รายการอ้างอิง

General Mechanical Engineering Standards Committee. British Standard Methods for Determination of particle size distribution Part1. Guide to powder sampling (BS3406: Part1: 1986). London : British Standard Institution, 1986.

General Mechanical Engineering Standards Committee. British Standard Methods for Determination of particle size distribution Part2. Recommendations for gravitational liquid sedimentation methods for powders and suspensions (BS3406: Part2: 1984). London : British Standard Institution, 1984.

Gregory R. Markowski. Improving Twomey's Algorithm for Inversion of Aerosol Measurement Data. Aerosol Science and Technology 7 (1987) : 127-141.

Japanese Industrial Standards Committee Divisional Council on Basic Items. General rule for the determination of particle size distribution by sedimentation in liquid (JIS Z 8820-1990). Tokyo : Japanese Standards Association, 1991.

Japanese Industrial Standards Committee Divisional Council on Basic Items. Determination of particle size distribution by the weight of sedimentation in liquid (JIS Z 8822-1990). Tokyo : Japanese Standards Association, 1991.

Japanese Industrial Standards Committee Divisional Council on Basic Items. Test powders and test particles (JIS Z8901-1995). Tokyo : Japanese Standards Association, 1995.

Japanese Industrial Standards Committee Divisional Council on General Machinery. Particulate materials General rules for methods of sampling (JIS M8100-1992). Tokyo : Japanese Standards Association, 1993.

Keishi Gotoh, Hiroaki Masuda, Ko Higasshitani. Powder Technology Handbook. 2nd edition. New York : Marcel Dekker,Inc., 1997.

SHIMADZU. Instruction Manual for Sedimentograph SA-2. Japan.

Terence Allen. Particle Size Measurement. Vol. 1. New York : Chapman & Hall. 1997.

รายการอ้างอิง (ต่อ)

Thai Powder Technology and Thai Association of Particle Industries. Data Reduction on the Measurement of Size Distribution with Sedimentation Balance Method (A seminar on Simulation of Cyclone, Louver Type Separators and Automatic Measurement of Particle Size Distribution). Chulalongkorn University, 1998.

Twomey, S. Comparison of Constrained Linear Inversion and an Iteration Nonlinear Algorithm Applied to the Indirect Estimation of Particle Size Distribution. J.Comput.Phys 18 (1975) : 188-200.

Wolfgang Winklmayr, Hwa-Chi Wang, Walter John. Adaptation of the Twomey Algorithm to the Inversion of Cascade Impactor Data. Aerosol Science and Technology 13 (1990) : 322-331.

ภาคผนวก ก.

APPIE – Coulter Multisizer

＊＊＊ COULTER MULTISIZER 粒度測定結果 ＊＊＊

FILE：0546　　日付：10／11／1

試料名　：ALUMINA-NO.1
コメント：98110(ISOTON)

測定者名：羽田
開孔径　：21 μm
MODE：FULL

＊＊＊ 計算結果 ＊＊＊

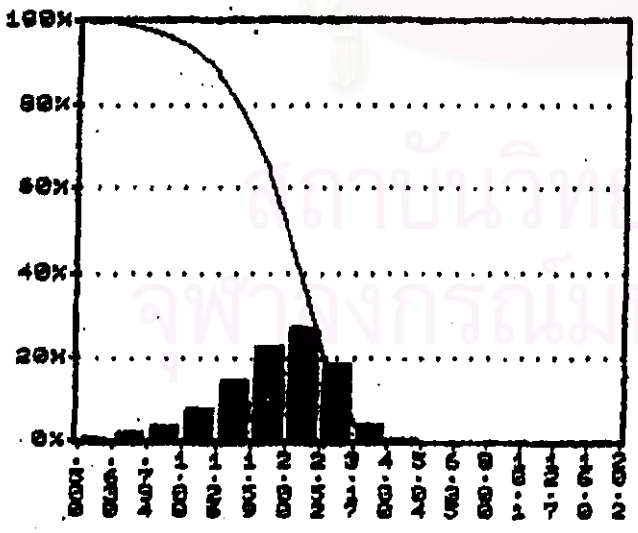
	算術径	平均径	標準偏差	変動係数	75%径	25%径
重量分布：	1.903μm	1.997μm	0.677μm	35.60%	1.634μm	2.471μm
個数分布：	1.187μm	1.134μm	0.566μm	49.16%	0.805μm	1.587μm

＊＊＊ データ表 ＊＊＊

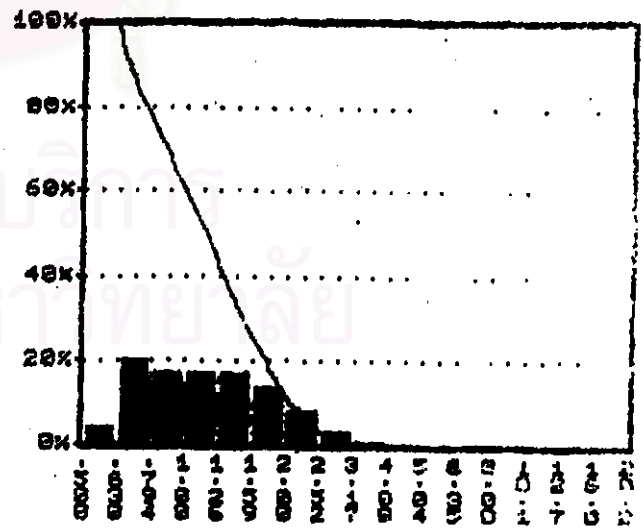
粒径	[重量分布] 微分	累積	[個数分布] 微分(%)	累積(%)	微分(N)	累積(N)
.500～.630	0.3	100.0	3.9	100.0	789	20000
.630～.794	2.1	99.7	20.0	96.1	4003	19211
.794～1.00	3.6	97.7	16.8	76.0	3366	15208
1.00～1.26	7.3	94.1	17.1	59.2	3418	11842
1.26～1.59	14.5	86.8	17.2	42.1	3449	8424
1.59～2.00	22.3	72.2	13.3	24.9	2666	4975
2.00～2.52	26.9	49.9	8.2	11.6	1645	2309
2.52～3.17	18.4	23.0	2.9	3.3	585	664
3.17～4.00	4.2	4.6	0.4	0.4	75	79
4.00～5.04	0.4	0.4	0.0	0.0	4	4
5.04～6.35	0.0	0.0	0.0	0.0	0	0
6.35～8.00	0.0	0.0	0.0	0.0	0	0
8.00～10.1	0.0	0.0	0.0	0.0	0	0
10.1～12.7	0.0	0.0	0.0	0.0	0	0
12.7～16.0	0.0	0.0	0.0	0.0	0	0
16.0～20.2	0.0	0.0	0.0	0.0	0	0

＊＊＊ 粒度分布図 ＊＊＊

[重量分布]



[個数分布]



*** COULTER MULTISIZER 粒度測定結果 ***

日付：10／11／19

FILE：0545

試料名　：ALUMINA-NO.3
コメント：98110(ISOTON)

測定者名：羽田
開孔径　：100 μm
MODE：FULL

*** 計算結果 ***

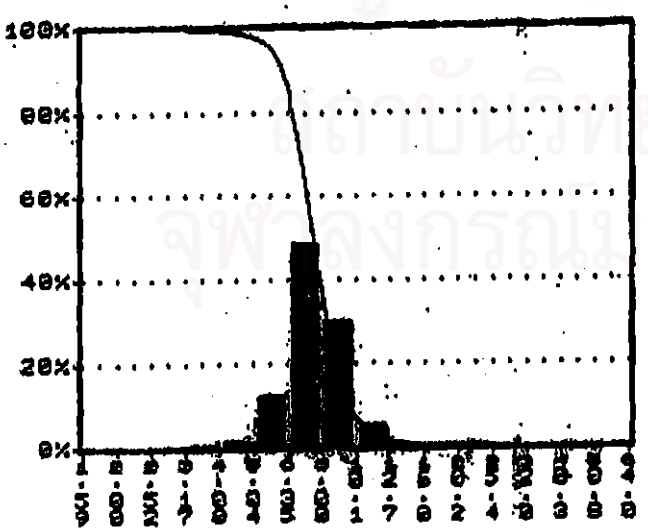
	算術径	平均径	標準偏差	変動係数	75%径	25%径
重量分布	7.507μm	7.558μm	1.806μm	23.74%	6.756μm	8.526μm
個数分布	6.406μm	6.601μm	1.705μm	26.62%	5.926μm	7.651μm

*** データ表 ***

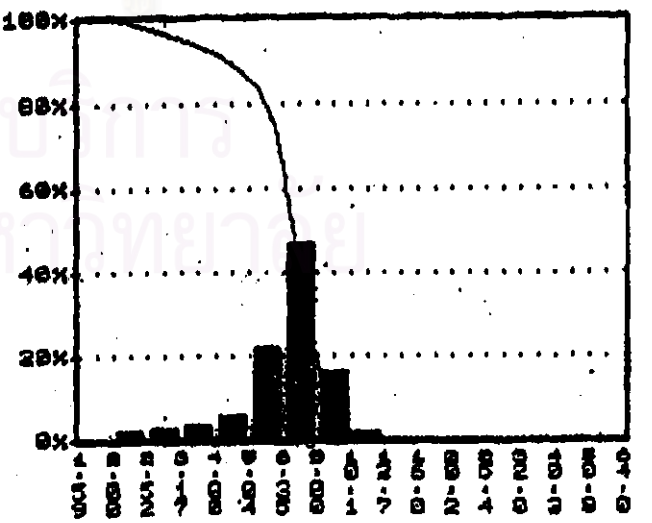
粒径	[重量分布] 微分	[重量分布] 累積	[個数分布] 微分(%)	[個数分布] 累積(%)	[個数分布] 微分(N)	[個数分布] 累積(N)
1.59～2.00	0.0	100.0	0.0	100.0	0	20000
2.00～2.52	0.1	100.0	2.2	100.0	445	20000
2.52～3.17	0.2	99.9	2.7	97.8	539	19555
3.17～4.00	0.5	99.7	3.5	95.1	706	19017
4.00～5.04	1.5	99.3	5.7	91.6	1143	18310
5.04～6.35	12.6	97.7	21.8	85.8	4363	17168
6.35～8.00	48.3	85.1	46.6	64.0	9315	12805
8.00～10.1	29.8	36.8	15.8	17.5	3158	3490
10.1～12.7	5.7	6.9	1.5	1.7	309	332
12.7～16.0	0.7	1.2	0.1	0.1	18	23
16.0～20.2	0.3	0.6	0.0	0.0	3	5
20.2～25.4	0.3	0.3	0.0	0.0	2	2
25.4～32.0	0.0	0.0	0.0	0.0	0	0
32.0～40.3	0.0	0.0	0.0	0.0	0	0
40.3～50.8	0.0	0.0	0.0	0.0	0	0
50.8～64.0	0.0	0.0	0.0	0.0	0	0

*** 粒度分布図 ***

[重量分布]



[個数分布]



＊＊＊ COULTER MULTISIZER 粒度測定結果 ＊＊＊

日付：96／10／02

FILE：0117

試料名 ：白色油溶ﾌｨﾙﾀ No.4
コメント：96100(ISOTON)

測定者名：羽田
細孔径 ：200 μm
MODE ：FULL

＊＊＊ 計算結果 ＊＊＊

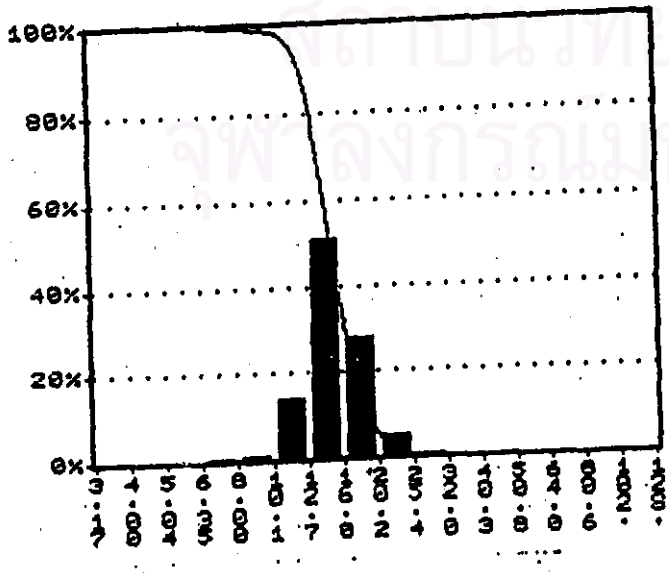
	算術径	平均径	標準偏差	変動係数	75%径	25%径
重量分布：	15.00μm	14.88μm	2.828μm	18.85%	13.37μm	16.73μm
個数分布：	13.26μm	13.64μm	2.898μm	21.84%	12.22μm	15.23μm

＊＊＊ データ表 ＊＊＊

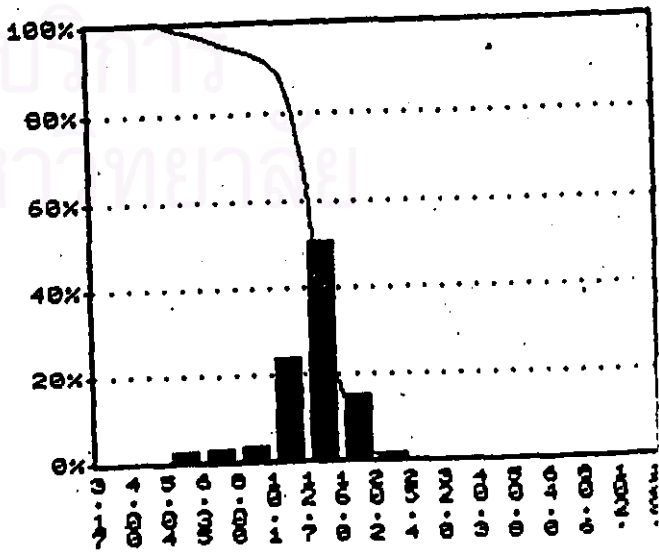
粒径	[重量分布] 微分	累積	微分(%)	累積(%)	[個数分布] 微分(N)	累積(N)
3.17～4.00	0.0	100.0	0.0	100.0	0	30000
4.00～5.04	0.0	100.0	0.0	100.0	0	30000
5.04～6.35	0.2	100.0	2.5	100.0	763	30000
6.35～8.00	0.4	99.8	2.8	97.5	837	29237
8.00～10.1	0.9	99.5	3.3	94.7	994	28400
10.1～12.7	13.9	98.6	24.0	91.4	7188	27407
12.7～16.0	51.1	84.7	50.7	67.4	15208	20219
16.0～20.2	28.2	33.6	15.2	16.7	4575	5011
20.2～25.4	4.9	5.4	1.4	1.5	415	437
25.4～32.0	0.5	0.5	0.1	0.1	22	22
32.0～40.3	0.0	0.0	0.0	0.0	0	0
40.3～50.8	0.0	0.0	0.0	0.0	0	0
50.8～64.0	0.0	0.0	0.0	0.0	0	0
64.0～80.6	0.0	0.0	0.0	0.0	0	0
80.6～102.	0.0	0.0	0.0	0.0	0	0
102.～128.	0.0	0.0	0.0	0.0	0	0

＊＊＊ 粒度分布図 ＊＊＊

[重量分布]



[個数分布]



ภาคผนวก ข.
ผลการวัดการกระจายขนาดด้วยเครื่อง Mastersizer S

ศูนย์เครื่องมือวิจัยวิทยาศาสตร์และเทคโนโลยี จุฬาลงกรณ์มหาวิทยาลัย
อาคารสถาบัน 2 จุฬาลงกรณ์ ซอย 62 ถ.พญาไท ปทุมวัน กรุงเทพฯ 10330 โทร 2188029-32, 2188101
Scientific and Technological Research Equipment Centre Chulalongkorn University
Building 2-3 Chula Soi 62 Phaya-Thai Rd. Phatumwan Bangkok 10330 Tel. 2188029-32, 2188101

Result: Analysis Report

Sample Details

Sample ID: 814 JTP22N1
Sample File: PEERAPAT
Sample Path: A:\
Sample Notes: Test by Pranee: Scientific and Technological Research Equipment Centre Chulalongkorn University
Liquid medium: Water

Run Number: 4
Record Number: 8

Measurement Date: Wed, Nov 17, 1999 9:48AM
Analysis Date: Wed, Nov 17, 1999 9:48AM
Result Source: Analysed

System Details

Range Lens: 300RF mm
Presentation: 3OHD
Analysis Model: Polydisperse
Modifications: Active --

Beam Length: 2.40 mm
[Particle R.I. = (1.5295, 0.1000); Dispersant R.I. = 1.3300]
Killed Data Channels: Low 0; High 2

Sampler: MS17

Obscuration: 31.0 %
Residual: 0.358 %

Result Statistics

Distribution Type: Volume
Mean Diameters:
D [4, 3] = 1.73 um

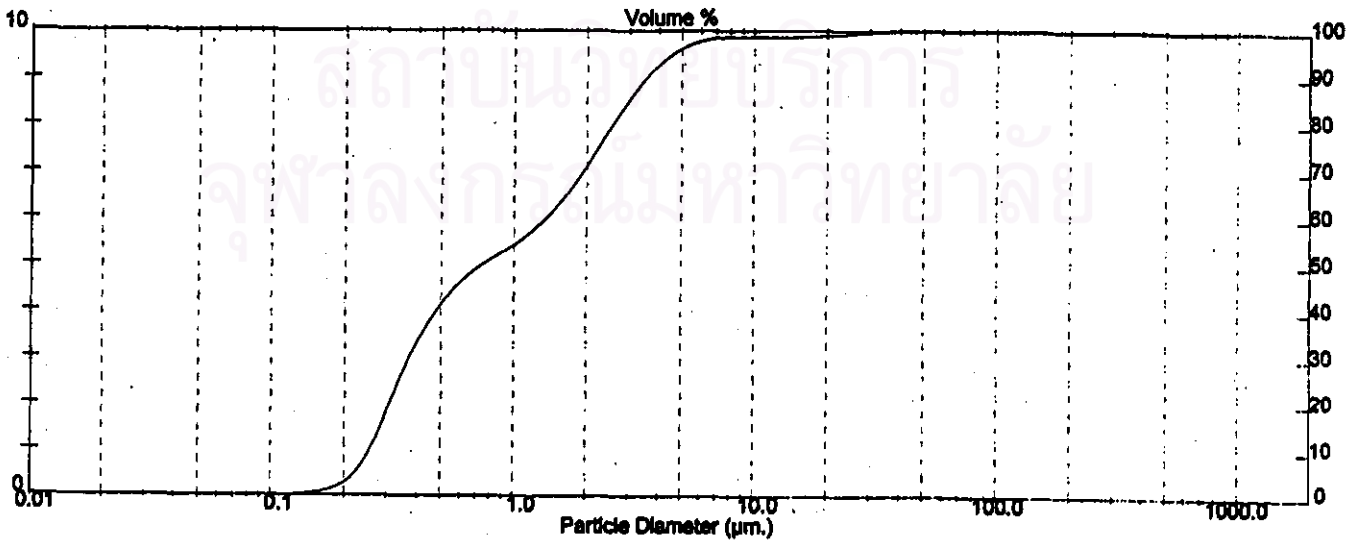
Concentration = 0.0071 %Vol
D (v, 0.1) = 0.26 um
D [3, 2] = 0.55 um

Density = 1.000 g / cub. cm
D (v, 0.5) = 0.76 um
Span = 4.422E+00

Specific S.A. = 10.9058 sq. m / g
D (v, 0.9) = 3.68 um
Uniformity = 1.822E+00

Size_Low (um)	In %	Size_High (um)	Under%
0.05	0.00	0.06	0.00
0.06	0.01	0.07	0.02
0.07	0.03	0.08	0.04
0.08	0.06	0.09	0.09
0.09	0.08	0.11	0.17
0.11	0.15	0.13	0.32
0.13	0.30	0.15	0.62
0.15	0.64	0.17	1.27
0.17	1.45	0.20	2.72
0.20	3.26	0.23	5.99
0.23	6.27	0.27	12.25
0.27	8.73	0.31	20.97
0.31	8.31	0.36	29.28
0.36	6.43	0.42	35.71
0.42	5.24	0.49	40.98
0.49	4.34	0.56	45.30
0.56	3.03	0.67	48.33
0.67	2.33	0.78	50.65
0.78	2.19	0.91	52.85
0.91	2.31	1.06	55.16
1.06	2.69	1.24	57.84
1.24	3.36	1.44	61.20
1.44	4.13	1.68	65.33
1.68	4.91	1.96	70.24
1.96	5.45	2.28	75.69
2.28	5.41	2.65	81.10
2.65	4.96	3.09	86.07
3.09	4.21	3.60	90.28
3.60	3.32	4.19	93.60
4.19	2.38	4.88	96.98
4.88	1.52	5.69	97.50
5.69	0.83	6.63	98.33

Size_Low (um)	In %	Size_High (um)	Under%
6.63	0.34	7.72	98.67
7.72	0.06	9.00	98.73
9.00	0.00	10.48	98.73
10.48	0.00	12.21	98.73
12.21	0.00	14.22	98.73
14.22	0.03	16.57	98.76
16.57	0.17	19.31	98.93
19.31	0.25	22.49	99.18
22.49	0.26	26.20	99.44
26.20	0.22	30.53	99.66
30.53	0.15	35.55	99.81
35.55	0.10	41.43	99.91
41.43	0.06	48.27	99.97
48.27	0.03	56.23	100.00
56.23	0.00	65.51	100.00
65.51	0.00	76.32	100.00
76.32	0.00	88.91	100.00
88.91	0.00	103.58	100.00
103.58	0.00	120.67	100.00
120.67	0.00	140.58	100.00
140.58	0.00	163.77	100.00
163.77	0.00	190.80	100.00
190.80	0.00	222.28	100.00
222.28	0.00	258.95	100.00
258.95	0.00	301.68	100.00
301.68	0.00	351.46	100.00
351.46	0.00	409.46	100.00
409.46	0.00	477.01	100.00
477.01	0.00	555.71	100.00
555.71	0.00	647.41	100.00
647.41	0.00	754.23	100.00
754.23	0.00	878.67	100.00



ศูนย์เครื่องมือวิจัยวิทยาศาสตร์และเทคโนโลยี จุฬาลงกรณ์มหาวิทยาลัย
อาคารสถาบัน 2 จุฬาลงกรณ์ ซอย 62 ถ.พญาไท ปทุมวัน กรุงเทพฯ 10330 โทร 2188029-32, 2188101
Scientific and Technological Research Equipment Centre Chulalongkorn University
Building 2-3 Chula Soi 62 Phaya-Thai Rd. Phatumwan Bangkok 10330 Tel. 2188029-32, 2188101

Result: Analysis Report

Sample Details

Sample ID: S14 JTP22N1
Sample File: PEERAPAT
Sample Path: A:\
Sample Notes: Test by Pranee: Scientific and Technological Research Equipment Centre Chulalongkorn University
Liquid medium: Water

Run Number: 4
Record Number: 8

Measurement Date: Wed, Nov 17, 1999 9:48AM
Analysis Date: Wed, Nov 17, 1999 9:48AM
Result Source: Analysed

System Details

Range Lens: 300RF mm
Presentation: 3OHD
Analysis Model: Polydisperse
Modifications: Active --

Beam Length: 2.40 mm
[Particle R.I. = (1.5295, 0.1000); Dispersant R.I. = 1.3300]
Killed Data Channels: Low 0; High 2

Sampler: MS17

Obscuration: 31.0 %
Residual: 0.358 %

Result Statistics

Distribution Type: Volume
Mean Diameters:
D [4, 3] = 1.73 um

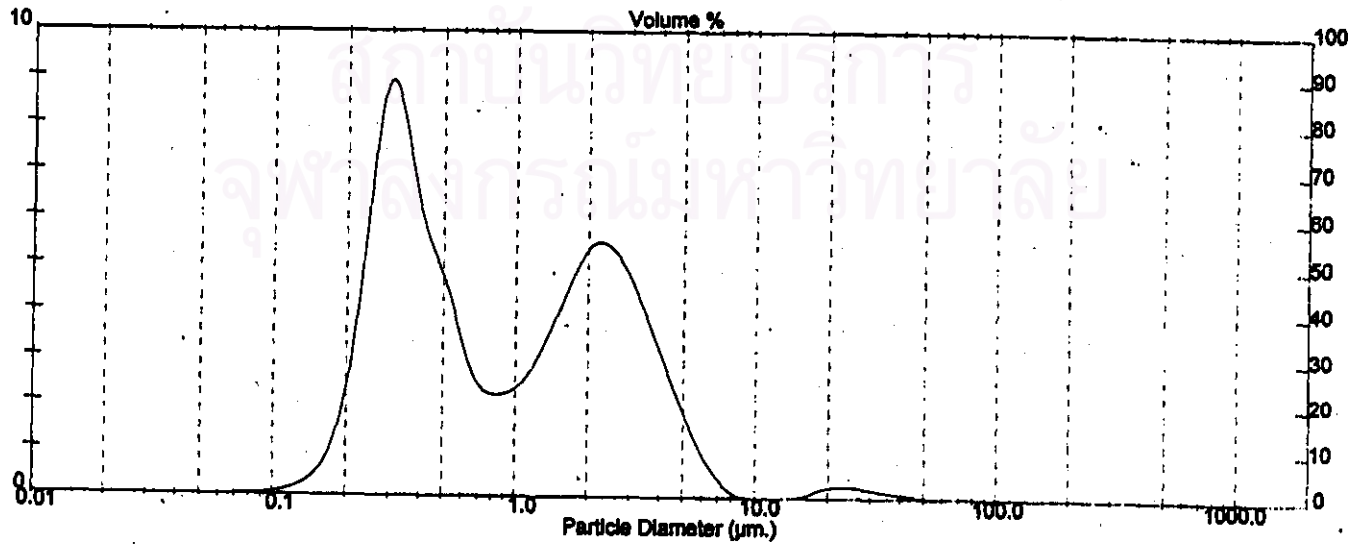
Concentration = 0.0071 %Vol
D (v, 0.1) = 0.28 um
D [3, 2] = 0.55 um

Density = 1.000 g / cub. cm
D (v, 0.5) = 0.75 um
Span = 4.422E+00

Specific S.A. = 10.9056 sq. m / g
D (v, 0.9) = 3.56 um
Uniformity = 1.822E+00

Size_Low (um)	In %	Size_High (um)	Under%
0.05	0.00	0.06	0.00
0.06	0.01	0.07	0.02
0.07	0.03	0.08	0.04
0.08	0.05	0.09	0.09
0.09	0.08	0.11	0.17
0.11	0.15	0.13	0.32
0.13	0.30	0.15	0.62
0.15	0.64	0.17	1.27
0.17	1.48	0.20	2.72
0.20	3.26	0.23	5.98
0.23	6.27	0.27	12.25
0.27	8.73	0.31	20.97
0.31	8.31	0.36	29.28
0.36	6.43	0.42	35.71
0.42	5.24	0.49	40.96
0.49	4.34	0.58	45.30
0.58	3.03	0.67	48.33
0.67	2.33	0.78	50.66
0.78	2.19	0.91	52.85
0.91	2.31	1.06	55.16
1.06	2.68	1.24	57.84
1.24	3.36	1.44	61.20
1.44	4.13	1.68	65.33
1.68	4.91	1.96	70.24
1.96	5.45	2.28	75.69
2.28	5.41	2.65	81.10
2.65	4.98	3.09	86.07
3.09	4.21	3.60	90.28
3.60	3.32	4.19	93.60
4.19	2.38	4.88	95.98
4.88	1.62	5.69	97.60
5.69	0.83	6.63	98.33

Size_Low (um)	In %	Size_High (um)	Under%
6.63	0.34	7.72	98.67
7.72	0.06	9.00	98.73
9.00	0.00	10.48	98.73
10.48	0.00	12.21	98.73
12.21	0.00	14.22	98.73
14.22	0.03	16.57	98.76
16.57	0.17	19.31	98.93
19.31	0.26	22.49	99.18
22.49	0.25	26.20	99.44
26.20	0.22	30.53	99.66
30.53	0.15	35.56	99.81
35.56	0.10	41.43	99.91
41.43	0.06	48.27	99.97
48.27	0.03	56.23	100.00
56.23	0.00	65.51	100.00
65.51	0.00	76.32	100.00
76.32	0.00	88.91	100.00
88.91	0.00	103.58	100.00
103.58	0.00	120.67	100.00
120.67	0.00	140.58	100.00
140.58	0.00	163.77	100.00
163.77	0.00	190.80	100.00
190.80	0.00	222.28	100.00
222.28	0.00	258.96	100.00
258.96	0.00	301.68	100.00
301.68	0.00	351.48	100.00
351.48	0.00	409.45	100.00
409.45	0.00	477.01	100.00
477.01	0.00	555.71	100.00
555.71	0.00	647.41	100.00
647.41	0.00	754.23	100.00
754.23	0.00	878.67	100.00



ศูนย์เครื่องมือวิจัยวิทยาศาสตร์และเทคโนโลยี จุฬาลงกรณ์มหาวิทยาลัย
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Scientific and Technological Research Equipment Centre Chulalongkorn University
Building 2-3 Chula Soi 62 Phaya-Thai Rd. Phatumwan Bangkok 10330 Tel. 2188029-32, 2188101

Result: Analysis Report

Sample Details

Sample ID: 814 JTP2ZN1
Sample File: PEERAPAT
Sample Path: A:\
Sample Notes: Test by Pranee: Scientific and Technological Research Equipment Centre Chulalongkorn University
Liquid medium: Water

Run Number: 4
Record Number: 8

Measurement Date: Wed, Nov 17, 1999 9:48AM
Analysis Date: Wed, Nov 17, 1999 9:48AM
Result Source: Analysed

System Details

Range Lens: 300RF mm
Presentation: 3OHD
Analysis Model: Polydisperse
Modifications: Active --

Beam Length: 2.40 mm
[Particle R.I. = (1.6295, 0.1000); Dispersant R.I. = 1.3300]
Killed Data Channels: Low 0; High 2

Sampler: M317

Obscuration: 31.0 %
Residual: 0.356 %

Result Statistics

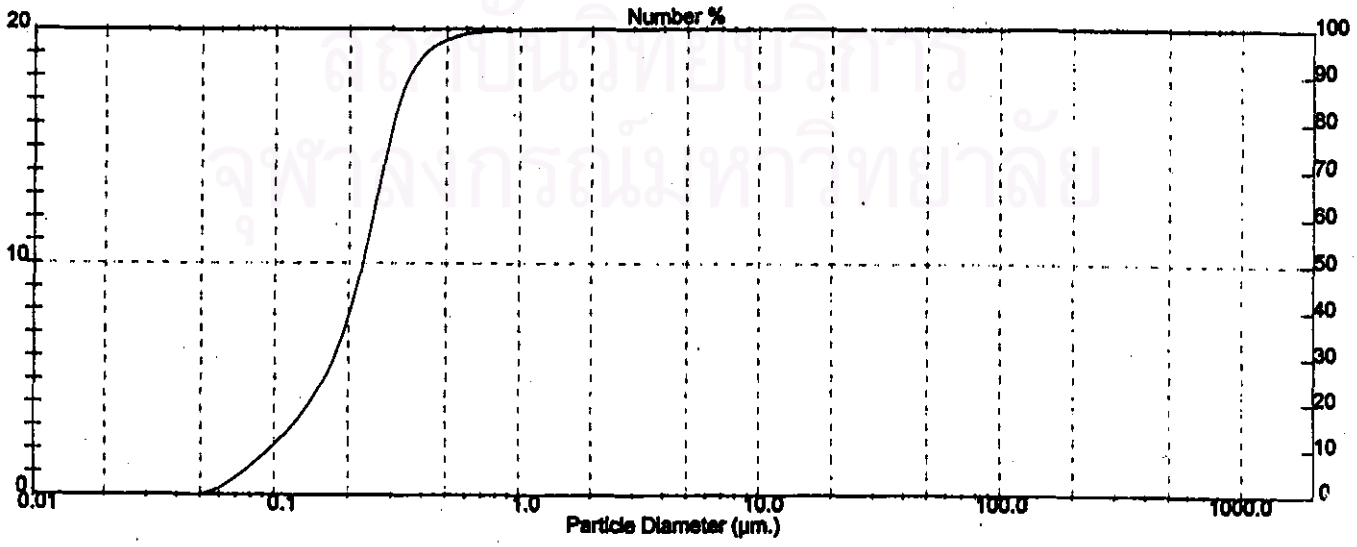
Distribution Type: Number
Mean Diameters:
D [4, 3] = 1.73 um

