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APPENDICES

APPENDIX A

Experimental Data

Table 1A The percentage of encapsulation efficiency of doxycycline loaded chitosan microspheres

Formulation	% encapsulation			Mean	SD
	n1	n2	n3		
1	1.96	2.19	2.10	2.08	0.11
2	2.93	2.82	3.42	3.06	0.32
3	4.92	4.83	4.94	4.90	0.06
4	1.11	1.48	1.61	1.40	0.26
5	6.61	6.31	6.62	6.51	0.18
6	27.54	28.06	28.48	28.03	0.47
7	43.16	42.96	41.20	42.44	1.08
8	111.45	108.42	95.45	105.11	8.50
9	1.22	1.88	1.66	1.58	0.34
10	45.82	45.00	46.73	45.85	0.86
11	38.08	37.85	37.81	37.91	0.15
12	6.73	6.14	6.02	6.29	0.38
13	11.08	12.04	10.56	11.23	0.75
14	6.44	6.09	6.47	6.33	0.21
15	82.98	82.73	80.21	81.97	1.53
16	5.23	4.77	4.68	4.90	0.29

Figure 1A Size and size distribution of formulation 1

Result Statistics

Distribution Type: Volume	Concentration = 0.0084 %Vol	Density = 1.000 g / cub. cm	Specific S.A. = 30.2141 sq. m / g
Mean Diameters:	D (v, 0.1) = 0.06 um	D (v, 0.5) = 13.84 um	D (v, 0.9) = 49.35 um
D [4, 3] = 19.52 um	D [3, 2] = 0.20 um	Span = 3.560E+00	Uniformity = 1.236E+00

Size_Low (um)	In %	Size_High (um)	Under%	Size_Low (um)	In %	Size_High (um)	Under%
0.05	6.17	0.06	6.18	6.63	1.55	7.72	42.27
0.06	9.07	0.07	15.24	7.72	1.72	9.00	43.99
0.07	8.66	0.08	23.90	9.00	1.90	10.48	45.90
0.08	6.17	0.09	30.07	10.48	2.13	12.21	48.02
0.09	3.36	0.11	33.42	12.21	2.44	14.22	50.46
0.11	1.42	0.13	34.84	14.22	2.87	16.57	53.33
0.13	0.48	0.15	35.32	16.57	3.43	19.31	56.76
0.15	0.13	0.17	35.45	19.31	4.11	22.49	60.86
0.17	0.03	0.20	35.48	22.49	4.86	26.20	65.72
0.20	0.01	0.23	35.49	26.20	5.63	30.53	71.35
0.23	0.00	0.27	35.49	30.53	6.32	35.56	77.67
0.27	0.00	0.31	35.49	35.56	6.18	41.43	83.86
0.31	0.00	0.36	35.49	41.43	5.44	48.27	89.30
0.36	0.00	0.42	35.49	48.27	4.31	56.23	93.61
0.42	0.00	0.49	35.49	56.23	3.05	65.51	96.67
0.49	0.00	0.58	35.49	65.51	1.91	76.32	98.57
0.58	0.00	0.67	35.49	76.32	1.02	88.91	99.59
0.67	0.00	0.78	35.49	88.91	0.41	103.58	100.00
0.78	0.00	0.91	35.49	103.58	0.00	120.67	100.00
0.91	0.00	1.06	35.50	120.67	0.00	140.58	100.00
1.06	0.01	1.24	35.50	140.58	0.00	163.77	100.00
1.24	0.02	1.44	35.52	163.77	0.00	190.80	100.00
1.44	0.03	1.68	35.55	190.80	0.00	222.28	100.00
1.68	0.07	1.95	35.62	222.28	0.00	258.95	100.00
1.95	0.12	2.28	35.75	258.95	0.00	301.68	100.00
2.28	0.20	2.65	35.94	301.68	0.00	351.46	100.00
2.65	0.31	3.09	36.26	351.46	0.00	409.45	100.00
3.09	0.46	3.60	36.72	409.45	0.00	477.01	100.00
3.60	0.65	4.19	37.37	477.01	0.00	555.71	100.00
4.19	0.88	4.88	38.25	555.71	0.00	647.41	100.00
4.88	1.12	5.69	39.37	647.41	0.00	754.23	100.00
5.69	1.35	6.63	40.73	754.23	0.00	878.67	100.00

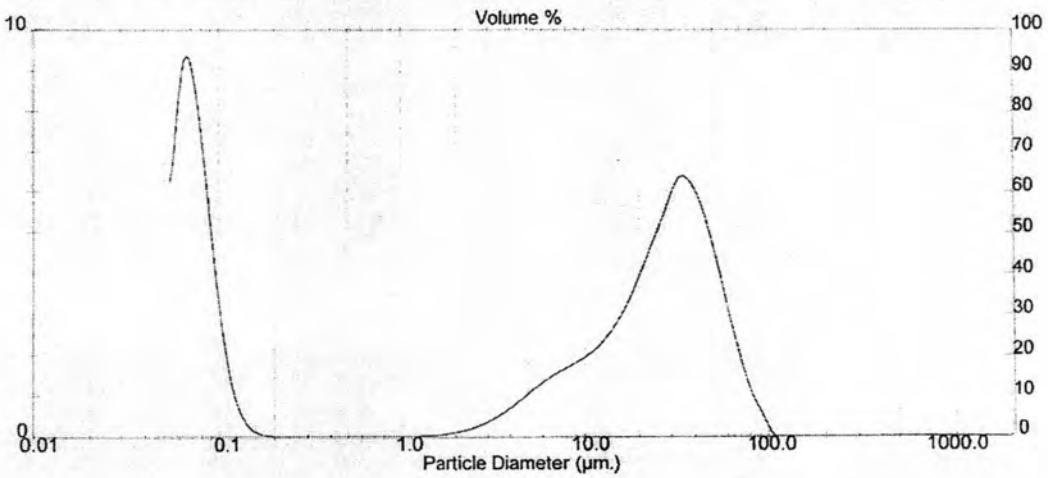


Figure 2A Size and size distribution of formulation 2

Result Statistics

Distribution Type: Volume
Mean Diameters:
D [4, 3] = 23.09 um

Concentration = 0.0101 %Vol
D (v, 0.1) = 0.06 um
D [3, 2] = 0.20 um

Density = 1.000 g / cub. cm
D (v, 0.5) = 18.46 um
Span = 3.312E+00

Specific S.A. = 29.9483 sq. m / g
D (v, 0.9) = 54.57 um
Uniformity = 1.219E+00

Size_Low (um)	In %	Size_High (um)	Under%
0.05	6.87	0.06	6.87
0.06	9.45	0.07	16.32
0.07	8.39	0.08	24.70
0.08	5.50	0.09	30.21
0.09	2.72	0.11	32.93
0.11	1.02	0.13	33.95
0.13	0.30	0.15	34.25
0.15	0.07	0.17	34.32
0.17	0.01	0.20	34.34
0.20	0.00	0.23	34.34
0.23	0.00	0.27	34.34
0.27	0.00	0.31	34.34
0.31	0.00	0.36	34.34
0.36	0.00	0.42	34.34
0.42	0.00	0.49	34.34
0.49	0.00	0.58	34.34
0.58	0.00	0.67	34.34
0.67	0.00	0.78	34.34
0.78	0.00	0.91	34.34
0.91	0.00	1.06	34.34
1.06	0.01	1.24	34.35
1.24	0.01	1.44	34.36
1.44	0.03	1.68	34.39
1.68	0.06	1.95	34.45
1.95	0.11	2.28	34.56
2.28	0.17	2.65	34.73
2.65	0.27	3.09	35.00
3.09	0.40	3.60	35.41
3.60	0.56	4.19	35.97
4.19	0.75	4.88	36.72
4.88	0.96	5.69	37.68
5.69	1.15	6.63	38.83
6.63	1.32	7.72	40.15
7.72	1.48	9.00	41.64
9.00	1.66	10.48	43.30
10.48	1.90	12.21	45.20
12.21	2.23	14.22	47.44
14.22	2.69	16.57	50.13
16.57	3.29	19.31	53.42
19.31	4.01	22.49	57.43
22.49	4.78	26.20	62.21
26.20	5.50	30.53	67.71
30.53	6.07	35.56	73.78
35.56	6.44	41.43	80.22
41.43	5.83	48.27	86.05
48.27	4.80	56.23	90.85
56.23	3.57	65.51	94.42
65.51	2.39	76.32	96.82
76.32	1.41	88.91	98.23
88.91	0.69	103.58	98.92
103.58	0.25	120.67	99.17
120.67	0.05	140.58	99.22
140.58	0.04	163.77	99.26
163.77	0.13	190.80	99.39
190.80	0.20	222.28	99.59
222.28	0.20	258.95	99.79
258.95	0.14	301.68	99.93
301.68	0.06	351.46	99.99
351.46	0.01	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

