Analysis Report

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ANALYSETTE 22 MicroTec plus

Customer	Sibelco AS Mrs. Irene Solas Glamsland N-4790 Lillesand
Representative	HECO-Laboratorieutstyr AS Mr. E. Gundersen N-0238 Oslo
Material	6x Feldspar and Sand
Record Number:	110012
By:	U. Gerber

Idar-Oberstein, 14. March 2011

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1 Sample Material

The sample material consists of 6 x Feldspar and Sand.

They were received as a dry powder in a bag.

The particle size distribution was measured in a *liquid dispersion* and in *dry form*.

Water was used with a total hardness: 2,6 – 2,8 °dH.

For more information about the water used please refer to : Idar-Oberstein water quality (German language only).

2 Procedure

2.1 Sample Preparation

At first, the sample was mixed with a spatula for homogenisation.

For wet measurement:

The sample was put directly to the ANALYSETTE 22 MicroTec plus wet dispersion unit till the preset beam obscuration of the laser beam was reached (the actual beam obscuration for the measurements can be found in the according report in the appendix).

For dry measurement:

The materials: M 32 45, NQ 45 and M 32 was taken from the bag and put to the funnel / vibratory feeder from the ANALYSETTE 22 dry dispersion unit.

2.2 Dispersion

Wet measurement:

The dispersion was performed in the wet dispersion unit of the ANALYSETTE 22 MicroTec plus. This unit is equipped with a 60 W ultrasonic bath that enhances the dispersion efficiency significantly.

The dispersing time with ultrasonic was 30s before measurement.

To check stability of the dispersion two subsequent measurements were performed before cleaning and refilling the sample circuit.

Dry measurement:

The dispersion of the sample takes place in the dry dispersion unit of the

ANALYSETTE 22 MicroTec plus. The dry dispersion unit consists of a feeding pipe, which is filled via a funnel and from where via a variable gap, the sample material falls on a vibratory feeder channel.

At the end of the vibratory feeder channel, the material falls in a funnel, from where the sample with the aid of a directed air current is transported to the Venturi nozzle system, which is operated with compressed air. Here the actual dispersion takes place. The measuring cell is directly situated behind the Venturi nozzle system, which is bordered by two protective sapphire glasses in order to prevent the soiling of the measuring instrument.

The mass flow of the measured material is measured via the total light absorption inside the measuring cell. A control unit varies the amplitude of the vibratory feeder channel and the width of the gap below the feeding pipe, so that during the entire measurement a constant value can be maintained. The herewith obtained values of the performed measurements are contained in the respective measurement protocols in the enclosures.

The degree of the dispersion can be influenced via the pressure of the air supply of the Venturi nozzle. In most cases, a value of 3 bar proves to be optimal and a beam absorption between 2-4%.

2.3 Measurement Parameters

One exceptional advantage of the ANALYSETTE 22 MicroTec plus is the possibility to place the measurement cell at two different positions along the optical path of the laser beam during one measurement (Fritsch patent). This results in an optimized measurement range and size resolution for each sample.

For the here analyzed samples the measurement range was set to 0,08 - 2000µm. The effective number of detector elements were 102 what yields a good resolution and sensitivity.

Further parameter: 100scans and shot/scan n=4.

The beam obscuration for the measurements can be found in the according report in the appendix.

Important:

A dry measurement is not recommended, since the statically charge is too high for a good dry dispersing. We also measure agglomerates (compare with wet measurement).

3 Results

For details please refer to the appendix.

