

Report No.: 18562
Date: 26.10.2017
Contact: MB

Task:

Application field: Medicine / Pharmaceuticals

Material: **Hemp Flower**

Feed size: up to 300 mm
 After manually pre-cutting: approx. 30 - 60 mm

Feed quantity: Procedure 1;
 Pre-cutting in SM 400 XL with 6 mm sieve: 2,5 kg
 Fine-grinding in SR 300: 1 - 2 handful of material

Procedure 2;
 Pre-cutting in SM 400 XL with 20 mm sieve: 3,7 kg
 Fine-grinding in SM 300: 1,2 kg each test (details see remarks)

Material specification(s): dry, fibrous

Customer requirements(s): 850 - 1000 µm, not more than 6 % < 600 µm, We need to grind 100kg/hour.
 Original feed size according to the questionnaire: 30 mm

Subsequent analysis: This equipment will be used for the trituration of Hemp Flower which will be used as raw material for the manufacturing of a pharmaceutical or nutraceutical product. The purpose of the grinder is to grind the hemp flowers in order to put them in the SFE system (supercritical Fluid Extracction)

Solution

Selected Instrument(s): Cutting Mill SM 400 XL
 Cutting Mill SM 300
 Rotor Beater Mill SR 300

Configuration(s) Item nos.:

1 x Cutting Mill SM 400 XL, 3x400V/50Hz , with collecting receptacle 5 litres, rotor , universal hopper, base frame , and knife set of hardened steel , (please order bottom sieve seperately)	210100001
1 x Bottorm Sieve 4 mm round holes, for SM 400 XL, of steel 1.0037	036470402
1 x Bottorm Sieve 20 mm round holes, for SM 400 XL, of steel 1.0037	036470406
<hr/>	
1 x SM 300, 220-230 V, 50/60 Hz, cutting bars stainless steel	207290002
1 x V-rotor for SM 300 stainless steel	226080034
1 x Universal hopper with plastic plunger, for SM 200 / SM 300	227850001

The application report is based solely on the processing of the available sample material in the indicated amount. No legal claims shall be derived from this test report.

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1 x Bottom sieve, trapezoid holes, 1.5 mm, stainless steel	036470316
1 x Bottom sieve, square holes, 4 mm, stainless steel	036470320
1 x Cyclone unit incl. 1 sample bottle 500 ml (to be used with industrial vacuum cleaner)	220200004
1 x Collecting receptacle 5 l with adapterlid, stainless steel	220030014
1 x Industrial vacuum cleaner, 230 V, 50/60 Hz	227480005

Parameter(s): SM 400 XL: Revolution speed 280 rpm (fix)
 SM 300: Revolution speed 700 - 3000 rpm
 SR 300: Revolution speed 3000 - 10000 rpm

Time: Details see "Remarks"

Achieved result(s): See Camsizer-reports.
 Always a high percentage of fine particles is noticeable and cannot be avoided due to the brittle material properties.
 Also a large quantity of particles > 1 mm can be found (coming from the stem and seeds).
 After testing the SR 300 and the SM 300 for fine grinding the SM 300 seems to achieve the best results.
 Evaluation by the customer!

Fine-grinding in the Rotor Beater Mill SR 300:
 With the 2 mm sieve (reverse inserted) and 3000 rpm:
 37 % are < 600 µm; 50,3 % < 850 µm but only 57,5 % < 1000 µm

Fine-grinding in Cutting Mill SM 300:
 With 1,5 mm sieve and 700 rpm:
 19,2 % are < 600 µm; 30,4 % < 850 µm but only 37,8 % < 1000 µm

With 4 mm sieve and 3000 rpm:
 17,8 % are < 600 µm; 26,8 % < 850 µm but only 32,8 % < 1000 µm

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Remark(s):

First pre-cutting tests of the 30 cm sample pieces with the Cutting Mill SM 300 and SM 400 XL resulted in clogging the hoppers. Bridge building due to the fibrous structure.

Manually pre-cutting the sample down to approx. < 60 mm (according to the questionnaire the original feed size is only 30 mm) with a pair of scissors.

Procedure 1:

Pre-cutting with the SM 400 XL + 6 mm bottom sieve as a preparation step for fine-grinding in the Rotor Beater Mill SR 300.

Sample has been fed slowly in order to minimize the risk of clogging the hopper.