Concentration = 0.0071 %Vol
D (n, 0.1) = 0.10 um
D [3, 2] = 0.55 um

Density = 1.000 g / cub. cm
D (n, 0.5) = 0.23 um
Span = 1.134E+00

Specific S.A. = 10.9056 sq. m / g
D (n, 0.9) = 0.38 um
Uniformity = 3.727E-01

Size_Low (um)	In %	Size_High (um)	Under%	Size_Low (um)	In %	Size_High (um)	Under%
0.06	1.27	0.06	1.27	6.63	0.00	7.72	100.00
0.06	2.13	0.07	3.39	7.72	0.00	9.00	100.00
0.07	2.63	0.08	6.03	9.00	0.00	10.48	100.00
0.08	3.00	0.09	9.03	10.48	0.00	12.21	100.00
0.09	3.39	0.11	12.42	12.21	0.00	14.22	100.00
0.11	3.97	0.13	16.39	14.22	0.00	16.57	100.00
0.13	4.96	0.15	21.35	16.57	0.00	19.31	100.00
0.15	6.69	0.17	28.04	19.31	0.00	22.49	100.00
0.17	9.58	0.20	37.62	22.49	0.00	26.20	100.00
0.20	13.58	0.23	51.20	26.20	0.00	30.53	100.00
0.23	16.53	0.27	67.73	30.53	0.00	35.58	100.00
0.27	14.56	0.31	82.29	35.58	0.00	41.43	100.00
0.31	8.77	0.36	91.06	41.43	0.00	48.27	100.00
0.36	4.29	0.42	95.36	48.27	0.00	56.23	100.00
0.42	2.21	0.49	97.57	56.23	0.00	65.51	100.00
0.49	1.16	0.58	98.73	65.51	0.00	76.32	100.00
0.58	0.51	0.67	99.24	76.32	0.00	88.91	100.00
0.67	0.25	0.78	99.49	88.91	0.00	103.58	100.00
0.78	0.15	0.91	99.64	103.58	0.00	120.67	100.00
0.91	0.10	1.06	99.74	120.67	0.00	140.58	100.00
1.06	0.07	1.24	99.81	140.58	0.00	163.77	100.00
1.24	0.06	1.44	99.87	163.77	0.00	190.80	100.00
1.44	0.04	1.68	99.91	190.80	0.00	222.28	100.00
1.68	0.03	1.96	99.94	222.28	0.00	258.96	100.00
1.96	0.02	2.28	99.97	258.96	0.00	301.68	100.00
2.28	0.01	2.65	99.98	301.68	0.00	351.46	100.00
2.65	0.01	3.09	99.99	351.46	0.00	409.45	100.00
3.09	0.00	3.60	100.00	409.45	0.00	477.01	100.00
3.60	0.00	4.19	100.00	477.01	0.00	555.71	100.00
4.19	0.00	4.88	100.00	555.71	0.00	647.41	100.00
4.88	0.00	5.69	100.00	647.41	0.00	754.23	100.00
5.69	0.00	6.63	100.00	754.23	0.00	878.67	100.00



ศูนย์เครื่องมือวิจัยวิทยาศาสตร์และเทคโนโลยี จุฬาลงกรณ์มหาวิทยาลัย
อาคารสถาบัน 2 จุฬาลงกรณ์ ซอย 62 ถ.พญาไท ปทุมวัน กรุงเทพฯ 10330 โทร. 2188029-32, 2188101

Scientific and Technological Research Equipment Centre Chulalongkorn University
Building 2-3 Chula Soi 62 Phaya-Thai Rd. Phatumwan Bangkok 10330 Tel. 2188029-32, 2188101

Result: Analysis Report

Sample Details

Sample ID: 814 JTP22N1
Sample File: PEERAPAT
Sample Path: A:\
Sample Notes: Test by Pranee: Scientific and Technological Research Equipment Centre Chulalongkorn University
Liquid medium: Water

Run Number: 4
Record Number: 8

Measurement Date: Wed, Nov 17, 1999 9:48AM
Analysis Date: Wed, Nov 17, 1999 9:48AM
Result Source: Analysed

System Details

Range Lens: 300RF mm
Presentation: 3OHD
Analysis Model: Polydisperse
Modifications: Active –

Beam Length: 2.40 mm
[Particle R.I. = (1.5295, 0.1000); Dispersant R.I. = 1.3300]
Killed Data Channels: Low 0; High 2

Sampler: MS17

Obscuration: 31.0 %
Residual: 0.366 %

Result Statistics

Distribution Type: Number
Mean Diameters:
D [4, 3] = 1.73 um

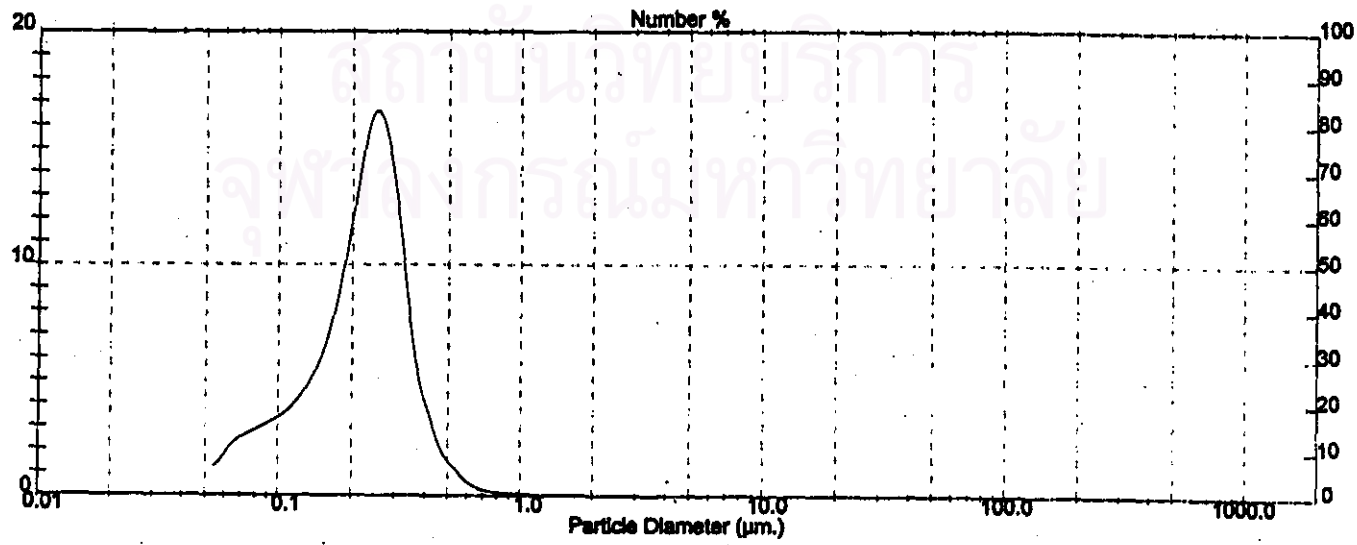
Concentration = 0.0071 %Vol
D (n, 0.1) = 0.10 um
D [3, 2] = 0.55 um

Density = 1.000 g / cub. cm
D (n, 0.5) = 0.23 um
Span = 1.134E+00

Specific S.A. = 10.9058 sq. m / g
D (n, 0.9) = 0.35 um
Uniformity = 3.727E-01

Size_Low (um)	In %	Size_High (um)	Under%
0.05	1.27	0.06	1.27
0.06	2.13	0.07	3.39
0.07	2.63	0.08	6.03
0.08	3.00	0.09	9.03
0.09	3.39	0.11	12.42
0.11	3.97	0.13	16.39
0.13	4.98	0.15	21.36
0.15	6.69	0.17	28.04
0.17	9.58	0.20	37.62
0.20	13.58	0.23	51.20
0.23	16.53	0.27	67.73
0.27	14.56	0.31	82.29
0.31	8.77	0.36	91.06
0.36	4.29	0.42	95.36
0.42	2.21	0.49	97.57
0.49	1.16	0.58	98.73
0.58	0.51	0.67	99.24
0.67	0.25	0.78	99.49
0.78	0.15	0.91	99.64
0.91	0.10	1.06	99.74
1.06	0.07	1.24	99.81
1.24	0.06	1.44	99.87
1.44	0.04	1.68	99.91
1.68	0.03	1.96	99.94
1.96	0.02	2.28	99.97
2.28	0.01	2.65	99.98
2.65	0.01	3.09	99.99
3.09	0.00	3.60	100.00
3.60	0.00	4.19	100.00
4.19	0.00	4.88	100.00
4.88	0.00	5.69	100.00
5.69	0.00	6.63	100.00

Size_Low (um)	In %	Size_High (um)	Under%
6.63	0.00	7.72	100.00
7.72	0.00	9.00	100.00
9.00	0.00	10.48	100.00
10.48	0.00	12.21	100.00
12.21	0.00	14.22	100.00
14.22	0.00	16.57	100.00
16.57	0.00	19.31	100.00
19.31	0.00	22.49	100.00
22.49	0.00	26.20	100.00
26.20	0.00	30.53	100.00
30.53	0.00	35.56	100.00
35.56	0.00	41.43	100.00
41.43	0.00	48.27	100.00
48.27	0.00	56.23	100.00
56.23	0.00	65.51	100.00
65.51	0.00	76.32	100.00
76.32	0.00	88.91	100.00
88.91	0.00	103.58	100.00
103.58	0.00	120.67	100.00
120.67	0.00	140.58	100.00
140.58	0.00	163.77	100.00
163.77	0.00	190.80	100.00
190.80	0.00	222.28	100.00
222.28	0.00	258.96	100.00
258.96	0.00	301.68	100.00
301.68	0.00	351.46	100.00
351.46	0.00	409.45	100.00
409.45	0.00	477.01	100.00
477.01	0.00	555.71	100.00
555.71	0.00	647.41	100.00
647.41	0.00	754.23	100.00
754.23	0.00	878.67	100.00



ศูนย์เครื่องมือวิจัยวิทยาศาสตร์และเทคโนโลยี จุฬาลงกรณ์มหาวิทยาลัย
อาคารสถาบัน 2 จุฬาลงกรณ์ ซอย 62 ถ.พญาไท ปทุมวัน กรุงเทพฯ 10330 โทร 2188029-32, 2188101
Scientific and Technological Research Equipment Centre Chulalongkorn University
Building 2-3 Chula Soi 62 Phaya-Thai Rd. Phatumwan Bangkok 10330 Tel. 2188029-32, 2188101

Result: Analysis Report

Sample Details

Sample ID: S10 JTP22N3
Sample File: PEERAPAT
Sample Path: A:\
Sample Notes: Test by Pranee: Scientific and Technological Research Equipment Centre Chulalongkorn University
Liquid medium: Water

Run Number: 1
Record Number: 1

Measurement Date: Wed, Nov 17, 1999 9:40AM
Analysis Date: Wed, Nov 17, 1999 9:40AM
Result Source: Analysed

System Details

Range Lens: 300RF mm
Presentation: 3OHD
Analysis Model: Polydisperse
Modifications: Active --

Beam Length: 2.40 mm
[Particle R.I. = (1.5295, 0.1000); Dispersant R.I. = 1.3300]
Killed Data Channels: Low 0; High 2

Sampler: MS17

Obscuration: 33.3 %
Residual: 0.224 %

Result Statistics

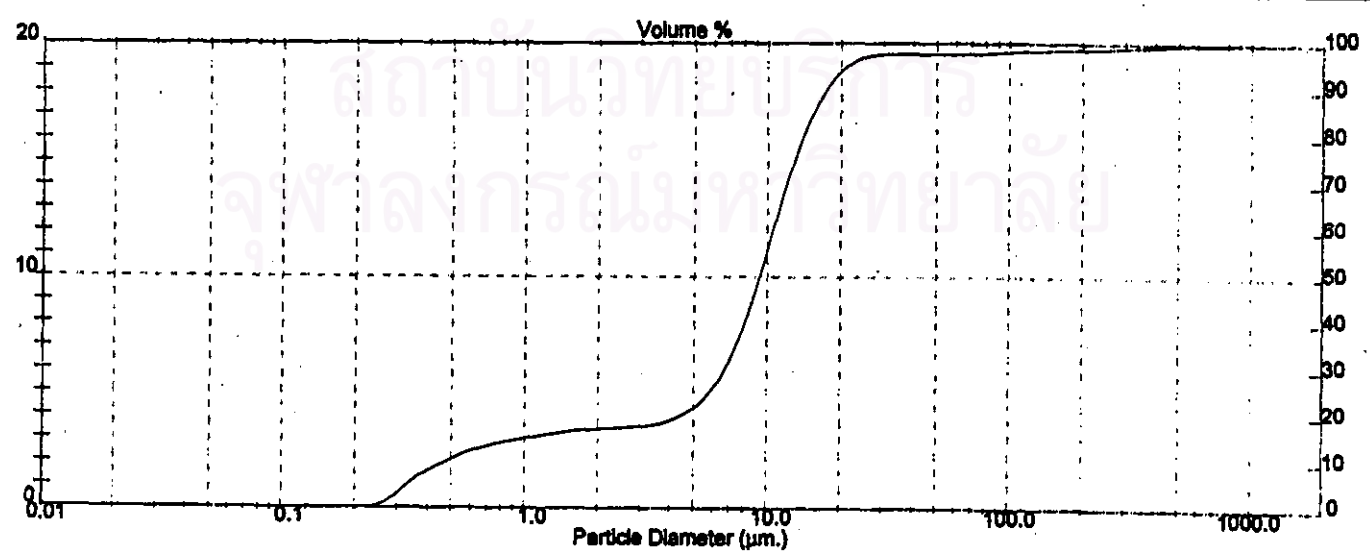
Distribution Type: Volume
Mean Diameters:
D [4, 3] = 14.91 um

Concentration = 0.0225 %Vol
D (v, 0.1) = 0.47 um
D [3, 2] = 2.03 um

Density = 1.000 g / cub. cm
D (v, 0.5) = 9.30 um
Span = 1.809E+00

Specific S.A. = 2.9614 sq. m / g
D (v, 0.9) = 17.30 um
Uniformity = 1.091E+00

Size_Low (um)	In %	Size_High (um)	Under%
0.05	0.00	0.06	0.00
0.06	0.00	0.07	0.00
0.07	0.00	0.08	0.00
0.08	0.00	0.09	0.00
0.09	0.00	0.11	0.00
0.11	0.00	0.13	0.00
0.13	0.00	0.15	0.00
0.15	0.01	0.17	0.01
0.17	0.04	0.20	0.04
0.20	0.23	0.23	0.28
0.23	1.12	0.27	1.39
0.27	2.66	0.31	4.05
0.31	2.79	0.36	6.84
0.36	1.96	0.42	8.80
0.42	1.68	0.49	10.48
0.49	1.56	0.58	12.04
0.58	1.05	0.67	13.11
0.67	0.56	0.78	13.97
0.78	0.67	0.91	14.64
0.91	0.61	1.06	15.24
1.06	0.56	1.24	15.82
1.24	0.53	1.44	16.35
1.44	0.41	1.68	16.76
1.68	0.27	1.96	17.03
1.96	0.18	2.28	17.21
2.28	0.18	2.65	17.39
2.65	0.30	3.09	17.69
3.09	0.58	3.60	18.27
3.60	1.09	4.19	19.36
4.19	1.92	4.88	21.28
4.88	3.23	5.69	24.51
5.69	5.16	6.63	29.67
6.63	7.59	7.72	37.26
7.72	10.16	9.00	47.41
9.00	12.22	10.48	59.63
10.48	11.77	12.21	71.40
12.21	9.79	14.22	81.19
14.22	7.23	16.57	88.42
16.57	4.79	19.31	93.22
19.31	2.79	22.49	96.01
22.49	1.33	26.20	97.34
26.20	0.39	30.53	97.73
30.53	0.00	35.56	97.73
35.56	0.00	41.43	97.73
41.43	0.00	48.27	97.73
48.27	0.00	56.23	97.73
56.23	0.03	65.51	97.76
65.51	0.14	76.32	97.90
76.32	0.19	88.91	98.09
88.91	0.20	103.58	98.29
103.58	0.17	120.67	98.46
120.67	0.13	140.58	98.59
140.58	0.10	163.77	98.69
163.77	0.08	190.80	98.77
190.80	0.08	222.28	98.85
222.28	0.11	258.96	98.96
258.96	0.14	301.66	99.10
301.66	0.18	351.46	99.28
351.46	0.20	409.45	99.49
409.45	0.20	477.01	99.68
477.01	0.16	555.71	99.85
555.71	0.11	647.41	99.95
647.41	0.05	754.23	100.00
754.23	0.00	878.67	100.00



ศูนย์เครื่องมือวิจัยวิทยาศาสตร์และเทคโนโลยี จุฬาลงกรณ์มหาวิทยาลัย
อาคารสถาบัน 2 จุฬาลงกรณ์ ซอย 62 ถ.พญาไท ปทุมวัน กรุงเทพฯ 10330 โทร 2188029-32, 2188101
Scientific and Technological Research Equipment Centre Chulalongkorn University
Building 2-3 Chula Soi 62 Phaya-Thai Rd. Phatumwan Bangkok 10330 Tel. 2188029-32, 2188101

Result: Analysis Report

Sample Details

Sample ID: 810 JTP22N3
Sample File: PEERAPAT
Sample Path: A:\
Sample Notes: Test by Pranee: Scientific and Technological Research Equipment Centre Chulalongkorn University
Liquid medium: Water

Run Number: 1
Record Number: 1

Measurement Date: Wed, Nov 17, 1999 9:40AM
Analysis Date: Wed, Nov 17, 1999 9:40AM
Result Source: Analysed

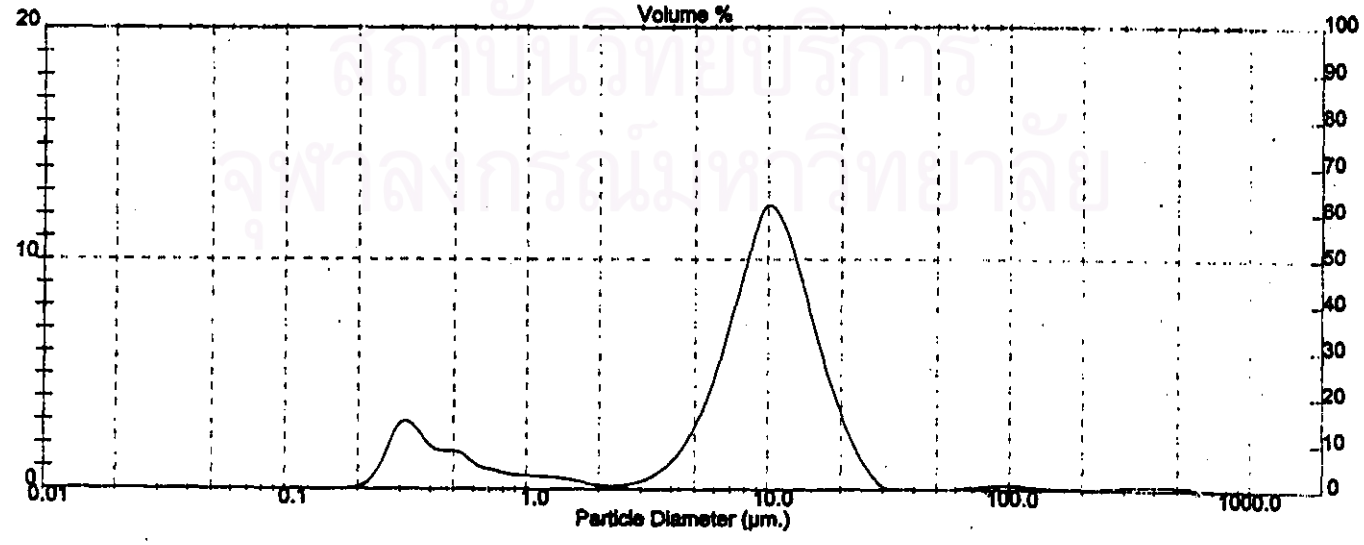
System Details

Range Lens: 300RF mm
Beam Length: 2.40 mm
Sampler: MS17
Obscuration: 33.3 %
Presentation: 3OHD
[Particle R.I. = (1.5295, 0.1000); Dispersant R.I. = 1.3300]
Analysis Model: Polydisperse
Residual: 0.224 %
Modifications: Active –
Killed Data Channels: Low 0; High 2

Result Statistics

Distribution Type: Volume
Concentration = 0.0225 %Vol
Density = 1.000 g / cub. cm
Specific S.A. = 2.0614 sq. m / g
Mean Diameters:
D (v, 0.1) = 0.47 um
D (v, 0.5) = 9.30 um
D (v, 0.9) = 17.30 um
D [4, 3] = 14.91 um
D [3, 2] = 2.03 um
Span = 1.809E+00
Uniformity = 1.091E+00

Size_Low (um)	In %	Size_High (um)	Under%
0.05	0.00	0.06	0.00
0.06	0.00	0.07	0.00
0.07	0.00	0.08	0.00
0.08	0.00	0.09	0.00
0.09	0.00	0.11	0.00
0.11	0.00	0.13	0.00
0.13	0.00	0.15	0.00
0.15	0.01	0.17	0.01
0.17	0.04	0.20	0.04
0.20	0.23	0.23	0.28
0.23	1.12	0.27	1.39
0.27	2.66	0.31	4.06
0.31	2.79	0.36	6.84
0.36	1.96	0.42	8.80
0.42	1.66	0.49	10.46
0.49	1.58	0.58	12.04
0.58	1.08	0.67	13.11
0.67	0.66	0.78	13.97
0.78	0.67	0.91	14.64
0.91	0.61	1.06	15.24
1.06	0.58	1.24	15.82
1.24	0.53	1.44	16.35
1.44	0.41	1.68	16.76
1.68	0.27	1.96	17.03
1.96	0.18	2.28	17.21
2.28	0.18	2.65	17.39
2.65	0.30	3.09	17.69
3.09	0.65	3.60	18.27
3.60	1.09	4.19	19.36
4.19	1.92	4.88	21.28
4.88	3.23	5.69	24.51
5.69	5.15	6.63	29.67
6.63	7.59	7.72	37.26
7.72	10.16	9.00	47.41
9.00	12.22	10.48	59.63
10.48	11.77	12.21	71.40
12.21	9.79	14.22	81.19
14.22	7.23	16.57	88.42
16.57	4.79	19.31	93.22
19.31	2.79	22.49	96.01
22.49	1.33	26.20	97.34
26.20	0.39	30.53	97.73
30.53	0.00	35.56	97.73
35.56	0.00	41.43	97.73
41.43	0.00	48.27	97.73
48.27	0.00	56.23	97.73
56.23	0.03	65.51	97.76
65.51	0.14	76.32	97.90
76.32	0.19	88.91	98.09
88.91	0.20	103.66	98.29
103.66	0.17	120.87	98.46
120.87	0.13	140.88	98.59
140.88	0.10	163.77	98.69
163.77	0.08	190.80	98.77
190.80	0.08	222.28	98.86
222.28	0.11	258.96	98.96
258.96	0.14	301.69	99.10
301.69	0.18	351.46	99.28
351.46	0.20	409.46	99.49
409.46	0.20	477.01	99.68
477.01	0.16	555.71	99.85
555.71	0.11	647.41	99.95
647.41	0.05	754.23	100.00
754.23	0.00	878.67	100.00



Malvern Instruments Ltd.
Malvern, UK
Tel:0684 892456 Fax:0684 892789

Mastersizer S long bed Ver. 2.11
Serial Number: 32734-89

ศูนย์เครื่องมือวิจัยวิทยาศาสตร์และเทคโนโลยี จุฬาลงกรณ์มหาวิทยาลัย
อาคารสถาบัน 2 จุฬาลงกรณ์ ซอย 62 ถ.พญาไท ปทุมวัน กรุงเทพฯ 10330 โทร 2188029-32, 2188101
Scientific and Technological Research Equipment Centre Chulalongkorn University
Building 2-3 Chula Soi 62 Phaya-Thai Rd. Phatumwan Bangkok 10330 Tel. 2188029-32, 2188101

Result: Analysis Report

Sample Details

Sample ID: S10 JTP22N3
Sample File: PEERAPAT
Sample Path: A:\
Sample Notes: Test by Pranee: Scientific and Technological Research Equipment Centre Chulalongkorn University
Liquid medium: Water

Run Number: 1
Record Number: 1

Measurement Data: Wed, Nov 17, 1999 9:40AM
Analysis Data: Wed, Nov 17, 1999 9:40AM
Result Source: Analysed

System Details

Range Lens: 300RF mm
Presentation: 3OHD
Analysis Model: Polydisperse
Modifications: Active --

Beam Length: 2.40 mm
[Particle R.I. = (1.5295, 0.1000); Dispersant R.I. = 1.3300]
Killed Data Channels: Low 0; High 2

Sampler: MS17

Obscuration: 33.3 %
Residual: 0.224 %

Result Statistics

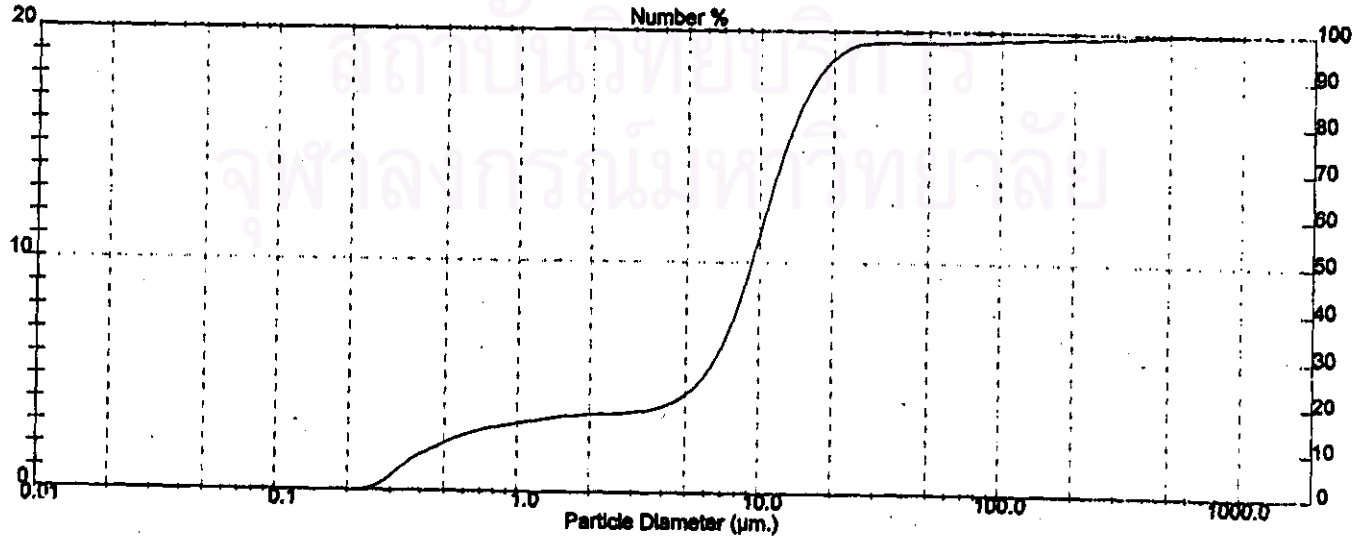
Distribution Type: Volume
Mean Diameters:
D [4, 3] = 14.91 um

Concentration = 0.0225 %Vol
D (v, 0.1) = 0.47 um
D [3, 2] = 2.03 um

Density = 1.000 g / cub. cm
D (v, 0.5) = 9.30 um
Span = 1.809E+00

Specific S.A. = 2.9814 sq. m / g
D (v, 0.9) = 17.30 um
Uniformity = 1.091E+00

Size_Low (um)	In %	Size_High (um)	Under%
0.06	0.00	0.06	0.00
0.06	0.00	0.07	0.00
0.07	0.00	0.08	0.00
0.08	0.00	0.09	0.00
0.09	0.00	0.11	0.00
0.11	0.00	0.13	0.00
0.13	0.00	0.15	0.00
0.15	0.01	0.17	0.01
0.17	0.04	0.20	0.04
0.20	0.23	0.23	0.28
0.23	1.12	0.27	1.39
0.27	2.66	0.31	4.05
0.31	2.79	0.36	6.84
0.36	1.95	0.42	8.80
0.42	1.66	0.49	10.46
0.49	1.58	0.58	12.04
0.58	1.05	0.67	13.11
0.67	0.86	0.78	13.97
0.78	0.67	0.91	14.64
0.91	0.61	1.06	15.24
1.06	0.58	1.24	15.82
1.24	0.53	1.44	16.36
1.44	0.41	1.68	16.76
1.68	0.27	1.96	17.03
1.96	0.18	2.28	17.21
2.28	0.18	2.66	17.39
2.66	0.30	3.09	17.69
3.09	0.59	3.60	18.27
3.60	1.09	4.19	19.35
4.19	1.92	4.88	21.28
4.88	3.23	5.69	24.51
5.69	5.15	6.63	29.67
6.63	7.59	7.72	37.26
7.72	10.15	9.00	47.41
9.00	12.22	10.48	59.63
10.48	11.77	12.21	71.40
12.21	9.79	14.22	81.19
14.22	7.23	16.57	88.42
16.57	4.79	19.31	93.22
19.31	2.79	22.49	96.01
22.49	1.33	26.20	97.34
26.20	0.39	30.53	97.73
30.53	0.00	35.56	97.73
35.56	0.00	41.43	97.73
41.43	0.00	48.27	97.73
48.27	0.00	56.23	97.73
56.23	0.03	65.51	97.76
65.51	0.14	76.32	97.90
76.32	0.19	88.91	98.09
88.91	0.20	103.58	98.29
103.58	0.17	120.67	98.46
120.67	0.13	140.58	98.59
140.58	0.10	163.77	98.69
163.77	0.08	190.80	98.77
190.80	0.08	222.28	98.85
222.28	0.11	258.96	98.96
258.96	0.14	301.68	99.10
301.68	0.18	351.46	99.29
351.46	0.20	409.45	99.49
409.45	0.20	477.01	99.68
477.01	0.16	555.71	99.85
555.71	0.11	647.41	99.96
647.41	0.06	754.23	100.00
754.23	0.00	878.67	100.00



Malvern Instruments Ltd.
Malvern, UK
Tel:0684 892456 Fax:0684 892789

Mastersizer S long bed Ver. 2.11
Serial Number: 32734-69

ศูนย์เครื่องมือวิจัยวิทยาศาสตร์และเทคโนโลยี จุฬาลงกรณ์มหาวิทยาลัย
อาคารสถาบัน 2 จุฬาลงกรณ์ ซอย 62 ถ.พญาไท ปทุมวัน กรุงเทพฯ 10330 โทร 2188029-32, 2188101
Scientific and Technological Research Equipment Centre Chulalongkorn University
Building 2-3 Chula Soi 62 Phaya-Thai Rd. Phatumwan Bangkok 10330 Tel. 2188029-32, 2188101