The D10, D50 and D90 of the different measurements are:

Wet measurement:

Sample M 32 45	D10 [µm]	D50 [µm]	D90 [µm]
Meas. # 29332	1,88	15,3	41,9
Meas. # 29333	1,88	15,3	41,9
Meas. # 29334	1,86	15,2	41,8

Sample M 32 60	D10 [µm]	D50 [µm]	D90 [µm]
Meas. # 29336	1,87	15,8	43,6
Meas. # 29337	1,86	15,6	43,4

Sample M 32 125	D10 [µm]	D50 [µm]	D90 [µm]
Meas. # 29338	2,28	20,2	57,0
Meas. # 29339	2,27	20,2	57,1

Sample NQ 45	D10 [µm]	D50 [µm]	D90 [µm]
Meas. # 29426	1,80	14,5	40,1
Meas. # 29428	1,80	14,7	41,3

Sample M32	D10 [µm]	D50 [µm]	D90 [µm]
Meas. # 29452	202	317	474
Meas. # 29453	204	321	477

Sample K600	D10 [µm]	D50 [µm]	D90 [µm]
Meas. # 29454	117	300	547
Meas. # 29455	109	292	524

Dry measurement:

Sample M 32 45	D10 [µm]	D50 [µm]	D90 [µm]
Meas. # 29494	0,8	15,1	47,1
Meas. # 29495	1,0	17,5	48,4
Meas. # 29498	1,1	19,7	51,1

Sample NQ 45	D10 [µm]	D50 [µm]	D90 [µm]
Meas. # 29507	1,2	22,2	59,0
Meas. # 29508	0,9	17,4	47,9
Meas. # 29509	0,7	13,0	35,2

Sample M 32	D10 [µm]	D50 [µm]	D90 [µm]
Meas. # 29515	195	339	541
Meas. # 29516	205	352	558

4 Appendix

The appendix contains the reports of the measurements. Not all subsequent measurements are shown in detail. If detailed data of all these measurements are required they can be requested from Fritsch GmbH.

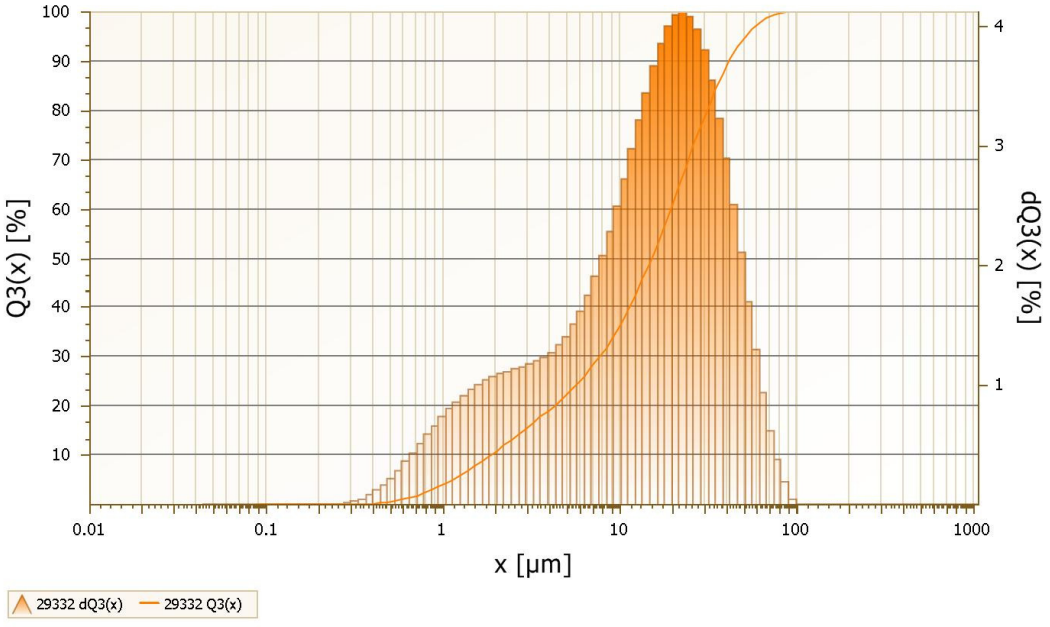
ANALYSETTE 22 MicroTec plus

Meas.Nr.	29332	**Date**	Donnerstag, 03 März 2011 04:08	**Personal Report No.:**	
Material	M 32 45		(Feldspa mel)		**110012**
Description	in water + 0,1% Na4P2O7, 30s ultrasonic				