Also the grinding chamber should not be overfilled.

2,5 kg of sample have been pre-cut in approx. 5 min. (--> approx. 3:20 h for 100 kg)

Minimum three SM 400 would be needed to grind 100 kg/h.

Simultaneously the fine-grinding has to be carried out with the first kilos of pre-cut sample.

Fine-grinding tests in the Rotor Beater Mill SR 300 with different sieve sizes and speeds + cyclone-vacuum-cleaner-combination.

Always the percentage of fine and/or big particles was much too high.

The best result (lowest percentage of fine particles without too many big particles) could be achieved with the 2 mm sieve, reverse inserted and the minimum speed of 3000 rpm.

Still 37 % are < 600 µm; 50,3 % < 850 µm but only 57,5 % < 1000 µm

Using the Cutting Mill SM 300 (= "procedure 2") the fine particle could be reduced.

Procedure 2:

Pre-cutting with the SM 400 XL + 20 mm bottom sieve as a preparation step for fine-grinding in the Cutting Mill SM 300.

Sample can be fed much faster compared to procedure 1.

3,7 kg of sample have been ground in approx. 2 min.

100 kg could get pre-cut in approx. 54 min. Therefore only one machine is needed for pre-cutting.

Simultaneously the fine-grinding has to be carried out with the first kilos of pre-cut sample.

Fine-grinding in the Cutting Mill SM 300 with different sieves and speeds + cyclone-vacuum-cleaner-combination + V-rotor.

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The best results with a low percentage of fine particles < 600 µm and not too many big particles could be achieved with the 1,5 mm bottom sieve (correctly inserted) and the minimum speed of 700 rpm and the 4 mm bottom sieve with the maximum speed of 3000 rpm.

With 1,5 mm sieve and 700 rpm:
1,2 kg of pre-cut sample could be ground in approx. 2 min.
That means that 1x SM 300 could grind approx. 36 kg/h (= 3x SM 300 are needed).

19,2 % are < 600 µm; 30,4 % < 850 µm but only 37,8 % < 1000 µm

With 4 mm sieve and 3000 rpm:
1,2 kg of pre-cut sample could be ground in approx. 50 s
That means that 1x SM 300 could grind approx. 72 kg/h (= 2x SM 300 are needed).
17,8 % are < 600 µm; 26,8 % < 850 µm but only 32,8 % < 1000 µm

Using the cyclone is recommended in order to avoid dust and to reduce the grinding time and heat.
Grinding without cyclone the risk of clogging the hopper, heat and dust are increased.
The maximum container volume working with the cyclone is currently 5 l, though.

Pre-cutting in SM 400 with the 20 mm bottom sieve and fine-grinding in the Cutting Mill SM 300 with the 4 mm bottom sieve seems to be the best option.

We cannot make any statement about grinding and throughput of the original customer sample (due to breaking properties, moisture content, feed size, industrial hemp (our sample) vs. active ingredient-containing cannabis (customers sample),....)

Recommendation: The Cutting Mill SM 400 for pre-cutting and the SM 300 for fine-grinding are suitable to grind the sample material under the above mentioned conditions.

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Pictures of the sample:



Picture 1: Industrial hemp (30 cm)



Picture 2: Industrial hemp after manually pre-cutting (approx. < 60 mm)



Picture 3: Industrial hemp after pre-cutting in SM 400; 6 mm sieve



Picture 4: Industrial hemp after pre-cutting in SM 400; 20 mm sieve

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Subject to technical modification and errors.

