13	100.00	5.867	2.62	28.71	0.150	0.00	0.00
200.0	0.37	99.87	5.122	2.17	26.08	0.131	0.00	0.00
174.6	0.74	99.49	4.472	1.86	23.91	0.115	0.00	0.00
152.5	1.40	98.76	3.905	1.62	22.05	0.100	0.00	0.00
133.1	2.29	97.36	3.409	1.40	20.43	0.087	0.00	0.00
116.2	2.95	95.07	2.976	1.24	19.02	0.076	0.00	0.00
101.5	2.47	92.12	2.599	1.15	17.79	0.067	0.00	0.00
88.58	2.37	89.65	2.269	1.09	16.64	0.058	0.00	0.00
77.34	2.05	87.28	1.981	1.17	15.55	0.051	0.00	0.00
67.52	1.75	85.23	1.729	1.44	14.38	0.044	0.00	0.00
58.95	1.49	83.48	1.510	1.67	12.94	0.039	0.00	0.00
51.47	1.15	81.99	1.318	2.07	11.27	0.034	0.00	0.00
44.94	1.26	80.84	1.151	2.38	9.20	0.029	0.00	0.00
39.23	1.50	79.58	1.005	2.41	6.82	0.026	0.00	0.00
34.25	1.73	78.08	0.877	2.01	4.41	0.022	0.00	0.00
29.91	1.72	76.36	0.766	1.31	2.40			

HORIBA LA-910

for Windows(TM) Ver.1.20j Oct/05/'01 12:25

Laser scattering particle size distribution analyzer

PARTICLE SIZE MEASUREMENT DATA

ID# : 011004-196 13:48
Filename : 11004196
Sample : S01T001871

Material : AY101
Source : Wade W Samples
Lot Numbe :

Condition
T%(He-Ne) : 87.2% Dist.Form : Std. Sampling times : 100
(LAMP) : 85.5% R.R.Index : 1.16-0.00i ( )

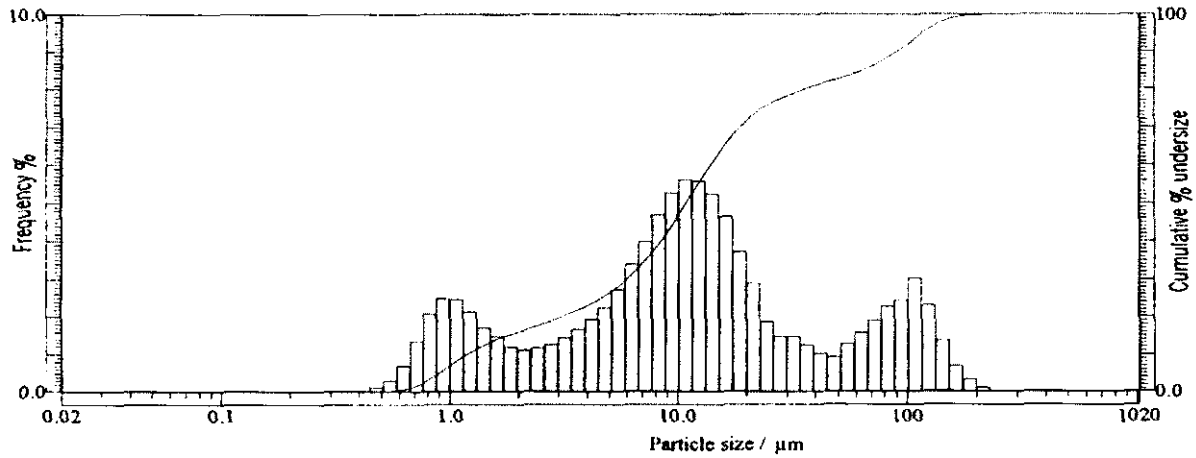
Agitation : 1 Circultn : 6 U.sonic : ON(120)

Format
Dist.base : Volume Scaling : Auto Axis : LogX - LinearY

Data
Median : 10.864μm SP.Area : 14549cm²/cm³ S.D. : 37.409μm
Mode : 10.846μm Mean : 26.228μm
C.V. : 142.63%

Span : (D 10.0-D 90.0) / D50 = 8.171

Dia. on %(5.0%) : 0.899μm % on Dia.(0.100μm) : 0.0%
Dia. on %(25.0%) : 4.572μm % on Dia.(1.000μm) : 7.0%
Dia. on %(50.0%) : 10.864μm % on Dia.(10.000μm) : 46.6%
Dia. on %(75.0%) : 23.332μm % on Dia.(100.000μm) : 91.9%
Dia. on %(95.0%) : 115.220μm % on Dia.(1000.000μm) : 100.0%



Size(μm)	Freq(%)	Und(%)	Size(μm)	Freq(%)	Und(%)	Size(μm)	Freq(%)	Und(%)
1019.5	0.00	100.00	26.11	1.87	76.55	0.669	0.69	1.12
890.1	0.00	100.00	22.80	2.90	74.68	0.584	0.30	0.43
777.1	0.00	100.00	19.90	3.73	71.78	0.510	0.13	0.13
678.5	0.00	100.00	17.38	4.65	68.05	0.445	0.00	0.00
592.4	0.00	100.00	15.17	5.24	63.39	0.389	0.00	0.00
517.2	0.00	100.00	13.25	5.57	58.15	0.339	0.00	0.00
451.6	0.00	100.00	11.56	5.61	52.58	0.296	0.00	0.00
394.2	0.00	100.00	10.10	5.26	46.97	0.259	0.00	0.00
344.2	0.00	100.00	8.816	4.70	41.71	0.226	0.00	0.00
300.5	0.00	100.00	7.697	3.99	37.01	0.197	0.00	0.00
262.4	0.00	100.00	6.720	3.40	33.02	0.172	0.00	0.00
229.1	0.10	100.00	5.867	2.74	29.63	0.150	0.00	0.00
200.0	0.33	99.90	5.122	2.26	26.89	0.131	0.00	0.00
174.6	0.69	99.57	4.472	1.93	24.63	0.115	0.00	0.00
152.5	1.37	98.88	3.905	1.67	22.70	0.100	0.00	0.00
133.1	2.32	97.51	3.409	1.44	21.03	0.087	0.00	0.00
116.2	3.03	95.19	2.976	1.27	19.60	0.076	0.00	0.00
101.5	2.44	92.17	2.599	1.18	18.33	0.067	0.00	0.00
88.58	2.29	89.72	2.269	1.11	17.15	0.058	0.00	0.00
77.34	1.90	87.44	1.981	1.20	16.04	0.051	0.00	0.00
67.52	1.56	85.54	1.729	1.47	14.84	0.044	0.00	0.00
58.95	1.27	83.97	1.510	1.72	13.36	0.039	0.00	0.00
51.47	0.93	82.70	1.318	2.14	11.64	0.034	0.00	0.00
44.94	1.03	81.77	1.151	2.46	9.51	0.029	0.00	0.00
39.23	1.25	80.73	1.005	2.49	7.05	0.026	0.00	0.00
34.25	1.47	79.49	0.877	2.08	4.56	0.022	0.00	0.00
29.91	1.47	78.02	0.766	1.35	2.47			

HORIBA LA-910

for Windows(TM) Ver.1.20j Oct/05/'01 12:25

Laser scattering particle size distribution analyzer

PARTICLE SIZE MEASUREMENT DATA

ID# : 011004-197 13:59
Filename : 11004197
Sample : S01T001871

Material : AY101
Source : Wade W Samples
Lot Numbe :

Condition
T%(He-Ne) : 88.9% Dist.Form: Std. Sampling times : 100
(LAMP) : 88.0% R.R.Index : 1.16-0.00i ( )

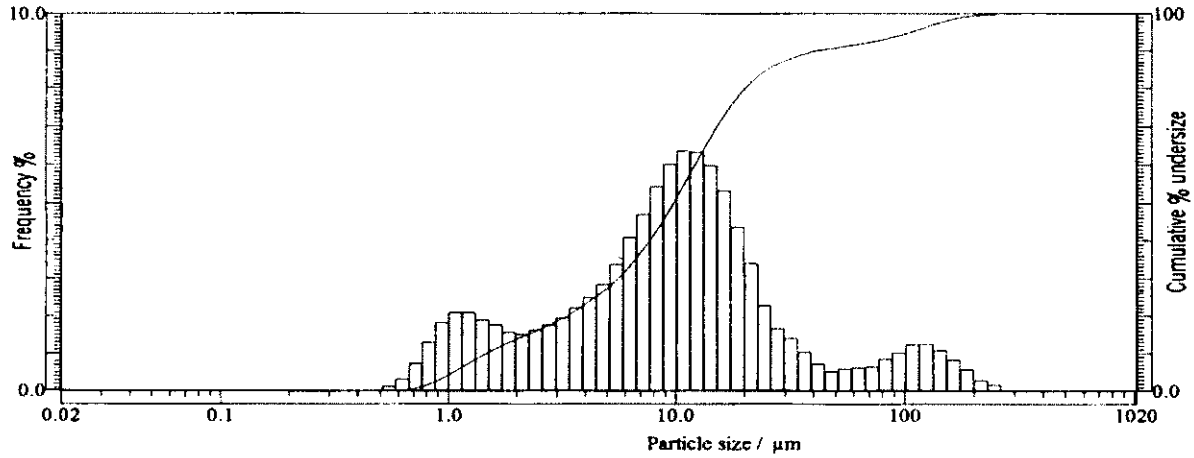
Agitation : 1 Circultn : 6 U.sonic : OFF(120)

Format
Dist.base : Volume Scaling : Auto Axis : LogX - LinearY

Data
Median : 9.752μm SP.Area : 13399cm²/cm³ S.D. : 34.458μm
Mode : 10.842μm Mean : 20.259μm
C.V. : 170.08%

Span : (D 10.0-D 90.0) / D50 = 4.153

Dia. on %(5.0%) : 1.054μm % on Dia.(0.100μm) : 0.0%
Dia. on %(25.0%) : 4.440μm % on Dia.(1.000μm) : 4.2%
Dia. on %(50.0%) : 9.752μm % on Dia.(10.000μm) : 51.1%
Dia. on %(75.0%) : 17.148μm % on Dia.(100.000μm) : 94.5%
Dia. on %(95.0%) : 105.954μm % on Dia.(1000.000μm) : 100.0%



Size(μm)	Freq(%)	Und(%)	Size(μm)	Freq(%)	Und(%)	Size(μm)	Freq(%)	Und(%)
1019.5	0.00	100.00	26.11	2.27	85.55	0.669	0.32	0.43
890.1	0.00	100.00	22.80	3.40	83.29	0.584	0.12	0.12
777.1	0.00	100.00	19.90	4.36	79.88	0.510	0.00	0.00
678.5	0.00	100.00	17.38	5.33	75.52	0.445	0.00	0.00
592.4	0.00	100.00	15.17	5.97	70.19	0.389	0.00	0.00
517.2	0.00	100.00	13.25	6.32	64.22	0.339	0.00	0.00
451.6	0.00	100.00	11.56	6.36	57.90	0.296	0.00	0.00
394.2	0.00	100.00	10.10	6.01	51.54	0.259	0.00	0.00
344.2	0.00	100.00	8.816	5.43	45.53	0.226	0.00	0.00
300.5	0.00	100.00	7.697	4.69	40.11	0.197	0.00	0.00
262.4	0.16	100.00	6.720	4.07	35.42	0.172	0.00	0.00
229.1	0.29	99.84	5.867	3.37	31.34	0.150	0.00	0.00
200.0	0.57	99.55	5.122	2.84	27.98	0.131	0.00	0.00
174.6	0.82	98.98	4.472	2.49	25.13	0.115	0.00	0.00
152.5	1.07	98.16	3.905	2.21	22.64	0.100	0.00	0.00
133.1	1.25	97.09	3.409	1.95	20.43	0.087	0.00	0.00
116.2	1.23	95.84	2.976	1.74	18.48	0.076	0.00	0.00
101.5	1.01	94.61	2.599	1.61	16.74	0.067	0.00	0.00
88.58	0.86	93.60	2.269	1.50	15.13	0.058	0.00	0.00
77.34	0.65	92.74	1.981	1.55	13.62	0.051	0.00	0.00
67.52	0.63	92.09	1.729	1.77	12.07	0.044	0.00	0.00
58.95	0.59	91.47	1.510	1.89	10.31	0.039	0.00	0.00
51.47	0.52	90.88	1.318	2.07	8.42	0.034	0.00	0.00
44.94	0.72	90.36	1.151	2.08	6.35	0.029	0.00	0.00
39.23	1.03	89.64	1.005	1.82	4.27	0.026	0.00	0.00
34.25	1.40	88.61	0.877	1.30	2.45	0.022	0.00	0.00
29.91	1.66	87.21	0.766	0.72	1.15			

HORIBA LA-910 for Windows(TM) Ver.1.20j Oct/05/'01 12:26

Laser scattering particle size distribution analyzer

PARTICLE SIZE MEASUREMENT DATA

ID# : 011004-198 14:03 Material : AY101
Filename : 11004198 Source : Wade W Samples
Sample : S01T001871 Lot Numbe :

Condition
T%(He-Ne) : 88.8% Dist.Form: Std. Sampling times : 100
(LAMP) : 87.9% R.R.Index: 1.16-0.00i ( )

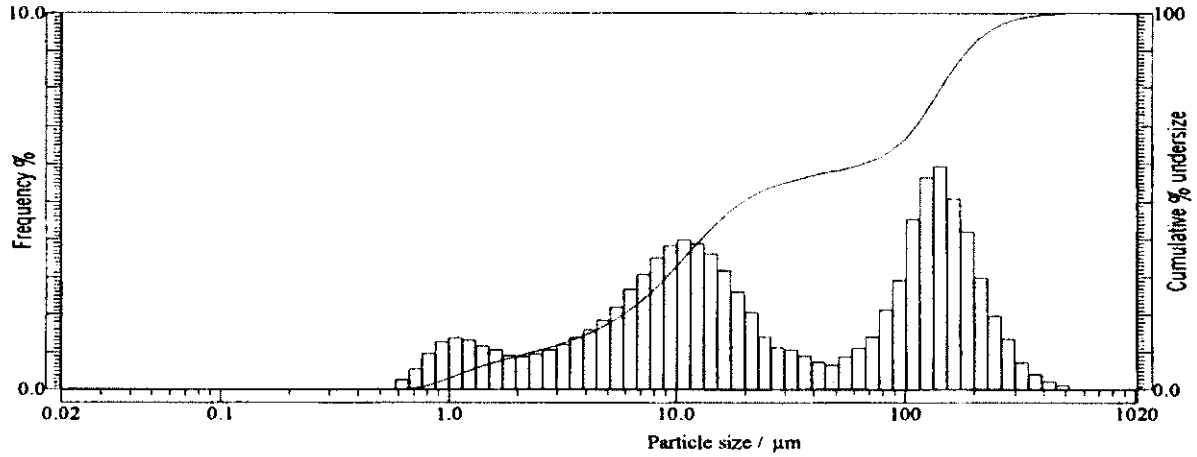
Agitation : 3 Circultn : 6 U.sonic : OFF(120)

Format
Dist.base : Volume Scaling : Auto Axis : LogX - LinearY

Data
Median : 19.505μm SP.Area : 8855cm²/cm³ S.D. : 82.647μm
Mode : 141.526μmMean : 70.172μm
C.V. : 117.78%

Span : (D 10.0-D 90.0) / D50 = 9.436

Dia. on %(5.0%) : 1.218μm % on Dia.(0.100μm) : 0.0%
Dia. on %(25.0%) : 7.437μm % on Dia.(1.000μm) : 3.0%
Dia. on %(50.0%) : 19.505μm % on Dia.(10.000μm) : 32.9%
Dia. on %(75.0%) :126.955μm % on Dia.(100.000μm) : 66.5%
Dia. on %(95.0%) :227.254μm % on Dia.(1000.000μm) : 100.0%



Size(μm)	Freq(%)	Und(%)	Size(μm)	Freq(%)	Und(%)	Size(μm)	Freq(%)	Und(%)
1019.5	0.00	100.00	26.11	1.40	53.85	0.669	0.26	0.26
890.1	0.00	100.00	22.80	2.06	52.45	0.584	0.00	0.00
777.1	0.00	100.00	19.90	2.60	50.39	0.510	0.00	0.00
678.5	0.00	100.00	17.38	3.18	47.78	0.445	0.00	0.00
592.4	0.00	100.00	15.17	3.61	44.61	0.389	0.00	0.00
517.2	0.13	100.00	13.25	3.88	41.00	0.339	0.00	0.00
451.6	0.23	99.87	11.56	3.99	37.11	0.296	0.00	0.00
394.2	0.41	99.64	10.10	3.84	33.12	0.259	0.00	0.00
344.2	0.74	99.23	8.816	3.51	29.29	0.226	0.00	0.00
300.5	1.34	98.49	7.697	3.07	25.78	0.197	0.00	0.00
262.4	1.97	97.15	6.720	2.67	22.71	0.172	0.00	0.00
229.1	2.99	95.18	5.867	2.20	20.03	0.150	0.00	0.00
200.0	4.21	92.19	5.122	1.85	17.83	0.131	0.00	0.00
174.6	5.07	87.97	4.472	1.60	15.98	0.115	0.00	0.00
152.5	5.94	82.90	3.905	1.39	14.39	0.100	0.00	0.00
133.1	5.64	76.97	3.409	1.20	13.00	0.087	0.00	0.00
116.2	4.53	71.32	2.976	1.05	11.80	0.076	0.00	0.00
101.5	2.93	66.79	2.599	0.96	10.75	0.067	0.00	0.00
88.58	2.12	63.86	2.269	0.89	9.79	0.058	0.00	0.00
77.34	1.41	61.74	1.981	0.92	8.90	0.051	0.00	0.00
67.52	1.12	60.33	1.729	1.06	7.99	0.044	0.00	0.00
58.95	0.88	59.21	1.510	1.16	6.93	0.039	0.00	0.00
51.47	0.66	58.33	1.318	1.32	5.77	0.034	0.00	0.00
44.94	0.74	57.66	1.151	1.38	4.45	0.029	0.00	0.00
39.23	0.90	56.92	1.005	1.27	3.07	0.026	0.00	0.00
34.25	1.06	56.02	0.877	0.96	1.80	0.022	0.00	0.00
29.91	1.12	54.97	0.766	0.57	0.83			

HORIBA LA-910

for Windows(TM) Ver.1.20} Oct/05/'01 12:26

Laser scattering particle size distribution analyzer

PARTICLE SIZE MEASUREMENT DATA

ID# : 011004-199 14:09
Filename : 11004199
Sample : S01T001871

Material : AY101
Source : Wade W Samples
Lot Numbe :

Condition
T%(He-Ne) : 88.3% Dist.Form: Std. Sampling times : 100
(LAMP) : 86.7% R.R.Index: 1.16-0.00i ( )

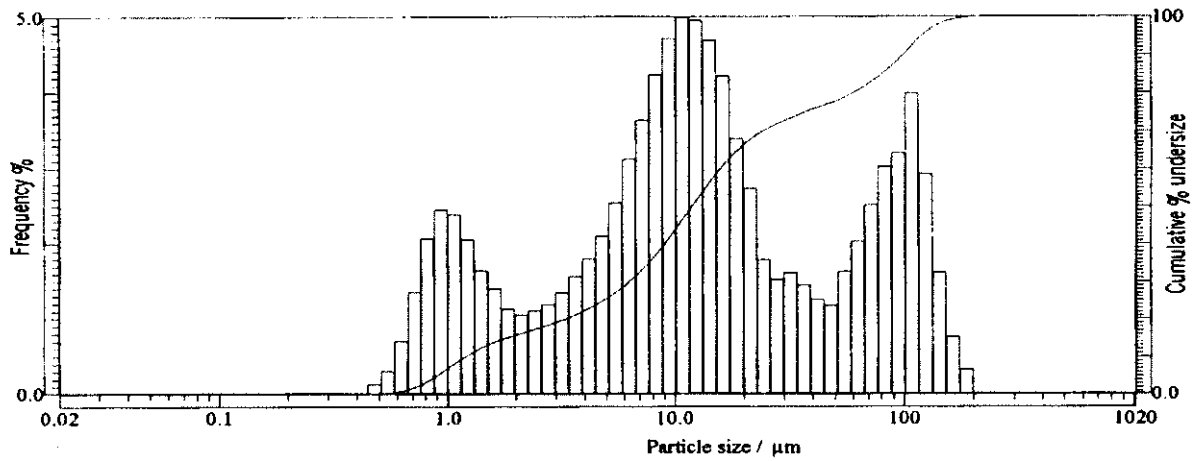
Agitation : 3 Circultn : 6 U.sonic : ON(120)