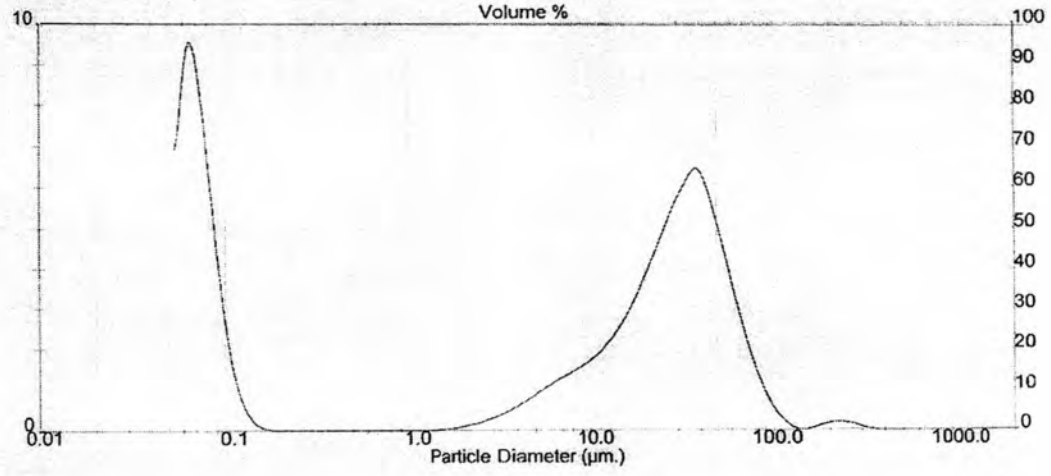


Figure 3A Size and size distribution of formulation 3

Result Statistics

Distribution Type: Volume	Concentration = 0.0096 %Vol	Density = 1.000 g / cub. cm	Specific S.A. = 27.2382 sq. m / g
Mean Diameters:	D (v, 0.1) = 0.06 um	D (v, 0.5) = 17.38 um	D (v, 0.9) = 71.90 um
D [4, 3] = 28.11 um	D [3, 2] = 0.22 um	Span = 4.133E+00	Uniformity = 1.415E+00

Size_Low (um)	In %	Size_High (um)	Under%
0.05	5.50	0.06	5.50
0.06	7.96	0.07	13.45
0.07	7.64	0.08	21.09
0.08	5.62	0.09	26.71
0.09	3.26	0.11	29.97
0.11	1.52	0.13	31.49
0.13	0.58	0.15	32.07
0.15	0.19	0.17	32.26
0.17	0.06	0.20	32.32
0.20	0.01	0.23	32.33
0.23	0.00	0.27	32.34
0.27	0.00	0.31	32.34
0.31	0.00	0.36	32.34
0.36	0.00	0.42	32.34
0.42	0.00	0.49	32.34
0.49	0.00	0.58	32.34
0.58	0.00	0.67	32.34
0.67	0.00	0.78	32.34
0.78	0.00	0.91	32.34
0.91	0.01	1.06	32.35
1.06	0.02	1.24	32.37
1.24	0.03	1.44	32.40
1.44	0.05	1.68	32.45
1.68	0.08	1.95	32.53
1.95	0.12	2.28	32.65
2.28	0.19	2.65	32.84
2.65	0.28	3.09	33.12
3.09	0.40	3.60	33.52
3.60	0.56	4.19	34.08
4.19	0.77	4.88	34.85
4.88	1.00	5.69	35.84
5.69	1.25	6.63	37.09
6.63	1.48	7.72	38.57
7.72	1.70	9.00	40.27
9.00	1.90	10.48	42.16
10.48	2.10	12.21	44.26
12.21	2.31	14.22	46.57
14.22	2.56	16.57	49.14
16.57	2.87	19.31	52.01
19.31	3.25	22.49	55.25
22.49	3.67	26.20	58.92
26.20	4.12	30.53	63.05
30.53	4.55	35.56	67.60
35.56	4.93	41.43	72.53
41.43	5.25	48.27	77.78
48.27	5.10	56.23	82.88
56.23	4.63	65.51	87.51
65.51	3.93	76.32	91.44
76.32	3.09	88.91	94.53
88.91	2.23	103.58	96.75
103.58	1.45	120.67	98.21
120.67	0.84	140.58	99.05
140.58	0.43	163.77	99.48
163.77	0.19	190.80	99.67
190.80	0.09	222.28	99.75
222.28	0.09	258.95	99.84
258.95	0.08	301.68	99.92
301.68	0.06	351.46	99.98
351.46	0.02	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

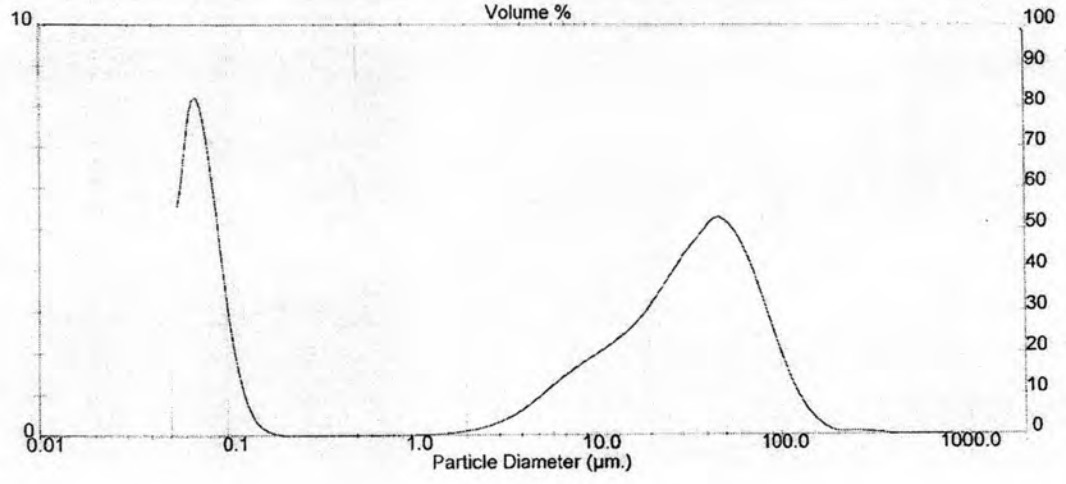


Figure 4A Size and size distribution of formulation 4

Result Statistics

Distribution Type: Volume	Concentration = 0.0092 %Vol	Density = 1.000 g / cub. cm	Specific S.A. = 24.9771 sq. m / g
Mean Diameters:	D (v, 0.1) = 0.07 um	D (v, 0.5) = 22.90 um	D (v, 0.9) = 74.78 um
D [4, 3] = 32.25 um	D [3, 2] = 0.24 um	Span = 3.263E+00	Uniformity = 1.184E+00