Calculation	Fraunhofer		very_broad			**TradeOff**	1.000000e+004
Scans Fine	100	**Scans Coarse**	100	**Channels**	102	**Beam Obscuration**	14.00 %
Meas. Range	0.08 [µm]	-	2000.00 [µm]	**Pump**	7	**Ultrasonics**	10

%	< µm
5	1.14
10	**1.88**
15	2.88
20	4.26
25	5.94
30	7.74
40	11.43
50	**15.27**
60	19.52
70	24.61
80	31.29
90	**41.85**
95	51.40
98	62.62
99	70.19

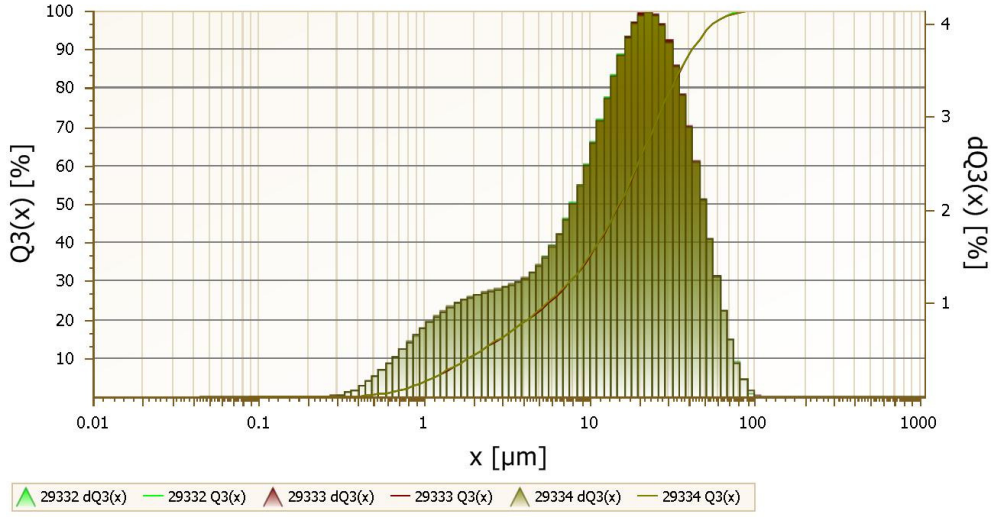
< µm	%
1.0	3.9
10.0	36.2
20.0	61.0
45.0	91.9
75.0	99.4
100.0	100.0



ANALYSETTE 22 MicroTec plus

% <	mean µm	CV [%]	M29332	M29333	M29334
10.0	1.87	0.47	1.88	1.88	1.86
50.0	15.28	0.26	15.27	15.33	15.23
90.0	41.87	0.07	41.85	41.9	41.84
99.0	70.38	0.21	70.19	70.55	70.41

µm	mean % <	CV [%]	M29332	M29333	M29334
1.00	3.9	0.58	3.89	3.91	3.94
10.00	36.2	0.29	36.15	36.06	36.32
20.00	61.0	0.13	61.03	60.89	61.08
45.00	91.9	0.02	91.93	91.9	91.94
75.00	99.4	0.02	99.42	99.38	99.4
100.00	100.0	0.01	100	99.98	100