Format
Dist.base : Volume Scaling : Auto Axis : LogX - LinearY

Data
Median : 11.844μm SP.Area : 14067cm²/cm³ S.D. : 39.827μm
Mode : 10.842μm Mean : 30.345μm
C.V. : 131.25%

Span : (D 10.0-D 90.0) / D50 = 8.333

Dia. on %(5.0%) : 0.898μm % on Dia.(0.100μm) : 0.0%
Dia. on %(25.0%) : 4.843μm % on Dia.(1.000μm) : 7.0%
Dia. on %(50.0%) : 11.844μm % on Dia.(10.000μm) : 43.8%
Dia. on %(75.0%) : 37.392μm % on Dia.(100.000μm) : 90.0%
Dia. on %(95.0%) :119.694μm % on Dia.(1000.000μm) : 100.0%



Size(μm)	Freq(%)	Und(%)	Size(μm)	Freq(%)	Und(%)	Size(μm)	Freq(%)	Und(%)
1019.5	0.00	100.00	26.11	1.79	70.92	0.669	0.70	1.14
890.1	0.00	100.00	22.80	2.74	69.13	0.584	0.31	0.44
777.1	0.00	100.00	19.90	3.40	66.39	0.510	0.13	0.13
678.5	0.00	100.00	17.38	4.22	62.99	0.445	0.00	0.00
592.4	0.00	100.00	15.17	4.69	58.77	0.389	0.00	0.00
517.2	0.00	100.00	13.25	4.96	54.08	0.339	0.00	0.00
451.6	0.00	100.00	11.56	5.00	49.13	0.296	0.00	0.00
394.2	0.00	100.00	10.10	4.71	44.13	0.259	0.00	0.00
344.2	0.00	100.00	8.816	4.24	39.42	0.226	0.00	0.00
300.5	0.00	100.00	7.697	3.64	35.17	0.197	0.00	0.00
262.4	0.00	100.00	6.720	3.13	31.54	0.172	0.00	0.00
229.1	0.00	100.00	5.867	2.54	28.41	0.150	0.00	0.00
200.0	0.33	100.00	5.122	2.11	25.87	0.131	0.00	0.00
174.6	0.76	99.67	4.472	1.81	23.77	0.115	0.00	0.00
152.5	1.62	98.91	3.905	1.57	21.96	0.100	0.00	0.00
133.1	2.93	97.29	3.409	1.35	20.39	0.087	0.00	0.00
116.2	4.00	94.36	2.976	1.19	19.04	0.076	0.00	0.00
101.5	3.21	90.37	2.599	1.11	17.84	0.067	0.00	0.00
88.58	3.02	87.16	2.269	1.05	16.73	0.058	0.00	0.00
77.34	2.52	84.13	1.981	1.14	15.68	0.051	0.00	0.00
67.52	2.04	81.61	1.729	1.40	14.54	0.044	0.00	0.00
58.95	1.63	79.57	1.510	1.65	13.14	0.039	0.00	0.00
51.47	1.18	77.94	1.318	2.06	11.49	0.034	0.00	0.00
44.94	1.26	76.77	1.151	2.39	9.43	0.029	0.00	0.00
39.23	1.45	75.51	1.005	2.46	7.04	0.026	0.00	0.00
34.25	1.62	74.07	0.877	2.08	4.58	0.022	0.00	0.00
29.91	1.53	72.45	0.766	1.36	2.51			

HORIBA LA-910

for Windows(TM) Ver.1.20j Oct/05/'01 12:26

Laser scattering particle size distribution analyzer

PARTICLE SIZE MEASUREMENT DATA

ID# : 011004-200 14:13
Filename : 11004200
Sample : S01T001871

Material : AY101
Source : Wade W Samples
Lot Numbe :

Condition
T%(He-Ne) : 88.5% Dist.Form: Std. Sampling times : 100
(LAMP) : 86.9% R.R.Index : 1.16-0.00i ( )

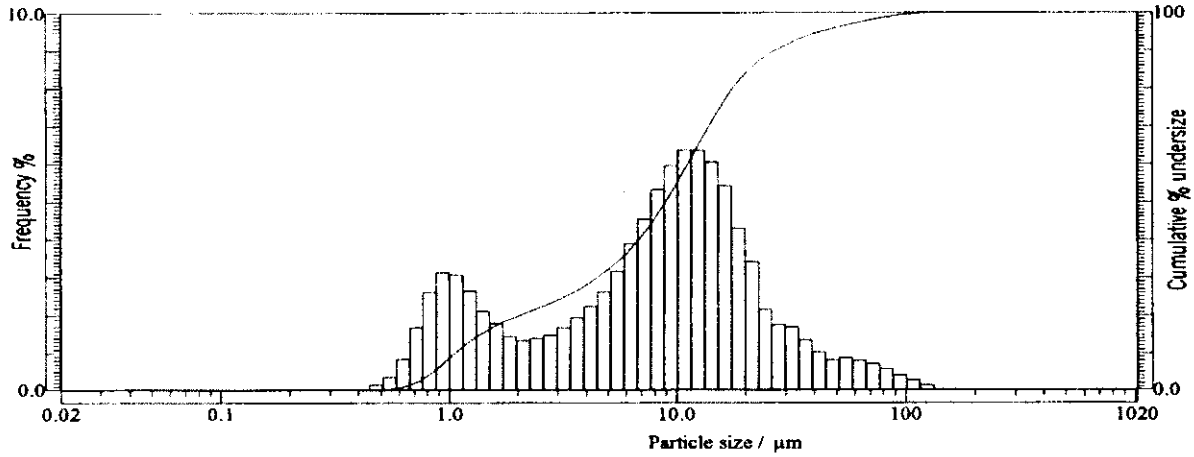
Agitation : 1 Circultn : 6 U.sonic : ON(120)

Format
Dist.base : Volume Scaling : Auto Axis : LogX - LinearY

Data
Median : 8.914μm SP.Area : 17507cm²/cm³ S.D. : 15.773μm
Mode : 10.852μm Mean : 12.870μm
C.V. : 122.55%

Span : (D 10.0-D 90.0) / D50 = 2.904

Dia. on %(5.0%) : 0.848μm % on Dia.(0.100μm) : 0.0%
Dia. on %(25.0%) : 3.205μm % on Dia.(1.000μm) : 8.7%
Dia. on %(50.0%) : 8.914μm % on Dia.(10.000μm) : 55.1%
Dia. on %(75.0%) : 15.449μm % on Dia.(100.000μm) : 99.5%
Dia. on %(95.0%) : 42.524μm % on Dia.(1000.000μm) : 100.0%



Size(μm)	Freq(%)	Und(%)	Size(μm)	Freq(%)	Und(%)	Size(μm)	Freq(%)	Und(%)
1019.5	0.00	100.00	26.11	2.16	89.59	0.669	0.85	1.35
890.1	0.00	100.00	22.80	3.41	87.43	0.584	0.36	0.51
777.1	0.00	100.00	19.90	4.30	84.02	0.510	0.15	0.15
678.5	0.00	100.00	17.38	5.44	79.72	0.445	0.00	0.00
592.4	0.00	100.00	15.17	6.05	74.27	0.389	0.00	0.00
517.2	0.00	100.00	13.25	6.37	68.22	0.339	0.00	0.00
451.6	0.00	100.00	11.56	6.38	61.86	0.296	0.00	0.00
394.2	0.00	100.00	10.10	5.97	55.48	0.259	0.00	0.00
344.2	0.00	100.00	8.816	5.33	49.51	0.226	0.00	0.00
300.5	0.00	100.00	7.697	4.55	44.18	0.197	0.00	0.00
262.4	0.00	100.00	6.720	3.89	39.63	0.172	0.00	0.00
229.1	0.00	100.00	5.867	3.16	35.73	0.150	0.00	0.00
200.0	0.00	100.00	5.122	2.61	32.58	0.131	0.00	0.00
174.6	0.00	100.00	4.472	2.25	29.96	0.115	0.00	0.00
152.5	0.00	100.00	3.905	1.95	27.72	0.100	0.00	0.00
133.1	0.14	100.00	3.409	1.69	25.76	0.087	0.00	0.00
116.2	0.29	99.86	2.976	1.49	24.08	0.076	0.00	0.00
101.5	0.41	99.58	2.599	1.40	22.59	0.067	0.00	0.00
88.58	0.57	99.17	2.269	1.33	21.19	0.058	0.00	0.00
77.34	0.71	98.60	1.981	1.45	19.85	0.051	0.00	0.00
67.52	0.80	97.89	1.729	1.80	18.41	0.044	0.00	0.00
58.95	0.86	97.09	1.510	2.12	16.61	0.039	0.00	0.00
51.47	0.81	96.22	1.318	2.65	14.49	0.034	0.00	0.00
44.94	1.02	95.42	1.151	3.07	11.84	0.029	0.00	0.00
39.23	1.35	94.39	1.005	3.13	8.77	0.026	0.00	0.00
34.25	1.69	93.04	0.877	2.61	5.64	0.022	0.00	0.00
29.91	1.75	91.34	0.766	1.68	3.03			

HORIBA LA-910

for Windows(TM) Ver.1.20j Oct/05/'01 12:26

Laser scattering particle size distribution analyzer

PARTICLE SIZE MEASUREMENT DATA

ID# : 011004-201 14:27
Filename : 11004201
Sample : S01T001874

Material : AY101
Source : Wade W Samples
Lot Numbe :

Condition
T%(He-Ne) : 88.4%
(LAMP) : 85.9%
Dist.Form: Std.
R.R.Index: 1.16-0.00i ( )
Sampling times : 100

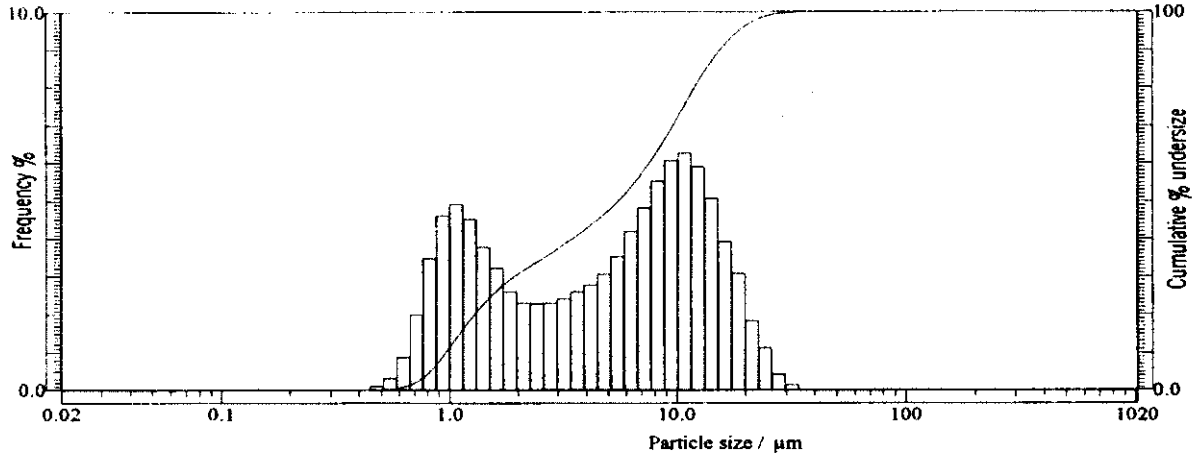
Agitation : 1 Circultn : 6 U.sonic : OFF(120)

Format
Dist.base : Volume Scaling : Auto Axis : LogX - LinearY

Data
Median : 5.504μm SP.Area : 23628cm²/cm³ S.D. : 6.005μm
Mode : 10.787μm Mean : 6.953μm
C.V. : 86.37%

Span : (D 10.0-D 90.0) / D50 = 2.633

Dia. on %(5.0%) : 0.818μm % on Dia.(0.100μm) : 0.0%
Dia. on %(25.0%) : 1.535μm % on Dia.(1.000μm) : 11.2%
Dia. on %(50.0%) : 5.504μm % on Dia.(10.000μm) : 71.8%
Dia. on %(75.0%) : 10.720μm % on Dia.(100.000μm) : 100.0%
Dia. on %(95.0%) : 18.663μm % on Dia.(1000.000μm) : 100.0%



Size(μm)	Freq(%)	Und(%)	Size(μm)	Freq(%)	Und(%)	Size(μm)	Freq(%)	Und(%)
1019.5	0.00	100.00	26.11	1.12	99.41	0.669	0.88	1.33
890.1	0.00	100.00	22.80	1.83	98.29	0.584	0.33	0.44
777.1	0.00	100.00	19.90	3.08	96.46	0.510	0.12	0.12
678.5	0.00	100.00	17.38	3.92	93.38	0.445	0.00	0.00
592.4	0.00	100.00	15.17	5.08	89.47	0.389	0.00	0.00
517.2	0.00	100.00	13.25	5.89	84.39	0.339	0.00	0.00
451.6	0.00	100.00	11.56	6.25	78.50	0.296	0.00	0.00
394.2	0.00	100.00	10.10	6.05	72.24	0.259	0.00	0.00
344.2	0.00	100.00	8.816	5.53	66.19	0.226	0.00	0.00
300.5	0.00	100.00	7.697	4.80	60.66	0.197	0.00	0.00
262.4	0.00	100.00	6.720	4.20	55.86	0.172	0.00	0.00
229.1	0.00	100.00	5.867	3.53	51.66	0.150	0.00	0.00
200.0	0.00	100.00	5.122	3.06	48.13	0.131	0.00	0.00
174.6	0.00	100.00	4.472	2.78	45.07	0.115	0.00	0.00
152.5	0.00	100.00	3.905	2.59	42.30	0.100	0.00	0.00
133.1	0.00	100.00	3.409	2.41	39.71	0.087	0.00	0.00
116.2	0.00	100.00	2.976	2.30	37.30	0.076	0.00	0.00
101.5	0.00	100.00	2.599	2.29	35.00	0.067	0.00	0.00
88.58	0.00	100.00	2.269	2.30	32.71	0.058	0.00	0.00
77.34	0.00	100.00	1.981	2.58	30.41	0.051	0.00	0.00
67.52	0.00	100.00	1.729	3.22	27.83	0.044	0.00	0.00
58.95	0.00	100.00	1.510	3.77	24.61	0.039	0.00	0.00
51.47	0.00	100.00	1.318	4.52	20.84	0.034	0.00	0.00
44.94	0.00	100.00	1.151	4.92	16.33	0.029	0.00	0.00
39.23	0.00	100.00	1.005	4.61	11.41	0.026	0.00	0.00
34.25	0.15	100.00	0.877	3.48	6.80	0.022	0.00	0.00
29.91	0.44	99.85	0.766	1.99	3.32			

HORIBA LA-910

for Windows(TM) Ver.1.20j Oct/05/'01 12:27

Laser scattering particle size distribution analyzer

PARTICLE SIZE MEASUREMENT DATA

ID# : 011004.202 14:32
Filename : 11004202
Sample : S01T001874

Material : AY101
Source : Wade W Samples
Lot Numbe :

Condition
T%(He-Ne) : 88.5% Dist.Form: Std. Sampling times : 100
(LAMP) : 86.1% R.R.Index : 1.16-0.00i ( )

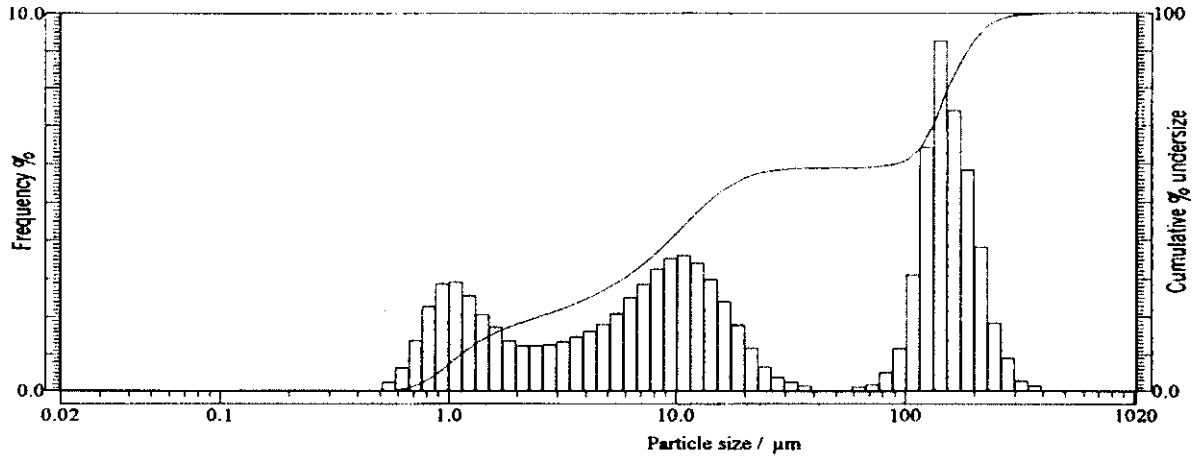
Agitation : 3 Circultn : 6 U.sonic : OFF(120)

Format
Dist.base : Volume Scaling : Auto Axis : LogX - LinearY

Data
Median : 13.751μm SP.Area : 14253cm²/cm³ S.D. : 81.252μm
Mode : 143.463μmMean : 70.248μm
C.V. : 115.66%

Span : (D 10.0-D 90.0) / D50 = 13.487

Dia. on %(5.0%) : 0.898μm % on Dia.(0.100μm) : 0.0%
Dia. on %(25.0%) : 4.067μm % on Dia.(1.000μm) : 7.3%
Dia. on %(50.0%) : 13.751μm % on Dia.(10.000μm) : 41.9%
Dia. on %(75.0%) :142.195μm % on Dia.(100.000μm) : 60.8%
Dia. on %(95.0%) :214.803μm % on Dia.(1000.000μm) : 100.0%



Size(μm)	Freq(%)	Und(%)	Size(μm)	Freq(%)	Und(%)	Size(μm)	Freq(%)	Und(%)
1019.5	0.00	100.00	26.11	0.66	58.19	0.669	0.63	0.88
890.1	0.00	100.00	22.80	1.17	57.53	0.584	0.24	0.24
777.1	0.00	100.00	19.90	1.79	56.36	0.510	0.00	0.00
678.5	0.00	100.00	17.38	2.41	54.57	0.445	0.00	0.00
592.4	0.00	100.00	15.17	2.99	52.16	0.389	0.00	0.00
517.2	0.00	100.00	13.25	3.41	49.18	0.339	0.00	0.00
451.6	0.00	100.00	11.56	3.62	45.77	0.296	0.00	0.00
394.2	0.16	100.00	10.10	3.53	42.15	0.259	0.00	0.00
344.2	0.29	99.84	8.816	3.25	38.63	0.226	0.00	0.00
300.5	0.90	99.56	7.697	2.85	35.38	0.197	0.00	0.00
262.4	1.84	98.66	6.720	2.50	32.53	0.172	0.00	0.00
229.1	3.83	96.82	5.867	2.09	30.02	0.150	0.00	0.00
200.0	5.84	92.98	5.122	1.80	27.93	0.131	0.00	0.00
174.6	7.39	87.15	4.472	1.61	26.13	0.115	0.00	0.00
152.5	9.27	79.76	3.905	1.47	24.52	0.100	0.00	0.00
133.1	6.42	70.49	3.409	1.34	23.05	0.087	0.00	0.00
116.2	3.11	64.07	2.976	1.25	21.71	0.076	0.00	0.00
101.5	1.17	60.96	2.599	1.22	20.46	0.067	0.00	0.00
88.58	0.51	59.79	2.269	1.22	19.24	0.058	0.00	0.00
77.34	0.18	59.28	1.981	1.37	18.02	0.051	0.00	0.00
67.52	0.12	59.10	1.729	1.73	16.65	0.044	0.00	0.00
58.95	0.00	58.98	1.510	2.07	14.92	0.039	0.00	0.00
51.47	0.00	58.98	1.318	2.57	12.85	0.034	0.00	0.00
44.94	0.00	58.98	1.151	2.91	10.28	0.029	0.00	0.00
39.23	0.16	58.98	1.005	2.86	7.37	0.026	0.00	0.00
34.25	0.26	58.82	0.877	2.27	4.51	0.022	0.00	0.00
29.91	0.37	58.56	0.766	1.36	2.24			

HORIBA LA-910 for Windows(TM) Ver.1.20j Oct/05/'01 12:27

Laser scattering particle size distribution analyzer

PARTICLE SIZE MEASUREMENT DATA

ID# : 011004.203 14:37
Filename : 11004203
Sample : S01T001874

Material : AY101
Source : Wade W Samples
Lot Numbe :

Condition
T%(He-Ne) : 88.7% Dist.Form : Std. Sampling times : 100
(LAMP) : 86.0% R.R.Index : 1.16-0.00i ( )