Size_Low (um)	In %	Size_High (um)	Under%	Size_Low (um)	In %	Size_High (um)	Under%
0.05	4.87	0.06	4.87	6.63	1.27	7.72	34.99
0.06	7.31	0.07	12.18	7.72	1.44	9.00	36.42
0.07	7.19	0.08	19.37	9.00	1.59	10.48	38.01
0.08	5.31	0.09	24.68	10.48	1.75	12.21	39.76
0.09	3.01	0.11	27.69	12.21	1.94	14.22	41.70
0.11	1.32	0.13	29.01	14.22	2.21	16.57	43.92
0.13	0.45	0.15	29.46	16.57	2.59	19.31	46.51
0.15	0.13	0.17	29.59	19.31	3.09	22.49	49.60
0.17	0.03	0.20	29.62	22.49	3.70	26.20	53.30
0.20	0.01	0.23	29.62	26.20	4.39	30.53	57.69
0.23	0.00	0.27	29.62	30.53	5.09	35.56	62.78
0.27	0.00	0.31	29.62	35.56	5.72	41.43	68.50
0.31	0.00	0.36	29.62	41.43	6.23	48.27	74.73
0.36	0.00	0.42	29.62	48.27	6.01	56.23	80.74
0.42	0.00	0.49	29.62	56.23	5.36	65.51	86.11
0.49	0.00	0.58	29.62	65.51	4.43	76.32	90.53
0.58	0.00	0.67	29.62	76.32	3.38	88.91	93.91
0.67	0.00	0.78	29.62	88.91	2.37	103.58	96.28
0.78	0.00	0.91	29.63	103.58	1.50	120.67	97.78
0.91	0.00	1.06	29.63	120.67	0.83	140.58	98.61
1.06	0.01	1.24	29.64	140.58	0.39	163.77	99.01
1.24	0.02	1.44	29.66	163.77	0.16	190.80	99.17
1.44	0.03	1.68	29.69	190.80	0.09	222.28	99.26
1.68	0.06	1.95	29.75	222.28	0.10	258.95	99.36
1.95	0.10	2.28	29.85	258.95	0.15	301.68	99.51
2.28	0.16	2.65	30.02	301.68	0.18	351.46	99.68
2.65	0.24	3.09	30.26	351.46	0.16	409.45	99.84
3.09	0.35	3.60	30.61	409.45	0.11	477.01	99.95
3.60	0.49	4.19	31.10	477.01	0.05	555.71	100.00
4.19	0.67	4.88	31.76	555.71	0.00	647.41	100.00
4.88	0.87	5.69	32.64	647.41	0.00	754.23	100.00
5.69	1.08	6.63	33.72	754.23	0.00	878.67	100.00

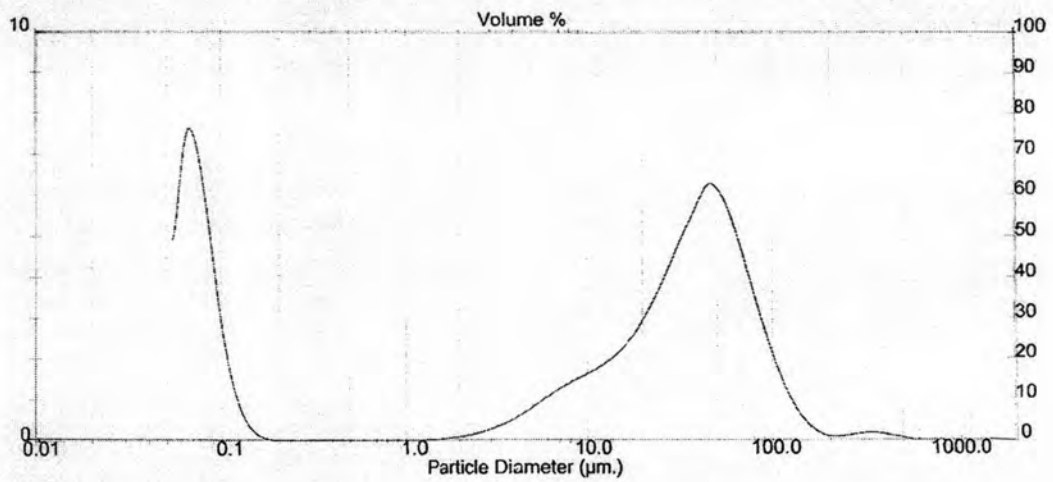


Figure 5A Size and size distribution of formulation 5

Result Statistics

Distribution Type: Volume
Mean Diameters:
D [4, 3] = 17.37 um

Concentration = 0.0087 %Vol
D (v, 0.1) = 0.06 um
D [3, 2] = 0.19 um

Density = 1.000 g / cub. cm
D (v, 0.5) = 11.53 um
Span = 3.622E+00

Specific S.A. = 31.7816 sq. m / g
D (v, 0.9) = 41.81 um
Uniformity = 1.356E+00

Size_Low (um)	In %	Size_High (um)	Under%	Size_Low (um)	In %	Size_High (um)	Under%
0.05	6.44	0.06	6.44	6.63	1.44	7.72	44.97
0.06	9.31	0.07	15.75	7.72	1.66	9.00	46.63
0.07	8.93	0.08	24.68	9.00	1.96	10.48	48.59
0.08	6.55	0.09	31.23	10.48	2.35	12.21	50 94
0.09	3.77	0.11	35.00	12.21	2.87	14.22	53.81
0.11	1.73	0.13	36.73	14.22	3.50	16.57	57.31
0.13	0.65	0.15	37.38	16.57	4 23	19.31	61.54
0.15	0.20	0.17	37.58	19.31	4.98	22.49	66.53
0.17	0.05	0.20	37.63	22.49	5.69	26.20	72.21
0.20	0.01	0.23	37.64	26.20	6.30	30.53	78.51
0.23	0.00	0.27	37.65	30.53	6.02	35.56	84.53
0.27	0.00	0.31	37.65	35.56	5.20	41.43	89.73
0.31	0.00	0.36	37.65	41.43	4.03	48.27	93.75
0.36	0.00	0.42	37.65	48.27	2.79	56.23	96.54
0.42	0.00	0.49	37.65	56.23	1.67	65.51	98.21
0.49	0.00	0.58	37.65	65.51	0.82	76.32	99.03
0.58	0.00	0.67	37.65	76.32	0.26	88.91	99.29
0.67	0.00	0.78	37.66	88.91	0.00	103.58	99.29
0.78	0.01	0.91	37.66	103.58	0.00	120.67	99.29
0.91	0 02	1.06	37.68	120.67	0.00	140.58	99.29
1.06	0.04	1.24	37.72	140.58	0.10	163.77	99.39
1.24	0.06	1.44	37.78	163.77	0.19	190.80	99.58
1.44	0.09	1.68	37.87	190.80	0.19	222.28	99.77
1.68	0.14	1.95	38.02	222.28	0.14	258.95	99.91
1.95	0.21	2.28	38.23	258.95	0.07	301.68	99.98
2.28	0.30	2.65	38.53	301.68	0.02	351.46	100.00
2.65	0.43	3.09	38.96	351.46	0.00	409.45	100.00
3.09	0.57	3.60	39.53	409.45	0.00	477.01	100.00
3.60	0.73	4.19	40.27	477.01	0.00	555.71	100.00
4.19	0.91	4.88	41.17	555.71	0.00	647.41	100.00
4.88	1.09	5.69	42.26	647.41	0.00	754.23	100.00
5.69	1.26	6.63	43.52	754.23	0.00	878.67	100.00

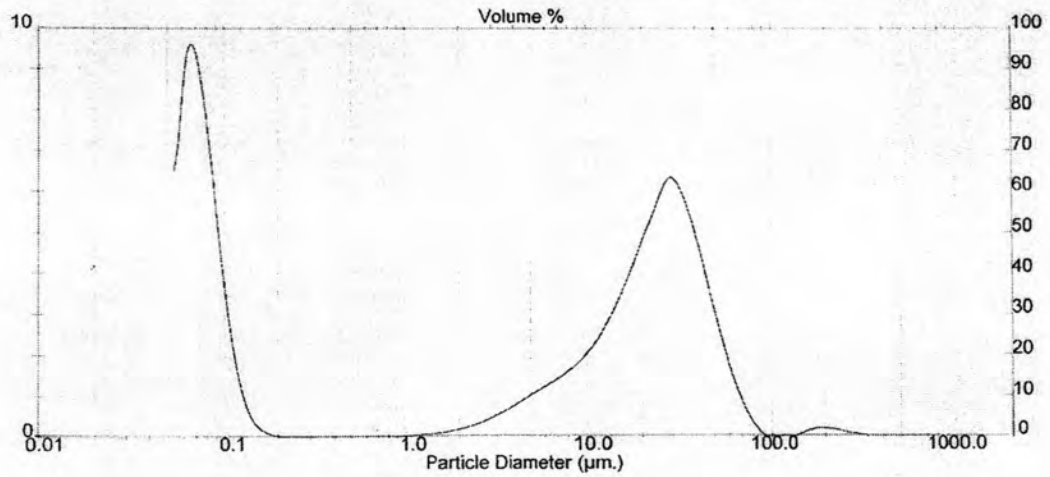


Figure 6A Size and size distribution of formulation 6

System Details

Range Lens: 300RF mm
Presentation: 3NHE
Analysis Model: Polydisperse
Modifications: None