Result: Analysis Report

Sample Details

Sample ID: S10 JTP22N3
Sample File: PEERAPAT
Sample Path: A:\
Sample Notes: Test by Pranee: Scientific and Technological Research Equipment Centre Chulalongkorn University
Liquid medium: Water

Run Number: 1
Record Number: 1

Measurement Data: Wed, Nov 17, 1999 9:40AM
Analysis Data: Wed, Nov 17, 1999 9:40AM
Result Source: Analysed

System Details

Range Lens: 300RF mm
Presentation: 3OHD
Analysis Model: Polydisperse
Modifications: Active –

Beam Length: 2.40 mm
[Particle R.I. = (1.5298, 0.1000); Dispersant R.I. = 1.3300]
Killed Data Channels: Low 0; High 2

Sampler: MS17

Obscuration: 33.3 %
Residual: 0.224 %

Result Statistics

Distribution Type: Number
Mean Diameters:
D [4, 3] = 14.91 um

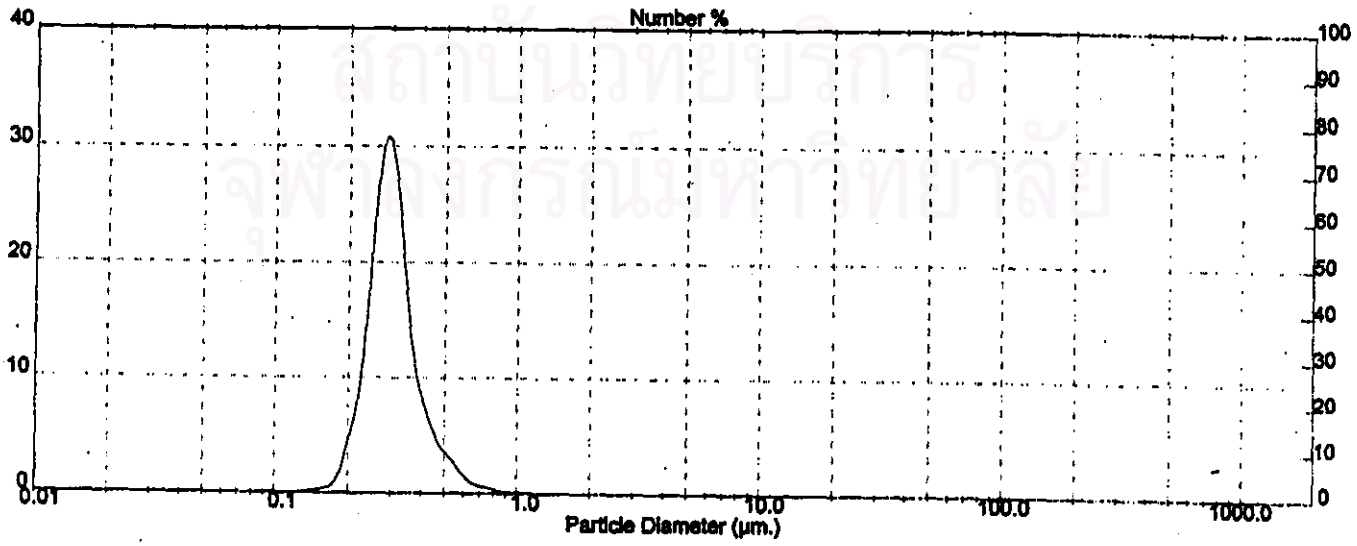
Concentration = 0.0225 %Vol
D (n, 0.1) = 0.23 um
D [3, 2] = 2.03 um

Density = 1.000 g / cub. cm
D (n, 0.5) = 0.30 um
Span = 6.583E-01

Specific S.A. = 2.9614 sq. m / g
D (n, 0.9) = 0.43 um
Uniformity = 2.287E-01

Size_Low (um)	In %	Size_High (um)	Under%
0.05	0.00	0.06	0.00
0.06	0.01	0.07	0.01
0.07	0.01	0.08	0.02
0.08	0.01	0.09	0.03
0.09	0.02	0.11	0.05
0.11	0.05	0.13	0.10
0.13	0.13	0.15	0.23
0.15	0.42	0.17	0.65
0.17	1.65	0.20	2.29
0.20	6.73	0.23	9.02
0.23	20.37	0.27	29.39
0.27	30.73	0.31	60.12
0.31	20.42	0.36	80.54
0.36	9.03	0.42	89.57
0.42	4.86	0.49	94.42
0.49	2.93	0.58	97.36
0.58	1.24	0.67	98.60
0.67	0.64	0.78	99.23
0.78	0.31	0.91	99.55
0.91	0.18	1.06	99.73
1.06	0.11	1.24	99.83
1.24	0.06	1.44	99.90
1.44	0.03	1.68	99.93
1.68	0.01	1.96	99.94
1.96	0.01	2.28	99.96
2.28	0.00	2.65	99.96
2.66	0.00	3.09	99.96
3.09	0.00	3.60	99.96
3.60	0.01	4.19	99.96
4.19	0.01	4.88	99.97
4.88	0.01	5.69	99.97
5.69	0.01	6.63	99.98

Size_Low (um)	In %	Size_High (um)	Under%
6.63	0.01	7.72	99.99
7.72	0.00	9.00	99.99
9.00	0.00	10.48	100.00
10.48	0.00	12.21	100.00
12.21	0.00	14.22	100.00
14.22	0.00	16.57	100.00
16.57	0.00	19.31	100.00
19.31	0.00	22.49	100.00
22.49	0.00	26.20	100.00
26.20	0.00	30.53	100.00
30.53	0.00	35.56	100.00
35.56	0.00	41.43	100.00
41.43	0.00	48.27	100.00
48.27	0.00	56.23	100.00
56.23	0.00	65.51	100.00
65.51	0.00	76.32	100.00
76.32	0.00	88.91	100.00
88.91	0.00	103.58	100.00
103.58	0.00	120.67	100.00
120.67	0.00	140.58	100.00
140.58	0.00	163.77	100.00
163.77	0.00	190.80	100.00
190.80	0.00	222.28	100.00
222.28	0.00	258.95	100.00
258.95	0.00	301.66	100.00
301.66	0.00	351.48	100.00
351.46	0.00	409.45	100.00
409.45	0.00	477.01	100.00
477.01	0.00	555.71	100.00
555.71	0.00	647.41	100.00
647.41	0.00	754.23	100.00
754.23	0.00	878.67	100.00



ศูนย์เครื่องมือวิจัยวิทยาศาสตร์และเทคโนโลยี จุฬาลงกรณ์มหาวิทยาลัย
อาคารอเนกประสงค์ 2 จุฬาลงกรณ์ ซอย 62 ถ.พญาไท ปทุมวัน กรุงเทพฯ 10330 โทร 2188029-32, 2188101
Scientific and Technological Research Equipment Centre Chulalongkorn University
Building 2-3 Chula Soi 62 Phaya-Thai Rd. Phatumwan Bangkok 10330 Tel. 2188029-32, 2188101

Result: Analysis Report

Sample Details

Sample ID: S12 JTP22N4
Sample File: PEERAPAT
Sample Path: A:\
Sample Notes: Test by Pranee: Scientific and Technological Research Equipment Centre Chulalongkorn University
Liquid medium: Water

Run Number: 3
Record Number: 11

Measurement Date: Wed, Nov 17, 1999 9:54AM
Analysis Date: Wed, Nov 17, 1999 9:54AM
Result Source: Analysed

System Details

Range Lens: 300RF mm
Presentation: 3OHD
Analysis Model: Polydisperse
Modifications: Active --'

Beam Length: 2.40 mm
[Particle R.I. = (1.5295, 0.1000); Dispersant R.I. = 1.3300]
Killed Data Channels: Low 0; High 2

Sampler: MS17

Obscuration: 25.3 %
Residual: 0.242 %

Result Statistics

Distribution Type: Volume
Mean Diameters:
D [4, 3] = 25.08 um

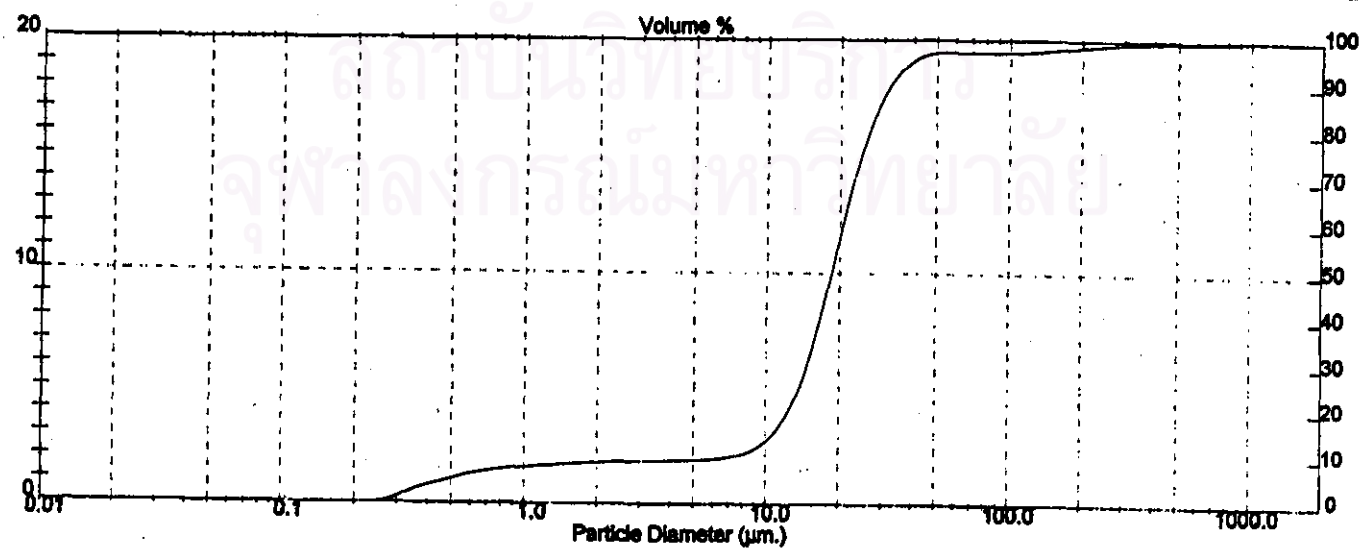
Concentration = 0.0300 %Vol
D (v, 0.1) = 6.86 um
D [3, 2] = 3.91 um

Density = 1.000 g / cub. cm
D (v, 0.5) = 18.52 um
Span = 1.356E+00

Specific S.A. = 1.5340 sq. m / g
D (v, 0.9) = 31.97 um
Uniformity = 7.260E-01

Size_Low (um)	In %	Size_High (um)	Under%
0.06	0.00	0.06	0.00
0.06	0.00	0.07	0.00
0.07	0.00	0.08	0.00
0.08	0.00	0.09	0.00
0.09	0.00	0.11	0.00
0.11	0.00	0.13	0.00
0.13	0.00	0.15	0.00
0.15	0.00	0.17	0.00
0.17	0.01	0.20	0.01
0.20	0.06	0.23	0.07
0.23	0.43	0.27	0.50
0.27	1.30	0.31	1.80
0.31	1.47	0.36	3.27
0.36	1.02	0.42	4.29
0.42	0.91	0.49	5.20
0.49	0.95	0.58	6.15
0.58	0.64	0.67	6.79
0.67	0.52	0.78	7.31
0.78	0.37	0.91	7.68
0.91	0.30	1.06	7.97
1.06	0.25	1.24	8.22
1.24	0.22	1.44	8.44
1.44	0.20	1.68	8.64
1.68	0.18	1.96	8.82
1.96	0.16	2.28	8.98
2.28	0.13	2.65	9.11
2.65	0.10	3.09	9.21
3.09	0.06	3.60	9.27
3.60	0.04	4.19	9.31
4.19	0.06	4.88	9.37
4.88	0.15	5.69	9.52
5.69	0.36	6.63	9.88

Size_Low (um)	In %	Size_High (um)	Under%
6.63	0.72	7.72	10.60
7.72	1.38	9.00	11.98
9.00	2.60	10.48	14.58
10.48	4.82	12.21	19.40
12.21	8.22	14.22	27.62
14.22	12.00	16.57	39.62
16.57	14.43	19.31	54.06
19.31	14.68	22.49	68.74
22.49	11.49	26.20	80.23
26.20	7.98	30.53	88.21
30.53	5.00	35.58	93.21
35.58	2.76	41.43	95.97
41.43	1.20	48.27	97.16
48.27	0.22	56.23	97.39
56.23	0.00	65.51	97.39
65.51	0.00	76.32	97.39
76.32	0.00	88.91	97.39
88.91	0.00	103.58	97.39
103.58	0.12	120.67	97.51
120.67	0.29	140.58	97.79
140.58	0.38	163.77	98.16
163.77	0.36	190.80	98.52
190.80	0.32	222.28	98.84
222.28	0.25	258.96	99.09
258.96	0.20	301.68	99.29
301.68	0.15	351.46	99.44
351.46	0.12	409.45	99.56
409.45	0.11	477.01	99.67
477.01	0.10	555.71	99.77
555.71	0.10	647.41	99.86
647.41	0.08	754.23	99.94
754.23	0.06	878.67	100.00



ศูนย์เครื่องมือวิจัยวิทยาศาสตร์และเทคโนโลยี จุฬาลงกรณ์มหาวิทยาลัย
อาคารสถาบัน 2 จุฬาลงกรณ์ ซอย 62 ถ.พญาไท ปทุมวัน กรุงเทพฯ 10330 โทร 2188029-32, 2188101
Scientific and Technological Research Equipment Centre Chulalongkorn University
Building 2-3 Chula Soi 62 Phaya-Thai Rd. Phatumwan Bangkok 10330 Tel. 2188029-32, 2188101

Result: Analysis Report

Sample Details

Sample ID: S12 JTP22N4
Sample File: PEERAPAT
Sample Path: A:\
Sample Notes: Test by Pranee: Scientific and Technological Research Equipment Centre Chulalongkorn University
Liquid medium: Water

Run Number: 3
Record Number: 11

Measurement Date: Wed, Nov 17, 1999 9:54AM
Analysis Date: Wed, Nov 17, 1999 9:54AM
Result Source: Analysed

System Details

Range Lens: 300RF mm
Presentation: 3OHD
Analysis Model: Polydisperse
Modifications: Active --

Beam Length: 2.40 mm
[Particle R.I. = (1.5295, 0.1000); Dispersant R.I. = 1.3300]
Killed Data Channels: Low 0; High 2

Sampler: MS17

Obscuration: 25.3 %
Residual: 0.242 %

Result Statistics

Distribution Type: Volume
Mean Diameters:
D [4, 3] = 25.08 um

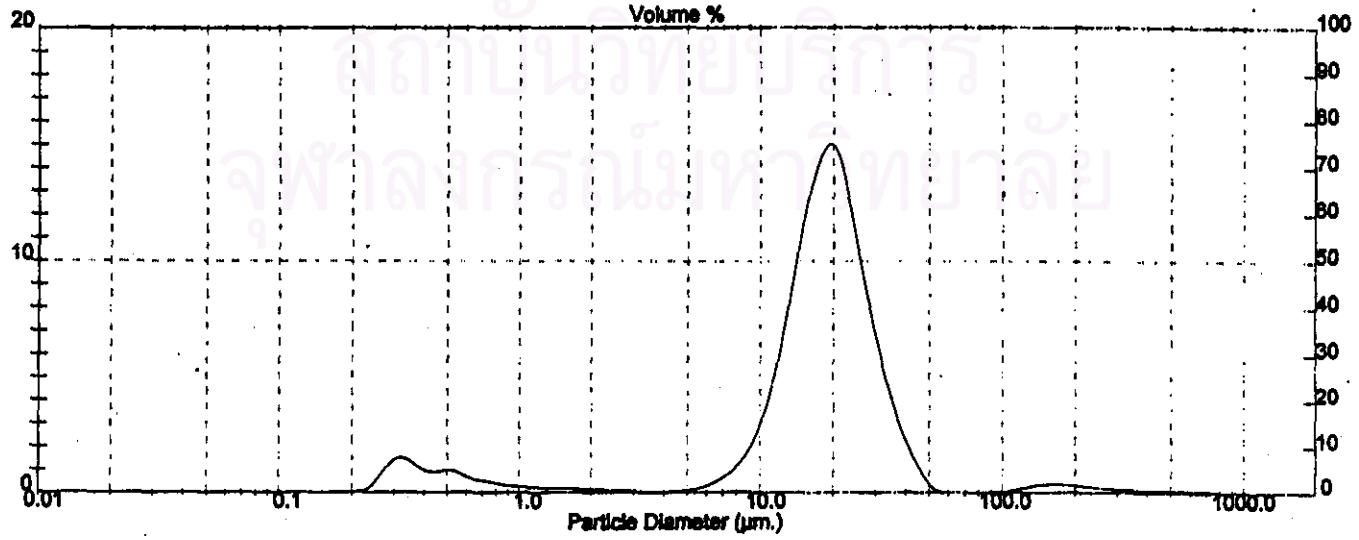
Concentration = 0.0300 %Vol
D (v, 0.1) = 5.66 um
D [3, 2] = 3.91 um

Density = 1.000 g / cub. cm
D (v, 0.5) = 18.52 um
Span = 1.366E+00

Specific S.A. = 1.5340 sq. m / g
D (v, 0.9) = 31.97 um
Uniformity = 7.260E-01

Size_Low (um)	In %	Size_High (um)	Under%
0.06	0.00	0.06	0.00
0.06	0.00	0.07	0.00
0.07	0.00	0.08	0.00
0.08	0.00	0.09	0.00
0.09	0.00	0.11	0.00
0.11	0.00	0.13	0.00
0.13	0.00	0.15	0.00
0.15	0.00	0.17	0.00
0.17	0.01	0.20	0.01
0.20	0.06	0.23	0.07
0.23	0.43	0.27	0.50
0.27	1.30	0.31	1.80
0.31	1.47	0.36	3.27
0.36	1.02	0.42	4.29
0.42	0.91	0.49	5.20
0.49	0.96	0.58	6.15
0.58	0.64	0.67	6.79
0.67	0.52	0.78	7.31
0.78	0.37	0.91	7.68
0.91	0.30	1.06	7.97
1.06	0.25	1.24	8.22
1.24	0.22	1.44	8.44
1.44	0.20	1.68	8.64
1.68	0.18	1.96	8.82
1.96	0.16	2.28	8.98
2.28	0.13	2.65	9.11
2.65	0.10	3.09	9.21
3.09	0.06	3.60	9.27
3.60	0.04	4.19	9.31
4.19	0.06	4.88	9.37
4.88	0.15	5.69	9.52
5.69	0.35	6.63	9.88

Size_Low (um)	In %	Size_High (um)	Under%
6.63	0.72	7.72	10.60
7.72	1.38	9.00	11.98
9.00	2.60	10.48	14.58
10.48	4.82	12.21	19.40
12.21	8.22	14.22	27.62
14.22	12.00	16.57	39.62
16.57	14.43	19.31	54.06
19.31	14.68	22.49	68.74
22.49	11.49	26.20	80.23
26.20	7.98	30.53	88.21
30.53	5.00	35.56	93.21
35.56	2.75	41.43	95.97
41.43	1.20	48.27	97.16
48.27	0.22	56.23	97.39
56.23	0.00	65.51	97.39
65.51	0.00	76.32	97.39
76.32	0.00	88.91	97.39
88.91	0.00	103.58	97.39
103.58	0.12	120.67	97.51
120.67	0.29	140.58	97.79
140.58	0.36	163.77	98.15
163.77	0.36	190.80	98.52
190.80	0.32	222.28	98.84
222.28	0.26	258.95	99.09
258.95	0.20	301.68	99.29
301.68	0.15	351.46	99.44
351.46	0.12	409.45	99.56
409.45	0.11	477.01	99.67
477.01	0.10	555.71	99.77
555.71	0.10	647.41	99.86
647.41	0.08	754.23	99.94
754.23	0.06	878.67	100.00



ศูนย์เครื่องมือวิจัยวิทยาศาสตร์และเทคโนโลยี จุฬาลงกรณ์มหาวิทยาลัย
อาคารอเนกประสงค์ 2 จุฬาลงกรณ์ ซอย 62 ถ.พญาไท ปทุมวัน กรุงเทพฯ 10330 โทร. 2188029-32, 2188101
Scientific and Technological Research Equipment Centre Chulalongkorn University
Building 2-3 Chula Soi 62 Phaya-Thai Rd. Phatumwan Bangkok 10330 Tel. 2188029-32, 2188101

Result: Analysis Report

Sample Details

Sample ID: S12 JTP22N4
Sample File: PEERAPAT
Sample Path: A:\
Sample Notes: Test by Pranee: Scientific and Technological Research Equipment Centre Chulalongkorn University
Liquid medium: Water

Run Number: 3
Record Number: 11

Measurement Date: Wed, Nov 17, 1999 9:54AM
Analysis Date: Wed, Nov 17, 1999 9:54AM
Result Source: Analysed

System Details

Range Lens: 300RF mm
Presentation: 3OHD
Analysis Model: Polydisperse
Modifications: Active --

Beam Length: 2.40 mm
[Particle R.I. = (1.5295, 0.1000); Dispersant R.I. = 1.3300]
Killed Data Channels: Low 0; High 2

Sampler: MS17

Obscuration: 28.3 %
Residual: 0.242 %

Result Statistics

Distribution Type: Number
Mean Diameters:
D [4, 3] = 25.08 um

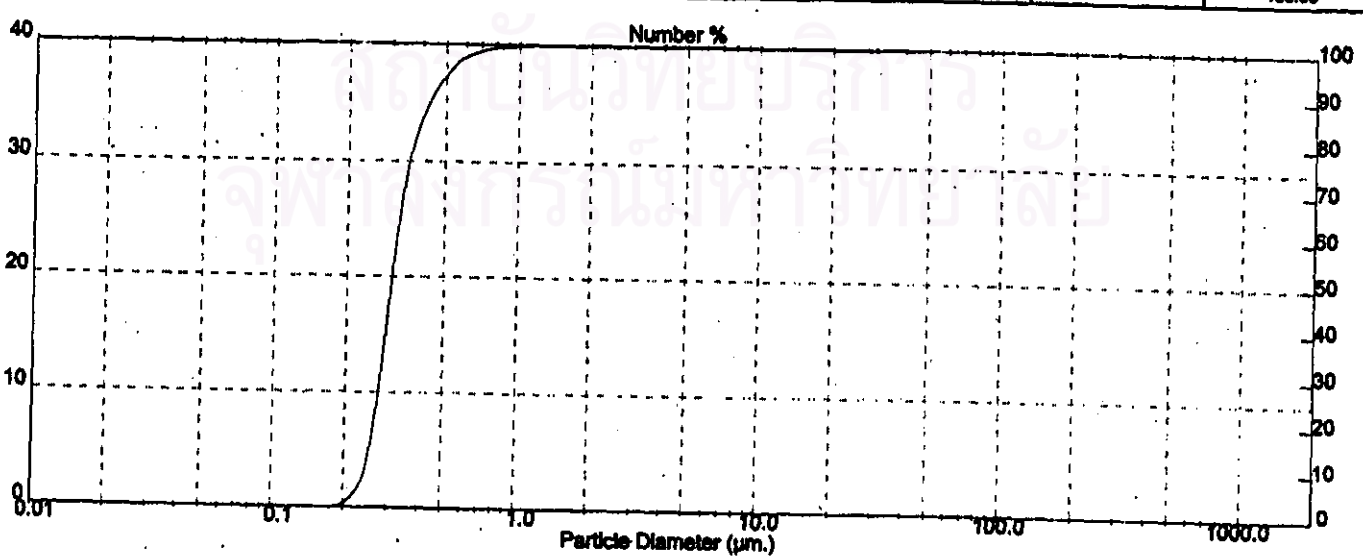
Concentration = 0.0300 %Vol
D (n, 0.1) = 0.26 um
D [3, 2] = 3.91 um

Density = 1.000 g / cub. cm
D (n, 0.5) = 0.31 um
Span = 6.665E-01

Specific S.A. = 1.5340 sq. m / g
D (n, 0.9) = 0.45 um
Uniformity = 2.258E-01

Size_Low (um)	In %	Size_High (um)	Under%
0.06	0.00	0.06	0.00
0.06	0.00	0.07	0.00
0.07	0.00	0.08	0.00
0.08	0.00	0.09	0.00
0.09	0.00	0.11	0.00
0.11	0.01	0.13	0.01
0.13	0.02	0.15	0.03
0.15	0.10	0.17	0.13
0.17	0.60	0.20	0.74
0.20	3.82	0.23	4.56
0.23	16.97	0.27	21.53
0.27	32.48	0.31	54.01
0.31	23.09	0.36	77.10
0.36	10.13	0.42	87.23
0.42	5.75	0.49	92.97
0.49	3.79	0.58	96.76
0.58	1.61	0.67	98.38
0.67	0.83	0.78	99.20
0.78	0.37	0.91	99.57
0.91	0.19	1.06	99.76
1.06	0.10	1.24	99.86
1.24	0.06	1.44	99.91
1.44	0.03	1.68	99.95
1.68	0.02	1.96	99.96
1.96	0.01	2.28	99.97
2.28	0.01	2.66	99.98
2.66	0.00	3.09	99.98
3.09	0.00	3.60	99.99
3.60	0.00	4.19	99.99
4.19	0.00	4.88	99.99
4.88	0.00	5.69	99.99
5.69	0.00	6.63	99.99

Size_Low (um)	In %	Size_High (um)	Under%
6.63	0.00	7.72	99.99
7.72	0.00	9.00	99.99
9.00	0.00	10.48	99.99
10.48	0.00	12.21	99.99
12.21	0.00	14.22	99.99
14.22	0.00	16.57	100.00
16.57	0.00	19.31	100.00
19.31	0.00	22.49	100.00
22.49	0.00	26.20	100.00
26.20	0.00	30.53	100.00
30.53	0.00	35.56	100.00
35.56	0.00	41.43	100.00
41.43	0.00	48.27	100.00
48.27	0.00	56.23	100.00
56.23	0.00	65.51	100.00
65.51	0.00	76.32	100.00
76.32	0.00	88.91	100.00
88.91	0.00	103.56	100.00
103.56	0.00	120.67	100.00
120.67	0.00	140.58	100.00
140.58	0.00	163.77	100.00
163.77	0.00	190.80	100.00
190.80	0.00	222.28	100.00
222.28	0.00	258.96	100.00
258.96	0.00	301.68	100.00
301.68	0.00	351.46	100.00
351.46	0.00	409.45	100.00
409.45	0.00	477.01	100.00
477.01	0.00	555.71	100.00
555.71	0.00	647.41	100.00
647.41	0.00	754.23	100.00
754.23	0.00	878.67	100.00



ศูนย์เครื่องมือวิจัยวิทยาศาสตร์และเทคโนโลยี จุฬาลงกรณ์มหาวิทยาลัย
อาคารสถาบัน 2 จุฬาลงกรณ์ ซอย 62 ถ.พญาไท ปทุมวัน กรุงเทพฯ 10330 โทร 2188029-32, 2188101
Scientific and Technological Research Equipment Centre Chulalongkorn University
Building 2-3 Chula Soi 62 Phaya-Thai Rd. Phatumwan Bangkok 10330 Tel. 2188029-32, 2188101

Result: Analysis Report

Sample Details

Sample ID: S12 JTP22N4
Sample File: PEERAPAT
Sample Path: A:\
Sample Notes: Test by Pranee: Scientific and Technological Research Equipment Centre Chulalongkorn University
Liquid medium: Water

Run Number: 3
Record Number: 11

Measurement Data: Wed, Nov 17, 1999 9:54AM
Analysis Data: Wed, Nov 17, 1999 9:54AM
Result Source: Analysed

System Details

Range Lens: 300RF mm
Presentation: 3OHD
Analysis Model: Polydisperse
Modifications: Active --

Beam Length: 2.40 mm
Particle R.I. = (1.5295, 0.1000); Dispersant R.I. = 1.3300]
Killed Data Channels: Low 0; High 2

Sampler: MS17

Obscuration: 25.3 %
Residual: 0.242 %

Result Statistics

Distribution Type: Number
Mean Diameters:
D [4, 3] = 25.06 um

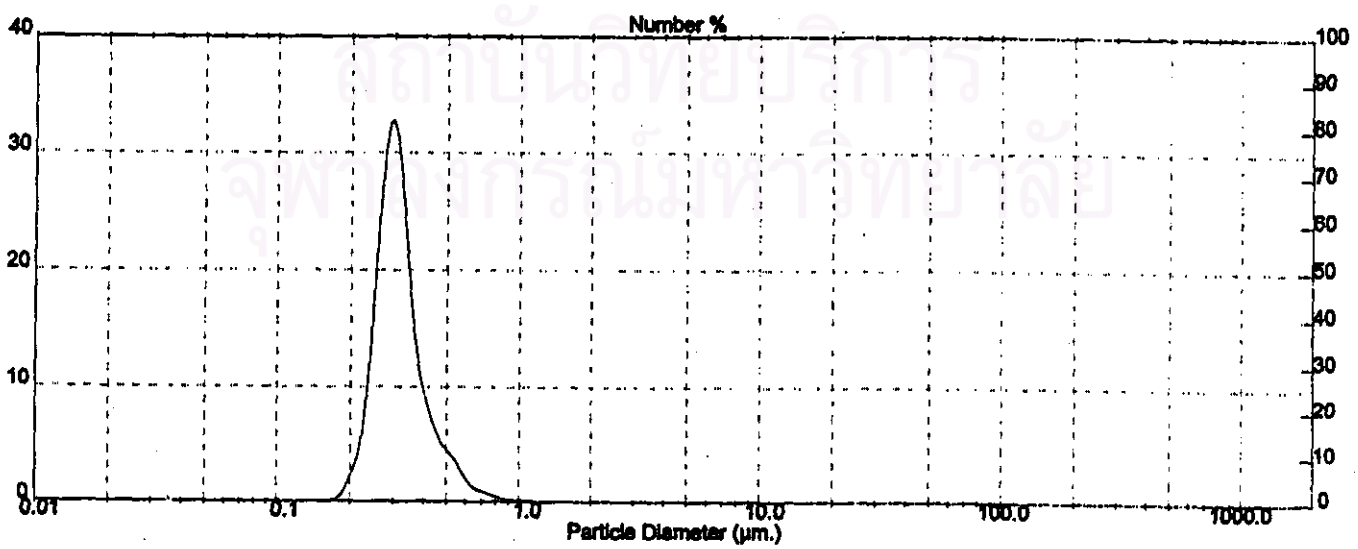
Concentration = 0.0300 %Vol
D (n, 0.1) = 0.25 um
D [3, 2] = 3.91 um

Density = 1.000 g / cub. cm
D (n, 0.5) = 0.31 um
Span = 6.665E-01

Specific S.A. = 1.5340 sq. m / g
D (n, 0.9) = 0.45 um
Uniformity = 2.258E-01

Size_Low (um)	In %	Size_High (um)	Under%
0.05	0.00	0.06	0.00
0.06	0.00	0.07	0.00
0.07	0.00	0.08	0.00
0.08	0.00	0.09	0.00
0.09	0.00	0.11	0.00
0.11	0.01	0.13	0.01
0.13	0.02	0.15	0.03
0.15	0.10	0.17	0.13
0.17	0.60	0.20	0.74
0.20	3.82	0.23	4.56
0.23	16.97	0.27	21.53
0.27	32.48	0.31	54.01
0.31	23.09	0.36	77.10
0.36	10.13	0.42	87.23
0.42	5.75	0.48	92.97
0.49	3.79	0.58	96.75
0.58	1.61	0.67	98.36
0.67	0.83	0.78	99.20
0.78	0.37	0.91	99.57
0.91	0.19	1.06	99.76
1.06	0.10	1.24	99.86
1.24	0.06	1.44	99.91
1.44	0.03	1.68	99.95
1.68	0.02	1.96	99.96
1.96	0.01	2.28	99.97
2.28	0.01	2.65	99.98
2.65	0.00	3.09	99.98
3.09	0.00	3.60	99.98
3.60	0.00	4.19	99.98
4.19	0.00	4.85	99.98
4.85	0.00	5.69	99.99
5.69	0.00	6.63	99.99