M 32 45 (Feldspa mel) **110012**

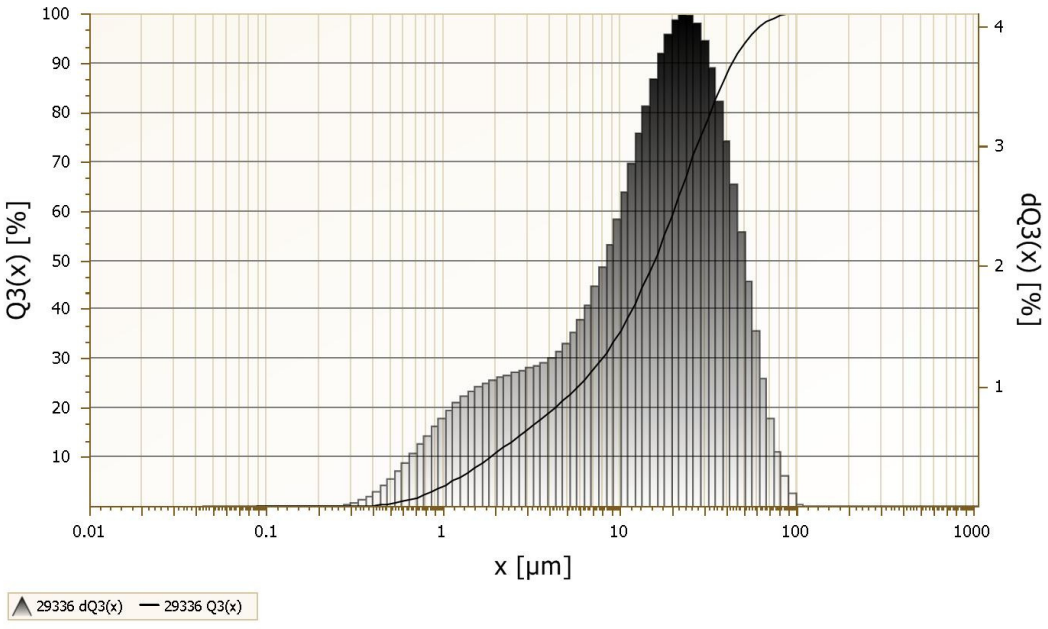
ANALYSETTE 22 MicroTec plus

Meas.Nr.	29336	**Date**	Donnerstag, 03 März 2011 04:16	**Personal Report No.:**
Material	M 32 60		(Feldspa mel)	**110012**
Description	in water + 0,1% Na4P2O7, 30s ultrasonic			

Calculation	Fraunhofer		very_broad			**TradeOff**	1.000000e+004
Scans Fine	100	**Scans Coarse**	100	**Channels**	102	**Beam Obscuration**	14.00 %
Meas. Range	0.08 [µm]	-	2000.00 [µm]	**Pump**	7	**Ultrasonics**	10

%	< µm
5	1.14
10	**1.87**
15	2.89
20	4.32
25	6.07
30	7.95
40	11.81
50	**15.82**
60	20.27
70	25.57
80	32.55
90	**43.60**
95	53.57
98	65.28
99	73.00

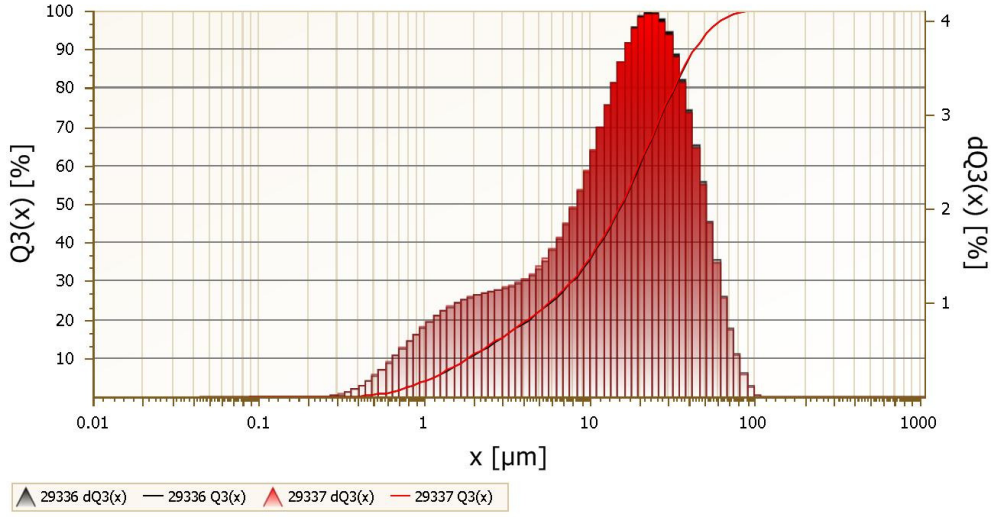
< µm	%
1.0	4.0
10.0	35.3
20.0	59.4
45.0	90.9
75.0	99.2
100.0	100.0