Beam Length: 2.40 mm
[Particle R.I. = (1.5330, 0.1000); Dispersant R.I. = 1.4000]

Sampler: MS1

Obscuration: 14.6 %
Residual: 0.448 %

Result Statistics

Distribution Type: Volume
Mean Diameters:
D [4, 3] = 20.43 um

Concentration = 0.0080 %Vol
D (v, 0.1) = 0.06 um
D [3, 2] = 0.21 um

Density = 1.000 g / cub. cm
D (v, 0.5) = 15.30 um
Span = 3.073E+00

Specific S.A. = 28.3003 sq. m / g
D (v, 0.9) = 47.08 um
Uniformity = 1.153E+00

Size_Low (um)	In %	Size_High (um)	Under%
0.05	4.97	0.06	4.97
0.06	7.56	0.07	12.53
0.07	7.82	0.08	20.34
0.08	6.36	0.09	26.70
0.09	4.21	0.11	30.91
0.11	2.31	0.13	33.22
0.13	1.07	0.15	34.29
0.15	0.43	0.17	34.73
0.17	0.16	0.20	34.88
0.20	0.05	0.23	34.93
0.23	0.02	0.27	34.95
0.27	0.01	0.31	34.95
0.31	0.00	0.36	34.96
0.36	0.00	0.42	34.96
0.42	0.00	0.49	34.96
0.49	0.00	0.58	34.96
0.58	0.01	0.67	34.97
0.67	0.01	0.78	34.98
0.78	0.02	0.91	34.99
0.91	0.03	1.06	35.03
1.06	0.05	1.24	35.08
1.24	0.07	1.44	35.15
1.44	0.10	1.68	35.25
1.68	0.14	1.95	35.39
1.95	0.20	2.28	35.58
2.28	0.28	2.65	35.85
2.65	0.35	3.09	36.20
3.09	0.45	3.60	36.65
3.60	0.56	4.19	37.22
4.19	0.68	4.88	37.89
4.88	0.80	5.69	38.69
5.69	0.94	6.63	39.63
6.63	1.10	7.72	40.73
7.72	1.33	9.00	42.06
9.00	1.65	10.48	43.71
10.48	2.09	12.21	45.80
12.21	2.67	14.22	48.47
14.22	3.40	16.57	51.87
16.57	4.23	19.31	56.10
19.31	5.08	22.49	61.18
22.49	5.81	26.20	67.00
26.20	6.34	30.53	73.34
30.53	6.65	35.56	79.99
35.56	5.92	41.43	85.91
41.43	4.79	48.27	90.69
48.27	3.52	56.23	94.21
56.23	2.33	65.51	96.54
65.51	1.36	76.32	97.91
76.32	0.68	88.91	98.59
88.91	0.28	103.58	98.87
103.58	0.11	120.67	98.97
120.67	0.13	140.58	99.11
140.58	0.19	163.77	99.30
163.77	0.24	190.80	99.54
190.80	0.22	222.28	99.76
222.28	0.15	258.95	99.91
258.95	0.07	301.68	99.98
301.68	0.02	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

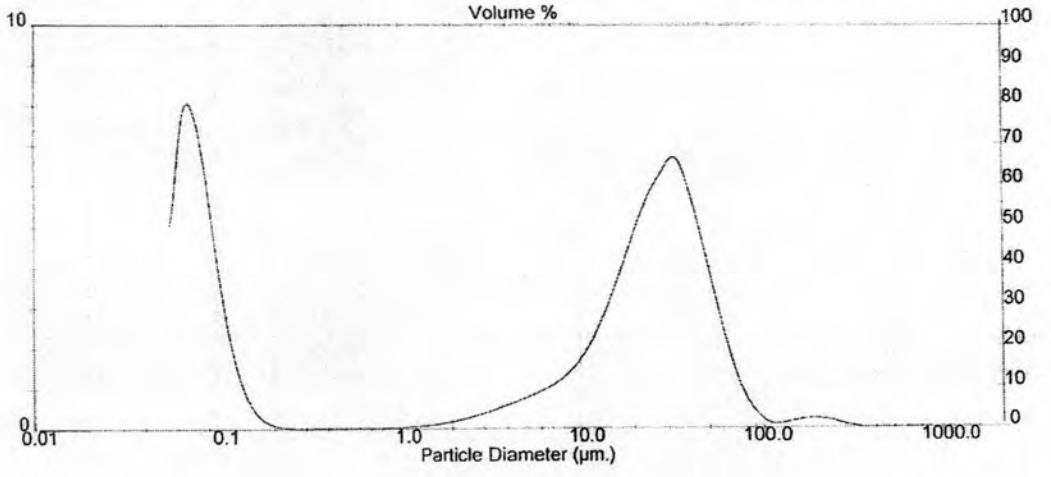


Figure 7A Size and size distribution of formulation 7

Result Statistics

Distribution Type: Volume	Concentration = 0.0077 %Vol	Density = 1.000 g / cub. cm	Specific S.A. = 31.9394 sq. m / g
Mean Diameters:	D (v, 0.1) = 0.05 um	D (v, 0.5) = 11.23 um	D (v, 0.9) = 44.10 um
D [4, 3] = 18.39 um	D [3, 2] = 0.19 um	Span = 3.920E+00	Uniformity = 1.509E+00

Size_Low (um)	In %	Size_High (um)	Under%	Size_Low (um)	In %	Size_High (um)	Under%
0.05	5.83	0.06	5.83	6.63	1.18	7.72	45.93
0.06	8.71	0.07	14.54	7.72	1.41	9.00	47.34
0.07	8.79	0.08	23.33	9.00	1.74	10.48	49.08
0.08	6.96	0.09	30.29	10.48	2.17	12.21	51.25
0.09	4.51	0.11	34.80	12.21	2.72	14.22	53.97
0.11	2.45	0.13	37.25	14.22	3.38	16.57	57.35
0.13	1.16	0.15	38.40	16.57	4.10	19.31	61.45
0.15	0.50	0.17	38.90	19.31	4.81	22.49	66.25
0.17	0.20	0.20	39.10	22.49	5.43	26.20	71.69
0.20	0.08	0.23	39.18	26.20	5.96	30.53	77.65
0.23	0.03	0.27	39.21	30.53	5.68	35.56	83.33
0.27	0.01	0.31	39.22	35.56	4.94	41.43	88.27
0.31	0.01	0.36	39.23	41.43	3.92	48.27	92.19
0.36	0.00	0.42	39.23	48.27	2.83	56.23	95.02
0.42	0.00	0.49	39.23	56.23	1.85	65.51	96.87
0.49	0.00	0.58	39.23	65.51	1.07	76.32	97.94
0.58	0.02	0.67	39.25	76.32	0.54	88.91	98.48
0.67	0.02	0.78	39.27	88.91	0.24	103.58	98.72
0.78	0.04	0.91	39.31	103.58	0.12	120.67	98.83
0.91	0.07	1.06	39.38	120.67	0.18	140.58	99.01
1.06	0.10	1.24	39.48	140.58	0.22	163.77	99.23
1.24	0.12	1.44	39.60	163.77	0.25	190.80	99.49
1.44	0.15	1.68	39.75	190.80	0.23	222.28	99.72
1.68	0.21	1.95	39.96	222.28	0.16	258.95	99.88
1.95	0.27	2.28	40.23	258.95	0.09	301.68	99.97
2.28	0.34	2.65	40.57	301.68	0.03	351.46	100.00
2.65	0.43	3.09	41.00	351.46	0.00	409.45	100.00
3.09	0.53	3.60	41.52	409.45	0.00	477.01	100.00
3.60	0.63	4.19	42.15	477.01	0.00	555.71	100.00
4.19	0.74	4.88	42.89	555.71	0.00	647.41	100.00
4.88	0.86	5.69	43.75	647.41	0.00	754.23	100.00
5.69	1.00	6.63	44.75	754.23	0.00	878.67	100.00

