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K-BASIN GEL FORMATION STUDIES

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Abstract: The baseline treatment proposed for disposal of K Basin sludge involves nitric acid dissolution of the sludge. Laboratory tests have shown that upon nitric acid dissolution of actual K-Basin sludge, a gel sometimes forms. Gels are known to be able to impair solid/liquid separation and/or material transfer. The purpose of this report is to aid in the determination process conditions that allow efficient solid/liquid separation. Determination of the cause(s) of the gel formation and to identify dissolution conditions to prevent its formation is also part of the scope of this report. Concrete was chosen as the non-radioactive surrogate material. A set of studies to vary process parameters was performed. Treatment of concrete with low concentration (1 or 4 molar) nitric acid resulted in a lack of filterability. Treatment with 8 molar or 10 molar acid did not result in filterability problems. The presence of gel is not related to the filterability problems.

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K-BASIN SLUDGE TREATMENT PROCESS STUDIES INTERIM REPORT

1.0 INTRODUCTION

A key part of the proposed waste treatment for K Basin sludge is the elimination of reactive uranium metal by dissolution in nitric acid (Flament, 1998). It has been found (Delegard, 1998a) that upon nitric acid dissolution of the sludge, a gel sometimes forms. Gels are known to sometimes impair solid/liquid separation and/or material transfer. The purpose of the work reported here is to determine the cause(s) of the gel formation and to determine operating parameters for the sludge dissolution that avoid formation of gel. This work and related work were planned in (Flament, 1998), (Jewett, 1998) and (Beck, 1998a). This report describes the results of the tests in (Beck, 1998a) with non-radioactive surrogates.

1.1 PAST ANALYSES:

Although extensive analyses of the basin sludges have been performed, the sludge analyses are not yet complete. A summary of the selected analyses performed to date are given in the following table:

Selected Past Analyses (Dry sludge basis).

Analyte	KE Basin (Welsh, 1996)	KE Canisters (Welsh, 1997)	KW Canisters (Makenas, 1998)
Fe	0.5 to 24%	0.04 to 25.6%	2.5 to 31%
U	0.1 to 20%	<0.02 to 74%	28 to 93%
Al	0.7 to 3.4%	1 to 14%	0.3 to 5.8%
Si	not determined	not determined	not determined
Acid digest insoluble residue	0.6 to 45%	not found in reference (not determined?)	0.3 to 88%

These analyses suggest that a potentially significant portion of the sludge has not been analyzed. This material has been assumed to be sand (largely SiO_2), but may be other species. Recent studies on the acid-dissolution residual solids indicate some crystalline calcium containing materials have identified as anorthite ($\text{CaAl}_2\text{Si}_2\text{O}_8$).

1.2 LITERATURE SURVEY

A review of the literature noted in the Bibliography (Section 7) provides some insights into the K-Basin gel formation under acid dissolution conditions. Most silica gels form when colloidal or soluble silica (both of which form in basic media) is acidified (Iler, 1979). As no intermediate step in basic media is employed in the baseline K-Basin treatment scheme, it does not seem likely that the gels are formed are the result of direct silica (SiO_2) gelation because of the low silica solubility in acid solution. The direct silica gel hypothesis was nevertheless tested. Iler (Iler,

1955) states that gel formation is not likely when a material has a continuous sheet or chain silicon-oxygen backbone structure (SiO), but is likely when a metal ion is incorporated in the structural backbone. It is known that when certain minerals are attacked by acid, the soluble silica undergoes continuous reprecipitation to form colloidal particles (Iler, 1979 pg 399).

The mechanism of gel formation during acid treatment of silicate minerals is discussed extensively in (Terry, 1983). The discussion indicates that gel forms from homogeneous dissolution (complete structure breakdown) of silicate minerals. Minerals which dissolve homogeneously in acid have a high fraction of non-Si acid-soluble metal ions in their structure. In addition, these gel-forming minerals are characterized by Si bonding with acid soluble metal ions (through -O-bridges), as opposed to Si-O-Si bonds. When the other metals dissolve in acid, the silica goes into solution as monomers. However, the solubility limit for H_4SiO_4 (about 0.001 M) is quickly reached and the excess begins polymerizing to form gels. Minerals which have extensive Si-O-Si bonding (e.g., quartz or mordenite as found in Zeolon-900 zeolite) have been tested and found not to dissolve nor form discernable gel. PNNL (Delegard, 1998a) has done tests with pure fine crystalline SiO_2 in 8 to 10 M HNO_3 and did not get any gel formation. Suggestions in the reference (Terry, 1983) on how to avoid gelation conditions include: 1) maintaining a high acid content (to enhance dehydration of monomeric silica) and 2) processing at an elevated temperature (well above atmospheric boiling temperature) to induce silica precipitation. (Terry, 1983) also notes that some high grade ores of uranium are known for the gelation of the leach solution.

The lack of nitric acid activity during tests on zeolite materials (Delegard, 1998a) are supported in Barrer (Barrer, 1982). Zeolites are minerals left after leaching rocks with strong hydrothermal solutions, and so would not be expected to yield much to acid attack.

Portland cement is largely a mixture of hydrated calcium silicates (Bogue, 1947). These calcium silicates have discrete silicate tetrahedra (Bye, 1983), which could be freed from the structure of the cement if the calcium was removed.

The literature on the reactivity of concrete with nitric acid is limited. The lack of discussion on this topic in the literature is due to the fact that there is no commercial value to mixing nitric acid and concrete, nor is it a common accident. However Keifer (Keifer, 1987) describes such an incident, which was caused by leakage of 50,000 liters of N_2O_4 oxidizer from a large missile into the steel-reinforced concrete silo structure. The N_2O_4 was eventually flushed with water, creating concentrated nitric acid which was pumped out and a water washdown of the structure was completed. Due to the large size of the accident and the extreme toxicity of N_2O_4 and fuming nitric acid, no observations on the actual reaction were possible. On entry into the structure, although sometimes severe degradation of the concrete was present, no gel was reported, even in the midst of several inches of degraded concrete. Of note for the K-Basin gel process, where reactive metals are being leached from other materials, is Keifer's observations that at several places in the structure, the steel reinforcing bars had been consumed, leaving behind an impression in "fairly sound" concrete. The differing reactivities of concrete and metal (in this case steel) may provide an analogy to K Basins.

Some PNNL work (Delegard, 1998a) has indicated some calcium-containing material [anorthite ($CaAl_2Si_2O_8$)] in the gel, which implicates the involvement of the concrete material of the basin in the formation of gels. Reactions between high alkali concretes and acidic aggregates is

described (Blanks, 1955) as having many deleterious effects on concrete, one of which is the production of a clear gel. The concrete used in this test is lower alkali, but the acid is much stronger.

Other literature sources (Bergna, 1994), (ARHCO, 1976) were examined for relevant information. Bergna (Bergna, 1994) discussed silica gelation from the acidification of sodium silicate solutions or sols. Process Aids (ARHCO, 1976) has a wealth of information on gel formation in PUREX and other process plant solutions as well as tank farms materials, however there is no clear analogy between these materials and the acid insolubles seen in this study or PNNL work (Bredt, 1998b). None of these sources had information closely analogous enough to be of use in this study.

2.0 EXPERIMENTAL

2.1 POTENTIAL SURROGATE COLLECTION/PREPARATION

The first set of tests was to observe whether gel formed in several siliceous materials that might serve as a non-radioactive surrogate for K basin sludge. A non-radioactive surrogate allows for more extensive testing.

The potential surrogates tested were : Sand/Dust from near K Basins, concrete, and diatomaceous earth.

2.1.1 Sand/Dust

Several kg of sand/dust was collected from a non-radiological area near K Basins (but outside the former property protection area fence) . The Sand/Dust used in these tests is best characterized as typical Hanford loess. Material from just outside the Basin building was not used for two reasons: 1) most of the ground covering inside the K Basins area fence is riverine/basaltic gravel and not likely to be wind-borne material, 2) it was impossible to determine what was native material and what was imported into the K Basins as construction material or ground cover. The material (Hanford loess) was sieved to exclude particles greater than 0.425 mm in diameter (40 mesh). This particle diameter is the largest seen in informal particle size studies on windblown dust gathered from various horizontal surfaces in Bldg. 222-SA (Beck, 1998b) and so replicates the largest particle size likely to be windblown into K Basins. Larger particle sizes tend to be purer in the quartz form of SiO_2 , while the smaller particles are more clay-like (mixed alkali metal aluminosilicates) (Glenn, 1971). K Basins dust was examined because some results from PNNL (Bredt, 1998a, 1998b) indicate that sand/dust from near K Basins can produce a gel.

2.1.2 Concrete

A concrete sample was obtained from Bill Frier at 100K area. This concrete is from 183 K basin, and is of the same type (ASTM C-150 Type II), batch plant and vintage as the K Basins concrete (Main, 1952), (Winkel, 1996). This surrogate is especially applicable to K East Basin sludge, as the walls of that basin were never coated to prevent water damage. The material was prepared by smashing it, removing the larger pieces of aggregate prior to grinding and sieving (to pass a 425 μm sieve). Aggregate removal ensured that the material tested was largely cement. Most

structural cements are fairly close in chemical composition (Bogue, 1947), but using a concrete sample as close as possible to the actual K Basins concrete adds to the credibility of the tests.

2.1.3 Diatomaceous Earth

Diatomaceous earth was tested to determine if a nearly pure silica material forms gels.

Diatomaceous earth (90+ % silica) is a finely divided equivalent of the larger particle sizes (such as sand which is largely silica) (Glenn, 1971) found in Hanford soils.

2.1.4 Material Not Tested

Some suggested materials were not tested for the various reasons given below.

Zeolon 900, an inorganic ion exchange resin, and a possible constituent in K Basins, was not tested since previous work (Delegard, 1998b) has indicated that it does not form gels under dissolution conditions. Hanford basalt (Flament, 1998) was not tested, since the windblown dust (Hanford dirt) is considerably different than the unweathered Hanford basalt that forms the bedrock in this area (Glenn, 1971).

2.1.5 Surrogate Preparation and Characterization

Each potential surrogate was sieved to less than 425 μm (40 U.S. mesh), and was analyzed by Polarized Light Microscopy (PLM) and particle size. Portions (10 g for diatomaceous earth, about 200 g concrete and 1 kg of sieved blow/sand/dust) will be retained for 1 year as archive reference material in case other analyses on this starting material are deemed necessary at a later date.

2.2 SURROGATE VALIDATION:

This set of potential surrogates was subjected to extreme conditions to determine which, if any, might produce gel similar to that seen in genuine K Basin sludge. About 12 g of each potential surrogate were subjected to 100 mL of 10 M nitric acid at 95 °C for 8 hours. A filter test (see below) was performed after about 30 minutes (with the material at 35-40 °C), unlike the gel formation tests.

The examination compared the solids from each test with the pictures of K-Basin sample 96-08 (also treated with 10 M nitric acid at 95 °C for 8 hrs) provided by P. Bredt.

The concrete was the only material that formed a gel that was visually similar to the Bredt tests. The sand/dust and diatomaceous earth showed no visual signs of any transformation reaction nor did they display any filter plugging behavior. The sand/dust and diatomaceous earth at the end of the test looked like wet sand/dust and diatomaceous earth. The concrete sample had a striking resemblance to the pictures of the actual KE Basin 96-08 sample gel formed under the same conditions.

The concrete specimen was selected as the worst case surrogate to use for further testing. The details of the results of these tests are presented along with the gel formation test results later in this paper.

2.3 GEL FORMATION TEST

A full-factorial experiment was run on three parameters. The gel-forming parameters were varied through all possible permutations for three levels of three parameters. The suspected gel-forming parameters were: temperature, nitric acid concentration and stirring. The effects of digestion time were examined by making several observations during the course each test.

2.3.1 Test Matrix

Explanation of Test ID: The Test ID is made up by the values of the parameters, which are separated by the alphabetic characters in **bold**. It follows the form: X Molar HNO_3 Y °C and Z Stirring (zz solids/liquids ratio (g/L)). The solids/liquids ratio value is noted only if the solids/liquids ratio value is something other than 120 g/L.

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The test matrix:

Test ID	Nitric Acid Molarity	Temperature (°C)	Stirring Low, Medium, or High setting	Other Parameter(s) (standard conditions unless specified) and Comments
8M95CHS	8	95	High	
8M95CMS	8	95	Medium	
8M95CLS	8	95	Low	
8M70CHS	8	70	High	
8M70CMS	8	70	Medium	
8M70CLS	8	70	Low	
8M45CHS	8	45	High	
8M45CMS	8	45	Medium	
8M45CLS	8	45	Low	
4M95CHS	4	95	High	
4M95CMS	4	95	Medium	
4M95CMSD	4	95	Medium	Duplicate of 4M95CMS
8M95CMS180	8	95	Medium	180g surrogate/L. soln
8M95CMS240	8	95	Medium	240g surrogate/L. soln
8M95CMS60	8	95	Medium	60 g surrogate/L. soln
4M95CLS	4	95	Low	
4M70CHS	4	70	High	
4M70CMS	4	70	Medium	
4M70CLS	4	70	Low	
4M45CHS	4	45	High	
4M45CMS	4	45	Medium	
4M45CLS	4	45	Low	
1M95CHS	1	95	High	
1M95CMS	1	95	Medium	
1M95CLS	1	95	Low	
1M70CHS	1	70	High	
1M70CMS	1	70	Medium	
1M70CLS	1	70	Low	
1M45CHS	1	45	High	
1M45CMS	1	45	Medium	
1M45CLS	1	45	Low	
00M95CLS	0	95	Low	Water "Blank"

The temperature was varied from 45 to 70 to 95°C. A temperature of 95°C was chosen as the high temperature as 1) boiling would be confounded with the stirring parameter, 2) the boiling points of the various acid concentrations are different and 3) 95 °C is the highest temperature used in PNNL studies on sample 98-06 (actual K-Basins gel forming) sludge.

A magnetic stir bar was used to vary the amount of stirring from no stirring to medium stirring (small vortex formed, 285 rpm) to high stirring (vortex formed, reaching the bottom of the flask, 1100-1300 rpm). The corresponding maximum linear speeds at the tip of the stir bar, are 149 cm/sec = high, 39 cm/sec = medium, and 0 cm/sec = low stirring.

The nitric acid concentration was varied from 1 M to 4 M to 8 M HNO₃. All experiments were run with a reflux condenser to maintain a constant volume and acid concentration.

The experiments were run for 8 hours. For the first hour, observations on gel/solids volume, color, and subjective texture comments were recorded every 15 minutes. After the first hour, observations were recorded every hour till the end (8 hours) of the digest portion of the tests.

For each test, about 9.0 g of concrete was put in 75 mL of gently stirring nitric acid yielding a 120 g concrete/L solution ratio unless specifically stated otherwise. The 120 g/L value is a baseline proposed value for the dissolution process. The temperature of the solution, and the stirring setting on the stirrer/hot plate were then adjusted to the desired test conditions for that test. The reaction vessel was a 250 mL Erlenmeyer flask with a air-cooled reflux condenser/thermocouple port. The tests were done in sets of 3 (for operational convenience).

Immediately after the dissolution test, the samples were set aside to cool and settle. They were examined after 24 hours for settled solids/gel volume. The filter test (see below) was then performed. The solids were analyzed for particle size and by PLM.

2.3.2 Filter Test

The test used to determine filterability was performed as follows: The samples were shaken and swirled to create a pourable slurry. The slurry were poured into a filter funnel and vacuum filtered with 222-SA house vacuum (approximately 22-24 in. Hg, 0.8 atm vacuum). The filter media was Millipore¹ mixed cellulose nitrate/cellulose acetate 3.0 µm pore size, 47mm filter. The time taken from initial vacuum application (just after pouring) until no interstitial liquids were seen was measured as the filtering time. For tests performed later in the test sequence, the time when the flow decreased to less than 1 drop per second was also noted. The solids were weighed and the liquid volume filtered recorded. Samples that plugged the filter (greater than 30 minutes filtration time) were deemed as "filter plugging". Filter plugging samples were centrifuged (see below). The filtering method was chosen based on tests performed on local dust samples (Beck, 1998c).

¹Millipore is a trademark of Millipore Corp.

2.3.3 Centrifugation

Filter plugging slurries were decanted into a centrifuge cone(s). The slurries were then centrifuged (5 minutes at 2500 rpm, 1000 G), the drainable liquid decanted and the solids weighed. The wet solids were then made available for particle size analysis and polarized light microscopy.

2.3.4 Dry mass determination

Several weeks after the wet mass was determined, the dry mass was determined. This was accomplished by taking the weights of the samples and centrifuge cones (to correct for any small sample loss to previous analytical testing). The samples and cones were then dried at about 55 °C for seven days. The 55 °C value was chosen because attempts to go to higher temperatures caused the polypropylene centrifuge cones to partially melt. Some plastic was lost (estimated worst case 0.18 g), but because the estimated loss was small in most instances, the loss was ignored in calculations.

2.3.5 pH

The pH of all available liquids was measured as recorded in (Beck, 1998c). The pH meter was tested against a standard. The pH of samples that have both filtered and centrifuged liquids are averaged for each test sample. All the values are close to zero (the end of the scale), and the filtered and centrifuged liquids have similar pH values.

These tests did not consider dispersants or gel breaking agents, as such tests are beyond the scope of the test plan (Beck, 1998a).

2.4 ANALYTICAL TESTING

2.4.1 Particle size analysis

The samples were run for particle size distribution analysis on a Horiba² LA-910. The Horiba LA-910 uses two separate optical systems, a helium-neon laser and a tungsten lamp, to determine the particle size distribution through Fraunhofer Diffraction and Mie Scattering theories. Combining these two theories gives the Horiba LA-910 a very broad range, 0.02 to 1020 μm (Horiba, 1995).

The samples were dispersed in deionized water. About 0.1 g of sample was dispersed in approximately 150 mL of water. Some species may have dissolved in the water used as the dispersing medium. The dispersed particles were circulated through the optical cell using agitation and the highest circulation setting. This combination of agitation and circulation was felt to be adequate to suspend the largest particles in the samples.

Standard laboratory quality control protocol was followed for the particle size distribution analyses. This protocol consists of one standard run at the beginning of the day and one duplicate per sample batch. A short summary of the results (mean, median) are contained in the Results Summary Table, and full printouts are attached as Appendix 1.

² Horiba is a trademark of Horiba Instrument Inc., Irvine, CA.

2.4.2 Polarized Light Microscopy (PLM)

The samples were analyzed by standard PLM methods. Photomicrographs, taken to record the observations, are available upon request. The results of the PLM analysis are given later in this paper.

3.0 RESULTS

3.1 VISUAL OBSERVATIONS

The temperature was raised to the desired value slowly (over about 1 hour), due to a need not to overshoot the desired value, especially for the 95°C tests. During the first hour of the test, observations were made at 15 minute intervals. Generally, the visual changes in the samples were largely completed in the first hour, or by the time the desired temperature had been reached. Later changes were minor and were additions to the initial (first hour) changes.

Visual Observations Summary

Tests	Stirred (high [xMxxCHS], medium [xMxxCMS]) Hours for solids to become flocculent (fluffy, ~50-60 mL)	No Stirring tests (xMxxCLS) Hours to generate gel or indications of gel
8M95Cxx	1	1
8M70Cxx	1	1
8M45Cxx	2	2
4M95Cxx	3	3 minor amount of gel
4M70Cxx	5	5, no noticeable gel, non-breaking bubbles on the surface
4M45Cxx	no floe solids	no noticeable gel
1M95Cxx	no flocculent solids	no gel
1M70Cxx	no flocculent solids	no gel, just non-breaking bubbles on surface
1M45Cxx	no flocculent solids	no gel
00M95CLS	no flocculent solids, no alteration of solids, no coloration of supernate	no gel
8M95CMSxxx	1 hour for 8M95CMS180, 2 hours for 8M95CMS240, 8M95CMS60	not applicable (all stirring tests)
10MConc95 (Surrogate test, Concrete)	Not applicable, a no stirring test	1 hr for a distinct gel formation

At the "high" stirring rate, mixing was quite vigorous, with the 75 mL of slurry in the flask swirling up to the 150 mL mark in the Erlenmeyer flask, and occasionally splashing out the top of the flask into the reflux column. The stirred tests often produced a slurry that was opaque enough and so similarly colored to the settled solids that some difficulty was experienced in determining the interface between the fast settling solids and the slurry of slower settling solids above it during the periodic observations in the heating part of the tests. The opacity of the liquid made a determination of gel formation during the stirred heating tests impossible.

3.2 GEL FORMATION

The visual appearance of the slurry after 24 hours was not a good predictor of filterability. Some material that had distinct indications of gel (bubbles entrained in clear filaments of gel) filtered well and some that had no indications of gel formation did not filter well. Some fluffy (flocculent) solids filtered well, and other material (especially 1 M HNO_3 tests) that looked untouched by the acid and quite granular, plugged the filter.

After 24 hours of settling, the settled solids volumes were generally identical to the settled solids volume after a few minutes, but the liquid layer was always much clearer after 24 hours of settling.

None of the tests (including those with visible gel, with bubbles imbedded in the volume of the gel) had materials with noticeable shear strength, as it was easy to swirl to a slurry to pour into the filter funnel.

The liquids were examined every few days to look for changes. The only visible changes took place in the centrifuged liquids from 4M45CHS, 4M45CMS, and 4M45CLS. In 4M45CHS and 4M45CMS, after 5 days the centrifuged liquids had a thin coating of transparently clear, colorless gel on the inside of the bottle in which they were stored, and an estimated 25% of the liquid in the same gel state as the film. For 4M45CLS, the centrifuged liquids gel was noticed with the above characteristics at 4 days after centrifugation. The estimated volume % of the gel for 4M45CLS was 50%. In all 4M45xxx samples, the gel turned milky and shrank in volume after about 7 days. The centrifuged liquids from the 1 molar HNO_3 tests were initially turbid, but cleared as the solids precipitated to the bottom of the storage bottle. Centrifuged liquids were only available for those samples that were "filter plugging". Filtered liquids were free of solids except for 00M95CLS, in which after about 2 weeks, was noticed a yellow-brown, flocculent material.

3.3 FILTRATION

Filtration had largely two different outcomes. Either the material filtered well or it couldn't be filtered at all. The filterable material was generally a stratified cake on top of the filter, with coarser (visually granular) material at the bottom and a mud/slime or a thin layer of gel on top. If filtering was not successful, the same coarse (visually granular) material was seen near the filter with a equal volume of turbid water on top. The filtrate (filtered liquid) was always clear. The color of the filtrate generally became more highly yellow colored for the tests with higher initial acid concentrations.

Centrifugation worked well, most often producing a clean supernate and a well compacted solid material. The centrifuged solid material was granular at the bottom, grading upwards to a gray mud/slime at the top. For some of the 1 molar HNO_3 acid tests, the supernate was slightly turbid after centrifugation. An example of the particle sizes in the turbid centrifuged supernate is shown in the Summary Table.

3.2 RESULTS SUMMARY

The Table below is a summary of the results. "Filter Time" denotes the amount of time (in minutes) taken from applying the vacuum to the end of filtering (either the sample had dried out or the 30 minute time limit for filtering had expired). The "Solids Mass- Wet Residual" is the mass (in grams) of wet filtered or centrifuged solids immediately after the test. The "% Wt Wet Residual Solids" is calculated from the "Solids Mass-Wet Residual" compared to the original dry mass of material tested. The "Solids Mass- Dry Residual" is derived from the mass of the cones after about 3 weeks of sitting (and some sample use). The "% Wt Dry Residual Solids" is calculated from the "Solids Mass- Dry Residual" compared to the original dry mass of material tested. The particle sizes are given as the "Mean" and "Median" of the volume distribution (which is related to the mass distribution) and are in units of μm . The "Time to slow flow" denotes the filtering time (in minutes) to reach a flow rate of less than 1 drop ($\sim 0.1\text{mL}$) per second. "Filtered liquids" denotes the amount of liquid (in mL) gathered after completion of filtering or 30 minutes, whichever was longer. "Settled solids" indicates the settled solids (in mL) after 24 hours at ambient temperature (usually about 20 °C).

Settled solids for the 10 molar HNO_3 test had a settling time of 1 hour and a temperature about 35-40 °C. Although not recorded in the notebook, it should be noted that the settled solids volume at 1 hour and 24 hours was not noticeably different. The experimental error on the settled solids values are estimated to be at least $\pm 5 \text{ mL}$, based on 1) the typical inaccuracy of markings on Erlenmeyer flasks, and visual estimation errors.

The particle size instrument printouts are contained in Appendix 1 of this paper.

RESULTS SUMMARY TABLE SHEET A

Test ID	Filter Time (min.)	Solids Mass - Wet, Residual (g)	%Wt Wet Residual Solids (g)	Solids Mass- Dry Residual (g)	%Wt Dry Residual Solids (g)	Median (µm)	Mean (µm)	Time to slow flow (filter) (minutes)	Filtered liquid (mL)	Settled solids @ 24 hrs (mL)	pH
8M95CHS	13.75	11.69	130	6.49	72	45.9	60.6		63	45	<0.001
8M95CMS	8.75	14.03	156	5.48	61	57.7	84.8		66	40	<0.001
8M95CLS	3.25	15.41	171	4.65	52	130.7	162.1		65	15	<0.001
8M70CHS	13.5	12.84	143	3.80	42	34.8	44		62	50	<0.001
8M70CMS	8.75	14.91	166	6.15	68	50.4	88.1		62	50	<0.001
8M70CLS	13.5	17.58	195	5.07	56	120	147.4		60	15	<0.001
8M45CHS	16	14.65	163	6.96	77	39.6	37.7		61	65	<0.001
8M45CHS (Rerun2 particle size run)						52.8	70.3				
8M45CHS (Dup of rerun2 particle size run)						53.6	70.8				
8M45CMS	12.25	18.55	206	6.83	76	51.1	81.8		62	65	<0.001
8M45CLS	9.5	16.11	179	5.18	58	119.4	160.8		62	50	<0.001
4M95CHS	30	18.09	201	8.41	93	38.6	70.6		55	60	<0.001
4M95CHS gel only						56.3	74.7		55		
4M95CMS	30	16.22	180	8.65	96	30.6	55.2		52	60	<0.001
4M95CMS gel only						41.1	50.3		52		
4M95CMSD	30	16.95	188	7.82	87	29.3	42.7		47	60	<0.001
4M95CMSD gel only						49.9	58.4		47		
4M95CLS	11	15.16	168	6.17	69	112.9	151.6	10	63	30	<0.001
4M70CHS	30	15.94	177	8.69	100	28.1	45.6	0.75	22	50	<0.001
4M70CHS gel only						23.1	27.7	0.75	22		
4M70CMS	30	15.58	173	8.46	94	52.2	86	1.25	22	50	<0.001
4M70CLS	30	16	178	8.89	99	115.7	151.8	4.75	37	20	<0.001
4M45CHS	30	10.35	115	4.73	53	19.9	28	1	4	20	<0.001
4M45CMS	30	9.79	109	4.47	50	40	74.9	1.45	8	20	<0.001
4M45CLS	30	9.31	103	4.02	45	137.2	163.9	0.5	8	10	<0.001

Gel only indicates that the particle sizes are of the top layer of the centrifuged solids.

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RESULTS SUMMARY TABLE SHEET B

Test ID	Filter Time (min.)	Solids Mass - Wet, Residual (g)	%Wt Wet Residual Solids (g)	Solids Mass- Dry Residual (g)	%Wt Dry Residual Solids (g)	Median (µm)	Mean (µm)	Time to slow flow (filter) (minutes)	Filtered liquid (mL)	Settled solids @ 24 hrs (mL)	pH
1M95CHS	30	8.24	92	3.54	39	16.6	27.7	1	19	15	0.52
1M95CHS Centrifuged Liquid						1.8	2.6				
1M95CMS	30	8.51	95	3.35	37	27.1	53.3	3	36	20	0.58
1M95CLS	1.5	6.02	67	1.34	15	85.6	136	N/a	69	15	0.36
1M70CHS	30	8.76	97	3.67	41	17.8	31.3	1.5	20	20	0.49
1M70CMS	30	8.33	93	3.49	39	20.5	34.8	5	50	20	0.41
1M70CLS	2.5	7.64	85	2.25	25	169	183	2.25	69	15	0.48
1M45CHS	30	8.23	91	3.48	39	17.8	24.5	1.5	29	15	0.63
1M45CMS	5	7.98	89	2.12	24	41.8	62.8	4.5	68	15	0.75
1M45CLS	2	7.49	83	2.08	23	225.6	221	1	68	20	0.92
00M95CLS	2	10.29	114	2.52	28	190.5	202.3	1.5	69	15	2.87
8M95CMS180	11	20.65	153	8.37	62	70.4	115.1	2	58	75	<0.001
8M95CMS240	15	27.26	240	10.22	57	45.4	74.4	3	59	80	<0.001
8M95CMS60	6	6.15	137	3.29	73	49.5	66.6	2	69	45	<0.001
10MConcrete95C	6.5	21.26	177	9.69	81	97.9	129.6			75*	<0.001
10MConcrete95C (2nd particle size run)						115.4	156.4				
10MDirt95C	1.9	11.55	96	3.08	26	81.2	113.1			10*	<0.001
10MDiaEarth95C	1.5	27.74	231	13.27	111	31.5	35			35*	<0.001
< 425 um Dirt (original material)						88	116.1				
< 424 um Concrete (original material)						94.9	123.6				
Diatomaceous Earth (original material)						33.5	51				
Average Treated samples only	16.7	13.6	141	5.6	59	69.8	92.8	2.4	48.9	32.7	
std dev	12	5	44	3	26	53	56	2	21	23	
Count	35	35	35	35	35	35	35	20	32	35	

* The 10 Molar HNO₃ surrogate validation tests were cool/sealed for 1 hour then filtered (slurry temperature about 35-40 °C).

The 8M95CxS values are those at 8hrs. The decrease in settled solids volume from 8 to 24 hours is usually (8M70CxS for example) 15-20 mL for high and medium stirring, and only 5 mL (within observational error) for low stirring.

Histograms of the data are provided as Figure 1 to show graphically the distribution of the data.

The units on the abscissa (x-axis) are the same as the Summary Table above:

- a) Filter time in minutes,
- b) solids mass in grams,
- c) particle sizes (max, median, mean and min.) in μm ,
- d) filtered liquid (volume in mL),
- e) Time to "slow flow" in minutes,
- f) settled solids in mL.

The "filter time" is clearly a bimodal distribution, with a set below 17 minutes and a set at 30 minutes, showing a clear separation between filterable and unfilterable samples.

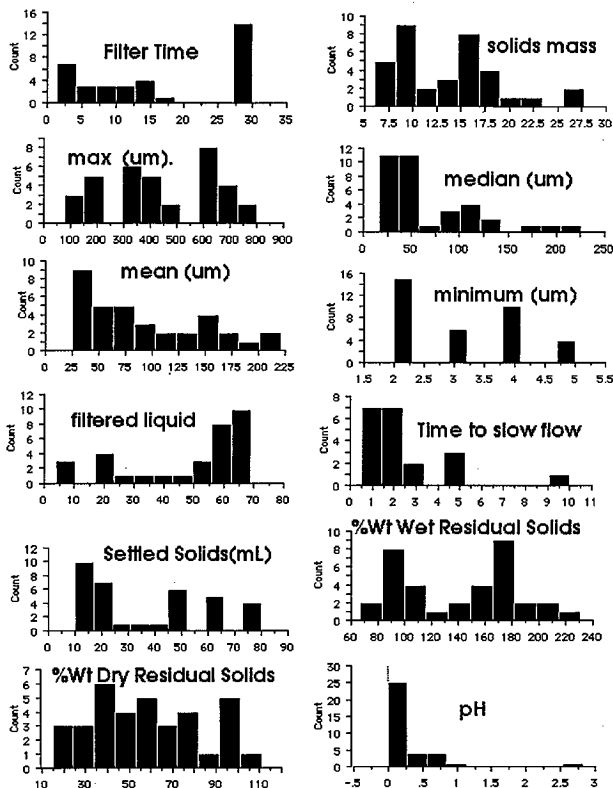


Figure 1. Histograms of the data presented in the Results Summary Table.

3.3 CORRELATION MATRIX:

A correlation coefficient shows the degree to which two variables are linearly related. A correlation coefficient of 1.0 (either positive or negative) denotes a perfectly linear relationship between two variables (Harnett, 1975). A correlation coefficient of 0 denotes a lack of a linear relationship. The sign of the coefficient denotes whether the relationship is negative or positive. The calculation was done as a pairwise correlation (to preserve data that would be excluded in a listwise calculation due to missing data). A lack of linear correlation does not imply a lack of relationship between two variables, as the relationship could be non-linear (as discussed below for initial acid molarity and filter time).

Only a few variables have high correlation coefficients (noted by underlining). Of note are the negative correlations between "Filter Time" and "filtered liquids", and between "rpm" and "mean" (particle size in μm).

CORRELATION COEFFICIENT TABLE

	Filter Time	Wet Solids Mass	Max (μm)	Median (μm)	Mean (μm)	Min (μm)	Molarity	Temperature ($^{\circ}\text{C}$)	RPM	Time to slow flow	Filtered liquids	Settled Solids	%Wt Wet Residual Solids	%Wt Dry Residual Solids	pH
Filter Time	1	-0.093	-0.337	-0.53	<u>-.525</u>	-0.363	-0.38	-0.199	0.504	-0.147	-0.829	0.053	-0.001	0.284	-0.189
Wet Solids Mass	-0.093	1	-0.083	-0.12	-0.057	0.437	0.647	0.281	-0.15	0.205	0.16	0.658	0.83	0.677	-0.398
Max	-0.337	-0.083	1	0.814	0.872	0.392	-0.046	0.041	-0.6	0.054	0.165	-0.173	-0.064	-0.226	0.257
Median	-0.531	-0.115	0.814	1	0.971	0.392	-0.093	-0.072	-0.63	0.03	0.379	-0.296	-0.12	-0.322	0.409
Mean	-0.525	-0.057	0.872	0.971	1	0.445	-0.036	-0.011	-0.71	0.099	0.388	-0.24	-0.068	-0.288	0.31
Minimum	-0.363	0.437	0.392	0.392	0.445	1	0.618	-0.022	-0.41	0.273	0.338	0.314	0.523	0.284	-0.251
Molarity	-0.38	0.647	-0.046	-0.09	-0.036	0.618	1	0.192	-0.12	0.049	0.309	0.502	0.63	0.455	-0.601
Temperature	-0.199	0.281	0.041	-0.07	-0.011	-0.022	0.192	1	-0.16	0.252	0.318	0.181	0.19	0.194	0.007
RPM	0.504	-0.15	-0.599	-0.63	<u>-.707</u>	-0.405	-0.123	-0.155	1	-0.354	-0.373	0.145	-0.085	0.113	-0.092
Time to slow flow	-0.147	0.205	0.054	0.03	0.099	0.273	0.049	0.252	-0.35	1	0.384	-0.023	0.295	0.146	-0.143
Filtered Liquid	<u>-0.829</u>	0.16	0.165	0.379	0.388	0.338	0.309	0.318	-0.37	0.384	1	0.188	0.179	-0.122	0.148
Settled Solids	0.053	0.658	-0.173	-0.3	-0.240	0.314	0.502	0.181	0.145	-0.023	0.188	1	0.622	0.64	-0.401
%Wt Wet Residual Solids	-0.001	0.83	-0.064	-0.12	-0.068	0.523	0.63	0.19	-0.09	0.295	0.179	0.622	1	0.864	-0.459
%Wt Dry Residual Solids	0.284	0.677	-0.226	-0.32	-0.288	0.284	0.455	0.194	0.113	0.146	-0.122	0.64	0.864	1	-0.509
pH	-0.189	-0.398	0.257	0.409	0.310	-0.251	-0.601	0.007	-0.09	-0.143	0.148	-0.401	-0.459	-0.509	1

The strong positive correlations between the particle size measures of "mean", "median", and "max" are not all that interesting, as they are all measures of the same phenomenon, particle size, and the mean and median are mathematically dependent on the maximum particle size.

3.4 GRAPHS

The strong positive correlations are discussed below, with explanatory graphs. Due to the linear limitations of the correlation table above, some of the low correlation relationships are graphically explored to determine if perhaps a non-linear relationship exists. Graphs that show no observable trends are included to clearly demonstrate the lack of relationships (either linear or non-linear) in the data.

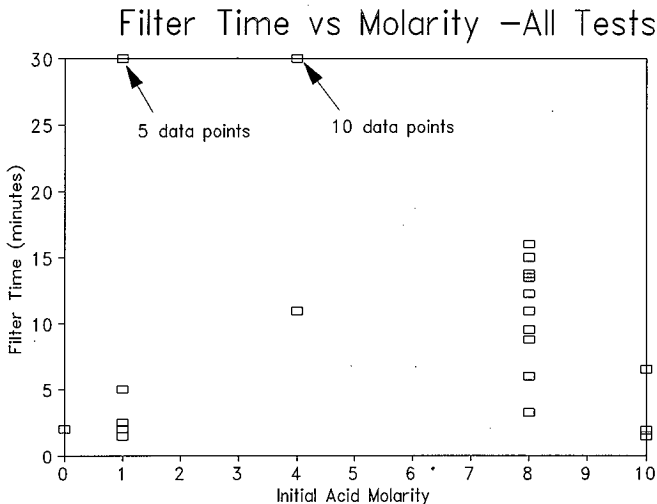


Figure 2. Filter Time versus Initial Acid Molarity - All Data

The most notable feature of the graph of filter time versus molarity (Figure 2) is that almost all the 4 molar HNO_3 tests had filtering times of 30 minutes. A best fit line through the data is an inverted parabola with the apex near the 4 molar HNO_3 tests. Note that the 30 minute filter time is shared by several data points for both the 1 molar HNO_3 and 4 molar HNO_3 tests. This is the only graph that has data for all the tests including the 10 molar HNO_3 "Surrogate Validation" tests (which includes the blow sand/dust and diatomaceous earth). The 30 minute limitation on filtering tests probably makes the parabola fit curve shorter and fatter than it would have been had the filtering tests been allowed infinite time for completion. The general shape, and position of the best fit line would not likely change. Note that although the linear correlation between filter time and molarity is low, the non-linear nature of the data is clear.

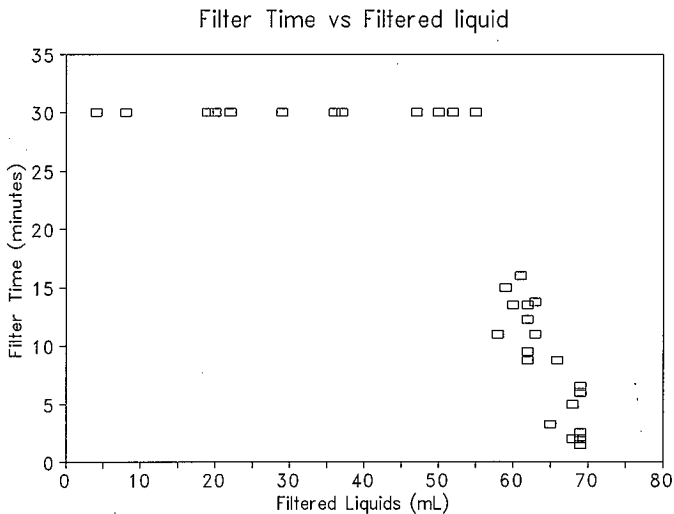


Figure 3. Filter Time (minutes) vs Filtered Liquids (mL) obtained.

The graph (Figure 3) of filter time versus the amount of liquid recovered shows the filterability of the reacted slurry measured two different ways. One can see that a better correlation might have been obtained if the filtering test had not been truncated at 30 minutes to maximize work flow and because of the realization that a 30 minute filtering time through a 3 μ m filter, on a bench scale. A minimal estimate of the time required can be obtained from a regression line. Since the regression line is less steep than it would be if the test had not been time-limited, filter times predicted by the filtered liquid volume are less than the probable actual filter time.

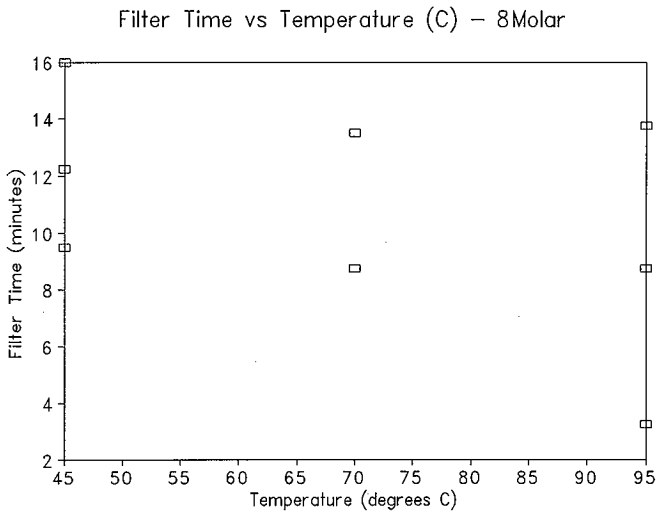


Figure 4. 8 Molar Tests Filter Time vs Temperature (°C)

As can be seen in Figure 4, the effect of test temperature on the filtering time of the 8 molar HNO_3 tests is minimal. A biased eye could perhaps see a slight negative slope to the data, but the scatter in the data indicates that temperature is not the primary agent of change for the filtering time.

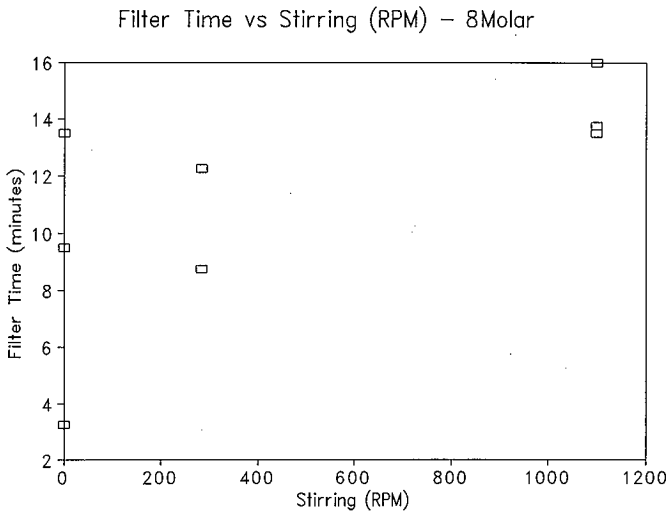


Figure 5. 8 Molar Tests, Filter Time versus Stirring (RPM)

Some small positive correlation can be seen in the relationship of filtering time versus stirring (Figure 5). This may be due to a grinding effect of the vigorous stirring. Or, the extra stirring could be enhancing acid-concrete contact and thereby increasing acid attack and dissolution of the concrete.

The 4 Molar HNO_3 initial tests are not shown in graphs of filter time versus temperature or stirring because all the tests with one exception (4M95CLS) had filter times of 30 minutes (the maximum time allowed for filtering).

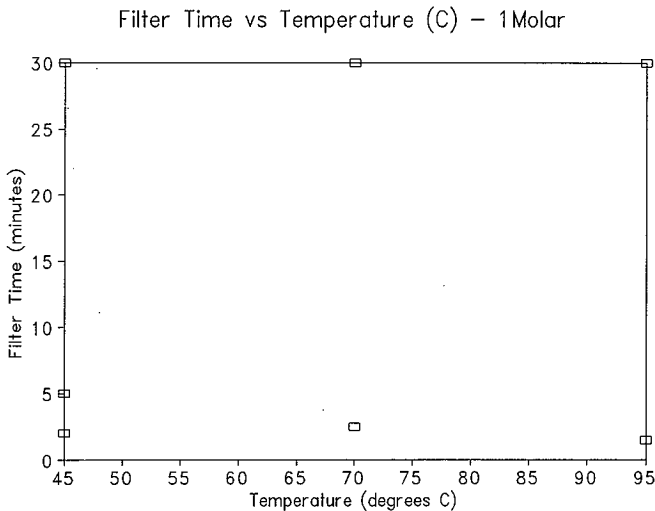


Figure 6. 1 Molar Tests Filter Time vs Stirring

No correlation can be seen in the graph of filter time versus temperature (Figure 6) for the 1 molar HNO_3 tests. On the contrary, the data are a good example of a "round", non-correlated data set. No non-linear relationships can be discerned from the graph. The correlation coefficient for all the data (8, 4, and 1 molar HNO_3) is small (-.2), so a scattergram that looks like this is expected.

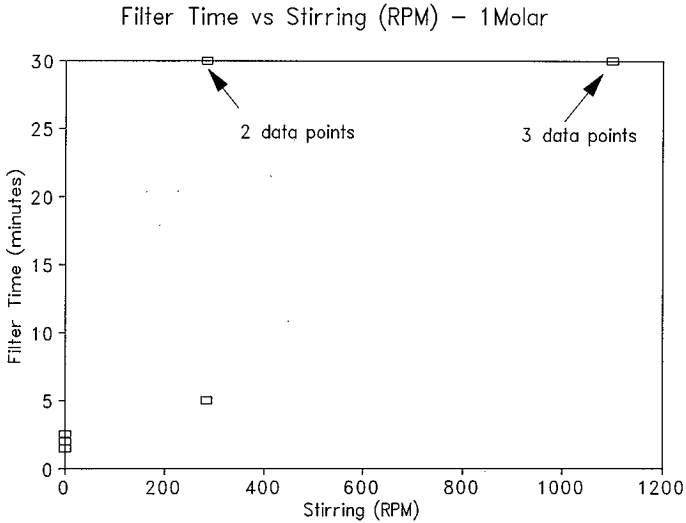


Figure 7. Filter time (minutes) versus stirring (rpm) 1 molar tests.

A small positive correlation can be discerned from the filtering time of the 1 molar HNO_3 tests versus stirring data shown in Figure 7. As with the 8 molar HNO_3 tests, the relationship may be explained by the grinding or shearing effect of stirring. An alternate hypothesis is that the extra stirring is enhancing acid-concrete contact and thereby increasing acid attack and dissolution of the concrete.