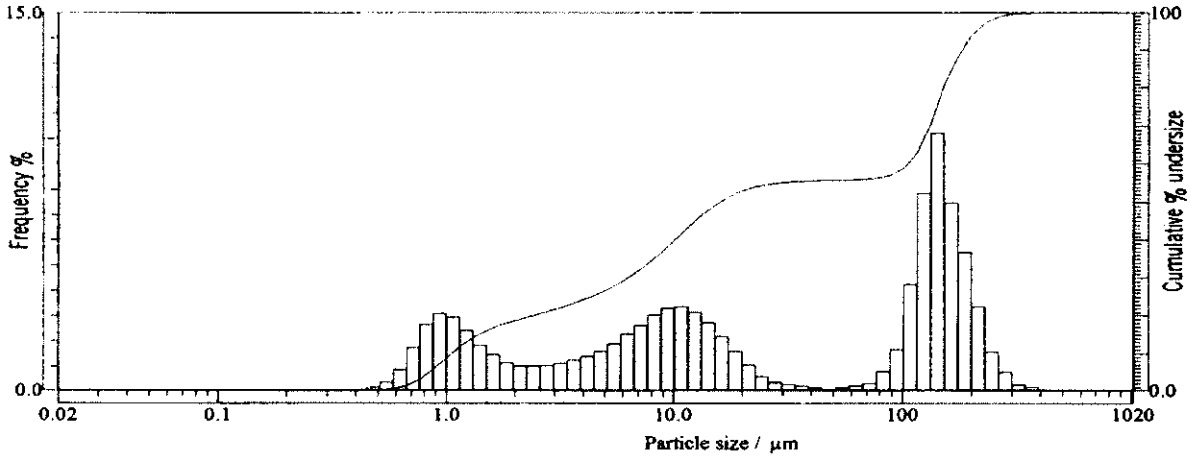
Agitation : 3 Circultn : 6 U.sonic : ON(120)

Format
Dist.base : Volume Scaling : Auto Axis : LogX - LinearY

Data
Median : 15.817μm SP.Area : 14782cm²/cm³ S.D. : 79.005μm
Mode : 142.103μmMean : 72.311μm
C.V. : 109.26%

Span : (D 10.0-D 90.0) / D50 = 11.402

Dia. on %(5.0%) : 0.843μm % on Dia.(0.100μm) : 0.0%
Dia. on %(25.0%) : 4.302μm % on Dia.(1.000μm) : 8.8%
Dia. on %(50.0%) : 15.817μm % on Dia.(10.000μm) : 39.8%
Dia. on %(75.0%) :140.809μm % on Dia.(100.000μm) : 58.5%
Dia. on %(95.0%) :208.519μm % on Dia.(1000.000μm) : 100.0%



Size(μm)	Freq(%)	Und(%)	Size(μm)	Freq(%)	Und(%)	Size(μm)	Freq(%)	Und(%)
1019.5	0.00	100.00	26.11	0.58	54.74	0.669	0.87	1.38
890.1	0.00	100.00	22.80	1.05	54.16	0.584	0.37	0.51
777.1	0.00	100.00	19.90	1.60	53.11	0.510	0.15	0.15
678.5	0.00	100.00	17.38	2.18	51.51	0.445	0.00	0.00
592.4	0.00	100.00	15.17	2.73	49.33	0.389	0.00	0.00
517.2	0.00	100.00	13.25	3.15	46.60	0.339	0.00	0.00
451.6	0.00	100.00	11.56	3.37	43.45	0.296	0.00	0.00
394.2	0.13	100.00	10.10	3.29	40.08	0.259	0.00	0.00
344.2	0.24	99.87	8.816	3.02	36.79	0.226	0.00	0.00
300.5	0.75	99.63	7.697	2.63	33.76	0.197	0.00	0.00
262.4	1.56	98.88	6.720	2.28	31.13	0.172	0.00	0.00
229.1	3.36	97.33	5.867	1.88	28.85	0.150	0.00	0.00
200.0	5.52	93.97	5.122	1.58	26.98	0.131	0.00	0.00
174.6	7.48	88.45	4.472	1.39	25.40	0.115	0.00	0.00
152.5	10.21	80.97	3.905	1.24	24.01	0.100	0.00	0.00
133.1	7.84	70.77	3.409	1.10	22.77	0.087	0.00	0.00
116.2	4.24	62.92	2.976	1.01	21.67	0.076	0.00	0.00
101.5	1.64	58.69	2.599	0.99	20.66	0.067	0.00	0.00
88.58	0.78	57.04	2.269	0.99	19.67	0.058	0.00	0.00
77.34	0.30	56.27	1.981	1.13	18.68	0.051	0.00	0.00
67.52	0.20	55.96	1.729	1.47	17.56	0.044	0.00	0.00
58.95	0.13	55.76	1.510	1.83	16.08	0.039	0.00	0.00
51.47	0.00	55.63	1.318	2.42	14.25	0.034	0.00	0.00
44.94	0.11	55.63	1.151	2.94	11.83	0.029	0.00	0.00
39.23	0.18	55.52	1.005	3.11	8.89	0.026	0.00	0.00
34.25	0.26	55.34	0.877	2.66	5.78	0.022	0.00	0.00
29.91	0.34	55.08	0.766	1.74	3.12			

HORIBA LA-910

for Windows(TM) Ver.1.20j Oct/05/'01 12:27

Laser scattering particle size distribution analyzer

PARTICLE SIZE MEASUREMENT DATA

ID# : 011004-204 14:41
Filename : 11004204
Sample : S01T001874

Material : AY101
Source : Wade W Samples
Lot Numbe :

Condition
T%(He-Ne) : 88.8% Dist.Form : Std. Sampling times : 100
(LAMP) : 86.2% R.R.Index : 1.16-0.00i ( )

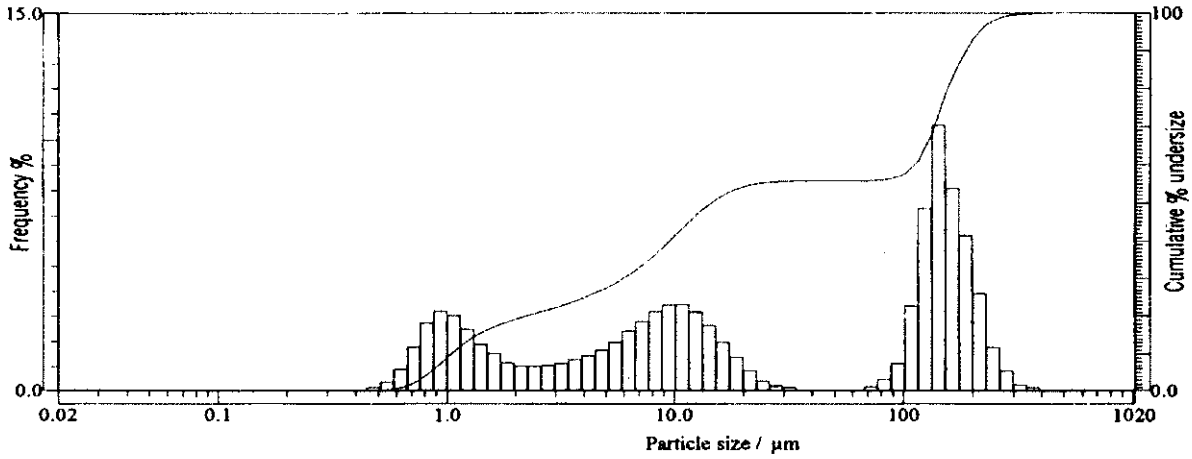
Agitation : 1 Circultn : 6 U.sonic : ON(120)

Format
Dist.base : Volume Scaling : Auto Axis : LogX - LinearY

Data
Median : 14.489μm SP.Area : 15172cm²/cm³ S.D. : 81.395μm
Mode : 143.170μmMean : 74.093μm
C.V. : 109.85%

Span : (D 10.0-D 90.0) / D50 = 12.820

Dia. on %(5.0%) : 0.838μm % on Dia.(0.100μm) : 0.0%
Dia. on %(25.0%) : 4.007μm % on Dia.(1.000μm) : 9.0%
Dia. on %(50.0%) : 14.489μm % on Dia.(10.000μm) : 41.4%
Dia. on %(75.0%) :145.096μm % on Dia.(100.000μm) : 57.5%
Dia. on %(95.0%) :213.514μm % on Dia.(1000.000μm) : 100.0%



Size(μm)	Freq(%)	Und(%)	Size(μm)	Freq(%)	Und(%)	Size(μm)	Freq(%)	Und(%)
1019.5	0.00	100.00	26.11	0.41	55.48	0.669	0.89	1.40
890.1	0.00	100.00	22.80	0.82	55.07	0.584	0.37	0.51
777.1	0.00	100.00	19.90	1.37	54.25	0.510	0.15	0.15
678.5	0.00	100.00	17.38	1.99	52.88	0.445	0.00	0.00
592.4	0.00	100.00	15.17	2.63	50.89	0.389	0.00	0.00
517.2	0.00	100.00	13.25	3.16	48.26	0.339	0.00	0.00
451.6	0.00	100.00	11.56	3.47	45.11	0.296	0.00	0.00
394.2	0.14	100.00	10.10	3.45	41.64	0.259	0.00	0.00
344.2	0.25	99.86	8.816	3.20	38.19	0.226	0.00	0.00
300.5	0.82	99.61	7.697	2.78	35.00	0.197	0.00	0.00
262.4	1.77	98.79	6.720	2.41	32.21	0.172	0.00	0.00
229.1	3.90	97.02	5.867	1.97	29.80	0.150	0.00	0.00
200.0	6.20	93.12	5.122	1.65	27.82	0.131	0.00	0.00
174.6	8.07	86.92	4.472	1.44	26.17	0.115	0.00	0.00
152.5	10.56	78.85	3.905	1.28	24.72	0.100	0.00	0.00
133.1	7.29	68.29	3.409	1.14	23.44	0.087	0.00	0.00
116.2	3.40	61.00	2.976	1.04	22.31	0.076	0.00	0.00
101.5	1.14	57.60	2.599	1.02	21.26	0.067	0.00	0.00
88.58	0.47	56.46	2.269	1.01	20.25	0.058	0.00	0.00
77.34	0.15	55.99	1.981	1.16	19.24	0.051	0.00	0.00
67.52	0.00	55.84	1.729	1.52	18.08	0.044	0.00	0.00
58.95	0.00	55.84	1.510	1.89	16.56	0.039	0.00	0.00
51.47	0.00	55.84	1.318	2.50	14.67	0.034	0.00	0.00
44.94	0.00	55.84	1.151	3.04	12.17	0.029	0.00	0.00
39.23	0.00	55.84	1.005	3.21	9.13	0.026	0.00	0.00
34.25	0.15	55.84	0.877	2.74	5.92	0.022	0.00	0.00
29.91	0.21	55.69	0.766	1.78	3.18			

HORIBA LA-910

for Windows(TM) Ver.1.20j Oct/05/'01 12:28

Laser scattering particle size distribution analyzer

PARTICLE SIZE MEASUREMENT DATA

ID# : 011004.205 14:59
Filename : 11004205
Sample : S01T001874

Material : AY101
Source : Wade W Samples
Lot Numbe :

Condition
T%(He-Ne) : 89.1% Dist.Form: Std. Sampling times : 100
(LAMP) : 87.0% R.R.Index : 1.16-0.00i ( )

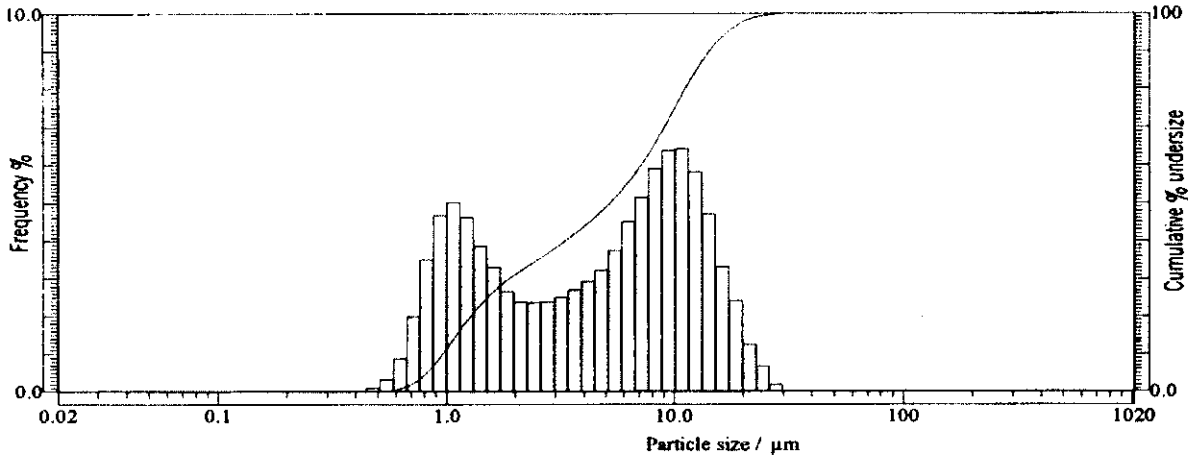
Agitation : 1 Circultn : 6 U.sonic : OFF(120)

Format
Dist.base : Volume Scaling : Auto Axis : LogX - LinearY

Data
Median : 5.217μm SP.Area : 24085cm²/cm³ S.D. : 5.480μm
Mode : 10.741μm Mean : 6.497μm
C.V. : 84.34%

Span : (D 10.0-D 90.0) / D50 = 2.549

Dia. on %(5.0%) : 0.817μm % on Dia.(0.100μm) : 0.0%
Dia. on %(25.0%) : 1.509μm % on Dia.(1.000μm) : 11.3%
Dia. on %(50.0%) : 5.217μm % on Dia.(10.000μm) : 74.7%
Dia. on %(75.0%) : 10.056μm % on Dia.(100.000μm) : 100.0%
Dia. on %(95.0%) : 17.053μm % on Dia.(1000.000μm) : 100.0%



Size(μm)	Freq(%)	Und(%)	Size(μm)	Freq(%)	Und(%)	Size(μm)	Freq(%)	Und(%)
1019.5	0.00	100.00	26.11	0.67	99.80	0.669	0.88	1.32
890.1	0.00	100.00	22.80	1.24	99.12	0.584	0.32	0.44
777.1	0.00	100.00	19.90	2.42	97.88	0.510	0.11	0.11
678.5	0.00	100.00	17.38	3.32	95.46	0.445	0.00	0.00
592.4	0.00	100.00	15.17	4.70	92.14	0.389	0.00	0.00
517.2	0.00	100.00	13.25	5.81	87.44	0.339	0.00	0.00
451.6	0.00	100.00	11.56	6.43	81.62	0.296	0.00	0.00
394.2	0.00	100.00	10.10	6.39	75.19	0.259	0.00	0.00
344.2	0.00	100.00	8.816	5.90	68.81	0.226	0.00	0.00
300.5	0.00	100.00	7.697	5.15	62.90	0.197	0.00	0.00
262.4	0.00	100.00	6.720	4.50	57.75	0.172	0.00	0.00
229.1	0.00	100.00	5.867	3.76	53.25	0.150	0.00	0.00
200.0	0.00	100.00	5.122	3.24	49.49	0.131	0.00	0.00
174.6	0.00	100.00	4.472	2.92	46.26	0.115	0.00	0.00
152.5	0.00	100.00	3.905	2.70	43.33	0.100	0.00	0.00
133.1	0.00	100.00	3.409	2.51	40.63	0.087	0.00	0.00
116.2	0.00	100.00	2.976	2.38	38.12	0.076	0.00	0.00
101.5	0.00	100.00	2.599	2.37	35.74	0.067	0.00	0.00
88.58	0.00	100.00	2.269	2.38	33.37	0.058	0.00	0.00
77.34	0.00	100.00	1.981	2.67	30.99	0.051	0.00	0.00
67.52	0.00	100.00	1.729	3.31	28.32	0.044	0.00	0.00
58.95	0.00	100.00	1.510	3.87	25.01	0.039	0.00	0.00
51.47	0.00	100.00	1.318	4.62	21.14	0.034	0.00	0.00
44.94	0.00	100.00	1.151	5.01	16.51	0.029	0.00	0.00
39.23	0.00	100.00	1.005	4.67	11.50	0.026	0.00	0.00
34.25	0.00	100.00	0.877	3.51	6.82	0.022	0.00	0.00
29.91	0.20	100.00	0.766	2.00	3.32			

HORIBA LA-910

for Windows(TM) Ver.1.20j Oct/05/'01 12:28

Laser scattering particle size distribution analyzer

PARTICLE SIZE MEASUREMENT DATA

ID# : 011004-206 15:04
Filename : 11004206
Sample : S01T001874

Material : AY101
Source : Wade W Samples
Lot Numbe :

Condition

T%(He-Ne) : 89.2% Dist.Form: Std. Sampling times : 100
(LAMP) : 87.3% R.R.Index : 1.16-0.00i ( )

Agitation : 3 Circultn : 6 U.sonic : OFF(120)

Format

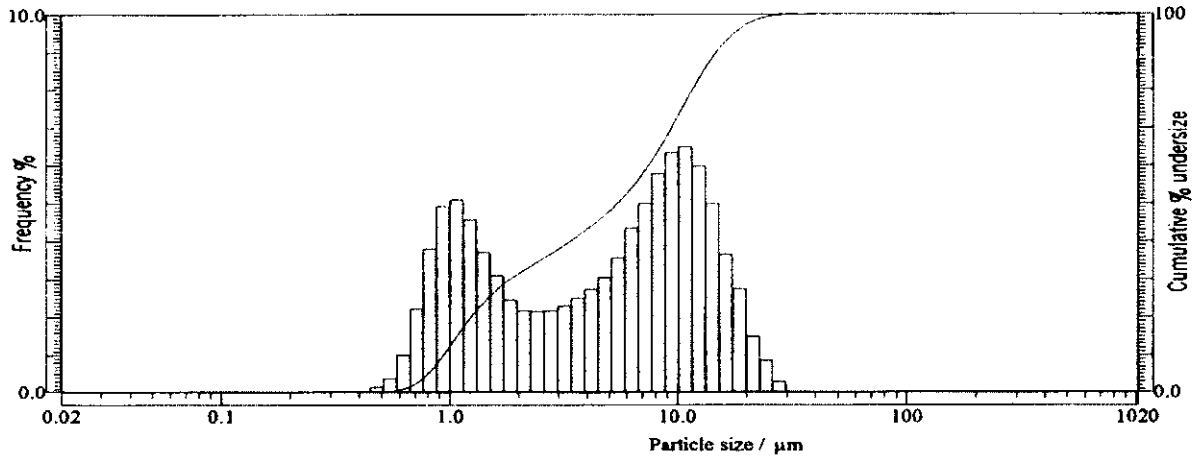
Dist.base : Volume Scaling : Auto Axis : LogX - LinearY

Data

Median : 5.433μm SP.Area : 24352cm²/cm³ S.D. : 5.702μm
Mode : 10.766μm Mean : 6.707μm
C.V. : 85.01%

Span : (D 10.0-D 90.0) / D50 = 2.547

Dia. on %(5.0%) : 0.802μm % on Dia.(0.100μm) : 0.0%
Dia. on %(25.0%) : 1.465μm % on Dia.(1.000μm) : 12.3%
Dia. on %(50.0%) : 5.433μm % on Dia.(10.000μm) : 73.0%
Dia. on %(75.0%) : 10.419μm % on Dia.(100.000μm) : 100.0%
Dia. on %(95.0%) : 17.703μm % on Dia.(1000.000μm) : 100.0%



Size(μm)	Freq(%)	Und(%)	Size(μm)	Freq(%)	Und(%)	Size(μm)	Freq(%)	Und(%)
1019.5	0.00	100.00	26.11	0.85	99.72	0.669	1.00	1.50
890.1	0.00	100.00	22.80	1.50	98.87	0.584	0.37	0.50
777.1	0.00	100.00	19.90	2.75	97.37	0.510	0.13	0.13
678.5	0.00	100.00	17.38	3.65	94.62	0.445	0.00	0.00
592.4	0.00	100.00	15.17	4.99	90.97	0.389	0.00	0.00
517.2	0.00	100.00	13.25	6.00	85.99	0.339	0.00	0.00
451.6	0.00	100.00	11.56	6.50	79.99	0.296	0.00	0.00
394.2	0.00	100.00	10.10	6.35	73.50	0.259	0.00	0.00
344.2	0.00	100.00	8.816	5.79	67.15	0.226	0.00	0.00
300.5	0.00	100.00	7.697	5.00	61.35	0.197	0.00	0.00
262.4	0.00	100.00	6.720	4.33	56.35	0.172	0.00	0.00
229.1	0.00	100.00	5.867	3.58	52.02	0.150	0.00	0.00
200.0	0.00	100.00	5.122	3.05	48.45	0.131	0.00	0.00
174.6	0.00	100.00	4.472	2.73	45.40	0.115	0.00	0.00
152.5	0.00	100.00	3.905	2.50	42.67	0.100	0.00	0.00
133.1	0.00	100.00	3.409	2.30	40.16	0.087	0.00	0.00
116.2	0.00	100.00	2.976	2.17	37.87	0.076	0.00	0.00
101.5	0.00	100.00	2.599	2.15	35.70	0.067	0.00	0.00
88.58	0.00	100.00	2.269	2.17	33.54	0.058	0.00	0.00
77.34	0.00	100.00	1.981	2.45	31.38	0.051	0.00	0.00
67.52	0.00	100.00	1.729	3.10	28.92	0.044	0.00	0.00
58.95	0.00	100.00	1.510	3.71	25.82	0.039	0.00	0.00
51.47	0.00	100.00	1.318	4.56	22.11	0.034	0.00	0.00
44.94	0.00	100.00	1.151	5.11	17.55	0.029	0.00	0.00
39.23	0.00	100.00	1.005	4.92	12.44	0.026	0.00	0.00
34.25	0.00	100.00	0.877	3.80	7.52	0.022	0.00	0.00
29.91	0.28	100.00	0.766	2.22	3.72			