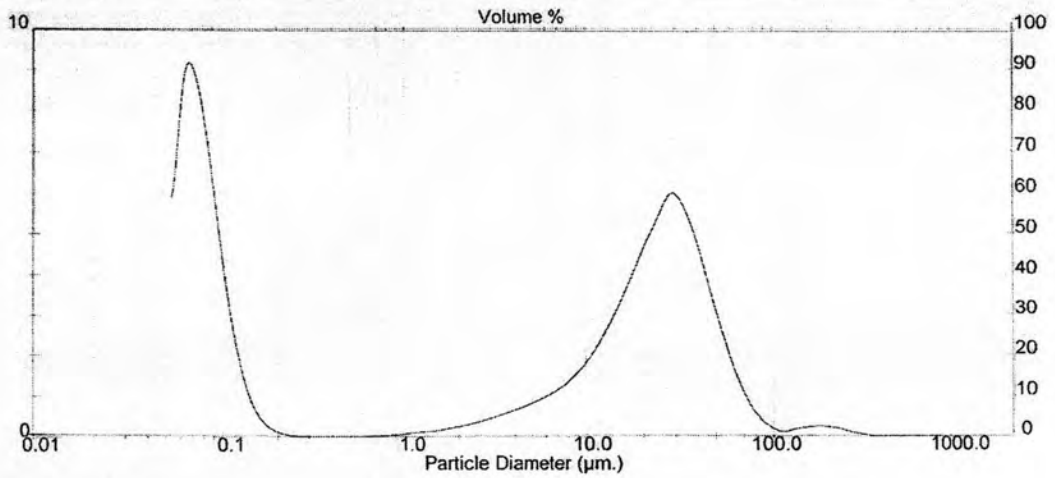


Figure 8A Size and size distribution of optimal formulation

Result Statistics

Distribution Type: Volume	Concentration = 0.0095 %Vol	Density = 1.000 g / cub. cm	Specific S.A. = 33.8797 sq. m / g
Mean Diameters:	D (v, 0.1) = 0.06 um	D (v, 0.5) = 8.82 um	D (v, 0.9) = 40.24 um
D [4, 3] = 16.19 um	D [3, 2] = 0.18 um	Span = 4.557E+00	Uniformity = 1.713E+00

Size_Low (um)	In %	Size_High (um)	Under%
0.05	6.59	0.06	6.59
0.06	9.61	0.07	16.19
0.07	9.37	0.08	25.56
0.08	7.10	0.09	32.67
0.09	4.35	0.11	37.02
0.11	2.23	0.13	39.25
0.13	1.00	0.15	40.25
0.15	0.41	0.17	40.65
0.17	0.16	0.20	40.81
0.20	0.06	0.23	40.87
0.23	0.02	0.27	40.90
0.27	0.01	0.31	40.91
0.31	0.01	0.36	40.91
0.36	0.00	0.42	40.91
0.42	0.00	0.49	40.92
0.49	0.00	0.58	40.92
0.58	0.01	0.67	40.93
0.67	0.01	0.78	40.94
0.78	0.02	0.91	40.95
0.91	0.03	1.06	40.99
1.06	0.05	1.24	41.04
1.24	0.08	1.44	41.12
1.44	0.10	1.68	41.22
1.68	0.14	1.95	41.36
1.95	0.20	2.28	41.55
2.28	0.26	2.65	41.81
2.65	0.35	3.09	42.17
3.09	0.47	3.60	42.63
3.60	0.62	4.19	43.25
4.19	0.82	4.88	44.07
4.88	1.07	5.69	45.14
5.69	1.36	6.63	46.51
6.63	1.70	7.72	48.21
7.72	2.09	9.00	50.30
9.00	2.52	10.48	52.82
10.48	2.99	12.21	55.80
12.21	3.47	14.22	59.28
14.22	3.94	16.57	63.22
16.57	4.36	19.31	67.58
19.31	4.68	22.49	72.26
22.49	4.89	26.20	77.15
26.20	5.01	30.53	82.17
30.53	4.60	35.56	86.76
35.56	3.92	41.43	90.69
41.43	3.10	48.27	93.78
48.27	2.25	56.23	96.03
56.23	1.48	65.51	97.51
65.51	0.87	76.32	98.38
76.32	0.44	88.91	98.82
88.91	0.19	103.58	99.01
103.58	0.07	120.67	99.09
120.67	0.09	140.58	99.18
140.58	0.13	163.77	99.31
163.77	0.18	190.80	99.49
190.80	0.19	222.28	99.68
222.28	0.16	258.95	99.83
258.95	0.10	301.68	99.94
301.68	0.05	351.46	99.99
351.46	0.01	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

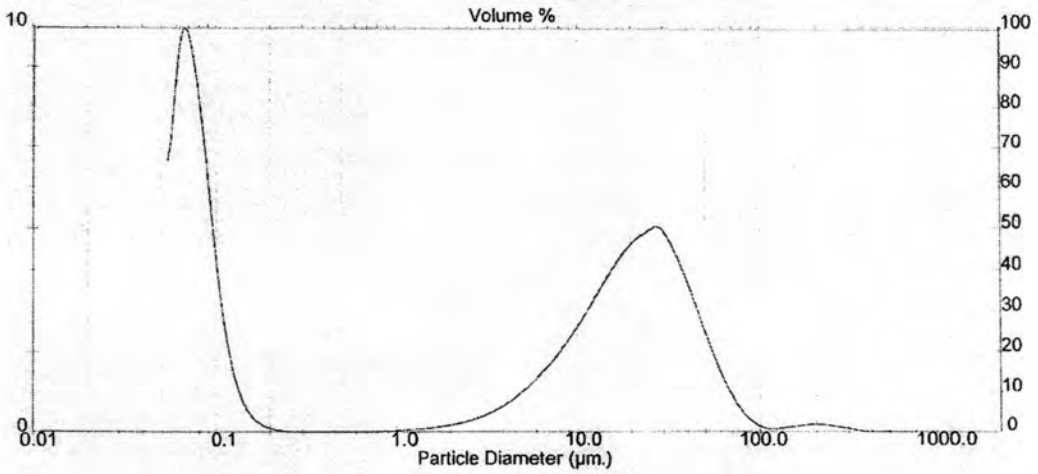


Figure 9A Size and size distribution of formulation 9

Result Statistics

Distribution Type: Volume	Concentration = 0.0098 %Vol	Density = 1.000 g / cub. cm	Specific S.A. = 26.8157 sq. m / g
Mean Diameters:	D (v, 0.1) = 0.06 um	D (v, 0.5) = 21.11 um	D (v, 0.9) = 58.79 um
D [4, 3] = 26.34 um	D [3, 2] = 0.22 um	Span = 2.782E+00	Uniformity = 1.024E+00