ANALYSETTE 22 MicroTec plus

% <	mean µm	CV [%]	M29336	M29337
10.0	1.86	0.48	1.87	1.86
50.0	15.73	0.60	15.82	15.63
90.0	43.48	0.28	43.6	43.36
99.0	72.88	0.17	73	72.76

µm	mean % <	CV [%]	M29336	M29337
1.00	4.0	0.75	3.95	4.01
10.00	35.5	0.58	35.33	35.75
20.00	59.7	0.35	59.45	59.87
45.00	91.0	0.08	90.89	91.04
75.00	99.2	0.01	99.19	99.22
100.00	100.0	0.00	99.98	99.99



M 32 60 (Feldspa mel) **110012**

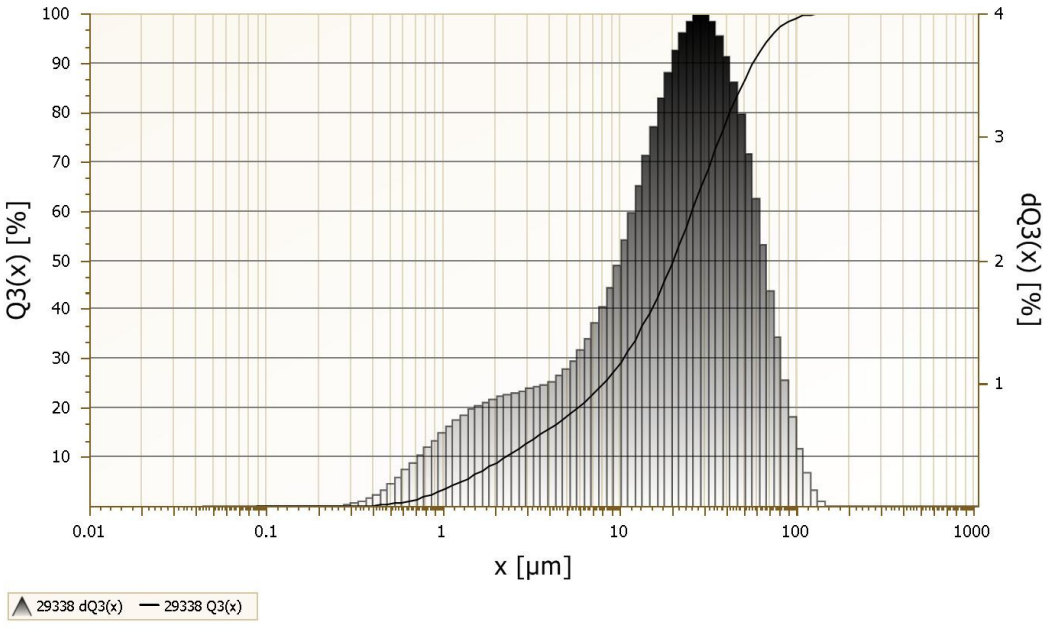
ANALYSETTE 22 MicroTec plus

Meas.Nr.	29338	**Date**	Donnerstag, 03 März 2011 04:31	**Personal Report No.:**
Material	M 32 125		(Feldspa mel)	**110012**
Description	in water + 0,1% Na4P2O7, 30s ultrasonic			

Calculation	Fraunhofer		very_broad			**TradeOff**	1.000000e+004
Scans Fine	100	**Scans Coarse**	100	**Channels**	102	**Beam Obscuration**	15.00 %
Meas. Range	0.08 [µm]	-	2000.00 [µm]	**Pump**	7	**Ultrasonics**	10

%	< µm
5	1.29
10	**2.28**
15	3.77
20	5.83
25	8.14
30	10.49
40	15.19
50	**20.16**
60	25.82
70	32.76
80	42.06
90	**56.96**
95	70.77
98	87.20
99	98.01