HORIBA LA-910

for Windows(TM) Ver.1.20j Oct/05/'01 12:28

Laser scattering particle size distribution analyzer

PARTICLE SIZE MEASUREMENT DATA

ID# : 011004-207 15:11
Filename : 11004207
Sample : S01T001874

Material : AY101
Source : Wade W Samples
Lot Numbe :

Condition
T%(He-Ne) : 89.4%
(LAMP) : 87.2%
Dist.Form: Std.
R.R.Index: 1.16-0.00i ( )
Sampling times : 100

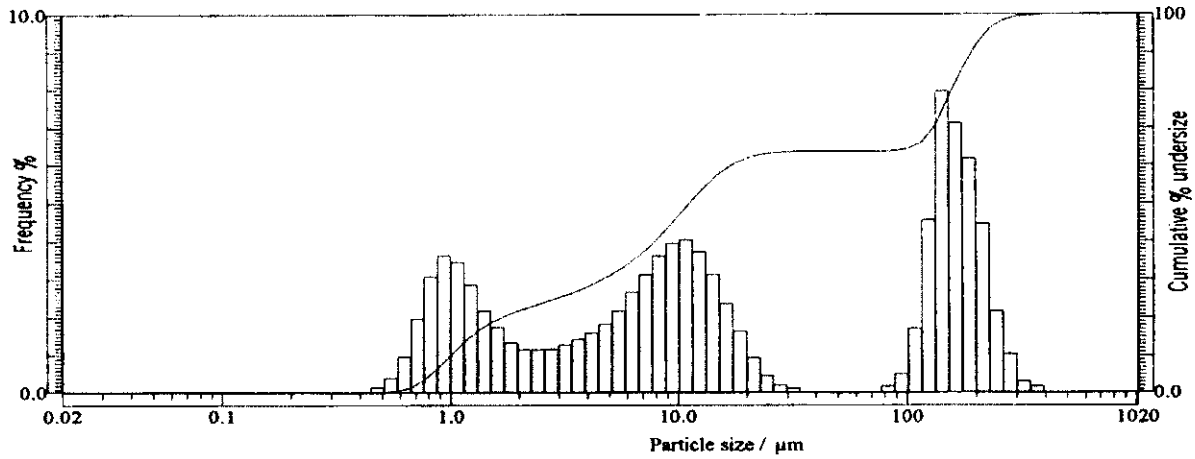
Agitation : 3 Circultn : 6 U.sonic : ON(120)

Format
Dist.base : Volume Scaling : Auto Axis : LogX - LinearY

Data
Median : 11.185μm SP.Area : 17060cm²/cm³ S.D. : 83.824μm
Mode : 145.605μm Mean : 66.349μm
C.V. : 126.34%

Span : (D 10.0-D 90.0) / D50 = 17.088

Dia. on %(5.0%) : 0.818μm % on Dia.(0.100μm) : 0.0%
Dia. on %(25.0%) : 2.879μm % on Dia.(1.000μm) : 10.1%
Dia. on %(50.0%) : 11.185μm % on Dia.(10.000μm) : 46.7%
Dia. on %(75.0%) : 143.554μm % on Dia.(100.000μm) : 64.3%
Dia. on %(95.0%) : 220.299μm % on Dia.(1000.000μm) : 100.0%



Size(μm)	Freq(%)	Und(%)	Size(μm)	Freq(%)	Und(%)	Size(μm)	Freq(%)	Und(%)
1019.5	0.00	100.00	26.11	0.47	63.28	0.669	0.98	1.53
890.1	0.00	100.00	22.80	0.95	62.81	0.584	0.40	0.56
777.1	0.00	100.00	19.90	1.64	61.86	0.510	0.16	0.16
678.5	0.00	100.00	17.38	2.37	60.22	0.445	0.00	0.00
592.4	0.00	100.00	15.17	3.13	57.85	0.389	0.00	0.00
517.2	0.00	100.00	13.25	3.73	54.72	0.339	0.00	0.00
451.6	0.00	100.00	11.56	4.04	50.99	0.296	0.00	0.00
394.2	0.18	100.00	10.10	3.95	46.96	0.259	0.00	0.00
344.2	0.32	99.82	8.816	3.61	43.00	0.226	0.00	0.00
300.5	1.05	99.50	7.697	3.11	39.39	0.197	0.00	0.00
262.4	2.17	98.45	6.720	2.68	36.28	0.172	0.00	0.00
229.1	4.45	96.28	5.867	2.18	33.60	0.150	0.00	0.00
200.0	6.19	91.83	5.122	1.83	31.42	0.131	0.00	0.00
174.6	7.11	85.64	4.472	1.60	29.59	0.115	0.00	0.00
152.5	7.97	78.53	3.905	1.43	27.99	0.100	0.00	0.00
133.1	4.54	70.56	3.409	1.28	26.56	0.087	0.00	0.00
116.2	1.71	66.02	2.976	1.18	25.29	0.076	0.00	0.00
101.5	0.52	64.31	2.599	1.16	24.11	0.067	0.00	0.00
88.58	0.18	63.79	2.269	1.16	22.95	0.058	0.00	0.00
77.34	0.00	63.61	1.981	1.33	21.79	0.051	0.00	0.00
67.52	0.00	63.61	1.729	1.75	20.46	0.044	0.00	0.00
58.95	0.00	63.61	1.510	2.18	18.71	0.039	0.00	0.00
51.47	0.00	63.61	1.318	2.87	16.53	0.034	0.00	0.00
44.94	0.00	63.61	1.151	3.46	13.66	0.029	0.00	0.00
39.23	0.00	63.61	1.005	3.63	10.20	0.026	0.00	0.00
34.25	0.12	63.61	0.877	3.07	6.58	0.022	0.00	0.00
29.91	0.21	63.49	0.766	1.97	3.51			

B3610-JBD-01-032

ATTACHMENT 2

Horiba LA-910 Generated Number Distribution

Consisting of 18 pages,
Including cover page

HORIBA LA-910

for Windows(TM) Ver. 1.31 Nov/01/'20013:04

Laser scattering particle size distribution analyzer

PARTICLE SIZE MEASUREMENT DATA

ID# : 19011004-208 15:14
Filename : 11004208
Sample : S01T001874
Material : AY101

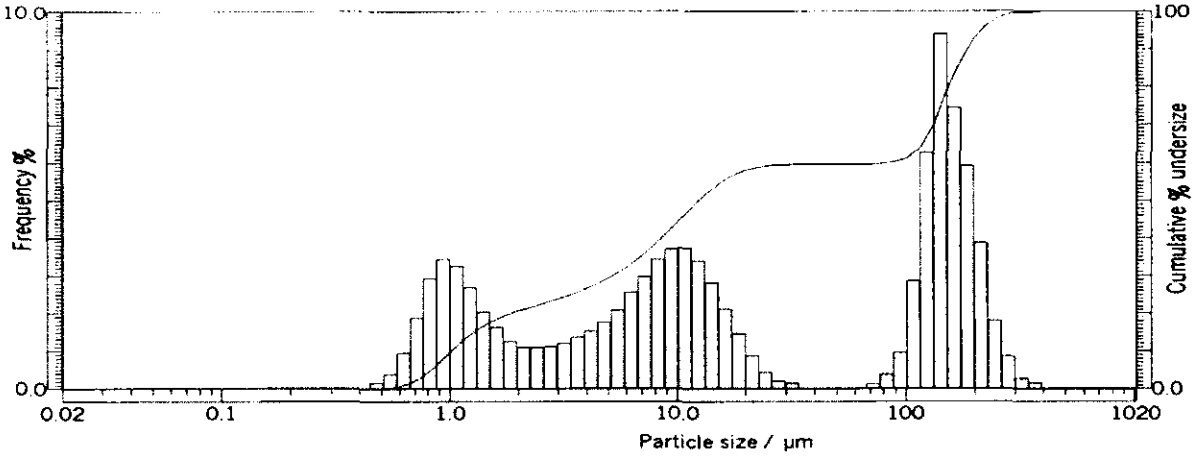
Source : Wade W Samples
Lot Numbe :
Test Numb : Dup
Instrument :

Condition
T%(He-Ne) : 89.5% Dist.Form : Std. Sampling times : 100
(LAMP) : 87.2% R.R.Index : 1.16-0.00i ( )
Agitation : 1 Circulation : 6 Ultrasonic : ON(120)

Format
Dist.base : Volume Scaling : Auto Axis : LogX - LinearY

Data
Median : 12.415μm SP.Area : 16189cm²/cm³ S.D. : 81.507μm
Mode : 143.668μm Mean : 69.231μm
C.V. : 117.73% Span : (D 10.0-D 90.0) / D50 = 14.935

Dia. on %(5.0%) : 0.826μm % on Dia.(0.100μm) : 0.0%
Dia. on %(25.0%) : 3.375μm % on Dia.(1.000μm) : 9.6%
Dia. on %(50.0%) : 12.415μm % on Dia.(10.000μm) : 44.2%
Dia. on %(75.0%) : 142.477μm % on Dia.(100.000μm) : 61.1%
Dia. on %(95.0%) : 214.098μm % on Dia.(1000.000μm) : 100.0%



Size(μm)	Freq(%)	Und(%)	Size(μm)	Freq(%)	Und(%)	Size(μm)	Freq(%)	Und(%)
1019.5	0.00	100.00	26.11	0.43	59.33	0.669	0.94	1.49
890.1	0.00	100.00	22.80	0.86	58.90	0.584	0.39	0.54
777.1	0.00	100.00	19.90	1.46	58.03	0.510	0.15	0.15
678.5	0.00	100.00	17.38	2.13	56.57	0.445	0.00	0.00
592.4	0.00	100.00	15.17	2.83	54.45	0.389	0.00	0.00
517.2	0.00	100.00	13.25	3.40	51.62	0.339	0.00	0.00
451.6	0.00	100.00	11.56	3.73	48.23	0.296	0.00	0.00
394.2	0.15	100.00	10.10	3.70	44.50	0.259	0.00	0.00
344.2	0.27	99.85	8.816	3.42	40.80	0.226	0.00	0.00
300.5	0.86	99.59	7.697	2.97	37.38	0.197	0.00	0.00
262.4	1.80	98.73	6.720	2.57	34.41	0.172	0.00	0.00
229.1	3.86	96.92	5.867	2.10	31.84	0.150	0.00	0.00
200.0	5.92	93.06	5.122	1.76	29.74	0.131	0.00	0.00
174.6	7.45	87.14	4.472	1.53	27.99	0.115	0.00	0.00
152.5	9.41	79.69	3.905	1.36	26.45	0.100	0.00	0.00
133.1	6.27	70.28	3.409	1.21	25.09	0.087	0.00	0.00
116.2	2.85	64.01	2.976	1.11	23.88	0.076	0.00	0.00
101.5	0.96	61.16	2.599	1.09	22.77	0.067	0.00	0.00
88.58	0.39	60.21	2.269	1.08	21.68	0.058	0.00	0.00
77.34	0.13	59.82	1.981	1.24	20.60	0.051	0.00	0.00
67.52	0.00	59.69	1.729	1.63	19.36	0.044	0.00	0.00
58.95	0.00	59.69	1.510	2.04	17.73	0.039	0.00	0.00
51.47	0.00	59.69	1.318	2.69	15.69	0.034	0.00	0.00
44.94	0.00	59.69	1.151	3.26	13.00	0.029	0.00	0.00
39.23	0.00	59.69	1.005	3.44	9.74	0.026	0.00	0.00
34.25	0.15	59.69	0.877	2.93	6.31	0.022	0.00	0.00
29.91	0.22	59.55	0.766	1.89	3.38			

HORIBA LA-910

for Windows(TM) Ver. 1.31 Oct/30/'2001 2:17

Laser scattering particle size distribution analyzer

PARTICLE SIZE MEASUREMENT DATA

ID# : 19011004-193 13:33
Filename : 11004193
Sample : S01T001871
Material : AY101

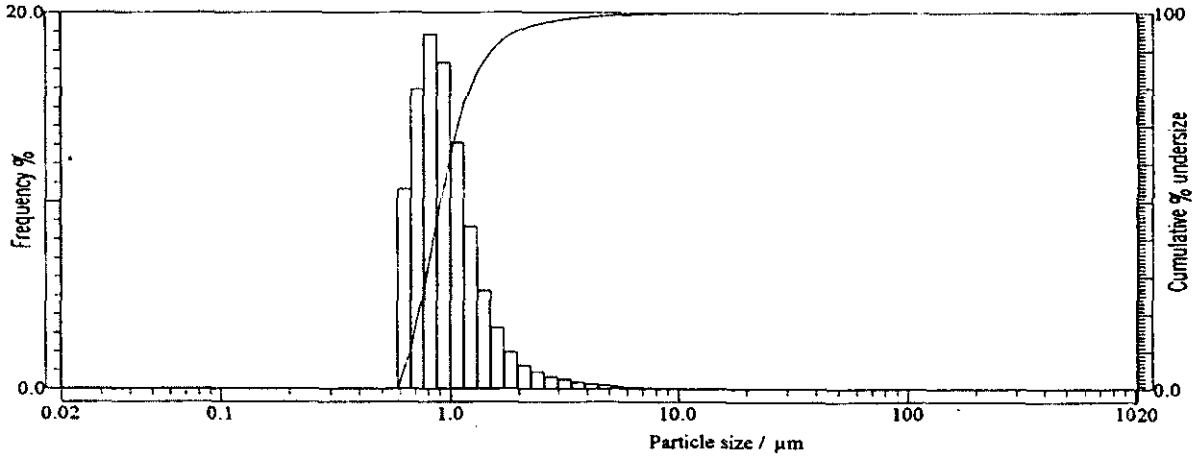
Source : Wade W Samples
Lot Numbe :
Test Numb :
Instrument :

Condition
T%(He-Ne) : 87.6%
(LAMP) : 86.8%
Agitation : 1
Dist.Form : Std.
R.R.Index : 1.16-0.00i ( )
Circulation : 6
Sampling times : 100
Ultrasonic : OFF(120)

Format
Dist.base : Number
Scaling : Auto
Axis : LogX - LinearY

Data
Median : 0.909μm
Mode : 0.824μm
C.V. : 74.20%
SP.Area : 10487cm²/cm³
Mean : 1.082μm
Span : (D 10.0-D 90.0) / D50 = 0.939
S.D. : 0.803μm

Dia. on %(5.0%) :	0.622μm	% on Dia.(0.100μm) :	0.0%
Dia. on %(25.0%) :	0.756μm	% on Dia.(1.000μm) :	62.2%
Dia. on %(50.0%) :	0.909μm	% on Dia.(10.000μm) :	99.9%
Dia. on %(75.0%) :	1.140μm	% on Dia.(100.000μm) :	100.0%
Dia. on %(95.0%) :	1.964μm	% on Dia.(1000.000μm) :	100.0%



Size(μm)	Freq(%)	Und(%)	Size(μm)	Freq(%)	Und(%)	Size(μm)	Freq(%)	Und(%)
1019.5	0.00	100.00	26.11	0.00	100.00	0.669	10.66	10.66
890.1	0.00	100.00	22.80	0.00	100.00	0.584	0.00	0.00
777.1	0.00	100.00	19.90	0.01	100.00	0.510	0.00	0.00
678.5	0.00	100.00	17.38	0.01	99.99	0.445	0.00	0.00
592.4	0.00	100.00	15.17	0.02	99.98	0.389	0.00	0.00
517.2	0.00	100.00	13.25	0.03	99.96	0.339	0.00	0.00
451.6	0.00	100.00	11.56	0.04	99.93	0.296	0.00	0.00
394.2	0.00	100.00	10.10	0.06	99.89	0.259	0.00	0.00
344.2	0.00	100.00	8.816	0.08	99.83	0.226	0.00	0.00
300.5	0.00	100.00	7.697	0.11	99.75	0.197	0.00	0.00
262.4	0.00	100.00	6.720	0.14	99.64	0.172	0.00	0.00
229.1	0.00	100.00	5.867	0.17	99.50	0.150	0.00	0.00
200.0	0.00	100.00	5.122	0.22	99.33	0.131	0.00	0.00
174.6	0.00	100.00	4.472	0.29	99.11	0.115	0.00	0.00
152.5	0.00	100.00	3.905	0.38	98.82	0.100	0.00	0.00
133.1	0.00	100.00	3.409	0.50	98.44	0.087	0.00	0.00
116.2	0.00	100.00	2.976	0.66	97.95	0.076	0.00	0.00
101.5	0.00	100.00	2.599	0.91	97.29	0.067	0.00	0.00
88.58	0.00	100.00	2.269	1.26	96.38	0.058	0.00	0.00
77.34	0.00	100.00	1.981	1.94	95.12	0.051	0.00	0.00
67.52	0.00	100.00	1.729	3.29	93.19	0.044	0.00	0.00
58.95	0.00	100.00	1.510	5.27	89.89	0.039	0.00	0.00
51.47	0.00	100.00	1.318	8.69	84.63	0.034	0.00	0.00
44.94	0.00	100.00	1.151	13.14	75.94	0.029	0.00	0.00
39.23	0.00	100.00	1.005	17.36	62.80	0.026	0.00	0.00
34.25	0.00	100.00	0.877	18.84	45.43	0.022	0.00	0.00
29.91	0.00	100.00	0.766	15.93	26.59			

HORIBA LA-910

for Windows(TM) Ver. 1.31 Oct/30/'2001 12:17

Laser scattering particle size distribution analyzer

PARTICLE SIZE MEASUREMENT DATA

ID# : 19011004-194 13:38
Filename : 11004194
Sample : S01T001871
Material : AY101

Source : Wade W Samples
Lot Numbe :
Test Numb :
Instrument :

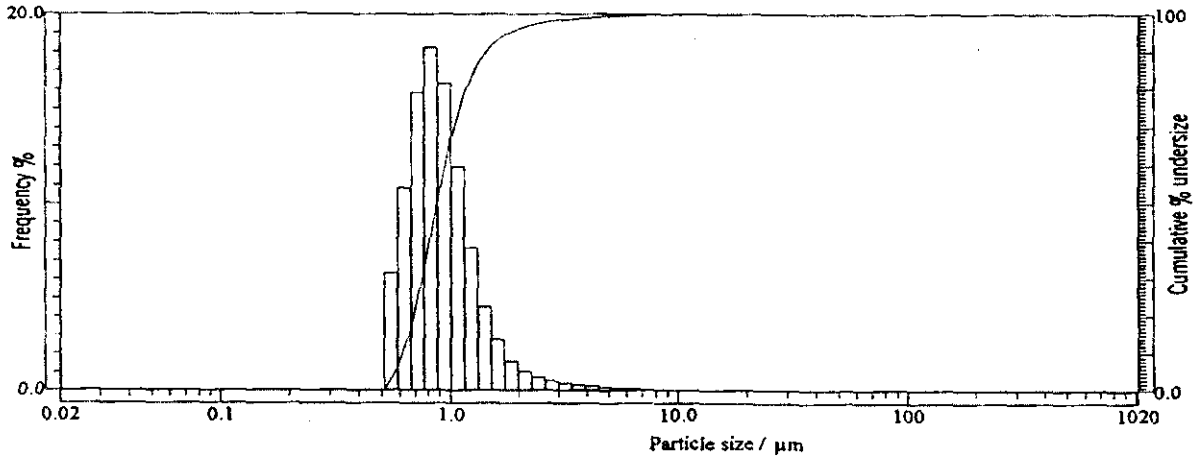
Condition
T%(He-Ne) : 87.6%
(LAMP) : 86.8%
Agitation : 3
Dist.Form : Std.
R.R.Index : 1.16-0.00i
Circulation : 6
Sampling times : 100
( )
Ultrasonic : OFF(120)