Size_Low (um)	In %	Size_High (um)	Under%
0.05	5.60	0.06	5.60
0.06	8.02	0.07	13.62
0.07	7.57	0.08	21.19
0.08	5.41	0.09	26.60
0.09	2.99	0.11	29.59
0.11	1.29	0.13	30.88
0.13	0.44	0.15	31.32
0.15	0.12	0.17	31.45
0.17	0.03	0.20	31.48
0.20	0.01	0.23	31.48
0.23	0.00	0.27	31.48
0.27	0.00	0.31	31.49
0.31	0.00	0.36	31.49
0.36	0.00	0.42	31.49
0.42	0.00	0.49	31.49
0.49	0.00	0.58	31.49
0.58	0.00	0.67	31.49
0.67	0.00	0.78	31.49
0.78	0.00	0.91	31.49
0.91	0.01	1.06	31.50
1.06	0.03	1.24	31.53
1.24	0.04	1.44	31.57
1.44	0.06	1.68	31.63
1.68	0.09	1.95	31.72
1.95	0.12	2.28	31.84
2.28	0.16	2.65	32.00
2.65	0.23	3.09	32.23
3.09	0.30	3.60	32.53
3.60	0.40	4.19	32.93
4.19	0.52	4.88	33.45
4.88	0.65	5.69	34.10
5.69	0.78	6.63	34.88
6.63	0.92	7.72	35.81
7.72	1.09	9.00	36.90
9.00	1.30	10.48	38.20
10.48	1.60	12.21	39.80
12.21	2.02	14.22	41.82
14.22	2.58	16.57	44.39
16.57	3.29	19.31	47.69
19.31	4.14	22.49	51.83
22.49	5.06	26.20	56.89
26.20	5.93	30.53	62.82
30.53	6.63	35.56	69.45
35.56	7.11	41.43	76.56
41.43	6.56	48.27	83.12
48.27	5.52	56.23	88.63
56.23	4.22	65.51	92.85
65.51	2.93	76.32	95.78
76.32	1.82	88.91	97.60
88.91	0.97	103.58	98.57
103.58	0.40	120.67	98.97
120.67	0.10	140.58	99.07
140.58	0.03	163.77	99.10
163.77	0.09	190.80	99.19
190.80	0.20	222.28	99.39
222.28	0.24	258.95	99.63
258.95	0.20	301.68	99.84
301.68	0.11	351.46	99.95
351.46	0.05	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

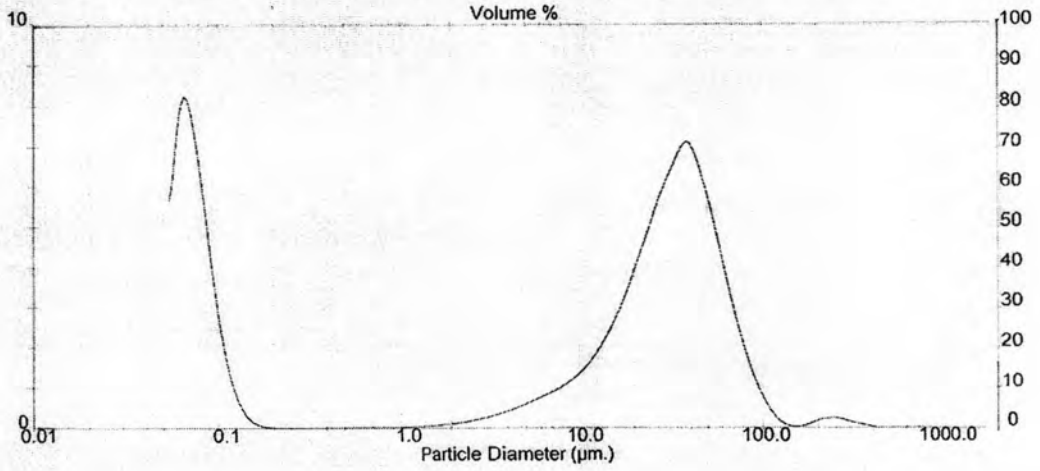


Figure 10A Size and size distribution of formulation 10

Result Statistics

Distribution Type: Volume	Concentration = 0.0089 %Vol	Density = 1.000 g / cub. cm	Specific S.A. = 31.4711 sq. m / g
Mean Diameters:	D (v, 0.1) = 0.06 um	D (v, 0.5) = 12.77 um	D (v, 0.9) = 44.59 um
D [4, 3] = 18.48 um	D [3, 2] = 0.19 um	Span = 3.487E+00	Uniformity = 1.302E+00

Size_Low (um)	In %	Size_High (um)	Under%
0.05	6.10	0.06	6.11
0.06	8.94	0.07	15.04
0.07	8.76	0.08	23.80
0.08	6.65	0.09	30.44
0.09	4.05	0.11	34.50
0.11	2.03	0.13	36.53
0.13	0.87	0.15	37.40
0.15	0.33	0.17	37.73
0.17	0.12	0.20	37.85
0.20	0.04	0.23	37.89
0.23	0.01	0.27	37.90
0.27	0.00	0.31	37.91
0.31	0.00	0.36	37.91
0.36	0.00	0.42	37.91
0.42	0.00	0.49	37.91
0.49	0.00	0.58	37.91
0.58	0.01	0.67	37.92
0.67	0.01	0.78	37.93
0.78	0.02	0.91	37.94
0.91	0.03	1.06	37.98
1.06	0.06	1.24	38.04
1.24	0.08	1.44	38.11
1.44	0.10	1.68	38.22
1.68	0.15	1.95	38.37
1.95	0.21	2.28	38.58
2.28	0.28	2.65	38.86
2.65	0.38	3.09	39.24
3.09	0.49	3.60	39.72
3.60	0.61	4.19	40.34
4.19	0.75	4.88	41.08
4.88	0.89	5.69	41.97
5.69	1.03	6.63	43.01
6.63	1.19	7.72	44.20
7.72	1.39	9.00	45.59
9.00	1.67	10.48	47.25
10.48	2.05	12.21	49.31
12.21	2.56	14.22	51.87
14.22	3.21	16.57	55.08
16.57	3.97	19.31	59.05
19.31	4.77	22.49	63.81
22.49	5.51	26.20	69.32
26.20	6.08	30.53	75.40
30.53	6.45	35.56	81.85
35.56	5.77	41.43	87.62
41.43	4.64	48.27	92.25
48.27	3.34	56.23	95.59
56.23	2.11	65.51	97.70
65.51	1.13	76.32	98.82
76.32	0.45	88.91	99.27
88.91	0.07	103.58	99.34
103.58	0.00	120.67	99.34
120.67	0.00	140.58	99.34
140.58	0.07	163.77	99.41
163.77	0.18	190.80	99.59
190.80	0.19	222.28	99.78
222.28	0.14	258.95	99.92
258.95	0.07	301.68	99.98
301.68	0.02	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

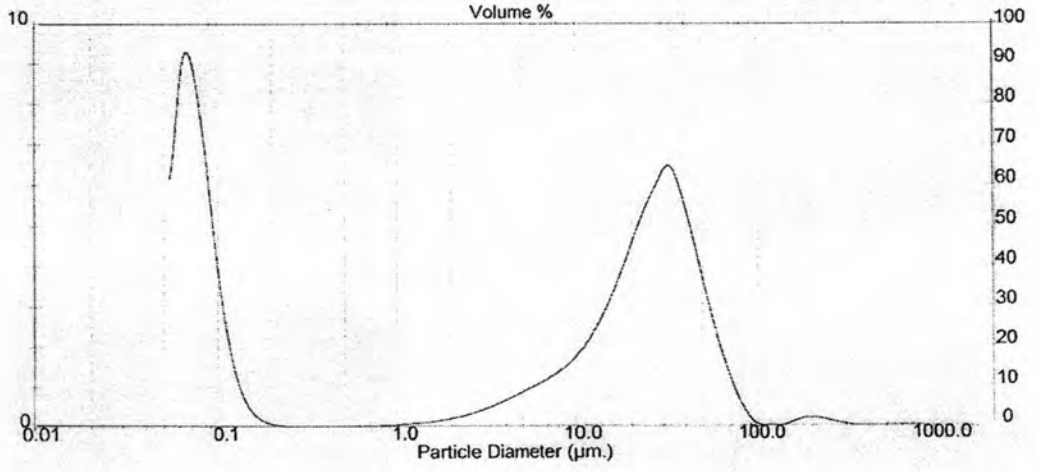


Figure 11A Size and size distribution of formulation 11

Result Statistics

Distribution Type: Volume	Concentration = 0.0087 %Vol	Density = 1.000 g / cub. cm	Specific S.A. = 27.0172 sq. m / g
Mean Diameters:	D (v, 0.1) = 0.07 um	D (v, 0.5) = 16.72 um	D (v, 0.9) = 63.27 um
D [4, 3] = 26.43 um	D [3, 2] = 0.22 um	Span = 3.781E+00	Uniformity = 1.407E+00