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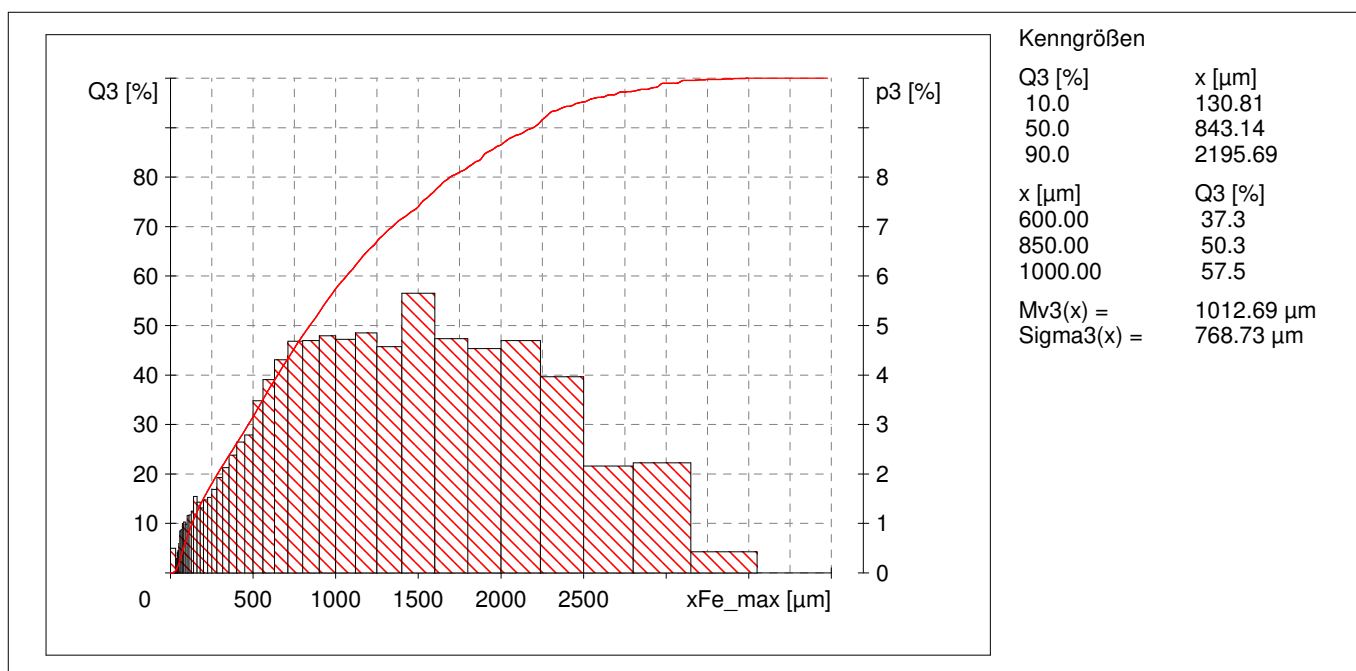


Picture 5: Industrial hemp after fine-grinding in SM 300

SR300_2mm_reverse_standard rotor_3000rpm

Firma:	
Benutzer:	SBR
Ergebnisdatei:	D:\...\CAMDAT\Hemp flower\SR300_2mm_reverse_standard rotor_3000rpm_xFemax_009.rdf
Messaufgabe:	C:\CamsizerX2_6.8.14\CAMSYS\R18562.afg
Zeit:	27-10-2017, 11:17, Dauer 3 min 22 s bei 0.1 % Flächendichte , Bildrate 1:1, mit X-Jet, Spaltbreite = 4.0 mm, dispersion pressure = 50.0 kPa
Größendefinition:	xFe_max
Formeinstellungen:	eckige Partikel
Partikelanzahl:	CCD-B = 2387518 , CCD-Z = 118806
Geschwindigkeitsanpassung:	Hemp flower.ftv
Anpassung:	nein
Material:	

Größenklasse	[µm]	p3 [%]	Q3 [%]	Größenklasse	[µm]	p3 [%]	Q3 [%]
0.00	31.50	0.50	0.50	355.00	400.00	2.37	26.15
31.50	35.50	0.21	0.71	400.00	450.00	2.65	28.80
35.50	40.00	0.29	1.00	450.00	500.00	2.79	31.59
40.00	45.00	0.41	1.41	500.00	560.00	3.48	35.07
45.00	50.00	0.45	1.86	560.00	630.00	3.91	38.98
50.00	56.00	0.59	2.45	630.00	710.00	4.30	43.28
56.00	63.00	0.85	3.30	710.00	800.00	4.69	47.97
63.00	71.00	0.87	4.17	800.00	900.00	4.70	52.67
71.00	80.00	0.99	5.16	900.00	1000.00	4.79	57.46
80.00	90.00	1.04	6.20	1000.00	1120.00	4.72	62.18
90.00	100.00	0.98	7.18	1120.00	1250.00	4.85	67.03
100.00	112.00	1.15	8.33	1250.00	1400.00	4.57	71.60
112.00	125.00	1.17	9.50	1400.00	1600.00	5.66	77.26
125.00	140.00	1.25	10.75	1600.00	1800.00	4.73	81.99
140.00	160.00	1.55	12.30	1800.00	2000.00	4.53	86.52
160.00	180.00	1.43	13.73	2000.00	2240.00	4.70	91.22
180.00	200.00	1.31	15.04	2240.00	2500.00	3.97	95.19
200.00	224.00	1.47	16.51	2500.00	2800.00	2.16	97.35
224.00	250.00	1.53	18.04	2800.00	3150.00	2.22	99.57
250.00	280.00	1.68	19.72	3150.00	3550.00	0.43	100.00
280.00	315.00	1.93	21.65	3550.00	4000.00	0.00	100.00
315.00	355.00	2.13	23.78	> 4000.00		0.00	100.00