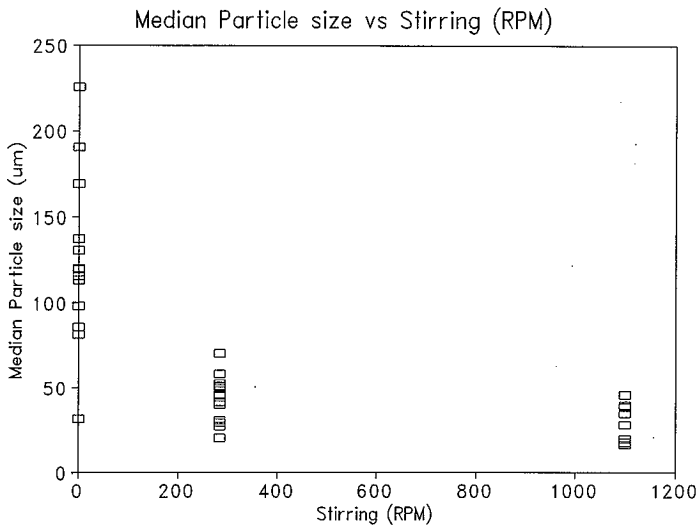


Figure 8. Median Particle size (μm) versus Stirring (rpm)

A negative correlation between median particle size and stirring (Figure 8) shows that stirring had a "grinding" or other (dissolution) particle size reduction effect. The differences between the medium stirring (285 rpm) and the high stirring (1100 rpm) are minimal, but still noticeable on the graph. The large scatter for the "low stirring" (0 rpm) case may be due to differences in acid attack, as four different initial acid molarities are represented on this graph. A graphical test of the linearity of the log of the median particle size versus stirring showed that relationship to also be non-linear.

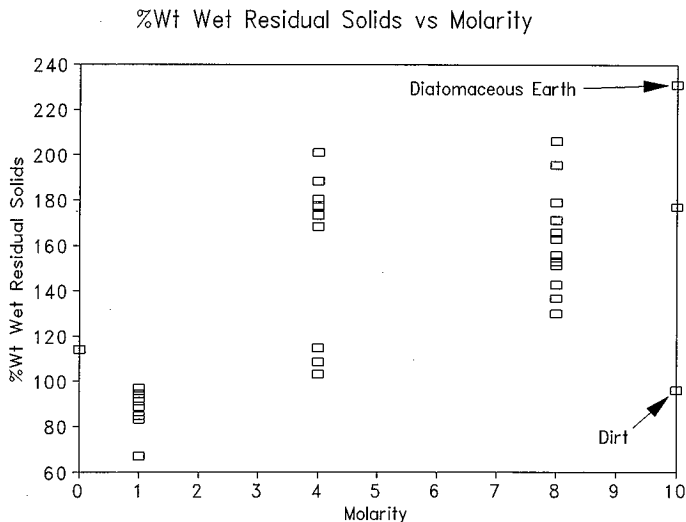


Figure 9. Weight Percent Wet Residual Solids versus Molarity.

The graph of weight percent wet residual solids versus molarity (Figure 9) shows a low correlation (0.63, due to the data scatter) but definite, positive trend of increasing solids. In contrast, the corresponding graph of filter time versus molarity (Figure 2) has a distinct maxima near 4 molar HNO_3 initial acid concentration. The different trends in the two graphs (Figure 2 and Figure 9) and the low correlation coefficient indicates that there is no distinct relationship between wet solids mass and filtering time.

It is interesting that the solids masses for the 1 molar tests are fairly close together, although the some of tests were filtered, and others were centrifuged (because they plugged the filter).

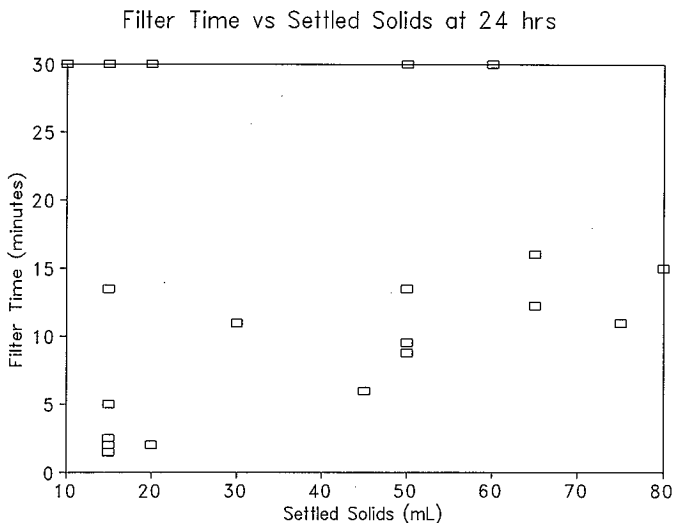


Figure 10. Settled Solids Volume at 24 hrs versus Filter Time (minutes).

The volume of settled solids (in mL after 24 hours of settling) does not seem to be related to filtering time. One feature of the data especially clear in the graph (Figure 10) is the clear separation between "non-filterable" and "filterable" materials. A gap in the filtering times is clearly seen, similar to the gap in the graph of filtering time versus filtered liquid (Figure 3). As pointed out in the text for Figure 9, no trend is apparent between settled solids and filtering time.

The low correlation coefficient (0.05) between filter time and settled solids also confirms the different trends for filter time and settled solids versus molarity. The point to be made from Figures 9 and 10, is that visual indications are not a reliable indicator of filtering time.

3.5 POLARIZED LIGHT MICROSCOPY (PLM)

Diatomaceous Earth

The dry powder showed a rather consistent size distribution of particles from 2 to 20 μm . Very few particles were smaller than 2 μm and none were found larger than 40 μm . The particles were almost completely isotropic and consisted of the various shapes of broken and pieces of spherically shaped diatoms (when whole). There was a considerable amount of straight and narrow pieces too that looked like bug legs (but much smaller, 5-10 μm) that were probably the pieces from non-spherical diatoms. The acid-washed sample of diatomaceous earth looked exactly like the original dry powder when viewed with the microscope. However, the acid washed sample as a bulk in the centrifuge tube was very much more fluffed up compared to the dry powder as if its bulk density had decreased by a factor of about 2 to 5.

Hanford Dirt

This sample consisted of mostly amorphous particles of low birefringence. Many of the particles existed as solitary particles but there were some aggregates too. The solitary amorphous particles were distributed in size ranging from about 20 μm to no greater than 200 μm . Also, there was a considerable amount of very small particles, some opaque, some birefringent, and some isotropic which existed in size from 1 to about 5 μm . Acid washing of this material did not seem to change the appearance of the particles or their particle size distribution as viewed by the microscope or as viewed as a bulk sample. Further analysis showed that the birefringent crystals were biaxial.

Ground Concrete

This sample, when mounted in water, showed about three major amorphous species present:

1. very small (<10 μm) isotropic or opaque particles.
2. amorphous, transparent, very weakly birefringent crystals 75-150 μm -- perhaps isotropic ones too.
3. amorphous, transparent, low birefringent crystals, 75-150 μm .

The analyst could not tell the difference between these concrete particles (hydrated, of course) that had been through acid treatment and those that were simply ground concrete. There were two aspects about the general appearance of the sample material that might give such a clue, however, and that was:

1. There were more solitary amorphous crystal present in the acid washed sample that might have been produced by the breakup of loosely bound aggregates during the acid treatment.
2. There was the presence of a gelatin like substance that would allow several solitary amorphous crystals or small aggregates of particles to loosely (very loosely) hang together to form "loose globules" of particles.

The presence of "loose globules" was not seen in the water mounted original (dry ground concrete) microscope slide samples.

Further analysis showed that the birefringent crystals were biaxial.

3.6 PARTICLE SIZE ANALYSIS

The mean and median (on a volume distribution basis) are shown in the Results Summary Table. The sample medians and means are not highly varied, with the exception of the difference between the low stirring and the stirred tests. The particles sizes as measured do not seem to be correlated with the filterability of the sample. The maximum particle sizes range from 300-800 μm and the minimum particle sizes have a range from 2 μm to 5 μm . As a few particles could drastically change the values of the maximum and minimum, they are not reported in the Results Summary, but are included in the particle size printouts in Section Appendix 1. An example of a number distribution is included for sample 8M95CMS as a comparison between the number and volume distributions.

3.7 DATA ARCHIVING

Data for this work is kept in a Controlled Laboratory Notebook (Beck, 1998c). A set of video tapes in Hi-8 format are available in the project file. PLM photomicrographs are also kept in the project file and are available upon request.

4.0 DISCUSSION

The gel formation study is strictly relevant only to concrete. However, the surrogate validation studies showed the concrete to be the best gel former of the three materials tested. Concrete or its decomposition products are likely to be found in basin floor or pit samples and in K East Basin canisters (which are open at the top).

The most striking feature of the results is that all of the tests producing filter plugging were run with 4 or 1 molar HNO_3 acid.

Stirring does not appear to have any effect on the filtering ability of the slurry. Stirring does increase the amount of settled solids and during the test to obscure gel formation. Tests that had no stirring had clear supernate and the gel (colorless, and essentially the same refractive index as the liquid) noticeable. All the tests were capable of being easily stirred with stir bars or by gentle hand swirling of the flask. No strength to the slurries or gels was noticeable. The stirring did have an effect on the median/mean particle sizes, as is shown by the greater mean particle sizes for the low stirring (LS) tests. The slurries and/or gels were easily suspendable for transfer to the filter funnel. Material that had splashed up above the liquid layer and adhered to the side of the Erlenmeyer flask was washed into the liquid with a small amount of scraping.

Other possible predictors or correlating factors have been examined and not found to correlate with filterability (as measured by filtering time). These factors include: particle size, visual settled solids character or volume, temperature, and solids mass.

A comparison of material used in this study to actual K Basin samples can determine the degree to which the chosen surrogate represents the behavior of the actual sample. One of the samples that caused this study to be conducted is sample 96-08. Sample 96-08 (used as a gel forming

comparison sample) is a KE Basin canister sludge sample (Welsh, 1997) and is from an aluminum canister with 5 of 7 damaged outer fuel rods. A cursory overview of the data in (Welsh, 1997) indicates that only about 65% of the material is accounted for by U (45% as UO_2) or Fe (19% as Fe_2O_3). The rest of the analyzed mass is largely accounted for by aluminum (14% assumed to be Al_2O_3 , 23% assuming $\text{Al}(\text{OH})_3$) and calcium (0.2% as $\text{Ca}(\text{OH})_2$) and magnesium (0.4% as $\text{Mg}(\text{OH})_2$). The total mass balance is about 80%, leaving 20% (dry weight basis) for various silicates (SiO_2 , or mixed aluminosilicates).

The solids masses may not correlate well with other variables because the solids mass was determined by two different methods (centrifugation and filtering). The two methods may remove different amounts of water from the solids. However, the data from this test does not include a direct comparison for the two methods and so no definitive conclusion can be drawn. The graph of solids mass versus molarity (Figure 9) indicates a smaller spread in residual wet mass for the 1 molar HNO_3 tests (where both filtration and centrifugation were used, than for the 8 molar HNO_3 tests, in which centrifugation was not used.

The degree of dissolution of the concrete may influence the filterability. The ratio of acid to dissolvable (non-silicon) metals may give a hint at the reasons for the differences in filterability. If calcium is the metal involved in the breakdown the silicate structure, then a comparison of the acid to calcium ratios may provide insight into the results. At a solid to liquid ratio of 120 g/L and a CaO content of 63% [Assuming pure cement, neglecting sand and aggregate (Bogue, 1947)], 8M acid yields an acid to calcium mole ratio of 5.9, 4M acid gives an acid to calcium ratio of 3 and a 1 M acid solution yields an acid to calcium ratio of 0.74. The high acid/calcium ratio may provide for complete dissolution, the medium ratio for partial dissolution and the low ratio may mean that there is insufficient acid to accomplish much dissolution. This hypothesis is not supported by the tests in which the initial acid concentration was kept at 8M and the ratio of acid to concrete was changed. No filtering problems (> 30 min. filter time) were encountered in these tests. The acid to calcium ratio was 11 (8M95CMS60, 60 g concrete/L solution), 4 (8M95CMS180, 180 g concrete/L solution), 2.9 (8M95CMS240, 240 g concrete/L solution). The 8M95CMS240 test has essentially an identical acid to calcium ratio as the 4 molar HNO_3 tests but only took 15 minutes to filter (versus the filtering time of 30 minutes [which was an arbitrary test end point] for the 4 molar HNO_3 tests). Since replicate concrete samples were used the same calculations and conclusions can be reached for other constituents of concrete. Since structural concretes are chemically very similar, equivalent results should be obtained for any ASTM Type I, II, III or IV concretes (the most common types of structural concretes). No clear conclusion can be drawn from the ratio of acid to concrete.

The pH values show the 1 molar HNO_3 tests are acid deficient at the end of the test. The pH of the 8 and 4 molar tests is very low (off scale) which indicates that the acid was not completely consumed. The relatively low pH (2.8) of the water tests (00M95CLS) could be due to acid contamination of the filter frit from a previous experiment. Silica is known to be highly insoluble (ppm level solubility) at pH values lower than 1 molar (Iler, 1979) so gel formation or precipitation would be expected. The mechanisms for forming a gel despite the low solubility of silica in acid solution discussed above in the literature survey section.

4.1 GEL FORMATION VS FILTERING

Gel formation is not related to filterability. Although one of the reasons for performing the tests described in this report was the formation of gel. Gels are known to be able to cause solid/liquid separations problems. Gels were seen in dissolution tests (Bredt, 1998b) of actual K Basins samples. However, this test has shown that filterability is not affected by gel formation. Figure 10 shows that no distinct relationship exists between filtering time and settled solids volume (the only available quantitative measure of a gel-like behavior).

4.2 COMPARISON OF CURRENT TEST RESULTS WITH THE LITERATURE

The surrogate validation studies differ from tests performed by PNNL on "Hanford Sand" (Bredt, 1998b). During the work reported here, no gel formation was seen in Hanford sand/dust, while the PNNL (Bredt, 1998b) studies did see some degree of gel formation. These differing results may be due to the different materials used. The PNNL studies used material from near the "roll-up bay doors" (Bredt, 1998b) at K Basin, while the present studies used Hanford loess for reasons discussed in Section 2.2.1.

The acid dissolution of aluminosilicates to form gel is supported by Iler (Iler, 1979, pg 511), and Terry (Terry, 1983). The action is on parts of the structure other than at siloxane (Si-O-Si) bonds to produce isolated siloxane groups which then recondense to form gelatinous material (Iler, 1979 pg 511). Concrete ("Portland") cement is essentially hydrated calcium aluminosilicates (Bye, 1983), (Bogue, 1947) and so could be seen have a structure subject to a gel forming attack.

Although Keifer (Keifer, 1987) did not see gel when examining the concrete, this could be reconciled with the current tests, in that the acid concentration started out much higher in the Keifer "test", the acid (and wash water) might have removed it, given the low yield strength of the gel seen in the current tests.

The analysis of the acid insoluble residue by Bredt, et al. (Bredt 1998b), shows a material that contains chemical constituents of concrete, with the exception of the iron concentration which is much higher than in concretes (Bogue, 1947). Given the high level of silicon and the fact that SiO₂ was not detected in the XRD of most of the T-20 samples (K Basin sludge (Bredt 1998b)), an acid-insoluble aluminosilicate residue is likely.

5.0 CONCLUSIONS

Concrete or material derived from concrete is a possible agent in gel formation in K-Basin sludge. This conclusion is based on the observation that of the potential surrogates tested, only concrete showed clear signs of gel formation (in a similar fashion to actual K Basin sample 96-08).

Gel formation does not indicate a disposition for filter-plugging. The visual presence of gel (for example in the "low stirring" tests) does not predict a filter plugging material. Possibly related phenomena (large amounts of settled solids) also do not predict a filter plugging material.

The only clear predictor of filter plugging in these tests is an initial acid concentration below 8 M (see Figure 2 and the associated text). This conclusion is based on the observation that not one of the 8 or 10 molar HNO_3 tests had filter times above 20 minutes. In contrast, 9 of 10 "4 molar HNO_3 " tests and 5 of the 9 "1 molar HNO_3 " tests had filter times that were limited to only 30 minutes by the test design, and probably would have lasted several times longer.

The key parameter for avoiding problems associated with gel formation are: high acid concentration as noted by Terry (Terry, 1983) and reiterated above in the introduction.

6.0 ACKNOWLEDGEMENTS

The author thanks Bill Frier for giving up his 183 K concrete sample (which had been a desk paperweight). Karl Pennock gave valuable sampling guidance and performed the collection of the dust/sand sample. Bruce E. Hey performed the polarized light microscopy, John F. O'Rourke analyzed the samples for particle size distribution. Jeffrey W. Chenault, Lino A. Guerra set up the experiments and spent long hours watching the tests to ensure close temperature control.

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Appendix A

Particle Size Instrument Printouts

HORIBA LA-910

Laser scattering particle size distribution analyzer

PARTICLE SIZE MEASUREMENT DATA

ID# : 980615-048 10:34
 Filename : 1UM_0615
 Sample : 0.993um Standard

Material : Standard
 Source : Duke Scientific
 Lot Number :

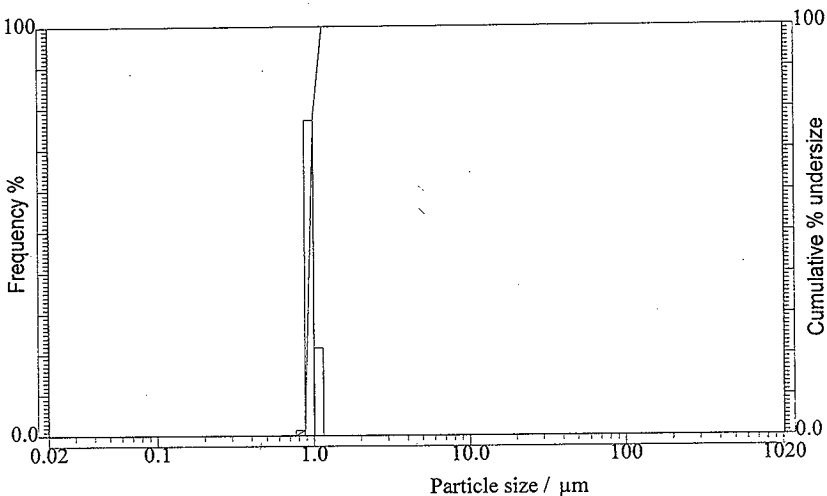
Condition

T%(He-Ne): 86.7% Dist.Form: Sharp Sampling times : 100
 (LAMP): 80.7% R.R.Index: 1.19-0.001 ()

Agitation : 3 Circultrn : 3 U.sonic : ON(3)

Format

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

**Data**

Memory Hist.	Cum.	SAMPLE NAME	ID#	Median(μm)
Main		0.993um Standard	980615-048	0.956

HORIBA LA-910

Laser scattering particle size distribution analyzer

PARTICLE SIZE MEASUREMENT DATA

ID# : 980615-048 10:34
 Filename : 1UM 0615
 Sample : 0.993um Standard
 Material : Standard
 Source : Duke Scientific
 Lot Number :
 Test Number : 1
 Preparation :
 Disp. Medium :
 Disp. Steps :
 Verification :

Condition :
 T%(He-Ne): 86.7% Dist.Form: Sharp Sampling times : 100
 (LAMP): 80.7% R.R.Index: 1.15-0.001
 Agitation : 3 Circultrn : 3 U.sonic : ON(3)
 Format :
 Dist.base : Volume Scaling : Auto Axis : LogX - LinearY

Data :
 Median : 0.956µm SP.Area : 62272cm²/cm³ S.D. : 0.059µm
 Mode : 0.956µm Mean : 0.967µm
 C.V. : 6.06%

Span : (D 10.0-D 90.0) / D50 = 0.199

Dia. on % (10.0%) :	0.891µm	% on Dia. (0.100µm) :	0.0%
Dia. on % (20.0%) :	0.907µm	% on Dia. (1.000µm) :	75.6%
Dia. on % (30.0%) :	0.923µm	% on Dia. (10.000µm) :	100.0%
Dia. on % (80.0%) :	1.015µm	% on Dia. (30.000µm) :	100.0%
Dia. on % (90.0%) :	1.081µm	% on Dia. (200.000µm) :	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	0.00	0.00
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	0.00	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	0.00	100.00	0.339	0.00	0.00
451.6	0.00	100.00	11.56	0.00	100.00	0.296	0.00	0.00
394.2	0.00	100.00	10.10	0.00	100.00	0.259	0.00	0.00
344.2	0.00	100.00	8.816	0.00	100.00	0.226	0.00	0.00
300.5	0.00	100.00	7.697	0.00	100.00	0.197	0.00	0.00
262.4	0.00	100.00	6.720	0.00	100.00	0.172	0.00	0.00
229.1	0.00	100.00	5.867	0.00	100.00	0.150	0.00	0.00
200.0	0.00	100.00	5.122	0.00	100.00	0.131	0.00	0.00
174.6	0.00	100.00	4.472	0.00	100.00	0.115	0.00	0.00
152.5	0.00	100.00	3.905	0.00	100.00	0.100	0.00	0.00
133.1	0.00	100.00	3.409	0.00	100.00	0.087	0.00	0.00
116.2	0.00	100.00	2.976	0.00	100.00	0.076	0.00	0.00
101.5	0.00	100.00	2.599	0.00	100.00	0.067	0.00	0.00
88.58	0.00	100.00	2.269	0.00	100.00	0.058	0.00	0.00
77.34	0.00	100.00	1.981	0.00	100.00	0.051	0.00	0.00
67.52	0.00	100.00	1.729	0.00	100.00	0.044	0.00	0.00
58.95	0.00	100.00	1.510	0.00	100.00	0.039	0.00	0.00
51.47	0.00	100.00	1.318	0.00	100.00	0.034	0.00	0.00
44.94	0.00	100.00	1.151	21.62	100.00	0.029	0.00	0.00
39.23	0.00	100.00	1.005	77.08	78.38	0.026	0.00	0.00
34.25	0.00	100.00	0.877	1.31	1.31	0.022	0.00	0.00
29.91	0.00	100.00	0.766	0.00	0.00			

HORIBA LA-910

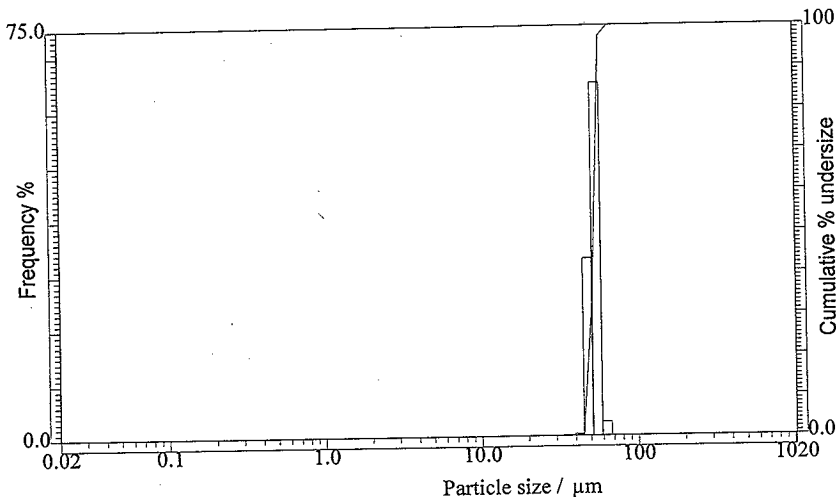
Laser scattering particle size distribution analyzer

PARTICLE SIZE MEASUREMENT DATA

ID# : 980610-040 09:22 Material : Standard
 Filename : 50UM 610 Source : Duke Scientific
 Sample : 50.4 um Standard Lot Number :

Condition : T%(He-Ne): 94.7% Dist.Form: Sharp Sampling times : 100
 (LAMP): 96.5% R.R.Index: 1.19-0.001
 Agitation : 3 Circulthn : 3 U.sonic : OFF(60)

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



Data	Memory	Hist.	Cum.	SAMPLE NAME	ID#	Median(μm)
Main	☐	☒	☐	50.4 um Standard	980610-040	53.358

HORIBA LA-910

Laser scattering particle size distribution analyzer

PARTICLE SIZE MEASUREMENT DATA

ID# : 980610-040 09:22
 Filename : 60UM 610
 Sample : 50.4 um Standard
 Material : Standard
 Source : Duke Scientific
 Lot Number :
 Test Number : 1
 Preparation :
 Disp. Medium : h20
 Disp. Steps :
 Verification :

Condition : T%(He-Ne): 94.7% Dist.Form: Sharp Sampling times : 100
 (LAMP): 96.5% R.R.Index: 1.19-0.001 ()
 Agitation : 3 Circuitn : 3 U.sonic : OFF(60)
 Format :
 Dist.base : Volume Scaling : Auto Axis : LogX - LinearY

Data :
 Median : 53.358µm SP.Area : 1138cm²/cm³ S.D. : 3.700µm
 Mode : 53.378µm Mean : 52.970µm
 C.V. : 6.98%

Span : (D 10.0-D 90.0) / D50 = 0.211

Dia. on % (10.0%) :	46.783µm	% on Dia. (0.100µm) :	0.0%
Dia. on % (20.0%) :	48.777µm	% on Dia. (1.000µm) :	0.0%
Dia. on % (30.0%) :	50.856µm	% on Dia. (10.000µm) :	0.0%
Dia. on % (80.0%) :	56.831µm	% on Dia. (100.000µm) :	100.0%
Dia. on % (90.0%) :	58.039µm	% on Dia. (200.000µm) :	100.0%

Size(µm)	Freq(%)	Und(%)	Size(µm)	Freq(%)	Und(%)	Size(µm)	Freq(%)	Und(%)
1019.5	0.00	100.00	26.11	0.00	0.00	0.669	0.00	0.00
890.1	0.00	100.00	22.80	0.00	0.00	0.584	0.00	0.00
777.1	0.00	100.00	19.90	0.00	0.00	0.510	0.00	0.00
678.5	0.00	100.00	17.38	0.00	0.00	0.445	0.00	0.00
592.4	0.00	100.00	15.17	0.00	0.00	0.389	0.00	0.00
517.2	0.00	100.00	13.25	0.00	0.00	0.339	0.00	0.00
451.6	0.00	100.00	11.56	0.00	0.00	0.296	0.00	0.00
394.2	0.00	100.00	10.10	0.00	0.00	0.259	0.00	0.00
344.2	0.00	100.00	8.816	0.00	0.00	0.226	0.00	0.00
300.5	0.00	100.00	7.697	0.00	0.00	0.197	0.00	0.00
262.4	0.00	100.00	6.720	0.00	0.00	0.172	0.00	0.00
229.1	0.00	100.00	5.867	0.00	0.00	0.150	0.00	0.00
200.0	0.00	100.00	5.122	0.00	0.00	0.131	0.00	0.00
174.6	0.00	100.00	4.472	0.00	0.00	0.115	0.00	0.00
152.5	0.00	100.00	3.905	0.00	0.00	0.100	0.00	0.00
133.1	0.00	100.00	3.409	0.00	0.00	0.087	0.00	0.00
116.2	0.00	100.00	2.976	0.00	0.00	0.076	0.00	0.00
101.5	0.00	100.00	2.599	0.00	0.00	0.067	0.00	0.00
88.58	0.00	100.00	2.269	0.00	0.00	0.058	0.00	0.00
77.34	0.00	100.00	1.981	0.00	0.00	0.051	0.00	0.00
67.52	2.57	100.00	1.729	0.00	0.00	0.044	0.00	0.00
58.95	64.56	97.43	1.510	0.00	0.00	0.039	0.00	0.00
51.47	32.51	32.88	1.318	0.00	0.00	0.034	0.00	0.00
44.94	0.36	0.36	1.151	0.00	0.00	0.029	0.00	0.00
39.23	0.00	0.00	1.005	0.00	0.00	0.026	0.00	0.00
34.25	0.00	0.00	0.877	0.00	0.00	0.022	0.00	0.00
29.91	0.00	0.00	0.766	0.00	0.00			

HORIBA LA-910

Laser scattering particle size distribution analyzer

PARTICLE SIZE MEASUREMENT DATA

ID# : 980625-100 13:36
 Filename : 8M95CMS60
 Sample : 8M95CMS60
 Material : 8M HNO3 95C Med Shear 60
 Source : Mark Beck
 Lot Number :
 Test Number : 1
 Preparation :
 Disp. Medium :
 Disp. Steps :
 Verification :

Condition : T%(He-Ne): 83.6% Dist. Form: Sharp Sampling times : 100
 (LAMP): 86.6% R.R. Index: 1.19-0.001
 Agitation : 5 Circultrn : 7 U.sonic : ON(3)
 Format :
 Dist. base : Volume Scaling : Auto Axis : LogX - LinearY

Data

Median : 49.461µm SP. Area : 2104cm²/cm³ S.D. : 58.639µm
 Mode : 55.111µm Mean : 66.627µm
 C.V. : 88.01%

Span : (D 10.0-D 90.0) / D50 = 2.891

Dia. on % (10.0%) :	13.148µm	% on Dia. (0.100µm) :	0.0%
Dia. on % (20.0%) :	21.335µm	% on Dia. (1.000µm) :	0.0%
Dia. on % (30.0%) :	30.344µm	% on Dia. (10.000µm) :	7.3%
Dia. on % (80.0%) :	97.004µm	% on Dia. (30.000µm) :	29.6%
Dia. on % (90.0%) :	156.137µm	% on Dia. (200.000µm) :	94.8%

Size(µm)	Freq(%)	Und(%)	Size(µm)	Freq(%)	Und(%)	Size(µm)	Freq(%)	Und(%)
1019.5	0.00	100.00	26.11	3.58	25.13	0.669	0.00	0.00
890.1	0.00	100.00	22.80	3.18	21.55	0.584	0.00	0.00
777.1	0.00	100.00	19.90	2.96	18.37	0.510	0.00	0.00
678.5	0.00	100.00	17.38	3.04	15.41	0.445	0.00	0.00
592.4	0.00	100.00	15.17	2.29	12.38	0.389	0.00	0.00
517.2	0.00	100.00	13.25	1.63	10.09	0.339	0.00	0.00
451.6	0.00	100.00	11.56	1.10	8.46	0.296	0.00	0.00
394.2	0.12	100.00	10.10	0.79	7.36	0.259	0.00	0.00
344.2	0.21	99.88	8.816	0.79	6.57	0.226	0.00	0.00
300.5	0.39	99.67	7.697	1.14	5.77	0.197	0.00	0.00
262.4	1.64	99.28	6.720	1.47	4.63	0.172	0.00	0.00
229.1	2.89	97.64	5.867	1.64	3.17	0.150	0.00	0.00
200.0	2.80	94.75	5.122	1.23	1.53	0.131	0.00	0.00
174.6	2.37	91.96	4.472	0.30	0.30	0.115	0.00	0.00
152.5	1.96	89.58	3.905	0.00	0.00	0.100	0.00	0.00
133.1	2.52	87.63	3.409	0.00	0.00	0.087	0.00	0.00
116.2	3.57	85.10	2.976	0.00	0.00	0.076	0.00	0.00
101.5	4.62	81.53	2.599	0.00	0.00	0.067	0.00	0.00
88.58	5.66	76.91	2.269	0.00	0.00	0.058	0.00	0.00
77.34	6.44	71.25	1.981	0.00	0.00	0.051	0.00	0.00
67.52	6.40	64.81	1.729	0.00	0.00	0.044	0.00	0.00
58.95	6.55	58.41	1.510	0.00	0.00	0.039	0.00	0.00
51.47	6.35	51.86	1.318	0.00	0.00	0.034	0.00	0.00
44.94	5.86	45.51	1.151	0.00	0.00	0.029	0.00	0.00
39.23	5.25	39.65	1.005	0.00	0.00	0.026	0.00	0.00
34.25	4.92	34.40	0.877	0.00	0.00	0.022	0.00	0.00
29.91	4.34	29.47	0.766	0.00	0.00			

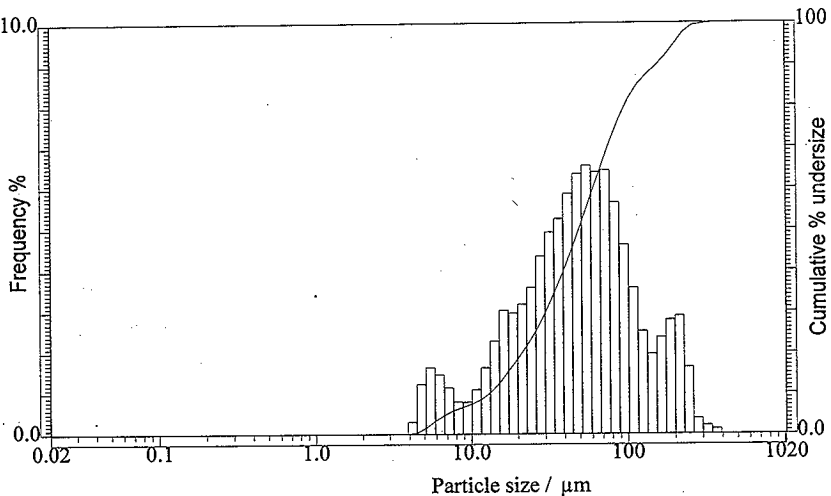
HORIBA LA-910

Laser scattering particle size distribution analyzer

PARTICLE SIZE MEASUREMENT DATA

ID# : 980625-100 13:36 Material : 8M HNO3 95C Med Shear 60
 Filename : 8M95CMS60 Source : Mark Beck
 Sample : 8M95CMS60 Lot Number :

Condition
 T%(He-Ne): 83.6% Dist.Form: Sharp Sampling times : 100
 (LAMP): 86.6% R.R.Index: 1.19-0.001 ()
 Agitation : 5 Circultrn : 7 U.sonic : ON(3)
 Format
 Dist.base : Volume Scaling : Auto Axis : LogX - Lineary

**Data**

Memory Hist.	Cum.	SAMPLE NAME	ID#	Median(μm)
Main	☐	8M95CMS60	980625-100	49.461

HORIBA LA-910

Laser scattering particle size distribution analyzer

PARTICLE SIZE MEASUREMENT DATA

ID# : 980625-101 13:49
 Filename : 8M95M180
 Sample : 8M95CMS180
 Material : 8M HNO3 95C Med Shear 180
 Source : Mark Beck
 Lot Number :
 Test Number : 1
 Preparation :
 Disp. Medium :
 Disp. Steps :
 Verification :

Condition :
 T%(He-Ne): 78.9% Dist.Form: Sharp Sampling times : 100
 (LAMP): 81.8% R.R.Index: 1.19-0.001 ()
 Agitation : 5 Circultrn : 7 U.sonic : ON(3)
 Format :
 Dist.base : Volume Scaling : Auto Axis : LogX - LinearY

Data :
 Median : 70.431µm SP.Area : 2097cm²/cm³ S.D. : 110.459µm
 Mode : 245.241µm Mean : 115.060µm
 C.V. : 96.00%

Span : (D 10.0-D 90.0) / D50 = 3.834

Dia. on % (10.0%) :	10.956µm	% on Dia.(0.100µm) :	0.0%
Dia. on % (20.0%) :	18.740µm	% on Dia.(1.000µm) :	0.0%
Dia. on % (30.0%) :	29.941µm	% on Dia.(10.000µm) :	9.1%
Dia. on % (80.0%) :	223.887µm	% on Dia.(30.000µm) :	30.0%
Dia. on % (90.0%) :	280.984µm	% on Dia.(200.000µm) :	75.5%

Size(µm)	Freq(%)	Und(%)	Size(µm)	Freq(%)	Und(%)	Size(µm)	Freq(%)	Und(%)
1019.5	0.00	100.00	26.11	2.84	26.95	0.669	0.00	0.00
890.1	0.00	100.00	22.80	2.81	24.11	0.584	0.00	0.00
777.1	0.00	100.00	19.90	2.95	21.31	0.510	0.00	0.00
678.5	0.00	100.00	17.38	3.30	18.36	0.445	0.00	0.00
592.4	0.25	100.00	15.17	2.62	15.06	0.389	0.00	0.00
517.2	0.45	99.75	13.25	1.90	12.44	0.339	0.00	0.00
451.6	0.81	99.30	11.56	1.33	10.53	0.296	0.00	0.00
394.2	1.95	98.49	10.10	0.95	9.20	0.259	0.00	0.00
344.2	3.82	96.54	8.816	0.92	8.25	0.226	0.00	0.00
300.5	5.49	92.72	7.697	1.25	7.33	0.197	0.00	0.00
262.4	6.31	87.23	6.720	1.60	6.08	0.172	0.00	0.00
229.1	5.46	80.92	5.867	1.93	4.48	0.150	0.00	0.00
200.0	4.27	75.46	5.122	1.74	2.55	0.131	0.00	0.00
174.6	3.29	71.19	4.472	0.68	0.82	0.115	0.00	0.00
152.5	2.64	67.90	3.905	0.13	0.13	0.100	0.00	0.00
133.1	2.84	65.27	3.409	0.00	0.00	0.087	0.00	0.00
116.2	3.16	62.43	2.976	0.00	0.00	0.076	0.00	0.00
101.5	3.38	59.26	2.599	0.00	0.00	0.067	0.00	0.00
88.58	3.47	55.88	2.269	0.00	0.00	0.058	0.00	0.00
77.34	3.50	52.41	1.981	0.00	0.00	0.051	0.00	0.00
67.52	3.28	48.91	1.729	0.00	0.00	0.044	0.00	0.00
58.95	3.31	45.63	1.510	0.00	0.00	0.039	0.00	0.00
51.47	3.23	42.33	1.318	0.00	0.00	0.034	0.00	0.00
44.94	3.12	39.10	1.151	0.00	0.00	0.029	0.00	0.00
39.23	3.01	35.98	1.005	0.00	0.00	0.026	0.00	0.00
34.25	2.99	32.97	0.877	0.00	0.00	0.022	0.00	0.00
29.91	3.02	29.97	0.766	0.00	0.00			

HORIBA LA-910

Laser scattering particle size distribution analyzer

PARTICLE SIZE MEASUREMENT DATA

ID# : 980625-101 13:49

Filename : 8M95M180

Sample : 8M95CMS180

Material : 8M HNO3 95C Med Shear 180

Source : Mark Beck

Lot Number :

Condition

T%(He-Ne): 78.9%

(LAMP): 81.8%

Dist.Form: Sharp

R.R.Index: 1.19-0.001

Sampling times : 100

()

Agitation : 5

Circultrn

: 7

U.sonic

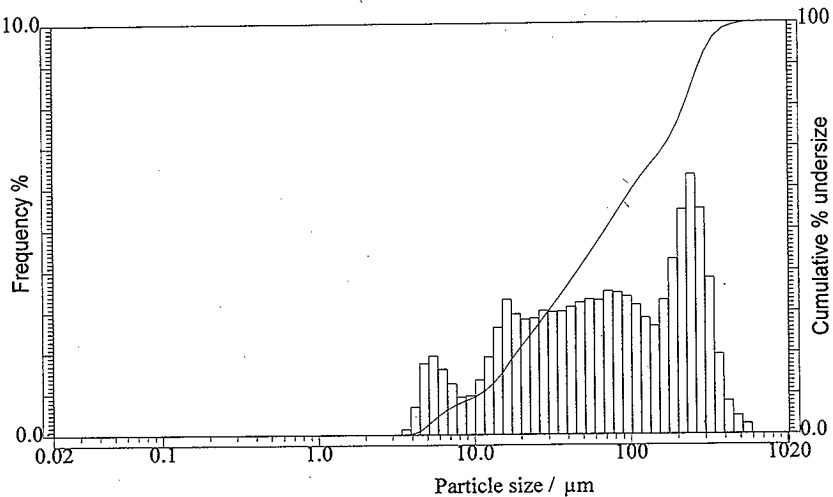
: ON(3)

Format

Dist.base : Volume

Scaling : Auto

Axis : LogX - LinearY



Data

Memory Hist.

Cum.

SAMPLE NAME

ID#

Median(μm)

Main



8M95CMS180

980625-101

70.431

HORIBA LA-910

Laser scattering particle size distribution analyzer

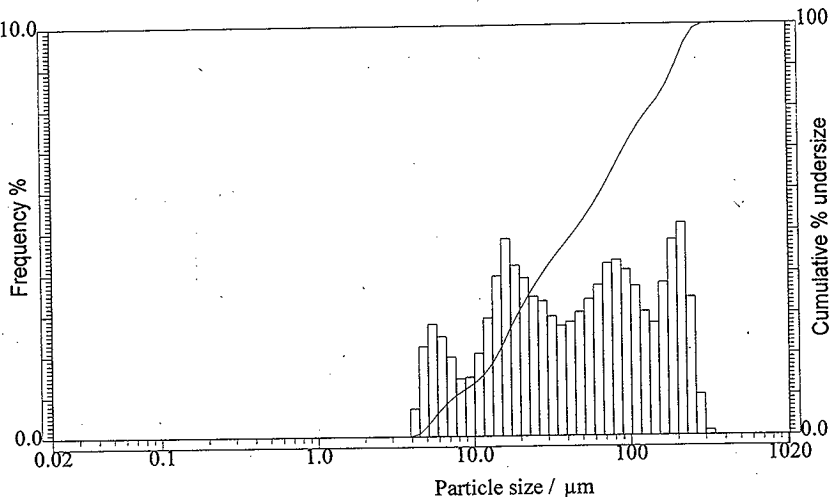
PARTICLE SIZE MEASUREMENT DATA

ID# : 980625-103 14:07 Material : 8M HNO3 95C Med Shear 240
 Filename : 8m95m240 Source : Mark Beck
 Sample : 8M95CMS240 Lot Number :

Condition : T%(He-Ne): 81.0% Dist.Form: Sharp Sampling times : 100
 (LAMP): 83.1% R.R.Index: 1.19-0.001 ()

Agitation : 5 Circuln : 7 U.sonic : ON(3)

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



Data	Memory	Hist.	Cum.	SAMPLE NAME	ID#	Median(μm)
Main	☐	☐	☒	8M95CMS240	980625-103	45.425

HORIBA LA-910

Laser scattering particle size distribution analyzer

PARTICLE SIZE MEASUREMENT DATA

ID# : 980625-103 14:07
 Filename : 8m95m240
 Sample : 8M95CMS240
 Material : 8M HNO3 95C Med Shear 240
 Source : Mark Beck
 Lot Number :
 Test Number : 1
 Preparation :
 Disp. Medium :
 Disp. Steps :
 Verification :

Condition :
 T%(He-Ne): 81.0% Dist.Form: Sharp Sampling times : 100
 (LAMP): 83.1% R.R.Index: 1.19-0.001 ()
 Agitation : 5 Circultrn : 7 U.sonic : ON(3)
 Format :
 Dist.base : Volume Scaling : Auto Axis : LogX - LinearY

Data :
 Median : 45.425µm SP.Area : 2704cm²/cm³ S.D. : 72.901µm
 Mode : 210.180µm Mean : 74.538µm
 C.V. : 97.80%

Span : (D 10.0-D 90.0) / D50 = 4.195

Dia. on % (10.0%) :	7.675µm	% on Dia. (0.100µm) :	0.0%
Dia. on % (20.0%) :	14.280µm	% on Dia. (1.000µm) :	0.0%
Dia. on % (30.0%) :	19.426µm	% on Dia. (10.000µm) :	12.8%
Dia. on % (80.0%) :	139.526µm	% on Dia. (30.000µm) :	41.4%
Dia. on % (90.0%) :	198.221µm	% on Dia. (200.000µm) :	90.3%

Size(µm)	Freq(%)	Und(%)	Size(µm)	Freq(%)	Und(%)	Size(µm)	Freq(%)	Und(%)
1019.5	0.00	100.00	26.11	3.42	39.04	0.669	0.00	0.00
890.1	0.00	100.00	22.80	3.88	34.62	0.584	0.00	0.00
777.1	0.00	100.00	19.90	4.17	30.75	0.510	0.00	0.00
678.5	0.00	100.00	17.38	4.82	26.57	0.445	0.00	0.00
592.4	0.00	100.00	15.17	3.92	21.75	0.389	0.00	0.00
517.2	0.00	100.00	13.25	2.90	17.83	0.339	0.00	0.00
451.6	0.00	100.00	11.56	2.03	14.93	0.296	0.00	0.00
394.2	0.00	100.00	10.10	1.45	12.90	0.259	0.00	0.00
344.2	0.13	100.00	8.816	1.41	11.45	0.226	0.00	0.00
300.5	1.00	99.87	7.697	1.95	10.04	0.197	0.00	0.00
262.4	3.38	98.87	6.720	2.45	8.09	0.172	0.00	0.00
229.1	5.17	95.49	5.867	2.75	5.64	0.150	0.00	0.00
200.0	4.77	90.31	5.122	2.21	2.89	0.131	0.00	0.00
174.6	3.74	85.54	4.472	0.68	0.68	0.115	0.00	0.00
152.5	2.76	81.80	3.905	0.00	0.00	0.100	0.00	0.00
133.1	3.04	79.04	3.409	0.00	0.00	0.087	0.00	0.00
116.2	3.65	76.01	2.976	0.00	0.00	0.076	0.00	0.00
101.5	4.05	72.35	2.599	0.00	0.00	0.067	0.00	0.00
88.58	4.28	68.30	2.269	0.00	0.00	0.058	0.00	0.00
77.34	4.21	64.02	1.981	0.00	0.00	0.051	0.00	0.00
67.52	3.68	59.81	1.729	0.00	0.00	0.044	0.00	0.00
58.95	3.34	56.13	1.510	0.00	0.00	0.039	0.00	0.00
51.47	3.03	52.79	1.318	0.00	0.00	0.034	0.00	0.00
44.94	2.79	49.76	1.151	0.00	0.00	0.029	0.00	0.00
39.23	2.69	46.97	1.005	0.00	0.00	0.026	0.00	0.00
34.25	2.93	44.28	0.877	0.00	0.00	0.022	0.00	0.00
29.91	3.31	41.35	0.766	0.00	0.00			

HORIBA LA-910

for Windows(TM) Ver.1.20j Jun/24/98 10:18

Laser scattering particle size distribution analyzer

PARTICLE SIZE MEASUREMENT DATA

ID# : 980624-097 09:35
 Filename : 1M45CLS
 Sample : 1m45cls
 Material : 1M HNO3 45C Low Shear
 Source : Mark Beck
 Lot Number :
 Test Number : 1
 Preparation :
 Disp. Medium :
 Disp. Steps :
 Verification :

Condition :
 T%(He-Ne): 83.9% Dist.Form: Sharp Sampling times : 100
 (LAMP): 85.5% R.R.Index: 1.19-0.001 ()
 Agitation : 5 Circultrn : 7 U.sonic : ON(3)
 Format :
 Dist.base : Volume Scaling : Auto Axis : LogX - LinearY

Data :
 Median : 225.679µm SP.Area : 1187cm²/cm³ S.D. : 151.499µm
 Mode : 320.545µm Mean : 221.075µm
 C.V. : 68.53%

Span : (D 10.0-D 90.0) / D50 = 1.732

Dia. on %(10.0%) :	20.072µm	% on Dia.(0.100µm) :	0.0%
Dia. on %(20.0%) :	60.571µm	% on Dia.(1.000µm) :	0.0%
Dia. on %(30.0%) :	109.159µm	% on Dia.(10.000µm) :	5.4%
Dia. on %(80.0%) :	347.759µm	% on Dia.(30.000µm) :	12.9%
Dia. on %(90.0%) :	410.709µm	% on Dia.(200.000µm) :	44.9%

Size(µm)	Freq(%)	Und(%)	Size(µm)	Freq(%)	Und(%)	Size(µm)	Freq(%)	Und(%)
1019.5	0.00	100.00	26.11	0.99	11.88	0.669	0.00	0.00
890.1	0.00	100.00	22.80	0.95	10.90	0.584	0.00	0.00
777.1	0.52	100.00	19.90	1.03	9.94	0.510	0.00	0.00
678.5	0.94	99.48	17.38	1.18	8.91	0.445	0.00	0.00
592.4	1.70	98.53	15.17	0.90	7.73	0.389	0.00	0.00
517.2	2.88	96.84	13.25	0.77	6.83	0.339	0.00	0.00
451.6	5.66	93.96	11.56	0.61	6.06	0.296	0.00	0.00
394.2	8.97	88.29	10.10	0.48	5.45	0.259	0.00	0.00
344.2	11.10	79.32	8.816	0.48	4.97	0.226	0.00	0.00
300.5	9.52	68.23	7.697	0.63	4.49	0.197	0.00	0.00
262.4	8.05	58.71	6.720	0.79	3.86	0.172	0.00	0.00
229.1	5.78	50.65	5.867	1.01	3.07	0.150	0.00	0.00
200.0	4.73	44.88	5.122	1.05	2.06	0.131	0.00	0.00
174.6	3.61	40.15	4.472	0.64	1.01	0.115	0.00	0.00
152.5	2.78	36.53	3.905	0.23	0.37	0.100	0.00	0.00
133.1	2.59	33.76	3.409	0.13	0.13	0.087	0.00	0.00
116.2	2.53	31.17	2.976	0.00	0.00	0.076	0.00	0.00
101.5	2.46	28.64	2.599	0.00	0.00	0.067	0.00	0.00
88.58	2.34	26.18	2.269	0.00	0.00	0.058	0.00	0.00
77.34	2.26	23.84	1.981	0.00	0.00	0.051	0.00	0.00
67.52	1.98	21.59	1.729	0.00	0.00	0.044	0.00	0.00
58.95	1.82	19.60	1.510	0.00	0.00	0.039	0.00	0.00
51.47	1.50	17.78	1.318	0.00	0.00	0.034	0.00	0.00
44.94	1.27	16.28	1.151	0.00	0.00	0.029	0.00	0.00
39.23	1.12	15.01	1.005	0.00	0.00	0.026	0.00	0.00
34.25	0.99	13.89	0.877	0.00	0.00	0.022	0.00	0.00
29.91	1.03	12.91	0.766	0.00	0.00			

HORIBA LA-910

Laser scattering particle size distribution analyzer

PARTICLE SIZE MEASUREMENT DATA

ID# : 980624-097 09:35

Filename : 1M45CLS

Sample : 1m45cls

Material : 1M HNO3 45C Low Shear

Source : Mark Beck

Lot Number :

Condition

T%(He-Ne): 83.9%

(LAMP): 85.5%

Dist.Form: Sharp

R.R.Index: 1.19-0.001

Sampling times : 100

()

Agitation : 5

Circultrn

: 7

U.sonic

: ON(3)

Format

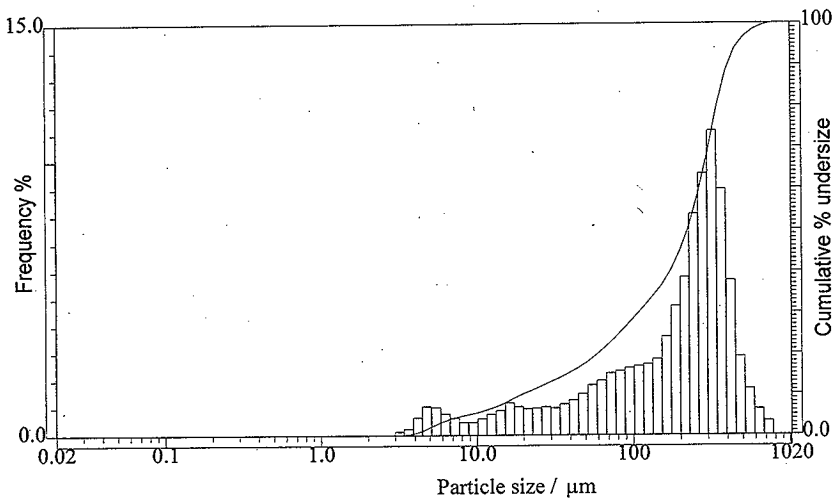
Dist.base : Volume

Scaling

: Auto

Axis : LogX - LinearY

A.40

**Data**

Memory Hist.