Size_Low (um)	In %	Size_High (um)	Under%
0.05	4.07	0.06	4.07
0.06	6.61	0.07	10.67
0.07	7.35	0.08	18.02
0.08	6.49	0.09	24.51
0.09	4.70	0.11	29.21
0.11	2.85	0.13	32.06
0.13	1.48	0.15	33.54
0.15	0.68	0.17	34.22
0.17	0.28	0.20	34.50
0.20	0.11	0.23	34.61
0.23	0.04	0.27	34.65
0.27	0.02	0.31	34.67
0.31	0.01	0.36	34.68
0.36	0.01	0.42	34.69
0.42	0.01	0.49	34.70
0.49	0.01	0.58	34.72
0.58	0.02	0.67	34.73
0.67	0.03	0.78	34.76
0.78	0.04	0.91	34.80
0.91	0.08	1.06	34.88
1.06	0.11	1.24	34.99
1.24	0.12	1.44	35.11
1.44	0.13	1.68	35.24
1.68	0.17	1.95	35.41
1.95	0.21	2.28	35.62
2.28	0.27	2.65	35.89
2.65	0.35	3.09	36.23
3.09	0.44	3.60	36.67
3.60	0.55	4.19	37.22
4.19	0.66	4.88	37.88
4.88	0.79	5.69	38.67
5.69	0.92	6.63	39.59

Size_Low (um)	In %	Size_High (um)	Under%
6.63	1.06	7.72	40.65
7.72	1.22	9.00	41.87
9.00	1.44	10.48	43.31
10.48	1.74	12.21	45.05
12.21	2.14	14.22	47.19
14.22	2.64	16.57	49.83
16.57	3.25	19.31	53.08
19.31	3.90	22.49	56.98
22.49	4.53	26.20	61.51
26.20	5.06	30.53	66.57
30.53	5.41	35.56	71.98
35.56	5.62	41.43	77.60
41.43	5.15	48.27	82.74
48.27	4.42	56.23	87.17
56.23	3.57	65.51	90.74
65.51	2.74	76.32	93.48
76.32	1.99	88.91	95.47
88.91	1.38	103.58	96.85
103.58	0.92	120.67	97.77
120.67	0.61	140.58	98.38
140.58	0.42	163.77	98.80
163.77	0.31	190.80	99.11
190.80	0.25	222.28	99.36
222.28	0.21	258.95	99.56
258.95	0.17	301.68	99.73
301.68	0.12	351.46	99.86
351.46	0.08	409.45	99.94
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

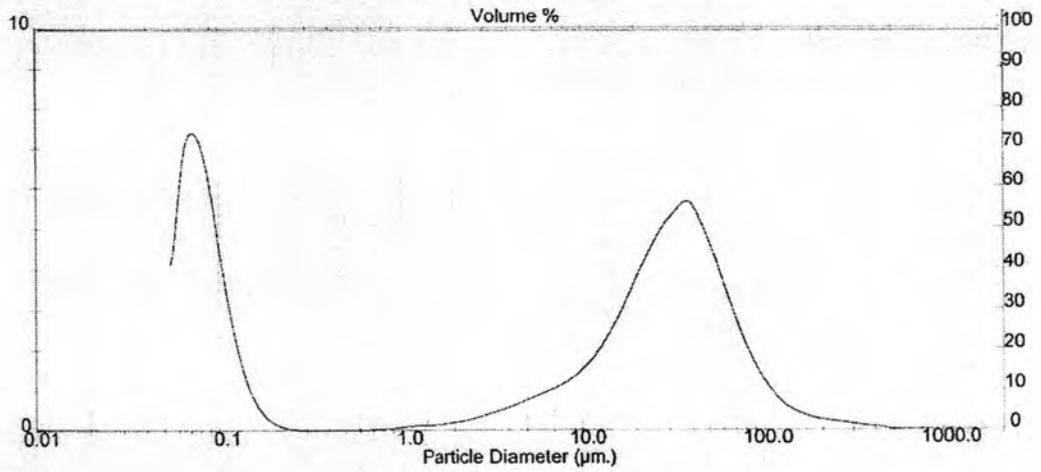


Figure 12A Size and size distribution of formulation 12

Result Statistics

Distribution Type: Volume	Concentration = 0.0115 %Vol	Density = 1.000 g / cub. cm	Specific S.A. = 20.4670 sq. m / g
Mean Diameters:	D (v, 0.1) = 0.07 um	D (v, 0.5) = 28.98 um	D (v, 0.9) = 82.35 um
D [4, 3] = 35.08 um	D [3, 2] = 0.29 um	Span = 2.857E+00	Uniformity = 9.576E-01

Size_Low (um)	In %	Size_High (um)	Under%	Size_Low (um)	In %	Size_High (um)	Under%
0.05	2.71	0.06	2.71	6.63	0.99	7.72	31.76
0.06	4.59	0.07	7.30	7.72	1.12	9.00	32.87
0.07	5.39	0.08	12.70	9.00	1.24	10.48	34.11
0.08	5.09	0.09	17.79	10.48	1.37	12.21	35.48
0.09	4.00	0.11	21.79	12.21	1.56	14.22	37.04
0.11	2.65	0.13	24.44	14.22	1.83	16.57	38.88
0.13	1.49	0.15	25.94	16.57	2.23	19.31	41.11
0.15	0.73	0.17	26.66	19.31	2.77	22.49	43.87
0.17	0.31	0.20	26.97	22.49	3.44	26.20	47.31
0.20	0.12	0.23	27.09	26.20	4.22	30.53	51.53
0.23	0.04	0.27	27.13	30.53	5.01	35.56	56.54
0.27	0.02	0.31	27.15	35.56	5.74	41.43	62.28
0.31	0.01	0.36	27.16	41.43	6.33	48.27	68.61
0.36	0.01	0.42	27.17	48.27	6.78	56.23	75.39
0.42	0.01	0.49	27.18	56.23	6.41	65.51	81.80
0.49	0.00	0.58	27.18	65.51	5.61	76.32	87.42
0.58	0.00	0.67	27.19	76.32	4.54	88.91	91.96
0.67	0.00	0.78	27.19	88.91	3.37	103.58	95.33
0.78	0.01	0.91	27.20	103.58	2.28	120.67	97.61
0.91	0.01	1.06	27.21	120.67	1.41	140.58	99.02
1.06	0.02	1.24	27.23	140.58	0.80	163.77	99.82
1.24	0.04	1.44	27.27	163.77	0.18	190.80	100.00
1.44	0.05	1.68	27.32	190.80	0.00	222.28	100.00
1.68	0.08	1.95	27.40	222.28	0.00	258.95	100.00
1.95	0.11	2.28	27.51	258.95	0.00	301.68	100.00
2.28	0.16	2.65	27.67	301.68	0.00	351.46	100.00
2.65	0.23	3.09	27.90	351.46	0.00	409.45	100.00
3.09	0.31	3.60	28.22	409.45	0.00	477.01	100.00
3.60	0.43	4.19	28.64	477.01	0.00	555.71	100.00
4.19	0.56	4.88	29.20	555.71	0.00	647.41	100.00
4.88	0.71	5.69	29.91	647.41	0.00	754.23	100.00
5.69	0.86	6.63	30.76	754.23	0.00	878.67	100.00