Ergebnisdatei: D:\...r\CAMDAT\Hemp flower\SR300_2mm_reverse_standard rotor_3000rpm_xFemax_009.rdf
Messaufgabe: C:\CamsizerX2_6.8.14\CAMSYS\R18562.afg

Benutzer

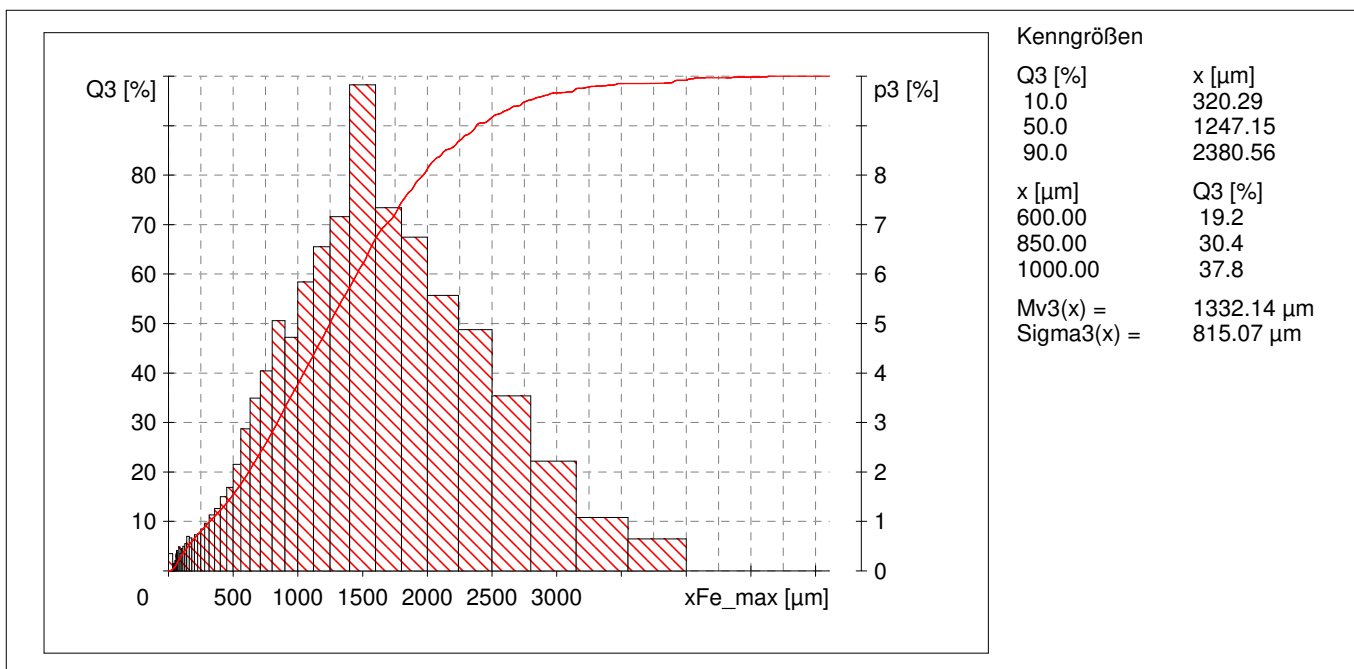
SM300_1.5mm_correct_V-rotor_700rpm

Firma:
 Benutzer: SBR
 Ergebnisdatei: D:\...-Ploer\CAMDAT\Hemp flower\SM300_1.5mm_correct_V-rotor_700rpm_xFemax_011.rdf
 Messaufgabe: C:\CamsizerX2_6.8.14\CAMSYS\R18562.afg
 Zeit: 27-10-2017, 11:51, Dauer 1 min 38 s bei 0.1 % Flächendichte , Bildrate 1:1, mit X-Jet, Spaltbreite = 4.0 mm, dispersion pressure = 50.0 kPa