Cum.

SAMPLE NAME

ID#

Median(μm)

Main



1m45cls

980624-097 225.579

HORIBA LA-910

Laser scattering particle size distribution analyzer

PARTICLE SIZE MEASUREMENT DATA

ID# : 980624-098 09:46
Filename : 00M95cls
Sample : 00m95cls
Material : Water 95C Low Shear
Source : Mark Beck
Lot Number :
Test Number : 1
Preparation :
Disp. Medium :
Disp. Steps :
Verification :

Condition :
T%(He-Ne): 82.6% Dist.Form: Sharp Sampling times : 100
(LAMP): 86.9% R.R.Index: 1.19-0.001
Agitation : 5 Circultrn : 7 U.sonic : ON(3)

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

Data :
Median : 190.539µm SP.Area : 1078cm²/cm³ S.D. : 141.967µm
Mode : 318.535µm Mean : 202.320µm
C.V. : 70.17%

Span : (D 10.0-D 90.0) / D50 = 1.926

Dia. on %(10.0%):	23.820µm	% on Dia.(0.100µm):	0.0%
Dia. on %(20.0%):	60.407µm	% on Dia.(1.000µm):	0.0%
Dia. on %(30.0%):	100.142µm	% on Dia.(10.000µm):	4.1%
Dia. on %(80.0%):	326.258µm	% on Dia.(30.000µm):	11.8%
Dia. on %(90.0%):	390.712µm	% on Dia.(200.000µm):	52.0%

Size(µm)	Freq(%)	Und(%)	Size(µm)	Freq(%)	Und(%)	Size(µm)	Freq(%)	Und(%)
1019.5	0.00	100.00	26.11	0.98	10.66	0.669	0.00	0.00
890.1	0.00	100.00	22.80	0.78	9.68	0.584	0.00	0.00
777.1	0.34	100.00	19.90	1.00	8.90	0.510	0.00	0.00
678.5	0.61	99.66	17.38	1.19	7.90	0.445	0.00	0.00
592.4	1.10	99.05	15.17	0.80	6.70	0.389	0.00	0.00
517.2	2.40	97.94	13.25	0.91	5.91	0.339	0.00	0.00
451.6	5.08	95.54	11.56	0.85	5.00	0.296	0.00	0.00
394.2	6.99	90.46	10.10	0.72	4.15	0.259	0.00	0.00
344.2	8.80	83.47	8.816	0.62	3.43	0.226	0.00	0.00
300.5	8.24	74.67	7.697	0.56	2.81	0.197	0.00	0.00
262.4	8.42	66.43	6.720	0.47	2.24	0.172	0.00	0.00
229.1	6.04	58.01	5.867	0.46	1.77	0.150	0.00	0.00
200.0	5.52	51.97	5.122	0.43	1.31	0.131	0.00	0.00
174.6	4.49	46.45	4.472	0.39	0.88	0.115	0.00	0.00
152.5	4.20	41.97	3.905	0.25	0.49	0.100	0.00	0.00
133.1	3.87	37.76	3.409	0.24	0.24	0.087	0.00	0.00
116.2	3.58	33.90	2.976	0.00	0.00	0.076	0.00	0.00
101.5	3.27	30.31	2.599	0.00	0.00	0.067	0.00	0.00
88.58	2.77	27.05	2.269	0.00	0.00	0.058	0.00	0.00
77.34	2.53	24.27	1.981	0.00	0.00	0.051	0.00	0.00
67.52	2.13	21.75	1.729	0.00	0.00	0.044	0.00	0.00
58.95	2.09	19.62	1.510	0.00	0.00	0.039	0.00	0.00
51.47	1.72	17.52	1.318	0.00	0.00	0.034	0.00	0.00
44.94	1.55	15.81	1.151	0.00	0.00	0.029	0.00	0.00
39.23	1.43	14.25	1.005	0.00	0.00	0.026	0.00	0.00
34.25	1.08	12.82	0.877	0.00	0.00	0.022	0.00	0.00
29.91	1.08	11.74	0.766	0.00	0.00			

HORIBA LA-910

Laser scattering particle size distribution analyzer

PARTICLE SIZE MEASUREMENT DATA

ID# : 980624-098 09:46

Filename : 00M95cls

Sample : 00m95cls

Material : Water 95C Low Shear

Source : Mark Beck

Lot Numbe :

Condition

T%(He-Ne): 82.6%

(LAMP): 86.9%

Dist.Form: Sharp

R.R.Index: 1.19-0.001 (

Sampling times : 100

Agitation : 5

Circultrn

: 7

U.sonic

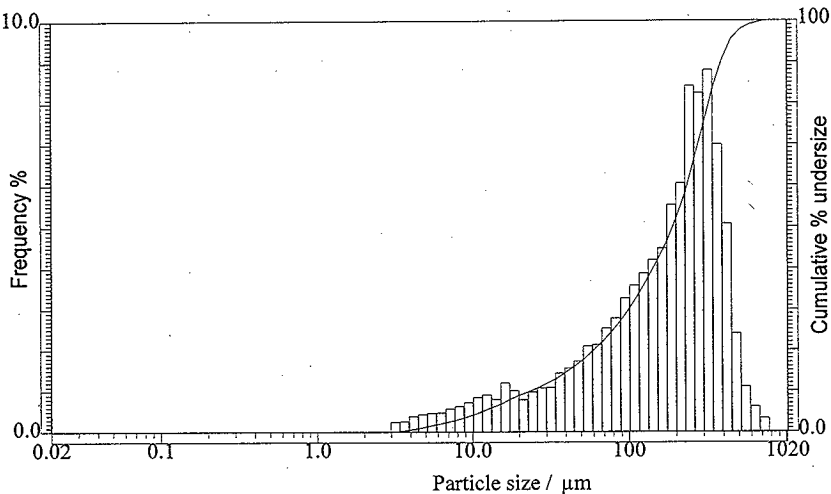
: ON(3)

Format

Dist.base : Volume

Scaling : Auto

Axis : LogX - Lineary

**Data**

Memory Hist.	Cum.	SAMPLE NAME	ID#	Median(μm)
Main	☐	00m95cls	980624-098	190.539

HORIBA LA-910

Laser scattering particle size distribution analyzer

PARTICLE SIZE MEASUREMENT DATA

ID# : 980619-083 09:16
 Filename : 1M95CHS
 Sample : 1m95chs
 Material : 1M HNO3 95C High Shear
 Source : Mark Beck
 Lot Number :
 Test Number : 1
 Preparation :
 Disp. Medium :
 Disp. Steps :
 Verification :

Condition

T%(He-Ne): 83.7%
 (LAMP): 83.3%

Dist.Form: Sharp
 R.R.Index: 1.19-0.001

Sampling times : 100
 ()

Agitation : 5

Circultrn

: 7

U.sonic

: ON(3)

Format

Dist.base : Volume

Scaling : Auto

Axis : LogX - LinearY

Data

Median : 15.596µm SP.Area : 6067cm²/cm³ S.D. : 55.185µm
 Mode : 16.237µm Mean : 27.666µm
 C.V. : 199.47%

Span : (D 10.0-D 90.0) / D50 = 2.824

Dia. on % (10.0%) : 4.488µm % on Dia.(0.100µm) : 0.0%
 Dia. on % (20.0%) : 5.664µm % on Dia.(1.000µm) : 0.0%
 Dia. on % (30.0%) : 7.782µm % on Dia.(10.000µm) : 35.3%
 Dia. on % (80.0%) : 37.761µm % on Dia.(30.000µm) : 72.9%
 Dia. on % (90.0%) : 48.529µm % on Dia.(200.000µm) : 98.1%

Size(µm)	Freq(%)	Und(%)	Size(µm)	Freq(%)	Und(%)	Size(µm)	Freq(%)	Und(%)
1019.5	0.00	100.00	26.11	3.98	68.48	0.669	0.00	0.00
990.1	0.00	100.00	22.80	4.34	64.50	0.584	0.00	0.00
777.1	0.00	100.00	19.90	5.20	60.16	0.510	0.00	0.00
678.5	0.00	100.00	17.38	6.22	54.96	0.445	0.00	0.00
592.4	0.11	100.00	15.17	5.20	48.74	0.389	0.00	0.00
517.2	0.20	99.89	13.25	4.49	43.54	0.339	0.00	0.00
451.6	0.36	99.69	11.56	3.58	39.04	0.296	0.00	0.00
394.2	1.24	99.32	10.10	2.85	35.46	0.259	0.00	0.00
344.2	0.00	98.08	8.816	2.84	32.61	0.226	0.00	0.00
300.5	0.00	98.08	7.697	3.69	29.77	0.197	0.00	0.00
262.4	0.00	98.08	6.720	4.60	26.08	0.172	0.00	0.00
229.1	0.00	98.08	5.867	5.71	21.48	0.150	0.00	0.00
200.0	0.00	98.08	5.122	5.92	15.77	0.131	0.00	0.00
174.6	0.00	98.08	4.472	3.71	9.84	0.115	0.00	0.00
152.5	0.00	98.08	3.905	1.58	6.13	0.100	0.00	0.00
133.1	0.00	98.08	3.409	1.09	4.56	0.087	0.00	0.00
116.2	0.00	98.08	2.976	0.98	3.46	0.076	0.00	0.00
101.5	0.00	98.08	2.599	1.68	2.49	0.067	0.00	0.00
88.58	0.00	98.08	2.269	0.69	0.80	0.058	0.00	0.00
77.34	0.22	98.08	1.981	0.12	0.12	0.051	0.00	0.00
67.52	1.40	97.86	1.729	0.00	0.00	0.044	0.00	0.00
58.95	4.00	96.46	1.510	0.00	0.00	0.039	0.00	0.00
51.47	5.67	92.46	1.318	0.00	0.00	0.034	0.00	0.00
44.94	5.49	86.79	1.151	0.00	0.00	0.029	0.00	0.00
39.23	4.61	81.30	1.005	0.00	0.00	0.026	0.00	0.00
34.25	3.93	76.69	0.877	0.00	0.00	0.022	0.00	0.00
29.91	4.28	72.76	0.766	0.00	0.00			

HORIBA LA-910

Laser scattering particle size distribution analyzer

PARTICLE SIZE MEASUREMENT DATA

ID# : 980619-083 09:16

Filename : 1M95CHS

Sample : 1m95chs

Material : 1M HNO3 95C High Shear

Source : Mark Beck

Lot Number :

Condition

T%(He-Ne): 83.7%

(LAMP): 83.3%

Dist.Form: Sharp

R.R.Index: 1.19-0.001 (

Sampling times : 100

Agitation : 5

Circultrn

: 7

U.sonic

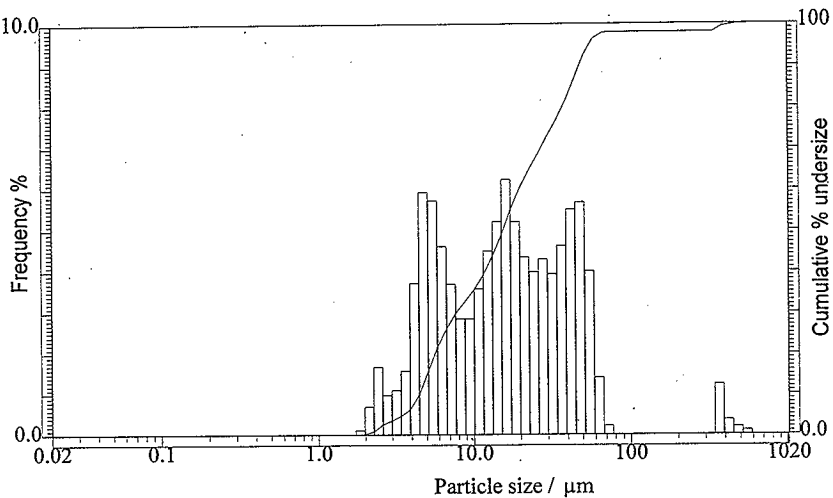
: ON(3)

Format

Dist.base : Volume

Scaling : Auto

Axis : LogX - LinearY

**Data**

Memory Hist.	Cum.	SAMPLE NAME	ID#	Median(μm)
Main	☐	1m95chs	980619-083	15.596

HORIBA LA-910

Laser scattering particle size distribution analyzer

PARTICLE SIZE MEASUREMENT DATA

ID# : 980619-081 08:51
 Filename : 4M45CLS
 Sample : 4m45cls
 Material : 4M HNO3 45C Low Shear
 Source : Mark Beck
 Lot Number :
 Test Number : 1
 Preparation :
 Disp. Medium :
 Disp. Steps :
 Verification :

Condition :
 T%(He-Ne): 80.5% Dist.Form: Sharp Sampling times : 100
 (LAMP): 83.8% R.R.Index: 1.19-0.001 ()

Agitation : 5 Circuitrn : 7 U.Sonic : ON(3)

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

Data
 Median : 137.183µm SP.Area : 1454cm²/cm³ S.D. : 129.998µm
 Mode : 247.368µm Mean : 163.898µm
 C.V. : 79.32%

Span : (D 10.0-D 90.0) / D50 = 2.376

Dia. on % (10.0%) :	14.857µm	% on Dia. (0.100µm) :	0.0%
Dia. on % (20.0%) :	34.710µm	% on Dia. (1.000µm) :	0.0%
Dia. on % (30.0%) :	62.691µm	% on Dia. (10.000µm) :	6.4%
Dia. on % (80.0%) :	279.611µm	% on Dia. (30.000µm) :	18.1%
Dia. on % (90.0%) :	340.803µm	% on Dia. (200.000µm) :	61.1%

Size(µm)	Freq(%)	Und(%)	Size(µm)	Freq(%)	Und(%)	Size(µm)	Freq(%)	Und(%)
1019.5	0.00	100.00	26.11	1.48	16.40	0.669	0.00	0.00
890.1	0.00	100.00	22.80	1.36	14.92	0.584	0.00	0.00
777.1	0.00	100.00	19.90	1.52	13.56	0.510	0.00	0.00
678.5	0.34	100.00	17.38	1.81	12.04	0.445	0.00	0.00
592.4	0.62	99.66	15.17	1.49	10.23	0.389	0.00	0.00
517.2	1.33	99.04	13.25	1.28	8.74	0.339	0.00	0.00
451.6	2.80	97.71	11.56	1.01	7.46	0.296	0.00	0.00
394.2	4.44	94.91	10.10	0.78	6.45	0.259	0.00	0.00
344.2	6.33	90.46	8.816	0.77	5.66	0.226	0.00	0.00
300.5	7.78	84.14	7.697	0.99	4.89	0.197	0.00	0.00
262.4	8.59	76.35	6.720	1.15	3.90	0.172	0.00	0.00
229.1	6.65	67.76	5.867	1.27	2.75	0.150	0.00	0.00
200.0	4.83	61.11	5.122	1.07	1.47	0.131	0.00	0.00
174.6	3.65	56.28	4.472	0.41	0.41	0.115	0.00	0.00
152.5	3.38	52.63	3.905	0.00	0.00	0.100	0.00	0.00
133.1	3.76	49.25	3.409	0.00	0.00	0.087	0.00	0.00
116.2	3.83	45.49	2.976	0.00	0.00	0.076	0.00	0.00
101.5	3.74	41.66	2.599	0.00	0.00	0.067	0.00	0.00
88.58	3.39	37.92	2.269	0.00	0.00	0.058	0.00	0.00
77.34	3.07	34.53	1.981	0.00	0.00	0.051	0.00	0.00
67.52	2.65	31.45	1.729	0.00	0.00	0.044	0.00	0.00
58.95	2.55	28.80	1.510	0.00	0.00	0.039	0.00	0.00
51.47	2.34	26.25	1.318	0.00	0.00	0.034	0.00	0.00
44.94	2.14	23.92	1.151	0.00	0.00	0.029	0.00	0.00
39.23	1.96	21.77	1.005	0.00	0.00	0.026	0.00	0.00
34.25	1.74	19.81	0.877	0.00	0.00	0.022	0.00	0.00
29.91	1.67	18.07	0.766	0.00	0.00			

HORIBA LA-910

Laser scattering particle size distribution analyzer

PARTICLE SIZE MEASUREMENT DATA

ID# : 980619-081 08:51

Filename : 4M45CLS

Sample : 4m45cls

Material : 4M HNO₃ 45C Low Shear

Source : Mark Beck

Lot Number :

Condition

T%(He-Ne): 80.5%

(LAMP): 83.8%

Dist.Form: Sharp

R.R.Index: 1.19-0.001

Sampling times : 100

()

Agitation : 5

Circultrn

: 7

U.sonic

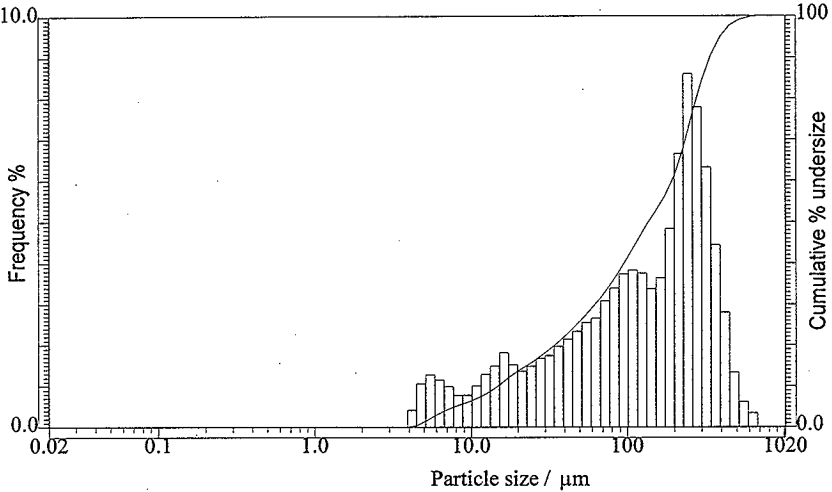
: ON(3)

Format

Dist.base : Volume

Scaling : Auto

Axis : LogX - LinearY

**Data**

Memory Hist.

Cum.

SAMPLE NAME

ID#

Median(μm)

Main



4m45cls

980619-081

137.183

HORIBA LA-910

Laser scattering particle size distribution analyzer

PARTICLE SIZE MEASUREMENT DATA

ID# : 980619-085 10:30
 Filename : 1M95CHSL
 Sample : 1m95chs Cent. Liquid
 Material : Liquid Cent. 1000G 5 min
 Source : Mark Beck
 Lot Number :
 Test Number : 1
 Preparation :
 Disp. Medium :
 Disp. Steps :
 Verification :

Condition :
 T%(He-Ne): 91.0% Dist. Form: Sharp Sampling times : 100
 (LAMP): 77.2% R.R. Index: 1.19-0.00i ()
 Agitation : 5 Circultn : 7 U.sonic : ON(3)

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

Data :
 Median : 1.812µm SP. Area : 61114cm²/cm³ S.D. : 2.295µm
 Mode : 0.422µm Mean : 2.577µm
 C.V. : 89.07%

Span : (D 10.0-D 90.0) / D50 = 3.254

Dia. on % (10.0%) :	0.410µm	% on Dia. (0.100µm) :	0.0%
Dia. on % (20.0%) :	0.448µm	% on Dia. (1.000µm) :	35.7%
Dia. on % (30.0%) :	0.565µm	% on Dia. (10.000µm) :	100.0%
Dia. on % (80.0%) :	5.269µm	% on Dia. (30.000µm) :	100.0%
Dia. on % (90.0%) :	6.308µm	% on Dia. (200.000µm) :	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	1.54	32.54
890.1	0.00	100.00	22.80	0.00	100.00	0.584	4.17	30.99
777.1	0.00	100.00	19.90	0.00	100.00	0.510	7.11	26.82
678.5	0.00	100.00	17.38	0.00	100.00	0.445	16.16	19.71
592.4	0.00	100.00	15.17	0.00	100.00	0.389	3.55	3.55
517.2	0.00	100.00	13.25	0.00	100.00	0.339	0.00	0.00
451.6	0.00	100.00	11.56	0.00	100.00	0.296	0.00	0.00
394.2	0.00	100.00	10.10	0.11	100.00	0.259	0.00	0.00
344.2	0.00	100.00	8.816	1.32	99.89	0.226	0.00	0.00
300.5	0.00	100.00	7.697	4.67	98.57	0.197	0.00	0.00
262.4	0.00	100.00	6.720	8.36	93.90	0.172	0.00	0.00
229.1	0.00	100.00	5.867	6.99	85.54	0.150	0.00	0.00
200.0	0.00	100.00	5.122	3.56	78.55	0.131	0.00	0.00
174.6	0.00	100.00	4.472	2.51	74.98	0.115	0.00	0.00
152.5	0.00	100.00	3.905	1.71	72.47	0.100	0.00	0.00
133.1	0.00	100.00	3.409	2.39	70.76	0.087	0.00	0.00
116.2	0.00	100.00	2.976	3.55	68.37	0.076	0.00	0.00
101.5	0.00	100.00	2.599	5.51	64.82	0.067	0.00	0.00
88.58	0.00	100.00	2.269	5.42	59.31	0.058	0.00	0.00
77.34	0.00	100.00	1.981	5.94	53.89	0.051	0.00	0.00
67.52	0.00	100.00	1.729	4.16	47.95	0.044	0.00	0.00
58.95	0.00	100.00	1.510	3.16	43.79	0.039	0.00	0.00
51.47	0.00	100.00	1.318	2.57	40.63	0.034	0.00	0.00
44.94	0.00	100.00	1.151	2.30	38.06	0.029	0.00	0.00
39.23	0.00	100.00	1.005	1.50	35.76	0.026	0.00	0.00
34.25	0.00	100.00	0.877	1.01	34.26	0.022	0.00	0.00
29.91	0.00	100.00	0.766	0.71	33.25			

HORIBA LA-910

HNF-2011 Rev. 0

for Windows(TM) Ver.1.20J Jun/19/98 11:41

Laser scattering particle size distribution analyzer

PARTICLE SIZE MEASUREMENT DATA

ID# : 980619-085 10:30 Material : Liquid Cent. 1000G 5 min
Filename : 1M95CHSL Source : Mark Beck
Sample : 1m95chs Cent. Liquid Lot Number :

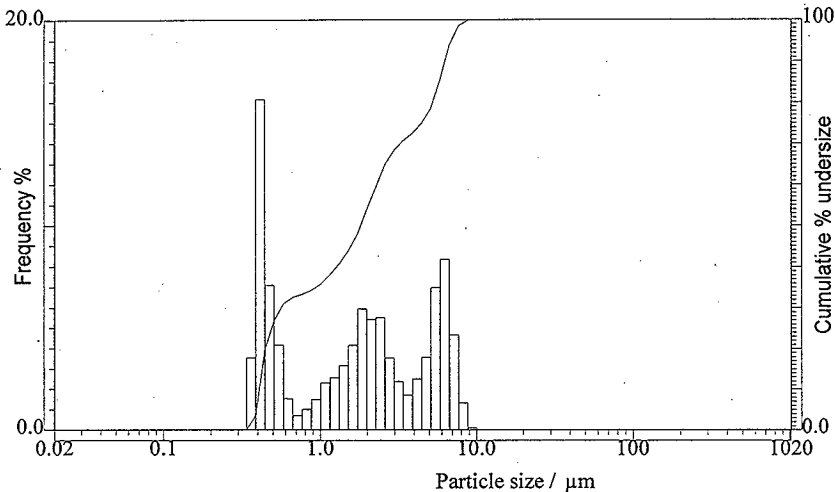
Condition

T%(He-Ne): 91.0% Dist.Form: Sharp Sampling times : 100
(LAMP): 77.2% R.R.Index: 1.19-0.001 ()

Agitation : 5 Circultn : 7 U.sonic : ON(3)

Format

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

**Data**

Memory Hist.	Cum.	SAMPLE NAME	ID#	Median(μm)
Main		1m95chs Cent. Liquid	980619-085	1.812

HORIBA LA-910

HNE-2011 Rev. 0

For Windows(TM) Ver.1.20j Jun/19/98 11:44

Laser scattering particle size distribution analyzer

PARTICLE SIZE MEASUREMENT DATA

ID# : 980619-084 09:59
 Filename : 4M70CMS
 Sample : 4M70cms
 Material : 4M HNO3 70C Med Shear
 Source : Mark Beck
 Lot Number :
 Test Number : 1
 Preparation :
 Disp. Medium :
 Disp. Steps :
 Verification :

Condition :
 T%(He-Ne): 83.5% Dist. Form: Sharp Sampling times : 100
 (LAMP): 86.1% R.R.Index: 1.19-0.00i
 Agitation : 5 Circulthr : 7 U.sonic : ON(3)
 Format :
 Dist.base : Volume Scaling : Auto Axis : LogX - Lineary

Data

Median : 52.151µm SP.Area : 2256cm²/cm³ S.D. : 90.747µm
 Mode : 72.098µm Mean : 86.000µm
 C.V. : 105.52%

Span : (D 10.0-D 90.0) / D50 = 4.109

Dia. on % (10.0%) :	10.582µm	% on Dia.(0.100µm) :	0.0%
Dia. on % (20.0%) :	18.587µm	% on Dia.(1.000µm) :	0.0%
Dia. on % (30.0%) :	27.811µm	% on Dia.(10.000µm) :	9.5%
Dia. on % (80.0%) :	141.580µm	% on Dia.(30.000µm) :	32.2%
Dia. on % (90.0%) :	224.881µm	% on Dia.(200.000µm) :	86.9%

Size(µm)	Freq(%)	Und(%)	Size(µm)	Freq(%)	Und(%)	Size(µm)	Freq(%)	Und(%)
1019.5	0.00	100.00	26.11	3.41	28.21	0.669	0.00	0.00
890.1	0.00	100.00	22.80	3.23	24.80	0.584	0.00	0.00
777.1	0.00	100.00	19.90	3.11	21.57	0.510	0.00	0.00
678.5	0.00	100.00	17.38	3.29	18.46	0.445	0.00	0.00
592.4	0.17	100.00	15.17	2.50	15.17	0.389	0.00	0.00
517.2	0.31	99.83	13.25	1.83	12.67	0.339	0.00	0.00
451.6	0.56	99.51	11.56	1.27	10.83	0.296	0.00	0.00
394.2	1.01	98.95	10.10	0.93	9.56	0.259	0.00	0.00
344.2	1.57	97.94	8.816	0.94	8.63	0.226	0.00	0.00
300.5	2.46	96.36	7.697	1.38	7.69	0.197	0.00	0.00
262.4	3.42	93.90	6.720	1.83	6.31	0.172	0.00	0.00
229.1	3.54	90.48	5.867	2.16	4.49	0.150	0.00	0.00
200.0	3.07	86.94	5.122	1.78	2.33	0.131	0.00	0.00
174.6	2.60	83.87	4.472	0.55	0.55	0.115	0.00	0.00
152.5	2.33	81.27	3.905	0.00	0.00	0.100	0.00	0.00
133.1	2.84	78.94	3.409	0.00	0.00	0.087	0.00	0.00
116.2	3.51	76.10	2.976	0.00	0.00	0.076	0.00	0.00
101.5	4.10	72.59	2.599	0.00	0.00	0.067	0.00	0.00
88.58	4.55	68.48	2.269	0.00	0.00	0.058	0.00	0.00
77.34	4.85	63.93	1.981	0.00	0.00	0.051	0.00	0.00
67.52	4.71	59.08	1.729	0.00	0.00	0.044	0.00	0.00
58.95	4.83	54.36	1.510	0.00	0.00	0.039	0.00	0.00
51.47	4.74	49.53	1.318	0.00	0.00	0.034	0.00	0.00
44.94	4.50	44.79	1.151	0.00	0.00	0.029	0.00	0.00
39.23	4.18	40.29	1.005	0.00	0.00	0.026	0.00	0.00
34.25	4.05	36.11	0.877	0.00	0.00	0.022	0.00	0.00
29.91	3.85	32.06	0.766	0.00	0.00			

HORIBA LA-910

Laser scattering particle size distribution analyzer

PARTICLE SIZE MEASUREMENT DATA

ID# : 980619-084 09:59

Filename : 4M70CMS

Sample : 4m70cms

Material : 4M HNO3 70C Med Shear

Source : Mark Beck

Lot Number :

Condition

T%(He-Ne): 83.5%

(LAMP): 86.1%

Dist.Form: Sharp

R.R.Index: 1.19-0.001 (

Sampling times : 100

Agitation : 5

Circultrn

: 7

U.sonic

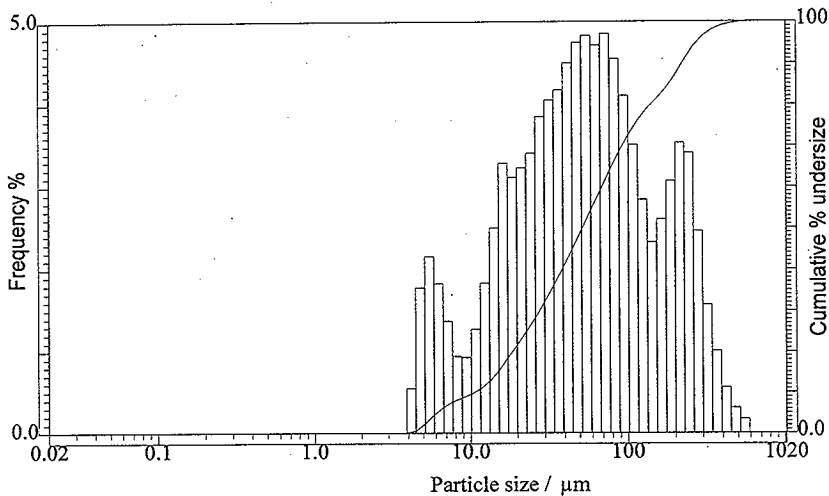
: ON(3)

Format

Dist.base : Volume

Scaling : Auto

Axis : LogX - LinearY

**Data**

Memory Hist.	Cum.	SAMPLE NAME	ID#	Median(μm)
Main	☐	4m70cms	980619-084	52.151

HORIBA LA-910

Laser scattering particle size distribution analyzer

PARTICLE SIZE MEASUREMENT DATA

ID# : 980622-088 11:10
 Filename : 1M95CMS
 Sample : 1m95cms
 Material : 1M HNO3 95C Med Shear
 Source : Mark Beck
 Lot Number :
 Test Number : 1
 Preparation :
 Disp. Medium :
 Disp. Steps :
 Verification :

Condition
 T%(He-Ne): 82.8% Dist.Form: Sharp Sampling times : 100
 (LAMP): 83.2% R.R.Index: 1.19-0.001 ()
 Agitation : 5 Circulthr : 7 U.sonic : ON(3)
 Format
 Dist.base : Volume Scaling : Auto Axis : LogX - LinearY

Data
 Median : 27.134µm SP.Area : 4668cm²/cm³ S.D. : 61.930µm
 Mode : 5.417µm Mean : 53.324µm
 C.V. : 116.14%

Span : (D 10.0-D 90.0) / D50 = 5.235

Dia. on % (10.0%) :	4.821µm	% on Dia.(0.100µm) :	0.0%
Dia. on % (20.0%) :	6.786µm	% on Dia.(1.000µm) :	0.0%
Dia. on % (30.0%) :	11.641µm	% on Dia.(10.000µm) :	27.1%
Dia. on % (80.0%) :	90.198µm	% on Dia.(30.000µm) :	52.3%
Dia. on % (90.0%) :	146.876µm	% on Dia.(200.000µm) :	95.2%

Size(µm)	Freq(%)	Und(%)	Size(µm)	Freq(%)	Und(%)	Size(µm)	Freq(%)	Und(%)
1019.5	0.00	100.00	26.11	2.94	49.12	0.669	0.00	0.00
890.1	0.00	100.00	22.80	2.79	46.18	0.584	0.00	0.00
777.1	0.00	100.00	19.90	3.33	43.39	0.510	0.00	0.00
678.5	0.00	100.00	17.38	3.97	40.06	0.445	0.00	0.00
592.4	0.00	100.00	15.17	3.15	36.09	0.389	0.00	0.00
517.2	0.00	100.00	13.25	3.09	32.94	0.339	0.00	0.00
451.6	0.00	100.00	11.56	2.62	29.85	0.296	0.00	0.00
394.2	0.00	100.00	10.10	2.21	27.23	0.259	0.00	0.00
344.2	0.14	100.00	8.816	2.30	25.02	0.226	0.00	0.00
300.5	0.74	99.86	7.697	2.93	22.72	0.197	0.00	0.00
262.4	1.72	99.12	6.720	3.54	19.79	0.172	0.00	0.00
229.1	2.19	97.40	5.867	4.33	16.25	0.150	0.00	0.00
200.0	2.36	95.21	5.122	4.30	11.92	0.131	0.00	0.00
174.6	2.26	92.84	4.472	2.72	7.62	0.115	0.00	0.00
152.5	2.12	90.58	3.905	1.21	4.90	0.100	0.00	0.00
133.1	2.46	88.47	3.409	0.94	3.69	0.087	0.00	0.00
116.2	3.02	86.01	2.976	0.80	2.75	0.076	0.00	0.00
101.5	3.44	82.99	2.599	1.27	1.95	0.067	0.00	0.00
88.58	3.64	79.54	2.269	0.56	0.68	0.058	0.00	0.00
77.34	3.79	75.90	1.981	0.12	0.12	0.051	0.00	0.00
67.52	3.56	72.11	1.729	0.00	0.00	0.044	0.00	0.00
58.95	3.60	68.55	1.510	0.00	0.00	0.039	0.00	0.00
51.47	3.37	64.95	1.318	0.00	0.00	0.034	0.00	0.00
44.94	3.26	61.58	1.151	0.00	0.00	0.029	0.00	0.00
39.23	3.15	58.31	1.005	0.00	0.00	0.026	0.00	0.00
34.25	2.93	55.16	0.877	0.00	0.00	0.022	0.00	0.00
29.91	3.11	52.23	0.766	0.00	0.00			

HORIBA LA-910

HNF-2011 Rev. 0

for Windows(TM) Ver.1.20J Jun/22/98 15:35

Laser scattering particle size distribution analyzer

PARTICLE SIZE MEASUREMENT DATA

ID# : 980622-088 11:10

Filename : 1M95CMS

Sample : 1m95cms

Material

: 1M HNO3 95C Med Shear

Source

: Mark Beck

Lot Number

Condition

T%(He-Ne): 82.8%

Dist.Form: Sharp

Sampling times : 100

(LAMP): 83.2%

R.R.Index: 1.19-0.001

Agitation : 5

Circultrn : 7

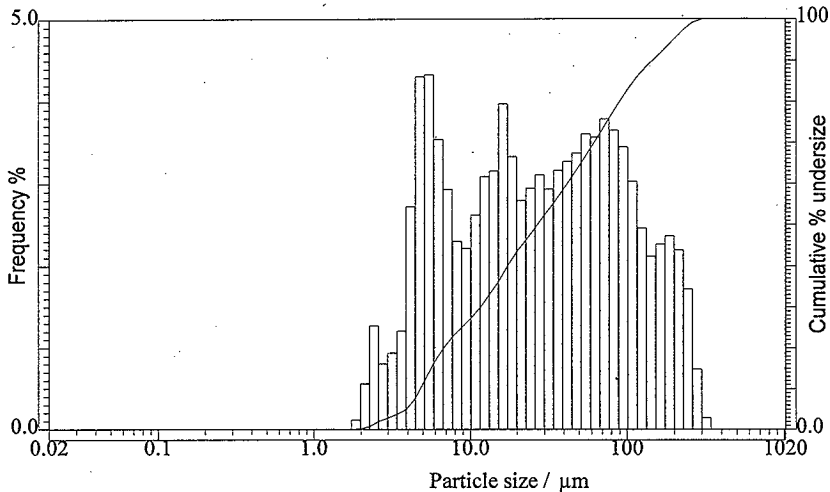
U.sonic : ON(3)

Format

Dist.base : Volume

Scaling : Auto

Axis : LogX - Lineary

**Data**

Memory Hist.	Cum.	SAMPLE NAME	ID#	Median(μm)
Main	☐	1m95cms	980622-088	27.134

HORIBA LA-910

HNF-2911 Rev. 0
for Windows(TM) Ver.1.20j Jun/22/98 15:33

Laser scattering particle size distribution analyzer

PARTICLE SIZE MEASUREMENT DATA

ID# : 980622-091 11:46
Filename : 1M95CLS
Sample : 1m95cls
Material : 1M HNO3 95C Low Shear
Source : Mark Beck
Lot Number :
Test Number : 1
Preparation :
Disp. Medium :
Disp. Steps :
Verification :

Condition
T%(He-Ne): 77.7% Dist. Form: Sharp Sampling times : 100
(LAMP): 79.5% R.R. Index: 1.19-0.001
Agitation : 5 Circultn : 7 U.sonic : ON(3)
Format :
Dist. base : Volume Scaling : Auto Axis : LogX - LinearY

Data

Median : 85.591µm SP.Area : 2536cm²/cm³ S.D. : 124.873µm
Mode : 316.633µm Mean : 136.522µm
C.V. : 91.47%

Span : (D 10.0-D 90.0) / D50 = 3.747

Dia. on %(10.0%) :	6.825µm	% on Dia.(0.100µm) :	0.0%
Dia. on %(20.0%) :	16.415µm	% on Dia.(1.000µm) :	0.0%
Dia. on %(30.0%) :	32.369µm	% on Dia.(10.000µm) :	13.5%
Dia. on %(80.0%) :	285.970µm	% on Dia.(30.000µm) :	29.0%
Dia. on %(90.0%) :	327.546µm	% on Dia.(200.000µm) :	67.8%

Size(µm)	Freq(%)	Und(%)	Size(µm)	Freq(%)	Und(%)	Size(µm)	Freq(%)	Und(%)
1019.5	0.00	100.00	26.11	1.89	27.01	0.669	0.00	0.00
890.1	0.00	100.00	22.80	1.91	25.11	0.584	0.00	0.00
777.1	0.00	100.00	19.90	2.16	23.21	0.510	0.00	0.00
678.5	0.00	100.00	17.38	2.50	21.05	0.445	0.00	0.00
592.4	0.00	100.00	15.17	1.93	18.55	0.389	0.00	0.00
517.2	0.00	100.00	13.25	1.70	16.62	0.339	0.00	0.00
451.6	0.73	100.00	11.56	1.38	14.91	0.296	0.00	0.00
394.2	5.14	99.27	10.10	1.11	13.53	0.259	0.00	0.00
344.2	11.30	94.13	8.816	1.13	12.42	0.226	0.00	0.00
300.5	7.74	82.83	7.697	1.46	11.30	0.197	0.00	0.00
262.4	4.32	75.09	6.720	1.81	9.83	0.172	0.00	0.00
229.1	2.96	70.77	5.867	2.28	8.02	0.150	0.00	0.00
200.0	3.10	67.81	5.122	2.34	5.74	0.131	0.00	0.00
174.6	3.04	64.71	4.472	1.47	3.39	0.115	0.00	0.00
152.5	2.34	61.67	3.905	0.61	1.93	0.100	0.00	0.00
133.1	2.30	59.33	3.409	0.43	1.32	0.087	0.00	0.00
116.2	2.85	57.03	2.976	0.32	0.89	0.076	0.00	0.00
101.5	3.28	54.18	2.599	0.44	0.57	0.067	0.00	0.00
88.58	3.57	50.90	2.269	0.13	0.13	0.058	0.00	0.00
77.34	3.68	47.34	1.981	0.00	0.00	0.051	0.00	0.00
67.52	3.26	43.66	1.729	0.00	0.00	0.044	0.00	0.00
58.95	2.97	40.39	1.510	0.00	0.00	0.039	0.00	0.00
51.47	2.49	37.42	1.313	0.00	0.00	0.034	0.00	0.00
44.94	2.19	34.93	1.151	0.00	0.00	0.029	0.00	0.00
39.23	1.99	32.74	1.005	0.00	0.00	0.026	0.00	0.00
34.25	1.81	30.75	0.877	0.00	0.00	0.022	0.00	0.00
29.91	1.94	28.95	0.766	0.00	0.00			