Format
Dist.base : Number
Scaling : Auto
Axis : LogX - LinearY

Data
Median : 0.870μm
Mode : 0.821μm
C.V. : 74.45%
SP.Area : 9862cm²/cm³
Mean : 1.023μm
Span : (D 10.0-D 90.0) / D50 = 0.953
S.D. : 0.762μm

Dia. on %(5.0%) : 0.568μm
Dia. on %(25.0%) : 0.715μm
Dia. on %(50.0%) : 0.870μm
Dia. on %(75.0%) : 1.095μm
Dia. on %(95.0%) : 1.830μm

% on Dia.(0.100μm) : 0.0%
% on Dia.(1.000μm) : 66.9%
% on Dia.(10.000μm) : 99.9%
% on Dia.(100.000μm) : 100.0%
% on Dia.(1000.000μm) : 100.0%



Size(μm)	Freq(%)	Und(%)	Size(μm)	Freq(%)	Und(%)	Size(μm)	Freq(%)	Und(%)
1019.5	0.00	100.00	26.11	0.00	100.00	0.669	10.82	17.14
890.1	0.00	100.00	22.80	0.00	100.00	0.584	6.32	6.32
777.1	0.00	100.00	19.90	0.00	100.00	0.510	0.00	0.00
678.5	0.00	100.00	17.38	0.01	99.99	0.445	0.00	0.00
592.4	0.00	100.00	15.17	0.01	99.98	0.389	0.00	0.00
517.2	0.00	100.00	13.25	0.02	99.97	0.339	0.00	0.00
451.6	0.00	100.00	11.56	0.04	99.94	0.296	0.00	0.00
394.2	0.00	100.00	10.10	0.05	99.91	0.259	0.00	0.00
344.2	0.00	100.00	8.816	0.07	99.85	0.226	0.00	0.00
300.5	0.00	100.00	7.697	0.09	99.78	0.197	0.00	0.00
262.4	0.00	100.00	6.720	0.12	99.69	0.172	0.00	0.00
229.1	0.00	100.00	5.867	0.15	99.57	0.150	0.00	0.00
200.0	0.00	100.00	5.122	0.19	99.42	0.131	0.00	0.00
174.6	0.00	100.00	4.472	0.24	99.23	0.115	0.00	0.00
152.5	0.00	100.00	3.905	0.32	98.99	0.100	0.00	0.00
133.1	0.00	100.00	3.409	0.41	98.67	0.087	0.00	0.00
116.2	0.00	100.00	2.976	0.55	98.26	0.076	0.00	0.00
101.5	0.00	100.00	2.599	0.75	97.71	0.067	0.00	0.00
88.58	0.00	100.00	2.269	1.04	96.97	0.058	0.00	0.00
77.34	0.00	100.00	1.981	1.60	95.93	0.051	0.00	0.00
67.52	0.00	100.00	1.729	2.77	94.33	0.044	0.00	0.00
58.95	0.00	100.00	1.510	4.52	91.56	0.039	0.00	0.00
51.47	0.00	100.00	1.318	7.66	87.04	0.034	0.00	0.00
44.94	0.00	100.00	1.151	11.93	79.38	0.029	0.00	0.00
39.23	0.00	100.00	1.005	16.28	67.45	0.026	0.00	0.00
34.25	0.00	100.00	0.877	18.22	51.17	0.022	0.00	0.00
29.91	0.00	100.00	0.766	15.82	32.95			

HORIBA LA-910

for Windows(TM) Ver. 1.31 Oct/30/'2001 2:18

Laser scattering particle size distribution analyzer

PARTICLE SIZE MEASUREMENT DATA

ID# : 19011004-195 13:44
Filename : 11004195
Sample : S01T001871
Material : AY101

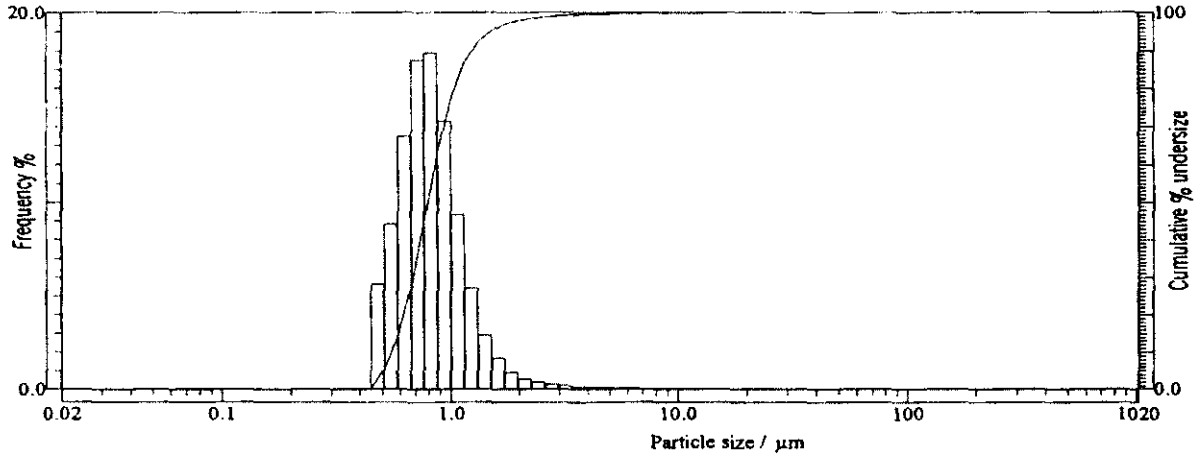
Source : Wade W Samples
Lot Numbe :
Test Numb :
Instrument :

Condition
T%(He-Ne) : 87.1% Dist.Form : Std. Sampling times : 100
(LAMP) : 85.3% R.R.Index : 1.16-0.00i ( )
Agitation : 3 Circulation : 6 Ultrasonic : ON(120)

Format
Dist.base : Number Scaling : Auto Axis : LogX - LinearY

Data
Median : 0.793μm SP.Area : 14130cm²/cm³ S.D. : 0.594μm
Mode : 0.810μm Mean : 0.894μm
C.V. : 66.44% Span : (D 10.0-D 90.0) / D50 = 0.879

Dia. on %(5.0%) : 0.502μm % on Dia.(0.100μm) : 0.0%
Dia. on %(25.0%) : 0.649μm % on Dia.(1.000μm) : 77.1%
Dia. on %(50.0%) : 0.793μm % on Dia.(10.000μm) : 99.9%
Dia. on %(75.0%) : 0.980μm % on Dia.(100.000μm) : 100.0%
Dia. on %(95.0%) : 1.490μm % on Dia.(1000.000μm) : 100.0%



Size(μm)	Freq(%)	Und(%)	Size(μm)	Freq(%)	Und(%)	Size(μm)	Freq(%)	Und(%)
1019.5	0.00	100.00	26.11	0.00	100.00	0.669	13.47	27.93
890.1	0.00	100.00	22.80	0.00	100.00	0.584	8.83	14.46
777.1	0.00	100.00	19.90	0.00	100.00	0.510	5.63	5.63
678.5	0.00	100.00	17.38	0.01	100.00	0.445	0.00	0.00
592.4	0.00	100.00	15.17	0.01	99.99	0.389	0.00	0.00
517.2	0.00	100.00	13.25	0.01	99.98	0.339	0.00	0.00
451.6	0.00	100.00	11.56	0.02	99.97	0.296	0.00	0.00
394.2	0.00	100.00	10.10	0.03	99.95	0.259	0.00	0.00
344.2	0.00	100.00	8.816	0.04	99.92	0.226	0.00	0.00
300.5	0.00	100.00	7.697	0.05	99.88	0.197	0.00	0.00
262.4	0.00	100.00	6.720	0.06	99.83	0.172	0.00	0.00
229.1	0.00	100.00	5.867	0.08	99.76	0.150	0.00	0.00
200.0	0.00	100.00	5.122	0.10	99.69	0.131	0.00	0.00
174.6	0.00	100.00	4.472	0.13	99.59	0.115	0.00	0.00
152.5	0.00	100.00	3.905	0.16	99.46	0.100	0.00	0.00
133.1	0.00	100.00	3.409	0.21	99.30	0.087	0.00	0.00
116.2	0.00	100.00	2.976	0.28	99.09	0.076	0.00	0.00
101.5	0.00	100.00	2.599	0.39	98.81	0.067	0.00	0.00
88.58	0.00	100.00	2.269	0.56	98.41	0.058	0.00	0.00
77.34	0.00	100.00	1.981	0.91	97.85	0.051	0.00	0.00
67.52	0.00	100.00	1.729	1.67	96.95	0.044	0.00	0.00
58.95	0.00	100.00	1.510	2.92	95.28	0.039	0.00	0.00
51.47	0.00	100.00	1.318	5.43	92.37	0.034	0.00	0.00
44.94	0.00	100.00	1.151	9.35	86.94	0.029	0.00	0.00
39.23	0.00	100.00	1.005	14.25	77.59	0.026	0.00	0.00
34.25	0.00	100.00	0.877	17.90	63.34	0.022	0.00	0.00
29.91	0.00	100.00	0.766	17.50	45.43			

HORIBA LA-910

for Windows(TM) Ver. 1.31 Oct/30/'2001 2:27

Laser scattering particle size distribution analyzer

PARTICLE SIZE MEASUREMENT DATA

ID# : 19011004-196 13:48
Filename : 11004196
Sample : S01T001871
Material : AY101

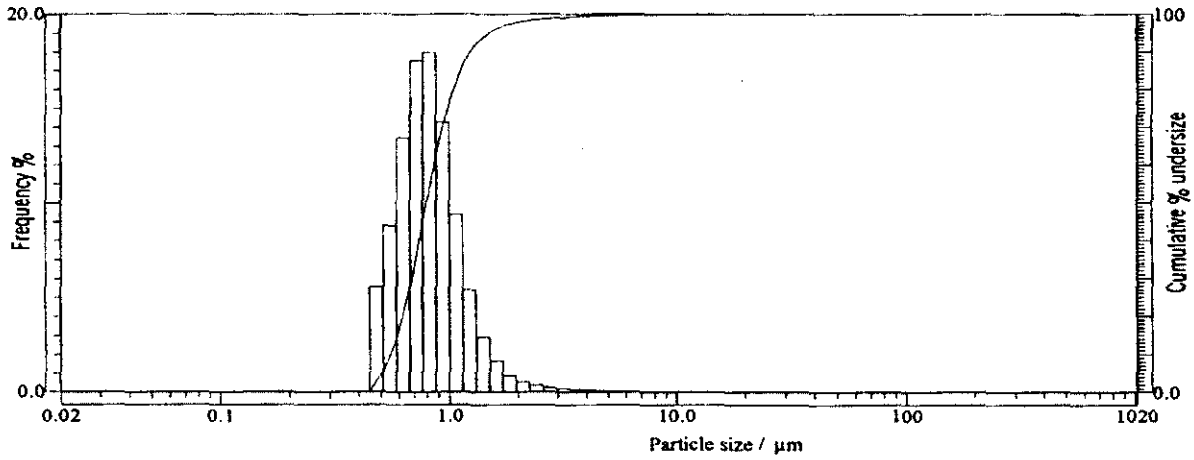
Source : Wade W Samples
Lot Numbe :
Test Numb :
Instrument :

Condition
T%(He-Ne) : 87.2% Dist.Form : Std. Sampling times : 100
(LAMP) : 85.5% R.R.Index : 1.16-0.00i ( )
Agitation : 1 Circulation : 6 Ultrasonic : ON(120)

Format
Dist.base : Number Scaling : Auto Axis : LogX - LinearY

Data
Median : 0.794μm SP.Area : 14548cm²/cm³ S.D. : 0.592μm
Mode : 0.810μm Mean : 0.895μm
C.V. : 66.16% Span : (D 10.0-D 90.0) / D50 = 0.877

Dia. on %(5.0%) : 0.503μm % on Dia.(0.100μm) : 0.0%
Dia. on %(25.0%) : 0.650μm % on Dia.(1.000μm) : 77.1%
Dia. on %(50.0%) : 0.794μm % on Dia.(10.000μm) : 99.9%
Dia. on %(75.0%) : 0.981μm % on Dia.(100.000μm) : 100.0%
Dia. on %(95.0%) : 1.489μm % on Dia.(1000.000μm) : 100.0%



Size(μm)	Freq(%)	Und(%)	Size(μm)	Freq(%)	Und(%)	Size(μm)	Freq(%)	Und(%)
1019.5	0.00	100.00	26.11	0.00	100.00	0.669	13.45	27.78
890.1	0.00	100.00	22.80	0.00	100.00	0.584	8.77	14.33
777.1	0.00	100.00	19.90	0.00	100.00	0.510	5.56	5.56
678.5	0.00	100.00	17.38	0.01	100.00	0.445	0.00	0.00
592.4	0.00	100.00	15.17	0.01	99.99	0.389	0.00	0.00
517.2	0.00	100.00	13.25	0.01	99.98	0.339	0.00	0.00
451.6	0.00	100.00	11.56	0.02	99.97	0.296	0.00	0.00
394.2	0.00	100.00	10.10	0.03	99.95	0.259	0.00	0.00
344.2	0.00	100.00	8.816	0.04	99.92	0.226	0.00	0.00
300.5	0.00	100.00	7.697	0.05	99.88	0.197	0.00	0.00
262.4	0.00	100.00	6.720	0.07	99.82	0.172	0.00	0.00
229.1	0.00	100.00	5.867	0.08	99.76	0.150	0.00	0.00
200.0	0.00	100.00	5.122	0.10	99.68	0.131	0.00	0.00
174.6	0.00	100.00	4.472	0.13	99.58	0.115	0.00	0.00
152.5	0.00	100.00	3.905	0.16	99.46	0.100	0.00	0.00
133.1	0.00	100.00	3.409	0.21	99.29	0.087	0.00	0.00
116.2	0.00	100.00	2.976	0.28	99.08	0.076	0.00	0.00
101.5	0.00	100.00	2.599	0.39	98.80	0.067	0.00	0.00
88.58	0.00	100.00	2.269	0.56	98.41	0.058	0.00	0.00
77.34	0.00	100.00	1.981	0.90	97.86	0.051	0.00	0.00
67.52	0.00	100.00	1.729	1.66	96.96	0.044	0.00	0.00
58.95	0.00	100.00	1.510	2.91	95.30	0.039	0.00	0.00
51.47	0.00	100.00	1.318	5.43	92.39	0.034	0.00	0.00
44.94	0.00	100.00	1.151	9.38	86.96	0.029	0.00	0.00
39.23	0.00	100.00	1.005	14.30	77.58	0.026	0.00	0.00
34.25	0.00	100.00	0.877	17.97	63.28	0.022	0.00	0.00
29.91	0.00	100.00	0.766	17.53	45.31			

HORIBA LA-910

for Windows(TM) Ver. 1.31 Oct/30/'2001 2:27

Laser scattering particle size distribution analyzer

PARTICLE SIZE MEASUREMENT DATA

ID# : 19011004-197 13:59
Filename : 11004197
Sample : S01T001871
Material : AY101

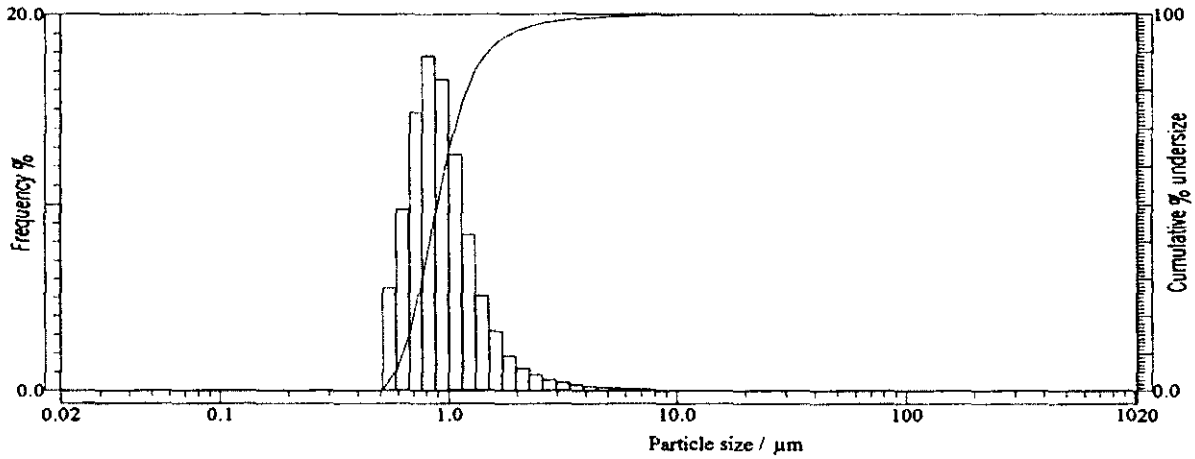
Source : Wade W Samples
Lot Numbe :
Test Numb : Dup
Instrument :

Condition
T%(He-Ne) : 88.9%
(LAMP) : 88.0%
Agitation : 1
Dist.Form : Std.
R.R.Index : 1.16-0.001 ( )
Circulation : 6
Sampling times : 100
Ultrasonic : OFF(120)

Format
Dist.base : Number
Scaling : Auto
Axis : LogX - LinearY

Data
Median : 0.893μm
Mode : 0.825μm
C.V. : 72.43%
SP.Area : 13399cm²/cm³
Mean : 1.052μm
Span : (D 10.0-D 90.0) / D50 = 0.973
S.D. : 0.762μm

Dia. on %(5.0%) :	0.577μm	% on Dia.(0.100μm) :	0.0%
Dia. on %(25.0%) :	0.731μm	% on Dia.(1.000μm) :	63.8%
Dia. on %(50.0%) :	0.893μm	% on Dia.(10.000μm) :	99.9%
Dia. on %(75.0%) :	1.126μm	% on Dia.(100.000μm) :	100.0%
Dia. on %(95.0%) :	1.910μm	% on Dia.(1000.000μm) :	100.0%



Size(μm)	Freq(%)	Und(%)	Size(μm)	Freq(%)	Und(%)	Size(μm)	Freq(%)	Und(%)
1019.5	0.00	100.00	26.11	0.00	100.00	0.669	9.75	15.24
890.1	0.00	100.00	22.80	0.00	100.00	0.584	5.49	5.49
777.1	0.00	100.00	19.90	0.01	100.00	0.510	0.00	0.00
678.5	0.00	100.00	17.38	0.01	99.99	0.445	0.00	0.00
592.4	0.00	100.00	15.17	0.02	99.98	0.389	0.00	0.00
517.2	0.00	100.00	13.25	0.03	99.96	0.339	0.00	0.00
451.6	0.00	100.00	11.56	0.04	99.94	0.296	0.00	0.00
394.2	0.00	100.00	10.10	0.05	99.90	0.259	0.00	0.00
344.2	0.00	100.00	8.816	0.07	99.85	0.226	0.00	0.00
300.5	0.00	100.00	7.697	0.10	99.77	0.197	0.00	0.00
262.4	0.00	100.00	6.720	0.12	99.68	0.172	0.00	0.00
229.1	0.00	100.00	5.867	0.15	99.55	0.150	0.00	0.00
200.0	0.00	100.00	5.122	0.20	99.40	0.131	0.00	0.00
174.6	0.00	100.00	4.472	0.26	99.20	0.115	0.00	0.00
152.5	0.00	100.00	3.905	0.34	98.95	0.100	0.00	0.00
133.1	0.00	100.00	3.409	0.46	98.60	0.087	0.00	0.00
116.2	0.00	100.00	2.976	0.61	98.15	0.076	0.00	0.00
101.5	0.00	100.00	2.599	0.85	97.54	0.067	0.00	0.00
88.58	0.00	100.00	2.269	1.19	96.69	0.058	0.00	0.00
77.34	0.00	100.00	1.981	1.85	95.49	0.051	0.00	0.00
67.52	0.00	100.00	1.729	3.16	93.65	0.044	0.00	0.00
58.95	0.00	100.00	1.510	5.07	90.49	0.039	0.00	0.00
51.47	0.00	100.00	1.318	8.37	85.42	0.034	0.00	0.00
44.94	0.00	100.00	1.151	12.62	77.04	0.029	0.00	0.00
39.23	0.00	100.00	1.005	16.57	64.42	0.026	0.00	0.00
34.25	0.00	100.00	0.877	17.79	47.86	0.022	0.00	0.00
29.91	0.00	100.00	0.766	14.82	30.07			

HORIBA LA-910

for Windows(TM) Ver. 1.31 Oct/30/'2001 2:28

Laser scattering particle size distribution analyzer

PARTICLE SIZE MEASUREMENT DATA

ID# : 19011004-198 14:03
Filename : 11004198
Sample : S01T001871
Material : AY101