< µm	%
1.0	3.2
10.0	29.0
20.0	49.7
45.0	82.4
75.0	96.1
100.0	99.1



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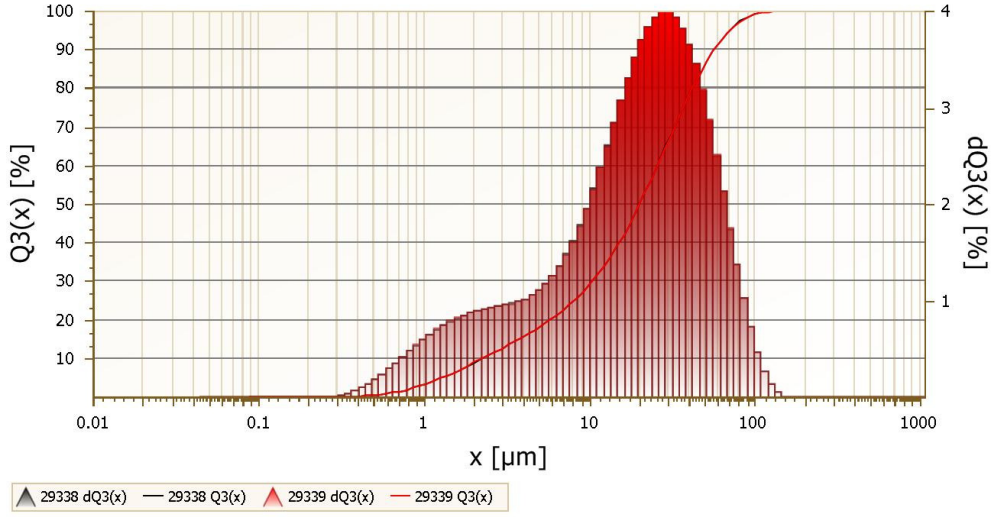
ANALYSETTE 22 MicroTec plus

% <	mean µm	CV [%]	M29338	M29339
10.0	2.28	0.17	2.28	2.27
50.0	20.18	0.12	20.16	20.21
90.0	57.03	0.13	56.96	57.11
99.0	98.28	0.28	98.01	98.56

µm	mean % <	CV [%]	M29338	M29339
1.00	3.2	0.08	3.2	3.19
10.00	28.9	0.10	28.96	28.9
20.00	49.7	0.09	49.7	49.61
45.00	82.4	0.05	82.43	82.34
75.00	96.0	0.03	96.06	96.01
100.00	99.1	0.02	99.13	99.09