HORIBA LA-910

Laser scattering particle size distribution analyzer

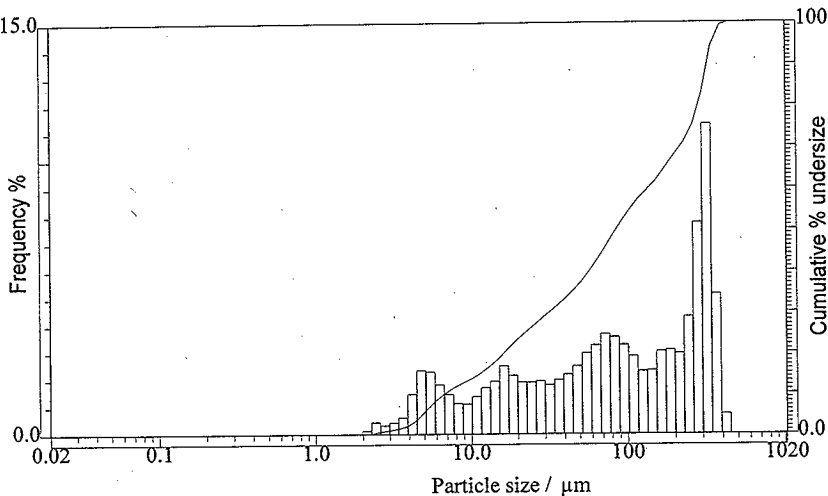
PARTICLE SIZE MEASUREMENT DATA

ID# : 980622-091 11:46 Material : 1M HNO3 95C Low Shear
Filename : 1M95CLS Source : Mark Beck
Sample : 1m95cls Lot Number :

Condition
T%(He-Ne): 77.7% Dist.Form: Sharp Sampling times : 100
(LAMP): 79.5% R.R.Index: 1.19-0.00i ()

Agitation : 5 Circultrn : 7 U.sonic : ON(3)

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



Data	Memory Hist.	Cum.	SAMPLE NAME	ID#	Median(μm)
Main	☐	☒	1m95cls	980622-091	85.591

HORIBA LA-910

HNF-2911 Rev. 0

for Windows(TM) Ver.1.20j Jun/22/98 15:31

Laser scattering particle size distribution analyzer

PARTICLE SIZE MEASUREMENT DATA

ID# : 980622-090 11:37
 Filename : 1M70CHS
 Sample : 1M70chs
 Material : 1M HNO3 70C High Shear
 Source : Mark Beck
 Lot Number :
 Test Number : 1
 Preparation :
 Disp. Medium :
 Verif. Steps :
 Verification :

Condition
 T%(He-Ne): 78.4% Dist.Form: Sharp Sampling times : 100
 (LAMP): 78.9% R.R.index: 1.19-0.001
 Agitation : 5 Circultrn : 7 U.sonic : ON(3)
 Format :
 Dist.base : Volume Scaling : Auto Axis : LogX - LinearY

Data

Median : 17.794µm SP.Area : 5606cm²/cm³ S.D. : 35.020µm
 Mode : 16.363µm Mean : 31.309µm
 C.V. : 111.85%

Span : (D 10.0-D 90.0) / D50 = 4.141

Dia. on % (10.0%) :	4.569µm	% on Dia.(0.100µm) :	0.0%
Dia. on % (20.0%) :	5.932µm	% on Dia.(1.000µm) :	0.0%
Dia. on % (30.0%) :	8.796µm	% on Dia.(10.000µm) :	32.5%
Dia. on % (80.0%) :	50.461µm	% on Dia.(30.000µm) :	66.3%
Dia. on % (90.0%) :	78.256µm	% on Dia.(200.000µm) :	99.9%

Size(µm)	Freq(%)	Und(%)	Size(µm)	Freq(%)	Und(%)	Size(µm)	Freq(%)	Und(%)
1019.5	0.00	100.00	26.11	4.11	62.06	0.669	0.00	0.00
890.1	0.00	100.00	22.80	4.06	57.95	0.584	0.00	0.00
777.1	0.00	100.00	19.90	4.70	53.88	0.510	0.00	0.00
678.5	0.00	100.00	17.38	5.37	49.18	0.445	0.00	0.00
592.4	0.00	100.00	15.17	4.09	43.81	0.389	0.00	0.00
517.2	0.00	100.00	13.25	3.89	39.71	0.339	0.00	0.00
451.6	0.00	100.00	11.56	3.17	35.82	0.296	0.00	0.00
394.2	0.00	100.00	10.10	2.60	32.65	0.259	0.00	0.00
344.2	0.00	100.00	8.816	2.69	30.05	0.226	0.00	0.00
300.5	0.00	100.00	7.697	3.46	27.36	0.197	0.00	0.00
262.4	0.00	100.00	6.720	4.24	23.90	0.172	0.00	0.00
229.1	0.15	100.00	5.867	5.24	19.66	0.150	0.00	0.00
200.0	0.46	99.85	5.122	5.24	14.42	0.131	0.00	0.00
174.6	1.04	99.39	4.472	3.26	9.17	0.115	0.00	0.00
152.5	1.03	98.35	3.905	1.42	5.91	0.100	0.00	0.00
133.1	1.28	97.33	3.409	1.07	4.50	0.087	0.00	0.00
116.2	1.75	96.05	2.976	0.94	3.43	0.076	0.00	0.00
101.5	2.08	94.30	2.599	1.59	2.48	0.067	0.00	0.00
88.58	2.44	92.23	2.269	0.74	0.90	0.058	0.00	0.00
77.34	2.84	89.79	1.981	0.16	0.16	0.051	0.00	0.00
67.52	3.05	86.95	1.729	0.00	0.00	0.044	0.00	0.00
58.95	3.39	83.90	1.510	0.00	0.00	0.039	0.00	0.00
51.47	3.45	80.50	1.318	0.00	0.00	0.034	0.00	0.00
44.94	3.54	77.06	1.151	0.00	0.00	0.029	0.00	0.00
39.23	3.63	73.51	1.005	0.00	0.00	0.026	0.00	0.00
34.25	3.66	69.88	0.877	0.00	0.00	0.022	0.00	0.00
29.91	4.16	66.22	0.766	0.00	0.00			

HORIBA LA-910

Laser scattering particle size distribution analyzer

PARTICLE SIZE MEASUREMENT DATA

ID# : 980622-090 11:37
Filename : 1M70CHS
Sample : 1m70chs

Material : 1M HNO3 70C High Shear
Source : Mark Beck
Lot Number :

Condition

T%(He-Ne): 78.4%
(LAMP): 78.9%

Dist.Form: Sharp
R.R.Index: 1.19-0.001

Sampling times : 100
()

Agitation : 5

Circulth : 7

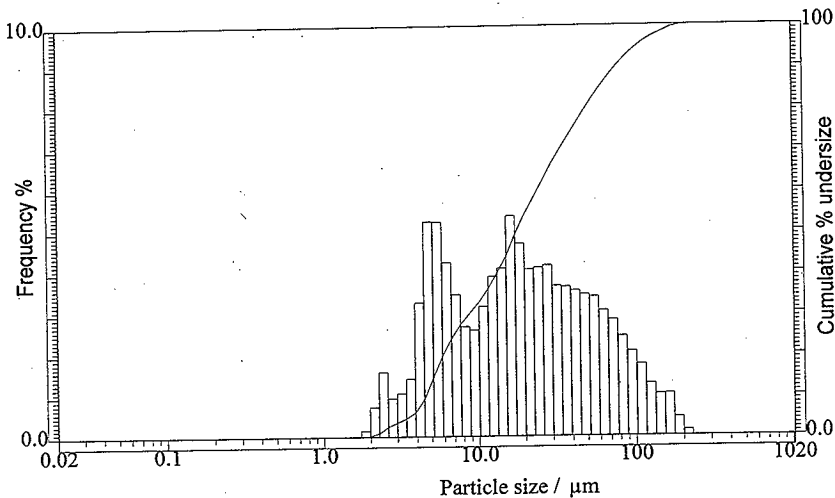
U.sonic : ON(3)

Format

Dist.base : Volume

Scaling : Auto

Axis : LogX - LinearY



Data

Memory Hist.

Cum.

SAMPLE NAME

ID#

Median(μm)

Main



1m70chs

980622-090

17.794

HORIBA LA-910

Laser scattering particle size distribution analyzer

PARTICLE SIZE MEASUREMENT DATA

ID# : 980622-092 13:36
 Filename : 1M70CMS
 Sample : 1m70cms
 Material : 1M HNO3 70C Med Shear
 Source : Mark Beck
 Lot Number :
 Test Number : 1
 Preparation :
 Disp. Medium :
 Disp. Steps :
 Verification :

Condition :
 T%(He-Ne): 84.1% Dist.Form: Sharp Sampling times : 100
 (LAMP): 84.1% R.R.Index: 1.19-0.001
 Agitation : 5 Circulthr : 7 U.Sonic : ON(3)
 Format :
 Dist.base : Volume Scaling : Auto Axis : LogX - LinearY

Data

Median : 20.544µm SP.Area : 5283cm²/cm³ S.D. : 35.695µm
 Mode : 16.399µm Mean : 34.836µm
 C.V. : 102.46%

Span : (D 10.0-D 90.0) / D50 = 4.065

Dia. on % (10.0%) :	4.628µm	% on Dia.(0.100µm) :	0.0%
Dia. on % (20.0%) :	6.273µm	% on Dia.(1.000µm) :	0.0%
Dia. on % (30.0%) :	9.908µm	% on Dia.(10.000µm) :	30.2%
Dia. on % (80.0%) :	59.918µm	% on Dia.(30.000µm) :	60.5%
Dia. on % (90.0%) :	88.133µm	% on Dia.(200.000µm) :	100.0%

Size(µm)	Freq(%)	Und(%)	Size(µm)	Freq(%)	Und(%)	Size(µm)	Freq(%)	Und(%)
1019.5	0.00	100.00	26.11	3.71	56.49	0.669	0.00	0.00
890.1	0.00	100.00	22.80	3.62	52.78	0.584	0.00	0.00
777.1	0.00	100.00	19.90	4.18	49.16	0.510	0.00	0.00
678.5	0.00	100.00	17.38	4.71	44.97	0.445	0.00	0.00
592.4	0.00	100.00	15.17	3.49	40.26	0.389	0.00	0.00
517.2	0.00	100.00	13.25	3.48	36.76	0.339	0.00	0.00
451.6	0.00	100.00	11.56	2.93	33.28	0.296	0.00	0.00
394.2	0.00	100.00	10.10	2.49	30.35	0.259	0.00	0.00
344.2	0.00	100.00	8.816	2.60	27.86	0.226	0.00	0.00
300.5	0.00	100.00	7.697	3.28	25.26	0.197	0.00	0.00
262.4	0.00	100.00	6.720	3.90	21.98	0.172	0.00	0.00
229.1	0.00	100.00	5.867	4.67	18.07	0.150	0.00	0.00
200.0	0.23	100.00	5.122	4.55	13.40	0.131	0.00	0.00
174.6	0.81	99.77	4.472	2.90	8.85	0.115	0.00	0.00
152.5	1.33	98.96	3.905	1.34	5.95	0.100	0.00	0.00
133.1	1.95	97.63	3.409	1.08	4.61	0.087	0.00	0.00
116.2	2.55	95.69	2.976	0.97	3.53	0.076	0.00	0.00
101.5	3.02	93.14	2.599	1.59	2.55	0.067	0.00	0.00
88.58	3.29	90.12	2.269	0.78	0.96	0.058	0.00	0.00
77.34	3.60	86.83	1.981	0.19	0.19	0.051	0.00	0.00
67.52	3.67	83.23	1.729	0.00	0.00	0.044	0.00	0.00
58.95	4.01	79.56	1.510	0.00	0.00	0.039	0.00	0.00
51.47	3.94	75.55	1.318	0.00	0.00	0.034	0.00	0.00
44.94	3.91	71.62	1.151	0.00	0.00	0.029	0.00	0.00
39.23	3.78	67.71	1.005	0.00	0.00	0.026	0.00	0.00
34.25	3.56	63.93	0.877	0.00	0.00	0.022	0.00	0.00
29.91	3.88	60.37	0.766	0.00	0.00			

HORIBA LA-910

HNF-2911 Rev. 0

for Windows(TM) Ver.1.20j Jun/22/98 15:29

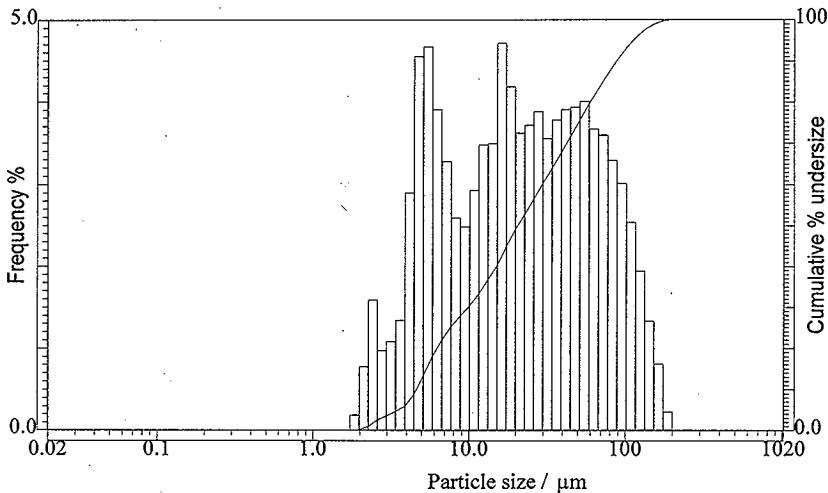
Laser scattering particle size distribution analyzer

PARTICLE SIZE MEASUREMENT DATA

ID# : 980622-092 13:36 Material : 1M HNO3 70C Med Shear
Filename : 1M70CMS Source : Mark Beck
Sample : 1m70cms Lot Number :

Condition
T%(He-Ne): 84.1% Dist.Form: Sharp Sampling times : 100
(LAMP): 84.1% R.R.Index: 1.19-0.00l)
Agitation : 5 Circultrn : 7 U.sonic : ON(3)

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

**Data**

Memory Hist.	Cum.	SAMPLE NAME	ID#	Median(μm)
Main	☐	1m70cms	980622-092	20.544

HORIBA LA-910

Laser scattering particle size distribution analyzer

PARTICLE SIZE MEASUREMENT DATA

ID# : 980622-093 13:55
 Filename : 1M70CLS
 Sample : 1m70cls
 Material : 1M HNO3 70C Low Shear
 Source : Mark Beck
 Lot Number :
 Test Number : 1
 Preparation :
 Disp. Medium :
 Disp. Steps :
 Verification :

Condition
 T%(He-Ne): 86.0% Dist.Form: Sharp Sampling times : 100
 (LAMP): 87.1% R.R.Index: 1.19-0.001 ()
 Agitation : 5 Circulthn : 7 U.Sonic : ON(3)
 Format
 Dist.base : Volume Scaling : Auto Axis : LogX - LinearY

Data
 Median : 169.904 μ m SP.Area : 1601cm²/cm³ S.D. : 140.088 μ m
 Mode : 319.579 μ m Mean : 183.921 μ m
 C.V. : 76.17%

Span : (D 10.0-D 90.0) / D50 = 2.121

Dia. on % (10.0%) :	13.327 μ m	% on Dia.(0.100 μ m) :	0.0%
Dia. on % (20.0%) :	35.650 μ m	% on Dia.(1.000 μ m) :	0.0%
Dia. on % (30.0%) :	72.662 μ m	% on Dia.(10.000 μ m) :	7.8%
Dia. on % (80.0%) :	317.272 μ m	% on Dia.(30.000 μ m) :	18.2%
Dia. on % (90.0%) :	373.746 μ m	% on Dia.(200.000 μ m) :	55.5%

Size(μ m)	Freq(%)	Und(%)	Size(μ m)	Freq(%)	Und(%)	Size(μ m)	Freq(%)	Und(%)
1019.5	0.00	100.00	26.11	1.30	16.80	0.669	0.00	0.00
890.1	0.00	100.00	22.80	1.25	15.51	0.584	0.00	0.00
777.1	0.00	100.00	19.90	1.40	14.25	0.510	0.00	0.00
678.5	0.42	100.00	17.38	1.63	12.86	0.445	0.00	0.00
592.4	0.75	99.58	15.17	1.28	11.23	0.389	0.00	0.00
517.2	1.74	98.84	13.25	1.13	9.94	0.339	0.00	0.00
451.6	4.21	97.10	11.56	0.91	8.81	0.296	0.00	0.00
394.2	7.33	92.88	10.10	0.73	7.90	0.259	0.00	0.00
344.2	9.26	85.56	8.816	0.73	7.17	0.226	0.00	0.00
300.5	8.19	76.30	7.697	0.95	6.44	0.197	0.00	0.00
262.4	7.15	68.11	6.720	1.15	5.49	0.172	0.00	0.00
229.1	5.46	60.95	5.867	1.41	4.34	0.150	0.00	0.00
200.0	4.71	55.50	5.122	1.40	2.93	0.131	0.00	0.00
174.6	3.90	50.79	4.472	0.81	1.53	0.115	0.00	0.00
152.5	3.37	46.89	3.905	0.30	0.72	0.100	0.00	0.00
133.1	3.32	43.51	3.409	0.18	0.42	0.087	0.00	0.00
116.2	3.24	40.20	2.976	0.11	0.24	0.076	0.00	0.00
101.5	3.07	36.95	2.599	0.13	0.13	0.067	0.00	0.00
88.58	2.74	33.88	2.269	0.00	0.00	0.058	0.00	0.00
77.34	2.47	31.14	1.981	0.00	0.00	0.051	0.00	0.00
67.52	2.12	28.66	1.729	0.00	0.00	0.044	0.00	0.00
58.95	2.01	26.54	1.510	0.00	0.00	0.039	0.00	0.00
51.47	1.80	24.53	1.318	0.00	0.00	0.034	0.00	0.00
44.94	1.65	22.73	1.151	0.00	0.00	0.029	0.00	0.00
39.23	1.53	21.08	1.005	0.00	0.00	0.026	0.00	0.00
34.25	1.36	19.55	0.877	0.00	0.00	0.022	0.00	0.00
29.91	1.39	18.19	0.766	0.00	0.00			

HORIBA LA-910

Laser scattering particle size distribution analyzer

PARTICLE SIZE MEASUREMENT DATA

ID# : 980622-093 13:55

Filename : 1M70CLS

Sample : 1m70cls

Material : 1M HNO3 70C Low Shear

Source : Mark Beck

Lot Number :

Condition

T%(He-Ne): 86.0%

(LAMP): 87.1%

Dist.Form: Sharp

R.R.Index: 1.19-0.00i

Sampling times : 100

()

Agitation : 5

Circultrn : 7

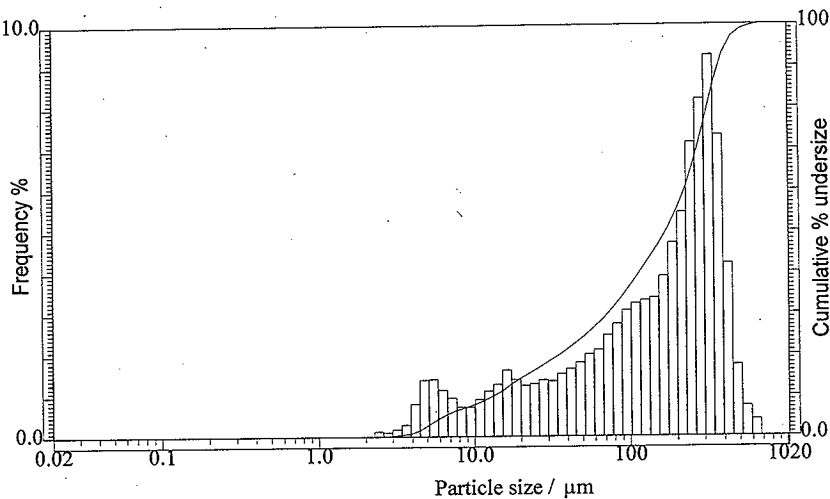
U.sonic : ON(3)

Format

Dist.base : Volume

Scaling : Auto

Axis : LogX - LinearY

**Data**

Memory Hist.

Cum.

SAMPLE NAME

ID#

Median(μm)

Main



—

1m70cls

980622-093 169.904

HORIBA LA-910

HNE 2011 Rev. 0

Dr. Winows(TM) Ver.1.20J Jun/22/98 15:27

Laser scattering particle size distribution analyzer

PARTICLE SIZE MEASUREMENT DATA

ID# : 980622-094 14:09
 Filename : 1M45CHS
 Sample : 1m45chs
 Material : 1M HNO3 45C High Shear
 Source : Mark Beck
 Lot Number :
 Test Number : 1
 Preparation :
 Disp. Medium :
 Disp. Steps :
 Verification :

Condition :
 T%(He-Ne): 76.6% Dist. Form: Sharp Sampling times : 100
 (LAMP): 76.7% R.R. Index: 1.19-0.00i
 Agitation : 5 Circultrn : 7 U.sonic : ON(3)
 Format :
 Dist. base : Volume Scaling : Auto Axis : LogX - LinearY

Data
 Median : 17.800µm SP. Area : 5648cm²/cm³ S.D. : 19.211µm
 Mode : 53.728µm Mean : 24.535µm
 C.V. : 78.30%

Span : (D 10.0-D 90.0) / D50 = 2.803

Dia. on % (10.0%) :	4.530µm	% on Dia. (0.100µm) :	0.0%
Dia. on % (20.0%) :	6.247µm	% on Dia. (1.000µm) :	0.0%
Dia. on % (30.0%) :	9.504µm	% on Dia. (10.000µm) :	31.1%
Dia. on % (80.0%) :	44.903µm	% on Dia. (30.000µm) :	65.5%
Dia. on % (90.0%) :	54.429µm	% on Dia. (200.000µm) :	100.0%

Size(µm)	Freq(%)	Und(%)	Size(µm)	Freq(%)	Und(%)	Size(µm)	Freq(%)	Und(%)
1019.5	0.00	100.00	26.11	3.79	61.24	0.669	0.00	0.00
890.1	0.00	100.00	22.80	3.63	57.45	0.584	0.00	0.00
777.1	0.00	100.00	19.90	4.64	53.82	0.510	0.00	0.00
678.5	0.00	100.00	17.38	5.61	49.18	0.445	0.00	0.00
592.4	0.00	100.00	15.17	4.40	43.57	0.389	0.00	0.00
517.2	0.00	100.00	13.25	4.27	39.17	0.339	0.00	0.00
451.6	0.00	100.00	11.56	3.58	34.90	0.296	0.00	0.00
394.2	0.00	100.00	10.10	2.95	31.32	0.259	0.00	0.00
344.2	0.00	100.00	8.816	2.91	28.37	0.226	0.00	0.00
300.5	0.00	100.00	7.697	3.41	25.45	0.197	0.00	0.00
262.4	0.00	100.00	6.720	3.80	22.04	0.172	0.00	0.00
229.1	0.00	100.00	5.867	4.39	18.24	0.150	0.00	0.00
200.0	0.00	100.00	5.122	4.25	13.85	0.131	0.00	0.00
174.6	0.00	100.00	4.472	2.86	9.60	0.115	0.00	0.00
152.5	0.00	100.00	3.905	1.44	6.74	0.100	0.00	0.00
133.1	0.00	100.00	3.409	1.25	5.30	0.087	0.00	0.00
116.2	0.00	100.00	2.976	1.14	4.05	0.076	0.00	0.00
101.5	0.00	100.00	2.599	1.79	2.91	0.067	0.00	0.00
88.58	0.12	100.00	2.269	0.89	1.12	0.058	0.00	0.00
77.34	1.29	99.88	1.981	0.23	0.23	0.051	0.00	0.00
67.52	4.36	98.59	1.729	0.00	0.00	0.044	0.00	0.00
58.95	7.19	94.23	1.510	0.00	0.00	0.039	0.00	0.00
51.47	7.01	87.04	1.318	0.00	0.00	0.034	0.00	0.00
44.94	5.86	80.03	1.151	0.00	0.00	0.029	0.00	0.00
39.23	4.82	74.17	1.005	0.00	0.00	0.026	0.00	0.00
34.25	3.93	69.35	0.877	0.00	0.00	0.022	0.00	0.00
29.91	4.18	65.42	0.766	0.00	0.00			

HORIBA LA-910

Laser scattering particle size distribution analyzer

PARTICLE SIZE MEASUREMENT DATA

ID# : 980622-094 14:09

Filename : 1M45CHS

Sample : 1m45chs

Material : 1M HNO3 45C High Shear

Source : Mark Beck

Lot Number :

Condition

T%(He-Ne): 76.6%

(LAMP): 76.7%

Dist.Form: Sharp

R.R.Index: 1.19-0.001

Sampling times : 100

()

Agitation : 5

Circuitn

: 7

U.sonic

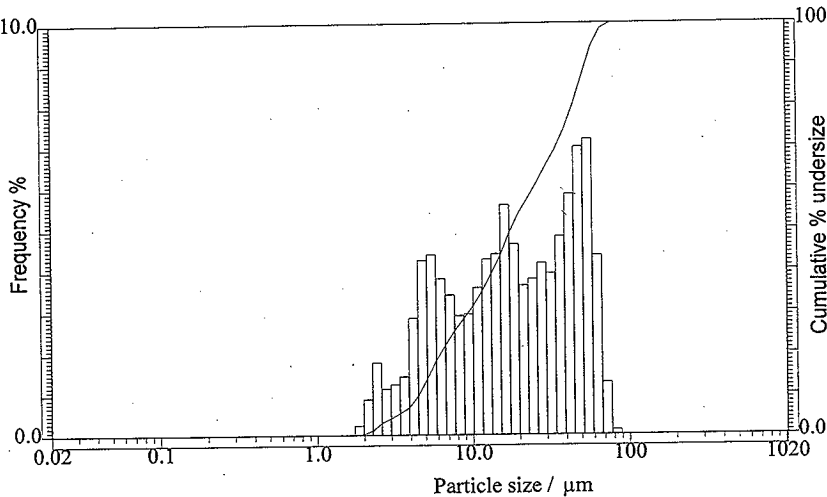
: ON(3)

Format

Dist.base : Volume

Scaling : Auto

Axis : LogX - Lineary



Data

Memory Hist.

Cum.

SAMPLE NAME

ID#

Median(μm)

Main

☐

☐

1m45chs

980622-094

17.800

HORIBA LA-910

Laser scattering particle size distribution analyzer

PARTICLE SIZE MEASUREMENT DATA

ID# : 980622-095 14:21
 Filename : 1M45CMS
 Sample : 1m45cms
 Material : 1M HNO3 45C Med Shear
 Source : Mark Beck
 Lot Number :
 Test Number : 1
 Preparation :
 Disp. Medium :
 Disp. Steps :
 Verification :

Condition :
 T%(He-Ne): 78.4% Dist.Form: Sharp Sampling times : 100
 (LAMP): 79.5% R.R.Index: 1.19-0.001 ()
 Agitation : 5 Circultrn : 7 U.sonic : ON(3)
 Format :
 Dist.base : Volume Scaling : Auto Axis : LogX - LinearY

Data :
 Median : 41.801µm SP.Area : 3596cm²/cm³ S.D. : 64.837µm
 Mode : 55.258µm Mean : 62.813µm
 C.V. : 103.22%

Span : (D 10.0-D 90.0) / D50 = 3.922

Dia. on % (10.0%) :	5.758µm	% on Dia. (0.100µm) :	0.0%
Dia. on % (20.0%) :	11.253µm	% on Dia. (1.000µm) :	0.0%
Dia. on % (30.0%) :	17.879µm	% on Dia. (10.000µm) :	18.0%
Dia. on % (80.0%) :	98.691µm	% on Dia. (30.000µm) :	40.7%
Dia. on % (90.0%) :	169.693µm	% on Dia. (200.000µm) :	93.4%

Size(µm)	Freq(%)	Und(%)	Size(µm)	Freq(%)	Und(%)	Size(µm)	Freq(%)	Und(%)
1019.5	0.00	100.00	26.11	2.78	37.42	0.669	0.00	0.00
890.1	0.00	100.00	22.80	2.32	34.65	0.584	0.00	0.00
777.1	0.00	100.00	19.90	2.95	32.33	0.510	0.00	0.00
679.5	0.00	100.00	17.38	3.53	29.38	0.445	0.00	0.00
592.4	0.00	100.00	15.17	2.68	25.86	0.389	0.00	0.00
517.2	0.00	100.00	13.25	2.71	23.18	0.339	0.00	0.00
451.6	0.00	100.00	11.56	2.34	20.47	0.296	0.00	0.00
394.2	0.00	100.00	10.10	1.95	18.13	0.259	0.00	0.00
344.2	0.16	100.00	8.816	1.85	16.18	0.226	0.00	0.00
300.5	0.86	99.84	7.697	1.99	14.34	0.197	0.00	0.00
262.4	2.48	98.98	6.720	2.04	12.35	0.172	0.00	0.00
229.1	3.09	96.51	5.867	2.26	10.31	0.150	0.00	0.00
200.0	2.92	93.41	5.122	2.19	8.05	0.131	0.00	0.00
174.6	2.34	90.49	4.472	1.66	5.86	0.115	0.00	0.00
152.5	2.02	88.15	3.905	0.98	4.20	0.100	0.00	0.00
133.1	2.32	86.14	3.409	0.97	3.23	0.087	0.00	0.00
116.2	3.05	83.82	2.976	0.82	2.25	0.076	0.00	0.00
101.5	3.77	80.77	2.599	1.03	1.43	0.067	0.00	0.00
88.58	4.37	77.00	2.269	0.40	0.40	0.058	0.00	0.00
77.34	5.03	72.62	1.981	0.00	0.00	0.051	0.00	0.00
67.52	5.06	67.59	1.729	0.00	0.00	0.044	0.00	0.00
58.95	5.35	62.53	1.510	0.00	0.00	0.039	0.00	0.00
51.47	4.81	57.18	1.318	0.00	0.00	0.034	0.00	0.00
44.94	4.45	52.37	1.151	0.00	0.00	0.029	0.00	0.00
39.23	4.03	47.92	1.005	0.00	0.00	0.026	0.00	0.00
34.25	3.29	43.89	0.877	0.00	0.00	0.022	0.00	0.00
29.91	3.18	40.60	0.766	0.00	0.00			

HORIBA LA-910

Laser scattering particle size distribution analyzer

PARTICLE SIZE MEASUREMENT DATA

ID# : 980622-095 14:21

Filename : 1M45CMS

Sample : 1m45cms

Material

1M HNO3 45C Med Shear

Source

Mark Beck

Lot Number

Condition

T%(He-Ne): 78.4%

Dist.Form: Sharp

Sampling times : 100

(LAMP): 79.5%

R.R.Index: 1.19-0.00i

Agitation : 5

Circuitn

: 7

U.sonic

: ON(3)

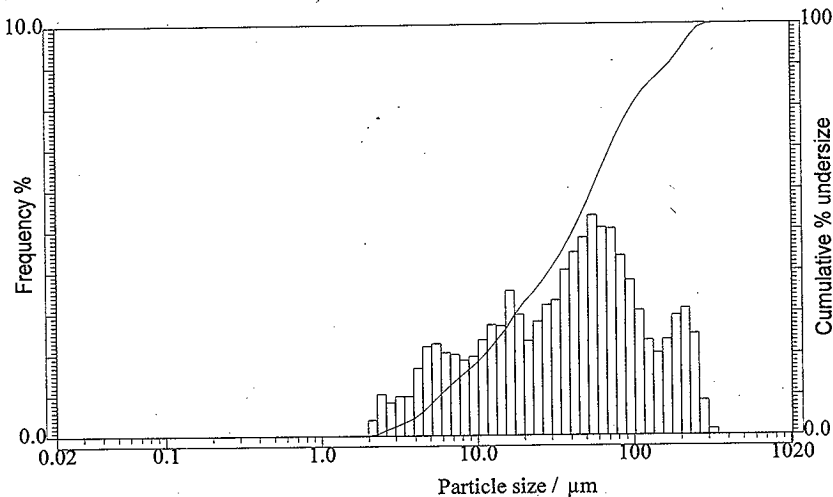
Format

Dist.base : Volume

Scaling

: Auto

Axis : LogX - Lineary



Data	Memory Hist.	Cum.	SAMPLE NAME	ID#	Median(μm)
Main	☐	☒	1m45cms	980622-095	41.801

HORIBA LA-910

Laser scattering particle size distribution analyzer

PARTICLE SIZE MEASUREMENT DATA

ID# : 980618-079 14:27
 Filename : 4M45CMS
 Sample : 4m45cms
 Material : Cement Med Shear 4M HNO3
 Source : Mark Beck
 Lot Number :
 Test Number : 1
 Preparation :
 Disp. Medium :
 Disp. Steps :
 Verification :

Condition :
 T%(He-Ne): 80.9% Dist.Form: Sharp Sampling times : 100
 (LAMP): 83.5% R.R.Index: 1.19-0.001 ()
 Agitation : 5 Circultrn : 7 U.Sonic : ON(3)

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

Data :
 Median : 39.957µm SP.Area : 3344cm²/cm³ S.D. : 97.305µm
 Mode : 82.446µm Mean : 74.912µm
 C.V. : 129.89%

Span : (D 10.0-D 90.0) / D50 = 5.258

Dia. on % (10.0%) :	6.035µm	% on Dia.(0.100µm) :	0.0%
Dia. on % (20.0%) :	10.580µm	% on Dia.(1.000µm) :	0.0%
Dia. on % (30.0%) :	16.421µm	% on Dia.(10.000µm) :	19.0%
Dia. on % (80.0%) :	99.664µm	% on Dia.(30.000µm) :	44.0%
Dia. on % (90.0%) :	216.121µm	% on Dia.(200.000µm) :	89.6%

Size(µm)	Freq(%)	Und(%)	Size(µm)	Freq(%)	Und(%)	Size(µm)	Freq(%)	Und(%)
1019.5	0.00	100.00	26.11	2.87	41.00	0.669	0.00	0.00
890.1	0.00	100.00	22.80	3.03	38.13	0.584	0.00	0.00
777.1	0.00	100.00	19.90	3.43	35.09	0.510	0.00	0.00
678.5	0.00	100.00	17.38	4.00	31.67	0.445	0.00	0.00
592.4	0.00	100.00	15.17	3.11	27.67	0.389	0.00	0.00
517.2	0.00	100.00	13.25	2.96	24.56	0.339	0.00	0.00
451.6	1.38	100.00	11.56	2.43	21.60	0.296	0.00	0.00
394.2	3.64	98.62	10.10	1.99	19.16	0.259	0.00	0.00
344.2	2.46	94.99	8.816	2.04	17.17	0.226	0.00	0.00
300.5	1.38	92.53	7.697	2.65	15.14	0.197	0.00	0.00
262.4	0.85	91.15	6.720	3.14	12.49	0.172	0.00	0.00
229.1	0.69	90.30	5.867	3.58	9.35	0.150	0.00	0.00
200.0	0.66	89.60	5.122	3.20	5.77	0.131	0.00	0.00
174.6	0.89	88.94	4.472	1.58	2.57	0.115	0.00	0.00
152.5	1.27	88.05	3.905	0.48	0.99	0.100	0.00	0.00
133.1	2.38	86.78	3.409	0.24	0.51	0.087	0.00	0.00
116.2	3.75	84.40	2.976	0.13	0.27	0.076	0.00	0.00
101.5	4.94	80.65	2.599	0.14	0.14	0.067	0.00	0.00
88.58	5.40	75.71	2.269	0.00	0.00	0.058	0.00	0.00
77.34	5.25	70.32	1.981	0.00	0.00	0.051	0.00	0.00
67.52	4.56	65.07	1.729	0.00	0.00	0.044	0.00	0.00
58.95	4.14	60.51	1.510	0.00	0.00	0.039	0.00	0.00
51.47	3.59	56.36	1.318	0.00	0.00	0.034	0.00	0.00
44.94	3.20	52.77	1.151	0.00	0.00	0.029	0.00	0.00
39.23	2.91	49.57	1.005	0.00	0.00	0.026	0.00	0.00
34.25	2.70	46.66	0.877	0.00	0.00	0.022	0.00	0.00
29.91	2.97	43.97	0.766	0.00	0.00			

HORIBA LA-910

Laser scattering particle size distribution analyzer

PARTICLE SIZE MEASUREMENT DATA

ID# : 980618-079 14:27

Filename : 4M45CMS

Sample : 4m45cms

Material : Cement Med Shear 4M HNO3

Source : Mark Beck

Lot Number :

Condition

T%(He-Ne): 80.9%

(LAMP): 83.5%

Dist.Form: Sharp

R.R.Index: 1.19-0.001

Sampling times : 100

()

Agitation : 5

Circultrn : 7

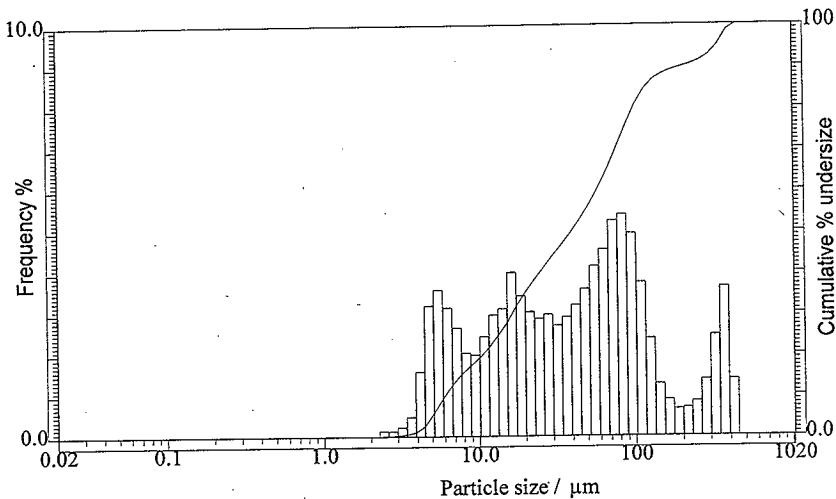
U.sonic : ON(3)

Format

Dist.base : Volume

Scaling : Auto

Axis : LogX - Lineary



Data

Memory Hist.

Cum.

SAMPLE NAME

ID#

Median(μm)

Main



4m45cms

980618-079 39.957

HORIBA LA-910

Laser scattering particle size distribution analyzer

PARTICLE SIZE MEASUREMENT DATA

ID# : 980618-078 14:20

Filename : 4M45CHS

Sample : 4m45chs

Material : Cement High Shear 4M HNO3

Source : Mark Beck

Lot Number :

Condition

T%(He-Ne): 80.6%

(LAMP): 82.8%

Dist.Form: Sharp

R.R.Index: 1.19-0.001 (

Sampling times : 100

Agitation : 5

Circultrn

: 7

U.sonic

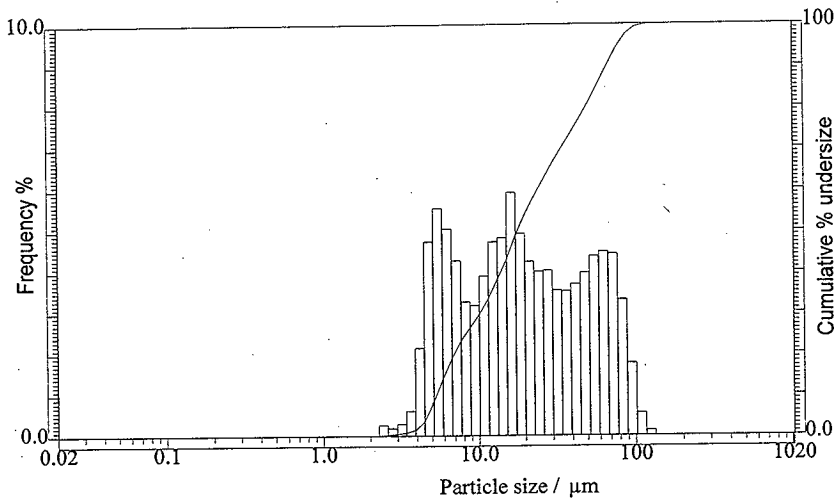
: ON(3)

Format

Dist.base : Volume

Scaling : Auto

Axis : LogX - LinearY



Data	Memory Hist.	Cum.	SAMPLE NAME	ID#	Median(μm)
Main	☐	☒	4m45chs	980618-078	17.879

HORIBA LA-910

Laser scattering particle size distribution analyzer

PARTICLE SIZE MEASUREMENT DATA

ID# : 980618-078 14:20
 Filename : 4M45CHS
 Sample : 4m45chs
 Material : Cement High Shear 4M HNO3
 Source : Mark Beck
 Lot Number :
 Test Number : 1
 Preparation :
 Disp. Medium :
 Disp. Steps :
 Verification :

Condition :
 T%(He-Ne): 80.6% Dist. Form: Sharp Sampling times : 100
 (LAMP): 82.8% R.R. Index: 1.19-0.001 ()
 Agitation : 5 Circultn : 7 U.Sonic : ON(3)

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

Data :
 Median : 17.879µm SP. Area : 4778cm²/cm³ S.D. : 24.780µm
 Mode : 16.256µm Mean : 27.955µm
 C.V. : 88.64%

Span : (D 10.0-D 90.0) / D50 = 3.499

Dia. on % (10.0%) :	5.348µm	% on Dia. (0.100µm) :	0.0%
Dia. on % (20.0%) :	6.971µm	% on Dia. (1.000µm) :	0.0%
Dia. on % (30.0%) :	10.248µm	% on Dia. (10.000µm) :	29.3%
Dia. on % (80.0%) :	49.841µm	% on Dia. (30.000µm) :	66.3%
Dia. on % (90.0%) :	67.910µm	% on Dia. (200.000µm) :	100.0%

Size(µm)	Freq(%)	Und(%)	Size(µm)	Freq(%)	Und(%)	Size(µm)	Freq(%)	Und(%)
1019.5	0.00	100.00	26.11	4.01	62.16	0.669	0.00	0.00
890.1	0.00	100.00	22.80	4.25	58.15	0.584	0.00	0.00
777.1	0.00	100.00	19.90	4.93	53.90	0.510	0.00	0.00
678.5	0.00	100.00	17.38	5.93	48.97	0.445	0.00	0.00
592.4	0.00	100.00	15.17	4.83	43.04	0.389	0.00	0.00
517.2	0.00	100.00	13.25	4.73	38.21	0.339	0.00	0.00
451.6	0.00	100.00	11.56	3.90	33.48	0.296	0.00	0.00
394.2	0.00	100.00	10.10	3.18	29.57	0.259	0.00	0.00
344.2	0.00	100.00	8.816	3.27	26.39	0.226	0.00	0.00
300.5	0.00	100.00	7.697	4.28	23.12	0.197	0.00	0.00
262.4	0.00	100.00	6.720	5.05	18.84	0.172	0.00	0.00
229.1	0.00	100.00	5.867	5.56	13.79	0.150	0.00	0.00
200.0	0.00	100.00	5.122	4.74	8.23	0.131	0.00	0.00
174.6	0.00	100.00	4.472	2.14	3.49	0.115	0.00	0.00
152.5	0.00	100.00	3.905	0.61	1.36	0.100	0.00	0.00
133.1	0.13	100.00	3.409	0.29	0.75	0.087	0.00	0.00
116.2	0.56	99.87	2.976	0.19	0.46	0.076	0.00	0.00
101.5	1.76	99.32	2.599	0.27	0.27	0.067	0.00	0.00
88.58	3.31	97.56	2.269	0.00	0.00	0.058	0.00	0.00
77.34	4.43	94.24	1.981	0.00	0.00	0.051	0.00	0.00
67.52	4.49	89.81	1.729	0.00	0.00	0.044	0.00	0.00
58.95	4.38	85.32	1.510	0.00	0.00	0.039	0.00	0.00
51.47	3.98	80.94	1.318	0.00	0.00	0.034	0.00	0.00
44.94	3.70	76.96	1.151	0.00	0.00	0.029	0.00	0.00
39.23	3.52	73.26	1.005	0.00	0.00	0.026	0.00	0.00
34.25	3.55	69.74	0.877	0.00	0.00	0.022	0.00	0.00
29.91	4.03	66.19	0.766	0.00	0.00			

A-39 (2/2)

HORIBA LA-910

Laser scattering particle size distribution analyzer

PARTICLE SIZE MEASUREMENT DATA

ID# : 980618-077 13:54
 Filename : 4M70CLS
 Sample : 4m70cls
 Material : Cement Low Shear 4M HNO3
 Source : Mark Beck
 Lot Number :
 Test Number : 1
 Preparation :
 Disp. Medium :
 Disp. Steps :
 Verification :

Condition :
 T%(He-Ne): 83.7% Dist.Form: Sharp Sampling times : 100
 (LAMP): 88.7% R.R.Index: 1.19-0.001
 Agitation : 5 Circultrn : 7 U.sonic : ON(3)
 Format :
 Dist.base : Volume Scaling : Auto Axis : LogX - LinearY

Data

Median : 115.729µm SP.Area : 1011cm²/cm³ S.D. : 113.375µm
 Mode : 243.824µm Mean : 151.775µm
 C.V. : 74.70%

Span : (D 10.0-D 90.0) / D50 = 2.475

Dia. on % (10.0%) :	30.522µm	% on Dia. (0.100µm) :	0.0%
Dia. on % (20.0%) :	51.881µm	% on Dia. (1.000µm) :	0.0%
Dia. on % (30.0%) :	70.946µm	% on Dia. (10.000µm) :	2.9%
Dia. on % (80.0%) :	252.330µm	% on Dia. (30.000µm) :	9.8%
Dia. on % (90.0%) :	316.897µm	% on Dia. (200.000µm) :	68.5%