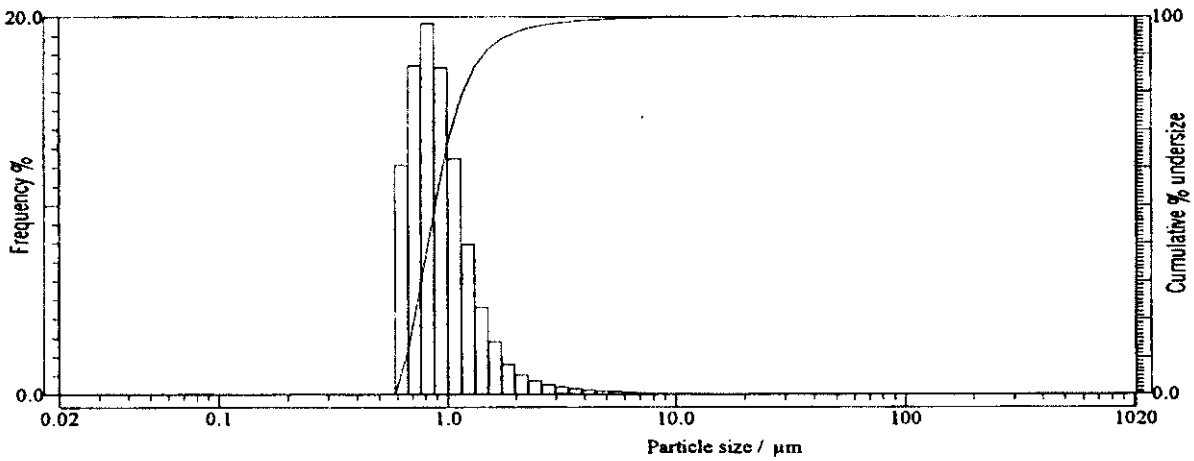
Source : Wade W Samples
Lot Numbe :
Test Numb : Dup
Instrument :

Condition
T%(He-Ne) : 88.8%
(LAMP) : 87.9%
Agitation : 3
Dist.Form : Std.
R.R.Index : 1.16-0.00i
Circulation : 6
Sampling times : 100 ( )
Ultrasonic : OFF(120)

Format
Dist.base : Number
Scaling : Auto
Axis : LogX - LinearY

Data
Median : 0.883μm
Mode : 0.819μm
C.V. : 72.59%
SP.Area : 8855cm²/cm³
Mean : 1.042μm
Span : (D 10.0-D 90.0) / D50 = 0.898
S.D. : 0.756μm

Dia. on %(5.0%) :	0.617μm	% on Dia.(0.100μm) :	0.0%
Dia. on %(25.0%) :	0.739μm	% on Dia.(1.000μm) :	65.8%
Dia. on %(50.0%) :	0.883μm	% on Dia.(10.000μm) :	99.9%
Dia. on %(75.0%) :	1.103μm	% on Dia.(100.000μm) :	100.0%
Dia. on %(95.0%) :	1.836μm	% on Dia.(1000.000μm) :	100.0%



Size(μm)	Freq(%)	Und(%)	Size(μm)	Freq(%)	Und(%)	Size(μm)	Freq(%)	Und(%)
1019.5	0.00	100.00	26.11	0.00	100.00	0.669	12.12	12.12
890.1	0.00	100.00	22.80	0.00	100.00	0.584	0.00	0.00
777.1	0.00	100.00	19.90	0.00	100.00	0.510	0.00	0.00
678.5	0.00	100.00	17.38	0.01	100.00	0.445	0.00	0.00
592.4	0.00	100.00	15.17	0.01	99.98	0.389	0.00	0.00
517.2	0.00	100.00	13.25	0.02	99.97	0.339	0.00	0.00
451.6	0.00	100.00	11.56	0.04	99.94	0.296	0.00	0.00
394.2	0.00	100.00	10.10	0.05	99.91	0.259	0.00	0.00
344.2	0.00	100.00	8.816	0.07	99.86	0.226	0.00	0.00
300.5	0.00	100.00	7.697	0.09	99.79	0.197	0.00	0.00
262.4	0.00	100.00	6.720	0.12	99.69	0.172	0.00	0.00
229.1	0.00	100.00	5.867	0.15	99.57	0.150	0.00	0.00
200.0	0.00	100.00	5.122	0.19	99.42	0.131	0.00	0.00
174.6	0.00	100.00	4.472	0.25	99.23	0.115	0.00	0.00
152.5	0.00	100.00	3.905	0.32	98.99	0.100	0.00	0.00
133.1	0.00	100.00	3.409	0.42	98.67	0.087	0.00	0.00
116.2	0.00	100.00	2.976	0.55	98.25	0.076	0.00	0.00
101.5	0.00	100.00	2.599	0.75	97.70	0.067	0.00	0.00
88.58	0.00	100.00	2.269	1.04	96.95	0.058	0.00	0.00
77.34	0.00	100.00	1.981	1.62	95.91	0.051	0.00	0.00
67.52	0.00	100.00	1.729	2.82	94.29	0.044	0.00	0.00
58.95	0.00	100.00	1.510	4.62	91.47	0.039	0.00	0.00
51.47	0.00	100.00	1.318	7.92	86.85	0.034	0.00	0.00
44.94	0.00	100.00	1.151	12.49	78.93	0.029	0.00	0.00
39.23	0.00	100.00	1.005	17.28	66.44	0.026	0.00	0.00
34.25	0.00	100.00	0.877	19.66	49.16	0.022	0.00	0.00
29.91	0.00	100.00	0.766	17.38	29.50			

HORIBA LA-910

for Windows(TM) Ver. 1.31 Oct/30/'2001 2:29

Laser scattering particle size distribution analyzer

PARTICLE SIZE MEASUREMENT DATA

ID# : 19011004-199 14:09
Filename : 11004199
Sample : S01T001871
Material : AY101

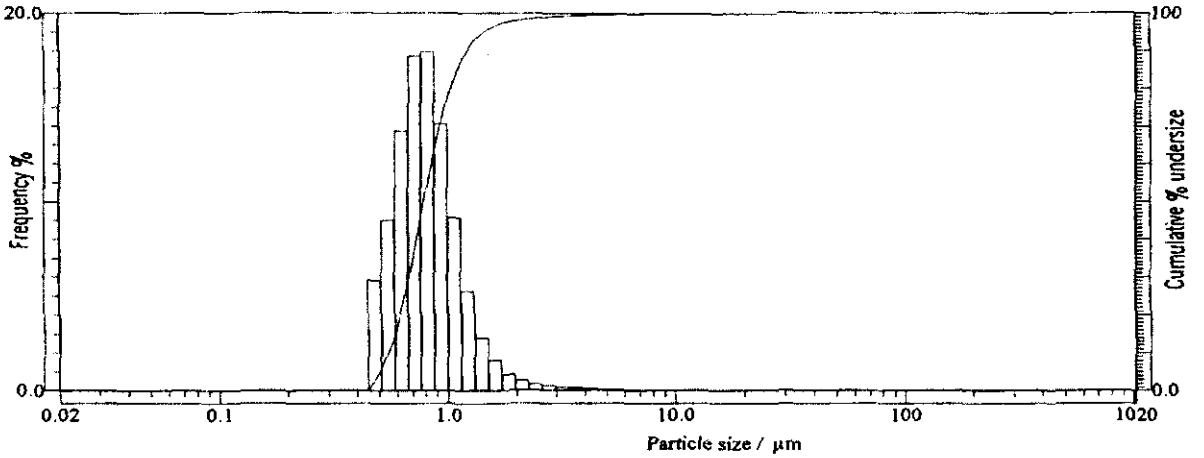
Source : Wade W Samples
Lot Numbe :
Test Numb : Dup
Instrument :

Condition
T%(He-Ne) : 88.3% Dist.Form : Std. Sampling times : 100
(LAMP) : 86.7% R.R.Index : 1.16-0.00i ( )
Agitation : 3 Circulation : 6 Ultrasonic : ON(120)

Format
Dist.base : Number Scaling : Auto Axis : LogX - LinearY

Data
Median : 0.788μm SP.Area : 14067cm²/cm³ S.D. : 0.576μm
Mode : 0.809μm Mean : 0.885μm
C.V. : 65.13% Span : (D 10.0-D 90.0) / D50 = 0.869

Dia. on %(5.0%) : 0.500μm % on Dia.(0.100μm) : 0.0%
Dia. on %(25.0%) : 0.645μm % on Dia.(1.000μm) : 77.8%
Dia. on %(50.0%) : 0.788μm % on Dia.(10.000μm) : 99.9%
Dia. on %(75.0%) : 0.973μm % on Dia.(100.000μm) : 100.0%
Dia. on %(95.0%) : 1.470μm % on Dia.(1000.000μm) : 100.0%



Size(μm)	Freq(%)	Und(%)	Size(μm)	Freq(%)	Und(%)	Size(μm)	Freq(%)	Und(%)
1019.5	0.00	100.00	26.11	0.00	100.00	0.669	13.73	28.59
890.1	0.00	100.00	22.80	0.00	100.00	0.584	9.05	14.85
777.1	0.00	100.00	19.90	0.00	100.00	0.510	5.80	5.80
678.5	0.00	100.00	17.38	0.00	100.00	0.445	0.00	0.00
592.4	0.00	100.00	15.17	0.01	99.99	0.389	0.00	0.00
517.2	0.00	100.00	13.25	0.01	99.98	0.339	0.00	0.00
451.6	0.00	100.00	11.56	0.02	99.97	0.296	0.00	0.00
394.2	0.00	100.00	10.10	0.03	99.95	0.259	0.00	0.00
344.2	0.00	100.00	8.816	0.04	99.92	0.226	0.00	0.00
300.5	0.00	100.00	7.697	0.05	99.89	0.197	0.00	0.00
262.4	0.00	100.00	6.720	0.06	99.84	0.172	0.00	0.00
229.1	0.00	100.00	5.867	0.07	99.78	0.150	0.00	0.00
200.0	0.00	100.00	5.122	0.09	99.71	0.131	0.00	0.00
174.6	0.00	100.00	4.472	0.12	99.62	0.115	0.00	0.00
152.5	0.00	100.00	3.905	0.15	99.50	0.100	0.00	0.00
133.1	0.00	100.00	3.409	0.20	99.34	0.087	0.00	0.00
116.2	0.00	100.00	2.976	0.26	99.15	0.076	0.00	0.00
101.5	0.00	100.00	2.599	0.37	98.88	0.067	0.00	0.00
88.58	0.00	100.00	2.269	0.53	98.51	0.058	0.00	0.00
77.34	0.00	100.00	1.981	0.85	97.99	0.051	0.00	0.00
67.52	0.00	100.00	1.729	1.58	97.13	0.044	0.00	0.00
58.95	0.00	100.00	1.510	2.79	95.55	0.039	0.00	0.00
51.47	0.00	100.00	1.318	5.25	92.76	0.034	0.00	0.00
44.94	0.00	100.00	1.151	9.16	87.51	0.029	0.00	0.00
39.23	0.00	100.00	1.005	14.12	78.35	0.026	0.00	0.00
34.25	0.00	100.00	0.877	17.94	64.23	0.022	0.00	0.00
29.91	0.00	100.00	0.766	17.70	46.29			

HORIBA LA-910

for Windows(TM) Ver. 1.31 Oct/30/'2001 2:29

Laser scattering particle size distribution analyzer

PARTICLE SIZE MEASUREMENT DATA

ID# : 19011004-200 14:13
Filename : 11004200
Sample : S01T001871
Material : AY101

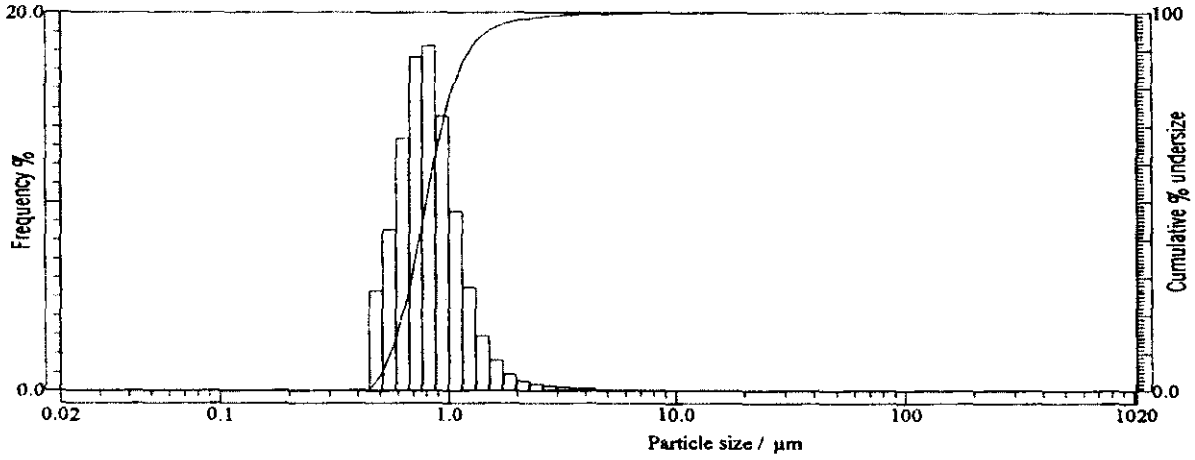
Source : Wade W Samples
Lot Numbe :
Test Numb : Dup
Instrument :

Condition
T%(He-Ne) : 88.5%
(LAMP) : 86.9%
Agitation : 1
Dist.Form : Std.
R.R.Index : 1.16-0.00i ( )
Circulation : 6
Sampling times : 100
Ultrasonic : ON(120)

Format
Dist.base : Number
Scaling : Auto
Axis : LogX - LinearY

Data
Median : 0.796μm
Mode : 0.810μm
C.V. : 63.79%
SP.Area : 17507cm²/cm³
Mean : 0.893μm
S.D. : 0.570μm
Span : (D 10.0-D 90.0) / D50 = 0.865

Dia. on %(5.0%) :	0.506μm	% on Dia.(0.100μm) :	0.0%
Dia. on %(25.0%) :	0.654μm	% on Dia.(1.000μm) :	77.0%
Dia. on %(50.0%) :	0.796μm	% on Dia.(10.000μm) :	99.9%
Dia. on %(75.0%) :	0.981μm	% on Dia.(100.000μm) :	100.0%
Dia. on %(95.0%) :	1.479μm	% on Dia.(1000.000μm) :	100.0%



Size(μm)	Freq(%)	Und(%)	Size(μm)	Freq(%)	Und(%)	Size(μm)	Freq(%)	Und(%)
1019.5	0.00	100.00	26.11	0.00	100.00	0.669	13.35	27.17
890.1	0.00	100.00	22.80	0.00	100.00	0.584	8.54	13.82
777.1	0.00	100.00	19.90	0.00	100.00	0.510	5.29	5.29
678.5	0.00	100.00	17.38	0.00	100.00	0.445	0.00	0.00
592.4	0.00	100.00	15.17	0.01	99.99	0.389	0.00	0.00
517.2	0.00	100.00	13.25	0.01	99.98	0.339	0.00	0.00
451.6	0.00	100.00	11.56	0.02	99.97	0.296	0.00	0.00
394.2	0.00	100.00	10.10	0.03	99.95	0.259	0.00	0.00
344.2	0.00	100.00	8.816	0.04	99.92	0.226	0.00	0.00
300.5	0.00	100.00	7.697	0.05	99.89	0.197	0.00	0.00
262.4	0.00	100.00	6.720	0.06	99.84	0.172	0.00	0.00
229.1	0.00	100.00	5.867	0.07	99.78	0.150	0.00	0.00
200.0	0.00	100.00	5.122	0.09	99.70	0.131	0.00	0.00
174.6	0.00	100.00	4.472	0.12	99.61	0.115	0.00	0.00
152.5	0.00	100.00	3.905	0.15	99.49	0.100	0.00	0.00
133.1	0.00	100.00	3.409	0.20	99.34	0.087	0.00	0.00
116.2	0.00	100.00	2.976	0.27	99.14	0.076	0.00	0.00
101.5	0.00	100.00	2.599	0.38	98.87	0.067	0.00	0.00
88.58	0.00	100.00	2.269	0.54	98.49	0.058	0.00	0.00
77.34	0.00	100.00	1.981	0.88	97.96	0.051	0.00	0.00
67.52	0.00	100.00	1.729	1.64	97.08	0.044	0.00	0.00
58.95	0.00	100.00	1.510	2.90	95.44	0.039	0.00	0.00
51.47	0.00	100.00	1.318	5.46	92.53	0.034	0.00	0.00
44.94	0.00	100.00	1.151	9.50	87.07	0.029	0.00	0.00
39.23	0.00	100.00	1.005	14.54	77.57	0.026	0.00	0.00
34.25	0.00	100.00	0.877	18.22	63.03	0.022	0.00	0.00
29.91	0.00	100.00	0.766	17.64	44.81			

HORIBA LA-910

for Windows(TM) Ver. 1.31 Oct/30/'2001 12:30

Laser scattering particle size distribution analyzer

PARTICLE SIZE MEASUREMENT DATA

ID# : 19011004-201 14:27
Filename : 11004201
Sample : S01T001874
Material : AY101

Source : Wade W Samples
Lot Numbe :
Test Numb :
Instrument :

Condition

T%(He-Ne) : 88.4%
(LAMP) : 85.9%
Agitation : 1

Dist.Form : Std.
R.R.Index : 1.16-0.00i
Circulation : 6

Sampling times : 100
( )
Ultrasonic : OFF(120)

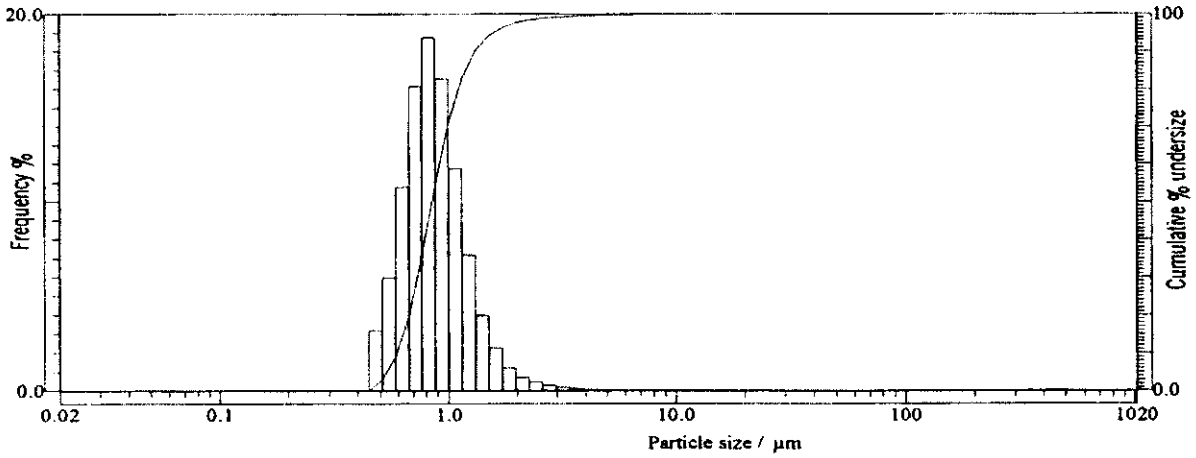
Format

Dist.base : Number Scaling : Auto Axis : LogX - LinearY

Data

Median : 0.847μm SP.Area : 23628cm²/cm³ S.D. : 0.527μm
Mode : 0.821μm Mean : 0.944μm
C.V. : 55.77% Span : (D 10.0-D 90.0) / D50 = 0.853

Dia. on %(5.0%) : 0.531μm % on Dia.(0.100μm) : 0.0%
Dia. on %(25.0%) : 0.698μm % on Dia.(1.000μm) : 70.7%
Dia. on %(50.0%) : 0.847μm % on Dia.(10.000μm) : 100.0%
Dia. on %(75.0%) : 1.049μm % on Dia.(100.000μm) : 100.0%
Dia. on %(95.0%) : 1.583μm % on Dia.(1000.000μm) : 100.0%