Size_Low (um)	In %	Size_High (um)	Under%
6.63	0.00	7.72	99.99
7.72	0.00	9.00	99.99
9.00	0.00	10.48	99.99
10.48	0.00	12.21	99.99
12.21	0.00	14.22	99.99
14.22	0.00	16.57	100.00
16.57	0.00	19.31	100.00
19.31	0.00	22.49	100.00
22.49	0.00	26.20	100.00
26.20	0.00	30.53	100.00
30.53	0.00	35.56	100.00
35.56	0.00	41.43	100.00
41.43	0.00	48.27	100.00
48.27	0.00	56.23	100.00
56.23	0.00	65.51	100.00
65.51	0.00	76.32	100.00
76.32	0.00	88.91	100.00
88.91	0.00	103.58	100.00
103.58	0.00	120.67	100.00
120.67	0.00	140.58	100.00
140.58	0.00	163.77	100.00
163.77	0.00	190.80	100.00
190.80	0.00	222.28	100.00
222.28	0.00	258.96	100.00
258.96	0.00	301.68	100.00
301.68	0.00	351.46	100.00
351.46	0.00	409.45	100.00
409.45	0.00	477.01	100.00
477.01	0.00	555.71	100.00
555.71	0.00	647.41	100.00
647.41	0.00	754.23	100.00
754.23	0.00	878.67	100.00



alvern Instruments Ltd.
alvern, UK
l:0684 892456 Fax:0684 892789

Mastersizer S long bed Ver. 2.11
Serial Number: 32734-89

ศูนย์เครื่องมือวิจัยวิทยาศาสตร์และเทคโนโลยี จุฬาลงกรณ์มหาวิทยาลัย
อาคารสถาบัน 2 จุฬาลงกรณ์ ซอย 62 ถ.พญาไท ปทุมวัน กรุงเทพฯ 10330 โทร 2188029-32, 2188101

Scientific and Technological Research Equipment Centre Chulalongkorn University
Building 2-3 Chula Soi 62 Phaya-Thai Rd. Phatumwan Bangkok 10330 Tel. 2188029-32, 2188101

Result: Analysis Report

Sample Details

Sample ID: white fuse alu 60:20
Sample File: PEERAP
Sample Path: A:\
Sample Notes: Test by Pranee: Scientific and Technological Research Equipment Centre Chulalongkorn University
Liquid medium: Water

Run Number: 1
Record Number: 8

Measurement Date: Thu, Dec 16, 1999 1:52PM
Analysis Date: Thu, Dec 16, 1999 1:52PM
Result Source: Analysed

System Details

Range Lens: 300RF mm
Presentation: 3OHD
Analysis Model: Polydisperse
Modifications: Active --

Beam Length: 2.40 mm
[Particle R.I. = (1.8295, 0.1000); Dispersant R.I. = 1.3300]

Killed Data Channels: Low 0; High 2

Sampler: MS17

Obscuration: 27.1 %
Residual: 0.242 %

Result Statistics

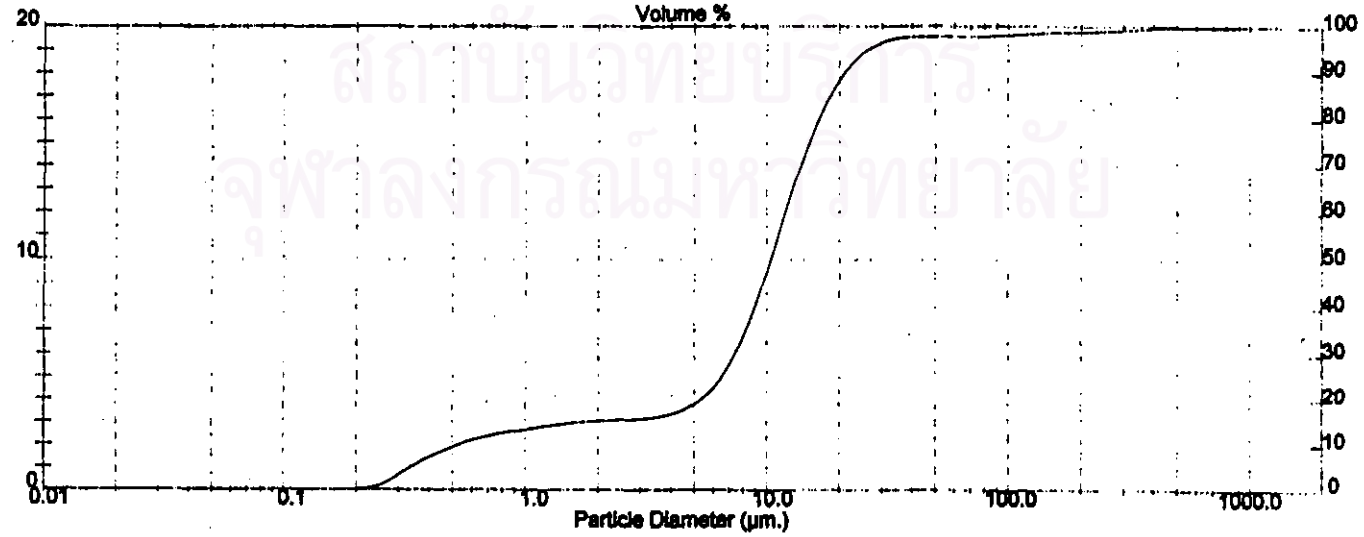
Distribution Type: Volume
Mean Diameters:
D [4, 3] = 15.96 um

Concentration = 0.0195 %Vol
D (v, 0.1) = 0.53 um
D [3, 2] = 2.21 um

Density = 1.000 g / cub. cm
D (v, 0.5) = 10.36 um
Span = 1.981E+00

Specific S.A. = 2.7121 sq. m / g
D (v, 0.9) = 21.10 um
Uniformity = 1.017E+00

Size_Low (um)	In %	Size_High (um)	Under%
0.06	0.00	0.06	0.00
0.06	0.00	0.07	0.00
0.07	0.00	0.08	0.00
0.08	0.00	0.09	0.00
0.09	0.00	0.11	0.00
0.11	0.00	0.13	0.01
0.13	0.01	0.15	0.02
0.15	0.03	0.17	0.05
0.17	0.11	0.20	0.15
0.20	0.40	0.23	0.56
0.23	1.21	0.27	1.78
0.27	2.19	0.31	3.96
0.31	2.23	0.35	6.19
0.35	1.69	0.42	7.88
0.42	1.46	0.49	9.33
0.49	1.35	0.58	10.68
0.58	0.97	0.67	11.65
0.67	0.79	0.76	12.43
0.76	0.63	0.91	13.07
0.91	0.56	1.06	13.62
1.06	0.51	1.24	14.13
1.24	0.45	1.44	14.58
1.44	0.35	1.68	14.93
1.68	0.24	1.95	15.16
1.95	0.16	2.28	15.32
2.28	0.14	2.65	15.46
2.65	0.24	3.09	15.70
3.09	0.47	3.60	16.16
3.60	0.91	4.19	17.09
4.19	1.64	4.88	18.72
4.88	2.78	5.69	21.46
5.69	4.36	6.63	25.84
6.63	6.35	7.72	32.20
7.72	8.41	9.00	40.60
9.00	10.04	10.48	50.64
10.48	11.06	12.21	61.71
12.21	10.16	14.22	71.88
14.22	8.53	16.57	80.39
16.57	6.63	19.31	87.02
19.31	4.75	22.49	91.77
22.49	3.10	26.20	94.87
26.20	1.80	30.53	96.67
30.53	0.86	35.58	97.53
35.58	0.27	41.43	97.79
41.43	0.00	48.27	97.79
48.27	0.00	56.23	97.79
56.23	0.00	65.51	97.79
65.51	0.05	76.32	97.84
76.32	0.13	88.91	97.97
88.91	0.19	103.58	98.16
103.58	0.20	120.67	98.36
120.67	0.18	140.58	98.54
140.58	0.16	163.77	98.68
163.77	0.12	190.80	98.81
190.80	0.12	222.28	98.92
222.28	0.14	258.96	99.06
258.96	0.17	301.69	99.23
301.69	0.20	351.46	99.43
351.46	0.21	409.45	99.64
409.45	0.18	477.01	99.82
477.01	0.12	555.71	99.94
555.71	0.05	647.41	100.00
647.41	0.00	754.23	100.00
754.23	0.00	878.67	100.00



ศูนย์เครื่องมือวิจัยวิทยาศาสตร์และเทคโนโลยี จุฬาลงกรณ์มหาวิทยาลัย
อาคารอเนกประสงค์ 2 จุฬาลงกรณ์ ซอย 62 ถ.พญาไท ปทุมวัน กรุงเทพฯ 10330 โทร. 2188029-32, 2188101
Scientific and Technological Research Equipment Centre Chulalongkorn University
Building 2-3 Chula Soi 62 Phaya-Thai Rd. Phatumwan Bangkok 10330 Tel. 2188029-32, 2188101

Result: Analysis Report

Sample Details

Sample ID: white fuse alu 80:20
Sample File: PEERAP
Sample Path: A:\
Sample Notes: Test by Pranee: Scientific and Technological Research Equipment Centre Chulalongkorn University
Liquid medium: Water

Run Number: 1
Record Number: 8

Measurement Date: Thu, Dec 16, 1999 1:52PM
Analysis Date: Thu, Dec 16, 1999 1:52PM
Result Source: Analysed

System Details

Range Lens: 300RF mm
Presentation: 3OHD
Analysis Model: Polydisperse
Modifications: Active –

Beam Length: 2.40 mm
[Particle R.I. = (1.5295, 0.1000); Dispersant R.I. = 1.3300]
Killed Data Channels: Low 0; High 2

Sampler: MS17

Obscuration: 27.1 %
Residual: 0.242 %

Result Statistics

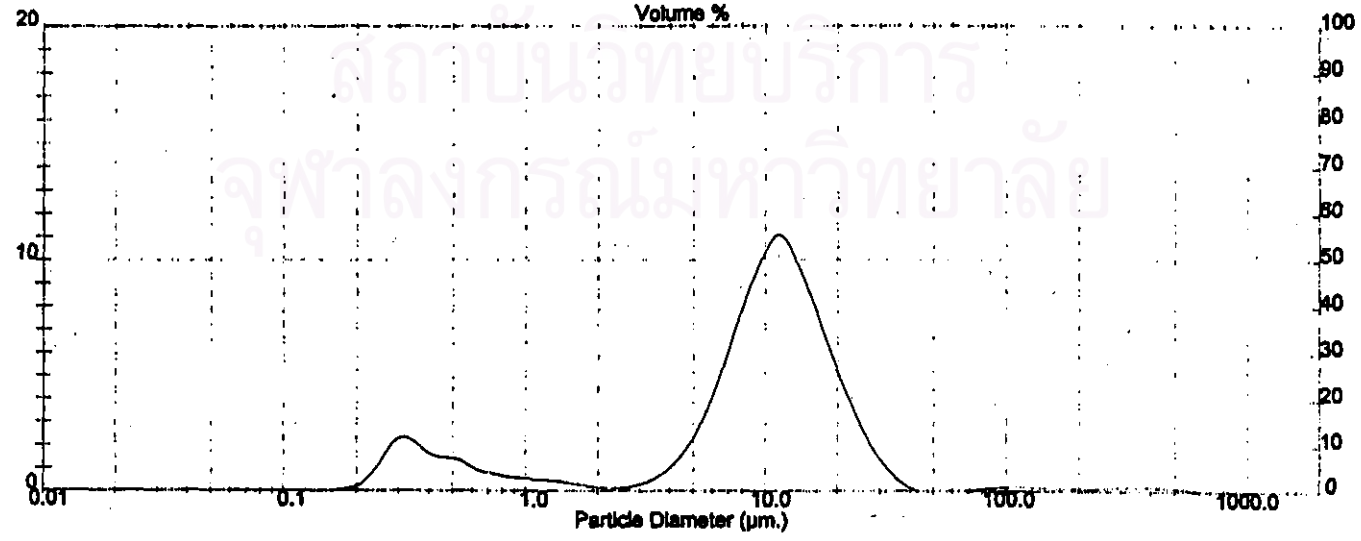
Distribution Type: Volume
Mean Diameters:
D [4, 3] = 16.98 um

Concentration = 0.0196 %Vol
D (v, 0.1) = 0.53 um
D [3, 2] = 2.21 um

Density = 1.000 g / cub. cm
D (v, 0.5) = 10.38 um
Span = 1.981E+00

Specific S.A. = 2.7121 sq. m / g
D (v, 0.9) = 21.10 um
Uniformity = 1.017E+00

Size_Low (um)	In %	Size_High (um)	Under%
0.06	0.00	0.06	0.00
0.06	0.00	0.07	0.00
0.07	0.00	0.08	0.00
0.08	0.00	0.09	0.00
0.09	0.00	0.11	0.00
0.11	0.00	0.13	0.01
0.13	0.01	0.15	0.02
0.15	0.03	0.17	0.05
0.17	0.11	0.20	0.16
0.20	0.40	0.23	0.56
0.23	1.21	0.27	1.76
0.27	2.19	0.31	3.96
0.31	2.23	0.36	6.19
0.36	1.69	0.42	7.88
0.42	1.48	0.49	9.33
0.49	1.35	0.58	10.68
0.58	0.97	0.67	11.65
0.67	0.79	0.78	12.43
0.78	0.63	0.91	13.07
0.91	0.58	1.06	13.62
1.06	0.51	1.24	14.13
1.24	0.45	1.44	14.58
1.44	0.35	1.68	14.93
1.68	0.24	1.96	15.16
1.96	0.16	2.28	15.32
2.28	0.14	2.65	15.46
2.65	0.24	3.09	15.70
3.09	0.47	3.60	16.18
3.60	0.91	4.19	17.09
4.19	1.64	4.88	18.72
4.88	2.76	5.69	21.48
5.69	4.36	6.63	25.84
6.63	6.35	7.72	32.20
7.72	8.41	9.00	40.60
9.00	10.04	10.48	50.64
10.48	11.06	12.21	61.71
12.21	10.18	14.22	71.88
14.22	8.53	16.57	80.39
16.57	6.53	19.31	87.02
19.31	4.76	22.49	91.77
22.49	3.10	26.20	94.87
26.20	1.80	30.53	96.67
30.53	0.86	35.58	97.53
35.58	0.27	41.43	97.79
41.43	0.00	48.27	97.79
48.27	0.00	56.23	97.79
56.23	0.00	65.51	97.79
65.51	0.05	76.32	97.84
76.32	0.13	88.91	97.97
88.91	0.19	103.56	98.16
103.56	0.20	120.67	98.36
120.67	0.18	140.58	98.54
140.58	0.15	163.77	98.68
163.77	0.12	190.80	98.81
190.80	0.12	222.28	98.92
222.28	0.14	258.96	99.06
258.96	0.17	301.68	99.23
301.68	0.20	351.48	99.43
351.48	0.21	409.45	99.64
409.45	0.18	477.01	99.82
477.01	0.12	555.71	99.94
555.71	0.06	647.41	100.00
647.41	0.00	754.23	100.00
754.23	0.00	878.67	100.00



ศูนย์เครื่องมือวิจัยวิทยาศาสตร์และเทคโนโลยี จุฬาลงกรณ์มหาวิทยาลัย
อาคารสถาบัน 2 จุฬาลงกรณ์ ซอย 62 ถ.พญาไท ปทุมวัน กรุงเทพฯ 10330 โทร 2188029-32, 2188101
Scientific and Technological Research Equipment Centre Chulalongkorn University
Building 2-3 Chula Soi 62 Phaya-Thai Rd. Phatumwan Bangkok 10330 Tel. 2188029-32, 2188101

Result: Analysis Report

Sample Details

Sample ID: white fuse alu 50:50
Sample File: PEERAP
Sample Path: A:\
Sample Notes: Test by Pranee: Scientific and Technological Research Equipment Centre Chulalongkorn University
Liquid medium: Water

Run Number: 1
Record Number: 11

Measurement Date: Thu, Dec 16, 1999 1:58PM
Analysis Date: Thu, Dec 16, 1999 1:58PM
Result Source: Analysed

System Details

Range Lens: 300RF mm
Presentation: 3OHD
Analysis Model: Polydisperse
Modifications: Active --

Beam Length: 2.40 mm
[Particle R.I. = (1.5295, 0.1000); Dispersant R.I. = 1.3300]
Killed Data Channels: Low 0; High 2

Sampler: M817

Obscuration: 20.4 %
Residual: 0.161 %

Result Statistics

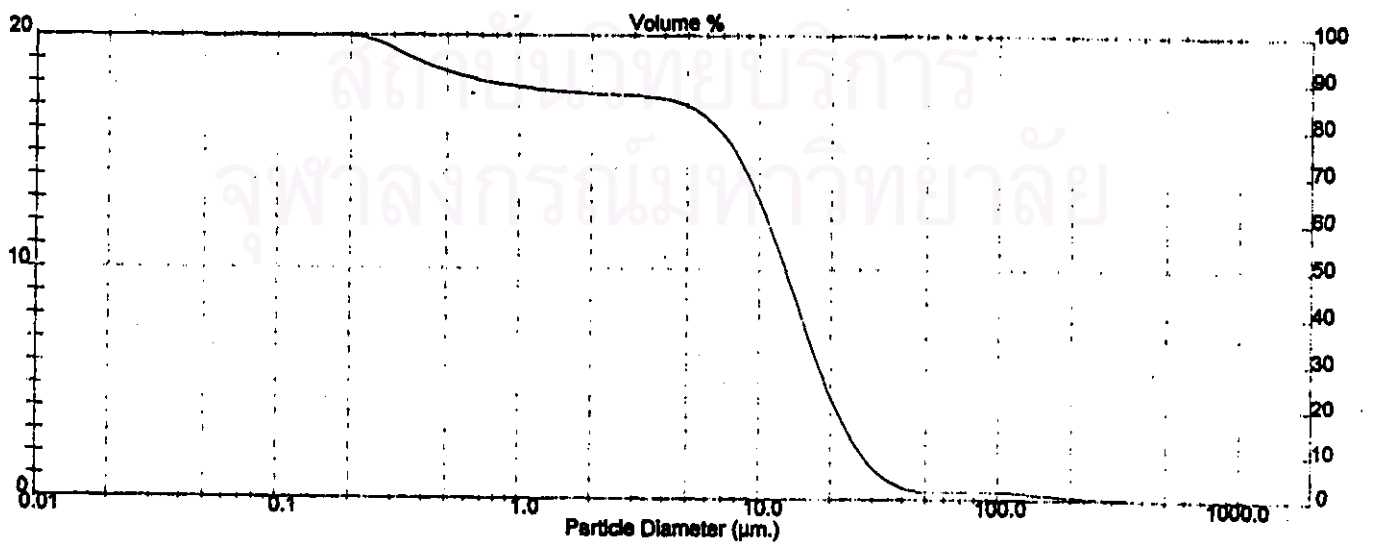
Distribution Type: Volume
Mean Diameters:
D [4, 3] = 17.10 um

Concentration = 0.0168 %Vol
D (v, 0.1) = 0.75 um
D [3, 2] = 2.65 um

Density = 1.000 g / cub. cm
D (v, 0.5) = 12.92 um
Span = 2.021E+00

Specific S.A. = 2.2630 sq. m / g
D (v, 0.9) = 29.85 um
Uniformity = 7.905E-01

Size_Low (um)	In %	Size_High (um)	Under%
0.05	0.00	0.06	0.00
0.06	0.00	0.07	0.00
0.07	0.00	0.08	0.00
0.08	0.00	0.09	0.00
0.09	0.00	0.11	0.01
0.11	0.01	0.13	0.01
0.13	0.01	0.15	0.03
0.15	0.04	0.17	0.07
0.17	0.13	0.20	0.19
0.20	0.39	0.23	0.58
0.23	1.01	0.27	1.59
0.27	1.70	0.31	3.29
0.31	1.73	0.36	5.02
0.36	1.36	0.42	6.38
0.42	1.19	0.49	7.58
0.49	1.11	0.58	8.69
0.58	0.82	0.67	9.51
0.67	0.67	0.78	10.18
0.78	0.54	0.91	10.72
0.91	0.47	1.06	11.19
1.06	0.41	1.24	11.60
1.24	0.38	1.44	11.98
1.44	0.29	1.68	12.26
1.68	0.22	1.95	12.47
1.95	0.15	2.28	12.62
2.28	0.12	2.65	12.74
2.65	0.16	3.09	12.90
3.09	0.30	3.60	13.20
3.60	0.56	4.19	13.75
4.19	1.07	4.88	14.85
4.88	1.83	5.69	16.69
5.69	2.94	6.63	19.62
6.63	4.39	7.72	24.01
7.72	6.05	9.00	30.06
9.00	7.63	10.48	37.68
10.48	8.86	12.21	46.54
12.21	9.62	14.22	56.16
14.22	10.08	16.57	66.24
16.57	9.21	19.31	75.45
19.31	7.75	22.49	83.21
22.49	5.99	26.20	89.20
26.20	4.23	30.53	93.44
30.53	2.66	35.56	96.11
35.56	1.48	41.43	97.58
41.43	0.56	48.27	98.14
48.27	0.05	56.23	98.21
56.23	0.00	65.51	98.21
65.51	0.00	76.32	98.21
76.32	0.00	88.91	98.21
88.91	0.06	103.58	98.27
103.58	0.18	120.67	98.45
120.67	0.25	140.58	98.70
140.58	0.26	163.77	98.96
163.77	0.24	190.80	99.20
190.80	0.21	222.28	99.41
222.28	0.18	258.96	99.59
258.96	0.15	301.68	99.74
301.68	0.12	351.46	99.87
351.46	0.09	409.45	99.95
409.45	0.06	477.01	100.00
477.01	0.00	555.71	100.00
555.71	0.00	647.41	100.00
647.41	0.00	754.23	100.00
754.23	0.00	878.67	100.00



ศูนย์เครื่องมือวิจัยวิทยาศาสตร์และเทคโนโลยี จุฬาลงกรณ์มหาวิทยาลัย
อาคารสถาบัน 2 จุฬาลงกรณ์ ซอย 62 ถ.พญาไท ปทุมวัน กรุงเทพฯ 10330 โทร 2188029-32, 2188101

Scientific and Technological Research Equipment Centre Chulalongkorn University
Building 2-3 Chula Soi 62 Phaya-Thai Rd. Phatumwan Bangkok 10330 Tel. 2188029-32, 2188101

Result: Analysis Report

Sample Details

Sample ID: white fuse stu 50:50
Sample File: PEERAP
Sample Path: A:\
Sample Notes: Test by Pranee: Scientific and Technological Research Equipment Centre Chulalongkorn University
Liquid medium: Water

Run Number: 1
Record Number: 11

Measurement Date: Thu, Dec 16, 1999 1:58PM
Analysis Date: Thu, Dec 16, 1999 1:58PM
Result Source: Analysed

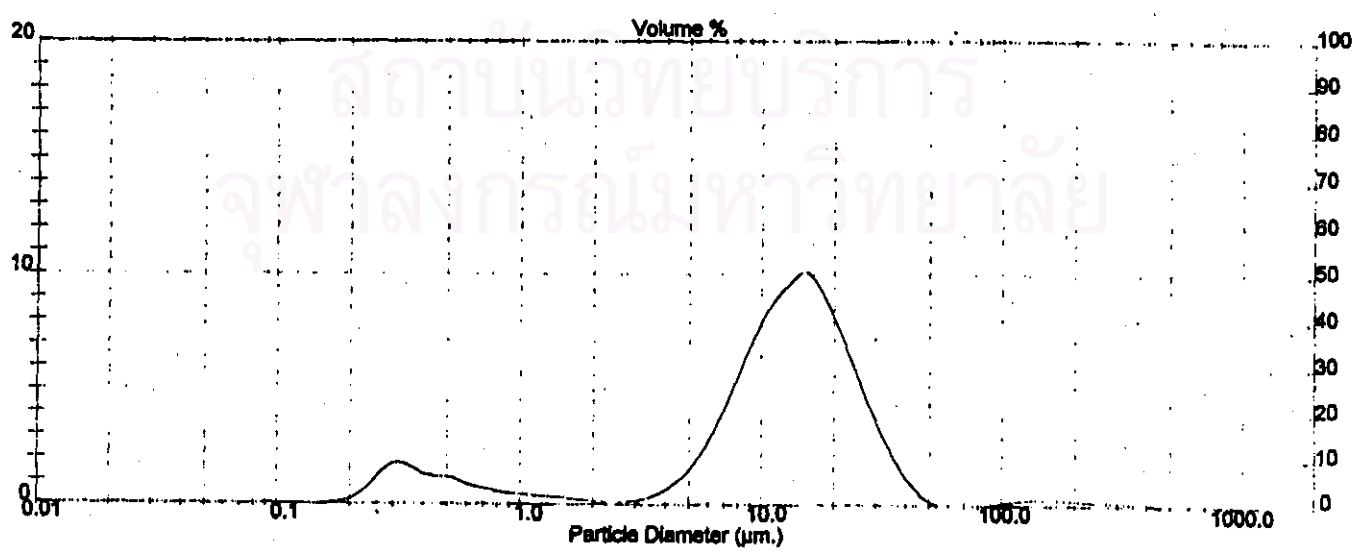
System Details

Range Lens: 300RF mm
Beam Length: 2.40 mm
Sampler: MS17
Obscuration: 20.4 %
Presentation: 3OHD
[Particle R.I. = (1.5298, 0.1000); Dispersant R.I. = 1.3300]
Analysis Model: Polydisperse
Residual: 0.181 %
Modifications: Active --
Killed Data Channels: Low 0; High 2

Result Statistics

Distribution Type: Volume
Concentration = 0.0166 %Vol
Density = 1.000 g / cub. cm
Specific S.A. = 2.2630 sq. m / g
Mean Diameters:
D (v, 0.1) = 0.78 um
D (v, 0.5) = 12.92 um
D (v, 0.9) = 28.65 um
D [4, 3] = 17.10 um
D [3, 2] = 2.65 um
Span = 2.021E+00
Uniformity = 7.905E-01

Size_Low (um)	In %	Size_High (um)	Under%
0.05	0.00	0.06	0.00
0.06	0.00	0.07	0.00
0.07	0.00	0.08	0.00
0.08	0.00	0.09	0.00
0.09	0.00	0.11	0.01
0.11	0.01	0.13	0.01
0.13	0.01	0.15	0.03
0.15	0.04	0.17	0.07
0.17	0.13	0.20	0.19
0.20	0.39	0.23	0.58
0.23	1.01	0.27	1.59
0.27	1.70	0.31	3.29
0.31	1.73	0.36	5.02
0.36	1.36	0.42	6.38
0.42	1.19	0.49	7.58
0.49	1.11	0.58	8.69
0.58	0.82	0.67	9.51
0.67	0.67	0.78	10.18
0.78	0.54	0.91	10.72
0.91	0.47	1.06	11.19
1.06	0.41	1.24	11.60
1.24	0.35	1.44	11.96
1.44	0.29	1.68	12.26
1.68	0.22	1.96	12.47
1.96	0.15	2.28	12.62
2.28	0.12	2.66	12.74
2.66	0.16	3.09	12.90
3.09	0.30	3.60	13.20
3.60	0.58	4.19	13.78
4.19	1.07	4.86	14.85
4.86	1.83	5.69	16.69
5.69	2.94	6.63	19.62
6.63	4.39	7.72	24.01
7.72	6.05	9.00	30.06
9.00	7.63	10.48	37.68
10.48	8.86	12.21	46.54
12.21	9.62	14.22	56.16
14.22	10.08	16.57	66.24
16.57	9.21	19.31	75.46
19.31	7.75	22.49	83.21
22.49	5.99	26.20	89.20
26.20	4.23	30.53	93.44
30.53	2.66	35.56	96.11
35.56	1.45	41.43	97.56
41.43	0.58	48.27	98.14
48.27	0.06	56.23	98.21
56.23	0.00	65.51	98.21
65.51	0.00	76.32	98.21
76.32	0.00	88.91	98.21
88.91	0.06	103.58	98.27
103.58	0.18	120.67	98.46
120.67	0.25	140.58	98.70
140.58	0.28	163.77	98.98
163.77	0.24	190.80	99.22
190.80	0.21	222.28	99.41
222.28	0.18	258.95	99.59
258.95	0.15	301.68	99.74
301.68	0.12	351.46	99.87
351.46	0.09	409.46	99.95
409.46	0.05	477.01	100.00
477.01	0.00	555.71	100.00
555.71	0.00	647.41	100.00
647.41	0.00	754.23	100.00
754.23	0.00	878.87	100.00



ศูนย์เครื่องมือวิจัยวิทยาศาสตร์และเทคโนโลยี จุฬาลงกรณ์มหาวิทยาลัย
อาคารสยามปั้น 2 จุฬาลงกรณ์ ซอย 62 ถ.พญาไท ปทุมวัน กรุงเทพฯ 10330 โทร 2188029-32, 2188101
Scientific and Technological Research Equipment Centre Chulalongkorn University
Building 2-3 Chula Soi 62 Phaya-Thai Rd. Phatumwan Bangkok 10330 Tel. 2188029-32, 2188101

Result: Analysis Report

Sample Details

Sample ID: white fuse atu 20:80
Sample File: PEERAP
Sample Path: A:\
Sample Notes: Test by Pranee: Scientific and Technological Research Equipment Centre Chulalongkorn University
Liquid medium: Water

Run Number: 2
Record Number: 2

Measurement Date: Thu, Dec 16, 1999 1:20PM
Analysis Date: Thu, Dec 16, 1999 1:20PM
Result Source: Analysed

System Details

Range Lens: 300RF mm
Presentation: 3OHD
Analysis Model: Polydisperse
Modifications: Active --

Beam Length: 2.40 mm
[Particle R.I. = (1.5295, 0.1000); Dispersant R.I. = 1.3300]
Killed Data Channels: Low 0; High 2