Size(µm)	Freq(%)Und(%)	Size(µm)	Freq(%)Und(%)	Size(µm)	Freq(%)Und(%)
1019.5	0.00 100.00	26.11	1.10 8.25	0.669	0.00 0.00
890.1	0.00 100.00	22.80	0.93 7.15	0.584	0.00 0.00
777.1	0.00 100.00	19.90	0.79 6.22	0.510	0.00 0.00
678.5	0.00 100.00	17.38	0.87 5.43	0.445	0.00 0.00
592.4	0.37 100.00	15.17	0.68 4.56	0.389	0.00 0.00
517.2	0.91 99.63	13.25	0.57 3.89	0.339	0.00 0.00
451.6	2.05 98.72	11.56	0.42 3.31	0.296	0.00 0.00
394.2	3.61 96.66	10.10	0.34 2.90	0.259	0.00 0.00
344.2	5.01 93.05	8.816	0.40 2.56	0.226	0.00 0.00
300.5	6.08 88.04	7.697	0.64 2.16	0.197	0.00 0.00
262.4	6.84 81.97	6.720	0.75 1.52	0.172	0.00 0.00
229.1	6.63 75.13	5.867	0.57 0.76	0.150	0.00 0.00
200.0	5.68 68.50	5.122	0.19 0.19	0.131	0.00 0.00
174.6	4.70 62.83	4.472	0.00 0.00	0.115	0.00 0.00
152.5	3.70 58.13	3.905	0.00 0.00	0.100	0.00 0.00
133.1	4.27 54.42	3.409	0.00 0.00	0.087	0.00 0.00
116.2	5.17 50.16	2.976	0.00 0.00	0.076	0.00 0.00
101.5	5.72 44.99	2.599	0.00 0.00	0.067	0.00 0.00
88.58	5.83 39.27	2.269	0.00 0.00	0.058	0.00 0.00
77.34	5.42 33.44	1.981	0.00 0.00	0.051	0.00 0.00
67.52	4.44 28.03	1.729	0.00 0.00	0.044	0.00 0.00
58.95	3.81 23.58	1.510	0.00 0.00	0.039	0.00 0.00
51.47	3.30 19.78	1.318	0.00 0.00	0.034	0.00 0.00
44.94	2.71 16.48	1.151	0.00 0.00	0.029	0.00 0.00
39.23	2.18 13.76	1.005	0.00 0.00	0.026	0.00 0.00
34.25	1.86 11.58	0.877	0.00 0.00	0.022	0.00 0.00
29.91	1.47 9.72	0.766	0.00 0.00		

HORIBA LA-910

Laser scattering particle size distribution analyzer

PARTICLE SIZE MEASUREMENT DATA

ID# : 980618-077 13:54

Filename : 4M70CLS

Sample : 4m70cls

Material : Cement Low Shear 4M HNO3

Source : Mark Beck

Lot Number :

Condition :

T%(He-Ne): 83.7%

(LAMP): 88.7%

Dist.Form: Sharp

R.R.Index: 1.19-0.00i

Sampling times : 100

Agitation : 5

Circultrn :

7

U.sonic

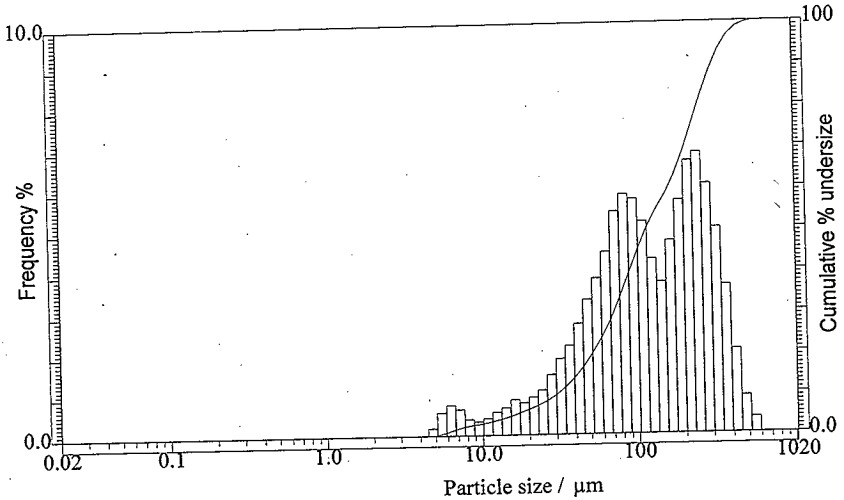
ON(3)

Format

Dist.base : Volume

Scaling : Auto

Axis : LogX - LinearY



Data	Memory	Hist.	Cum.	SAMPLE NAME	ID#	Median(μm)
Main	☐	☐	☐	4m70cls	980618-077	115.729

HORIBA LA-910

Laser scattering particle size distribution analyzer

PARTICLE SIZE MEASUREMENT DATA

ID# : 980618-072 10:44
 Filename : 4M70CHSC
 Sample : 4m70chs (composited layers)
 Material : Cement High Shear 4M HNO3
 Source : Mark Beck
 Lot Number :
 Test Number : 1
 Preparation :
 Disp. Medium :
 Disp. Steps :
 Verification :

Condition : T%(He-Ne): 78.5% Dist.Form: Sharp Sampling times : 100
 (LAMP): 80.8% R.R.Index: 1.19-0.00i ()
 Agitation : 5 Circultrn : 7 U.sonic : ON(3)
 Format :
 Dist.base : Volume Scaling : Auto Axis : LogX - LinearY

Data
 Median : 28.061µm SP.Area : 3810cm²/cm³ S.D. : 49.374µm
 Mode : 16.246µm Mean : 45.614µm
 C.V. : 108.24%

Span : (D 10.0-D 90.0) / D50 = 3.649

Dia. on % (10.0%) :	5.808µm	% on Dia.(0.100µm) :	0.0%
Dia. on % (20.0%) :	9.717µm	% on Dia.(1.000µm) :	0.0%
Dia. on % (30.0%) :	14.628µm	% on Dia.(10.000µm) :	20.5%
Dia. on % (80.0%) :	70.682µm	% on Dia.(30.000µm) :	52.1%
Dia. on % (90.0%) :	108.214µm	% on Dia.(200.000µm) :	98.0%

Size(µm)	Freq(%)	Und(%)	Size(µm)	Freq(%)	Und(%)	Size(µm)	Freq(%)	Und(%)
1019.5	0.00	100.00	26.11	3.87	47.77	0.669	0.00	0.00
890.1	0.00	100.00	22.80	3.70	43.90	0.584	0.00	0.00
777.1	0.00	100.00	19.90	4.17	40.20	0.510	0.00	0.00
678.5	0.00	100.00	17.38	4.92	36.03	0.445	0.00	0.00
592.4	0.00	100.00	15.17	4.13	31.11	0.389	0.00	0.00
517.2	0.00	100.00	13.25	3.58	26.98	0.339	0.00	0.00
451.6	0.00	100.00	11.56	2.79	23.40	0.296	0.00	0.00
394.2	0.00	100.00	10.10	2.15	20.61	0.259	0.00	0.00
344.2	0.16	100.00	8.816	2.12	18.46	0.226	0.00	0.00
300.5	0.29	99.84	7.697	2.75	16.34	0.197	0.00	0.00
262.4	0.52	99.55	6.720	3.31	13.59	0.172	0.00	0.00
229.1	1.03	99.04	5.867	3.77	10.28	0.150	0.00	0.00
200.0	1.61	98.00	5.122	3.40	6.51	0.131	0.00	0.00
174.6	1.84	96.40	4.472	1.63	3.11	0.115	0.00	0.00
152.5	1.59	94.56	3.905	0.50	1.49	0.100	0.00	0.00
133.1	1.77	92.97	3.409	0.27	0.99	0.087	0.00	0.00
116.2	2.28	91.20	2.976	0.21	0.71	0.076	0.00	0.00
101.5	2.81	88.92	2.599	0.37	0.50	0.067	0.00	0.00
88.58	3.41	86.11	2.269	0.13	0.13	0.058	0.00	0.00
77.34	4.07	82.70	1.981	0.00	0.00	0.051	0.00	0.00
67.52	4.34	78.63	1.729	0.00	0.00	0.044	0.00	0.00
58.95	4.71	74.29	1.510	0.00	0.00	0.039	0.00	0.00
51.47	4.68	69.58	1.318	0.00	0.00	0.034	0.00	0.00
44.94	4.51	64.90	1.151	0.00	0.00	0.029	0.00	0.00
39.23	4.29	60.39	1.005	0.00	0.00	0.026	0.00	0.00
34.25	4.13	56.10	0.877	0.00	0.00	0.022	0.00	0.00
29.91	4.20	51.97	0.766	0.00	0.00			

HORIBA LA-910

Laser scattering particle size distribution analyzer

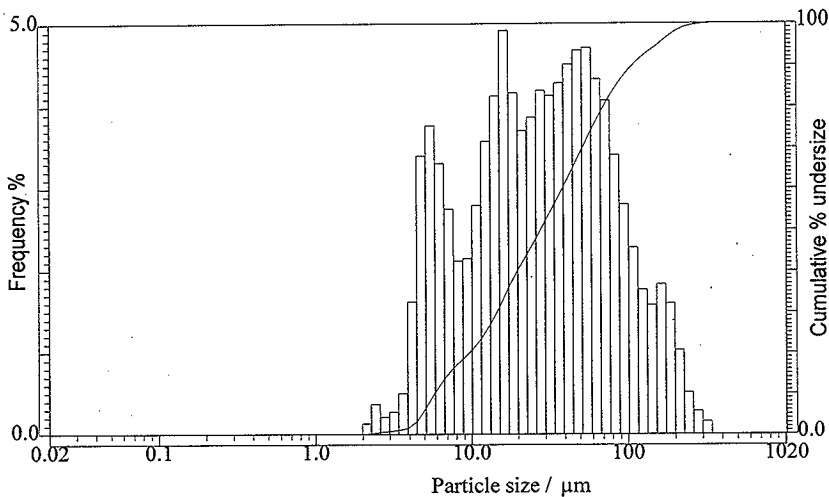
PARTICLE SIZE MEASUREMENT DATA

ID# : 980618-072 10:44 Material : Cement High Shear 4M HNO₃
 Filename : 4M70CHSC Source : Mark Beck
 Sample : 4m70chs (composited layer) Lot Number :

Condition
 T%(He-Ne): 78.5% Dist.Form: Sharp Sampling times : 100
 (LAMP): 80.8% R.R.Index: 1.19-0.00i ()

Agitation : 5 Circultrn : 7 U.sonic : ON(3)

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

**Data**

Memory	Hist.	Cum.	SAMPLE NAME	ID#	Median(μm)
Main	☐	☒	4m70chs (composited layers)	980618-072	28.061

HORIBA LA-910

Laser scattering particle size distribution analyzer

PARTICLE SIZE MEASUREMENT DATA

ID# : 980618-071 10:30
Filename : 4M70CHSG
Sample : 4m70chs (gel only)
Material : Cement High Shear 4M HNO3
Source : Mark Beck
Lot Number :
Test Number : 1
Preparation :
Disp. Medium :
Disp. Steps :
Verification :

Condition :
T%(He-Ne): 84.1% Dist.Form: Sharp Sampling times : 100
(LAMP): 84.8% R.R.Index: 1.19-0.001 ()
Agitation : 5 Circultn : 7 U.Sonic : ON(3)

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

Data

Median : 23.072µm SP.Area : 3977cm²/cm³ S.D. : 17.848µm
Mode : 48.847µm Mean : 27.662µm
C.V. : 64.52%

Span : (D 10.0-D 90.0) / D50 = 2.079

Dia. on %(10.0%) : 5.864µm % on Dia.(0.100µm) : 0.0%
Dia. on %(20.0%) : 10.302µm % on Dia.(1.000µm) : 0.0%
Dia. on %(30.0%) : 14.360µm % on Dia.(10.000µm) : 19.4%
Dia. on %(80.0%) : 47.265µm % on Dia.(30.000µm) : 59.4%
Dia. on %(90.0%) : 53.840µm % on Dia.(200.000µm) : 100.0%

Size(µm)	Freq(%)	Und(%)	Size(µm)	Freq(%)	Und(%)	Size(µm)	Freq(%)	Und(%)
1019.5	0.00	100.00	26.11	4.53	54.13	0.669	0.00	0.00
890.1	0.00	100.00	22.80	4.88	49.60	0.584	0.00	0.00
777.1	0.00	100.00	19.90	5.76	44.72	0.510	0.00	0.00
678.5	0.00	100.00	17.38	6.62	38.96	0.445	0.00	0.00
592.4	0.00	100.00	15.17	5.76	32.33	0.389	0.00	0.00
517.2	0.00	100.00	13.25	4.17	26.57	0.339	0.00	0.00
451.6	0.00	100.00	11.56	2.82	22.40	0.296	0.00	0.00
394.2	0.00	100.00	10.10	1.93	19.58	0.259	0.00	0.00
344.2	0.00	100.00	8.816	1.83	17.65	0.226	0.00	0.00
300.5	0.00	100.00	7.697	2.50	15.82	0.197	0.00	0.00
262.4	0.00	100.00	6.720	3.30	13.32	0.172	0.00	0.00
229.1	0.00	100.00	5.867	4.00	10.02	0.150	0.00	0.00
200.0	0.00	100.00	5.122	3.76	6.02	0.131	0.00	0.00
174.6	0.00	100.00	4.472	1.60	2.26	0.115	0.00	0.00
152.5	0.00	100.00	3.905	0.38	0.67	0.100	0.00	0.00
133.1	0.00	100.00	3.409	0.14	0.28	0.087	0.00	0.00
116.2	0.00	100.00	2.976	0.00	0.14	0.076	0.00	0.00
101.5	0.00	100.00	2.599	0.14	0.14	0.067	0.00	0.00
88.58	0.00	100.00	2.269	0.00	0.00	0.058	0.00	0.00
77.34	0.20	100.00	1.981	0.00	0.00	0.051	0.00	0.00
67.52	3.32	99.80	1.729	0.00	0.00	0.044	0.00	0.00
58.95	9.70	96.48	1.510	0.00	0.00	0.039	0.00	0.00
51.47	10.80	86.78	1.318	0.00	0.00	0.034	0.00	0.00
44.94	7.22	75.98	1.151	0.00	0.00	0.029	0.00	0.00
39.23	5.23	68.76	1.005	0.00	0.00	0.026	0.00	0.00
34.25	4.27	63.53	0.877	0.00	0.00	0.022	0.00	0.00
29.91	5.13	59.26	0.766	0.00	0.00			

HORIBA LA-910

Laser scattering particle size distribution analyzer

PARTICLE SIZE MEASUREMENT DATA

ID# : 980618-071 10:30

Material : Cement High Shear 4M HNO3

Filename : 4M70CHSG

Source : Mark Beck

Sample : 4m70chs (gel only)

Lot Number :

Condition

T%(He-Ne): 84.1%

Dist.Form: Sharp

Sampling times : 100

(LAMP): 84.8%

R.R.Index: 1.19-0.001 ()

Agitation : 5

Circulth : 7

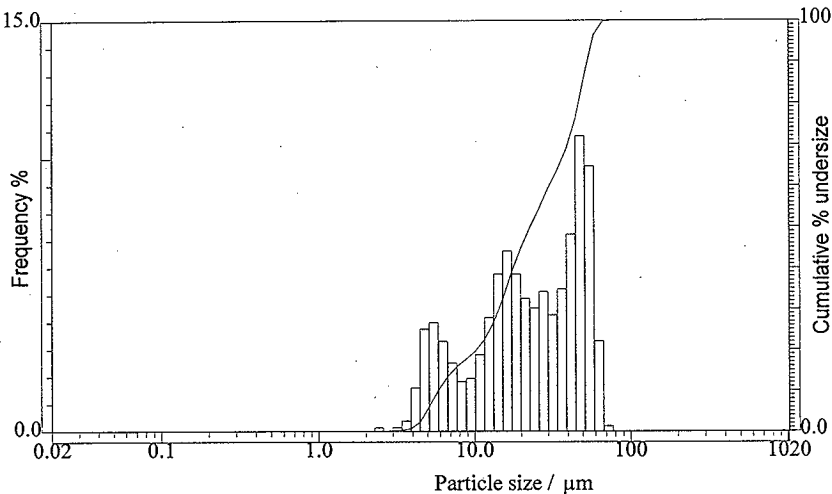
U.sonic : ON(3)

Format

Dist.base : Volume

Scaling : Auto

Axis : LogX - LinearY

**Data**

Memory	Hist.	Cum.	SAMPLE NAME	ID#	Median(μm)
Main	☐	☒	4m70chs (gel only)	980618-071	23.072

HORIBA LA-910

Laser scattering particle size distribution analyzer

PARTICLE SIZE MEASUREMENT DATA

ID# : 980618-076 13:35
Filename : 4M95CLS
Sample : 4m95cls
Material : Cement Low Shear 4M HNO3
Source : Mark Beck
Lot Number :
Test Number : 1
Preparation :
Disp. Medium :
Disp. Steps :
Verification :

Condition :
T%(He-Ne): 78.7% Dist.Form: Sharp Sampling times : 100
(LAMP): 85.5% R.R.Index: 1.19-0.001 ()
Agitation : 5 Circultrn : 7 U.sonic : ON(3)

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

Data

Median : 112.869µm SP.Area : 1022cm²/cm³ S.D. : 120.715µm
Mode : 215.991µm Mean : 151.589µm
C.V. : 79.63%

Span : (D 10.0-D 90.0) / D50 = 2.591

Dia. on %(10.0%) :	28.981µm	% on Dia.(0.100µm) :	0.0%
Dia. on %(20.0%) :	50.263µm	% on Dia.(1.000µm) :	0.0%
Dia. on %(30.0%) :	70.571µm	% on Dia.(10.000µm) :	2.8%
Dia. on %(80.0%) :	246.221µm	% on Dia.(30.000µm) :	10.4%
Dia. on %(90.0%) :	321.388µm	% on Dia.(200.000µm) :	70.4%

Size(µm)	Freq(%)Und(%)	Size(µm)	Freq(%)Und(%)	Size(µm)	Freq(%)Und(%)
1019.5	0.00 100.00	26.11	1.20 8.78	0.669	0.00 0.00
890.1	0.00 100.00	22.80	1.00 7.58	0.584	0.00 0.00
777.1	0.00 100.00	19.90	0.87 6.58	0.510	0.00 0.00
678.5	0.44 100.00	17.38	0.96 5.71	0.445	0.00 0.00
592.4	0.80 99.56	15.17	0.77 4.75	0.389	0.00 0.00
517.2	1.38 98.76	13.25	0.67 3.98	0.339	0.00 0.00
451.6	2.22 97.38	11.56	0.50 3.31	0.296	0.00 0.00
394.2	3.14 95.15	10.10	0.41 2.81	0.259	0.00 0.00
344.2	3.99 92.02	8.816	0.46 2.40	0.226	0.00 0.00
300.5	5.13 88.02	7.697	0.67 1.95	0.197	0.00 0.00
262.4	6.19 82.90	6.720	0.69 1.28	0.172	0.00 0.00
229.1	6.31 76.71	5.867	0.45 0.58	0.150	0.00 0.00
200.0	5.35 70.40	5.122	0.13 0.13	0.131	0.00 0.00
174.6	4.62 65.05	4.472	0.00 0.00	0.115	0.00 0.00
152.5	4.15 60.44	3.905	0.00 0.00	0.100	0.00 0.00
133.1	5.04 56.28	3.409	0.00 0.00	0.087	0.00 0.00
116.2	5.78 51.24	2.976	0.00 0.00	0.076	0.00 0.00
101.5	6.09 45.46	2.599	0.00 0.00	0.067	0.00 0.00
88.58	5.87 39.38	2.269	0.00 0.00	0.058	0.00 0.00
77.34	5.19 33.51	1.981	0.00 0.00	0.051	0.00 0.00
67.52	4.16 28.31	1.729	0.00 0.00	0.044	0.00 0.00
58.95	3.59 24.15	1.510	0.00 0.00	0.039	0.00 0.00
51.47	3.20 20.56	1.318	0.00 0.00	0.034	0.00 0.00
44.94	2.71 17.36	1.151	0.00 0.00	0.029	0.00 0.00
39.23	2.26 14.65	1.005	0.00 0.00	0.026	0.00 0.00
34.25	2.02 12.39	0.877	0.00 0.00	0.022	0.00 0.00
29.91	1.59 10.37	0.766	0.00 0.00		

HORIBA LA-910

Laser scattering particle size distribution analyzer

PARTICLE SIZE MEASUREMENT DATA

ID# : 980618-076 13:35

Filename : 4M95CLS

Sample : 4m95cls

Material : Cement Low Shear 4M HNO3

Source : Mark Beck

Lot Number :

Condition

T%(He-Ne): 78.7%

(LAMP): 85.5%

Dist.Form: Sharp

R.R.Index: 1.19-0.00i (

Sampling times : 100

)

Agitation : 5

Circultrn : 7

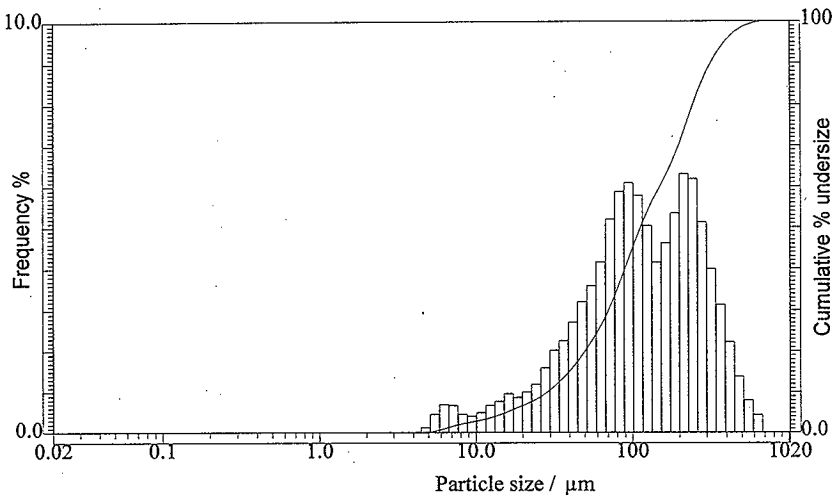
U.sonic : ON(3)

Format

Dist.base : Volume

Scaling : Auto

Axis : LogX - LinearY

**Data**

Memory	Hist.	Cum.	SAMPLE NAME	ID#	Median(μm)
Main	☐	☒	4m95cls	980618-076	112.869

HORIBA LA-910

Laser scattering particle size distribution analyzer

PARTICLE SIZE MEASUREMENT DATA

ID# : 980618-070 10:10
 Filename : 4M95MSDC
 Sample : 4m95msdc (composed)
 Material : Cement Med Shear 4M HNO3
 Source : Mark Beck
 Lot Number :
 Test Number : 1
 Preparation :
 Disp. Medium :
 Disp. Steps :
 Verification :

Condition :
 T%(He-Ne): 81.5% Dist.Form: Sharp Sampling times : 100
 (LAMP): 83.2% R.R.Index: 1.19-0.001 ()
 Agitation : 5 Circultrn : 7 U.sonic : ON(3)

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

Data

Median : 29.319µm SP.Area : 3478cm²/cm³ S.D. : 34.904µm
 Mode : 93.882µm Mean : 42.658µm
 C.V. : 81.82%

Span : (D 10.0-D 90.0) / D50 = 3.117

Dia. on %(10.0%) : 6.310µm % on Dia.(0.100µm) : 0.0%
 Dia. on %(20.0%) : 11.753µm % on Dia.(1.000µm) : 0.0%
 Dia. on %(30.0%) : 16.183µm % on Dia.(10.000µm) : 16.9%
 Dia. on %(80.0%) : 80.658µm % on Dia.(30.000µm) : 50.8%
 Dia. on %(90.0%) : 97.707µm % on Dia.(200.000µm) : 100.0%

Size(µm)	Freq(%)	Und(%)	Size(µm)	Freq(%)	Und(%)	Size(µm)	Freq(%)	Und(%)
1019.5	0.00	100.00	26.11	4.25	46.17	0.669	0.00	0.00
890.1	0.00	100.00	22.80	4.21	41.91	0.584	0.00	0.00
777.1	0.00	100.00	19.90	4.82	37.70	0.510	0.00	0.00
678.5	0.00	100.00	17.38	5.50	32.89	0.445	0.00	0.00
592.4	0.00	100.00	15.17	4.31	27.39	0.389	0.00	0.00
517.2	0.00	100.00	13.25	3.49	23.07	0.339	0.00	0.00
451.6	0.00	100.00	11.56	2.55	19.58	0.296	0.00	0.00
394.2	0.00	100.00	10.10	1.85	17.04	0.259	0.00	0.00
344.2	0.00	100.00	8.816	1.75	15.18	0.226	0.00	0.00
300.5	0.00	100.00	7.697	2.21	13.43	0.197	0.00	0.00
262.4	0.00	100.00	6.720	2.64	11.22	0.172	0.00	0.00
229.1	0.00	100.00	5.867	3.08	8.59	0.150	0.00	0.00
200.0	0.00	100.00	5.122	2.89	5.50	0.131	0.00	0.00
174.6	0.00	100.00	4.472	1.47	2.61	0.115	0.00	0.00
152.5	0.16	100.00	3.905	0.47	1.14	0.100	0.00	0.00
133.1	2.44	99.84	3.409	0.25	0.68	0.087	0.00	0.00
116.2	5.25	97.40	2.976	0.17	0.43	0.076	0.00	0.00
101.5	7.76	92.16	2.599	0.26	0.26	0.067	0.00	0.00
88.58	6.36	84.39	2.269	0.00	0.00	0.058	0.00	0.00
77.34	4.60	78.03	1.981	0.00	0.00	0.051	0.00	0.00
67.52	3.66	73.43	1.729	0.00	0.00	0.044	0.00	0.00
58.95	3.56	69.76	1.510	0.00	0.00	0.039	0.00	0.00
51.47	3.66	66.20	1.318	0.00	0.00	0.034	0.00	0.00
44.94	3.82	62.55	1.151	0.00	0.00	0.029	0.00	0.00
39.23	3.98	58.72	1.005	0.00	0.00	0.026	0.00	0.00
34.25	4.09	54.75	0.877	0.00	0.00	0.022	0.00	0.00
29.91	4.49	50.66	0.766	0.00	0.00			

HORIBA LA-910

Laser scattering particle size distribution analyzer

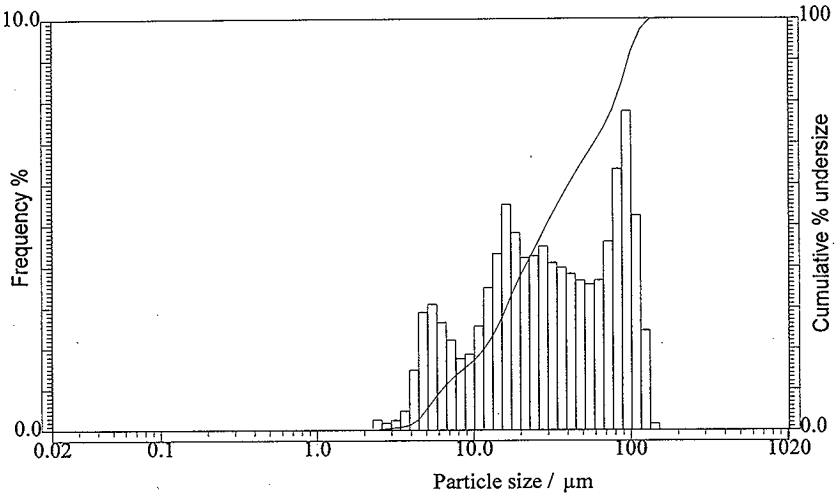
PARTICLE SIZE MEASUREMENT DATA

ID# : 980618-070 10:10 Material : Cement Med Shear 4M HNO₃
 Filename : 4M95MSDC Source : Mark Beck
 Sample : 4m95msdc (composited) Lot Number :

Condition
 T%(He-Ne): 81.5% Dist.Form: Sharp Sampling times : 100
 (LAMP): 83.2% R.R.Index: 1.19-0.001 ()

Agitation : 5 Circultrn : 7 U.sonic : ON(3)

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



Data	Memory Hist.	Cum.	SAMPLE NAME	ID#	Median(μm)
Main	☐	☒	4m95msdc (composited)	980618-070	29.319

HORIBA LA-910

Laser scattering particle size distribution analyzer

PARTICLE SIZE MEASUREMENT DATA

ID# : 980617-060 09:08
 Filename : 8M45CLS
 Sample : 8m45cls
 Material : Cement Low Shear 8M HNO3
 Source : Mark Beck
 Lot Number :
 Test Number : 1
 Preparation :
 Disp. Medium :
 Disp. Steps :
 Verification :

Condition :
 T%(He-Ne): 79.2% Dist.Form: Sharp Sampling times : 100
 (LAMP): 86.1% R.R.Index: 1.19-0.001 ()
 Agitation : 5 Circulth : 7 U.sonic : ON(3)

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

Data :
 Median : 119.378µm SP.Area : 933cm²/cm³ S.D. : 126.398µm
 Mode : 216.422µm Mean : 160.765µm
 C.V. : 78.62%

Span : (D 10.0-D 90.0) / D50 = 2.639

Dia. on % (10.0%):	32.267µm	% on Dia.(0.100µm):	0.0%
Dia. on % (20.0%):	52.436µm	% on Dia.(1.000µm):	0.0%
Dia. on % (30.0%):	71.434µm	% on Dia.(10.000µm):	2.2%
Dia. on % (80.0%):	256.420µm	% on Dia.(30.000µm):	8.9%
Dia. on % (90.0%):	347.253µm	% on Dia.(200.000µm):	66.8%

Size(µm)	Freq(%)	Und(%)	Size(µm)	Freq(%)	Und(%)	Size(µm)	Freq(%)	Und(%)
1019.5	0.00	100.00	26.11	1.09	7.38	0.669	0.00	0.00
890.1	0.00	100.00	22.80	0.90	6.29	0.584	0.00	0.00
777.1	0.00	100.00	19.90	0.73	5.40	0.510	0.00	0.00
678.5	0.40	100.00	17.38	0.80	4.66	0.445	0.00	0.00
592.4	0.72	99.60	15.17	0.60	3.86	0.389	0.00	0.00
517.2	2.21	98.87	13.25	0.58	3.26	0.339	0.00	0.00
451.6	3.45	96.66	11.56	0.43	2.68	0.296	0.00	0.00
394.2	3.43	93.21	10.10	0.37	2.25	0.259	0.00	0.00
344.2	3.61	89.78	8.816	0.44	1.88	0.226	0.00	0.00
300.5	4.98	86.17	7.697	0.63	1.44	0.197	0.00	0.00
262.4	7.02	81.19	6.720	0.55	0.81	0.172	0.00	0.00
229.1	7.40	74.17	5.867	0.25	0.25	0.150	0.00	0.00
200.0	5.82	66.77	5.122	0.00	0.00	0.131	0.00	0.00
174.6	4.40	60.95	4.472	0.00	0.00	0.115	0.00	0.00
152.5	3.35	56.56	3.905	0.00	0.00	0.100	0.00	0.00
133.1	4.00	53.20	3.409	0.00	0.00	0.087	0.00	0.00
116.2	4.90	49.21	2.976	0.00	0.00	0.076	0.00	0.00
101.5	5.49	44.31	2.599	0.00	0.00	0.067	0.00	0.00
88.58	5.68	38.82	2.269	0.00	0.00	0.058	0.00	0.00
77.34	5.36	33.13	1.981	0.00	0.00	0.051	0.00	0.00
67.52	4.44	27.78	1.729	0.00	0.00	0.044	0.00	0.00
58.95	3.87	23.34	1.510	0.00	0.00	0.039	0.00	0.00
51.47	3.45	19.47	1.318	0.00	0.00	0.034	0.00	0.00
44.94	2.86	16.03	1.151	0.00	0.00	0.029	0.00	0.00
39.23	2.29	13.16	1.005	0.00	0.00	0.026	0.00	0.00
34.25	1.99	10.88	0.877	0.00	0.00	0.022	0.00	0.00
29.91	1.51	8.89	0.766	0.00	0.00			

HORIBA LA-910

Laser scattering particle size distribution analyzer

PARTICLE SIZE MEASUREMENT DATA

ID# : 980617-060 09:08

Filename : 8M45CLS

Sample : 8m45cls

Material : Cement Low Shear 8M HNO3

Source : Mark Beck

Lot Number :

Condition

T%(He-Ne): 79.2%

(LAMP): 86.1%

Dist.Form: Sharp

R.R.Index: 1.19-0.001

Sampling times : 100

()

Agitation : 5

Circultrn

: 7

U.sonic

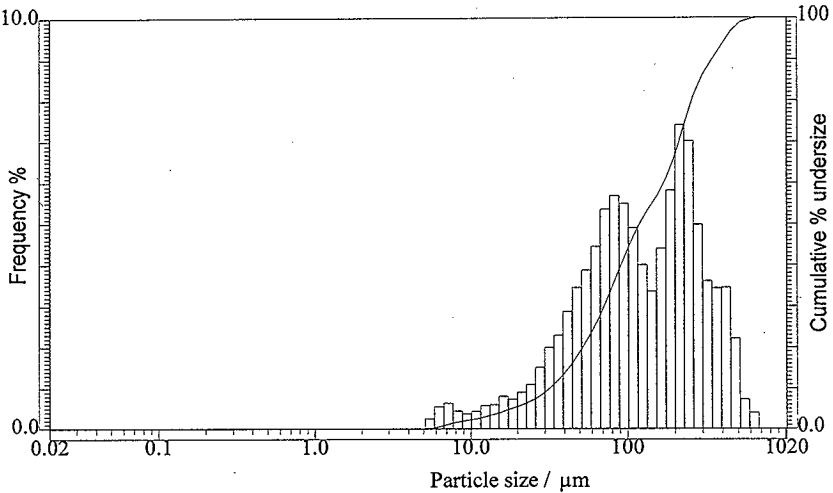
: ON(3)

Format

Dist.base : Volume

Scaling : Auto

Axis : LogX - LinearY



Data

Memory Hist.	Cum.	SAMPLE NAME	ID#	Median(μm)
Main	☐	8m45cls	980617-060	119.378

HORIBA LA-910

Laser scattering particle size distribution analyzer

PARTICLE SIZE MEASUREMENT DATA

ID# : 980617-059 08:54
 Filename : 8M45CMS
 Sample : 8m45cms
 Material : Cement Med Shear 8M HNO3
 Source : Mark Beck
 Lot Number :
 Test Number : 1
 Preparation :
 Disp. Medium :
 Disp. Steps :
 Verification :

Condition :
 T%(He-Ne): 83.6% Dist.Form: Sharp Sampling times : 100
 (LAMP): 87.2% R.R.Index: 1.19-0.001
 Agitation : 5 Circultrn : 7 U.sonic : ON(3)

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

Data

Median : 51.136µm SP.Area : 1952cm²/cm³ S.D. : 83.024µm
 Mode : 54.820µm Mean : 81.824µm
 C.V. : 101.47%

Span : (D 10.0-D 90.0) / D50 = 3.871

Dia. on % (10.0%) :	13.751µm	% on Dia. (0.100µm) :	0.0%
Dia. on % (20.0%) :	22.598µm	% on Dia. (1.000µm) :	0.0%
Dia. on % (30.0%) :	32.002µm	% on Dia. (10.000µm) :	6.7%
Dia. on % (80.0%) :	136.398µm	% on Dia. (30.000µm) :	27.7%
Dia. on % (90.0%) :	211.672µm	% on Dia. (200.000µm) :	88.2%

Size(µm)	Freq(%)	Und(%)	Size(µm)	Freq(%)	Und(%)	Size(µm)	Freq(%)	Und(%)
1019.5	0.00	100.00	26.11	3.33	23.53	0.669	0.00	0.00
890.1	0.00	100.00	22.80	3.05	20.20	0.584	0.00	0.00
777.1	0.00	100.00	19.90	2.72	17.14	0.510	0.00	0.00
678.5	0.00	100.00	17.38	2.87	14.42	0.445	0.00	0.00
592.4	0.11	100.00	15.17	2.15	11.56	0.389	0.00	0.00
517.2	0.20	99.89	13.25	1.60	9.41	0.339	0.00	0.00
451.6	0.36	99.69	11.56	1.07	7.81	0.296	0.00	0.00
394.2	0.64	99.34	10.10	0.79	6.74	0.259	0.00	0.00
344.2	1.15	98.70	8.816	0.86	5.95	0.226	0.00	0.00
300.5	1.85	97.55	7.697	1.31	5.09	0.197	0.00	0.00
262.4	3.20	95.70	6.720	1.62	3.78	0.172	0.00	0.00
229.1	4.29	92.50	5.867	1.46	2.16	0.150	0.00	0.00
200.0	4.04	88.21	5.122	0.70	0.70	0.131	0.00	0.00
174.6	2.90	84.17	4.472	0.00	0.00	0.115	0.00	0.00
152.5	1.55	81.27	3.905	0.00	0.00	0.100	0.00	0.00
133.1	1.53	79.72	3.409	0.00	0.00	0.087	0.00	0.00
116.2	2.14	78.19	2.976	0.00	0.00	0.076	0.00	0.00
101.5	2.91	76.05	2.599	0.00	0.00	0.067	0.00	0.00
88.58	4.11	73.14	2.269	0.00	0.00	0.058	0.00	0.00
77.34	5.54	69.03	1.981	0.00	0.00	0.051	0.00	0.00
67.52	6.30	63.48	1.729	0.00	0.00	0.044	0.00	0.00
58.95	6.86	57.19	1.510	0.00	0.00	0.039	0.00	0.00
51.47	6.79	50.33	1.318	0.00	0.00	0.034	0.00	0.00
44.94	6.05	43.54	1.151	0.00	0.00	0.029	0.00	0.00
39.23	5.12	37.49	1.005	0.00	0.00	0.026	0.00	0.00
34.25	4.73	32.37	0.877	0.00	0.00	0.022	0.00	0.00
29.91	4.11	27.64	0.766	0.00	0.00			

HORIBA LA-910

Laser scattering particle size distribution analyzer

PARTICLE SIZE MEASUREMENT DATA

ID# : 980617-059 08:54

Material : Cement Med Shear 8M HNO3

Filename : 8M45CMS

Source : Mark Beck

Sample : 8m45cms

Lot Number :

Condition

T%(He-Ne): 83.6%

Dist.Form: Sharp

Sampling times : 100

(LAMP): 87.2%

R.R.Index: 1.19-0.001

Agitation : 5

Circuitn : 7

U.sonic

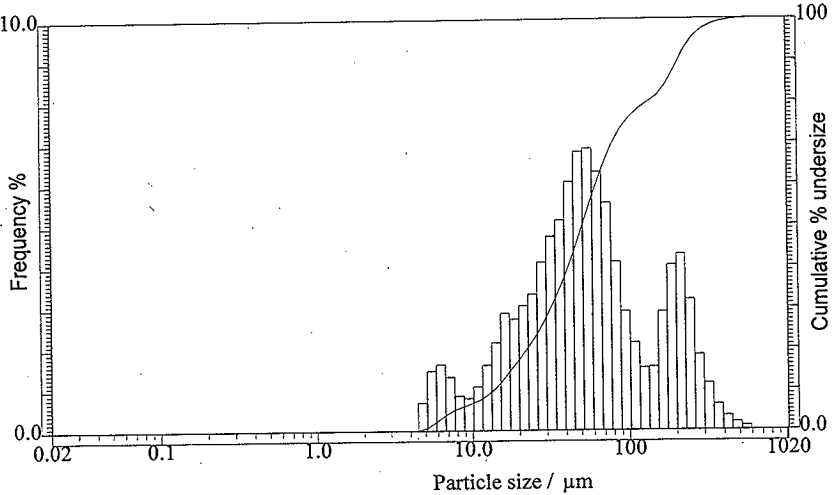
ON(3)

Format

Dist.base : Volume

Scaling : Auto

Axis : LogX - LinearY



Data

Memory Hist.

Cum.

SAMPLE NAME

ID#

Median(μm)

Main



—

8m45cms

980617-059

51.136

HORIBA LA-910

Laser scattering particle size distribution analyzer

PARTICLE SIZE MEASUREMENT DATA

ID# : 980617-064 13:48
 Filename : 4M95CMSG
 Sample : 4m95cms (gel only)
 Material : Cement Med Shear 4M HNO3
 Source : Mark Beck
 Lot Number :
 Test Number : 1
 Preparation :
 Disp. Medium :
 Disp. Steps :
 Verification :

Condition :
 T%(He-Ne): 78.4% Dist.Form: Sharp Sampling times : 100
 (LAMP): 85.9% R.R.Index: 1.19-0.001 ()
 Agitation : 3 Circultrn : 3 U.sonic : ON(3)
 Format :
 Dist.base : Volume Scaling : Auto Axis : LogX - LinearY

Data

Median : 41.105µm SP.Area : 2429cm²/cm³ S.D. : 36.241µm
 Mode : 42.112µm Mean : 50.305µm
 C.V. : 72.04%

Span : (D 10.0-D 90.0) / D50 = 2.231

Dia. on %(10.0%) :	12.015µm	% on Dia.(0.100µm) :	0.0%
Dia. on %(20.0%) :	19.777µm	% on Dia.(1.000µm) :	0.0%
Dia. on %(30.0%) :	26.931µm	% on Dia.(10.000µm) :	8.6%
Dia. on %(80.0%) :	77.958µm	% on Dia.(30.000µm) :	34.5%
Dia. on %(90.0%) :	103.714µm	% on Dia.(200.000µm) :	100.0%

Size(µm)	Freq(%)	Und(%)	Size(µm)	Freq(%)	Und(%)	Size(µm)	Freq(%)	Und(%)
1019.5	0.00	100.00	26.11	4.65	28.71	0.669	0.00	0.00
890.1	0.00	100.00	22.80	3.89	24.06	0.584	0.00	0.00
777.1	0.00	100.00	19.90	3.44	20.16	0.510	0.00	0.00
678.5	0.00	100.00	17.38	3.28	16.73	0.445	0.00	0.00
592.4	0.00	100.00	15.17	2.37	13.44	0.389	0.00	0.00
517.2	0.00	100.00	13.25	1.50	11.08	0.339	0.00	0.00
451.6	0.00	100.00	11.56	0.94	9.58	0.296	0.00	0.00
394.2	0.00	100.00	10.10	0.64	8.64	0.259	0.00	0.00
344.2	0.00	100.00	8.816	0.63	8.00	0.226	0.00	0.00
300.5	0.00	100.00	7.697	0.97	7.37	0.197	0.00	0.00
262.4	0.00	100.00	6.720	1.44	6.40	0.172	0.00	0.00
229.1	0.00	100.00	5.867	1.99	4.96	0.150	0.00	0.00
200.0	0.27	100.00	5.122	2.01	2.97	0.131	0.00	0.00
174.6	1.21	99.73	4.472	0.81	0.96	0.115	0.00	0.00
152.5	2.15	98.52	3.905	0.15	0.15	0.100	0.00	0.00
133.1	3.11	96.37	3.409	0.00	0.00	0.087	0.00	0.00
116.2	3.89	93.26	2.976	0.00	0.00	0.076	0.00	0.00
101.5	4.57	89.37	2.599	0.00	0.00	0.067	0.00	0.00
88.58	5.10	84.80	2.269	0.00	0.00	0.058	0.00	0.00
77.34	5.64	79.70	1.981	0.00	0.00	0.051	0.00	0.00
67.52	5.86	74.06	1.729	0.00	0.00	0.044	0.00	0.00
58.95	6.59	68.19	1.510	0.00	0.00	0.039	0.00	0.00
51.47	7.00	61.61	1.318	0.00	0.00	0.034	0.00	0.00
44.94	7.01	54.60	1.151	0.00	0.00	0.029	0.00	0.00
39.23	6.70	47.60	1.005	0.00	0.00	0.026	0.00	0.00
34.25	6.51	40.89	0.877	0.00	0.00	0.022	0.00	0.00
29.91	5.68	34.38	0.766	0.00	0.00			

HORIBA LA-910

Laser scattering particle size distribution analyzer

PARTICLE SIZE MEASUREMENT DATA

ID# : 980617-064 13:48

Filename : 4M95CMSG

Sample : 4m95cms (gel only)

Material

Source

Lot Number

Cement Med Shear 4M HNO3

Mark Beck

Condition

T%(He-Ne): 78.4%

(LAMP): 85.9%

Dist.Form: Sharp

R.R.Index: 1.19-0.001

Sampling times : 100

()

Agitation : 3

Circultrn

: 3

U,sonic

: ON(3)

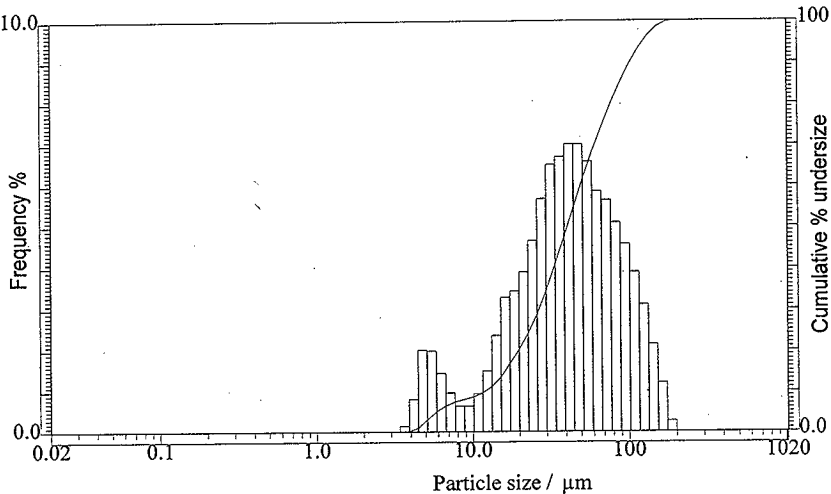
Format

Dist.base : Volume

Scaling

: Auto

Axis : LogX - LineaY



Data

Memory Hist.

Cum.