Size(μm)	Freq(%)	Und(%)	Size(μm)	Freq(%)	Und(%)	Size(μm)	Freq(%)	Und(%)
1019.5	0.00	100.00	26.11	0.00	100.00	0.669	10.75	19.90
890.1	0.00	100.00	22.80	0.00	100.00	0.584	5.97	9.15
777.1	0.00	100.00	19.90	0.00	100.00	0.510	3.17	3.17
678.5	0.00	100.00	17.38	0.00	100.00	0.445	0.00	0.00
592.4	0.00	100.00	15.17	0.01	100.00	0.389	0.00	0.00
517.2	0.00	100.00	13.25	0.01	99.99	0.339	0.00	0.00
451.6	0.00	100.00	11.56	0.01	99.98	0.296	0.00	0.00
394.2	0.00	100.00	10.10	0.02	99.97	0.259	0.00	0.00
344.2	0.00	100.00	8.816	0.03	99.94	0.226	0.00	0.00
300.5	0.00	100.00	7.697	0.04	99.92	0.197	0.00	0.00
262.4	0.00	100.00	6.720	0.05	99.88	0.172	0.00	0.00
229.1	0.00	100.00	5.867	0.06	99.83	0.150	0.00	0.00
200.0	0.00	100.00	5.122	0.08	99.76	0.131	0.00	0.00
174.6	0.00	100.00	4.472	0.11	99.68	0.115	0.00	0.00
152.5	0.00	100.00	3.905	0.16	99.57	0.100	0.00	0.00
133.1	0.00	100.00	3.409	0.22	99.41	0.087	0.00	0.00
116.2	0.00	100.00	2.976	0.32	99.19	0.076	0.00	0.00
101.5	0.00	100.00	2.599	0.47	98.87	0.067	0.00	0.00
88.58	0.00	100.00	2.269	0.72	98.40	0.058	0.00	0.00
77.34	0.00	100.00	1.981	1.21	97.68	0.051	0.00	0.00
67.52	0.00	100.00	1.729	2.26	96.47	0.044	0.00	0.00
58.95	0.00	100.00	1.510	3.98	94.21	0.039	0.00	0.00
51.47	0.00	100.00	1.318	7.17	90.22	0.034	0.00	0.00
44.94	0.00	100.00	1.151	11.74	83.05	0.029	0.00	0.00
39.23	0.00	100.00	1.005	16.53	71.31	0.026	0.00	0.00
34.25	0.00	100.00	0.877	18.73	54.78	0.022	0.00	0.00
29.91	0.00	100.00	0.766	16.15	36.05			

HORIBA LA-910

for Windows(TM) Ver. 1.31 Oct/30/'2001 12:30

Laser scattering particle size distribution analyzer

PARTICLE SIZE MEASUREMENT DATA

ID# : 19011004-202 14:32
Filename : 11004202
Sample : S01T001874
Material : AY101

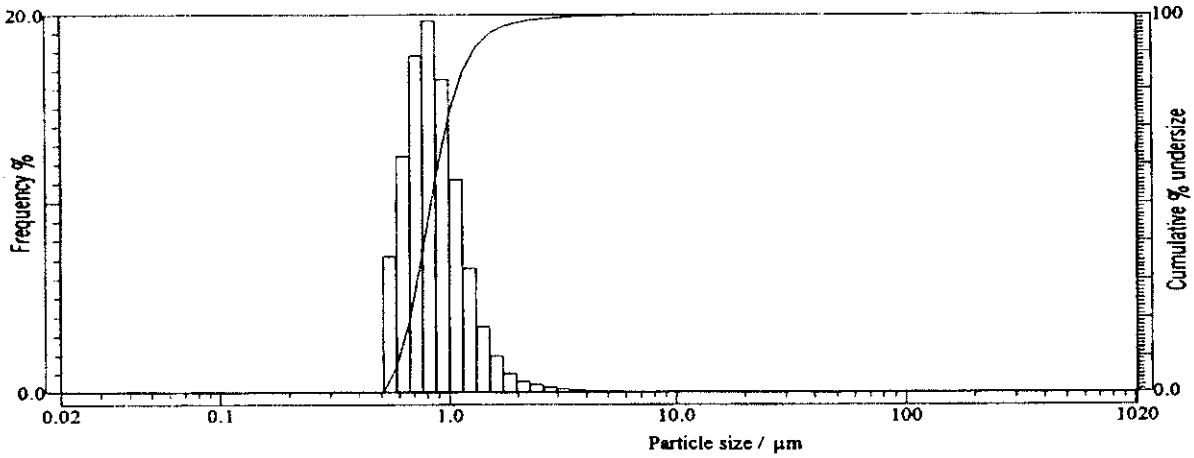
Source : Wade W Samples
Lot Numbe :
Test Numb :
Instrument :

Condition
T%(He-Ne) : 88.5% Dist.Form : Std. Sampling times : 100
(LAMP) : 86.1% R.R.Index : 1.16-0.00i ( )
Agitation : 3 Circulation : 6 Ultrasonic : OFF(120)

Format
Dist.base : Number Scaling : Auto Axis : LogX - LinearY

Data
Median : 0.835μm SP.Area : 14253cm²/cm³ S.D. : 0.520μm
Mode : 0.816μm Mean : 0.931μm
C.V. : 55.83% Span : (D 10.0-D 90.0) / D50 = 0.812

Dia. on %(5.0%) : 0.560μm % on Dia.(0.100μm) : 0.0%
Dia. on %(25.0%) : 0.697μm % on Dia.(1.000μm) : 73.1%
Dia. on %(50.0%) : 0.835μm % on Dia.(10.000μm) : 100.0%
Dia. on %(75.0%) : 1.021μm % on Dia.(100.000μm) : 100.0%
Dia. on %(95.0%) : 1.515μm % on Dia.(1000.000μm) : 100.0%



Size(μm)	Freq(%)	Und(%)	Size(μm)	Freq(%)	Und(%)	Size(μm)	Freq(%)	Und(%)
1019.5	0.00	100.00	26.11	0.00	100.00	0.669	12.41	19.62
890.1	0.00	100.00	22.80	0.00	100.00	0.584	7.21	7.21
777.1	0.00	100.00	19.90	0.00	100.00	0.510	0.00	0.00
678.5	0.00	100.00	17.38	0.00	100.00	0.445	0.00	0.00
592.4	0.00	100.00	15.17	0.01	100.00	0.389	0.00	0.00
517.2	0.00	100.00	13.25	0.01	99.99	0.339	0.00	0.00
451.6	0.00	100.00	11.56	0.01	99.98	0.296	0.00	0.00
394.2	0.00	100.00	10.10	0.02	99.97	0.259	0.00	0.00
344.2	0.00	100.00	8.816	0.03	99.95	0.226	0.00	0.00
300.5	0.00	100.00	7.697	0.04	99.92	0.197	0.00	0.00
262.4	0.00	100.00	6.720	0.05	99.88	0.172	0.00	0.00
229.1	0.00	100.00	5.867	0.06	99.83	0.150	0.00	0.00
200.0	0.00	100.00	5.122	0.08	99.77	0.131	0.00	0.00
174.6	0.00	100.00	4.472	0.11	99.70	0.115	0.00	0.00
152.5	0.00	100.00	3.905	0.14	99.59	0.100	0.00	0.00
133.1	0.00	100.00	3.409	0.20	99.44	0.087	0.00	0.00
116.2	0.00	100.00	2.976	0.28	99.25	0.076	0.00	0.00
101.5	0.00	100.00	2.599	0.41	98.97	0.067	0.00	0.00
88.58	0.00	100.00	2.269	0.61	98.56	0.058	0.00	0.00
77.34	0.00	100.00	1.981	1.03	97.95	0.051	0.00	0.00
67.52	0.00	100.00	1.729	1.96	96.92	0.044	0.00	0.00
58.95	0.00	100.00	1.510	3.52	94.95	0.039	0.00	0.00
51.47	0.00	100.00	1.318	6.57	91.43	0.034	0.00	0.00
44.94	0.00	100.00	1.151	11.21	84.86	0.029	0.00	0.00
39.23	0.00	100.00	1.005	16.54	73.64	0.026	0.00	0.00
34.25	0.00	100.00	0.877	19.68	57.10	0.022	0.00	0.00
29.91	0.00	100.00	0.766	17.81	37.42			

HORIBA LA-910

for Windows(TM) Ver. 1.31 Oct/30/'2001 12:46

Laser scattering particle size distribution analyzer

PARTICLE SIZE MEASUREMENT DATA

ID# : 19011004-203 14:37
Filename : 11004203
Sample : S01T001874
Material : AY101

Source : Wade W Samples
Lot Numbe :
Test Numb :
Instrument :

Condition

T%(He-Ne) : 88.7%
(LAMP) : 86.0%
Agitation : 3
Dist.Form : Std.
R.R.Index : 1.16-0.00i
Circulation : 6
Sampling times : 100 ( )
Ultrasonic : ON(120)

Format

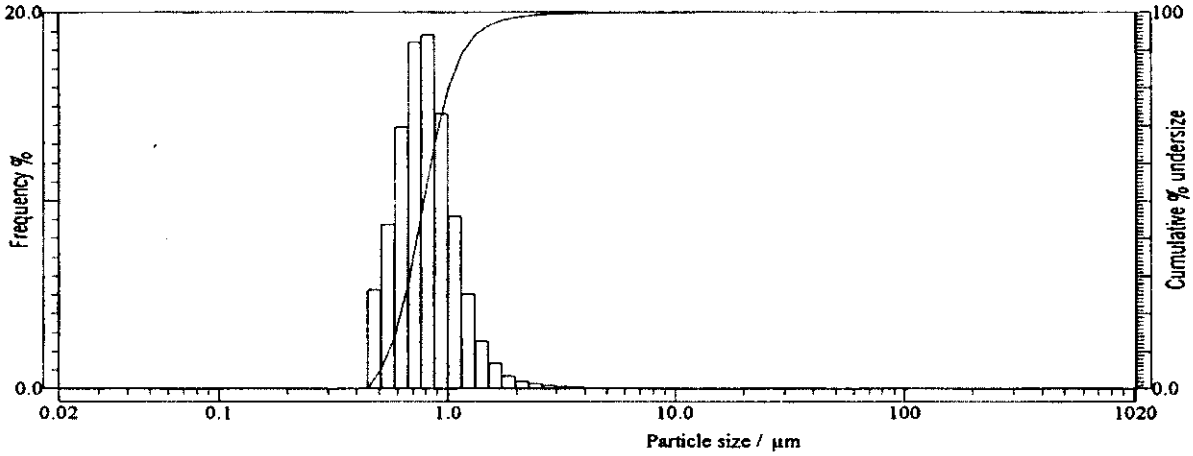
Dist.base : Number
Scaling : Auto
Axis : LogX · LinearY

Data

Median : 0.786μm
Mode : 0.809μm
C.V. : 54.03%
SP.Area : 14782cm²/cm³
Mean : 0.861μm
Span : (D 10.0-D 90.0) / D50 = 0.807
S.D. : 0.465μm

Dia. on %(5.0%) : 0.506μm
Dia. on %(25.0%) : 0.650μm
Dia. on %(50.0%) : 0.786μm
Dia. on %(75.0%) : 0.961μm
Dia. on %(95.0%) : 1.389μm

% on Dia.(0.100μm) : 0.0%
% on Dia.(1.000μm) : 79.3%
% on Dia.(10.000μm) : 100.0%
% on Dia.(100.000μm) : 100.0%
% on Dia.(1000.000μm) : 100.0%



Size(μm)	Freq(%)	Und(%)	Size(μm)	Freq(%)	Und(%)	Size(μm)	Freq(%)	Und(%)
1019.5	0.00	100.00	26.11	0.00	100.00	0.669	13.92	27.95
890.1	0.00	100.00	22.80	0.00	100.00	0.584	8.76	14.03
777.1	0.00	100.00	19.90	0.00	100.00	0.510	5.27	5.27
678.5	0.00	100.00	17.38	0.00	100.00	0.445	0.00	0.00
592.4	0.00	100.00	15.17	0.00	100.00	0.389	0.00	0.00
517.2	0.00	100.00	13.25	0.01	100.00	0.339	0.00	0.00
451.6	0.00	100.00	11.56	0.01	99.99	0.296	0.00	0.00
394.2	0.00	100.00	10.10	0.02	99.98	0.259	0.00	0.00
344.2	0.00	100.00	8.816	0.02	99.96	0.226	0.00	0.00
300.5	0.00	100.00	7.697	0.03	99.94	0.197	0.00	0.00
262.4	0.00	100.00	6.720	0.04	99.91	0.172	0.00	0.00
229.1	0.00	100.00	5.867	0.04	99.88	0.150	0.00	0.00
200.0	0.00	100.00	5.122	0.06	99.83	0.131	0.00	0.00
174.6	0.00	100.00	4.472	0.07	99.78	0.115	0.00	0.00
152.5	0.00	100.00	3.905	0.10	99.70	0.100	0.00	0.00
133.1	0.00	100.00	3.409	0.13	99.60	0.087	0.00	0.00
116.2	0.00	100.00	2.976	0.18	99.47	0.076	0.00	0.00
101.5	0.00	100.00	2.599	0.27	99.29	0.067	0.00	0.00
88.58	0.00	100.00	2.269	0.40	99.02	0.058	0.00	0.00
77.34	0.00	100.00	1.981	0.69	98.61	0.051	0.00	0.00
67.52	0.00	100.00	1.729	1.36	97.92	0.044	0.00	0.00
58.95	0.00	100.00	1.510	2.54	96.57	0.039	0.00	0.00
51.47	0.00	100.00	1.318	5.04	94.02	0.034	0.00	0.00
44.94	0.00	100.00	1.151	9.19	88.98	0.029	0.00	0.00
39.23	0.00	100.00	1.005	14.61	79.79	0.026	0.00	0.00
34.25	0.00	100.00	0.877	18.80	65.18	0.022	0.00	0.00
29.91	0.00	100.00	0.766	18.43	46.38			

HORIBA LA-910

for Windows(TM) Ver. 1.31 Oct/30/'2001 2:46

Laser scattering particle size distribution analyzer

PARTICLE SIZE MEASUREMENT DATA

ID# : 19011004-204 14:41
Filename : 11004204
Sample : S01T001874
Material : AY101

Source : Wade W Samples
Lot Numbe :
Test Numb :
Instrument :

Condition

T%(He-Ne) : 88.8% Dist.Form : Std. Sampling times : 100
(LAMP) : 86.2% R.R.Index : 1.16-0.00i ( )
Agitation : 1 Circulation : 6 Ultrasonic : ON(120)

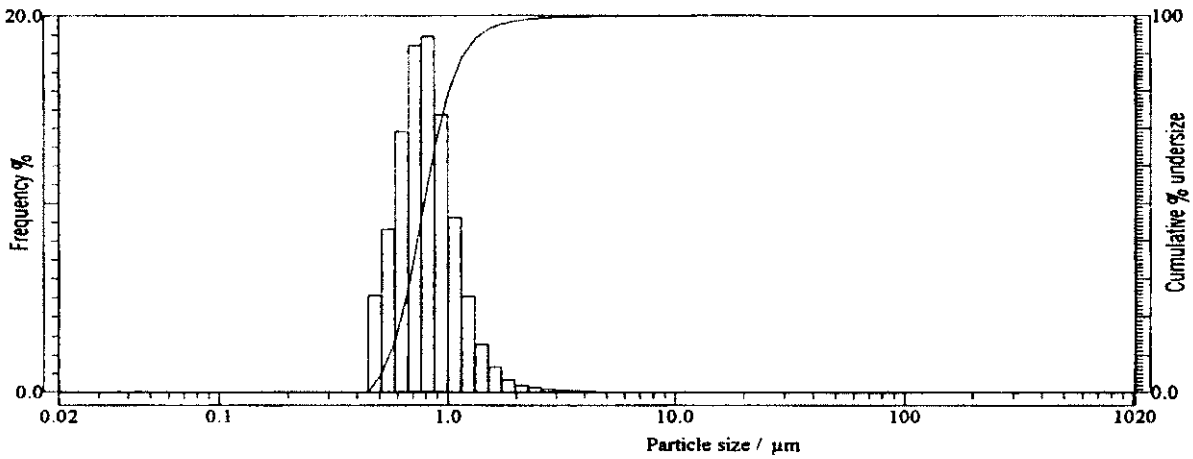
Format

Dist.base : Number Scaling : Auto Axis : LogX - LinearY

Data

Median : 0.788μm SP.Area : 15172cm²/cm³ S.D. : 0.463μm
Mode : 0.809μm Mean : 0.863μm
C.V. : 53.68% Span : (D 10.0-D 90.0) / D50 = 0.805

Dia. on %(5.0%) : 0.508μm % on Dia.(0.100μm) : 0.0%
Dia. on %(25.0%) : 0.652μm % on Dia.(1.000μm) : 79.1%
Dia. on %(50.0%) : 0.788μm % on Dia.(10.000μm) : 100.0%
Dia. on %(75.0%) : 0.963μm % on Dia.(100.000μm) : 100.0%
Dia. on %(95.0%) : 1.391μm % on Dia.(1000.000μm) : 100.0%



Size(μm)	Freq(%)	Und(%)	Size(μm)	Freq(%)	Und(%)	Size(μm)	Freq(%)	Und(%)
1019.5	0.00	100.00	26.11	0.00	100.00	0.669	13.82	27.56
890.1	0.00	100.00	22.80	0.00	100.00	0.584	8.61	13.74
777.1	0.00	100.00	19.90	0.00	100.00	0.510	5.13	5.13
678.5	0.00	100.00	17.38	0.00	100.00	0.445	0.00	0.00
592.4	0.00	100.00	15.17	0.00	100.00	0.389	0.00	0.00
517.2	0.00	100.00	13.25	0.01	100.00	0.339	0.00	0.00
451.6	0.00	100.00	11.56	0.01	99.99	0.296	0.00	0.00
394.2	0.00	100.00	10.10	0.02	99.98	0.259	0.00	0.00
344.2	0.00	100.00	8.816	0.02	99.96	0.226	0.00	0.00
300.5	0.00	100.00	7.697	0.03	99.94	0.197	0.00	0.00
262.4	0.00	100.00	6.720	0.04	99.91	0.172	0.00	0.00
229.1	0.00	100.00	5.867	0.05	99.87	0.150	0.00	0.00
200.0	0.00	100.00	5.122	0.06	99.83	0.131	0.00	0.00
174.6	0.00	100.00	4.472	0.08	99.77	0.115	0.00	0.00
152.5	0.00	100.00	3.905	0.10	99.70	0.100	0.00	0.00
133.1	0.00	100.00	3.409	0.13	99.60	0.087	0.00	0.00
116.2	0.00	100.00	2.976	0.18	99.46	0.076	0.00	0.00
101.5	0.00	100.00	2.599	0.27	99.28	0.067	0.00	0.00
88.58	0.00	100.00	2.269	0.40	99.01	0.058	0.00	0.00
77.34	0.00	100.00	1.981	0.69	98.60	0.051	0.00	0.00
67.52	0.00	100.00	1.729	1.37	97.91	0.044	0.00	0.00
58.95	0.00	100.00	1.510	2.56	96.55	0.039	0.00	0.00
51.47	0.00	100.00	1.318	5.08	93.98	0.034	0.00	0.00
44.94	0.00	100.00	1.151	9.27	88.90	0.029	0.00	0.00
39.23	0.00	100.00	1.005	14.73	79.63	0.026	0.00	0.00
34.25	0.00	100.00	0.877	18.90	64.90	0.022	0.00	0.00
29.91	0.00	100.00	0.766	18.44	46.00			

HORIBA LA-910

for Windows(TM) Ver. 1.31 Oct/30/'2001 12:47

Laser scattering particle size distribution analyzer

PARTICLE SIZE MEASUREMENT DATA

ID# : 19011004-205 14:59
Filename : 11004205
Sample : S01T001874
Material : AY101

Source : Wade W Samples
Lot Numbe :
Test Numb : Dup
Instrument :

Condition

T%(He-Ne) : 89.1%
(LAMP) : 87.0%
Agitation : 1
Dist.Form : Std.
R.R.Index : 1.16-0.00i
Circulation : 6
Sampling times : 100
( )
Ultrasonic : OFF(120)

Format

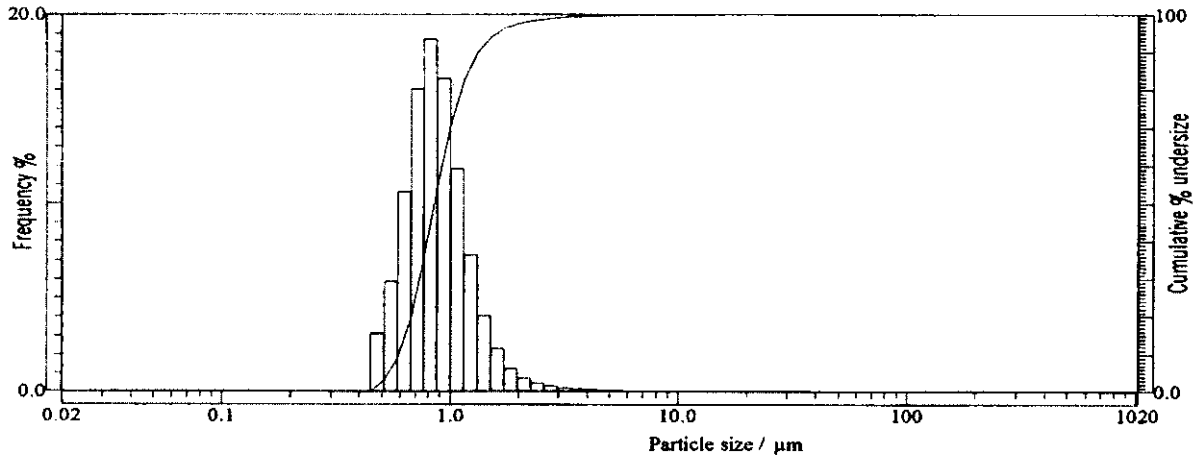
Dist.base : Number
Scaling : Auto
Axis : LogX - LinearY