Sampler: MS17

Obscuration: 22.8 %
Residual: 0.296 %

Result Statistics

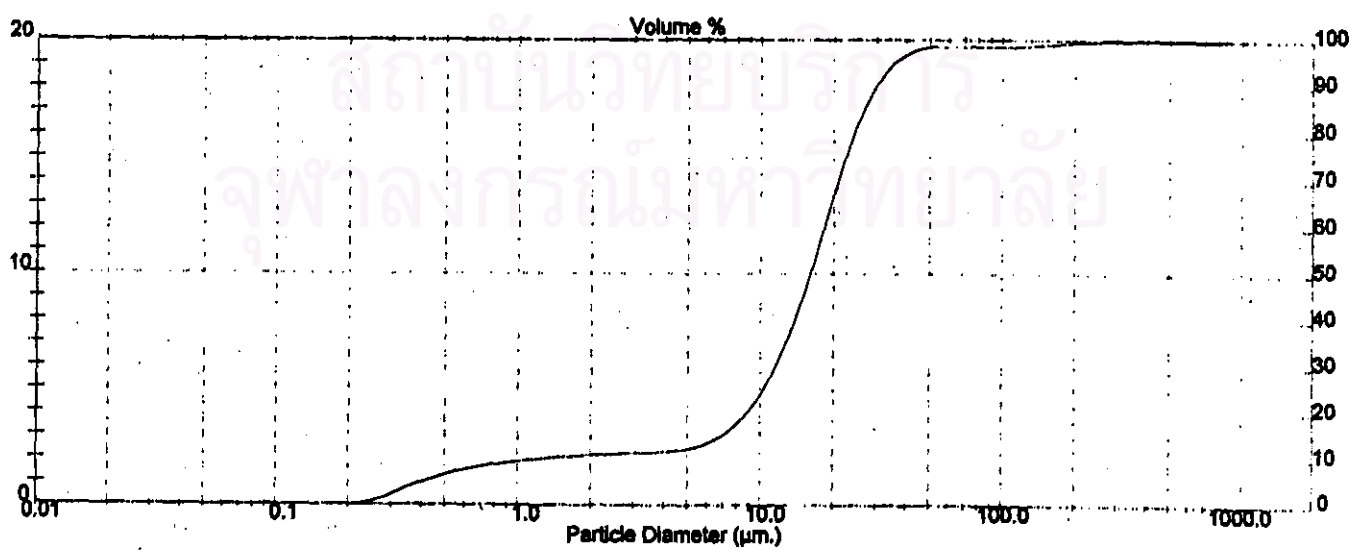
Distribution Type: Volume
Mean Diameters:
D [4, 3] = 16.89 um

Concentration = 0.0223 %Vol
D (v, 0.1) = 1.33 um
D [3, 2] = 3.13 um

Density = 1.000 g / cub. cm
D (v, 0.5) = 16.07 um
Span = 1.784E+00

Specific S.A. = 1.9164 sq. m / g
D (v, 0.9) = 30.01 um
Uniformity = 6.184E-01

Size_Low (um)	In %	Size_High (um)	Under%	Size_Low (um)	In %	Size_High (um)	Under%
0.05	0.00	0.06	0.00	6.63	2.42	7.72	16.75
0.06	0.00	0.07	0.00	7.72	3.65	9.00	20.40
0.07	0.00	0.08	0.00	9.00	5.22	10.48	25.62
0.08	0.00	0.09	0.00	10.48	7.05	12.21	32.67
0.09	0.00	0.11	0.00	12.21	8.95	14.22	41.62
0.11	0.00	0.13	0.01	14.22	10.64	16.57	52.25
0.13	0.01	0.15	0.02	16.57	11.87	19.31	64.12
0.15	0.03	0.17	0.05	19.31	10.95	22.49	75.07
0.17	0.10	0.20	0.16	22.49	8.97	26.20	84.04
0.20	0.32	0.23	0.48	26.20	6.58	30.53	90.62
0.23	0.83	0.27	1.31	30.53	4.30	35.56	94.92
0.27	1.42	0.31	2.73	35.56	2.42	41.43	97.34
0.31	1.48	0.36	4.18	41.43	1.05	48.27	98.39
0.36	1.16	0.42	5.35	48.27	0.18	56.23	98.57
0.42	1.04	0.49	6.38	56.23	0.00	65.51	98.57
0.49	0.96	0.58	7.35	65.51	0.00	76.32	98.57
0.58	0.73	0.67	8.09	76.32	0.00	88.91	98.57
0.67	0.59	0.78	8.68	88.91	0.00	103.56	98.57
0.78	0.48	0.91	9.14	103.56	0.10	120.67	98.67
0.91	0.39	1.06	9.53	120.67	0.22	140.58	98.89
1.06	0.33	1.24	9.86	140.58	0.28	163.77	99.16
1.24	0.29	1.44	10.15	163.77	0.28	190.80	99.41
1.44	0.26	1.68	10.41	190.80	0.23	222.28	99.64
1.68	0.22	1.95	10.63	222.28	0.17	258.95	99.81
1.95	0.19	2.28	10.82	258.95	0.12	301.68	99.93
2.28	0.15	2.65	10.97	301.68	0.07	351.46	100.00
2.65	0.13	3.09	11.10	351.46	0.00	409.45	100.00
3.09	0.14	3.60	11.24	409.45	0.00	477.01	100.00
3.60	0.24	4.19	11.48	477.01	0.00	555.71	100.00
4.19	0.46	4.88	11.95	555.71	0.00	647.41	100.00
4.88	0.87	5.69	12.82	647.41	0.00	754.23	100.00
5.69	1.51	6.63	14.33	754.23	0.00	878.67	100.00



ศูนย์เครื่องมือวิจัยวิทยาศาสตร์และเทคโนโลยี จุฬาลงกรณ์มหาวิทยาลัย
อาคารสถาบัน 2 จุฬาลงกรณ์ ซอย 62 ถ.พญาไท ปทุมวัน กรุงเทพฯ 10330 โทร. 2188029-32, 2188101

Scientific and Technological Research Equipment Centre Chulalongkorn University
Building 2-3 Chula Soi 62 Phaya-Thai Rd. Phatumwan Bangkok 10330 Tel. 2188029-32, 2188101

Result: Analysis Report

Sample Details

Sample ID: white fuse alu 20:80
Sample File: PEERAP
Sample Path: A:\
Sample Notes: Test by Pranee: Scientific and Technological Research Equipment Centre Chulalongkorn University
Liquid medium: Water

Run Number: 2
Record Number: 2

Measurement Date: Thu, Dec 16, 1999 1:20PM
Analysis Date: Thu, Dec 16, 1999 1:20PM
Result Source: Analysed

System Details

Range Lens: 300RF mm
Presentation: 3OHD
Analysis Model: Polydisperse
Modifications: Active --

Beam Length: 2.40 mm
[Particle R.I. = (1.5295, 0.1000); Dispersant R.I. = 1.3300]
Killed Data Channels: Low 0; High 2

Sampler: MS17

Obscuration: 22.8 %
Residual: 0.298 %

Result Statistics

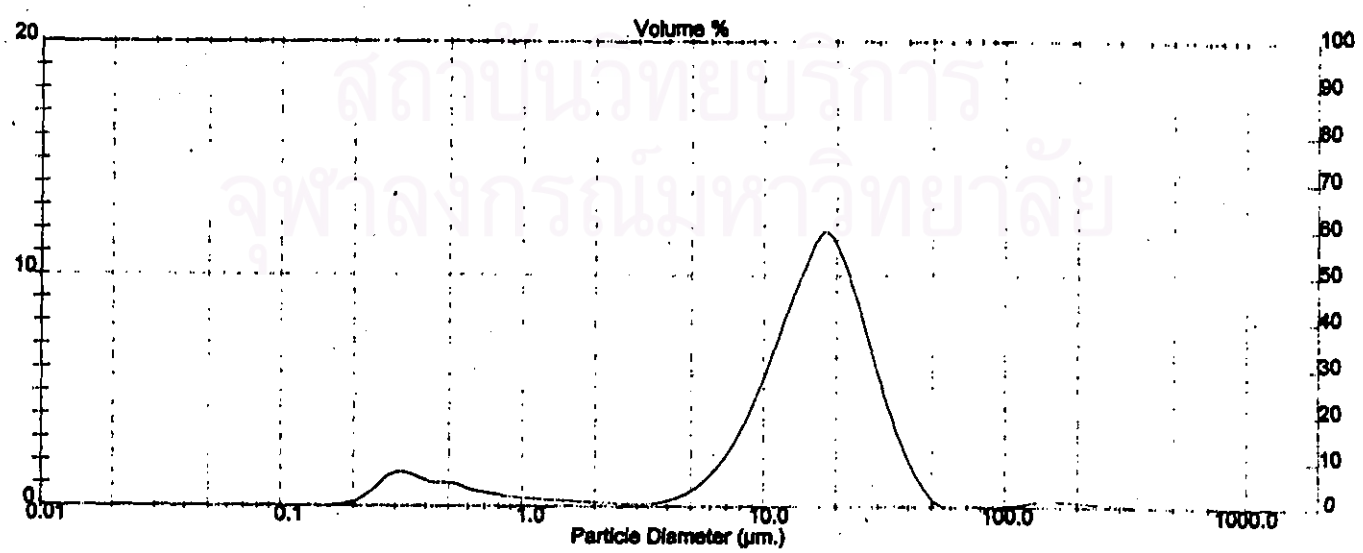
Distribution Type: Volume
Mean Diameters:
D [4, 3] = 18.89 um

Concentration = 0.0223 %Vol
D (v, 0.1) = 1.33 um
D [3, 2] = 3.13 um

Density = 1.000 g / cub. cm
D (v, 0.5) = 16.07 um
Span = 1.784E+00

Specific S.A. = 1.9164 sq. m / g
D (v, 0.9) = 30.01 um
Uniformity = 6.184E-01

Size_Low (um)	In %	Size_High (um)	Under%
0.05	0.00	0.06	0.00
0.06	0.00	0.07	0.00
0.07	0.00	0.09	0.00
0.08	0.00	0.09	0.00
0.09	0.00	0.11	0.00
0.11	0.00	0.13	0.01
0.13	0.01	0.15	0.02
0.15	0.03	0.17	0.05
0.17	0.10	0.20	0.16
0.20	0.32	0.23	0.48
0.23	0.83	0.27	1.31
0.27	1.42	0.31	2.73
0.31	1.46	0.36	4.18
0.36	1.18	0.42	5.35
0.42	1.04	0.49	6.38
0.49	0.96	0.58	7.35
0.58	0.73	0.67	8.09
0.67	0.59	0.78	8.65
0.76	0.46	0.91	9.14
0.91	0.39	1.09	9.53
1.08	0.33	1.24	9.86
1.24	0.29	1.44	10.15
1.44	0.26	1.68	10.41
1.68	0.22	1.96	10.63
1.96	0.19	2.28	10.82
2.28	0.15	2.65	10.97
2.65	0.13	3.09	11.10
3.09	0.14	3.60	11.24
3.60	0.24	4.19	11.48
4.19	0.48	4.88	11.95
4.88	0.87	5.69	12.82
5.69	1.51	6.63	14.33
6.63	2.42	7.72	16.75
7.72	3.65	9.00	20.40
9.00	5.22	10.48	25.62
10.48	7.05	12.21	32.67
12.21	8.95	14.22	41.62
14.22	10.64	16.57	52.25
16.57	11.87	19.31	64.12
19.31	10.95	22.49	75.07
22.49	8.97	26.20	84.04
26.20	6.58	30.53	90.62
30.53	4.30	35.56	94.92
35.56	2.42	41.43	97.34
41.43	1.05	48.27	98.39
48.27	0.18	56.23	98.57
56.23	0.00	65.51	98.57
65.51	0.00	76.32	98.57
76.32	0.00	88.91	98.57
88.91	0.00	103.58	98.57
103.58	0.10	120.67	98.67
120.67	0.22	140.58	98.89
140.58	0.26	163.77	99.15
163.77	0.26	190.80	99.41
190.80	0.23	222.28	99.64
222.28	0.17	258.95	99.81
258.95	0.12	301.68	99.93
301.68	0.07	351.48	100.00
351.48	0.00	409.48	100.00
409.48	0.00	477.01	100.00
477.01	0.00	555.71	100.00
555.71	0.00	647.41	100.00
647.41	0.00	754.23	100.00
754.23	0.00	878.67	100.00



ศูนย์เครื่องมือวิจัยวิทยาศาสตร์และเทคโนโลยี จุฬาลงกรณ์มหาวิทยาลัย
อาคารสถาบัน 2 จุฬาลงกรณ์ ซอย 62 ถ.พญาไท ปทุมวัน กรุงเทพฯ 10330 โทร 2188029-32, 2188101
Scientific and Technological Research Equipment Centre Chulalongkorn University
Building 2-3 Chula Soi 62 Phaya-Thai Rd. Phatumwan Bangkok 10330 Tel. 2188029-32, 2188101

Result: Analysis Report

Sample Details

Sample ID: S2 JTP1N5/T4/10
Sample File: PEERAPAT
Sample Path: A:\
Sample Notes: Test by Pranee: Scientific and Technological Research Equipment Centre Chulalongkorn University
Liquid medium: Water

Run Number: 2
Record Number: 16

Measurement Date: Wed, Nov 17, 1999 10:04AM
Analysis Date: Wed, Nov 17, 1999 10:04AM
Result Source: Analysed

System Details

Range Lens: 300RF mm
Presentation: 3OHD
Analysis Model: Polydisperse
Modifications: Active --

Beam Length: 2.40 mm
[Particle R.I. = (1.5295, 0.1000); Dispersant R.I. = 1.3300]

Sampler: MS17

Obscuration: 29.9 %
Residual: 0.208 %

Killed Data Channels: Low 0; High 2

Result Statistics

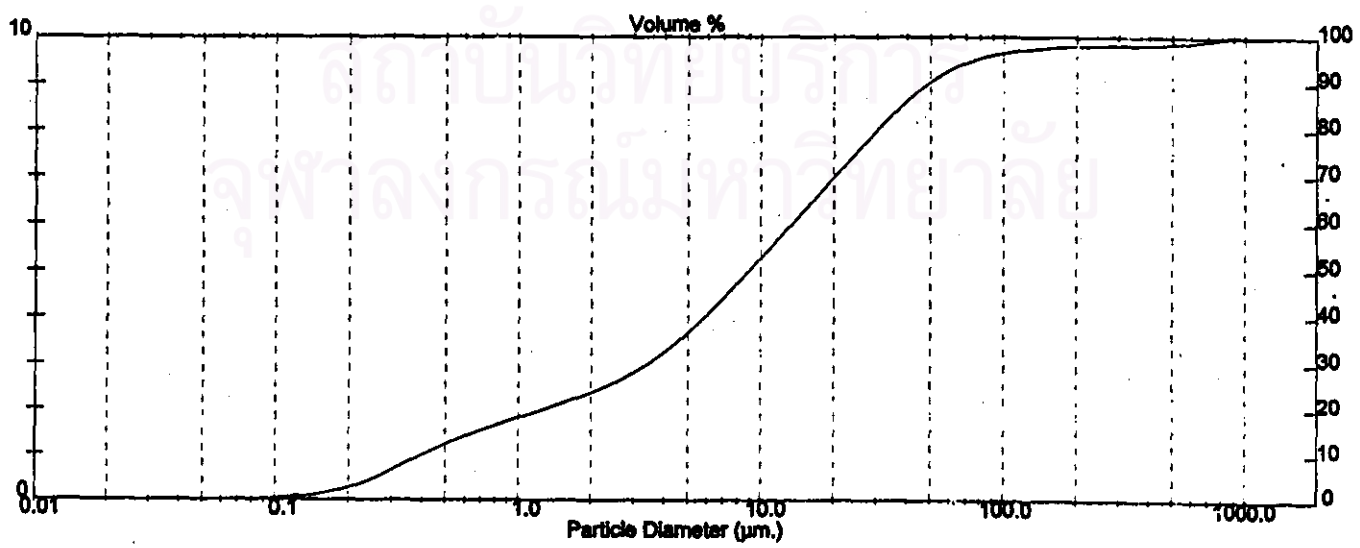
Distribution Type: Volume
Mean Diameters:
D [4, 3] = 28.50 um

Concentration = 0.0166 %Vol
D (v, 0.1) = 0.40 um
D [3, 2] = 1.38 um

Density = 1.000 g / cub. cm
D (v, 0.5) = 8.96 um
Span = 5.436E+00

Specific S.A. = 4.3328 sq. m / g
D (v, 0.9) = 49.09 um
Uniformity = 2.842E+00

Size_Low (um)	In %	Size_High (um)	Under%
0.05	0.03	0.06	0.03
0.06	0.06	0.07	0.09
0.07	0.10	0.08	0.19
0.08	0.15	0.09	0.34
0.09	0.20	0.11	0.54
0.11	0.28	0.13	0.83
0.13	0.40	0.15	1.23
0.15	0.57	0.17	1.79
0.17	0.82	0.20	2.61
0.20	1.16	0.23	3.77
0.23	1.55	0.27	5.32
0.27	1.81	0.31	7.12
0.31	1.81	0.36	8.93
0.36	1.67	0.42	10.60
0.42	1.57	0.49	12.17
0.49	1.50	0.58	13.67
0.58	1.35	0.67	15.02
0.67	1.25	0.78	16.28
0.78	1.19	0.91	17.47
0.91	1.15	1.06	18.62
1.06	1.15	1.24	19.77
1.24	1.17	1.44	20.94
1.44	1.22	1.68	22.16
1.68	1.31	1.96	23.46
1.96	1.45	2.28	24.92
2.28	1.66	2.66	26.57
2.66	1.92	3.09	28.49
3.09	2.23	3.60	30.73
3.60	2.57	4.19	33.30
4.19	2.91	4.88	36.21
4.88	3.20	5.69	39.41
5.69	3.44	6.63	42.85
6.63	3.59	7.72	46.43
7.72	3.67	9.00	50.10
9.00	3.70	10.48	53.81
10.48	3.72	12.21	57.52
12.21	3.72	14.22	61.25
14.22	3.74	16.57	64.99
16.57	3.78	19.31	68.77
19.31	3.82	22.49	72.59
22.49	3.82	26.20	76.42
26.20	3.74	30.53	80.16
30.53	3.54	35.56	83.70
35.56	3.22	41.43	86.93
41.43	2.79	48.27	89.72
48.27	2.30	56.23	92.02
56.23	1.80	65.51	93.82
65.51	1.34	76.32	95.16
76.32	0.98	88.91	96.13
88.91	0.68	103.58	96.81
103.58	0.48	120.67	97.28
120.67	0.34	140.58	97.62
140.58	0.25	163.77	97.87
163.77	0.18	190.80	98.05
190.80	0.12	222.28	98.17
222.28	0.08	258.96	98.25
258.96	0.01	301.68	98.26
301.68	0.02	351.45	98.28
351.45	0.06	409.45	98.34
409.45	0.13	477.01	98.47
477.01	0.25	555.71	98.72
555.71	0.38	647.41	99.10
647.41	0.49	754.23	99.59
754.23	0.41	878.67	100.00



Malvern Instruments Ltd.
Malvern, UK
Tel:0684 892456 Fax:0684 892789

Mastersizer S long bed Ver. 2.11
Serial Number:

ศูนย์เครื่องมือวิจัยวิทยาศาสตร์และเทคโนโลยี จุฬาลงกรณ์มหาวิทยาลัย
อาคารสยามปั้น 2 จุฬาซอย 62 ถ.พญาไท ปทุมวัน กรุงเทพฯ 10330 โทร. 2188029-32, 2188101
Scientific and Technological Research Equipment Centre Chulalongkorn University
Building 2-3 Chula Soi 62 Phaya-Thai Rd. Phatumwan Bangkok 10330 Tel. 2188029-32, 2188101

Result: Analysis Report

Sample Details

Sample ID: S2 JTP1N6/T4/10
Sample File: PEERAPAT
Sample Path: A:\
Sample Notes: Test by Pranee: Scientific and Technological Research Equipment Centre Chulalongkorn University
Liquid medium: Water

Run Number: 2
Record Number: 16

Measurement Date: Wed, Nov 17, 1999 10:04AM
Analysis Date: Wed, Nov 17, 1999 10:04AM
Result Source: Analysed

System Details

Range Lens: 300RF mm
Presentation: 3OHD
Analysis Model: Polydisperse
Modifications: Active –

Beam Length: 2.40 mm
[Particle R.I. = (1.5295, 0.1000); Dispersant R.I. = 1.3300]

Killed Data Channels: Low 0; High 2

Sampler: MS17

Obscuration: 29.9 %
Residual: 0.208 %

Result Statistics

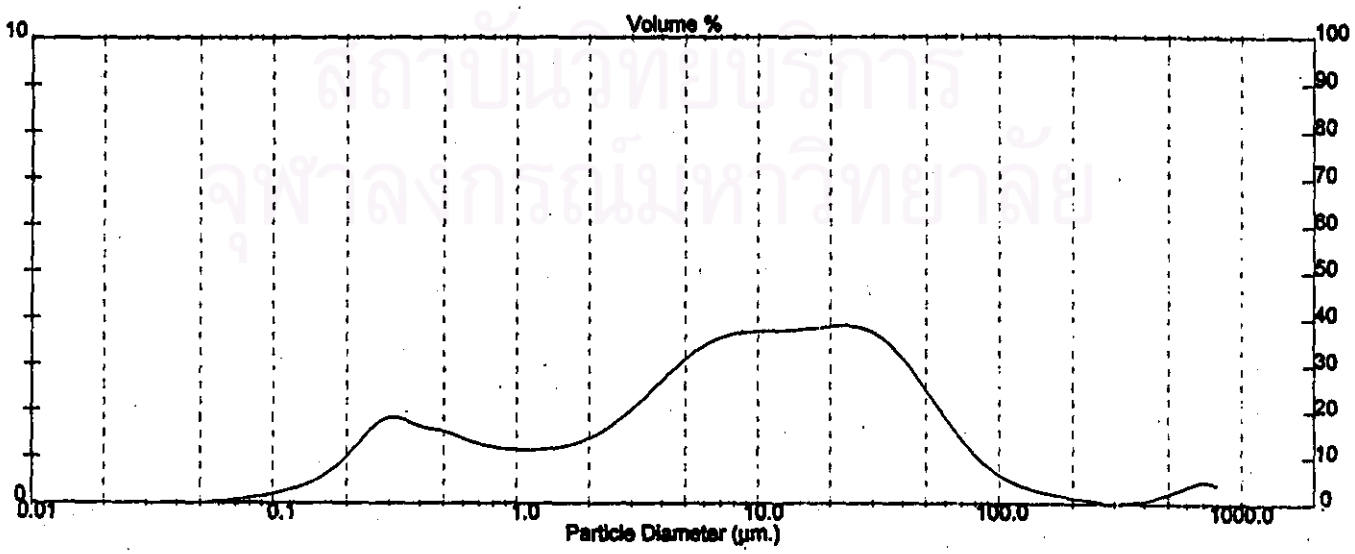
Distribution Type: Volume
Mean Diameters:
D [4, 3] = 28.50 um

Concentration = 0.0188 %Vol
D (v, 0.1) = 0.40 um
D [3, 2] = 1.38 um

Density = 1.000 g / cub. cm
D (v, 0.5) = 8.96 um
Span = 5.436E+00

Specific S.A. = 4.3328 sq. m / g
D (v, 0.9) = 49.09 um
Uniformity = 2.842E+00

Size_Low (um)	In %	Size_High (um)	Under%
0.05	0.03	0.06	0.03
0.06	0.06	0.07	0.09
0.07	0.10	0.09	0.19
0.09	0.15	0.11	0.34
0.11	0.20	0.13	0.54
0.13	0.28	0.15	0.83
0.15	0.40	0.17	1.23
0.17	0.57	0.20	1.79
0.20	0.82	0.23	2.61
0.23	1.16	0.27	3.77
0.27	1.55	0.31	5.32
0.31	1.81	0.36	7.12
0.36	1.81	0.42	8.93
0.42	1.67	0.49	10.60
0.49	1.57	0.58	12.17
0.58	1.50	0.67	13.67
0.67	1.35	0.78	15.02
0.78	1.26	0.91	16.28
0.91	1.19	1.06	17.47
1.06	1.15	1.24	18.62
1.24	1.15	1.44	19.77
1.44	1.17	1.68	20.94
1.68	1.22	1.96	22.16
1.96	1.31	2.28	23.48
2.28	1.46	2.66	24.93
2.66	1.66	3.09	26.57
3.09	1.92	3.60	28.49
3.60	2.23	4.19	30.73
4.19	2.57	4.88	33.30
4.88	2.91	5.69	36.21
5.69	3.20	6.63	39.41
6.63	3.44	7.72	42.85
7.72	3.59	9.00	46.43
9.00	3.67	10.48	50.10
10.48	3.70	12.21	53.81
12.21	3.72	14.22	57.52
14.22	3.72	16.57	61.25
16.57	3.74	19.31	64.99
19.31	3.78	22.49	68.77
22.49	3.82	26.20	72.59
26.20	3.82	30.53	76.42
30.53	3.74	35.56	80.16
35.56	3.64	41.43	83.80
41.43	3.22	48.27	87.02
48.27	2.79	56.23	89.82
56.23	2.30	65.51	92.12
65.51	1.80	76.32	93.92
76.32	1.34	88.91	95.26
88.91	0.96	103.58	96.22
103.58	0.68	120.67	96.90
120.67	0.48	140.58	97.38
140.58	0.34	163.77	97.72
163.77	0.26	190.80	97.98
190.80	0.18	222.28	98.16
222.28	0.12	258.95	98.28
258.95	0.08	301.68	98.36
301.68	0.01	351.48	98.37
351.48	0.02	409.46	98.39
409.46	0.08	477.01	98.47
477.01	0.13	555.71	98.60
555.71	0.25	647.41	98.85
647.41	0.38	754.23	99.23
754.23	0.49	878.67	99.72
878.67	0.41	1023.50	100.00



ศูนย์เครื่องมือวิจัยวิทยาศาสตร์และเทคโนโลยี จุฬาลงกรณ์มหาวิทยาลัย
อาคารสถาบัน 2 จุฬาลงกรณ์ ซอย 62 ถ.พญาไท ปทุมวัน กรุงเทพฯ 10330 โทร 2188029-32, 2188101
Scientific and Technological Research Equipment Centre Chulalongkorn University
Building 2-3 Chula Soi 62 Phaya-Thai Rd. Phatumwan Bangkok 10330 Tel. 2188029-32, 2188101

Result: Analysis Report

Sample Details

Sample ID: JisTest Powder No.10
Sample File: NARISARA
Sample Path: A:\
Sample Notes: Test by Pranee: Scientific and Technological Research Equipment Centre Chulalongkorn University
Liquid medium: Water

Run Number: 2
Record Number: 15

Measurement Date: Thu, Jan 27, 2000 9:58AM
Analysis Date: Thu, Jan 27, 2000 9:58AM
Result Source: Analysed

System Details

Range Lens: 300RF mm
Presentation: 3OHD
Analysis Model: Polydisperse
Modifications: Active --

Beam Length: 2.40 mm
(Particle R.I. = (1.5295, 0.1000); Dispersant R.I. = 1.3300)
Killed Data Channels: Low 0; High 2.

Sampler: MS17

Obscuration: 20.2 %
Residual: 0.611 %

Result Statistics

Distribution Type: Volume
Mean Diameters:
D [4, 3] = 5.46 um

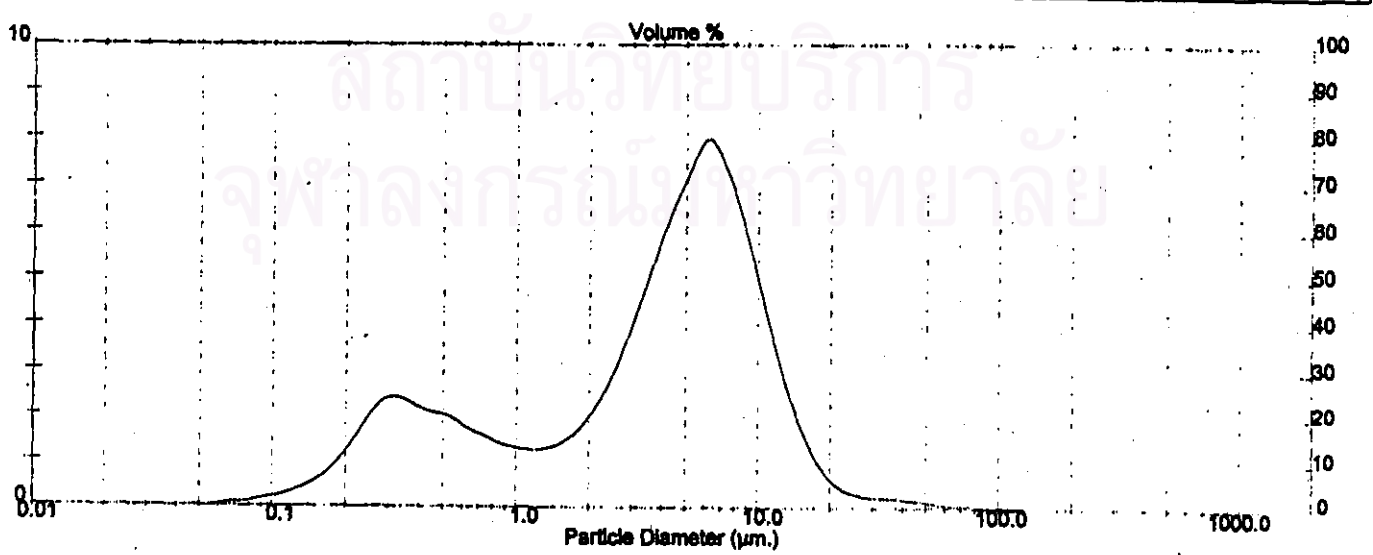
Concentration = 0.0076 %Vol
D (v, 0.1) = 0.34 um
D [3, 2] = 1.10 um

Density = 1.000 g / cub. cm
D (v, 0.5) = 4.42 um
Span = 2.386E+00

Specific S.A. = 5.4590 sq. m / g
D (v, 0.9) = 10.90 um
Uniformity = 8.375E-01

Size_Low (um)	In %	Size_High (um)	Under %
0.05	0.03	0.06	0.03
0.06	0.06	0.07	0.09
0.07	0.10	0.08	0.20
0.08	0.16	0.09	0.36
0.09	0.22	0.11	0.58
0.11	0.31	0.13	0.87
0.13	0.44	0.15	1.31
0.15	0.64	0.17	1.95
0.17	0.96	0.20	2.91
0.20	1.43	0.23	4.34
0.23	1.97	0.27	6.31
0.27	2.35	0.31	8.66
0.31	2.36	0.36	11.02
0.36	2.18	0.42	13.20
0.42	2.09	0.49	15.25
0.49	1.96	0.58	17.21
0.58	1.73	0.67	18.95
0.67	1.57	0.78	20.52
0.78	1.41	0.91	21.93
0.91	1.30	1.06	23.23
1.06	1.25	1.24	24.48
1.24	1.28	1.44	25.76
1.44	1.41	1.68	27.17
1.68	1.69	1.95	28.86
1.95	2.15	2.28	31.01
2.28	2.81	2.65	33.82
2.65	3.66	3.09	37.48
3.09	4.64	3.60	42.12
3.60	5.65	4.19	47.77
4.19	6.67	4.88	54.36
4.88	7.34	5.69	61.69
5.69	7.95	6.63	69.63

Size_Low (um)	In %	Size_High (um)	Under %
6.63	7.49	7.72	77.12
7.72	6.52	9.00	83.65
9.00	5.24	10.48	88.89
10.48	3.88	12.21	92.77
12.21	2.64	14.22	95.41
14.22	1.64	16.57	97.05
16.57	0.95	19.31	97.99
19.31	0.53	22.49	98.52
22.49	0.32	26.20	98.84
26.20	0.25	30.53	99.09
30.53	0.22	35.58	99.31
35.58	0.20	41.43	99.51
41.43	0.16	48.27	99.68
48.27	0.12	56.23	99.79
56.23	0.07	65.51	99.86
65.51	0.04	76.32	99.91
76.32	0.03	88.91	99.94
88.91	0.02	103.58	99.96
103.58	0.02	120.67	99.98
120.67	0.01	140.56	99.99
140.56	0.01	163.77	100.00
163.77	0.00	190.80	100.00
190.80	0.00	222.28	100.00
222.28	0.00	258.95	100.00
258.95	0.00	301.68	100.00
301.68	0.00	351.46	100.00
351.46	0.00	409.45	100.00
409.45	0.00	477.01	100.00
477.01	0.00	555.71	100.00
555.71	0.00	647.41	100.00
647.41	0.00	754.23	100.00
754.23	0.00	878.67	100.00