SAMPLE NAME

ID#

Median(μm)

Main



—

4m95cms (gel only)

980617-064

41.105

HORIBA LA-910

Laser scattering particle size distribution analyzer

PARTICLE SIZE MEASUREMENT DATA

ID# : 980617-065 14:13
 Filename : 4M95CMSD
 Sample : 4m95cmsd (gel only)
 Material : Cement Med Shear 4M HNO3
 Source : Mark Beck
 Lot Number :
 Test Number : 1
 Preparation :
 Disp. Medium :
 Disp. Steps :
 Verification :

Condition :
 T%(He-Ne): 81.5% Dist.Form: Sharp Sampling times : 100
 (LAMP): 84.8% R.R.Index: 1.15-0.001
 Agitation : 3 Circultrn : 3 U.sonic : ON(3)
 Format :
 Dist.base : Volume Scaling : Auto Axis : LogX - LinearY

Data :
 Median : 49.894µm SP.Area : 2106cm²/cm³ S.D. : 43.562µm
 Mode : 71.740µm Mean : 58.401µm
 C.V. : 74.59%

Span : (D 10.0-D 90.0) / D50 = 1.892

Dia. on %(10.0%) :	14.123µm	% on Dia.(0.100µm) :	0.0%
Dia. on %(20.0%) :	23.909µm	% on Dia.(1.000µm) :	0.0%
Dia. on %(30.0%) :	32.658µm	% on Dia.(10.000µm) :	7.2%
Dia. on %(80.0%) :	84.251µm	% on Dia.(30.000µm) :	26.7%
Dia. on %(90.0%) :	108.546µm	% on Dia.(200.000µm) :	98.4%

Size(µm)	Freq(%)	Und(%)	Size(µm)	Freq(%)	Und(%)	Size(µm)	Freq(%)	Und(%)
1019.5	0.00	100.00	26.11	3.44	22.23	0.669	0.00	0.00
890.1	0.00	100.00	22.80	2.84	18.79	0.584	0.00	0.00
777.1	0.00	100.00	19.90	2.53	15.96	0.510	0.00	0.00
678.5	0.00	100.00	17.38	2.47	13.42	0.445	0.00	0.00
592.4	0.00	100.00	15.17	1.81	10.95	0.389	0.00	0.00
517.2	0.00	100.00	13.25	1.17	9.15	0.339	0.00	0.00
451.6	0.00	100.00	11.56	0.75	7.98	0.296	0.00	0.00
394.2	0.00	100.00	10.10	0.53	7.22	0.259	0.00	0.00
344.2	0.13	100.00	8.816	0.55	6.70	0.226	0.00	0.00
300.5	0.23	99.87	7.697	0.86	6.15	0.197	0.00	0.00
262.4	0.41	99.65	6.720	1.29	5.29	0.172	0.00	0.00
229.1	0.84	99.24	5.867	1.75	4.00	0.150	0.00	0.00
200.0	1.15	98.40	5.122	1.67	2.25	0.131	0.00	0.00
174.6	1.37	97.25	4.472	0.59	0.59	0.115	0.00	0.00
152.5	1.54	95.88	3.905	0.00	0.00	0.100	0.00	0.00
133.1	2.40	94.34	3.409	0.00	0.00	0.087	0.00	0.00
116.2	3.84	91.93	2.976	0.00	0.00	0.076	0.00	0.00
101.5	5.49	88.09	2.599	0.00	0.00	0.067	0.00	0.00
88.58	7.04	82.60	2.269	0.00	0.00	0.058	0.00	0.00
77.34	8.11	75.56	1.981	0.00	0.00	0.051	0.00	0.00
67.52	7.91	67.46	1.729	0.00	0.00	0.044	0.00	0.00
58.95	7.86	59.55	1.510	0.00	0.00	0.039	0.00	0.00
51.47	7.38	51.69	1.318	0.00	0.00	0.034	0.00	0.00
44.94	6.66	44.31	1.151	0.00	0.00	0.029	0.00	0.00
39.23	5.81	37.66	1.005	0.00	0.00	0.026	0.00	0.00
34.25	5.24	31.84	0.877	0.00	0.00	0.022	0.00	0.00
29.91	4.37	26.60	0.766	0.00	0.00			

HORIBA LA-910

Laser scattering particle size distribution analyzer

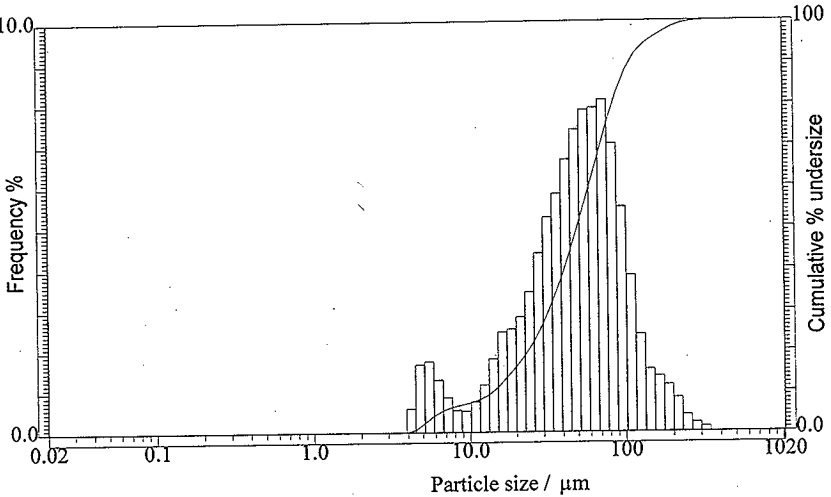
PARTICLE SIZE MEASUREMENT DATA

ID# : 980617-065 14:13 Material : Cement Med Shear 4M HNO3
 Filename : 4M95CMSD Source : Mark Beck
 Sample : 4m95cmsd (gel only) Lot Number :

Condition :
 T%(He-Ne): 81.5% Dist.Form: Sharp Sampling times : 100
 (LAMP): 84.8% R.R.Index: 1.19-0.001 ()

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

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



Data	Memory	Hist.	Cum.	SAMPLE NAME	ID#	Median(μm)
Main	☐	☐	☒	4m95cmsd (gel only)	980617-065	49.894

HORIBA LA-910

Laser scattering particle size distribution analyzer

PARTICLE SIZE MEASUREMENT DATA

ID# : 980617-063 10:49
 Filename : 4M95CHSG
 Sample : 4m95chs (gel)
 Material : Cement High Shear 4M HNO3
 Source : Mark Beck
 Lot Number :
 Test Number : 1
 Preparation :
 Disp. Medium :
 Disp. Steps :
 Verification :

Condition :
 T%(He-Ne): 81.6% Dist.Form: Sharp Sampling times : 100
 (LAMP): 82.5% R.R.index: 1.19-0.001
 Agitation : 3 Circultrn : 3 U.sonic : ON(3)

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

Data

Median : 56.259µm SP.Area : 2267cm²/cm² S.D. : 67.794µm
 Mode : 72.232µm Mean : 74.700µm
 C.V. : 90.76%

Span : (D 10.0-D 90.0) / D50 = 2.998

Dia. on %(10.0%) : 9.864µm % on Dia.(0.100µm) : 0.0%
 Dia. on %(20.0%) : 20.201µm % on Dia.(1.000µm) : 0.0%
 Dia. on %(30.0%) : 33.080µm % on Dia.(10.000µm) : 10.1%
 Dia. on %(80.0%) : 109.569µm % on Dia.(30.000µm) : 27.4%
 Dia. on %(90.0%) : 178.531µm % on Dia.(200.000µm) : 92.1%

Size(µm)	Freq(%)Und(%)	Size(µm)	Freq(%)Und(%)	Size(µm)	Freq(%)Und(%)
1019.5	0.00 100.00	26.11	2.41 24.24	0.669	0.00 0.00
890.1	0.00 100.00	22.80	2.06 21.84	0.584	0.00 0.00
777.1	0.00 100.00	19.90	2.15 19.77	0.510	0.00 0.00
678.5	0.00 100.00	17.38	2.49 17.63	0.445	0.00 0.00
592.4	0.00 100.00	15.17	2.23 15.14	0.389	0.00 0.00
517.2	0.00 100.00	13.25	1.61 12.91	0.339	0.00 0.00
451.6	0.13 100.00	11.56	1.15 11.29	0.296	0.00 0.00
394.2	0.23 99.87	10.10	0.83 10.14	0.259	0.00 0.00
344.2	0.42 99.64	8.816	0.85 9.31	0.226	0.00 0.00
300.5	1.43 99.21	7.697	1.27 8.46	0.197	0.00 0.00
262.4	2.68 97.79	6.720	1.80 7.18	0.172	0.00 0.00
229.1	3.01 95.11	5.867	2.29 5.38	0.150	0.00 0.00
200.0	2.51 92.10	5.122	2.13 3.10	0.131	0.00 0.00
174.6	2.21 89.59	4.472	0.81 0.96	0.115	0.00 0.00
152.5	2.24 87.39	3.905	0.16 0.16	0.100	0.00 0.00
133.1	3.22 85.15	3.409	0.00 0.00	0.087	0.00 0.00
116.2	4.43 81.92	2.976	0.00 0.00	0.076	0.00 0.00
101.5	5.60 77.49	2.599	0.00 0.00	0.067	0.00 0.00
88.58	6.43 71.89	2.269	0.00 0.00	0.058	0.00 0.00
77.34	6.84 65.46	1.981	0.00 0.00	0.051	0.00 0.00
67.52	6.48 58.63	1.729	0.00 0.00	0.044	0.00 0.00
58.95	6.25 52.15	1.510	0.00 0.00	0.039	0.00 0.00
51.47	5.78 45.91	1.318	0.00 0.00	0.034	0.00 0.00
44.94	5.00 40.13	1.151	0.00 0.00	0.029	0.00 0.00
39.23	4.20 35.13	1.005	0.00 0.00	0.026	0.00 0.00
34.25	3.62 30.93	0.877	0.00 0.00	0.022	0.00 0.00
29.91	3.07 27.31	0.766	0.00 0.00		

HORIBA LA-910

Laser scattering particle size distribution analyzer

PARTICLE SIZE MEASUREMENT DATA

ID# : 980617-063 10:49

Filename : 4M95CHSG

Sample : 4m95chs (gel)

Material : Cement High Shear 4M HNO3

Source : Mark Beck

Lot Number :

Condition

T%(He-Ne): 81.6%

(LAMP): 82.5%

Dist.Form: Sharp

R.R.Index: 1.19-0.001 (

Sampling times : 100

Agitation : 3

Circultrn : 3

U.sonic

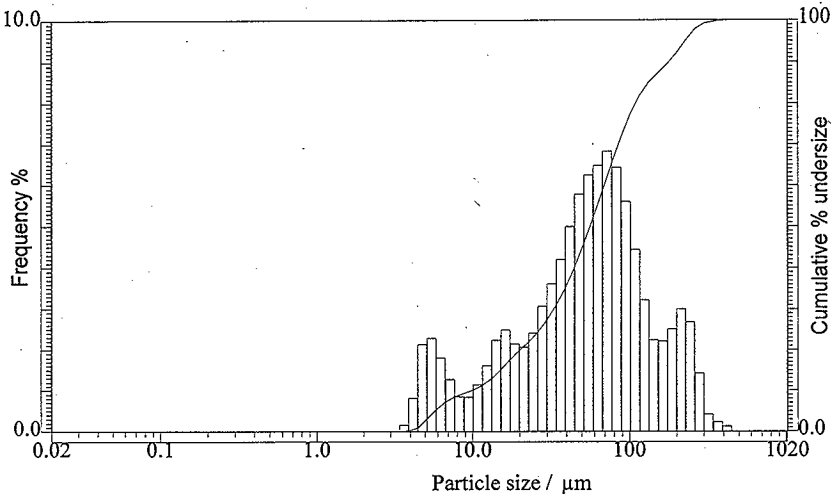
: ON(3)

Format

Dist.base : Volume

Scaling : Auto

Axis : LogX - LinearY

**Data**

Memory Hist.

Cum.

SAMPLE NAME

ID#

Median(μm)

Main



4m95chs (gel)

980617-063

56.259

HORIBA LA-910

Laser scattering particle size distribution analyzer

PARTICLE SIZE MEASUREMENT DATA

ID# : 980617-067 15:25
 Filename : 4M95CHSC
 Sample : 4m95chs (composite)
 Material : Cement High Shear 4M HNO3
 Source : Mark Beck
 Lot Number :
 Test Number : 1
 Preparation :
 Disp. Medium :
 Disp. Steps :
 Verification :

Condition :
 T%(He-Ne): 81.4% Dist.Form: Sharp Sampling times : 100
 (LAMP): 85.9% R.R.Index: 1.19-0.00i ()
 Agitation : 5 Circultrn : 7 U.sonic : ON(3)
 Format :
 Dist.base : Volume Scaling : Auto Axis : LogX - LinearY

Data

Median : 38.603µm SP.Area : 3356cm²/cm³ S.D. : 81.000µm
 Mode : 236.963µm Mean : 70.581µm
 C.V. : 114.76%

Span : (D 10.0-D 90.0) / D50 = 5.530

Dia. on % (10.0%) :	5.897µm	% on Dia. (0.100µm) :	0.0%
Dia. on % (20.0%) :	10.377µm	% on Dia. (1.000µm) :	0.0%
Dia. on % (30.0%) :	16.028µm	% on Dia. (10.000µm) :	19.5%
Dia. on % (80.0%) :	106.733µm	% on Dia. (30.000µm) :	44.8%
Dia. on % (90.0%) :	219.376µm	% on Dia. (200.000µm) :	86.7%

Size(µm)	Freq(%)	Und(%)	Size(µm)	Freq(%)	Und(%)	Size(µm)	Freq(%)	Und(%)
1019.5	0.00	100.00	26.11	2.81	41.77	0.669	0.00	0.00
890.1	0.00	100.00	22.80	2.86	38.96	0.584	0.00	0.00
777.1	0.00	100.00	19.90	3.44	36.09	0.510	0.00	0.00
678.5	0.00	100.00	17.38	4.45	32.65	0.445	0.00	0.00
592.4	0.00	100.00	15.17	3.62	28.20	0.389	0.00	0.00
517.2	0.00	100.00	13.25	2.89	24.58	0.339	0.00	0.00
451.6	0.16	100.00	11.56	2.11	21.68	0.296	0.00	0.00
394.2	0.29	99.84	10.10	1.57	19.57	0.259	0.00	0.00
344.2	0.53	99.55	8.816	1.72	18.01	0.226	0.00	0.00
300.5	2.12	99.02	7.697	2.66	16.29	0.197	0.00	0.00
262.4	5.37	96.90	6.720	3.77	13.63	0.172	0.00	0.00
229.1	4.81	91.53	5.867	4.68	9.86	0.150	0.00	0.00
200.0	2.50	86.72	5.122	3.74	5.18	0.131	0.00	0.00
174.6	1.26	84.22	4.472	1.13	1.44	0.115	0.00	0.00
152.5	0.75	82.97	3.905	0.19	0.31	0.100	0.00	0.00
133.1	1.04	82.22	3.409	0.00	0.12	0.087	0.00	0.00
116.2	1.88	81.18	2.976	0.00	0.12	0.076	0.00	0.00
101.5	2.96	79.30	2.599	0.12	0.12	0.067	0.00	0.00
88.58	4.20	76.34	2.269	0.00	0.00	0.058	0.00	0.00
77.34	5.15	72.14	1.981	0.00	0.00	0.051	0.00	0.00
67.52	4.98	66.99	1.729	0.00	0.00	0.044	0.00	0.00
58.95	4.53	62.01	1.510	0.00	0.00	0.039	0.00	0.00
51.47	3.83	57.47	1.318	0.00	0.00	0.034	0.00	0.00
44.94	3.30	53.65	1.151	0.00	0.00	0.029	0.00	0.00
39.23	2.92	50.35	1.005	0.00	0.00	0.026	0.00	0.00
34.25	2.73	47.43	0.877	0.00	0.00	0.022	0.00	0.00
29.91	2.94	44.70	0.766	0.00	0.00			

Laser scattering particle size distribution analyzer

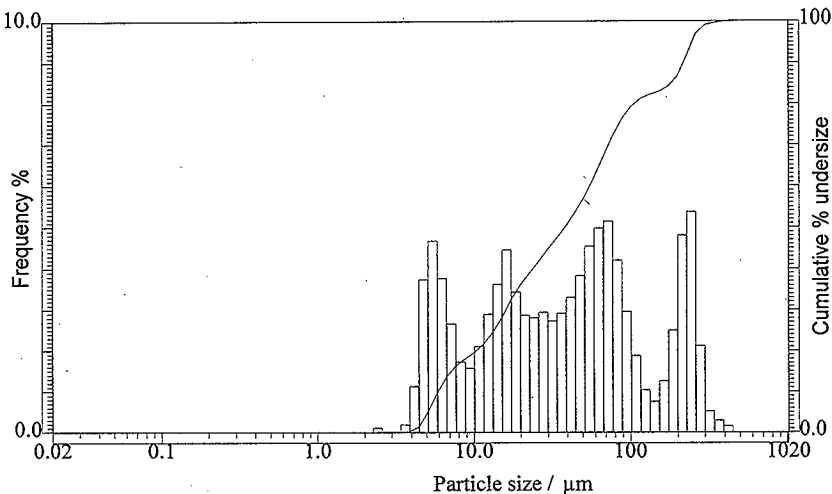
PARTICLE SIZE MEASUREMENT DATA

ID# : 980617-067 15:25 Material : Cement High Shear 4M HNO3
 Filename : 4M95CHSC Source : Mark Beck
 Sample : 4m95chs (composite) Lot Number :

Condition
 T%(He-Ne) : 81.4% Dist.Form: Sharp Sampling times : 100
 (LAMP) : 85.9% R.R.Index: 1.19-0.001 ()

Agitation : 5 Circuln : 7 U.sonic : ON(3)

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



Data

Memory	Hist.	Cum.	SAMPLE NAME	ID#	Median(μm)
Main			4m95chs (composite)	980617-067	38.603

HORIBA LA-910

Laser scattering particle size distribution analyzer

PARTICLE SIZE MEASUREMENT DATA

ID# : 980617-068 15:57
 Filename : 4m95cmsc
 Sample : 4m95cms (composed)
 Material : Cement Med Shear 4M HNO3
 Source : Mark Beck
 Lot Number :
 Test Number : 1
 Preparation :
 Disp. Medium :
 Disp. Steps :
 Verification :

Condition :
 T%(He-Ne) : 86.2% Dist.Form: Sharp Sampling times : 100
 (LAMP) : 87.8% R.R.Index: 1.19-0.001
 Agitation : 5 Circultrn : 7 U.sonic : ON(3)
 Format :
 Dist.base : Volume Scaling : Auto Axis : LogX - LinearY

Data :
 Median : 30.584µm SP.Area : 3305cm²/cm³ S.D. : 58.598µm
 Mode : 16.334µm Mean : 55.185µm
 C.V. : 106.18%

Span : (D 10.0-D 90.0) / D50 = 4.514

Dia. on % (10.0%) :	6.402µm	% on Dia.(0.100µm) :	0.0%
Dia. on % (20.0%) :	12.206µm	% on Dia.(1.000µm) :	0.0%
Dia. on % (30.0%) :	16.563µm	% on Dia.(10.000µm) :	16.2%
Dia. on % (80.0%) :	90.338µm	% on Dia.(30.000µm) :	49.5%
Dia. on % (90.0%) :	144.472µm	% on Dia.(200.000µm) :	95.8%

Size(µm)	Freq(%)	Und(%)	Size(µm)	Freq(%)	Und(%)	Size(µm)	Freq(%)	Und(%)
1019.5	0.00	100.00	26.11	4.02	45.50	0.669	0.00	0.00
890.1	0.00	100.00	22.80	4.60	41.48	0.584	0.00	0.00
777.1	0.00	100.00	19.90	4.93	36.89	0.510	0.00	0.00
678.5	0.00	100.00	17.38	5.55	31.96	0.445	0.00	0.00
592.4	0.00	100.00	15.17	4.44	26.41	0.389	0.00	0.00
517.2	0.00	100.00	13.25	3.28	21.98	0.339	0.00	0.00
451.6	0.00	100.00	11.56	2.33	18.70	0.296	0.00	0.00
394.2	0.00	100.00	10.10	1.66	16.37	0.259	0.00	0.00
344.2	0.17	100.00	8.816	1.59	14.70	0.226	0.00	0.00
300.5	0.31	99.83	7.697	2.14	13.11	0.197	0.00	0.00
262.4	1.28	99.51	6.720	2.72	10.97	0.172	0.00	0.00
229.1	2.40	98.24	5.867	3.24	8.25	0.150	0.00	0.00
200.0	2.62	95.84	5.122	3.04	5.01	0.131	0.00	0.00
174.6	2.39	93.21	4.472	1.37	1.98	0.115	0.00	0.00
152.5	2.07	90.82	3.905	0.36	0.61	0.100	0.00	0.00
133.1	2.50	88.75	3.409	0.14	0.25	0.087	0.00	0.00
116.2	3.13	86.25	2.976	0.00	0.11	0.076	0.00	0.00
101.5	3.65	83.12	2.599	0.11	0.11	0.067	0.00	0.00
88.58	4.03	79.47	2.269	0.00	0.00	0.058	0.00	0.00
77.34	4.21	75.45	1.981	0.00	0.00	0.051	0.00	0.00
67.52	3.98	71.24	1.729	0.00	0.00	0.044	0.00	0.00
58.95	3.90	67.25	1.510	0.00	0.00	0.039	0.00	0.00
51.47	3.69	63.35	1.318	0.00	0.00	0.034	0.00	0.00
44.94	3.46	59.66	1.151	0.00	0.00	0.029	0.00	0.00
39.23	3.30	56.20	1.005	0.00	0.00	0.026	0.00	0.00
34.25	3.47	52.90	0.877	0.00	0.00	0.022	0.00	0.00
29.91	3.93	49.43	0.766	0.00	0.00			

HORIBA LA-910

Laser scattering particle size distribution analyzer

PARTICLE SIZE MEASUREMENT DATA

ID# : 980617-068 15:57 Material : Cement Med Shear 4M HNO3
 Filename : 4m95cmssc Source : Mark Beck
 Sample : 4m95cms (composited) Lot Numbe :

Condition

T%(He-Ne): 86.2%
 (LAMP): 87.8%

Dist.Form: Sharp
 R.R.Index: 1.19-0.001 ()

Sampling times : 100

Agitation : 5

Circultrn

: 7

U.sonic

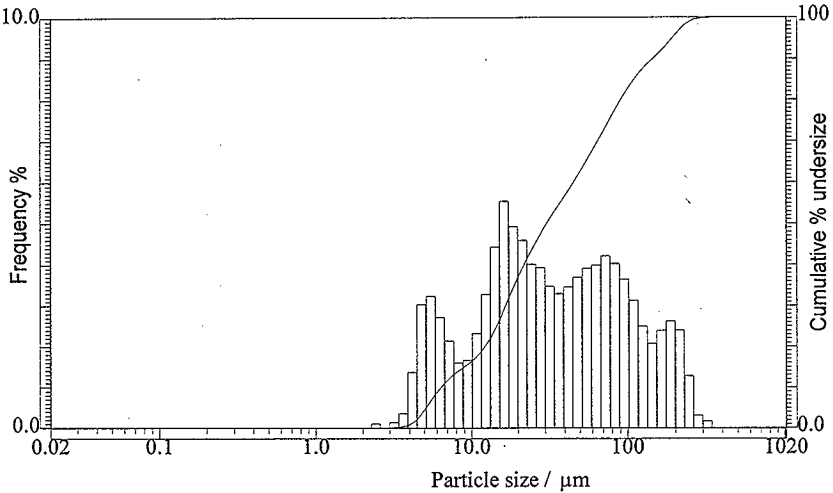
: ON(3)

Format

Dist.base : Volume

Scaling : Auto

Axis : LogX - LinearY

**Data**

Memory	Hist.	Cum.	SAMPLE NAME	ID#	Median(μm)
Main	☐	☒	4m95cms (composited)	980617-068	30.584

HORIBA LA-910

Laser scattering particle size distribution analyzer

PARTICLE SIZE MEASUREMENT DATA

ID# : 980617-062 09:56
 Filename : 8M45CHSD *no 6/1/98*
 Sample : 8m45c8 (dup)
 Material : Cement High Shear 8M HNO3
 Source : Mark Beck
 Lot Number :
 Test Number : 1
 Preparation :
 Disp. Medium :
 Disp. Steps :
 Verification :

Condition :
 T%(He-Ne): 83.2% Dist.Form: Sharp Sampling times : 100
 (LAMP): 86.9% R.R.Index: 1.19-0.001 ()
 Agitation : 5 Circultrn : 7 U.sonic : ON(3)
 Format :
 Dist.base : Volume Scaling : Auto Axis : LogX - LinearY

Data

Median : 53.595µm SP.Area : 2108cm²/cm³ S.D. : 62.363µm
 Mode : 72.395µm Mean : 70.760µm
 C.V. : 88.13%

Span : (D 10.0-D 90.0) / D50 = 2.788

Dia. on % (10.0%) :	12.339µm	% on Dia. (0.100µm) :	0.0%
Dia. on % (20.0%) :	21.357µm	% on Dia. (1.000µm) :	0.0%
Dia. on % (30.0%) :	31.464µm	% on Dia. (10.000µm) :	8.1%
Dia. on % (80.0%) :	104.846µm	% on Dia. (30.000µm) :	28.5%
Dia. on % (90.0%) :	161.738µm	% on Dia. (200.000µm) :	94.4%

Size(µm)	Freq(%)	Und(%)	Size(µm)	Freq(%)	Und(%)	Size(µm)	Freq(%)	Und(%)
1019.5	0.00	100.00	26.11	3.19	24.50	0.669	0.00	0.00
890.1	0.00	100.00	22.80	2.74	21.32	0.584	0.00	0.00
777.1	0.00	100.00	19.90	2.68	18.58	0.510	0.00	0.00
678.5	0.00	100.00	17.38	2.89	15.90	0.445	0.00	0.00
592.4	0.00	100.00	15.17	2.17	13.01	0.389	0.00	0.00
517.2	0.00	100.00	13.25	1.61	10.84	0.339	0.00	0.00
451.6	0.11	100.00	11.56	1.10	9.23	0.296	0.00	0.00
394.2	0.20	99.89	10.10	0.80	8.13	0.259	0.00	0.00
344.2	0.37	99.68	8.816	0.84	7.33	0.226	0.00	0.00
300.5	0.66	99.31	7.697	1.25	6.49	0.197	0.00	0.00
262.4	1.65	98.65	6.720	1.66	5.24	0.172	0.00	0.00
229.1	2.55	97.00	5.867	1.89	3.59	0.150	0.00	0.00
200.0	2.89	94.45	5.122	1.38	1.70	0.131	0.00	0.00
174.6	2.76	91.56	4.472	0.32	0.32	0.115	0.00	0.00
152.5	2.42	88.80	3.905	0.00	0.00	0.100	0.00	0.00
133.1	3.08	86.37	3.409	0.00	0.00	0.087	0.00	0.00
116.2	4.34	83.29	2.976	0.00	0.00	0.076	0.00	0.00
101.5	5.50	78.95	2.599	0.00	0.00	0.067	0.00	0.00
88.58	6.35	73.45	2.269	0.00	0.00	0.058	0.00	0.00
77.34	6.74	67.09	1.981	0.00	0.00	0.051	0.00	0.00
67.52	6.18	60.35	1.729	0.00	0.00	0.044	0.00	0.00
58.95	5.95	54.18	1.510	0.00	0.00	0.039	0.00	0.00
51.47	5.58	48.23	1.318	0.00	0.00	0.034	0.00	0.00
44.94	5.19	42.65	1.151	0.00	0.00	0.029	0.00	0.00
39.23	4.72	37.46	1.005	0.00	0.00	0.026	0.00	0.00
34.25	4.37	32.73	0.877	0.00	0.00	0.022	0.00	0.00
29.91	3.86	28.37	0.766	0.00	0.00			

HORIBA LA-910

Laser scattering particle size distribution analyzer

PARTICLE SIZE MEASUREMENT DATA

ID# : 980617-062 09:56

Material : Cement High Shear 8M HNO3

Filename : 8m45cls

Source : Mark Beck

Sample : 8m45cls (dup)

Lot Number :

Condition

T%(He-Ne): 83.2%

Dist.Form: Sharp

Sampling times : 100

(LAMP): 86.9%

R.R.Index: 1.19-0.001

()

Agitation : 5

Circuln

: 7

U.sonic

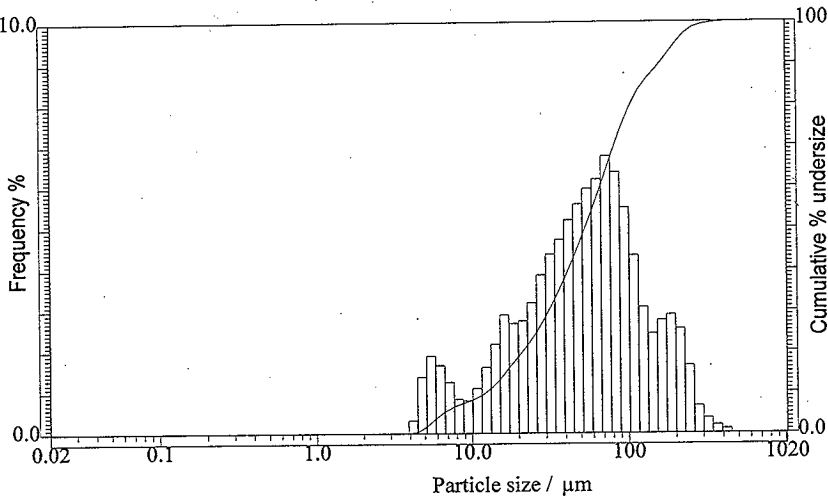
: ON(3)

Format

Dist.base : Volume

Scaling : Auto

Axis : LogX - LinearY



Data

Memory Hist.

Cum.

SAMPLE NAME

ID#

Median(μm)

Main



8m45cls (dup)

980617-062

53.595

HORIBA LA-910

Laser scattering particle size distribution analyzer

PARTICLE SIZE MEASUREMENT DATA

ID# : 980617-061 09:47
 Filename : 8M45CHS2 JFD 6/12/98
 Sample : 8m4506 (rerun2)
 Material : Cement High Shear 8M HNO3
 Source : Mark Beck
 Lot Number :
 Test Number : 1
 Preparation :
 Disp. Medium :
 Disp. Steps :
 Verification :

Condition :
 T%(He-Ne): 84.5% Dist.Form: Sharp Sampling times : 100
 (LAMP): 86.9% R.R.Index: 1.19-0.001 ()
 Agitation : 5 Circultn : 7 U.sonic : ON(3)

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

Data

Median : 52.881µm SP.Area : 2099cm²/cm³ S.D. : 62.945µm
 Mode : 72.004µm Mean : 70.318µm
 C.V. : 89.52%

Span : (D 10.0-D 90.0) / D50 = 2.793

Dia. on % (10.0%) :	12.616µm	% on Dia. (0.100µm) :	0.0%
Dia. on % (20.0%) :	21.738µm	% on Dia. (1.000µm) :	0.0%
Dia. on % (30.0%) :	31.925µm	% on Dia. (10.000µm) :	7.8%
Dia. on % (80.0%) :	101.632µm	% on Dia. (30.000µm) :	28.0%
Dia. on % (90.0%) :	160.314µm	% on Dia. (200.000µm) :	94.1%

Size(µm)	Freq(%)	Und(%)	Size(µm)	Freq(%)	Und(%)	Size(µm)	Freq(%)	Und(%)
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1019.5	0.00	100.00	26.11	3.12	24.08	0.669	0.00	0.00
890.1	0.00	100.00	22.80	2.73	20.96	0.584	0.00	0.00
777.1	0.00	100.00	19.90	2.64	18.23	0.510	0.00	0.00
678.5	0.00	100.00	17.38	2.83	15.58	0.445	0.00	0.00
592.4	0.00	100.00	15.17	2.18	12.75	0.389	0.00	0.00
517.2	0.00	100.00	13.25	1.58	10.57	0.339	0.00	0.00
451.6	0.12	100.00	11.56	1.09	8.99	0.296	0.00	0.00
394.2	0.21	99.88	10.10	0.78	7.90	0.259	0.00	0.00
344.2	0.38	99.67	8.816	0.80	7.12	0.226	0.00	0.00
300.5	0.93	99.28	7.697	1.16	6.32	0.197	0.00	0.00
262.4	1.83	98.35	6.720	1.54	5.16	0.172	0.00	0.00
229.1	2.47	96.52	5.867	1.80	3.62	0.150	0.00	0.00
200.0	2.55	94.05	5.122	1.43	1.81	0.131	0.00	0.00
174.6	2.40	91.51	4.472	0.39	0.39	0.115	0.00	0.00
152.5	2.21	89.11	3.905	0.00	0.00	0.100	0.00	0.00
133.1	2.90	86.90	3.409	0.00	0.00	0.087	0.00	0.00
116.2	4.05	84.00	2.976	0.00	0.00	0.076	0.00	0.00
101.5	5.21	79.95	2.599	0.00	0.00	0.067	0.00	0.00
88.58	6.18	74.74	2.269	0.00	0.00	0.058	0.00	0.00
77.34	6.82	68.57	1.981	0.00	0.00	0.051	0.00	0.00
67.52	6.54	61.75	1.729	0.00	0.00	0.044	0.00	0.00
58.95	6.50	55.21	1.510	0.00	0.00	0.039	0.00	0.00
51.47	6.10	48.71	1.318	0.00	0.00	0.034	0.00	0.00
44.94	5.51	42.60	1.151	0.00	0.00	0.029	0.00	0.00
39.23	4.83	37.09	1.005	0.00	0.00	0.026	0.00	0.00
34.25	4.36	32.26	0.877	0.00	0.00	0.022	0.00	0.00
29.91	3.82	27.90	0.766	0.00	0.00			

HORIBA LA-910

Laser scattering particle size distribution analyzer

PARTICLE SIZE MEASUREMENT DATA

ID# : 980617-061 09:47

Filename : 8M45CHS2

Sample : 8m45cls (rerun2)

Material : Cement High Shear 8M HNO3

Source : Mark Beck

Lot Number :

Condition :

T%(He-Ne): 84.5%

(LAMP): 86.9%

Dist.Form: Sharp

R.R.Index: 1.19-0.001

Sampling times : 100

()

Agitation : 5

Circultrn :

7

U.sonic :

ON(3)

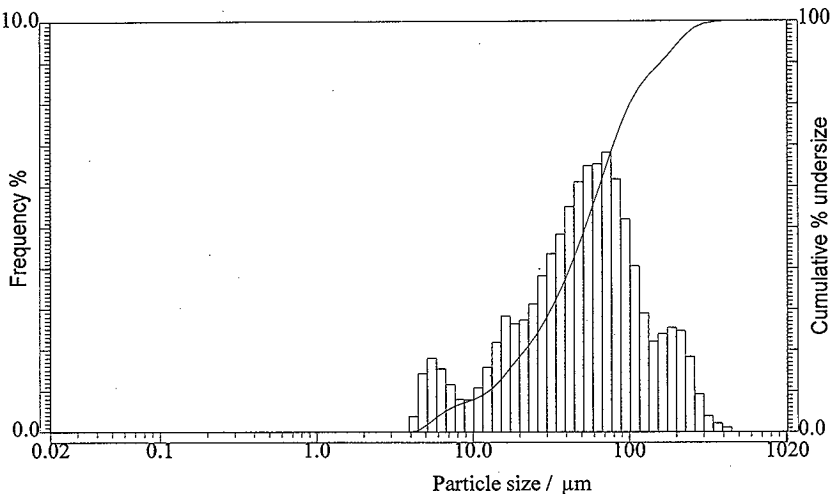
Format :

Dist.base : Volume

Scaling :

Auto

Axis : LogX - LinearY

**Data**

Memory Hist.	Cum.	SAMPLE NAME	ID#	Median(μm)
Main	☐	8m45cls (rerun2)	980617-061	52.881

HORIBA LA-910

Laser scattering particle size distribution analyzer

PARTICLE SIZE MEASUREMENT DATA

ID# : 980615-056 15:56
 Filename : 8M45CHSR
 Sample : 8m45chs (rerun)
 Material : Cement High Shear 8M HNO3
 Source : Mark Beck
 Lot Number :
 Test Number : 1
 Preparation :
 Disp. Medium :
 Disp. Steps :
 Verification :

Condition :
 T%(He-Ne): 80.9% Dist.Form: Sharp Sampling times : 100
 (LAMP): 86.8% R.R.Index: 1.19-0.001 ()
 Agitation : 5 Circulth : 7 U.Sonic : ON(3)

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

Data :
 Median : 39.590µm SP.Area : 2734cm²/cm³ S.D. : 19.868µm
 Mode : 55.826µm Mean : 37.666µm
 C.V. : 52.75%

Span : (D 10.0-D 90.0) / D50 = 1.365

Dia. on % (10.0%) :	9.056µm	% on Dia. (0.100µm) :	0.0%
Dia. on % (20.0%) :	16.550µm	% on Dia. (1.000µm) :	0.0%
Dia. on % (30.0%) :	22.866µm	% on Dia. (10.000µm) :	10.7%
Dia. on % (80.0%) :	57.472µm	% on Dia. (30.000µm) :	39.9%
Dia. on % (90.0%) :	63.091µm	% on Dia. (200.000µm) :	100.0%

Size(µm)	Freq(%)	Und(%)	Size(µm)	Freq(%)	Und(%)	Size(µm)	Freq(%)	Und(%)
1019.5	0.00	100.00	26.11	4.74	34.63	0.669	0.00	0.00
890.1	0.00	100.00	22.80	4.22	29.89	0.584	0.00	0.00
777.1	0.00	100.00	19.90	4.11	25.67	0.510	0.00	0.00
678.5	0.00	100.00	17.38	4.35	21.56	0.445	0.00	0.00
592.4	0.00	100.00	15.17	2.99	17.22	0.389	0.00	0.00
517.2	0.00	100.00	13.25	2.14	14.23	0.339	0.00	0.00
451.6	0.00	100.00	11.56	1.34	12.09	0.296	0.00	0.00
394.2	0.00	100.00	10.10	0.93	10.75	0.259	0.00	0.00
344.2	0.00	100.00	8.816	1.02	9.82	0.226	0.00	0.00
300.5	0.00	100.00	7.697	1.66	8.79	0.197	0.00	0.00
262.4	0.00	100.00	6.720	2.38	7.13	0.172	0.00	0.00
229.1	0.00	100.00	5.867	2.74	4.75	0.150	0.00	0.00
200.0	0.00	100.00	5.122	1.74	2.01	0.131	0.00	0.00
174.6	0.00	100.00	4.472	0.27	0.27	0.115	0.00	0.00
152.5	0.00	100.00	3.905	0.00	0.00	0.100	0.00	0.00
133.1	0.00	100.00	3.409	0.00	0.00	0.087	0.00	0.00
116.2	0.00	100.00	2.976	0.00	0.00	0.076	0.00	0.00
101.5	0.00	100.00	2.599	0.00	0.00	0.067	0.00	0.00
88.58	0.00	100.00	2.269	0.00	0.00	0.058	0.00	0.00
77.34	3.04	100.00	1.981	0.00	0.00	0.051	0.00	0.00
67.52	13.91	96.96	1.729	0.00	0.00	0.044	0.00	0.00
58.95	16.26	83.05	1.510	0.00	0.00	0.039	0.00	0.00
51.47	10.71	66.79	1.318	0.00	0.00	0.034	0.00	0.00
44.94	6.52	56.08	1.151	0.00	0.00	0.029	0.00	0.00
39.23	5.04	49.57	1.005	0.00	0.00	0.026	0.00	0.00
34.25	4.76	44.53	0.877	0.00	0.00	0.022	0.00	0.00
29.91	5.14	39.77	0.766	0.00	0.00			

HORIBA LA-910

Laser scattering particle size distribution analyzer

PARTICLE SIZE MEASUREMENT DATA

ID# : 980615-056 15:56

Filename : 8M45CHSR

Sample : 8m45chs (rerun)

Material : Cement High Shear 8M HNO3

Source : Mark Beck

Lot Number :

Condition

T%(He-Ne): 80.9%

(LAMP): 86.8%

Dist.Form: Sharp

R.R.Index: 1.19-0.001

Sampling times : 100

Agitation : 5

Circultrn

: 7

U.sonic

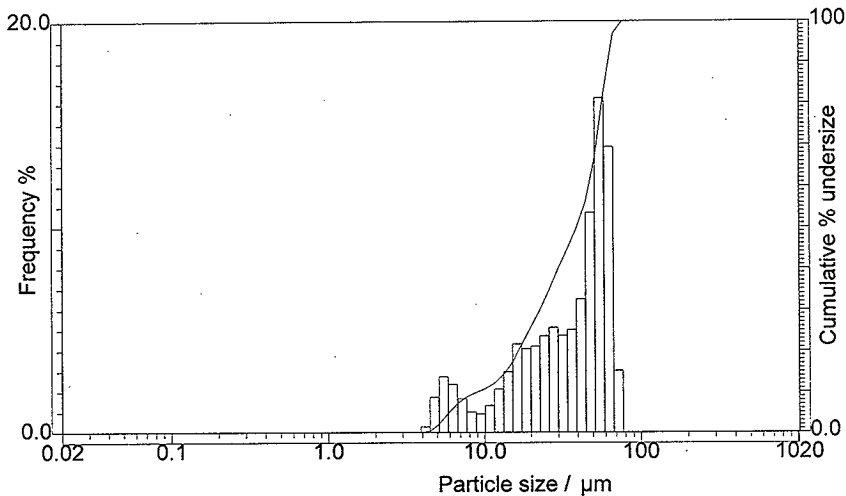
: ON(3)

Format

Dist.base : Volume

Scaling : Auto

Axis : LogX - LinearY

**Data**

Memory	Hist.	Cum.	SAMPLE NAME	ID#	Median(μm)
Main	☐	☒	8m45chs (rerun)	980615-056	39.590

HORIBA LA-910

Laser scattering particle size distribution analyzer

PARTICLE SIZE MEASUREMENT DATA

ID# : 980615-054 14:17
 Filename : 8M70CLS
 Sample : 8m70cls
 Material : Cement Low Shear 8M HNO3
 Source : Mark Beck
 Lot Number :
 Test Number : 1
 Preparation :
 Disp. Medium :
 Disp. Steps :
 Verification :

Condition :
 T%(He-Ne): 80.5% Dist.Form: Sharp Sampling times : 100
 (LAMP): 87.2% R.R.Index: 1.19-0.001 ()
 Agitation : 5 Circultrn : 7 U.sonic : ON(3)

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

Data :
 Median : 120.008 μ m SP.Area : 909cm²/cm³ S.D. : 104.495 μ m
 Mode : 213.337 μ m Mean : 147.384 μ m
 C.V. : 70.90%

Span : (D 10.0-D 90.0) / D50 = 2.231

Dia. on % (10.0%) :	33.404 μ m	% on Dia. (0.100 μ m) :	0.0%
Dia. on % (20.0%) :	54.847 μ m	% on Dia. (1.000 μ m) :	0.0%
Dia. on % (30.0%) :	76.047 μ m	% on Dia. (10.000 μ m) :	2.0%
Dia. on % (80.0%) :	236.623 μ m	% on Dia. (30.000 μ m) :	8.4%
Dia. on % (90.0%) :	301.108 μ m	% on Dia. (200.000 μ m) :	72.1%

Size(μ m)	Freq(%)	Und(%)	Size(μ m)	Freq(%)	Und(%)	Size(μ m)	Freq(%)	Und(%)
1019.5	0.00	100.00	26.11	1.06	6.93	0.669	0.00	0.00
890.1	0.00	100.00	22.80	0.87	5.87	0.584	0.00	0.00
777.1	0.00	100.00	19.90	0.68	5.00	0.510	0.00	0.00
678.5	0.00	100.00	17.38	0.73	4.32	0.445	0.00	0.00
592.4	0.27	100.00	15.17	0.55	3.59	0.389	0.00	0.00
517.2	0.48	99.73	13.25	0.56	3.04	0.339	0.00	0.00
451.6	1.43	99.25	11.56	0.43	2.49	0.296	0.00	0.00
394.2	3.20	97.82	10.10	0.37	2.06	0.259	0.00	0.00
344.2	4.69	94.62	8.816	0.43	1.68	0.226	0.00	0.00
300.5	5.38	89.93	7.697	0.60	1.25	0.197	0.00	0.00
262.4	5.98	84.55	6.720	0.47	0.85	0.172	0.00	0.00
229.1	6.45	78.57	5.867	0.18	0.18	0.150	0.00	0.00
200.0	6.29	72.12	5.122	0.00	0.00	0.131	0.00	0.00
174.6	5.93	65.83	4.472	0.00	0.00	0.115	0.00	0.00
152.5	5.31	59.90	3.905	0.00	0.00	0.100	0.00	0.00
133.1	6.01	54.59	3.409	0.00	0.00	0.087	0.00	0.00
116.2	6.25	48.57	2.976	0.00	0.00	0.076	0.00	0.00
101.5	6.11	42.32	2.599	0.00	0.00	0.067	0.00	0.00
88.58	5.61	36.21	2.269	0.00	0.00	0.058	0.00	0.00
77.34	4.87	30.60	1.981	0.00	0.00	0.051	0.00	0.00
67.52	3.91	25.74	1.729	0.00	0.00	0.044	0.00	0.00
58.95	3.43	21.83	1.510	0.00	0.00	0.039	0.00	0.00
51.47	3.16	18.39	1.318	0.00	0.00	0.034	0.00	0.00
44.94	2.68	15.24	1.151	0.00	0.00	0.029	0.00	0.00
39.23	2.19	12.55	1.005	0.00	0.00	0.026	0.00	0.00
34.25	1.96	10.36	0.877	0.00	0.00	0.022	0.00	0.00
29.91	1.47	8.40	0.766	0.00	0.00			

HORIBA LA-910

Laser scattering particle size distribution analyzer

PARTICLE SIZE MEASUREMENT DATA

ID# : 980615-054 14:17

Filename : 8M70CLS

Sample : 8m70cls

Material : Cement Low Shear 8M HNO3

Source : Mark Beck

Lot Number :

Condition

T%(He-Ne): 80.5%

(LAMP): 87.2%

Dist.Form: Sharp

R.R.Index: 1.19-0.001 (

Sampling times : 100

Agitation : 5

Circultrn

: 7

U.sonic

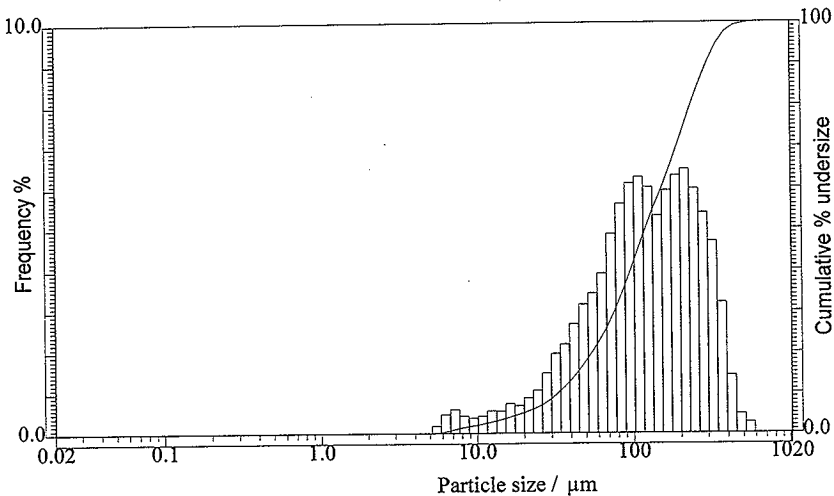
: ON(3)

Format

Dist.base : Volume

Scaling : Auto

Axis : LogX - LinearY

**Data**

Memory Hist.