Data

Median : 0.850μm
Mode : 0.821μm
C.V. : 55.74%
SP.Area : 24085cm²/cm³
Mean : 0.949μm
Span : (D 10.0-D 90.0) / D50 = 0.854
S.D. : 0.529μm

Dia. on %(5.0%) : 0.533μm
Dia. on %(25.0%) : 0.700μm
Dia. on %(50.0%) : 0.850μm
Dia. on %(75.0%) : 1.053μm
Dia. on %(95.0%) : 1.595μm

% on Dia.(0.100μm) : 0.0%
% on Dia.(1.000μm) : 70.3%
% on Dia.(10.000μm) : 100.0%
% on Dia.(100.000μm) : 100.0%
% on Dia.(1000.000μm) : 100.0%



Size(μm)	Freq(%)	Und(%)	Size(μm)	Freq(%)	Und(%)	Size(μm)	Freq(%)	Und(%)
1019.5	0.00	100.00	26.11	0.00	100.00	0.669	10.61	19.57
890.1	0.00	100.00	22.80	0.00	100.00	0.584	5.86	8.96
777.1	0.00	100.00	19.90	0.00	100.00	0.510	3.10	3.10
678.5	0.00	100.00	17.38	0.00	100.00	0.445	0.00	0.00
592.4	0.00	100.00	15.17	0.00	100.00	0.389	0.00	0.00
517.2	0.00	100.00	13.25	0.01	100.00	0.339	0.00	0.00
451.6	0.00	100.00	11.56	0.01	99.98	0.296	0.00	0.00
394.2	0.00	100.00	10.10	0.02	99.97	0.259	0.00	0.00
344.2	0.00	100.00	8.816	0.03	99.94	0.226	0.00	0.00
300.5	0.00	100.00	7.697	0.04	99.91	0.197	0.00	0.00
262.4	0.00	100.00	6.720	0.05	99.87	0.172	0.00	0.00
229.1	0.00	100.00	5.867	0.07	99.82	0.150	0.00	0.00
200.0	0.00	100.00	5.122	0.09	99.75	0.131	0.00	0.00
174.6	0.00	100.00	4.472	0.12	99.67	0.115	0.00	0.00
152.5	0.00	100.00	3.905	0.16	99.55	0.100	0.00	0.00
133.1	0.00	100.00	3.409	0.23	99.38	0.087	0.00	0.00
116.2	0.00	100.00	2.976	0.33	99.16	0.076	0.00	0.00
101.5	0.00	100.00	2.599	0.49	98.83	0.067	0.00	0.00
88.58	0.00	100.00	2.269	0.73	98.34	0.058	0.00	0.00
77.34	0.00	100.00	1.981	1.24	97.61	0.051	0.00	0.00
67.52	0.00	100.00	1.729	2.31	96.37	0.044	0.00	0.00
58.95	0.00	100.00	1.510	4.05	94.07	0.039	0.00	0.00
51.47	0.00	100.00	1.318	7.27	90.01	0.034	0.00	0.00
44.94	0.00	100.00	1.151	11.85	82.74	0.029	0.00	0.00
39.23	0.00	100.00	1.005	16.59	70.90	0.026	0.00	0.00
34.25	0.00	100.00	0.877	18.70	54.30	0.022	0.00	0.00
29.91	0.00	100.00	0.766	16.03	35.60			

HORIBA LA-910

for Windows(TM) Ver. 1.31 Oct/30/'2001 12:47

Laser scattering particle size distribution analyzer

PARTICLE SIZE MEASUREMENT DATA

ID# : 19011004-206 15:04
Filename : 11004206
Sample : S01T001874
Material : AY101

Source : Wade W Samples
Lot Numbe :
Test Numb : Dup
Instrument :

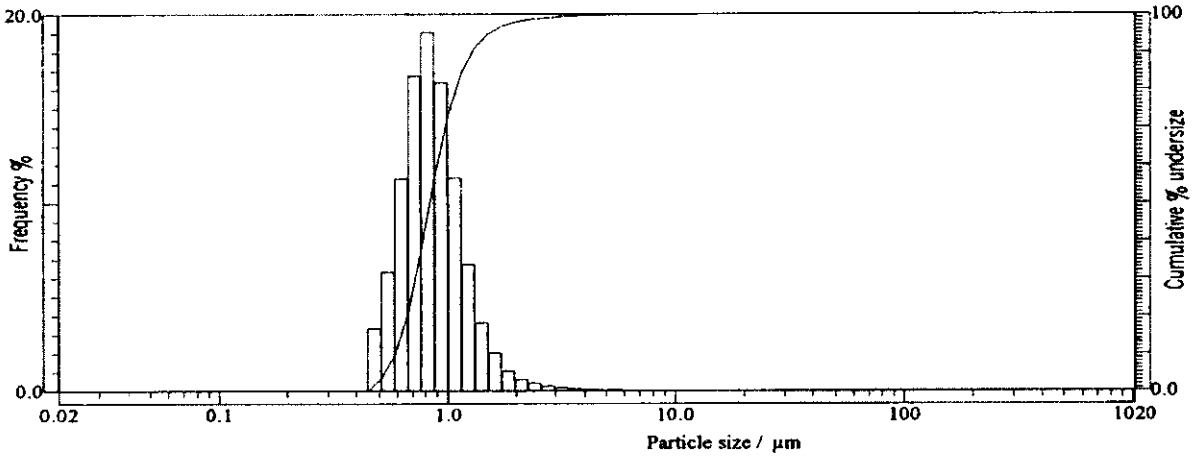
Condition
T%(He-Ne) : 89.2%
(LAMP) : 87.3%
Agitation : 3
Dist.Form : Std.
R.R.Index : 1.16-0.001i
Circulation : 6
Sampling times : 100 ( )
Ultrasonic : OFF(120)

Format
Dist.base : Number
Scaling : Auto
Axis : LogX - LinearY

Data
Median : 0.836μm
Mode : 0.819μm
C.V. : 54.96%
SP.Area : 24352cm²/cm³
Mean : 0.927μm
Span : (D 10.0-D 90.0) / D50 = 0.838
S.D. : 0.510μm

Dia. on %(5.0%) : 0.528μm
Dia. on %(25.0%) : 0.691μm
Dia. on %(50.0%) : 0.836μm
Dia. on %(75.0%) : 1.028μm
Dia. on %(95.0%) : 1.527μm

% on Dia.(0.100μm) : 0.0%
% on Dia.(1.000μm) : 72.5%
% on Dia.(10.000μm) : 100.0%
% on Dia.(100.000μm) : 100.0%
% on Dia.(1000.000μm) : 100.0%



Size(μm)	Freq(%)	Und(%)	Size(μm)	Freq(%)	Und(%)	Size(μm)	Freq(%)	Und(%)
1019.5	0.00	100.00	26.11	0.00	100.00	0.669	11.28	20.95
890.1	0.00	100.00	22.80	0.00	100.00	0.584	6.31	9.67
777.1	0.00	100.00	19.90	0.00	100.00	0.510	3.36	3.36
678.5	0.00	100.00	17.38	0.00	100.00	0.445	0.00	0.00
592.4	0.00	100.00	15.17	0.00	100.00	0.389	0.00	0.00
517.2	0.00	100.00	13.25	0.01	100.00	0.339	0.00	0.00
451.6	0.00	100.00	11.56	0.01	99.98	0.296	0.00	0.00
394.2	0.00	100.00	10.10	0.02	99.97	0.259	0.00	0.00
344.2	0.00	100.00	8.816	0.03	99.95	0.226	0.00	0.00
300.5	0.00	100.00	7.697	0.04	99.92	0.197	0.00	0.00
262.4	0.00	100.00	6.720	0.05	99.88	0.172	0.00	0.00
229.1	0.00	100.00	5.867	0.06	99.83	0.150	0.00	0.00
200.0	0.00	100.00	5.122	0.08	99.77	0.131	0.00	0.00
174.6	0.00	100.00	4.472	0.10	99.70	0.115	0.00	0.00
152.5	0.00	100.00	3.905	0.14	99.59	0.100	0.00	0.00
133.1	0.00	100.00	3.409	0.20	99.45	0.087	0.00	0.00
116.2	0.00	100.00	2.976	0.28	99.25	0.076	0.00	0.00
101.5	0.00	100.00	2.599	0.42	98.98	0.067	0.00	0.00
88.58	0.00	100.00	2.269	0.63	98.56	0.058	0.00	0.00
77.34	0.00	100.00	1.981	1.07	97.93	0.051	0.00	0.00
67.52	0.00	100.00	1.729	2.03	96.87	0.044	0.00	0.00
58.95	0.00	100.00	1.510	3.65	94.84	0.039	0.00	0.00
51.47	0.00	100.00	1.318	6.74	91.19	0.034	0.00	0.00
44.94	0.00	100.00	1.151	11.33	84.45	0.029	0.00	0.00
39.23	0.00	100.00	1.005	16.40	73.12	0.026	0.00	0.00
34.25	0.00	100.00	0.877	19.04	56.72	0.022	0.00	0.00
29.91	0.00	100.00	0.766	16.73	37.68			

HORIBA LA-910

for Windows(TM) Ver. 1.31 Oct/30/'2001 2:48

Laser scattering particle size distribution analyzer

PARTICLE SIZE MEASUREMENT DATA

ID# : 19011004-207 15:11
Filename : 11004207
Sample : S01T001874
Material : AY101

Source : Wade W Samples
Lot Numbe :
Test Numb : Dup
Instrument :

Condition

T%(He-Ne) : 89.4%
(LAMP) : 87.2%
Agitation : 3

Dist.Form : Std.
R.R.Index : 1.16-0.00i
Circulation : 6

Sampling times : 100 ( )
Ultrasonic : ON(120)

Format

Dist.base : Number
Scaling : Auto
Axis : LogX - LinearY

Data

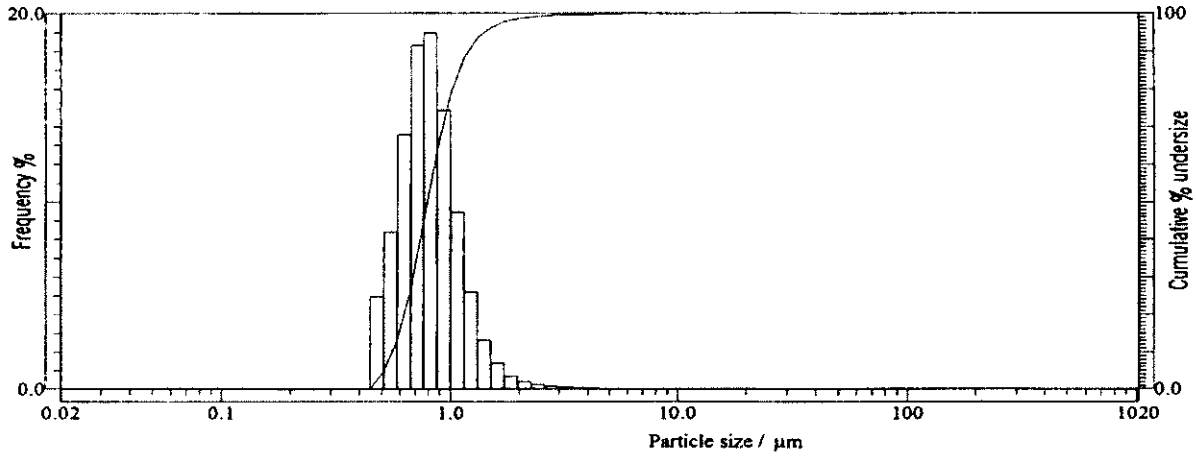
Median : 0.792μm
Mode : 0.810μm
C.V. : 53.31%

SP.Area : 17060cm²/cm³
Mean : 0.868μm
Span : (D 10.0-D 90.0) / D50 = 0.809

S.D. : 0.463μm

Dia. on %(5.0%) : 0.510μm
Dia. on %(25.0%) : 0.656μm
Dia. on %(50.0%) : 0.792μm
Dia. on %(75.0%) : 0.968μm
Dia. on %(95.0%) : 1.401μm

% on Dia.(0.100μm) : 0.0%
% on Dia.(1.000μm) : 78.6%
% on Dia.(10.000μm) : 100.0%
% on Dia.(100.000μm) : 100.0%
% on Dia.(1000.000μm) : 100.0%



Size(μm)	Freq(%)	Und(%)	Size(μm)	Freq(%)	Und(%)	Size(μm)	Freq(%)	Und(%)
1019.5	0.00	100.00	26.11	0.00	100.00	0.669	13.60	26.96
890.1	0.00	100.00	22.80	0.00	100.00	0.584	8.40	13.36
777.1	0.00	100.00	19.90	0.00	100.00	0.510	4.95	4.95
678.5	0.00	100.00	17.38	0.00	100.00	0.445	0.00	0.00
592.4	0.00	100.00	15.17	0.00	100.00	0.389	0.00	0.00
517.2	0.00	100.00	13.25	0.01	100.00	0.339	0.00	0.00
451.6	0.00	100.00	11.56	0.01	99.99	0.296	0.00	0.00
394.2	0.00	100.00	10.10	0.02	99.98	0.259	0.00	0.00
344.2	0.00	100.00	8.816	0.02	99.96	0.226	0.00	0.00
300.5	0.00	100.00	7.697	0.03	99.94	0.197	0.00	0.00
262.4	0.00	100.00	6.720	0.04	99.91	0.172	0.00	0.00
229.1	0.00	100.00	5.867	0.05	99.87	0.150	0.00	0.00
200.0	0.00	100.00	5.122	0.06	99.83	0.131	0.00	0.00
174.6	0.00	100.00	4.472	0.07	99.77	0.115	0.00	0.00
152.5	0.00	100.00	3.905	0.10	99.70	0.100	0.00	0.00
133.1	0.00	100.00	3.409	0.13	99.60	0.087	0.00	0.00
116.2	0.00	100.00	2.976	0.19	99.46	0.076	0.00	0.00
101.5	0.00	100.00	2.599	0.28	99.28	0.067	0.00	0.00
88.58	0.00	100.00	2.269	0.41	99.00	0.058	0.00	0.00
77.34	0.00	100.00	1.981	0.72	98.58	0.051	0.00	0.00
67.52	0.00	100.00	1.729	1.41	97.87	0.044	0.00	0.00
58.95	0.00	100.00	1.510	2.64	96.46	0.039	0.00	0.00
51.47	0.00	100.00	1.318	5.22	93.82	0.034	0.00	0.00
44.94	0.00	100.00	1.151	9.46	88.60	0.029	0.00	0.00
39.23	0.00	100.00	1.005	14.91	79.13	0.026	0.00	0.00
34.25	0.00	100.00	0.877	18.95	64.23	0.022	0.00	0.00
29.91	0.00	100.00	0.766	18.31	45.27			

HORIBA LA-910

for Windows(TM) Ver. 1.31 Oct/30/'2001 2:48

Laser scattering particle size distribution analyzer

PARTICLE SIZE MEASUREMENT DATA

ID# : 19011004-208 15:14
Filename : 11004208
Sample : S01T001874
Material : AY101

Source : Wade W Samples
Lot Numbe :
Test Numb : Dup
Instrument :

Condition

T%(He-Ne) : 89.5%
(LAMP) : 87.2%
Agitation : 1

Dist.Form : Std.
R.R.Index : 1.16-0.00i
Circulation : 6

Sampling times : 100 ( )
Ultrasonic : ON(120)

Format

Dist.base : Number
Scaling : Auto
Axis : LogX - LinearY

Data

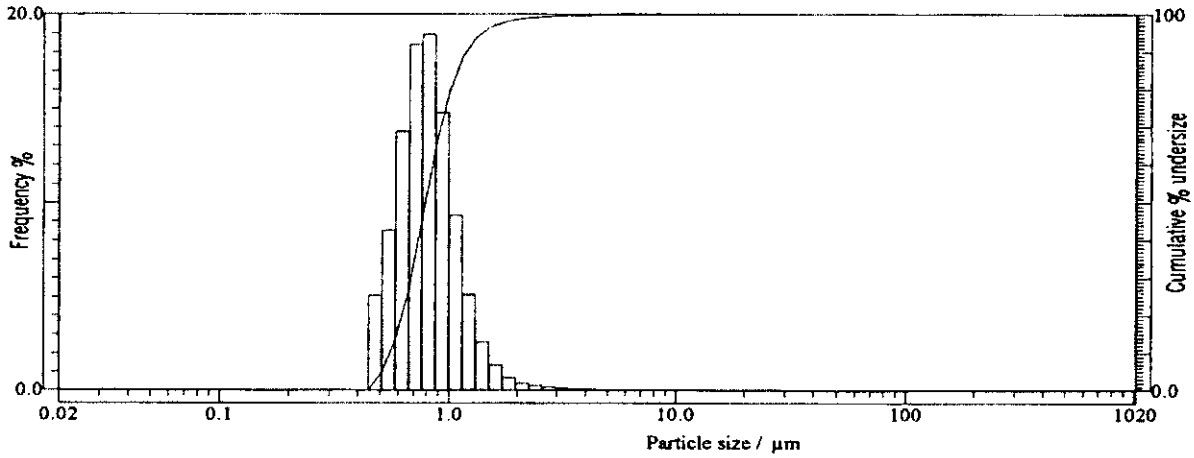
Median : 0.790μm
Mode : 0.809μm
C.V. : 53.41%

SP.Area : 16189cm²/cm³
Mean : 0.865μm
Span : (D 10.0-D 90.0) / D50 = 0.806

S.D. : 0.462μm

Dia. on %(5.0%) : 0.509μm
Dia. on %(25.0%) : 0.653μm
Dia. on %(50.0%) : 0.790μm
Dia. on %(75.0%) : 0.964μm
Dia. on %(95.0%) : 1.393μm

% on Dia.(0.100μm) : 0.0%
% on Dia.(1.000μm) : 79.0%
% on Dia.(10.000μm) : 100.0%
% on Dia.(100.000μm) : 100.0%
% on Dia.(1000.000μm) : 100.0%



Size(μm)	Freq(%)	Und(%)	Size(μm)	Freq(%)	Und(%)	Size(μm)	Freq(%)	Und(%)
1019.5	0.00	100.00	26.11	0.00	100.00	0.669	13.76	27.37
890.1	0.00	100.00	22.80	0.00	100.00	0.584	8.55	13.61
777.1	0.00	100.00	19.90	0.00	100.00	0.510	5.07	5.07
678.5	0.00	100.00	17.38	0.00	100.00	0.445	0.00	0.00
592.4	0.00	100.00	15.17	0.00	100.00	0.389	0.00	0.00
517.2	0.00	100.00	13.25	0.01	100.00	0.339	0.00	0.00
451.6	0.00	100.00	11.56	0.01	99.99	0.296	0.00	0.00
394.2	0.00	100.00	10.10	0.02	99.98	0.259	0.00	0.00
344.2	0.00	100.00	8.816	0.02	99.96	0.226	0.00	0.00
300.5	0.00	100.00	7.697	0.03	99.94	0.197	0.00	0.00
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229.1	0.00	100.00	5.867	0.05	99.87	0.150	0.00	0.00
200.0	0.00	100.00	5.122	0.06	99.83	0.131	0.00	0.00
174.6	0.00	100.00	4.472	0.07	99.77	0.115	0.00	0.00
152.5	0.00	100.00	3.905	0.10	99.70	0.100	0.00	0.00
133.1	0.00	100.00	3.409	0.13	99.60	0.087	0.00	0.00
116.2	0.00	100.00	2.976	0.18	99.46	0.076	0.00	0.00
101.5	0.00	100.00	2.599	0.27	99.28	0.067	0.00	0.00
88.58	0.00	100.00	2.269	0.41	99.01	0.058	0.00	0.00
77.34	0.00	100.00	1.981	0.70	98.60	0.051	0.00	0.00
67.52	0.00	100.00	1.729	1.38	97.91	0.044	0.00	0.00
58.95	0.00	100.00	1.510	2.58	96.53	0.039	0.00	0.00
51.47	0.00	100.00	1.318	5.12	93.95	0.034	0.00	0.00
44.94	0.00	100.00	1.151	9.33	88.83	0.029	0.00	0.00
39.23	0.00	100.00	1.005	14.79	79.49	0.026	0.00	0.00
34.25	0.00	100.00	0.877	18.93	64.71	0.022	0.00	0.00
29.91	0.00	100.00	0.766	18.41	45.77			