ศูนย์เครื่องมือวิจัยวิทยาศาสตร์และเทคโนโลยี จุฬาลงกรณ์มหาวิทยาลัย
อาคารสถาบัน 2 จุฬาลงกรณ์ ซอย 62 ถ.พญาไท ปทุมวัน กรุงเทพฯ 10330 โทร 2188029-32, 2188101
Scientific and Technological Research Equipment Centre Chulalongkorn University
Building 2-3 Chula Soi 62 Phaya-Thai Rd. Phatumwan Bangkok 10330 Tel. 2188029-32, 2188101

Result: Analysis Report

Sample Details

Sample ID: JIS POWDER NO.11
Sample File: PEERAPAT
Sample Path: A:\
Sample Notes: Test by Pranee: Scientific and Technological Research Equipment Centre Chulalongkorn University
Liquid medium: Water

Run Number: 2
Record Number: 21

Measurement Date: Sun, Jan 06, 1980 10:51AM
Analysis Date: Sun, Jan 06, 1980 10:51AM
Result Source: Analysed

System Details

Range Lens: 300RF mm
Presentation: 3OHD
Analysis Model: Polydisperse
Modifications: Active --

Beam Length: 2.40 mm
[Particle R.I. = (1.5295, 0.1000); Dispersant R.I. = 1.3300]
Killed Data Channels: Low 0; High 2

Sampler: MS17

Obscuration: 34.0 %
Residual: 0.294 %

Result Statistics

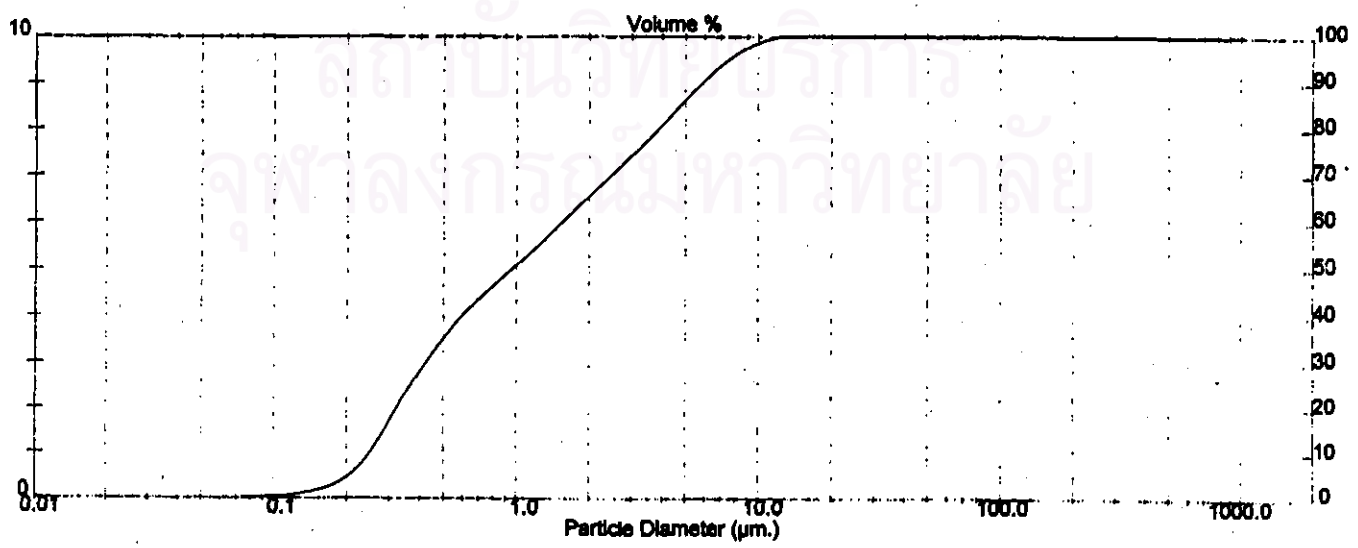
Distribution Type: Volume
Mean Diameters:
D [4, 3] = 2.12 um

Concentration = 0.0066 %Vol
D (v, 0.1) = 0.25 um
D [3, 2] = 0.58 um

Density = 1.000 g / cub. cm
D (v, 0.5) = 0.95 um
Span = 5.875E+00

Specific S.A. = 10.3856 sq. m / g
D (v, 0.9) = 5.86 um
Uniformity = 1.777E+00

Size_Low (um)	In %	Size_High (um)	Under%
0.05	0.03	0.06	0.03
0.06	0.06	0.07	0.09
0.07	0.11	0.08	0.20
0.08	0.16	0.09	0.36
0.09	0.25	0.11	0.61
0.11	0.39	0.13	1.00
0.13	0.63	0.15	1.63
0.15	1.06	0.17	2.69
0.17	1.84	0.20	4.53
0.20	3.17	0.23	7.70
0.23	4.95	0.27	12.64
0.27	6.22	0.31	18.86
0.31	6.10	0.36	24.97
0.36	5.26	0.42	30.21
0.42	4.70	0.49	34.92
0.49	4.32	0.58	39.23
0.58	3.59	0.67	42.83
0.67	3.21	0.78	46.04
0.78	3.02	0.91	49.06
0.91	3.01	1.06	52.07
1.06	3.10	1.24	55.17
1.24	3.23	1.44	58.40
1.44	3.28	1.68	61.68
1.68	3.27	1.95	64.95
1.95	3.29	2.28	68.24
2.28	3.27	2.65	71.50
2.65	3.35	3.09	74.85
3.09	3.48	3.60	78.33
3.60	3.84	4.19	81.97
4.19	3.72	4.88	85.69
4.88	3.64	5.69	89.33
5.69	3.33	6.63	92.66
6.63	2.80	7.72	95.46
7.72	2.13	9.00	97.59
9.00	1.47	10.48	99.06
10.48	0.80	12.21	99.86
12.21	0.14	14.22	100.00
14.22	0.00	16.57	100.00
16.57	0.00	19.31	100.00
19.31	0.00	22.49	100.00
22.49	0.00	26.20	100.00
26.20	0.00	30.53	100.00
30.53	0.00	35.56	100.00
35.56	0.00	41.43	100.00
41.43	0.00	48.27	100.00
48.27	0.00	56.23	100.00
56.23	0.00	65.51	100.00
65.51	0.00	76.32	100.00
76.32	0.00	88.91	100.00
88.91	0.00	103.58	100.00
103.58	0.00	120.67	100.00
120.67	0.00	140.58	100.00
140.58	0.00	163.77	100.00
163.77	0.00	190.80	100.00
190.80	0.00	222.28	100.00
222.28	0.00	258.95	100.00
258.95	0.00	301.68	100.00
301.68	0.00	351.48	100.00
351.48	0.00	409.46	100.00
409.46	0.00	477.01	100.00
477.01	0.00	555.71	100.00
555.71	0.00	647.41	100.00
647.41	0.00	754.23	100.00
754.23	0.00	878.67	100.00



ศูนย์เครื่องมือวิจัยวิทยาศาสตร์และเทคโนโลยี จุฬาลงกรณ์มหาวิทยาลัย
อาคารสถาบัน 2 จุฬาลงกรณ์ ซอย 62 ถ.พญาไท ปทุมวัน กรุงเทพฯ 10330 โทร 2188029-32, 2188101

Scientific and Technological Research Equipment Centre Chulalongkorn University
Building 2-3 Chula Soi 62 Phaya-Thai Rd. Phatumwan Bangkok 10330 Tel. 2188029-32, 2188101

Result: Analysis Report

Sample Details

Sample ID: JIS POWDER NO.11
Sample File: PEERAPAT
Sample Path: A:\
Sample Notes: Test by Pranee: Scientific and Technological Research Equipment Centre Chulalongkorn University
Liquid medium: Water

Run Number: 2
Record Number: 21

Measurement Date: Sun, Jan 06, 1980 10:51AM
Analysis Date: Sun, Jan 06, 1980 10:51AM
Result Source: Analysed

System Details

Range Lens: 300RF mm
Presentation: 3OHD
Analysis Model: Polydisperse
Modifications: Active –

Beam Length: 2.40 mm
[Particle R.I. = (1.5298, 0.1000); Dispersant R.I. = 1.3300]
Killed Data Channels: Low 0; High 2

Sampler: MS17

Obscuration: 34.0 %
Residual: 0.294 %

Result Statistics

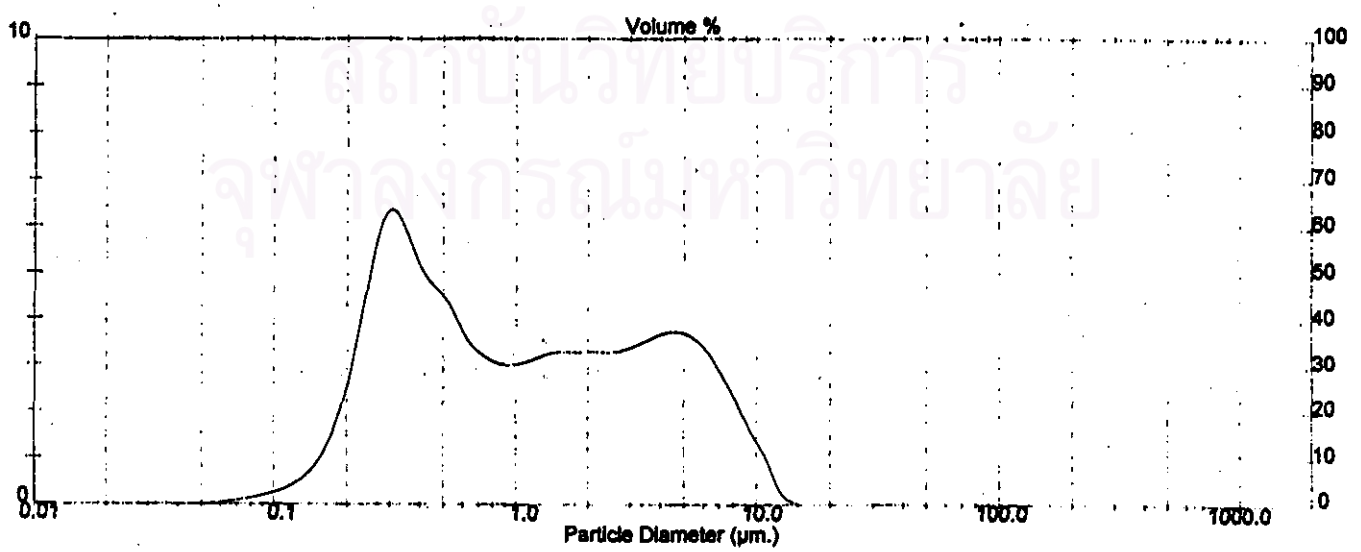
Distribution Type: Volume
Mean Diameters:
D [4, 3] = 2.12 um

Concentration = 0.0066 %Vol
D (v, 0.1) = 0.25 um
D [3, 2] = 0.58 um

Density = 1.000 g / cub. cm
D (v, 0.5) = 0.95 um
Span = 5.875E+00

Specific S.A. = 10.3558 sq. m / g
D (v, 0.9) = 5.66 um
Uniformity = 1.777E+00

Size_Low (um)	In %	Size_High (um)	Under%
0.05	0.03	0.06	0.03
0.06	0.06	0.07	0.09
0.07	0.11	0.08	0.20
0.08	0.16	0.09	0.36
0.09	0.25	0.11	0.61
0.11	0.39	0.13	1.00
0.13	0.63	0.15	1.63
0.15	1.06	0.17	2.69
0.17	1.64	0.20	4.53
0.20	3.17	0.23	7.70
0.23	4.95	0.27	12.64
0.27	6.22	0.31	18.86
0.31	6.10	0.36	24.97
0.36	5.25	0.42	30.21
0.42	4.70	0.49	34.92
0.49	4.32	0.58	39.23
0.58	3.59	0.67	42.83
0.67	3.21	0.78	46.04
0.78	3.02	0.91	49.06
0.91	3.01	1.06	52.07
1.06	3.10	1.24	55.17
1.24	3.23	1.44	58.40
1.44	3.28	1.68	61.68
1.68	3.27	1.95	64.95
1.95	3.29	2.28	68.24
2.28	3.27	2.66	71.50
2.65	3.36	3.09	74.86
3.09	3.48	3.60	78.33
3.60	3.64	4.19	81.97
4.19	3.72	4.88	85.69
4.88	3.64	5.69	89.33
5.69	3.33	6.63	92.66
6.63	2.80	7.72	95.46
7.72	2.13	9.00	97.59
9.00	1.47	10.48	99.06
10.48	0.80	12.21	99.86
12.21	0.14	14.22	100.00
14.22	0.00	16.57	100.00
16.57	0.00	19.31	100.00
19.31	0.00	22.49	100.00
22.49	0.00	26.20	100.00
26.20	0.00	30.53	100.00
30.53	0.00	35.56	100.00
35.56	0.00	41.43	100.00
41.43	0.00	48.27	100.00
48.27	0.00	56.23	100.00
56.23	0.00	65.51	100.00
65.51	0.00	76.32	100.00
76.32	0.00	88.91	100.00
88.91	0.00	103.58	100.00
103.58	0.00	120.67	100.00
120.67	0.00	140.58	100.00
140.58	0.00	163.77	100.00
163.77	0.00	190.80	100.00
190.80	0.00	222.28	100.00
222.28	0.00	258.95	100.00
258.95	0.00	301.68	100.00
301.68	0.00	351.46	100.00
351.46	0.00	409.48	100.00
409.48	0.00	477.01	100.00
477.01	0.00	555.71	100.00
555.71	0.00	647.41	100.00
647.41	0.00	754.23	100.00
754.23	0.00	878.67	100.00

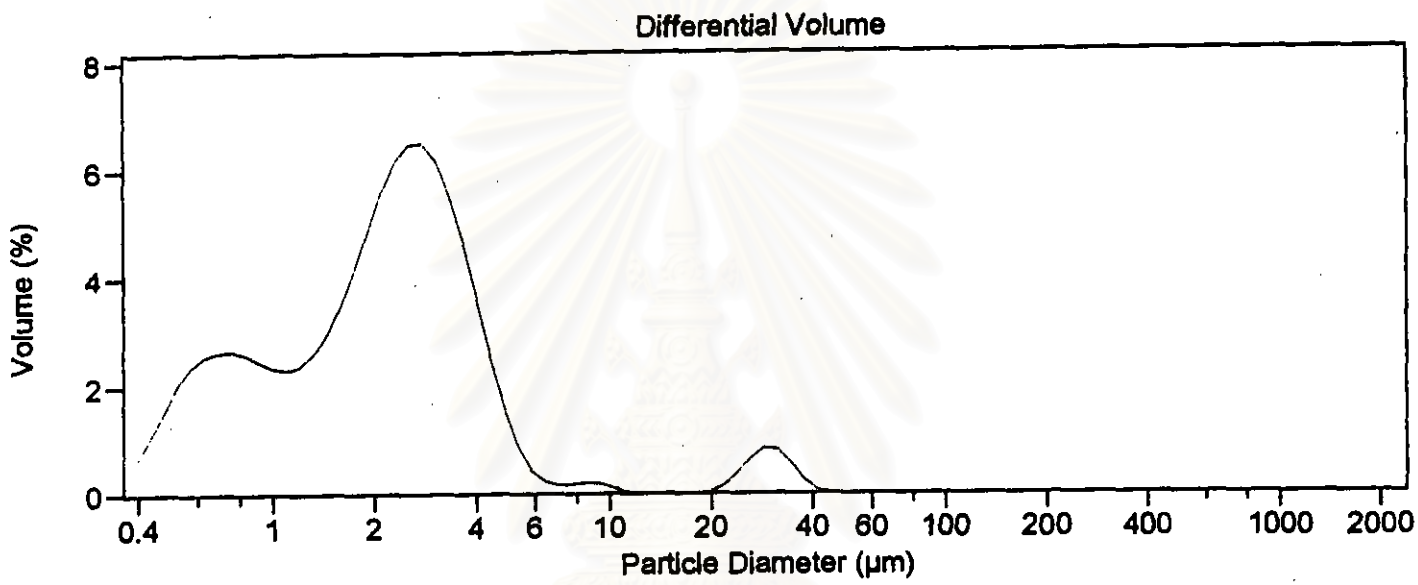


ภาคผนวก ค.

ผลการวัดการกระจายขนาดด้วยเครื่อง Beckman Coulter LS230

COULTER

File name:	p22n1r~1.$01	Group ID:	RUN1
Sample ID:	S15JTP22N1(S1)		
Operator:		Run number:	1
Comments:	JIS TEST POWDERII-2,NO1 DISPERSING AGENT:SODIUM HEXAMETHAPHOSPHATE		
Optical model:	Fraunhofer		
LS 230	Micro-volume Module		
Start time:	17:14 16 Nov 1999	Run length:	60 Seconds
Obscuration:	11%		
Software:	2.11	Firmware:	2.02 2.02



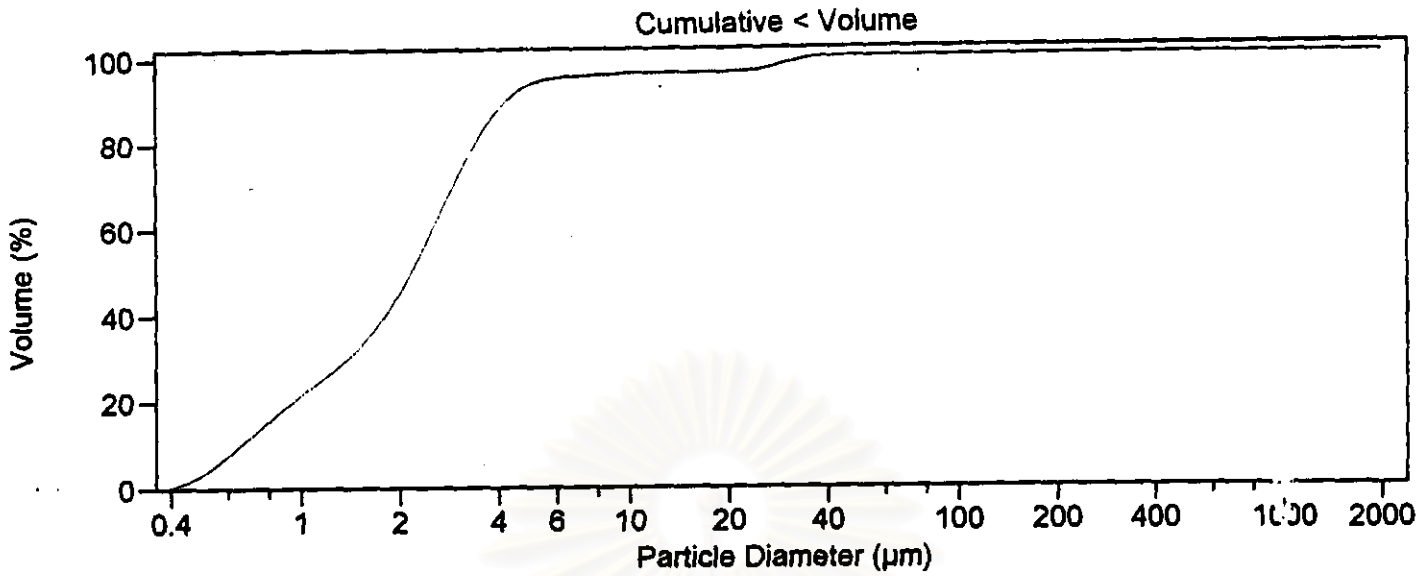
Volume Statistics (Arithmetic) p22n1r~1.$01

Calculations from 0.375 µm to 2000 µm

Volume	100.0%		
Mean:	3.235 µm	S.D.:	5.408 µm
Median:	2.171 µm	C.V.:	167%
D(3,2):	1.490 µm	Skewness:	4.686 Right skewed
Mode:	2.787 µm	Kurtosis:	22.13 Leptokurtic
d_{50}:	2.171 µm		

% >	5	10	20	30	40
Size µm	5.764	4.249	3.418	2.916	2.528

COULTER



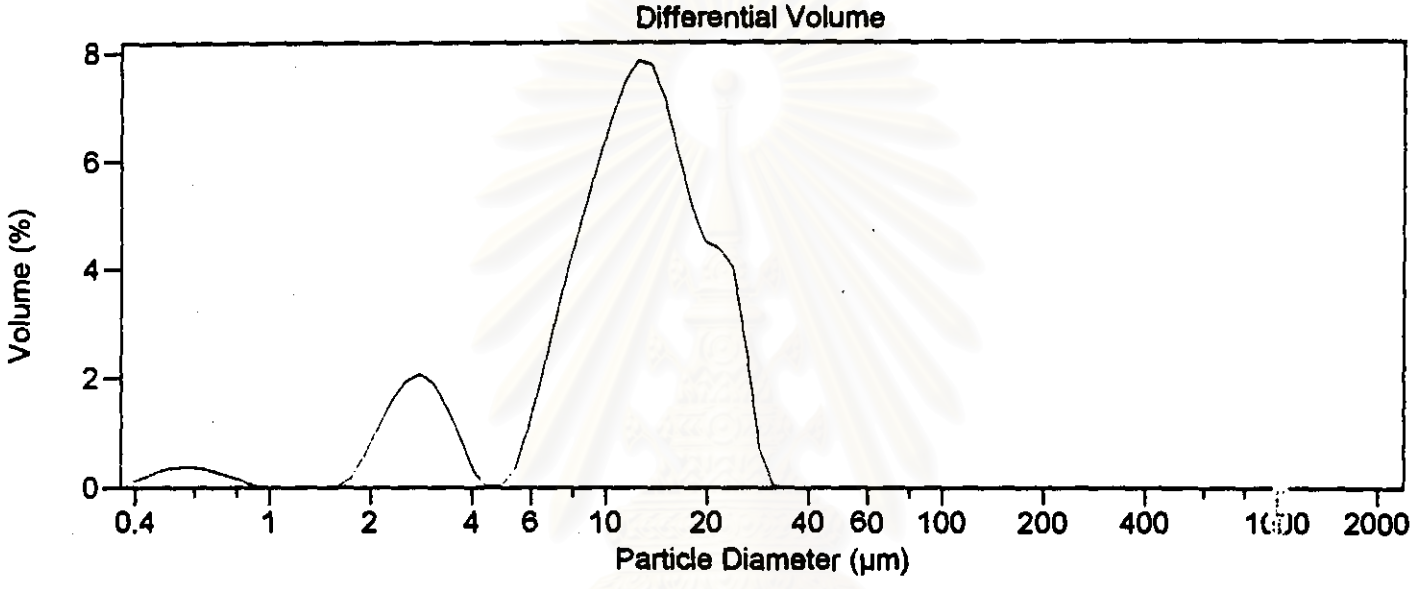
COULTER

>22n1r~1.$01

Channel Diameter (Center) µm	Diff. Volume %	Cum. > Volume %	Channel Diameter (Center) µm	Diff. Volume %	Cum. > Volume %
0.393	0.59	100	37.96	0.25	0.31
0.432	1.04	99.4	41.67	0.053	0.057
0.474	1.48	98.4	45.75	0.0047	0.0047
0.520	2.01	96.9	50.23	0	0
0.571	2.35	94.9	55.14	0	0
0.627	2.55	92.5	60.52	0	0
0.688	2.63	90.0	66.44	0	0
0.755	2.65	87.3	72.95	0	0
0.829	2.59	84.7	80.08	0	0
0.910	2.47	82.1	87.90	0	0
0.999	2.34	79.6	96.49	0	0
1.097	2.29	77.3	105.9	0	0
1.204	2.37	75.0	116.3	0	0
1.322	2.59	72.6	127.6	0	0
1.451	2.97	70.0	140.1	0	0
1.593	3.49	67.1	153.8	0	0
1.749	4.14	63.6	168.8	0	0
1.919	4.87	59.4	185.3	0	0
2.106	5.57	54.6	203.5	0	0
2.312	6.14	49.0	223.4	0	0
2.539	6.46	42.9	245.2	0	0
2.787	6.49	36.4	269.2	0	0
3.060	6.17	29.9	295.5	0	0
3.359	5.52	23.7	324.3	0	0
3.687	4.61	18.2	356.1	0	0
4.047	3.56	13.6	390.9	0	0
4.444	2.50	10.0	429.2	0	0
4.878	1.57	7.55	471.1	0	0
5.355	0.87	5.98	517.2	0	0
5.878	0.42	5.12	567.8	0	0
6.452	0.22	4.70	623.3	0	0
7.083	0.15	4.48	684.2	0	0
7.776	0.17	4.33	751.1	0	0
8.536	0.20	4.16	824.5	0	0
9.371	0.18	3.96	905.1	0	0
10.29	0.10	3.78	993.5	0	0
11.29	0.026	3.67	1091	0	0
12.40	0.0028	3.65	1198	0	0
13.61	0	3.64	1315	0	0
14.94	0	3.64	1443	0	0
16.40	0	3.64	1584	0	0
18.00	0.0013	3.64	1739	0	0
19.76	0.022	3.64	1909	0	0
21.69	0.13	3.62			0
23.81	0.36	3.50			
26.14	0.64	3.14			
28.69	0.83	2.49			
31.50	0.81	1.67			
34.58	0.55	0.86			

COULTER

le name:	p22n3r~2.$01	Group ID:	RUN3
ample ID:	S10JTP22N3(S3)		
perator:		Run number:	1
omments:	JIS TEST POWDERS II-2,NO3 DISPERSING AGENT: SODIUM HEXA METHAPHOSPHATE		
ptical model:	Fraunhofer		
S 230	Micro-volume Module		
tart time:	11:58 16 Nov 1999	Run length:	60 Seconds
bscuration:	9%		
oftware:	2.11	Firmware:	2.02 2.02



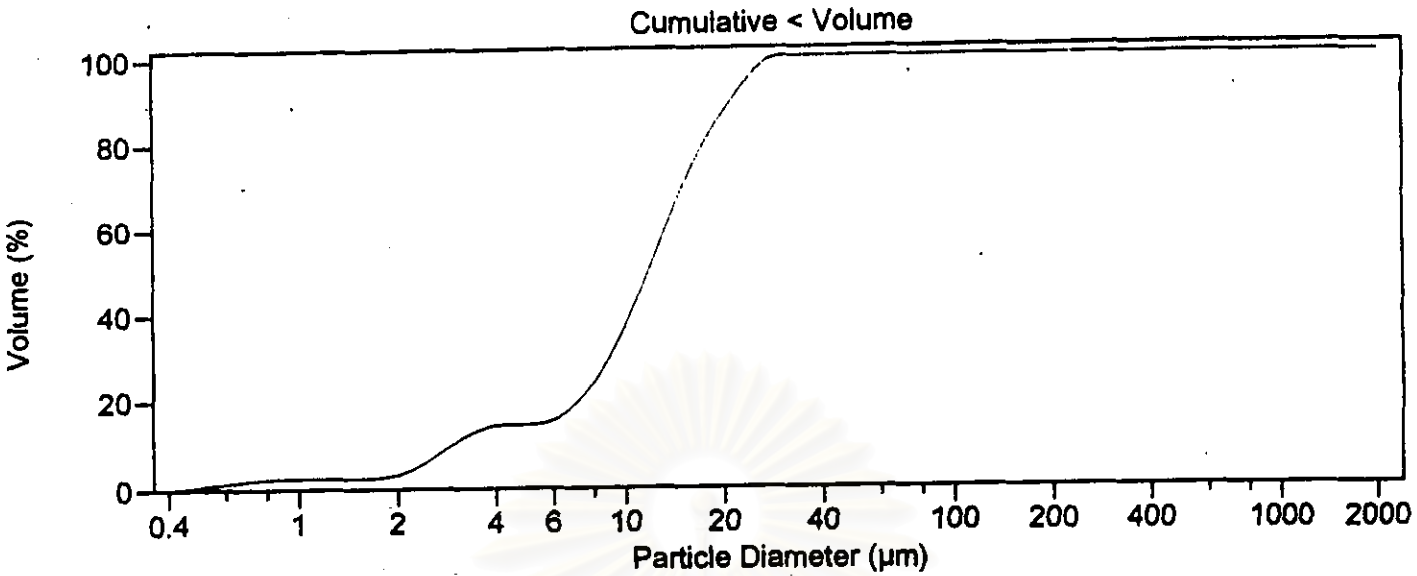
Volume Statistics (Arithmetic) p22n3r~2.$01

alculations from 0.375 µm to 2000 µm

olume	100.0%		
ean:	12.28 µm	S.D.:	6.360 µm
edian:	11.85 µm	C.V.:	51.8%
3,2):	6.359 µm	Skewness:	0.275 Right skewed
ode:	12.40 µm	Kurtosis:	-0.378 Platykurtic
o:	11.85 µm		

% >	5	10	20	30	40
Size µm	23.97	21.46	17.59	15.14	13.36

COULTER



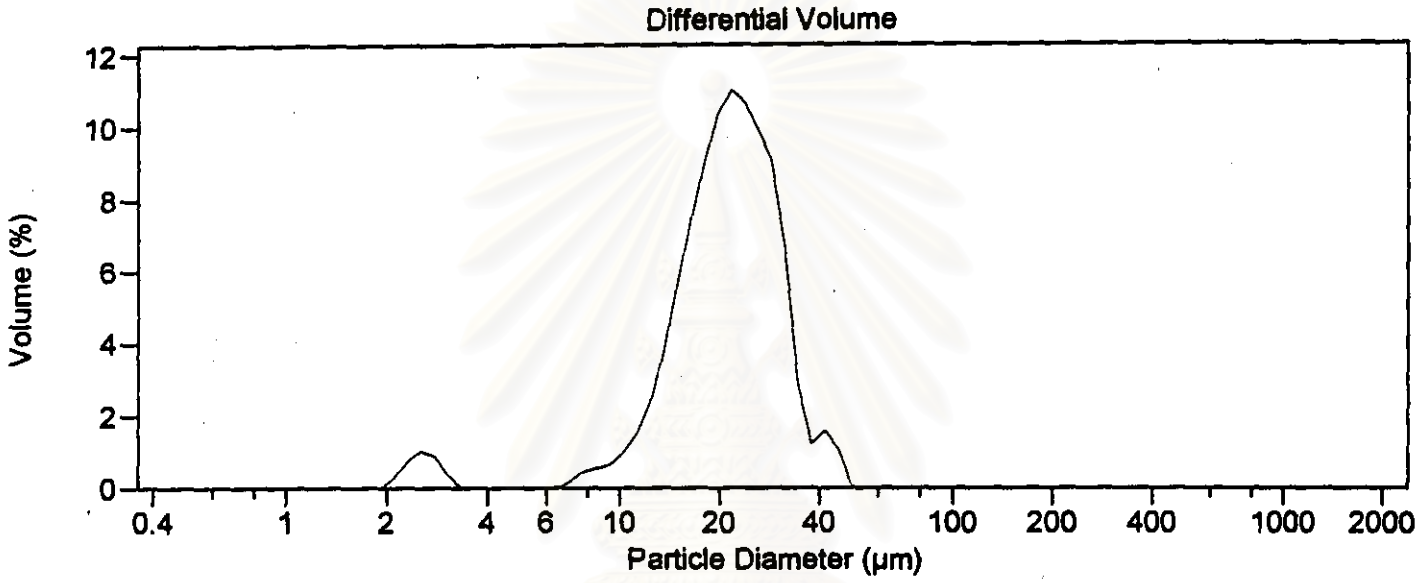
COULTER

p22n3r~2.$01

Channel Diameter (Center) µm	Diff. Volume %	Cum. > Volume %	Channel Diameter (Center) µm	Diff. Volume %	Cum. > Volume %
0.393	0.11	100	37.96	0	0
0.432	0.20	99.9	41.67	0	0
0.474	0.30	99.7	45.75	0	0
0.520	0.36	99.4	50.23	0	0
0.571	0.38	99.0	55.14	0	0
0.627	0.35	98.7	60.52	0	0
0.688	0.29	98.3	66.44	0	0
0.755	0.21	98.0	72.95	0	0
0.829	0.12	97.8	80.08	0	0
0.910	0.039	97.7	87.90	0	0
0.999	0.0031	97.7	96.49	0	0
1.097	0	97.7	105.9	0	0
1.204	0	97.7	116.3	0	0
1.322	0	97.7	127.6	0	0
1.451	0	97.7	140.1	0	0
1.593	0.013	97.7	153.8	0	0
1.749	0.18	97.6	168.8	0	0
1.919	0.58	97.5	185.3	0	0
2.106	1.07	96.9	203.5	0	0
2.312	1.56	95.8	223.4	0	0
2.539	1.93	94.2	245.2	0	0
2.787	2.06	92.3	269.2	0	0
3.060	1.90	90.3	295.5	0	0
3.359	1.48	88.4	324.3	0	0
3.687	0.91	86.9	356.1	0	0
4.047	0.30	86.0	390.9	0	0
4.444	0.023	85.7	429.2	0	0
4.878	0.021	85.6	471.1	0	0
5.355	0.31	85.6	517.2	0	0
5.878	1.06	85.3	567.8	0	0
6.452	2.02	84.3	623.3	0	0
7.083	3.05	82.2	684.2	0	0
7.776	4.06	79.2	751.1	0	0
8.536	4.99	75.1	824.5	0	0
9.371	5.88	70.1	905.1	0	0
10.29	6.73	64.3	993.5	0	0
11.29	7.43	57.5	1091	0	0
12.40	7.83	50.1	1198	0	0
13.61	7.76	42.3	1315	0	0
14.94	7.13	34.5	1443	0	0
16.40	6.13	27.4	1584	0	0
18.00	5.12	21.2	1739	0	0
19.76	4.49	16.1	1909	0	0
21.69	4.38	11.6			0
23.81	4.03	7.26			
26.14	2.49	3.23			
28.69	0.69	0.73			
31.50	0.042	0.042			
34.58	0	0			