Cum.

SAMPLE NAME

ID#

Median(μm)

Main



8m70cls

980615-054 120.008

HORIBA LA-910

Laser scattering particle size distribution analyzer

PARTICLE SIZE MEASUREMENT DATA

ID# : 980615-053 13:55
 Filename : 8M70CMS
 Sample : 8m70cms
 Material : Cement Med Shear 8M HNO3
 Source : Mark Beck
 Lot Number :
 Test Number : 1
 Preparation :
 Disp. Medium :
 Disp. Steps :
 Verification :

Condition : T%(He-Ne): 83.3% Dist.Form: Sharp Sampling times : 100
 (LAMP): 86.9% R.R.Index: 1.19-0.001
 Agitation : 5 Circulth : 7 U.sonic : ON(3)
 Format :
 Dist.base : Volume Scaling : Auto Axis : LogX - LinearY

Data
 Median : 50.362µm SP.Area : 2123cm²/cm³ S.D. : 85.009µm
 Mode : 211.639µm Mean : 88.136µm
 C.V. : 96.45%

Span : (D 10.0-D 90.0) / D50 = 4.205

Dia. on % (10.0%) :	11.915µm	% on Dia.(0.100µm) :	0.0%
Dia. on % (20.0%) :	19.120µm	% on Dia.(1.000µm) :	0.0%
Dia. on % (30.0%) :	27.798µm	% on Dia.(10.000µm) :	8.2%
Dia. on % (80.0%) :	180.717µm	% on Dia.(30.000µm) :	32.3%
Dia. on % (90.0%) :	223.691µm	% on Dia.(200.000µm) :	84.5%

Size(µm)	Freq(%)	Und(%)	Size(µm)	Freq(%)	Und(%)	Size(µm)	Freq(%)	Und(%)
1019.5	0.00	100.00	26.11	3.65	28.08	0.669	0.00	0.00
890.1	0.00	100.00	22.80	3.47	24.43	0.584	0.00	0.00
777.1	0.00	100.00	19.90	3.23	20.95	0.510	0.00	0.00
678.5	0.00	100.00	17.38	3.47	17.73	0.445	0.00	0.00
592.4	0.00	100.00	15.17	2.73	14.26	0.389	0.00	0.00
517.2	0.00	100.00	13.25	1.96	11.53	0.339	0.00	0.00
451.6	0.16	100.00	11.56	1.31	9.57	0.296	0.00	0.00
394.2	0.30	99.84	10.10	0.94	8.26	0.259	0.00	0.00
344.2	0.92	99.54	8.816	0.97	7.32	0.226	0.00	0.00
300.5	2.51	98.62	7.697	1.46	6.35	0.197	0.00	0.00
262.4	4.94	96.11	6.720	1.85	4.90	0.172	0.00	0.00
229.1	6.65	91.16	5.867	1.83	3.05	0.150	0.00	0.00
200.0	6.05	84.52	5.122	1.07	1.22	0.131	0.00	0.00
174.6	4.00	78.47	4.472	0.15	0.15	0.115	0.00	0.00
152.5	1.81	74.47	3.905	0.00	0.00	0.100	0.00	0.00
133.1	1.51	72.66	3.409	0.00	0.00	0.087	0.00	0.00
116.2	1.89	71.15	2.976	0.00	0.00	0.076	0.00	0.00
101.5	2.32	69.25	2.599	0.00	0.00	0.067	0.00	0.00
88.58	3.07	66.93	2.269	0.00	0.00	0.058	0.00	0.00
77.34	3.93	63.86	1.981	0.00	0.00	0.051	0.00	0.00
67.52	4.37	59.93	1.729	0.00	0.00	0.044	0.00	0.00
58.95	4.77	55.57	1.510	0.00	0.00	0.039	0.00	0.00
51.47	4.93	50.79	1.318	0.00	0.00	0.034	0.00	0.00
44.94	4.72	45.86	1.151	0.00	0.00	0.029	0.00	0.00
39.23	4.41	41.14	1.005	0.00	0.00	0.026	0.00	0.00
34.25	4.49	36.73	0.877	0.00	0.00	0.022	0.00	0.00
29.91	4.17	32.25	0.766	0.00	0.00			

HORIBA LA-910

Laser scattering particle size distribution analyzer

PARTICLE SIZE MEASUREMENT DATA

ID# : 980615-053 13:55

Filename : 8M70CMS

Sample : 8m70cms

Material : Cement Med Shear 8M HNO3

Source : Mark Beck

Lot Number :

Condition

T%(He-Ne): 83.3%

(LAMP): 86.9%

Dist.Form: Sharp

R.R.Index: 1.19-0.001

Sampling times : 100

()

Agitation : 5

Circultrn

: 7

U.sonic

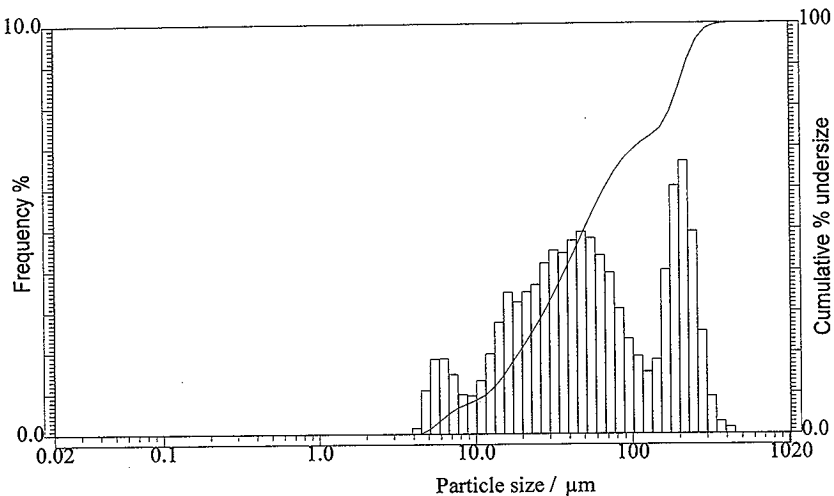
: ON(3)

Format

Dist.base : Volume

Scaling : Auto

Axis : LogX - LinearY

**Data**

Memory Hist.

Cum.

SAMPLE NAME

ID#

Median(μm)

Main



8m70cms

980615-053

50.362

HORIBA LA-910

Laser scattering particle size distribution analyzer

PARTICLE SIZE MEASUREMENT DATA

ID# : 980615-052 13:34
 Filename : 8M70CHS
 Sample : 8M70chs
 Material : Cement High Shear 8M HNO3
 Source : Mark Beck
 Lot Number :
 Test Number : 1
 Preparation :
 Disp. Medium :
 Disp. Steps :
 Verification :

Condition :
 T%(He-Ne): 77.6% Dist.Form: Sharp Sampling times : 100
 (LAMP): 81.2% R.R.Index: 1.19-0.00i ()
 Agitation : 5 Circultrn : 7 U.sonic : ON(3)
 Format :
 Dist.base : Volume Scaling : Auto Axis : LogX - LinearY

Data :
 Median : 34.823µm SP.Area : 3020cm²/cm³ S.D. : 35.045µm
 Mode : 55.142µm Mean : 44.045µm
 C.V. : 79.57%

Span : (D 10.0-D 90.0) / D50 = 2.419

Dia. on %(10.0%) :	6.951µm	% on Dia.(0.100µm) :	0.0%
Dia. on %(20.0%) :	14.410µm	% on Dia.(1.000µm) :	0.0%
Dia. on %(30.0%) :	19.942µm	% on Dia.(10.000µm) :	13.6%
Dia. on %(80.0%) :	70.556µm	% on Dia.(30.000µm) :	44.2%
Dia. on %(90.0%) :	91.189µm	% on Dia.(200.000µm) :	99.8%

Size(µm)	Freq(%)	Und(%)	Size(µm)	Freq(%)	Und(%)	Size(µm)	Freq(%)	Und(%)
1019.5	0.00	100.00	26.11	4.63	38.92	0.669	0.00	0.00
890.1	0.00	100.00	22.80	4.35	34.29	0.584	0.00	0.00
777.1	0.00	100.00	19.90	4.20	29.94	0.510	0.00	0.00
678.5	0.00	100.00	17.38	4.44	25.74	0.445	0.00	0.00
592.4	0.00	100.00	15.17	3.43	21.30	0.389	0.00	0.00
517.2	0.00	100.00	13.25	2.47	17.87	0.339	0.00	0.00
451.6	0.00	100.00	11.56	1.67	15.40	0.296	0.00	0.00
394.2	0.00	100.00	10.10	1.19	13.73	0.259	0.00	0.00
344.2	0.00	100.00	8.816	1.20	12.54	0.226	0.00	0.00
300.5	0.00	100.00	7.697	1.79	11.34	0.197	0.00	0.00
262.4	0.00	100.00	6.720	2.48	9.55	0.172	0.00	0.00
229.1	0.18	100.00	5.867	3.11	7.07	0.150	0.00	0.00
200.0	0.44	99.82	5.122	2.80	3.96	0.131	0.00	0.00
174.6	0.77	99.38	4.472	0.99	1.15	0.115	0.00	0.00
152.5	1.03	98.62	3.905	0.16	0.16	0.100	0.00	0.00
133.1	1.72	97.59	3.409	0.00	0.00	0.087	0.00	0.00
116.2	2.75	95.87	2.976	0.00	0.00	0.076	0.00	0.00
101.5	3.96	93.12	2.599	0.00	0.00	0.067	0.00	0.00
88.58	5.12	89.15	2.269	0.00	0.00	0.058	0.00	0.00
77.34	5.97	84.04	1.981	0.00	0.00	0.051	0.00	0.00
67.52	5.97	78.07	1.729	0.00	0.00	0.044	0.00	0.00
58.95	6.06	72.10	1.510	0.00	0.00	0.039	0.00	0.00
51.47	5.87	66.04	1.318	0.00	0.00	0.034	0.00	0.00
44.94	5.56	60.17	1.151	0.00	0.00	0.029	0.00	0.00
39.23	5.25	54.61	1.005	0.00	0.00	0.026	0.00	0.00
34.25	5.30	49.36	0.877	0.00	0.00	0.022	0.00	0.00
29.91	5.15	44.06	0.766	0.00	0.00			

HORIBA LA-910

Laser scattering particle size distribution analyzer

PARTICLE SIZE MEASUREMENT DATA

ID# : 980615-052 13:34

Filename : 8M70CHS

Sample : 8m70chs

Material

Source

Lot Number

Cement High Shear 8M HNO3

Mark Beck

Condition

T%(He-Ne): 77.6%

(LAMP): 81.2%

Dist.Form: Sharp

R.R.Index: 1.19-0.00i

Sampling times : 100

()

Agitation : 5

Circuitn : 7

U.sonic

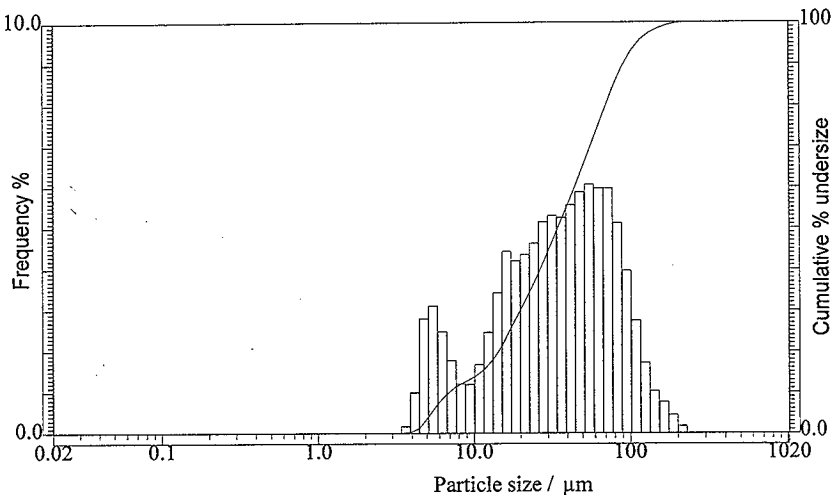
ON(3)

Format

Dist.base : Volume

Scaling : Auto

Axis : LogX - Lineary

**Data**

Memory Hist.	Cum.	SAMPLE NAME	ID#	Median(μm)
Main		8m70chs	980615-052	34.823

HORIBA LA-910

Laser scattering particle size distribution analyzer

PARTICLE SIZE MEASUREMENT DATA

ID# : 980615-051 11:18
 Filename : 8M95CLS
 Sample : 8m95cls
 Material : Cement Low Shear 8M HNO3
 Source : Mark Beck
 Lot Number :
 Test Number : 1
 Preparation :
 Disp. Medium :
 Disp. Steps :
 Verification :

Condition :
 T%(He-Ne): 85.1% Dist.Form: Sharp Sampling times : 100
 (LAMP): 89.7% R.R.Index: 1.19-0.001 ()
 Agitation : 5 Circulthn : 7 U.sonic : ON(3)

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

Data

Median : 130.715µm SP.Area : 904cm²/cm³ S.D. : 114.231µm
 Mode : 281.083µm Mean : 162.095µm
 C.V. : 70.47%

Span : (D 10.0-D 90.0) / D50 = 2.265

Dia. on % (10.0%) :	32.305µm	% on Dia. (0.100µm) :	0.0%
Dia. on % (20.0%) :	54.421µm	% on Dia. (1.000µm) :	0.0%
Dia. on % (30.0%) :	75.816µm	% on Dia. (10.000µm) :	2.1%
Dia. on % (80.0%) :	275.712µm	% on Dia. (30.000µm) :	8.9%
Dia. on % (90.0%) :	328.350µm	% on Dia. (200.000µm) :	63.4%

Size(µm)	Freq(%)	Und(%)	Size(µm)	Freq(%)	Und(%)	Size(µm)	Freq(%)	Und(%)
1019.5	0.00	100.00	26.11	1.16	7.36	0.669	0.00	0.00
890.1	0.00	100.00	22.80	0.96	6.21	0.584	0.00	0.00
777.1	0.00	100.00	19.90	0.78	5.24	0.510	0.00	0.00
678.5	0.00	100.00	17.38	0.81	4.47	0.445	0.00	0.00
592.4	0.20	100.00	15.17	0.59	3.66	0.389	0.00	0.00
517.2	0.36	99.80	13.25	0.54	3.07	0.339	0.00	0.00
451.6	1.82	99.44	11.56	0.40	2.53	0.296	0.00	0.00
394.2	5.00	97.62	10.10	0.34	2.13	0.259	0.00	0.00
344.2	7.55	92.62	8.816	0.39	1.79	0.226	0.00	0.00
300.5	8.00	85.07	7.697	0.56	1.40	0.197	0.00	0.00
262.4	7.43	77.08	6.720	0.54	0.84	0.172	0.00	0.00
229.1	6.30	69.65	5.867	0.30	0.30	0.150	0.00	0.00
200.0	5.03	63.36	5.122	0.00	0.00	0.131	0.00	0.00
174.6	4.21	58.33	4.472	0.00	0.00	0.115	0.00	0.00
152.5	3.55	54.11	3.905	0.00	0.00	0.100	0.00	0.00
133.1	4.22	50.56	3.409	0.00	0.00	0.087	0.00	0.00
116.2	4.98	46.34	2.976	0.00	0.00	0.076	0.00	0.00
101.5	5.36	41.36	2.599	0.00	0.00	0.067	0.00	0.00
88.58	5.30	36.00	2.269	0.00	0.00	0.058	0.00	0.00
77.34	4.81	30.71	1.981	0.00	0.00	0.051	0.00	0.00
67.52	3.90	25.89	1.729	0.00	0.00	0.044	0.00	0.00
58.95	3.38	21.99	1.510	0.00	0.00	0.039	0.00	0.00
51.47	3.02	18.61	1.318	0.00	0.00	0.034	0.00	0.00
44.94	2.59	15.59	1.151	0.00	0.00	0.029	0.00	0.00
39.23	2.16	13.00	1.005	0.00	0.00	0.026	0.00	0.00
34.25	1.94	10.84	0.877	0.00	0.00	0.022	0.00	0.00
29.91	1.53	8.90	0.766	0.00	0.00			

HORIBA LA-910

Laser scattering particle size distribution analyzer

PARTICLE SIZE MEASUREMENT DATA

ID# : 980615-051 11:18

Filename : 8M95CLS

Sample : 8m95cls

Material

: Cement Low Shear 8M HNO3

Source

: Mark Beck

Lot Number

:

Condition

T%(He-Ne): 85.1%

(LAMP): 89.7%

Dist.Form: Sharp

R.R.Index: 1.19-0.001

Sampling times : 100

()

Agitation : 5

Circultrn

: 7

U.sonic

: ON(3)

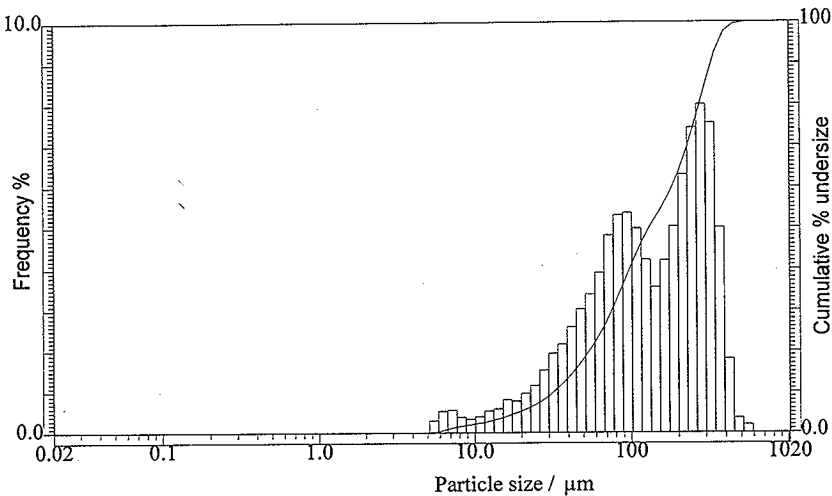
Format

Dist.base : Volume

Scaling

: Auto

Axis : LogX - LinearY

**Data**

Memory Hist.

Cum.

SAMPLE NAME

ID#

Median(μm)

Main



—

8m95cls

980615-051

130.715

HORIBA LA-910

Laser scattering particle size distribution analyzer

PARTICLE SIZE MEASUREMENT DATA

ID# : 980615-050 11:06
 Filename : 8M95CMS
 Sample : 8m95cms
 Material : Cement Med Shear 8M HNO3
 Source : Mark Beck
 Lot Number :
 Test Number : 1
 Preparation :
 Disp. Medium :
 Disp. Steps :
 Verification :

Condition :
 T%(He-Ne): 84.0% Dist.Form: Sharp Sampling times : 100
 (LAMP): 86.9% R.R.Index: 1.19-0.001 ()
 Agitation : 5 Circultrn : 7 U.Sonic : ON(3)

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

Data :
 Median : 5.628µm SP.Area : 1952cm²/cm³ S.D. : 5.667µm
 Mode : 5.349µm Mean : 7.190µm
 C.V. : 78.82%

Span : (D 10.0-D 90.0) / D50 = 1.219

Dia. on % (10.0%) :	4.547µm	% on Dia. (0.100µm) :	0.0%
Dia. on % (20.0%) :	4.797µm	% on Dia. (1.000µm) :	0.0%
Dia. on % (30.0%) :	5.062µm	% on Dia. (10.000µm) :	87.9%
Dia. on % (80.0%) :	7.435µm	% on Dia. (30.000µm) :	99.0%
Dia. on % (90.0%) :	11.405µm	% on Dia. (200.000µm) :	100.0%

Size(µm)	Freq(%)	Und(%)	Size(µm)	Freq(%)	Und(%)	Size(µm)	Freq(%)	Und(%)
1019.5	0.00	100.00	26.11	0.60	98.48	0.669	0.00	0.00
890.1	0.00	100.00	22.80	0.82	97.88	0.584	0.00	0.00
777.1	0.00	100.00	19.90	1.11	97.07	0.510	0.00	0.00
678.5	0.00	100.00	17.38	1.71	95.95	0.445	0.00	0.00
592.4	0.00	100.00	15.17	1.91	94.24	0.389	0.00	0.00
517.2	0.00	100.00	13.25	2.11	92.33	0.339	0.00	0.00
451.6	0.00	100.00	11.56	2.14	90.22	0.296	0.00	0.00
394.2	0.00	100.00	10.10	2.33	88.08	0.259	0.00	0.00
344.2	0.00	100.00	8.816	3.65	85.75	0.226	0.00	0.00
300.5	0.00	100.00	7.697	8.22	82.10	0.197	0.00	0.00
262.4	0.00	100.00	6.720	16.04	73.88	0.172	0.00	0.00
229.1	0.00	100.00	5.867	25.62	57.84	0.150	0.00	0.00
200.0	0.00	100.00	5.122	25.30	32.22	0.131	0.00	0.00
174.6	0.00	100.00	4.472	6.93	6.93	0.115	0.00	0.00
152.5	0.00	100.00	3.905	0.00	0.00	0.100	0.00	0.00
133.1	0.00	100.00	3.409	0.00	0.00	0.087	0.00	0.00
116.2	0.01	99.99	2.976	0.00	0.00	0.076	0.00	0.00
101.5	0.01	99.98	2.599	0.00	0.00	0.067	0.00	0.00
88.58	0.02	99.97	2.269	0.00	0.00	0.058	0.00	0.00
77.34	0.03	99.94	1.981	0.00	0.00	0.051	0.00	0.00
67.52	0.05	99.91	1.729	0.00	0.00	0.044	0.00	0.00
58.95	0.07	99.86	1.510	0.00	0.00	0.039	0.00	0.00
51.47	0.11	99.79	1.316	0.00	0.00	0.034	0.00	0.00
44.94	0.16	99.68	1.151	0.00	0.00	0.029	0.00	0.00
39.23	0.23	99.52	1.005	0.00	0.00	0.026	0.00	0.00
34.25	0.34	99.29	0.877	0.00	0.00	0.022	0.00	0.00
29.91	0.47	98.95	0.766	0.00	0.00			

HORIBA LA-910

Laser scattering particle size distribution analyzer

PARTICLE SIZE MEASUREMENT DATA

ID# : 980615-050 11:06

Filename : 8M95CMS

Sample : 8m95cms

Material : Cement Med Shear 8M HNO3

Source : Mark Beck

Lot Number :

Condition

T%(He-Ne): 84.0%

(LAMP): 86.9%

Dist.Form: Sharp

R.R.index: 1.19-0.001

Sampling times : 100

()

Agitation : 5

Circultrn :

7

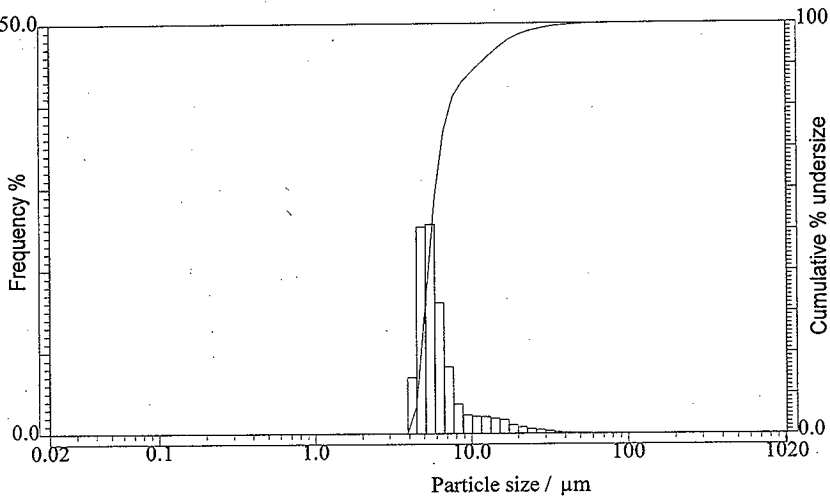
U.sonic : ON(3)

Format

Dist.base : Number

Scaling : Auto

Axis : LogX - LinearY

**Data**

Memory Hist.	Cum.	SAMPLE NAME	ID#	Median(μm)
Main		8m95cms	980615-050	5.628

HORIBA LA-910

Laser scattering particle size distribution analyzer

PARTICLE SIZE MEASUREMENT DATA

ID# : 980615-050 11:06
 Filename : 8M95CMS
 Sample : 8m95cms
 Material : Cement Med Shear 8M HNO3
 Source : Mark Beck
 Lot Number :
 Test Number : 1
 Preparation :
 Disp. Medium :
 Disp. Steps :
 Verification :

Condition :
 T%(He-Ne): 84.0% Dist. Form: Sharp Sampling times : 100
 (LAMP): 86.9% R.R. Index: 1.19-0.001 ()
 Agitation : 5 Circuln : 7 U. sonic : ON(3)
 Format :
 Dist. base : Volume Scaling : Auto Axis : LogX - LinearY

Data :
 Median : 57.699µm SP. Area : 1952cm²/cm³ S.D. : 73.430µm
 Mode : 210.874µm Mean : 84.810µm
 C.V. : 86.58%

Span : (D 10.0-D 90.0) / D50 = 3.377

Dia. on % (10.0%) :	13.428µm	% on Dia. (0.100µm) :	0.0%
Dia. on % (20.0%) :	22.214µm	% on Dia. (1.000µm) :	0.0%
Dia. on % (30.0%) :	31.907µm	% on Dia. (10.000µm) :	7.1%
Dia. on % (80.0%) :	160.828µm	% on Dia. (30.000µm) :	28.0%
Dia. on % (90.0%) :	208.259µm	% on Dia. (200.000µm) :	87.7%

Size(µm)	Freq(%)	Und(%)	Size(µm)	Freq(%)	Und(%)	Size(µm)	Freq(%)	Und(%)
1019.5	0.00	100.00	26.11	3.39	23.97	0.669	0.00	0.00
890.1	0.00	100.00	22.80	3.06	20.59	0.584	0.00	0.00
777.1	0.00	100.00	19.90	2.77	17.52	0.510	0.00	0.00
678.5	0.00	100.00	17.38	2.84	14.75	0.445	0.00	0.00
592.4	0.00	100.00	15.17	2.12	11.90	0.389	0.00	0.00
517.2	0.00	100.00	13.25	1.55	9.79	0.339	0.00	0.00
451.6	0.00	100.00	11.56	1.05	8.24	0.296	0.00	0.00
394.2	0.14	100.00	10.10	0.76	7.19	0.259	0.00	0.00
344.2	0.25	99.86	8.816	0.79	6.43	0.226	0.00	0.00
300.5	0.45	99.61	7.697	1.19	5.64	0.197	0.00	0.00
262.4	3.84	99.16	6.720	1.54	4.45	0.172	0.00	0.00
229.1	7.58	95.32	5.867	1.64	2.91	0.150	0.00	0.00
200.0	5.51	87.74	5.122	1.08	1.27	0.131	0.00	0.00
174.6	3.68	82.23	4.472	0.20	0.20	0.115	0.00	0.00
152.5	2.50	78.55	3.905	0.00	0.00	0.100	0.00	0.00
133.1	3.03	76.05	3.409	0.00	0.00	0.087	0.00	0.00
116.2	3.78	73.01	2.976	0.00	0.00	0.076	0.00	0.00
101.5	4.26	69.23	2.599	0.00	0.00	0.067	0.00	0.00
88.58	4.66	64.97	2.269	0.00	0.00	0.058	0.00	0.00
77.34	4.87	60.31	1.981	0.00	0.00	0.051	0.00	0.00
67.52	4.68	55.44	1.729	0.00	0.00	0.044	0.00	0.00
58.95	4.77	50.76	1.510	0.00	0.00	0.039	0.00	0.00
51.47	4.78	45.99	1.318	0.00	0.00	0.034	0.00	0.00
44.94	4.60	41.21	1.151	0.00	0.00	0.029	0.00	0.00
39.23	4.34	36.61	1.005	0.00	0.00	0.026	0.00	0.00
34.25	4.33	32.26	0.877	0.00	0.00	0.022	0.00	0.00
29.91	3.96	27.94	0.766	0.00	0.00			

HORIBA LA-910

Laser scattering particle size distribution analyzer

PARTICLE SIZE MEASUREMENT DATA

ID# : 980615-050 11:06

Filename : 8M95CMS

Sample : 8m95cms

Material : Cement Med Shear 8M HNO3

Source : Mark Beck

Lot Number :

Condition

T%(He-Ne): 84.0%

(LAMP): 86.9%

Dist.Form: Sharp

R.R.Index: 1.19-0.001 (

Sampling times : 100

Agitation : 5

Circulth :

: 7

U.sonic

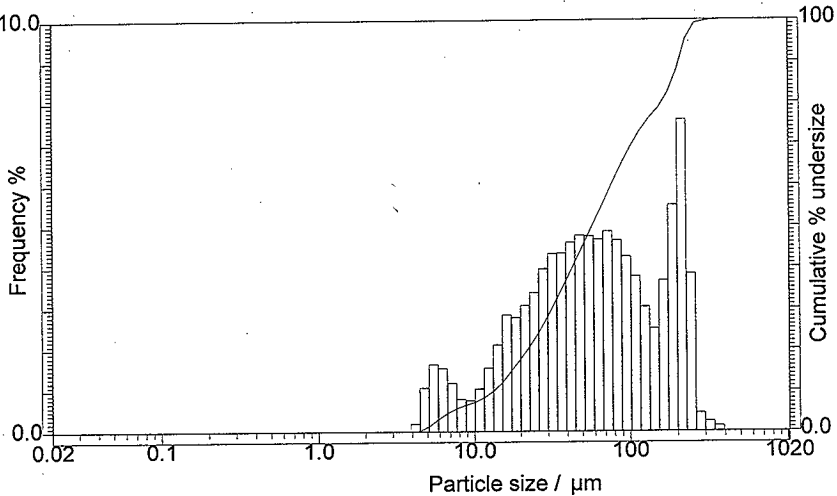
: ON(3)

Format

Dist.base : Volume

Scaling : Auto

Axis : LogX - LinearY

**Data**

Memory Hist.	Cum.	SAMPLE NAME	ID#	Median(μm)
Main	☐	8m95cms	980615-050	57.699

HORIBA LA-910

Laser scattering particle size distribution analyzer

PARTICLE SIZE MEASUREMENT DATA

ID# : 980615-049 10:49
 Filename : 8M95CHS
 Sample : 8m95chs
 Material : Cement High Shear 8M HNO3
 Source : Mark Beck
 Lot Number :
 Test Number : 1
 Preparation :
 Disp. Medium :
 Disp. Steps :
 Verification :

Condition :
 T%(He-Ne): 82.7% Dist.Form: Sharp Sampling times : 100
 (LAMP): 84.9% R.R.Index: 1.19-0.001 ()
 Agitation : 5 Circultrn : 7 U.sonic : ON(3)

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

Data :
 Median : 45.911µm SP.Area : 2523cm²/cm³ S.D. : 51.891µm
 Mode : 54.939µm Mean : 60.563µm
 C.V. : 85.68%

Span : (D 10.0-D 90.0) / D50 = 2.816

Dia. on %(10.0%) :	9.401µm	% on Dia.(0.100µm) :	0.0%
Dia. on %(20.0%) :	17.327µm	% on Dia.(1.000µm) :	0.0%
Dia. on %(30.0%) :	26.256µm	% on Dia.(10.000µm) :	10.4%
Dia. on %(80.0%) :	94.381µm	% on Dia.(30.000µm) :	34.0%
Dia. on %(90.0%) :	138.690µm	% on Dia.(200.000µm) :	97.4%

Size(µm)	Freq(%)	Und(%)	Size(µm)	Freq(%)	Und(%)	Size(µm)	Freq(%)	Und(%)
1019.5	0.00	100.00	26.11	3.44	29.83	0.669	0.00	0.00
890.1	0.00	100.00	22.80	3.08	26.39	0.584	0.00	0.00
777.1	0.00	100.00	19.90	3.24	23.31	0.510	0.00	0.00
678.5	0.00	100.00	17.38	3.55	20.08	0.445	0.00	0.00
592.4	0.00	100.00	15.17	2.77	16.53	0.389	0.00	0.00
517.2	0.00	100.00	13.25	1.94	13.76	0.339	0.00	0.00
451.6	0.00	100.00	11.56	1.33	11.82	0.296	0.00	0.00
394.2	0.00	100.00	10.10	0.93	10.49	0.259	0.00	0.00
344.2	0.00	100.00	8.816	0.90	9.56	0.226	0.00	0.00
300.5	0.00	100.00	7.697	1.24	8.66	0.197	0.00	0.00
262.4	0.57	100.00	6.720	1.65	7.43	0.172	0.00	0.00
229.1	2.01	99.43	5.867	2.15	5.77	0.150	0.00	0.00
200.0	2.84	97.42	5.122	2.17	3.63	0.131	0.00	0.00
174.6	2.85	94.58	4.472	1.06	1.46	0.115	0.00	0.00
152.5	2.48	91.73	3.905	0.28	0.40	0.100	0.00	0.00
133.1	3.02	89.25	3.409	0.12	0.12	0.087	0.00	0.00
116.2	3.83	86.23	2.976	0.00	0.00	0.076	0.00	0.00
101.5	4.50	82.40	2.599	0.00	0.00	0.067	0.00	0.00
88.58	5.11	77.90	2.269	0.00	0.00	0.058	0.00	0.00
77.34	5.69	72.79	1.981	0.00	0.00	0.051	0.00	0.00
67.52	5.81	67.09	1.729	0.00	0.00	0.044	0.00	0.00
58.95	6.19	61.28	1.510	0.00	0.00	0.039	0.00	0.00
51.47	6.05	55.10	1.318	0.00	0.00	0.034	0.00	0.00
44.94	5.62	49.05	1.151	0.00	0.00	0.029	0.00	0.00
39.23	5.01	43.42	1.005	0.00	0.00	0.026	0.00	0.00
34.25	4.47	38.41	0.877	0.00	0.00	0.022	0.00	0.00
29.91	4.10	33.94	0.766	0.00	0.00			

HORIBA LA-910

Laser scattering particle size distribution analyzer

PARTICLE SIZE MEASUREMENT DATA

ID# : 980615-049 10:49

Filename : 8M95CHS

Sample : 8m95chs

Material

: Cement High Shear 8M HNO3

Source

: Mark Beck

Lot Number

Condition

T%(He-Ne): 82.7%

Dist.Form: Sharp

Sampling times : 100

(LAMP): 84.9%

R.R.Index: 1.19-0.001

Agitation : 5

Circultrn : 7

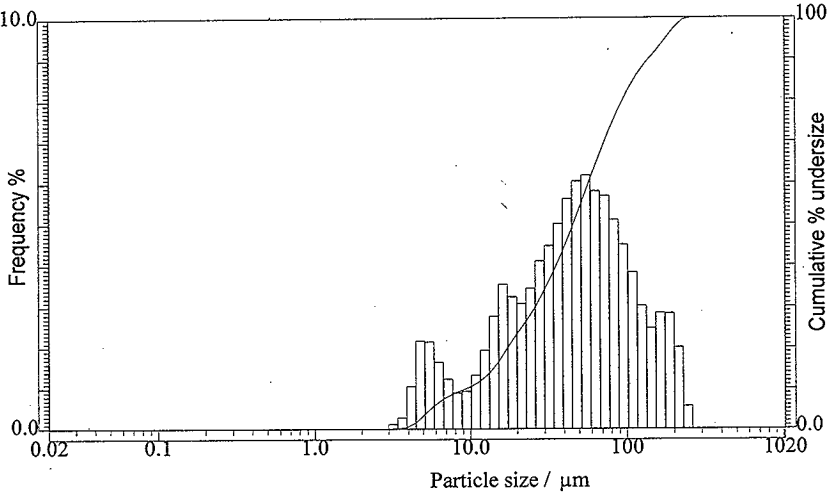
U.sonic : ON(3)

Format

Dist.base : Volume

Scaling : Auto

Axis : LogX - LinearY



Data

Memory Hist.

Cum.

SAMPLE NAME

ID#

Median(μm)

Main



8m95chs

980615-049 45.911

HORIBA LA-910

Laser scattering particle size distribution analyzer

PARTICLE SIZE MEASUREMENT DATA

ID# : 980610-041 09:48
 Filename : DTOM 10M
 Sample : diatom 10M Nitric
 Material : diatomaceous earth
 Source : Mark Beck
 Lot Number :
 Test Number : 1
 Preparation :
 Disp. Medium :
 Disp. Steps :
 Verification :

Condition
 T%(He-Ne): 84.2% Dist.Form: Sharp Sampling times : 100
 (LAMP): 88.4% R.R.Index: 1.19-0.00i
 Agitation : 3 Circulthn : 3 U.Sonic : ON(3)

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

Data
 Median : 31.494µm SP.Area : 2930cm²/cm³ S.D. : 21.033µm
 Mode : 54.731µm Mean : 35.004µm
 C.V. : 60.09%

Span : (D 10.0-D 90.0) / D50 = 1.784

Dia. on % (10.0%) :	9.372µm	% on Dia. (0.100µm) :	0.0%
Dia. on % (20.0%) :	15.447µm	% on Dia. (1.000µm) :	0.0%
Dia. on % (30.0%) :	19.918µm	% on Dia. (10.000µm) :	10.7%
Dia. on % (80.0%) :	54.701µm	% on Dia. (30.000µm) :	47.6%
Dia. on % (90.0%) :	65.572µm	% on Dia. (200.000µm) :	100.0%

Size(µm)	Freq(%)	Und(%)	Size(µm)	Freq(%)	Und(%)	Size(µm)	Freq(%)	Und(%)
1019.5	0.00	100.00	26.11	5.77	40.93	0.669	0.00	0.00
890.1	0.00	100.00	22.80	5.19	35.17	0.584	0.00	0.00
777.1	0.00	100.00	19.90	5.39	29.97	0.510	0.00	0.00
678.5	0.00	100.00	17.38	5.28	24.58	0.445	0.00	0.00
592.4	0.00	100.00	15.17	3.59	19.30	0.389	0.00	0.00
517.2	0.00	100.00	13.25	2.86	15.71	0.339	0.00	0.00
451.6	0.00	100.00	11.56	2.04	12.85	0.296	0.00	0.00
394.2	0.00	100.00	10.10	1.49	10.82	0.259	0.00	0.00
344.2	0.00	100.00	8.816	1.38	9.33	0.226	0.00	0.00
300.5	0.00	100.00	7.697	1.61	7.95	0.197	0.00	0.00
262.4	0.00	100.00	6.720	1.77	6.35	0.172	0.00	0.00
229.1	0.00	100.00	5.867	1.91	4.58	0.150	0.00	0.00
200.0	0.00	100.00	5.122	1.65	2.67	0.131	0.00	0.00
174.6	0.00	100.00	4.472	0.80	1.02	0.115	0.00	0.00
152.5	0.00	100.00	3.905	0.22	0.22	0.100	0.00	0.00
133.1	0.00	100.00	3.409	0.00	0.00	0.087	0.00	0.00
116.2	0.00	100.00	2.976	0.00	0.00	0.076	0.00	0.00
101.5	0.60	100.00	2.599	0.00	0.00	0.067	0.00	0.00
88.58	2.53	99.40	2.269	0.00	0.00	0.058	0.00	0.00
77.34	5.35	96.87	1.981	0.00	0.00	0.051	0.00	0.00
67.52	7.06	91.53	1.729	0.00	0.00	0.044	0.00	0.00
58.95	8.09	84.46	1.510	0.00	0.00	0.039	0.00	0.00
51.47	7.83	76.37	1.318	0.00	0.00	0.034	0.00	0.00
44.94	7.44	68.54	1.151	0.00	0.00	0.029	0.00	0.00
39.23	6.97	61.10	1.005	0.00	0.00	0.026	0.00	0.00
34.25	6.67	54.13	0.877	0.00	0.00	0.022	0.00	0.00
29.91	6.53	47.46	0.766	0.00	0.00			

HORIBA LA-910

Laser scattering particle size distribution analyzer

PARTICLE SIZE MEASUREMENT DATA

ID# : 980610-041 09:48

Material : diatomaceous earth

Filename : DTOM 10M

Source : Mark Beck

Sample : diatom 10M Nitric

Lot Number :

Condition

T%(He-Ne): 84.2%

Dist.Form: Sharp

Sampling times : 100

(LAMP): 88.4%

R.R.Index: 1.19-0.001

Agitation : 3

Circulth : 3

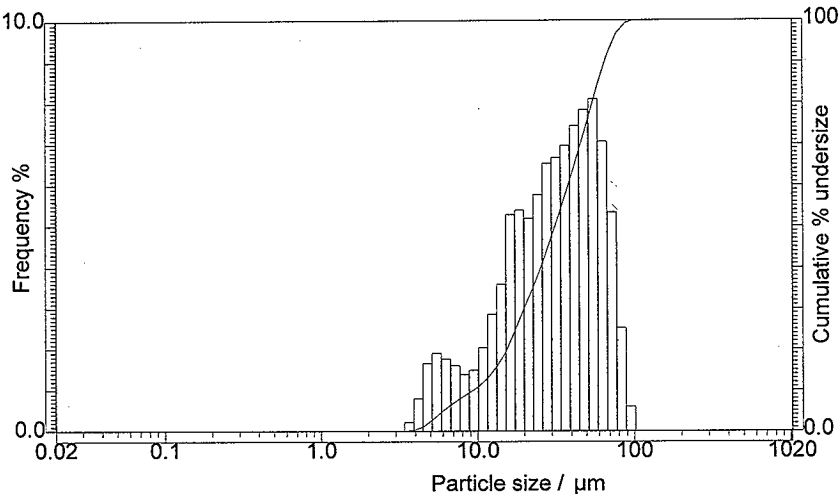
U.sonic : ON(3)

Format

Dist.base : Volume

Scaling : Auto

Axis : LogX - LinearY

**Data**

Memory Hist.	Cum.	SAMPLE NAME	ID#	Median(μm)
Main	☐	diatom 10M Nitric	980610-041	31.494

HORIBA LA-910

Laser scattering particle size distribution analyzer

PARTICLE SIZE MEASUREMENT DATA

ID# : 980610-045 14:15
 Filename : DTOM0610
 Sample : Diatomaceous Earth (orig)
 Material : diatomaceous earth (sm vol)
 Source : Mark Beck
 Lot Number :
 Test Number : 1
 Preparation :
 Disp. Medium :
 Disp. Steps :
 Verification :

Condition :
 T%(He-Ne): 80.8% Dist.Form: Sharp Sampling times : 100
 (LAMP): 86.7% R.R.Index: 1.15-0.001
 Agitation : 3 Circultrn : 3 U.sonic : ON(3)
 Format :
 Dist.base : Volume Scaling : Auto Axis : LogX - LinearY

Data :
 Median : 33.543µm SP.Area : 2673cm²/cm³ S.D. : 62.687µm
 Mode : 41.955µm Mean : 51.029µm
 C.V. : 122.85%

Span : (D 10.0-D 90.0) / D50 = 2.328

Dia. on % (10.0%) :	10.687µm	% on Dia. (0.100µm) :	0.0%
Dia. on % (20.0%) :	16.409µm	% on Dia. (1.000µm) :	0.0%
Dia. on % (30.0%) :	21.439µm	% on Dia. (10.000µm) :	9.1%
Dia. on % (80.0%) :	61.612µm	% on Dia. (30.000µm) :	44.6%
Dia. on % (90.0%) :	88.766µm	% on Dia. (200.000µm) :	94.9%

Size(µm)	Freq(%)	Und(%)	Size(µm)	Freq(%)	Und(%)	Size(µm)	Freq(%)	Und(%)
1019.5	0.00	100.00	26.11	5.78	38.02	0.669	0.00	0.00
890.1	0.00	100.00	22.80	4.93	32.23	0.584	0.00	0.00
777.1	0.00	100.00	19.90	5.17	27.30	0.510	0.00	0.00
678.5	0.00	100.00	17.38	5.05	22.13	0.445	0.00	0.00
592.4	0.00	100.00	15.17	3.29	17.08	0.389	0.00	0.00
517.2	0.13	100.00	13.25	2.67	13.80	0.339	0.00	0.00
451.6	0.23	99.87	11.56	1.94	11.13	0.296	0.00	0.00
394.2	0.42	99.64	10.10	1.42	9.19	0.259	0.00	0.00
344.2	0.75	99.23	8.816	1.27	7.77	0.226	0.00	0.00
300.5	1.35	98.48	7.697	1.38	6.50	0.197	0.00	0.00
262.4	1.31	97.13	6.720	1.41	5.12	0.172	0.00	0.00
229.1	0.95	95.82	5.867	1.49	3.70	0.150	0.00	0.00
200.0	0.66	94.88	5.122	1.30	2.21	0.131	0.00	0.00
174.6	0.51	94.21	4.472	0.70	0.91	0.115	0.00	0.00
152.5	0.44	93.70	3.905	0.22	0.22	0.100	0.00	0.00
133.1	0.61	93.26	3.409	0.00	0.00	0.087	0.00	0.00
116.2	1.03	92.65	2.976	0.00	0.00	0.076	0.00	0.00
101.5	1.65	91.62	2.599	0.00	0.00	0.067	0.00	0.00
88.58	2.59	89.97	2.269	0.00	0.00	0.058	0.00	0.00
77.34	3.96	87.39	1.981	0.00	0.00	0.051	0.00	0.00
67.52	5.08	83.43	1.729	0.00	0.00	0.044	0.00	0.00
58.95	6.52	78.35	1.510	0.00	0.00	0.039	0.00	0.00
51.47	6.85	71.83	1.318	0.00	0.00	0.034	0.00	0.00
44.94	7.02	64.98	1.151	0.00	0.00	0.029	0.00	0.00
39.23	6.93	57.96	1.005	0.00	0.00	0.026	0.00	0.00
34.25	6.63	51.03	0.877	0.00	0.00	0.022	0.00	0.00
29.91	6.38	44.40	0.766	0.00	0.00			

HORIBA LA-910

Laser scattering particle size distribution analyzer

PARTICLE SIZE MEASUREMENT DATA

ID# : 980610-045 14:15

Material : diatomaceous earth (am-vel)

Filename : DTOM0610

Source : Mark Beck

Sample : Diatomaceous Earth (orig)

Lot Number :

Condition

T%(He-Ne): 80.8%

Dist.Form: Sharp

Sampling times : 100

(LAMP): 86.7%

R.R.Index: 1.19-0.00i

Agitation : 3

Circulth :

3

U.sonic :

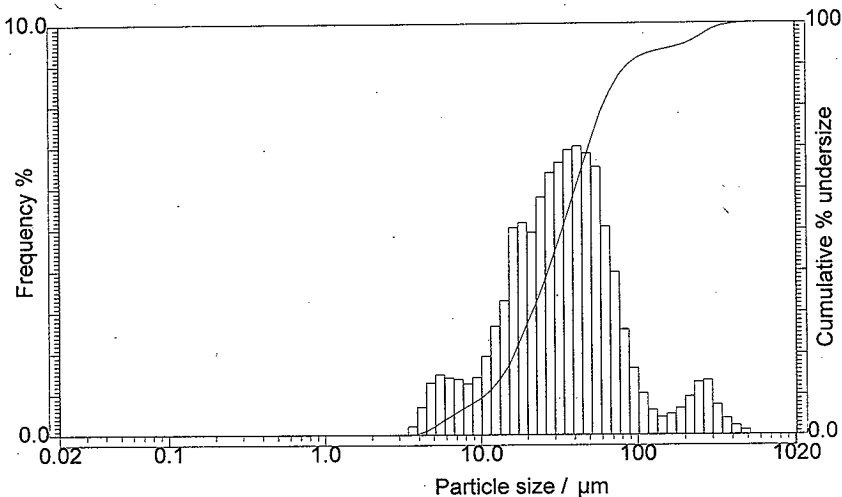
ON(3)

Format

Dist.base : Volume

Scaling : Auto

Axis : LogX - LinearY

**Data**

Memory Hist.