M 32 125 (Feldspa mel) **110012**

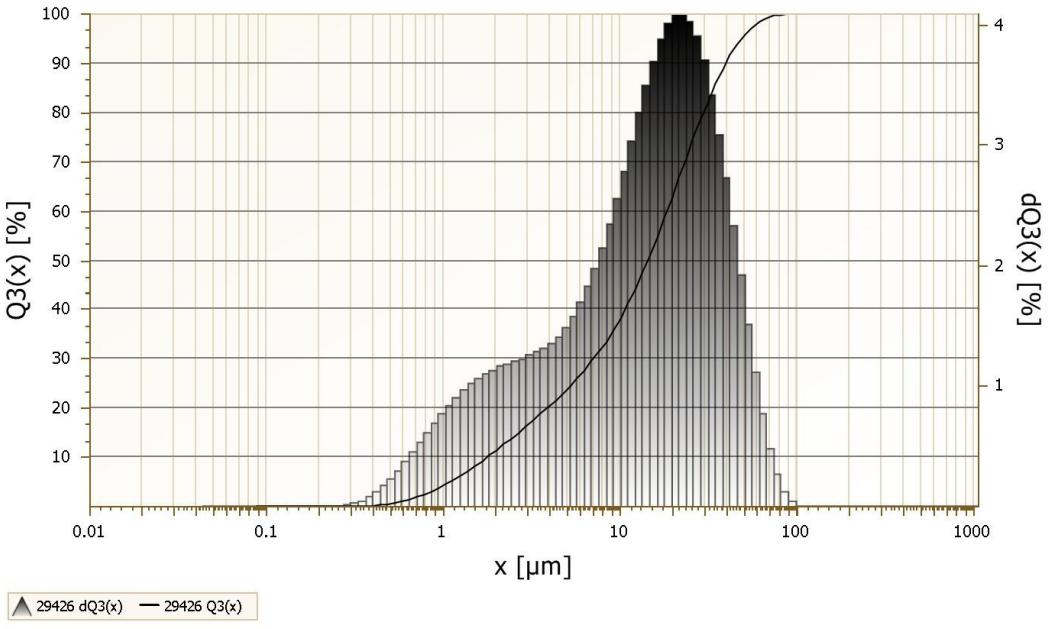
ANALYSETTE 22 MicroTec plus

Meas.Nr.	29426	**Date**	Freitag, 04 März 2011 08:01	**Personal Report No.:**
Material	NQ 45 P.NR. 5868		(Feldspa mel)	**110012**
Description	in water + 0,1% Na4P2O7, 30s ultrasonic			

Calculation	Fraunhofer		very_broad			**TradeOff**	1.000000e+004
Scans Fine	100	**Scans Coarse**	100	**Channels**	102	**Beam Obscuration**	16.00 %
Meas. Range	0.08 [µm]	-	2000.00 [µm]	**Pump**	7	**Ultrasonics**	10

%	< µm
5	1.12
10	**1.80**
15	2.70
20	3.93
25	5.48
30	7.19
40	10.76
50	**14.50**
60	18.64
70	23.53
80	29.97
90	**40.11**
95	49.28
98	60.03
99	67.09

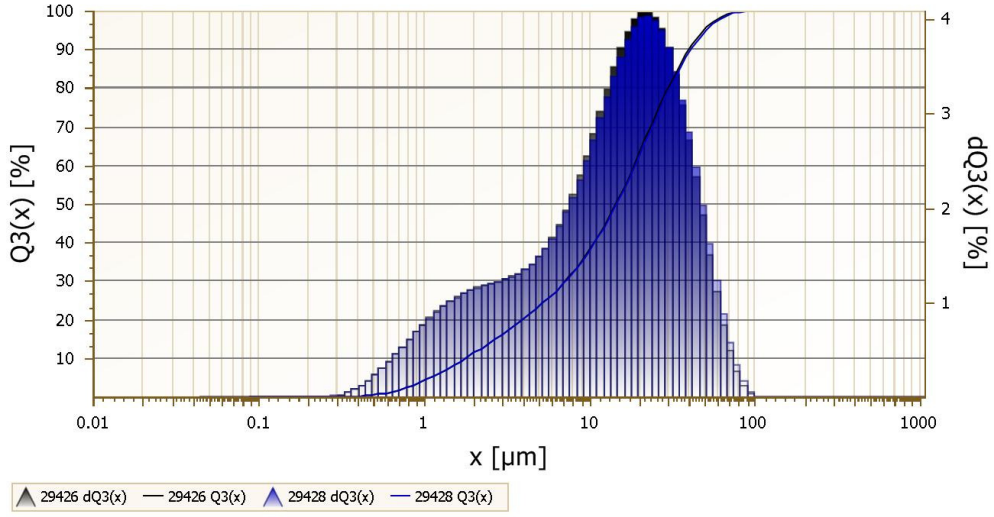
< µm	%
1.0	4.1
10.0	37.9
20.0	63.0
45.0	93.0
75.0	99.6
100.0	100.0



ANALYSETTE 22 MicroTec plus

% <	mean µm	CV [%]	M29426	M29428
10.0	1.80	0.01	1.8	1.8
50.0	14.60	0.66	14.5	14.69
90.0	40.69	1.42	40.11	41.27
99.0	68.28	1.75	67.09	69.48

µm	mean % <	CV [%]	M29426	M29428
1.00	4.1	0.33	4.06	4.08
10.00	37.8	0.26	37.9	37.71
20.00	62.6	0.62	63.01	62.23
45.00	92.7	0.40	93.03	92.3
75.00	99.5	0.06	99.58	99.46
100.00	100.0	0.01	99.99	100



NQ 45 P.NR. 5868 (Feldspa mel) **110012**