COULTER

File name: p22n4r~2.$01
Group ID: RUN2
Sample ID: S13JTP22N4(S2)
Operator:
Run number: 1
Comments: JIS TEST POWDERS II-2,NO4
Dispersing Agent : Sodium Hexamethaphosphate
Optical model: Fraunhofer
LS 230 Micro-volume Module
Start time: 19:19 16 Nov 1999
Run length: 30 Seconds
Obscuration: 8%
Software: 2.11
Firmware: 2.02 2.02

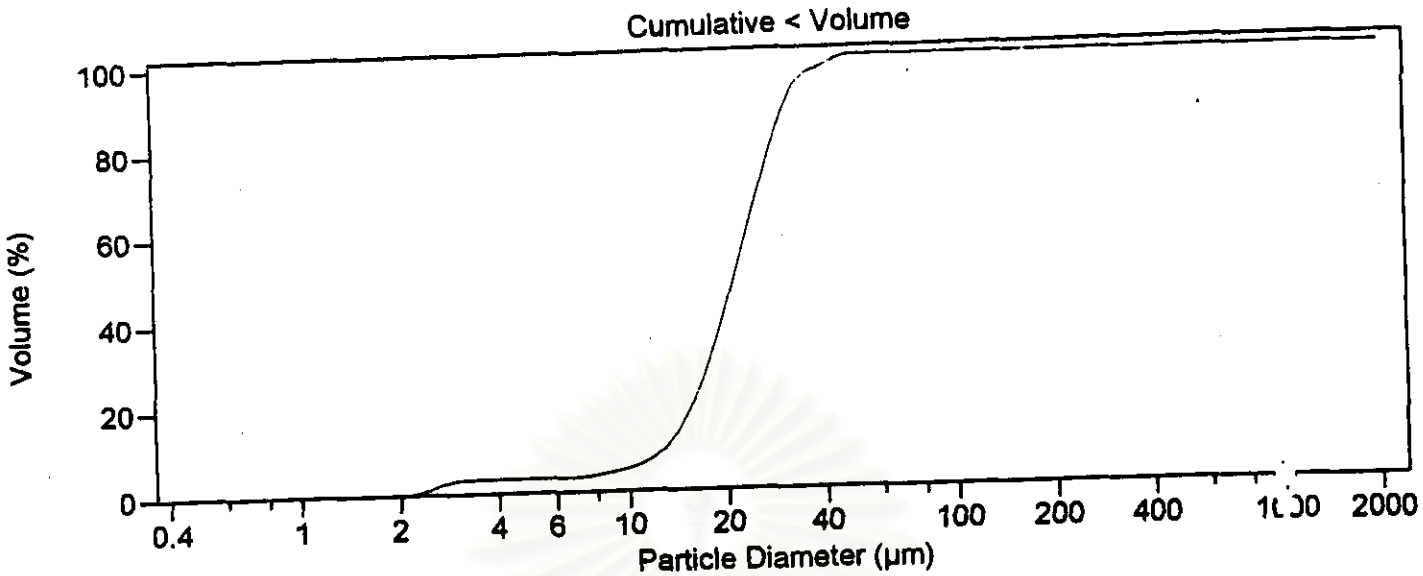


Volume Statistics (Arithmetic) p22n4r~2.$01

Calculations from 0.375 µm to 2000 µm

Volume	100.0%		
Mean:	21.83 µm	S.D.:	7.878 µm
Median:	21.44 µm	C.V.:	36.1%
D(3,2):	16.51 µm	Skewness:	0.188 Right skewed
Mode:	21.69 µm	Kurtosis:	0.680 Leptokurtic
D50:	21.44 µm		

% >	5	10	20	30	40
Size µm	34.90	31.54	28.10	25.53	23.36



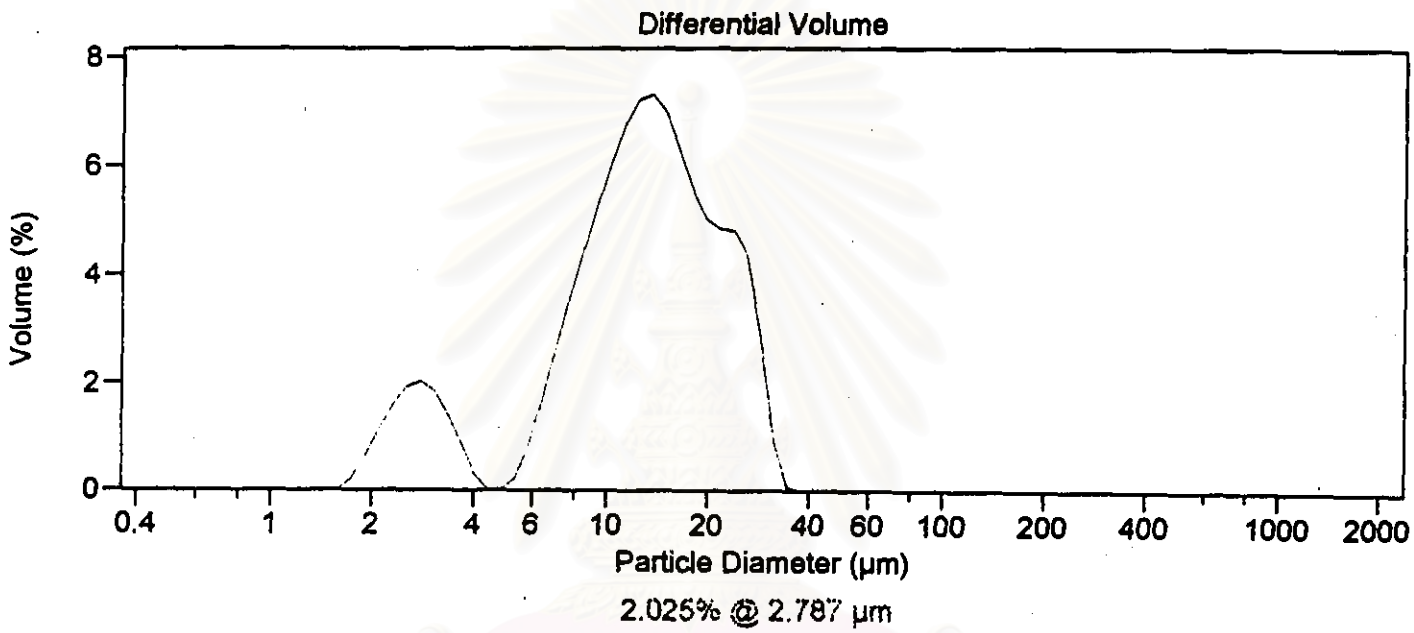
COULTER

b22n4r~2.$01

Channel Diameter (Center) µm	Diff. Volume %	Cum. > Volume %	Channel Diameter (Center) µm	Diff. Volume %	Cum. > Volume %
0.393	0	100	37.96	1.20	3.82
0.432	0	100	41.67	1.57	2.62
0.474	0	100	45.75	1.05	1.05
0.520	0	100	50.23	0	0
0.571	0	100	55.14	0	0
0.627	0	100	60.52	0	0
0.688	0	100	66.44	0	0
0.755	0	100	72.95	0	0
0.829	0	100	80.08	0	0
0.910	0	100	87.90	0	0
0.999	0	100	96.49	0	0
1.097	0	100	105.9	0	0
1.204	0	100	116.3	0	0
1.322	0	100	127.6	0	0
1.451	0	100	140.1	0	0
1.593	0	100	153.8	0	0
1.749	0	100	168.8	0	0
1.919	0	100	185.3	0	0
2.106	0.25	100	203.5	0	0
2.312	0.73	99.7	223.4	0	0
2.539	1.01	99.0	245.2	0	0
2.787	0.87	98.0	269.2	0	0
3.060	0.35	97.1	295.5	0	0
3.359	0	96.8	324.3	0	0
3.687	0	96.8	356.1	0	0
4.047	0	96.8	390.9	0	0
4.444	0	96.8	429.2	0	0
4.878	0	96.8	471.1	0	0
5.355	0	96.8	517.2	0	0
5.878	0	96.8	567.8	0	0
6.452	0	96.8	623.3	0	0
7.083	0.17	96.8	684.2	0	0
7.776	0.44	96.6	751.1	0	0
8.536	0.54	96.2	824.5	0	0
9.371	0.63	95.6	905.1	0	0
10.29	0.95	95.0	993.5	0	0
11.29	1.50	94.1	1091	0	0
12.40	2.37	92.6	1198	0	0
13.61	3.81	90.2	1315	0	0
14.94	5.64	86.4	1443	0	0
16.40	7.41	80.7	1584	0	0
18.00	8.99	73.3	1739	0	0
19.76	10.3	64.3	1909	0	0
21.69	11.0	54.0			0
23.81	10.7	43.0			
26.14	9.92	32.4			
28.69	9.06	22.4			
31.50	6.71	13.4			
34.58	2.85	6.67			

COULTER

File name:	bm2.$04	Group ID:	
Sample ID:	BIMODAL2(80:20)		
Operator:		Run number:	1
Comments:	White Fused Alumina NO.3:NO.4		
	Water - Sodium Hexamethaphosphate		
Optical model:	Fraunhofer		
LS 230	Micro-volume Module		
Start time:	22:42 14 Dec 1999	Run length:	10 Seconds
Obscuration:	8%		
Software:	2.11	Firmware:	2.02 2.02

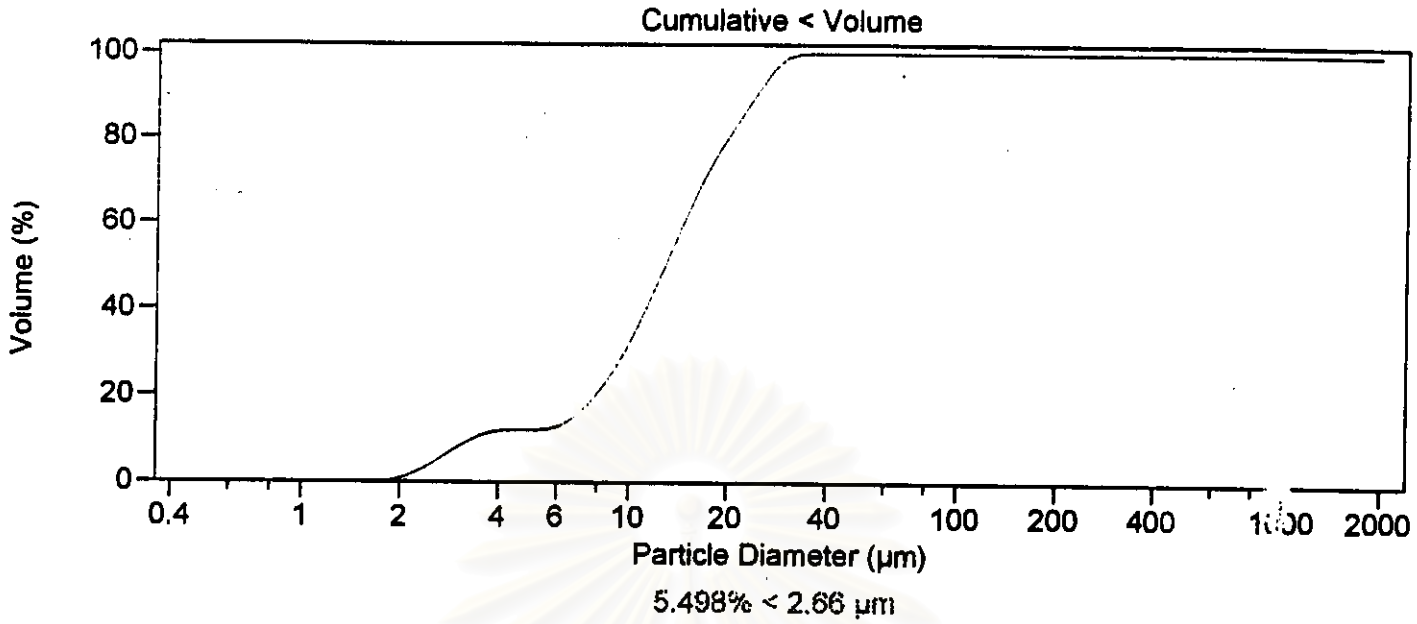


Volume Statistics (Arithmetic) bm2.$04

Calculations from 0.375 µm to 2000 µm

Volume	100.0%		
Mean:	13.66 µm	S.D.:	7.039 µm
Median:	12.83 µm	C.V.:	51.5%
D(3,2):	8.805 µm	Skewness:	0.381 Right skewed
Mode:	13.61 µm	Kurtosis:	-0.436 Platykurtic

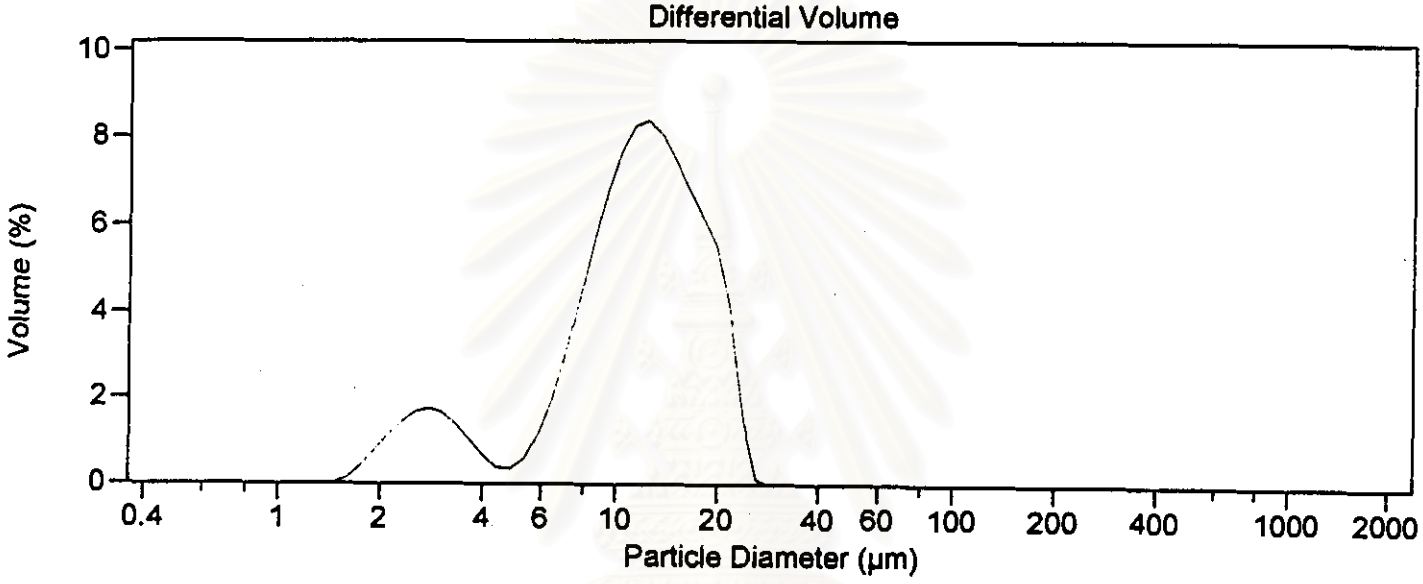
% <	10	25	50	75	90
Size µm	3.344	8.825	12.83	18.21	24.10



bm2.$04

Channel Diameter (Center) µm	Diff. Volume %	Cum. < Volume %	Channel Diameter (Center) µm	Diff. Volume %	Cum. < Volume %
0.393	0	0	37.96	0	100
0.432	0	0	41.67	0	100
0.474	0	0	45.75	0	100
0.520	0	0	50.23	0	100
0.571	0	0	55.14	0	100
0.627	0	0	60.52	0	100
0.688	0	0	66.44	0	100
0.755	0	0	72.95	0	100
0.829	0	0	80.08	0	100
0.910	0	0	87.90	0	100
0.999	0	0	96.49	0	100
1.097	0	0	105.9	0	100
1.204	0	0	116.3	0	100
1.322	0	0	127.6	0	100
1.451	0	0	140.1	0	100
1.593	0.016	0	153.8	0	100
1.749	0.21	0.016	168.8	0	100
1.919	0.64	0.23	185.3	0	100
2.106	1.12	0.87	203.5	0	100
2.312	1.59	1.99	223.4	0	100
2.539	1.92	3.58	245.2	0	100
2.787	2.03	5.50	269.2	0	100
3.060	1.85	7.52	295.5	0	100
3.359	1.43	9.37	324.3	0	100
3.687	0.87	10.8	356.1	0	100
4.047	0.29	11.7	390.9	0	100
4.444	0.021	12.0	429.2	0	100
4.878	0.014	12.0	471.1	0	100
5.355	0.23	12.0	517.2	0	100
5.878	0.88	12.2	567.8	0	100
6.452	1.76	13.1	623.3	0	100
7.083	2.70	14.9	684.2	0	100
7.776	3.63	17.6	751.1	0	100
8.536	4.48	21.2	824.5	0	100
9.371	5.29	25.7	905.1	0	100
10.29	6.07	31.0	993.5	0	100
11.29	6.76	37.0	1091	0	100
12.40	7.21	43.8	1198	0	100
13.61	7.31	51.0	1315	0	100
14.94	6.98	58.3	1443	0	100
16.40	6.31	65.3	1584	0	100
18.00	5.56	71.6	1739	0	100
19.76	5.03	77.1	1909	0	100
21.69	4.84	82.2			100
23.81	4.82	87.0			
26.14	4.36	91.8			
28.69	2.84	96.2			
31.50	0.89	99.0			
34.58	0.063	99.9			

File name:	bm3.$01	Group ID:	
Sample ID:	BIMODAL3(50:50)		
Operator:		Run number:	1
Comments:	White Fused Alumina NO.3:NO.4		
	Water - Sodium Hexamethaphosphate		
Optical model:	Fraunhofer		
LS 230	Micro-volume Module		
Start time:	22:58 14 Dec 1999	Run length:	10 Seconds
Obscuration:	6%		
Software:	2.11	Firmware:	2.02 2.02

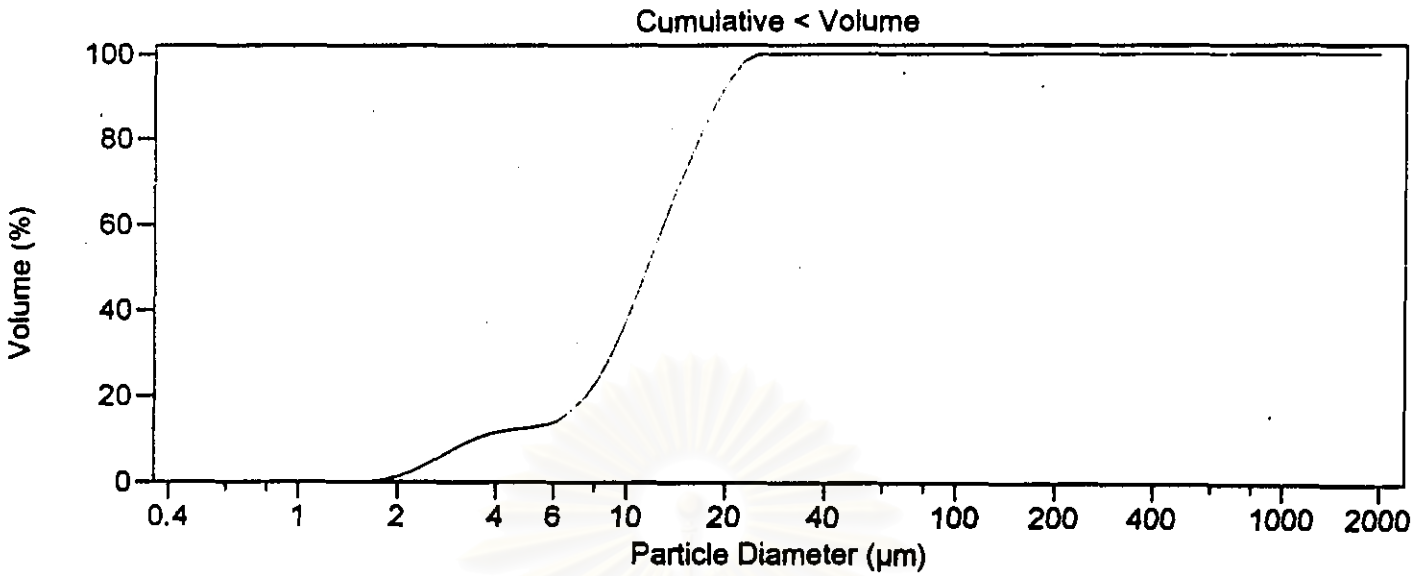


Volume Statistics (Arithmetic) bm3.$01

Calculations from 0.375 µm to 2000 µm

Volume	100.0%		
Mean:	11.82 µm	S.D.:	5.349 µm
Median:	11.59 µm	C.V.:	45.3%
D(3,2):	8.228 µm	Skewness:	0.082 Right skewed
Mode:	12.40 µm	Kurtosis:	-0.547 Platykurtic

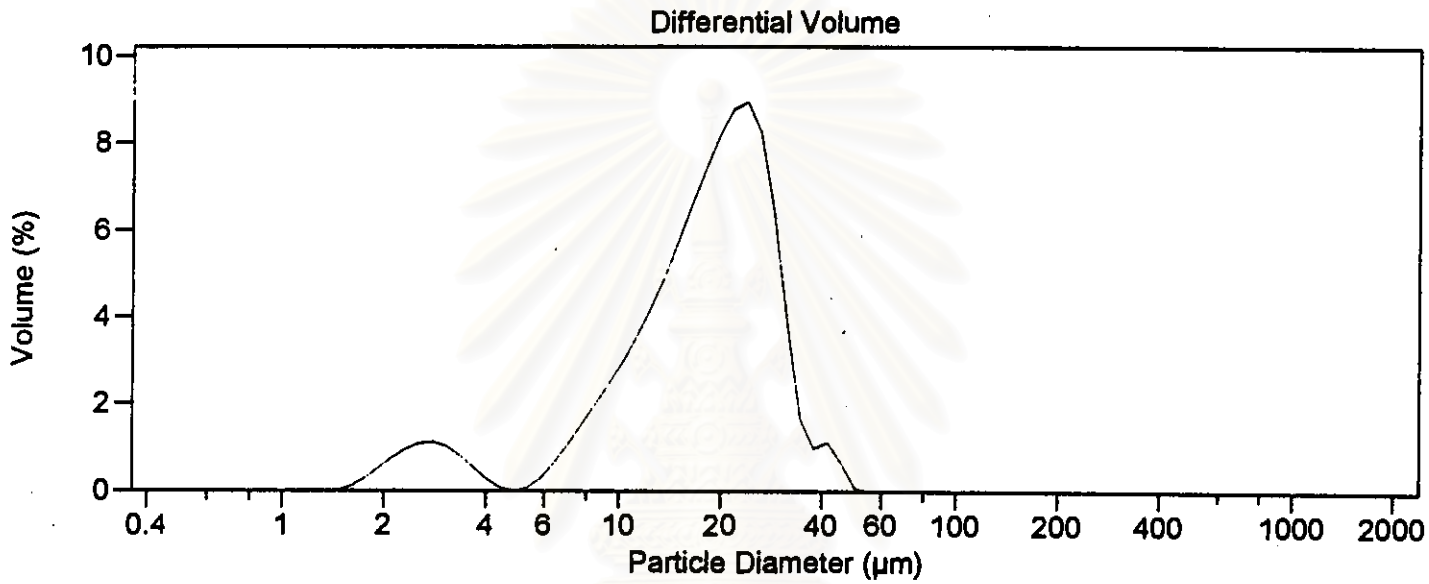
% <	10	25	50	75	90
Size µm	3.469	8.344	11.59	15.51	19.29



bm3.$01

Channel Diameter (Center) µm	Diff. Volume %	Cum. < Volume %	Channel Diameter (Center) µm	Diff. Volume %	Cum. < Volume %
0.393	0	0	37.96	0	100
0.432	0	0	41.67	0	100
0.474	0	0	45.75	0	100
0.520	0	0	50.23	0	100
0.571	0	0	55.14	0	100
0.627	0	0	60.52	0	100
0.688	0	0	66.44	0	100
0.755	0	0	72.95	0	100
0.829	0	0	80.08	0	100
0.910	0	0	87.90	0	100
0.999	0	0	96.49	0	100
1.097	0	0	105.9	0	100
1.204	0	0	116.3	0	100
1.322	0	0	127.6	0	100
1.451	0.011	0	140.1	0	100
1.593	0.13	0.011	153.8	0	100
1.749	0.40	0.14	168.8	0	100
1.919	0.73	0.55	185.3	0	100
2.106	1.10	1.28	203.5	0	100
2.312	1.43	2.38	223.4	0	100
2.539	1.66	3.81	245.2	0	100
2.787	1.74	5.47	269.2	0	100
3.060	1.64	7.21	295.5	0	100
3.359	1.37	8.85	324.3	0	100
3.687	1.00	10.2	356.1	0	100
4.047	0.63	11.2	390.9	0	100
4.444	0.39	11.8	429.2	0	100
4.878	0.35	12.2	471.1	0	100
5.355	0.58	12.6	517.2	0	100
5.878	1.12	13.2	567.8	0	100
6.452	1.98	14.3	623.3	0	100
7.083	3.07	16.3	684.2	0	100
7.776	4.30	19.3	751.1	0	100
8.536	5.56	23.6	824.5	0	100
9.371	6.74	29.2	905.1	0	100
10.29	7.68	35.9	993.5	0	100
11.29	8.25	43.6	1091	0	100
12.40	8.38	51.9	1198	0	100
13.61	8.05	60.2	1315	0	100
14.94	7.46	68.3	1443	0	100
16.40	6.80	75.7	1584	0	100
18.00	6.17	82.6	1739	0	100
19.76	5.56	88.7	1909	0	100
21.69	4.12	94.3			100
23.81	1.49	98.4			
26.14	0.11	99.9			
28.69	0	100			
31.50	0	100			
34.58	0	100			

File name:	bm4.$01	Group ID:	
Sample ID:	BIMODAL4 (20:80)		
Operator:		Run number:	1
Comments:	White Fused Alumina NO.3:NO.4 Water - Sodium Hexamethaphosphate		
Optical model:	Fraunhofer		
LS 230	Micro-volume Module		
Start time	23:13 14 Dec 1999	Run length:	30 Seconds
Obscuration:	6%		
Software:	2.11	Firmware:	2.02 2.02

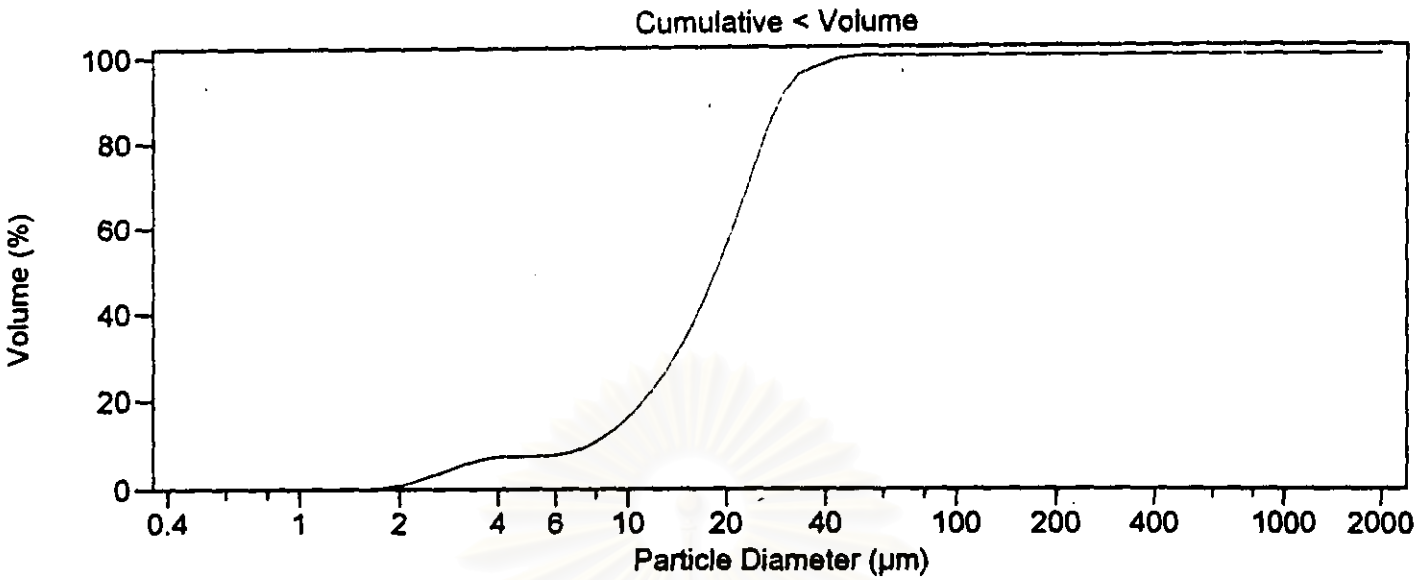


Volume Statistics (Arithmetic) bm4.$01

Calculations from 0.375 µm to 2000 µm

Volume	100.0%		
Mean:	18.65 µm	S.D.:	8.708 µm
Median:	18.60 µm	C.V.:	46.7%
D(3,2):	11.96 µm	Skewness:	0.251 Right skewed
Mode:	23.81 µm	Kurtosis:	0.110 Leptokurtic