Cum.

SAMPLE NAME

ID#

Median(μm)

Main



Diatomaceous Earth (orig)

980610-045

33.543

HORIBA LA-910

Laser scattering particle size distribution analyzer

PARTICLE SIZE MEASUREMENT DATA

ID# : 980610-044 13:54
Filename : CEM_10MD
Sample : Cement 10M Nitric (dup)
Material : Cement 10M HNO3
Source : Mark Beck
Lot Number :
Test Number : 1
Preparation :
Disp. Medium :
Disp. Steps :
Verification :

Condition :
T%(He-Ne): 77.8% Dist.Form: Sharp Sampling times : 100
(LAMP): 84.5% R.R.Index: 1.19-0.001 ()
Agitation : 5 Circultn : 7 U.sonic : ON (3)

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

Data
Median : 6.251µm SP.Area : 1054cm²/cm³ S.D. : 7.915µm
Mode : 5.628µm Mean : 8.187µm
C.V. : 96.68%

Span : (D 10.0-D 90.0) / D50 = 1.195

Dia. on %(10.0%) :	4.958µm	% on Dia.(0.100µm) :	0.0%
Dia. on %(20.0%) :	5.309µm	% on Dia.(1.000µm) :	0.0%
Dia. on %(30.0%) :	5.593µm	% on Dia.(10.000µm) :	85.5%
Dia. on %(80.0%) :	8.373µm	% on Dia.(30.000µm) :	98.2%
Dia. on %(90.0%) :	12.427µm	% on Dia.(200.000µm) :	100.0%

Size(µm)	Freq(%)Und(%)	Size(µm)	Freq(%)Und(%)	Size(µm)	Freq(%)Und(%)
1019.5	0.00 100.00	26.11	0.69 97.58	0.669	0.00 0.00
890.1	0.00 100.00	22.80	0.87 96.89	0.584	0.00 0.00
777.1	0.00 100.00	19.90	1.10 96.02	0.510	0.00 0.00
678.5	0.00 100.00	17.38	1.75 94.92	0.445	0.00 0.00
592.4	0.00 100.00	15.17	1.96 93.18	0.389	0.00 0.00
517.2	0.00 100.00	13.25	2.59 91.22	0.339	0.00 0.00
451.6	0.00 100.00	11.56	2.84 88.63	0.296	0.00 0.00
394.2	0.00 100.00	10.10	3.49 85.79	0.259	0.00 0.00
344.2	0.00 100.00	8.816	6.04 82.30	0.226	0.00 0.00
300.5	0.00 100.00	7.697	13.87 76.25	0.197	0.00 0.00
262.4	0.00 100.00	6.720	23.24 62.38	0.172	0.00 0.00
229.1	0.01 100.00	5.867	25.98 39.14	0.150	0.00 0.00
200.0	0.01 99.99	5.122	13.16 13.16	0.131	0.00 0.00
174.6	0.01 99.98	4.472	0.00 0.00	0.115	0.00 0.00
152.5	0.01 99.97	3.905	0.00 0.00	0.100	0.00 0.00
133.1	0.02 99.96	3.409	0.00 0.00	0.087	0.00 0.00
116.2	0.03 99.95	2.976	0.00 0.00	0.076	0.00 0.00
101.5	0.05 99.92	2.599	0.00 0.00	0.067	0.00 0.00
88.58	0.07 99.87	2.269	0.00 0.00	0.058	0.00 0.00
77.34	0.10 99.80	1.981	0.00 0.00	0.051	0.00 0.00
67.52	0.12 99.70	1.729	0.00 0.00	0.044	0.00 0.00
58.95	0.16 99.58	1.510	0.00 0.00	0.039	0.00 0.00
51.47	0.20 99.42	1.318	0.00 0.00	0.034	0.00 0.00
44.94	0.26 99.21	1.151	0.00 0.00	0.029	0.00 0.00
39.23	0.33 98.95	1.005	0.00 0.00	0.026	0.00 0.00
34.25	0.46 98.62	0.877	0.00 0.00	0.022	0.00 0.00
29.91	0.58 98.16	0.766	0.00 0.00		

HORIBA LA-910

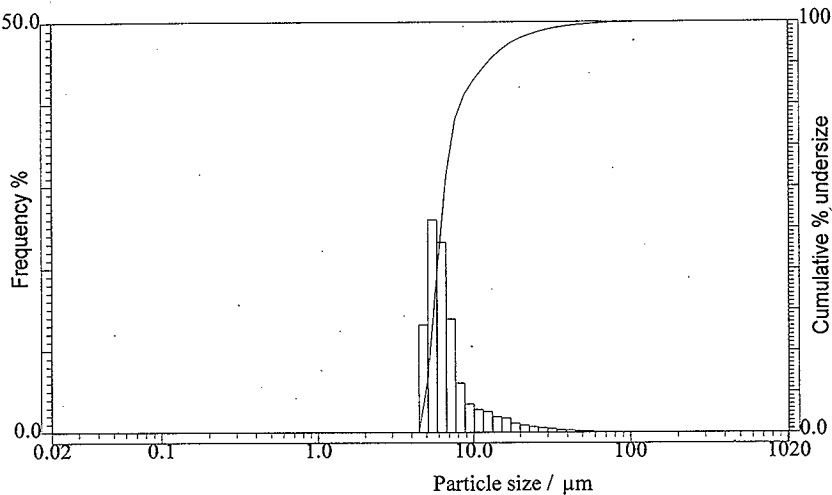
Laser scattering particle size distribution analyzer

PARTICLE SIZE MEASUREMENT DATA

ID# : 980610-044 13:54 Material : Cement 10M HNO3
 Filename : CEM_10MD Source : Mark Beck
 Sample : Cement 10M Nitric (dup) Lot Number :

Condition
 T%(He-Ne): 77.8% Dist.Form: Sharp Sampling times : 100
 (LAMP): 84.5% R.R.Index: 1.19-0.001
 Agitation : 5 Circultrn : 7 U.sonic : ON(3)

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



Data	Memory Hist.	Cum.	SAMPLE NAME	ID#	Median(μm)
Main	☐	☒	Cement 10M Nitric (dup)	980610-044	6.251

HORIBA LA-910

Laser scattering particle size distribution analyzer

PARTICLE SIZE MEASUREMENT DATA

ID# : 980610-044 13:54
 Filename : CEM 10MD
 Sample : Cement 10M Nitric (dup)
 Material : Cement 10M HNO3
 Source : Mark Beck
 Lot Number :
 Test Number : 1
 Preparation :
 Disp. Medium :
 Disp. Steps :
 Verification :

Condition :
 T%(He-Ne): 77.8% Dist.Form: Sharp Sampling times : 100
 (LAMP): 84.5% R.R.Index: 1.19-0.001 ()
 Agitation : 5 Circultrn : 7 U.sonic : ON(3)
 Format :
 Dist.base : Volume Scaling : Auto Axis : LogX - Lineary

Data

Median : 115.799 μ m SP.Area : 1054cm²/cm³ S.D. : 128.754 μ m
 Mode : 215.527 μ m Mean : 156.358 μ m
 C.V. : 82.35%

Span : (D 10.0-D 90.0) / D50 = 2.626

Dia. on %(10.0%) :	27.201 μ m	% on Dia.(0.100 μ m) :	0.0%
Dia. on %(20.0%) :	48.891 μ m	% on Dia.(1.000 μ m) :	0.0%
Dia. on %(30.0%) :	69.548 μ m	% on Dia.(10.000 μ m) :	3.1%
Dia. on %(80.0%) :	249.991 μ m	% on Dia.(30.000 μ m) :	11.2%
Dia. on %(90.0%) :	331.263 μ m	% on Dia.(200.000 μ m) :	69.0%

Size(μ m)	Freq(%)	Und(%)	Size(μ m)	Freq(%)	Und(%)	Size(μ m)	Freq(%)	Und(%)
1019.5	0.00	100.00	26.11	1.36	9.49	0.669	0.00	0.00
890.1	0.00	100.00	22.80	1.14	8.13	0.584	0.00	0.00
777.1	0.31	100.00	19.90	0.96	6.99	0.510	0.00	0.00
678.5	0.56	99.69	17.38	1.01	6.03	0.445	0.00	0.00
592.4	1.00	99.14	15.17	0.76	5.02	0.389	0.00	0.00
517.2	1.68	98.14	13.25	0.66	4.26	0.339	0.00	0.00
451.6	2.42	96.46	11.56	0.49	3.60	0.296	0.00	0.00
394.2	2.98	94.04	10.10	0.40	3.11	0.259	0.00	0.00
344.2	3.74	91.06	8.816	0.46	2.71	0.226	0.00	0.00
300.5	4.99	87.32	7.697	0.70	2.25	0.197	0.00	0.00
262.4	6.54	82.33	6.720	0.78	1.56	0.172	0.00	0.00
229.1	6.75	75.79	5.867	0.58	0.78	0.150	0.00	0.00
200.0	5.85	69.04	5.122	0.20	0.20	0.131	0.00	0.00
174.6	4.78	63.19	4.472	0.00	0.00	0.115	0.00	0.00
152.5	3.86	58.41	3.905	0.00	0.00	0.100	0.00	0.00
133.1	4.42	54.55	3.409	0.00	0.00	0.087	0.00	0.00
116.2	5.12	50.13	2.976	0.00	0.00	0.076	0.00	0.00
101.5	5.50	45.02	2.599	0.00	0.00	0.067	0.00	0.00
88.58	5.52	39.52	2.269	0.00	0.00	0.058	0.00	0.00
77.34	5.11	34.00	1.981	0.00	0.00	0.051	0.00	0.00
67.52	4.15	28.89	1.729	0.00	0.00	0.044	0.00	0.00
58.95	3.56	24.73	1.510	0.00	0.00	0.039	0.00	0.00
51.47	3.09	21.17	1.318	0.00	0.00	0.034	0.00	0.00
44.94	2.61	18.08	1.151	0.00	0.00	0.029	0.00	0.00
39.23	2.23	15.47	1.005	0.00	0.00	0.026	0.00	0.00
34.25	2.05	13.24	0.877	0.00	0.00	0.022	0.00	0.00
29.91	1.71	11.19	0.766	0.00	0.00			

HORIBA LA-910

HNF-2911 Rev. 0

for Windows(TM) Ver.1.20j Jun/16/98 11:40

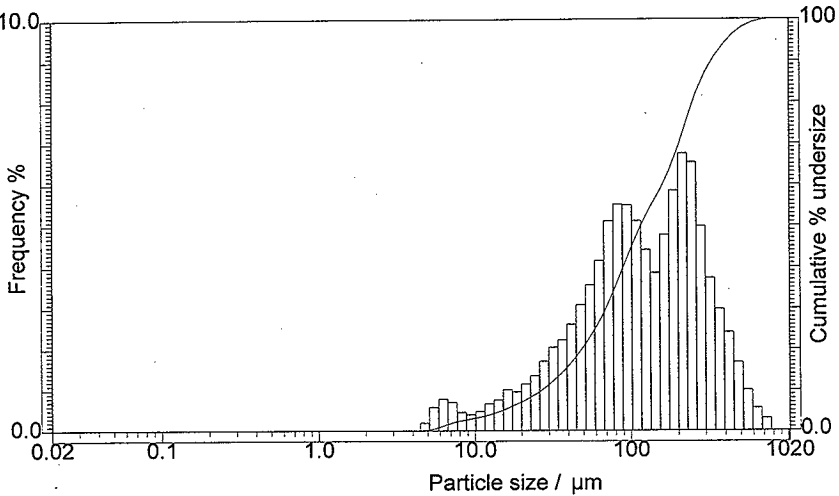
Laser scattering particle size distribution analyzer

PARTICLE SIZE MEASUREMENT DATA

ID# : 980610-044 13:54 Material : Cement 10M HNO3
 Filename : CEM 10MD Source : Mark Beck
 Sample : Cement 10M Nitric (dup) Lot Numbe :

Condition
 T%(He-Ne): 77.8% Dist.Form: Sharp Sampling times : 100
 (LAMP): 84.5% R.R.Index: 1.19-0.001
 Agitation : 5 Circultrn : 7 U.sonic : ON(3)

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



Data	Memory	Hist.	Cum.	SAMPLE NAME	ID#	Median(μm)
Main	☐	☒	☐	Cement 10M Nitric (dup)	980610-044	115.799

HORIBA LA-910

HNE 2011 Rev. 0

HP Windows(TM) Ver.1.20J Jun/16/98 11:28

Laser scattering particle size distribution analyzer

PARTICLE SIZE MEASUREMENT DATA

ID# : 980610-043 13:36
 Filename : CEM 10M
 Sample : Cement 10M Nitric
 Material : Cement 10M HNO3
 Source : Mark Beck
 Lot Number :
 Test Number : 1
 Preparation :
 Disp. Medium :
 Disp. Steps :
 Verification :

Condition :
 T%(He-Ne): 81.8% Dist.Form: Sharp Sampling times : 100
 (LAMP): 87.4% R.R.Index: 1.19-0.001 ()
 Agitation : 5 Circulthr : 7 U.Sonic : ON(3)

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

Data :
 Median : 97.886µm SP.Area : 1201cm²/cm³ S.D. : 102.176µm
 Mode : 215.029µm Mean : 129.572µm
 C.V. : 78.86%

Span : (D 10.0-D 90.0) / D50 = 2.559

Dia. on % (10.0%) :	23.334µm	% on Dia.(0.100µm) :	0.0%
Dia. on % (20.0%) :	43.020µm	% on Dia.(1.000µm) :	0.0%
Dia. on % (30.0%) :	60.913µm	% on Dia.(10.000µm) :	3.7%
Dia. on % (80.0%) :	215.970µm	% on Dia.(30.000µm) :	13.1%
Dia. on % (90.0%) :	273.809µm	% on Dia.(200.000µm) :	76.4%

Size(µm)	Freq(%)	Und(%)	Size(µm)	Freq(%)	Und(%)	Size(µm)	Freq(%)	Und(%)
1019.5	0.00	100.00	26.11	1.44	11.19	0.669	0.00	0.00
890.1	0.00	100.00	22.80	1.29	9.75	0.584	0.00	0.00
777.1	0.00	100.00	19.90	1.12	8.47	0.510	0.00	0.00
678.5	0.00	100.00	17.38	1.23	7.35	0.445	0.00	0.00
592.4	0.31	100.00	15.17	0.95	6.12	0.389	0.00	0.00
517.2	0.57	99.69	13.25	0.80	5.17	0.339	0.00	0.00
451.6	1.16	99.12	11.56	0.58	4.36	0.296	0.00	0.00
394.2	1.97	97.95	10.10	0.47	3.78	0.259	0.00	0.00
344.2	2.98	95.98	8.816	0.55	3.31	0.226	0.00	0.00
300.5	4.39	93.01	7.697	0.85	2.77	0.197	0.00	0.00
262.4	5.90	88.62	6.720	0.97	1.91	0.172	0.00	0.00
229.1	6.28	82.72	5.867	0.71	0.94	0.150	0.00	0.00
200.0	5.47	76.45	5.122	0.23	0.23	0.131	0.00	0.00
174.6	4.66	70.97	4.472	0.00	0.00	0.115	0.00	0.00
152.5	4.04	66.32	3.905	0.00	0.00	0.100	0.00	0.00
133.1	4.88	62.28	3.409	0.00	0.00	0.087	0.00	0.00
116.2	5.75	57.40	2.976	0.00	0.00	0.076	0.00	0.00
101.5	6.23	51.65	2.599	0.00	0.00	0.067	0.00	0.00
88.68	6.18	45.41	2.269	0.00	0.00	0.058	0.00	0.00
77.34	5.66	39.23	1.981	0.00	0.00	0.051	0.00	0.00
67.52	4.70	33.57	1.729	0.00	0.00	0.044	0.00	0.00
58.95	4.14	28.87	1.510	0.00	0.00	0.039	0.00	0.00
51.47	3.71	24.72	1.318	0.00	0.00	0.034	0.00	0.00
44.94	3.14	21.01	1.151	0.00	0.00	0.029	0.00	0.00
39.23	2.56	17.87	1.005	0.00	0.00	0.026	0.00	0.00
34.25	2.26	15.31	0.877	0.00	0.00	0.022	0.00	0.00
29.91	1.86	13.05	0.766	0.00	0.00			

HORIBA LA-910

HNF-2011 Rev. 0

for Windows(TM) Ver.1.20J Jun/16/98 11:29

Laser scattering particle size distribution analyzer

PARTICLE SIZE MEASUREMENT DATA

ID# : 980610-043 13:36

Filename : CEM 10M

Sample : Cement 10M Nitric

Material : Cement 10M HNO3

Source : Mark Beck

Lot Number

Condition

T%(He-Ne): 81.8%

Dist.Form: Sharp

Sampling times : 100

(LAMP): 87.4%

R.R.Index: 1.19-0.001

(

Agitation : 5

Circultrn : 7

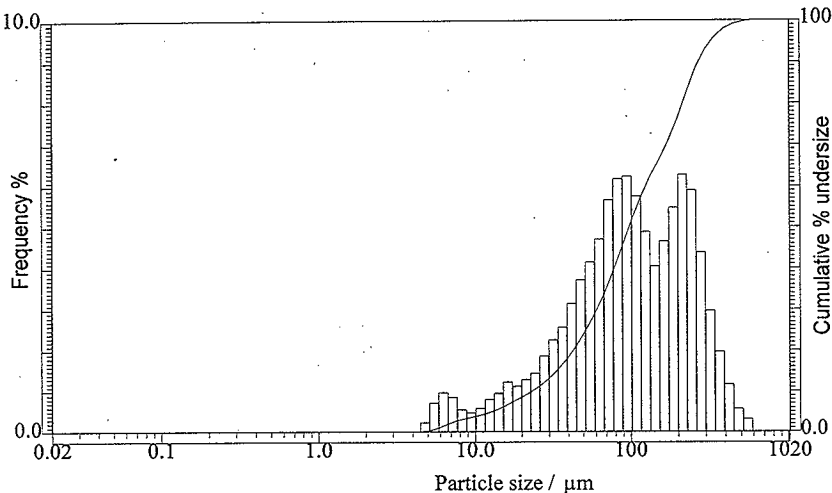
U.sonic : ON(3)

Format

Dist.base : Volume

Scaling : Auto

Axis : Log X - Lineary



Data

Memory Hist.	Cum.	SAMPLE NAME	ID#	Median(μm)
Main	☐	Cement 10M Nitric	980610-043	97.886

HORIBA LA-910

Laser scattering particle size distribution analyzer

PARTICLE SIZE MEASUREMENT DATA

ID# : 980610-047 14:51
 Filename : CEM ORIG
 Sample : Cement (original)
 Material : Cement
 Source : Mark Beck
 Lot Number :
 Test Number : 1
 Preparation :
 Disp. Medium :
 Disp. Steps :
 Verification :

Condition :
 T%(He-Ne): 83.5% Dist. Form: Sharp Sampling times : 100
 (LAMP): 85.7% R.R. Index: 1.19-0.001 ()

Agitation : 5 Circultra : 7 U.sonic : ON(3)

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

Data

Median : 94.911 μ m SP. Area : 2143cm²/cm³ S.D. : 103.746 μ m
 Mode : 240.712 μ m Mean : 123.586 μ m
 C.V. : 83.95%

Span : (D 10.0-D 90.0) / D50 = 2.668

Dia. on % (10.0%) :	10.966 μ m	% on Dia. (0.100 μ m) :	0.0%
Dia. on % (20.0%) :	25.980 μ m	% on Dia. (1.000 μ m) :	0.0%
Dia. on % (30.0%) :	46.627 μ m	% on Dia. (10.000 μ m) :	9.1%
Dia. on % (80.0%) :	221.471 μ m	% on Dia. (30.000 μ m) :	21.9%
Dia. on % (90.0%) :	264.156 μ m	% on Dia. (200.000 μ m) :	74.8%

Size(μ m)	Freq(%)	Und(%)	Size(μ m)	Freq(%)	Und(%)	Size(μ m)	Freq(%)	Und(%)
1019.5	0.00	100.00	26.11	1.64	20.06	0.669	0.00	0.00
890.1	0.00	100.00	22.80	1.36	18.43	0.584	0.00	0.00
777.1	0.00	100.00	19.90	1.72	17.07	0.510	0.00	0.00
678.5	0.00	100.00	17.38	1.97	15.35	0.445	0.00	0.00
592.4	0.24	100.00	15.17	1.33	13.39	0.389	0.00	0.00
517.2	0.44	99.76	13.25	1.50	12.06	0.339	0.00	0.00
451.6	0.79	99.32	11.56	1.41	10.55	0.296	0.00	0.00
394.2	1.42	98.53	10.10	1.22	9.14	0.259	0.00	0.00
344.2	2.61	97.12	8.816	1.08	7.93	0.226	0.00	0.00
300.5	4.75	94.51	7.697	0.96	6.85	0.197	0.00	0.00
262.4	8.04	89.76	6.720	0.80	5.89	0.172	0.00	0.00
229.1	6.92	81.72	5.867	0.77	5.09	0.150	0.00	0.00
200.0	5.75	74.80	5.122	0.69	4.32	0.131	0.00	0.00
174.6	4.28	69.06	4.472	0.64	3.63	0.115	0.00	0.00
152.5	4.21	64.78	3.905	0.53	2.99	0.100	0.00	0.00
133.1	4.31	60.57	3.409	0.77	2.46	0.087	0.00	0.00
116.2	4.21	56.26	2.976	0.70	1.69	0.076	0.00	0.00
101.5	4.17	52.05	2.599	0.71	0.99	0.067	0.00	0.00
88.58	3.91	47.88	2.269	0.28	0.28	0.058	0.00	0.00
77.34	3.96	43.97	1.981	0.00	0.00	0.051	0.00	0.00
67.52	3.73	40.01	1.729	0.00	0.00	0.044	0.00	0.00
58.95	3.90	36.28	1.510	0.00	0.00	0.039	0.00	0.00
51.47	3.27	32.38	1.318	0.00	0.00	0.034	0.00	0.00
44.94	2.87	29.11	1.151	0.00	0.00	0.029	0.00	0.00
39.23	2.49	26.24	1.005	0.00	0.00	0.026	0.00	0.00
34.25	1.86	23.75	0.877	0.00	0.00	0.022	0.00	0.00
29.91	1.83	21.89	0.766	0.00	0.00			

HORIBA LA-910

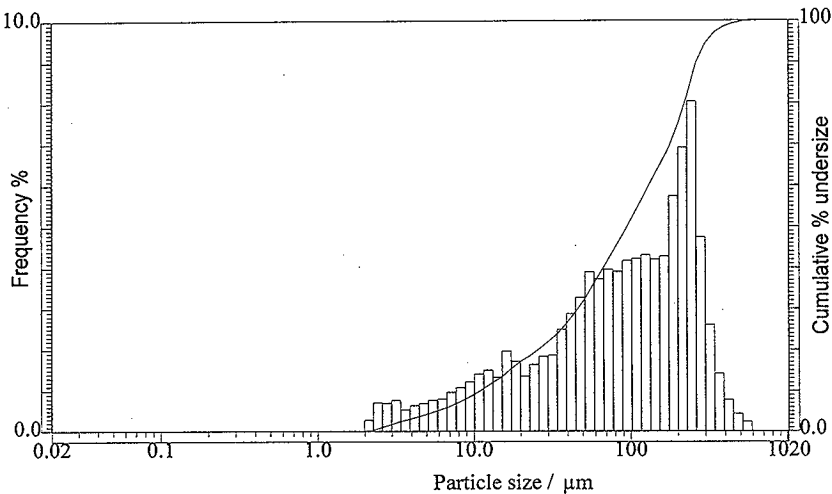
HNF-2911 Rev. 0

for Windows(TM) Ver.1.20J Jun/16/98 11:29

Laser scattering particle size distribution analyzer

PARTICLE SIZE MEASUREMENT DATA

ID# : 980610-047 14:51 Material : Cement
 Filename : CEM ORIG Source : Mark Beck
 Sample : Cement (original) Lot Number :
 Condition :
 T%(He-Ne): 83.5% Dist.Form: Sharp Sampling times : 100
 (LAMP): 85.7% R.R.Index: 1.19-0.001
 Agitation : 5 Circultrn : 7 U.sonic : ON(3)
 Format :
 Dist.base : Volume Scaling : Auto Axis : LogX - Lineary



Data

Memory Hist.	Cum.	SAMPLE NAME	ID#	Median(μm)
Main		Cement (original)	980610-047	94.911

HORIBA LA-910

Laser scattering particle size distribution analyzer

PARTICLE SIZE MEASUREMENT DATA

ID# : 980609-035 15:40
 Filename : CEMENT1
 Sample : Cement (<425 um)
 Material : K Basin Cement
 Source : Mark Beck
 Lot Number :
 Test Number : 1 (frac cell)
 Preparation :
 Disp. Medium : h2o
 Disp. Steps :
 Verification :

Condition :
 T%(He-Ne): 83.5% Dist.Form: Sharp Sampling times : 100
 (LAMP): 75.0% R.R.Index: 1.19-0.00i
 Agitation : 7 Circultrn : 7 U.sonic : OFF(60)
 Format :
 Dist.base : Volume Scaling : Auto Axis : LogX - LinearY

Data

Median : 57.908µm SP.Area : 2217cm²/cm³ S.D. : 84.258µm
 Mode : 55.068µm Mean : 87.023µm
 C.V. : 96.82%

Span : (D 10.0-D 90.0) / D50 = 3.506

Dia. on % (10.0%) :	11.645µm	% on Dia.(0.100µm) :	0.0%
Dia. on % (20.0%) :	19.933µm	% on Dia.(1.000µm) :	0.0%
Dia. on % (30.0%) :	33.107µm	% on Dia.(10.000µm) :	7.6%
Dia. on % (80.0%) :	141.591µm	% on Dia.(100.000µm) :	69.8%
Dia. on % (90.0%) :	214.673µm	% on Dia.(200.000µm) :	88.3%

Size(µm)	Freq(%)	Und(%)	Size(µm)	Freq(%)	Und(%)	Size(µm)	Freq(%)	Und(%)
1019.5	0.00	100.00	26.11	2.63	24.41	0.669	0.00	0.00
890.1	0.00	100.00	22.80	1.80	21.78	0.584	0.00	0.00
777.1	0.00	100.00	19.90	2.69	19.98	0.510	0.00	0.00
678.5	0.00	100.00	17.38	3.21	17.29	0.445	0.00	0.00
592.4	0.12	100.00	15.17	1.91	14.08	0.389	0.00	0.00
517.2	0.21	99.88	13.25	2.28	12.17	0.339	0.00	0.00
451.6	0.37	99.68	11.56	2.12	9.88	0.296	0.00	0.00
394.2	0.67	99.30	10.10	1.69	7.76	0.259	0.00	0.00
344.2	1.28	98.63	8.816	1.24	6.07	0.226	0.00	0.00
300.5	2.16	97.35	7.697	0.82	4.83	0.197	0.00	0.00
262.4	3.63	95.19	6.720	0.50	4.01	0.172	0.00	0.00
229.1	3.25	91.56	5.867	0.41	3.50	0.150	0.00	0.00
200.0	3.41	88.30	5.122	0.34	3.09	0.131	0.00	0.00
174.6	3.05	84.89	4.472	0.40	2.75	0.115	0.00	0.00
152.5	3.39	81.85	3.905	0.46	2.35	0.100	0.00	0.00
133.1	3.73	78.46	3.409	0.88	1.90	0.087	0.00	0.00
116.2	4.37	74.72	2.976	0.64	1.01	0.076	0.00	0.00
101.5	4.88	70.35	2.599	0.37	0.37	0.067	0.00	0.00
88.58	4.82	65.47	2.269	0.00	0.00	0.058	0.00	0.00
77.34	5.11	60.65	1.981	0.00	0.00	0.051	0.00	0.00
67.52	4.82	55.55	1.729	0.00	0.00	0.044	0.00	0.00
58.95	5.50	50.72	1.510	0.00	0.00	0.039	0.00	0.00
51.47	4.85	45.23	1.318	0.00	0.00	0.034	0.00	0.00
44.94	4.85	40.38	1.151	0.00	0.00	0.029	0.00	0.00
39.23	4.70	35.53	1.005	0.00	0.00	0.026	0.00	0.00
34.25	3.31	30.83	0.877	0.00	0.00	0.022	0.00	0.00
29.91	3.11	27.52	0.766	0.00	0.00			

HORIBA LA-910

HNF-2011 Rev. 0

for Windows(TM) Ver.1.20j Jun/16/98 11:54

Laser scattering particle size distribution analyzer

PARTICLE SIZE MEASUREMENT DATA

ID# : 980609-035 15:40

Filename : CEMENT1

Sample : Cement (<425 um)

Material : K Basin Cement

Source : Mark Beck

Lot Number :

Condition

T%(He-Ne): 63.6%

(LAMP): 75.0%

Dist.Form: Sharp

R.R.Index: 1.19-0.001

Sampling times : 100

()

Agitation : 7

Circultrn

: 7

U.sonic

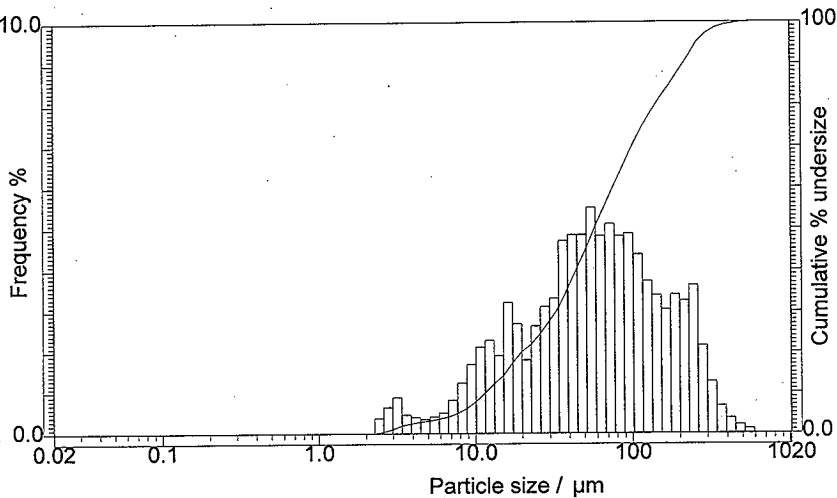
: OFF(60)

Format

Dist.base : Volume

Scaling : Auto

Axis : LogX - Lineary



Data

Memory	Hist.	Cum.	SAMPLE NAME	ID#	Median(μm)
Main	☐	☒	Cement (<425 um)	980609-035	57.908

HORIBA LA-910

HNE-2011 Rev. 0

For Windows(TM) Ver.1.20j Jun/16/98 11:27

Laser scattering particle size distribution analyzer

PARTICLE SIZE MEASUREMENT DATA

ID# : 980610-042 10:13
 Filename : BSD 10M
 Sample : Blow Sand Dust 10M Nitric
 Material : Blow Sand Dust 10M HNO3
 Source : Mark Beck
 Lot Number :
 Test Number : 1
 Preparation :
 Disp. Medium :
 Disp. Steps :
 Verification :

Condition :
 T%(He-Ne) : 83.1% Dist.Form: Sharp Sampling times : 100
 (LAMP) : 84.8% R.R.Index: 1.19-0.001
 Agitation : 5 Circultrn : 7 U.Sonic : ON(3)
 Format :
 Dist.base : Volume Scaling : Auto Axis : LogX - LinearY

Data

Median : 81.160µm SP.Area : 1876cm²/cm³ S.D. : 99.271µm
 Mode : 72.768µm Mean : 113.103µm
 C.V. : 87.77%

Span : (D 10.0-D 90.0) / D50 = 2.984

Dia. on % (10.0%) :	14.235µm	% on Dia.(0.100µm) :	0.0%
Dia. on % (20.0%) :	34.260µm	% on Dia.(1.000µm) :	0.0%
Dia. on % (30.0%) :	50.216µm	% on Dia.(10.000µm) :	7.6%
Dia. on % (80.0%) :	189.751µm	% on Dia.(30.000µm) :	17.8%
Dia. on % (90.0%) :	256.391µm	% on Dia.(200.000µm) :	81.8%

Size(µm)	Freq(%)	Und(%)	Size(µm)	Freq(%)	Und(%)	Size(µm)	Freq(%)	Und(%)
1019.5	0.00	100.00	26.11	1.53	15.83	0.669	0.00	0.00
890.1	0.00	100.00	22.80	1.13	14.30	0.584	0.00	0.00
777.1	0.00	100.00	19.90	1.28	13.17	0.510	0.00	0.00
678.5	0.00	100.00	17.38	1.41	11.89	0.445	0.00	0.00
592.4	0.27	100.00	15.17	1.02	10.48	0.389	0.00	0.00
517.2	0.49	99.73	13.25	0.97	9.46	0.339	0.00	0.00
451.6	1.08	99.24	11.56	0.82	8.48	0.296	0.00	0.00
394.2	1.62	98.17	10.10	0.68	7.66	0.259	0.00	0.00
344.2	2.43	96.55	8.816	0.67	6.98	0.226	0.00	0.00
300.5	3.34	94.12	7.697	0.79	6.30	0.197	0.00	0.00
262.4	4.58	90.78	6.720	0.88	5.52	0.172	0.00	0.00
229.1	4.45	86.20	5.867	1.05	4.64	0.150	0.00	0.00
200.0	4.53	81.75	5.122	1.08	3.59	0.131	0.00	0.00
174.6	4.06	77.23	4.472	0.81	2.51	0.115	0.00	0.00
152.5	3.81	73.17	3.905	0.44	1.69	0.100	0.00	0.00
133.1	4.26	69.36	3.409	0.41	1.25	0.087	0.00	0.00
116.2	5.19	65.10	2.976	0.32	0.84	0.076	0.00	0.00
101.5	5.93	59.92	2.599	0.39	0.52	0.067	0.00	0.00
88.58	6.18	53.99	2.269	0.13	0.13	0.058	0.00	0.00
77.34	6.31	47.80	1.981	0.00	0.00	0.051	0.00	0.00
67.52	5.54	41.50	1.729	0.00	0.00	0.044	0.00	0.00
58.95	5.20	35.96	1.510	0.00	0.00	0.039	0.00	0.00
51.47	4.21	30.77	1.318	0.00	0.00	0.034	0.00	0.00
44.94	3.56	26.55	1.151	0.00	0.00	0.029	0.00	0.00
39.23	3.00	23.00	1.005	0.00	0.00	0.026	0.00	0.00
34.25	2.24	20.00	0.877	0.00	0.00	0.022	0.00	0.00
29.91	1.92	17.76	0.766	0.00	0.00			

HORIBA LA-910

Laser scattering particle size distribution analyzer

PARTICLE SIZE MEASUREMENT DATA

ID# : 980610-042 10:13 Material : Blow Sand Dust 10M HNO3
 Filename : BSD 10M Source : Mark Beck
 Sample : Blow Sand Dust 10M Nitric Lot Number :

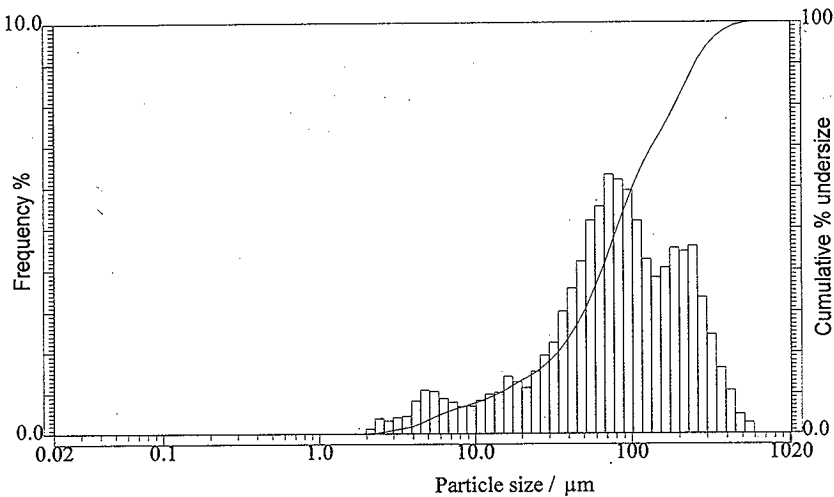
Condition

T%(He-Ne): 83.1% Dist.Form: Sharp Sampling times : 100
 (LAMP): 84.8% R.R.Index: 1.19-0.001 ()

Agitation : 5 Circultrn : 7 U.sonic : ON(3)

Format

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

**Data**

Memory Hist.	Cum.	SAMPLE NAME	ID#	Median(μm)
Main	☐	Blow Sand Dust 10M Nitric	980610-042	81.160

HORIBA LA-910

HNE-2011 Rev. 0

for Windows(TM) Ver.1.20J

Jun/16/98 11:28

Laser scattering particle size distribution analyzer

PARTICLE SIZE MEASUREMENT DATA

ID# : 980610-046 14:34
 Filename : BSD ORIG
 Sample : Blow Sand Dust (original)
 Material : Blow Sand Dust
 Source : Mark Beck
 Lot Number :
 Test Number : 1
 Preparation :
 Disp. Medium :
 Verif. Steps :
 Verification :

Condition :
 T%(He-Ne): 83.6% Dist.Form: Sharp Sampling times : 100
 (LAMP): 86.9% R.R.Index: 1.19-0.00i ()
 Agitation : 5 Circultrn : 7 U.Sonic : ON(3)
 Format :
 Dist.base : Volume Scaling : Auto Axis : LogX - LinearY

Data
 Median : 88.020µm SP.Area : 1426cm²/cm³ S.D. : 93.454µm
 Mode : 94.540µm Mean : 116.071µm
 C.V. : 80.51%

Span : (D 10.0-D 90.0) / D50 = 2.610

Dia. on % (10.0%) :	21.245µm	% on Dia.(0.100µm) :	0.0%
Dia. on % (20.0%) :	41.635µm	% on Dia.(1.000µm) :	0.0%
Dia. on % (30.0%) :	56.140µm	% on Dia.(10.000µm) :	4.3%
Dia. on % (80.0%) :	189.300µm	% on Dia.(30.000µm) :	13.5%
Dia. on % (90.0%) :	251.006µm	% on Dia.(200.000µm) :	81.9%

Size(µm)	Freq(%)	Und(%)	Size(µm)	Freq(%)	Und(%)	Size(µm)	Freq(%)	Und(%)
1019.5	0.00	100.00	26.11	1.30	11.76	0.669	0.00	0.00
890.1	0.00	100.00	22.80	0.89	10.46	0.584	0.00	0.00
777.1	0.00	100.00	19.90	1.19	9.57	0.510	0.00	0.00
678.5	0.00	100.00	17.38	1.46	8.38	0.445	0.00	0.00
592.4	0.22	100.00	15.17	0.97	6.92	0.389	0.00	0.00
517.2	0.40	99.78	13.25	0.88	5.95	0.339	0.00	0.00
451.6	0.73	99.37	11.56	0.71	5.07	0.296	0.00	0.00
394.2	1.31	98.64	10.10	0.54	4.36	0.259	0.00	0.00
344.2	2.26	97.34	8.816	0.47	3.82	0.226	0.00	0.00
300.5	3.39	95.08	7.697	0.47	3.35	0.197	0.00	0.00
262.4	5.17	91.69	6.720	0.46	2.88	0.172	0.00	0.00
229.1	4.61	86.52	5.867	0.53	2.43	0.150	0.00	0.00
200.0	4.71	81.91	5.122	0.54	1.90	0.131	0.00	0.00
174.6	4.23	77.20	4.472	0.45	1.36	0.115	0.00	0.00
152.5	4.67	72.97	3.905	0.28	0.91	0.100	0.00	0.00
133.1	5.41	68.30	3.409	0.30	0.63	0.087	0.00	0.00
116.2	6.05	62.89	2.976	0.18	0.33	0.076	0.00	0.00
101.5	6.54	56.84	2.599	0.15	0.15	0.067	0.00	0.00
88.58	6.32	50.30	2.269	0.00	0.00	0.058	0.00	0.00
77.34	6.35	43.98	1.981	0.00	0.00	0.051	0.00	0.00
67.52	5.61	37.62	1.729	0.00	0.00	0.044	0.00	0.00
58.95	5.57	32.01	1.510	0.00	0.00	0.039	0.00	0.00
51.47	4.38	26.43	1.318	0.00	0.00	0.034	0.00	0.00
44.94	3.65	22.05	1.151	0.00	0.00	0.029	0.00	0.00
39.23	2.99	18.40	1.005	0.00	0.00	0.026	0.00	0.00
34.25	1.97	15.42	0.877	0.00	0.00	0.022	0.00	0.00
29.91	1.68	13.44	0.766	0.00	0.00			

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HNF-2011 Rev. 0

For Windows(TM) Ver.1.20j Jun/16/98 11:28

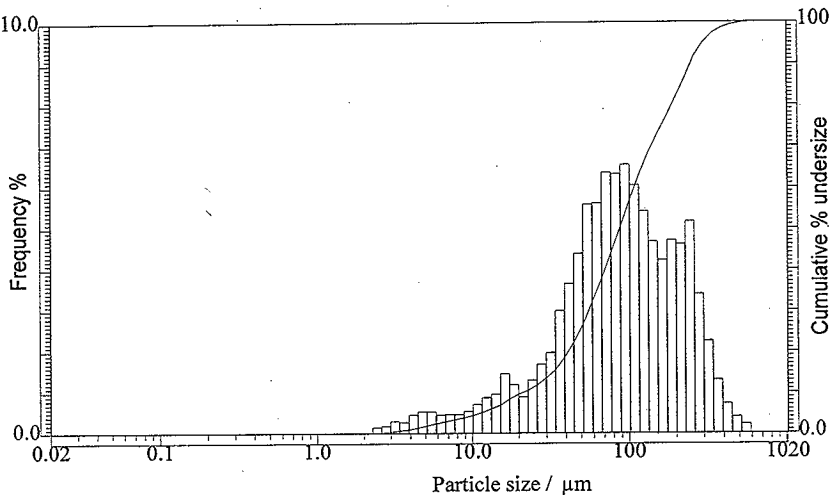
Laser scattering particle size distribution analyzer

PARTICLE SIZE MEASUREMENT DATA

ID# : 980610-046 14:34 Material : Blow Sand Dust
 Filename : BSD ORIG Source : Mark Beck
 Sample : Blow Sand Dust (original) Lot Number :

Condition :
 T%(He-Ne): 83.6% Dist.Form: Sharp Sampling times : 100
 (LAMP): 86.9% R.R.Index: 1.19-0.001
 Agitation : 5 Circultrn : 7 U.sonic : ON(3)

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



Data

Memory Hist.	Cum.	SAMPLE NAME	ID#	Median(μm)
Main		Blow Sand Dust (original)	980610-046	88.020