Größendefinition: xFe_max
 Formeinstellungen: eckige Partikel
 Partikelanzahl: CCD-B = 984710 , CCD-Z = 62800
 Geschwindigkeitsanpassung: Hemp flower.ftv
 Anpassung: nein

Material:

Größenklasse	[µm]	p3 [%]	Q3 [%]	Größenklasse	[µm]	p3 [%]	Q3 [%]
0.00	31.50	0.35	0.35	355.00	400.00	1.26	12.25
31.50	35.50	0.09	0.44	400.00	450.00	1.50	13.75
35.50	40.00	0.14	0.58	450.00	500.00	1.68	15.43
40.00	45.00	0.16	0.74	500.00	560.00	2.16	17.59
45.00	50.00	0.14	0.88	560.00	630.00	2.87	20.46
50.00	56.00	0.20	1.08	630.00	710.00	3.49	23.95
56.00	63.00	0.34	1.42	710.00	800.00	4.04	27.99
63.00	71.00	0.42	1.84	800.00	900.00	5.06	33.05
71.00	80.00	0.38	2.22	900.00	1000.00	4.72	37.77
80.00	90.00	0.49	2.71	1000.00	1120.00	5.84	43.61
90.00	100.00	0.35	3.06	1120.00	1250.00	6.55	50.16
100.00	112.00	0.46	3.52	1250.00	1400.00	7.16	57.32
112.00	125.00	0.50	4.02	1400.00	1600.00	9.82	67.14
125.00	140.00	0.55	4.57	1600.00	1800.00	7.35	74.49
140.00	160.00	0.70	5.27	1800.00	2000.00	6.75	81.24
160.00	180.00	0.66	5.93	2000.00	2240.00	5.57	86.81
180.00	200.00	0.63	6.56	2240.00	2500.00	4.87	91.68
200.00	224.00	0.73	7.29	2500.00	2800.00	3.54	95.22
224.00	250.00	0.75	8.04	2800.00	3150.00	2.22	97.44
250.00	280.00	0.85	8.89	3150.00	3550.00	1.08	98.52
280.00	315.00	0.97	9.86	3550.00	4000.00	0.65	99.17
315.00	355.00	1.13	10.99	> 4000.00		0.83	100.00



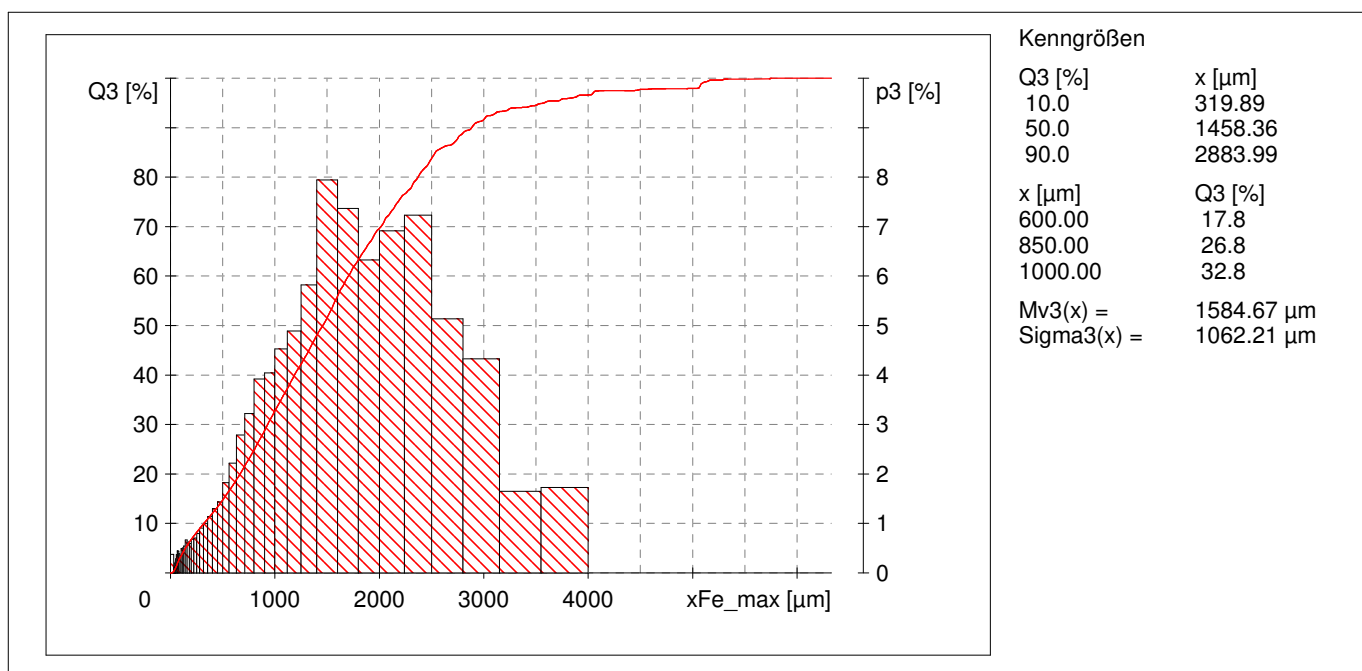
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Messaufgabe: C:\CamsizerX2_6.8.14\CAMSYS\R18562.afg