% <	10	25	50	75	90
Size µm	7.636	12.61	18.60	24.45	29.35

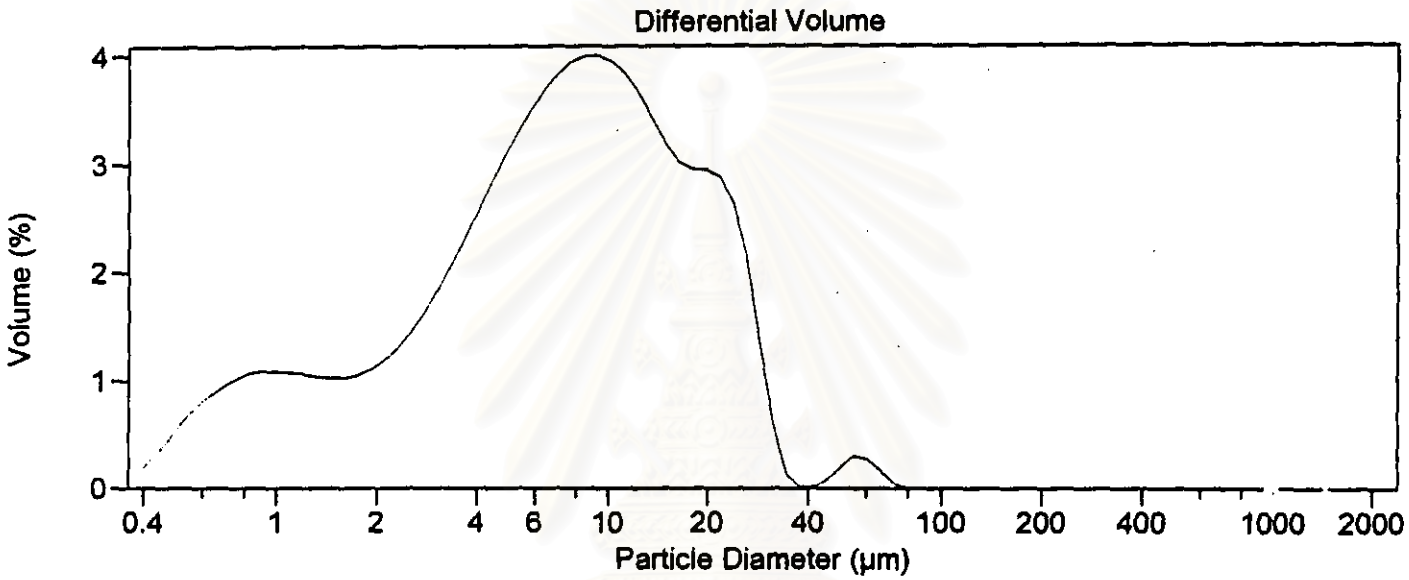


bm4.$01

Channel Diameter (Center) µm	Diff. Volume %	Cum. < Volume %	Channel Diameter (Center) µm	Diff. Volume %	Cum. < Volume %
0.393	0	0	37.96	0.97	97.2
0.432	0	0	41.67	1.10	98.2
0.474	0	0	45.75	0.65	99.3
0.520	0	0	50.23	0.063	99.9
0.571	0	0	55.14	0	100
0.627	0	0	60.52	0	100
0.688	0	0	66.44	0	100
0.755	0	0	72.95	0	100
0.829	0	0	80.08	0	100
0.910	0	0	87.90	0	100
0.999	0	0	96.49	0	100
1.097	0	0	105.9	0	100
1.204	0	0	116.3	0	100
1.322	0	0	127.6	0	100
1.451	0.0075	0	140.1	0	100
1.593	0.091	0.0075	153.8	0	100
1.749	0.27	0.099	168.8	0	100
1.919	0.49	0.37	185.3	0	100
2.106	0.74	0.87	203.5	0	100
2.312	0.95	1.60	223.4	0	100
2.539	1.09	2.55	245.2	0	100
2.787	1.11	3.64	269.2	0	100
3.060	1.01	4.75	295.5	0	100
3.359	0.81	5.76	324.3	0	100
3.687	0.54	6.57	356.1	0	100
4.047	0.26	7.11	390.9	0	100
4.444	0.062	7.36	429.2	0	100
4.878	0.014	7.42	471.1	0	100
5.355	0.067	7.44	517.2	0	100
5.878	0.29	7.51	567.8	0	100
6.452	0.66	7.80	623.3	0	100
7.083	1.08	8.46	684.2	0	100
7.776	1.55	9.54	751.1	0	100
8.536	2.01	11.1	824.5	0	100
9.371	2.50	13.1	905.1	0	100
10.29	3.01	15.6	993.5	0	100
11.29	3.57	18.6	1091	0	100
12.40	4.22	22.2	1198	0	100
13.61	4.95	26.4	1315	0	100
14.94	5.76	31.3	1443	0	100
16.40	6.60	37.1	1584	0	100
18.00	7.42	43.7	1739	0	100
19.76	8.18	51.1	1909	0	100
21.69	8.78	59.3			100
23.81	8.95	68.1			
26.14	8.24	77.0			
28.69	6.46	85.3			
31.50	3.83	91.7			
34.58	1.65	95.6			

COULTER

ile name:	p1n5run2.$01	Group ID:	RUN2
ample ID:	S2JTP1N5(S2)		
perator:		Run number:	1
omments:	JIS TEST POWDERS I,NO5 DISPERSING AGENT: SODIUM HEXA METHAPHOSPHATE		
ptical model:	Fraunhofer		
S 230	Micro-volume Module		
tart time:	12:50 16 Nov 1999	Run length:	60 Seconds
bscuration:	8%		
oftware:	2.11	Firmware:	2.02 2.02

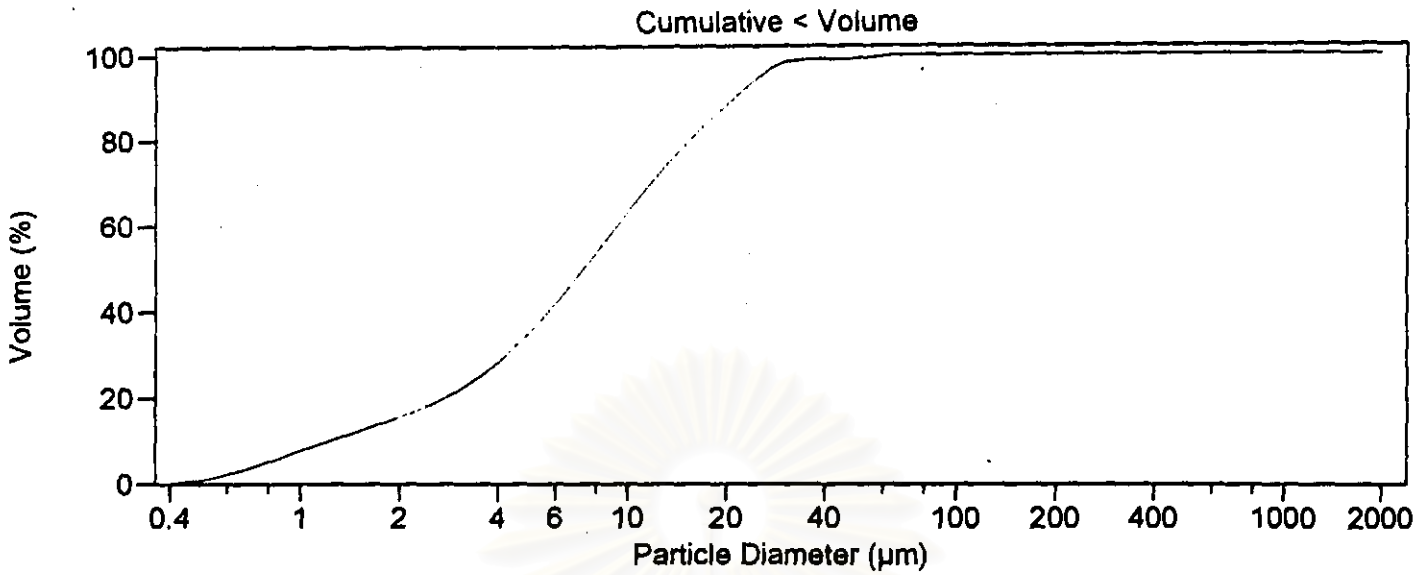


Volume Statistics (Arithmetic) p1n5run2.$01

alculations from 0.375 µm to 2000 µm

olume	100.0%		
ean:	9.697 µm	S.D.:	8.792 µm
edian:	7.371 µm	C.V.:	90.7%
(3,2):	3.401 µm	Skewness:	2.195 Right skewed
ode:	8.536 µm	Kurtosis:	8.507 Leptokurtic
50:	7.371 µm		

% >	5	10	20	30	40
Size µm	25.27	21.28	15.54	11.83	9.331



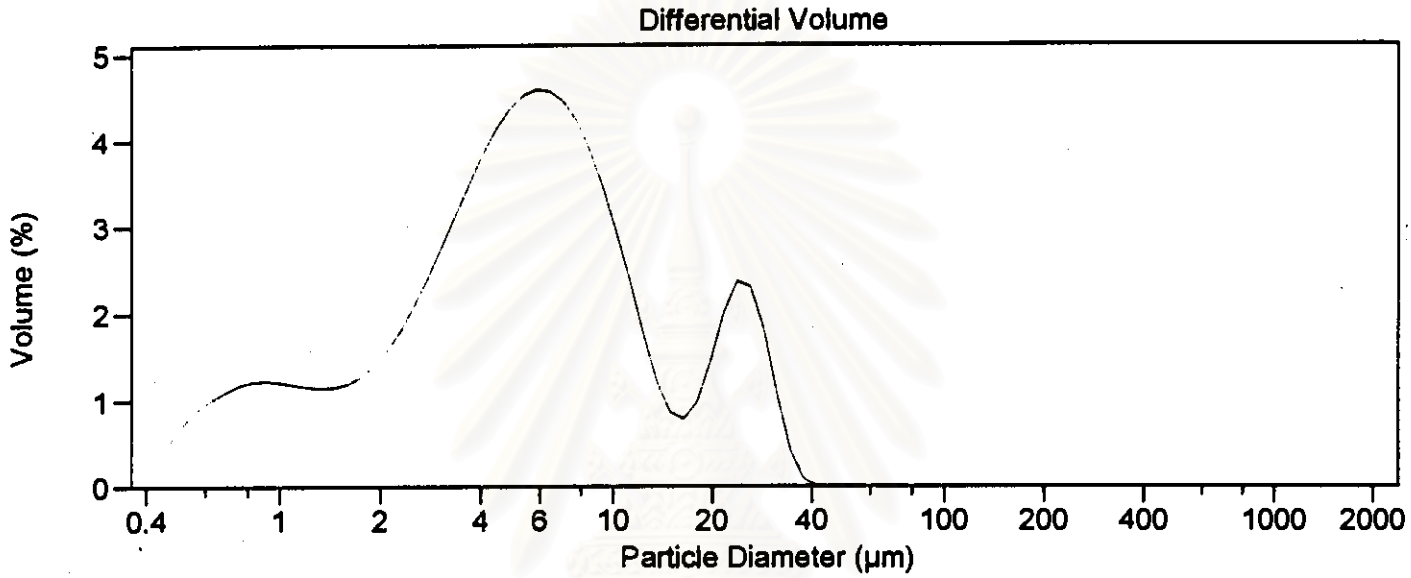
COULTER

1n5run2.$01

Channel Diameter (Center) µm	Diff. Volume %	Cum. > Volume %	Channel Diameter (Center) µm	Diff. Volume %	Cum. > Volume %
0.393	0.16	100	37.96	0.018	1.06
0.432	0.29	99.8	41.67	0.015	1.04
0.474	0.43	99.5	45.75	0.076	1.03
0.520	0.60	99.1	50.23	0.19	0.95
0.571	0.74	98.5	55.14	0.29	0.76
0.627	0.85	97.8	60.52	0.27	0.46
0.688	0.94	96.9	66.44	0.15	0.20
0.755	1.01	96.0	72.95	0.039	0.043
0.829	1.06	95.0	80.08	0.0043	0.0043
0.910	1.08	93.9	87.90	0	0
0.999	1.08	92.8	96.49	0	0
1.097	1.07	91.7	105.9	0	0
1.204	1.06	90.7	116.3	0	0
1.322	1.04	89.6	127.6	0	0
1.451	1.02	88.6	140.1	0	0
1.593	1.02	87.6	153.8	0	0
1.749	1.05	86.5	168.8	0	0
1.919	1.10	85.5	185.3	0	0
2.106	1.18	84.4	203.5	0	0
2.312	1.30	83.2	223.4	0	0
2.539	1.45	81.9	245.2	0	0
2.787	1.63	80.5	269.2	0	0
3.060	1.84	78.8	295.5	0	0
3.359	2.08	77.0	324.3	0	0
3.687	2.32	74.9	356.1	0	0
4.047	2.58	72.6	390.9	0	0
4.444	2.84	70.0	429.2	0	0
4.878	3.09	67.2	471.1	0	0
5.355	3.31	64.1	517.2	0	0
5.878	3.52	60.8	567.8	0	0
6.452	3.69	57.2	623.3	0	0
7.083	3.84	53.6	684.2	0	0
7.776	3.95	49.7	751.1	0	0
8.536	4.00	45.8	824.5	0	0
9.371	4.00	41.8	905.1	0	0
10.29	3.94	37.8	993.5	0	0
11.29	3.83	33.8	1091	0	0
12.40	3.65	30.0	1198	0	0
13.61	3.42	26.4	1315	0	0
14.94	3.19	22.9	1443	0	0
16.40	3.02	19.7	1584	0	0
18.00	2.95	16.7	1739	0	0
19.76	2.95	13.8	1909	0	0
21.69	2.89	10.8			0
23.81	2.65	7.94			
26.14	2.16	5.28			
28.69	1.35	3.12			
31.50	0.59	1.77			
34.58	0.12	1.18			

COULTER

File name:	p1n10r3.$01	Group ID:	
Sample ID:	Powders I,NO.10		
Operator:	Peerapat Kritanusorn	Run number:	10
Comments:	Water - Na-H.M.P		
Optical model:	Fraunhofer		
LS 230	Micro-volume Module		
Start time:	22:47 3 Jan 2000	Run length:	60 Seconds
Obscuration:	11%		
Software:	2.11	Firmware:	2.02 2.02

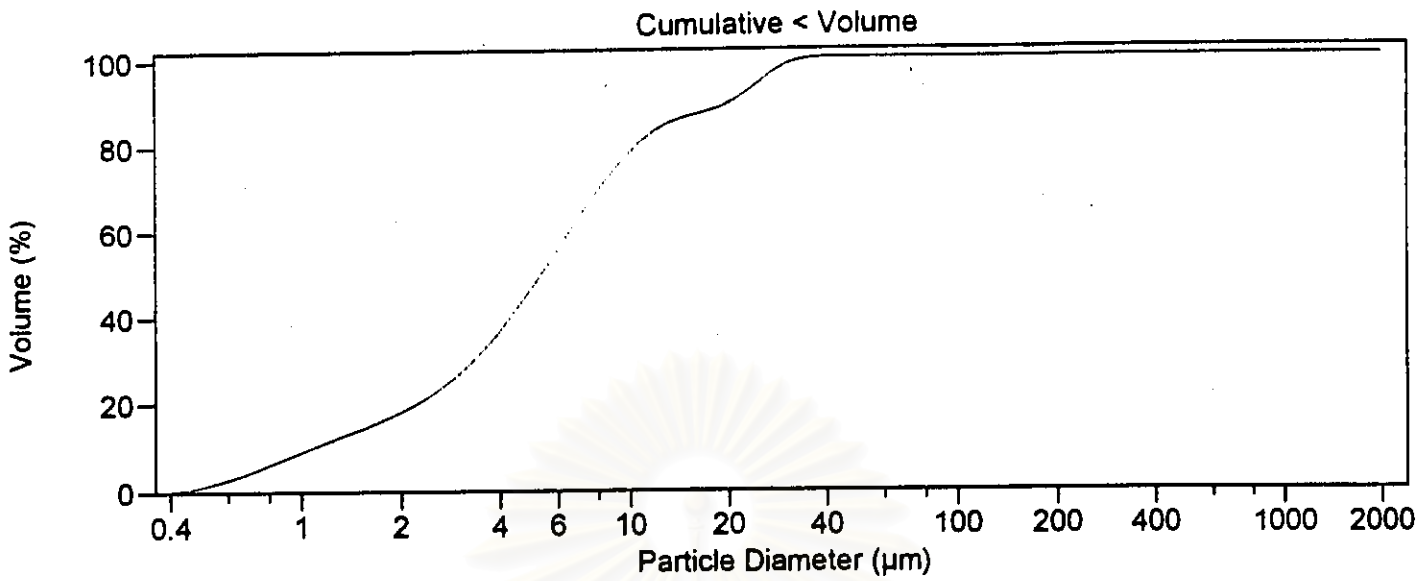


Volume Statistics (Arithmetic) p1n10r3.$01

Calculations from 0.375 µm to 2000 µm

Volume	100.0%		
Mean:	7.692 µm	S.D.:	7.436 µm
Median:	5.351 µm	C.V.:	96.7%
D(3,2):	2.889 µm	Skewness:	1.691 Right skewed
Mode:	5.878 µm	Kurtosis:	2.242 Leptokurtic

% <	10	25	50	75	90
Size µm	1.077	2.805	5.351	9.176	20.81



p1n10r3.$01

Channel Diameter (Center) µm	Diff. Volume %	Cum. < Volume %	Cum. > Volume %
0.393	0.20	0	100
0.432	0.36	0.20	99.8
0.474	0.52	0.56	99.4
0.520	0.73	1.08	98.9
0.571	0.89	1.81	98.2
0.627	1.01	2.70	97.3
0.688	1.10	3.71	96.3
0.755	1.18	4.82	95.2
0.829	1.22	6.00	94.0
0.910	1.23	7.22	92.8
0.999	1.21	8.44	91.6
1.097	1.18	9.65	90.3
1.204	1.16	10.8	89.2
1.322	1.15	12.0	88.0
1.451	1.15	13.1	86.9
1.593	1.19	14.3	85.7
1.749	1.27	15.5	84.5
1.919	1.40	16.8	83.2
2.106	1.58	18.2	81.8
2.312	1.81	19.7	80.3
2.539	2.10	21.5	78.5
2.787	2.42	23.6	76.4
3.060	2.77	26.1	73.9
3.359	3.14	28.8	71.2
3.687	3.50	32.0	68.0
4.047	3.84	35.5	64.5
4.444	4.14	39.3	60.7
4.878	4.37	43.5	56.5
5.355	4.52	47.8	52.2
5.878	4.59	52.4	47.6
6.452	4.57	56.9	43.1
7.083	4.45	61.5	38.5
7.776	4.23	66.0	34.0
8.536	3.89	70.2	29.8
9.371	3.46	74.1	25.9
10.29	2.94	77.5	22.5
11.29	2.36	80.5	19.5
12.40	1.76	82.8	17.2
13.61	1.21	84.6	15.4
14.94	0.86	85.8	14.2
16.40	0.78	86.7	13.3
18.00	0.98	87.5	12.5
19.76	1.45	88.4	11.6
21.69	2.01	89.9	10.1
23.81	2.37	91.9	8.10
26.14	2.31	94.3	5.73
28.69	1.83	96.6	3.42
31.50	1.07	98.4	1.59
34.58	0.42	99.5	0.51

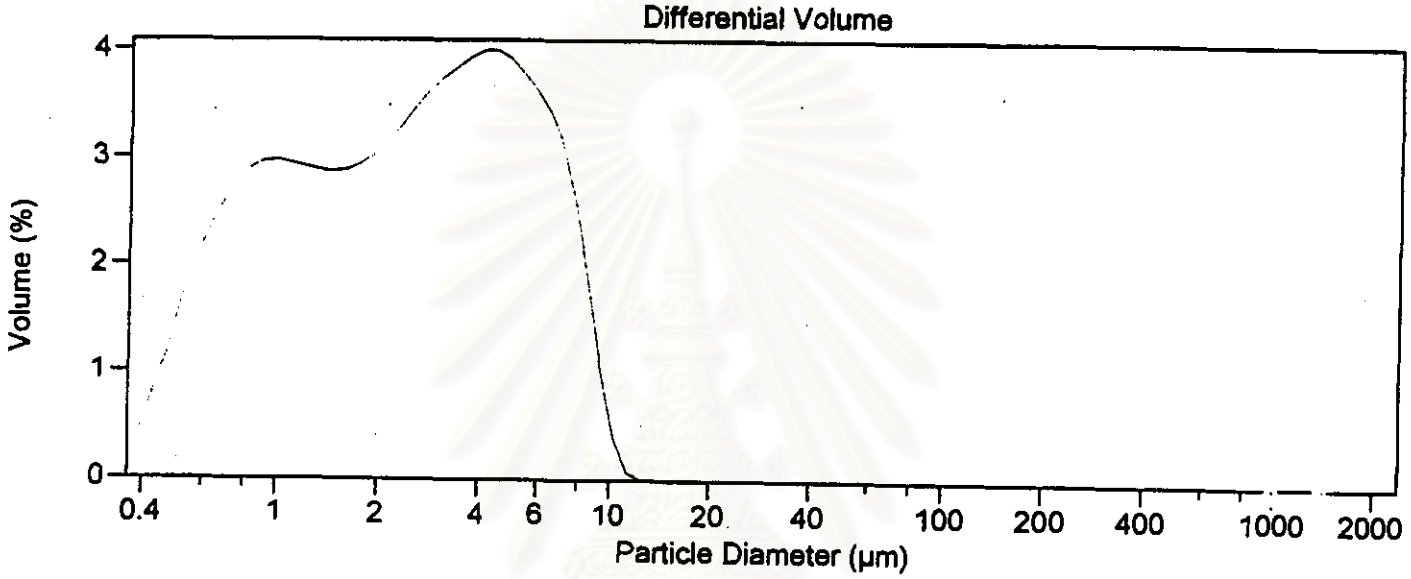
p1n10r3.$01

Channel Diameter (Center) µm	Diff. Volume %	Cum. < Volume %	Cum. > Volume %
37.96	0.082	99.9	0.089
41.67	0.0065	100.0	0.0065
45.75	0	100	0
50.23	0	100	0
55.14	0	100	0
60.52	0	100	0
66.44	0	100	0
72.95	0	100	0
80.08	0	100	0
87.90	0	100	0
96.49	0	100	0
105.9	0	100	0
116.3	0	100	0
127.6	0	100	0
140.1	0	100	0
153.8	0	100	0
168.8	0	100	0
185.3	0	100	0
203.5	0	100	0
223.4	0	100	0
245.2	0	100	0
269.2	0	100	0
295.5	0	100	0
324.3	0	100	0
356.1	0	100	0
390.9	0	100	0
429.2	0	100	0
471.1	0	100	0
517.2	0	100	0
567.8	0	100	0
623.3	0	100	0
684.2	0	100	0
751.1	0	100	0
824.5	0	100	0
905.1	0	100	0
993.5	0	100	0
1091	0	100	0
1198	0	100	0
1315	0	100	0
1443	0	100	0
1584	0	100	0
1739	0	100	0
1909	0	100	0
		100	0

p1n10r3.$01

Channel Diameter (Center) µm	Diff. Volume %	Cum. < Volume %	Cum. > Volume %
0.393	0.20	0	100
0.627	1.01	2.70	97.3
0.999	1.21	8.44	91.6
1.593	1.19	14.3	85.7
2.539	2.10	21.5	78.5
4.047	3.84	35.5	64.5
6.452	4.57	56.9	43.1
10.29	2.94	77.5	22.5
16.40	0.78	86.7	13.3
26.14	2.31	94.3	5.73
41.67	0.0085	100.0	0.0065
66.44	0	100	0
105.9	0	100	0
168.8	0	100	0
269.2	0	100	0
429.2	0	100	0
684.2	0	100	0
1091	0	100	0
1739	0	100	0

File name:	p1n11.$01	Group ID:	
Sample ID:	Powders I, No.11		
Operator:	Peerapat Kritanusorn	Run number:	1
Comments:	Water - Na-H.M.P		
Optical model:	Fraunhofer		
LS 230	Micro-volume Module		
Start time:	21:48 3 Jan 2000	Run length:	60 Seconds
Obscuration:	14%		
Software:	2.11	Firmware:	2.02 2.02

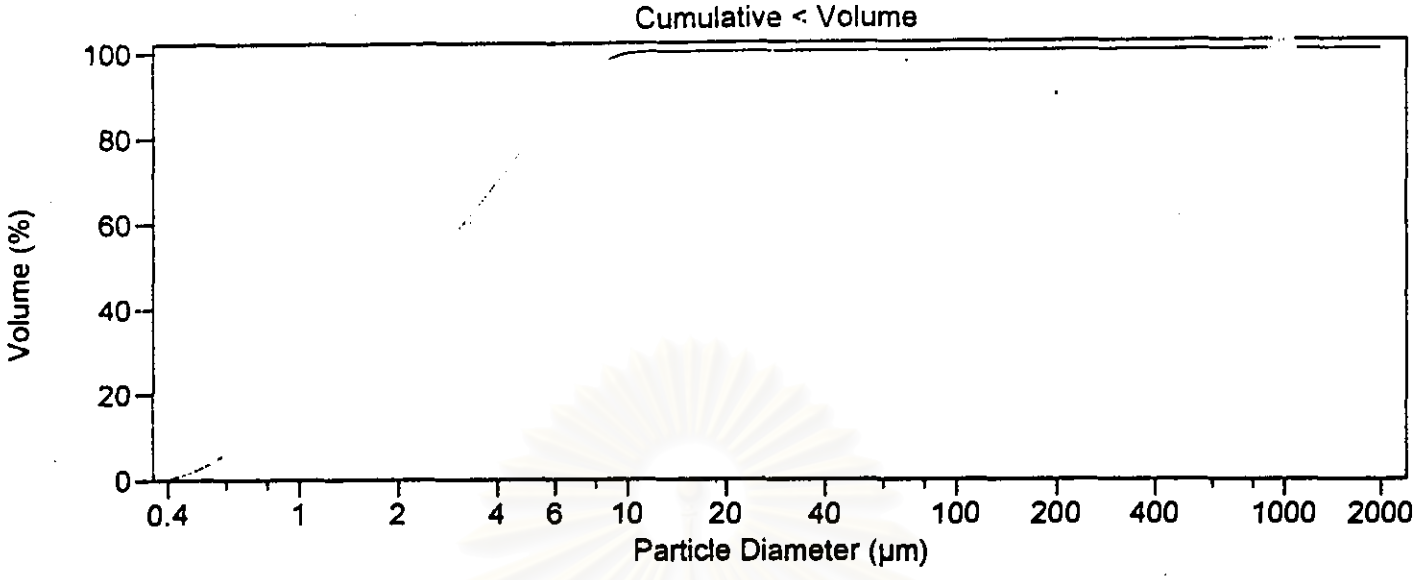


Volume Statistics (Arithmetic) p1n11.$01

Calculations from 0.375 µm to 2000 µm

Volume	100.0%		
Mean:	3.080 µm	S.D.:	2.301 µm
Median:	2.447 µm	C.V.:	74.7%
D(3,2):	1.603 µm	Skewness:	0.920 Right skewed
Mode:	4.047 µm	Kurtosis:	0.039 Leptokurtic

% <	10	25	50	75	90
Size µm	0.692	1.125	2.447	4.532	6.601



o1n11.$01

Channel Diameter (Center) µm	Diff. Volume %	Cum. < Volume %	Cum. > Volume %
0.393	0.47	0	100
0.432	0.83	0.47	99.5
0.474	1.20	1.29	98.7
0.520	1.68	2.49	97.5
0.571	2.05	4.17	95.8
0.627	2.35	6.22	93.8
0.688	2.58	8.57	91.4
0.755	2.77	11.2	88.8
0.829	2.90	13.9	86.1
0.910	2.96	16.8	83.2
0.999	2.97	19.8	80.2
1.097	2.94	22.8	77.2
1.204	2.91	25.7	74.3
1.322	2.88	28.6	71.4
1.451	2.87	31.5	68.5
1.593	2.89	34.4	65.6
1.749	2.94	37.2	62.8
1.919	3.02	40.2	59.8
2.106	3.15	43.2	56.8
2.312	3.30	46.4	53.6
2.539	3.46	49.7	50.3
2.787	3.61	53.1	46.9
3.060	3.73	56.7	43.3
3.359	3.83	60.5	39.5
3.687	3.92	64.3	35.7
4.047	3.99	68.2	31.8
4.444	3.99	72.2	27.8
4.878	3.91	76.2	23.8
5.355	3.77	80.1	19.9
5.878	3.61	83.9	16.1
6.452	3.42	87.5	12.5
7.083	3.11	90.9	9.09
7.776	2.60	94.0	5.98
8.536	1.87	96.6	3.39
9.371	1.04	98.5	1.52
10.29	0.40	99.5	0.48
11.29	0.076	99.9	0.082
12.40	0.0061	100.0	0.0061
13.61	0	100	0
14.94	0	100	0
16.40	0	100	0
18.00	0	100	0
19.76	0	100	0
21.69	0	100	0
23.81	0	100	0
26.14	0	100	0
28.69	0	100	0
31.50	0	100	0
34.58	0	100	0

p1n11.S01

Channel Diameter (Center) µm	Diff. Volume %	Cum. < Volume %	Cum. > Volume %
37.96	0	100	0
41.67	0	100	0
45.75	0	100	0
50.23	0	100	0
55.14	0	100	0
60.52	0	100	0
66.44	0	100	0
72.95	0	100	0
80.08	0	100	0
87.90	0	100	0
96.49	0	100	0
105.9	0	100	0
116.3	0	100	0
127.6	0	100	0
140.1	0	100	0
153.8	0	100	0
168.8	0	100	0
185.3	0	100	0
203.5	0	100	0
223.4	0	100	0
245.2	0	100	0
269.2	0	100	0
295.5	0	100	0
324.3	0	100	0
356.1	0	100	0
390.9	0	100	0
429.2	0	100	0
471.1	0	100	0
517.2	0	100	0
567.8	0	100	0
623.3	0	100	0
684.2	0	100	0
751.1	0	100	0
824.5	0	100	0
905.1	0	100	0
993.5	0	100	0
1091	0	100	0
1198	0	100	0
1315	0	100	0
1443	0	100	0
1584	0	100	0
1739	0	100	0
1909	0	100	0
		100	0

p1n11.S01

Channel Diameter (Center) µm	Diff. Volume %	Cum. < Volume %	Cum. > Volume %
0.393	0.47	0	100
0.627	2.35	6.22	93.8
0.999	2.97	19.8	80.2
1.593	2.89	34.4	65.6
2.539	3.46	49.7	50.3
4.047	3.99	68.2	31.8
6.452	3.42	87.5	12.5
10.29	0.40	99.5	0.48
16.40	0	100	0
26.14	0	100	0
41.67	0	100	0
66.44	0	100	0
105.9	0	100	0
168.8	0	100	0
269.2	0	100	0
429.2	0	100	0
684.2	0	100	0
1091	0	100	0
1739	0	100	0

ประวัติผู้เขียน

นายพีระพัฒน์ กฤตานุสรณ์ เกิดเมื่อวันที่ 28 มกราคม พ.ศ.2518 จบการศึกษาชั้นมัธยมศึกษาจากโรงเรียนอัสสัมชัญธนบุรี จากนั้นเข้าศึกษาต่อในระดับอุดมศึกษา ที่คณะวิทยาศาสตร์ ภาควิชาเคมี มหาวิทยาลัยเกษตรศาสตร์ เมื่อเดือนมิถุนายน พ.ศ.2535 และสำเร็จการศึกษาเมื่อปี 2539 หลังจากนั้นได้เข้าศึกษาในหลักสูตรปริญญาวิศวกรรมศาสตร์มหาบัณฑิต ภาควิชาวิศวกรรมเคมี จุฬาลงกรณ์มหาวิทยาลัยในปีเดียวกัน และสำเร็จการศึกษาในปีการศึกษา 2542