Benutzer

SM300_4mm_square_reverse_V-rotor_3000rpm

Firma:	
Benutzer:	SBR
Ergebnisdatei:	D:\...\CAMDAT\Hemp flower\SM300_4mm_square_reverse_V-rotor_3000rpm_xFemax_004.rdf
Messaufgabe:	C:\CamsizerX2_6.8.14\CAMSYS\R18562.afg
Zeit:	25-10-2017, 16:54, Dauer 2 min 38 s bei 0.1 % Flächendichte , Bildrate 1:1, mit X-Jet, Spaltbreite = 4.0 mm, dispersion pressure = 50.0 kPa
Größendefinition:	xFe_max
Formeinstellungen:	eckige Partikel
Partikelanzahl:	CCD-B = 1772685 , CCD-Z = 83621
Geschwindigkeitsanpassung:	Hemp flower.ftv
Anpassung:	nein
Material:	

Größenklasse	[µm]	p3 [%]	Q3 [%]	Größenklasse	[µm]	p3 [%]	Q3 [%]
0.00	31.50	0.38	0.38	355.00	400.00	1.13	12.01
31.50	35.50	0.12	0.50	400.00	450.00	1.30	13.31
35.50	40.00	0.15	0.65	450.00	500.00	1.44	14.75
40.00	45.00	0.20	0.85	500.00	560.00	1.82	16.57
45.00	50.00	0.23	1.08	560.00	630.00	2.22	18.79
50.00	56.00	0.29	1.37	630.00	710.00	2.79	21.58
56.00	63.00	0.36	1.73	710.00	800.00	3.23	24.81
63.00	71.00	0.45	2.18	800.00	900.00	3.91	28.72
71.00	80.00	0.44	2.62	900.00	1000.00	4.04	32.76
80.00	90.00	0.39	3.01	1000.00	1120.00	4.53	37.29
90.00	100.00	0.36	3.37	1120.00	1250.00	4.89	42.18
100.00	112.00	0.49	3.86	1250.00	1400.00	5.82	48.00
112.00	125.00	0.50	4.36	1400.00	1600.00	7.94	55.94
125.00	140.00	0.55	4.91	1600.00	1800.00	7.37	63.31
140.00	160.00	0.67	5.58	1800.00	2000.00	6.33	69.64
160.00	180.00	0.62	6.20	2000.00	2240.00	6.91	76.55
180.00	200.00	0.60	6.80	2240.00	2500.00	7.23	83.78
200.00	224.00	0.68	7.48	2500.00	2800.00	5.13	88.91
224.00	250.00	0.70	8.18	2800.00	3150.00	4.33	93.24
250.00	280.00	0.79	8.97	3150.00	3550.00	1.65	94.89
280.00	315.00	0.91	9.88	3550.00	4000.00	1.72	96.61
315.00	355.00	1.00	10.88	> 4000.00		3.39	100.00



Ergebnisdatei: D:\...\CAMDAT\Hemp flower\SM300_4mm_square_reverse_V-rotor_3000rpm_xFemax_004.rdf
Messaufgabe: C:\CamsizerX2_6.8.14\CAMSYS\R18562.afg

Benutzer