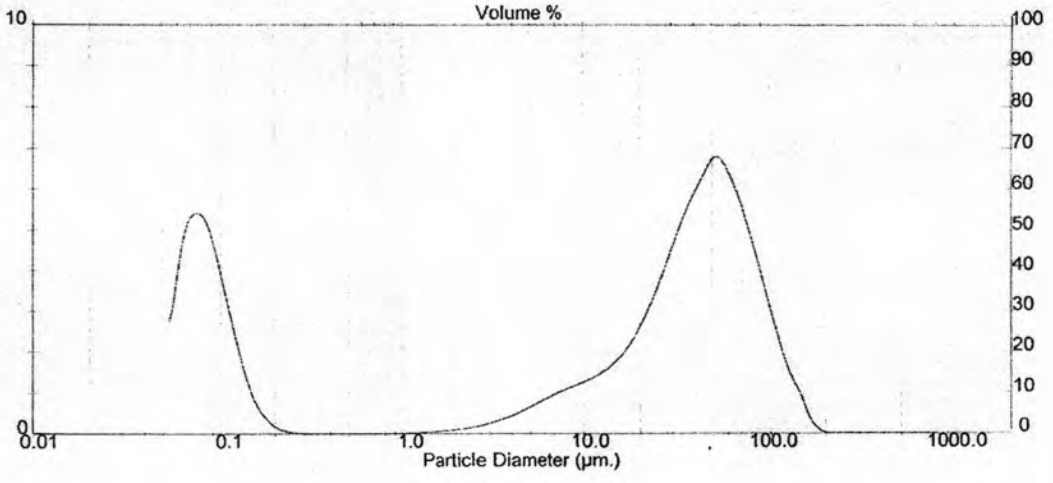


Figure 13A Size and size distribution of formulation 13

Result Statistics

Distribution Type: Volume	Concentration = 0.0068 %Vol	Density = 1.000 g / cub. cm	Specific S.A. = 14.6190 sq. m / g
Mean Diameters:	D (v, 0.1) = 0.09 um	D (v, 0.5) = 71.05 um	D (v, 0.9) = 337.37 um
D [4, 3] = 122.08 um	D [3, 2] = 0.41 um	Span = 4.747E+00	Uniformity = 1.396E+00

Size_Low (um)	In %	Size_High (um)	Under%	Size_Low (um)	In %	Size_High (um)	Under%
0.05	1.62	0.06	1.62	6.63	0.33	7.72	23.91
0.06	2.85	0.07	4.48	7.72	0.37	9.00	24.28
0.07	3.54	0.08	8.00	9.00	0.40	10.48	24.68
0.08	3.62	0.09	11.62	10.48	0.46	12.21	25.14
0.09	3.16	0.11	14.78	12.21	0.53	14.22	25.66
0.11	2.40	0.13	17.18	14.22	0.62	16.57	26.29
0.13	1.59	0.15	18.77	16.57	0.76	19.31	27.04
0.15	0.94	0.17	19.71	19.31	0.94	22.49	27.99
0.17	0.50	0.20	20.21	22.49	1.20	26.20	29.19
0.20	0.25	0.23	20.45	26.20	1.55	30.53	30.74
0.23	0.13	0.27	20.58	30.53	2.01	35.56	32.75
0.27	0.07	0.31	20.65	35.56	2.57	41.43	35.32
0.31	0.05	0.36	20.71	41.43	3.25	48.27	38.57
0.36	0.05	0.42	20.75	48.27	3.98	56.23	42.55
0.42	0.04	0.49	20.79	56.23	4.70	65.51	47.25
0.49	0.03	0.58	20.83	65.51	5.29	76.32	52.53
0.58	0.04	0.67	20.86	76.32	5.63	88.91	58.16
0.67	0.04	0.78	20.90	88.91	5.66	103.58	63.82
0.78	0.06	0.91	20.96	103.58	5.38	120.67	69.20
0.91	0.09	1.06	21.05	120.67	4.87	140.58	74.07
1.06	0.12	1.24	21.16	140.58	4.25	163.77	78.32
1.24	0.13	1.44	21.29	163.77	3.43	190.80	81.75
1.44	0.14	1.68	21.44	190.80	2.73	222.28	84.48
1.68	0.17	1.95	21.61	222.28	2.24	258.95	86.72
1.95	0.19	2.28	21.79	258.95	1.94	301.68	88.66
2.28	0.20	2.65	22.00	301.68	1.82	351.46	90.49
2.65	0.22	3.09	22.22	351.46	1.83	409.45	92.32
3.09	0.24	3.60	22.46	409.45	1.88	477.01	94.19
3.60	0.25	4.19	22.71	477.01	1.88	555.71	96.08
4.19	0.27	4.88	22.98	555.71	1.74	647.41	97.81
4.88	0.29	5.69	23.27	647.41	1.40	754.23	99.21
5.69	0.31	6.63	23.58	754.23	0.79	878.67	100.00

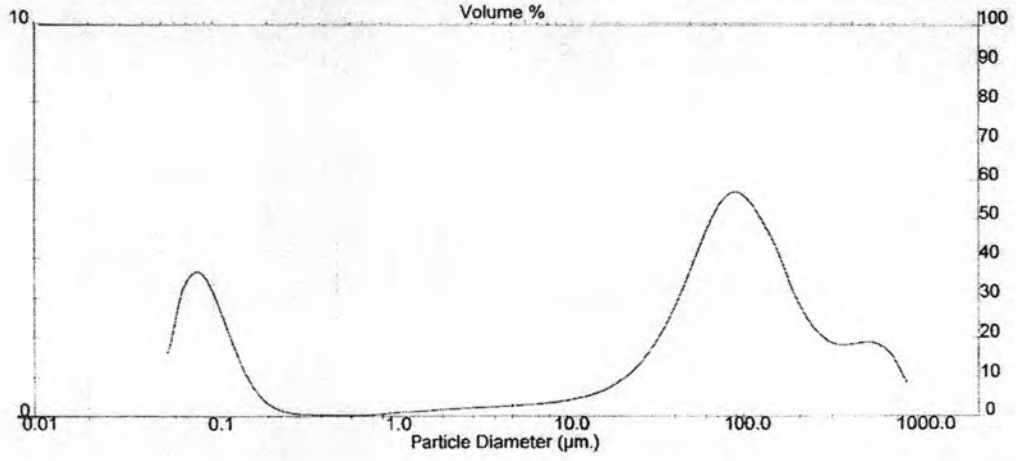


Figure 14ASize and size distribution of formulation 14

Result Statistics

Distribution Type: Volume	Concentration = 0.0356 %Vol	Density = 1.000 g / cub. cm	Specific S.A. = 0.4741 sq. m / g
Mean Diameters:	D (v, 0.1) = 6.81 um	D (v, 0.5) = 28.03 um	D (v, 0.9) = 61.75 um
D [4, 3] = 35.14 um	D [3, 2] = 12.66 um	Span = 1.96OE+00	Uniformity = 7.129E-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	0.00	0.13	0.00
0.13	0.00	0.15	0.00
0.15	0.00	0.17	0.00
0.17	0.00	0.20	0.00
0.20	0.00	0.23	0.00
0.23	0.00	0.27	0.00
0.27	0.01	0.31	0.01
0.31	0.03	0.36	0.04
0.36	0.06	0.42	0.11
0.42	0.08	0.49	0.18
0.49	0.09	0.58	0.27
0.58	0.12	0.67	0.40
0.67	0.14	0.78	0.53
0.78	0.17	0.91	0.70
0.91	0.20	1.06	0.90
1.06	0.22	1.24	1.12
1.24	0.25	1.44	1.37
1.44	0.29	1.68	1.67
1.68	0.35	1.95	2.02
1.95	0.44	2.28	2.46
2.28	0.55	2.65	3.01
2.65	0.69	3.09	3.70
3.09	0.86	3.60	4.56
3.60	1.04	4.19	5.60
4.19	1.21	4.88	6.81
4.88	1.37	5.69	8.18
5.69	1.53	6.63	9.71
6.63	1.72	7.72	11.43
7.72	1.96	9.00	13.39
9.00	2.32	10.48	15.72
10.48	2.85	12.21	18.57
12.21	3.58	14.22	22.14
14.22	4.49	16.57	26.63
16.57	5.53	19.31	32.16
19.31	6.60	22.49	38.76
22.49	7.61	26.20	46.37
26.20	8.48	30.53	54.85
30.53	9.24	35.56	64.09
35.56	8.84	41.43	72.93
41.43	7.78	48.27	80.71
48.27	6.28	56.23	86.99
56.23	4.60	65.51	91.59
65.51	3.03	76.32	94.62
76.32	1.77	88.91	96.39
88.91	0.90	103.58	97.28
103.58	0.41	120.67	97.69
120.67	0.23	140.58	97.92
140.58	0.23	163.77	98.15
163.77	0.32	190.80	98.47
190.80	0.40	222.28	98.87
222.28	0.41	258.95	99.27
258.95	0.35	301.68	99.62
301.68	0.24	351.46	99.87
351.46	0.13	409.45	99.99
409.45	0.01	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

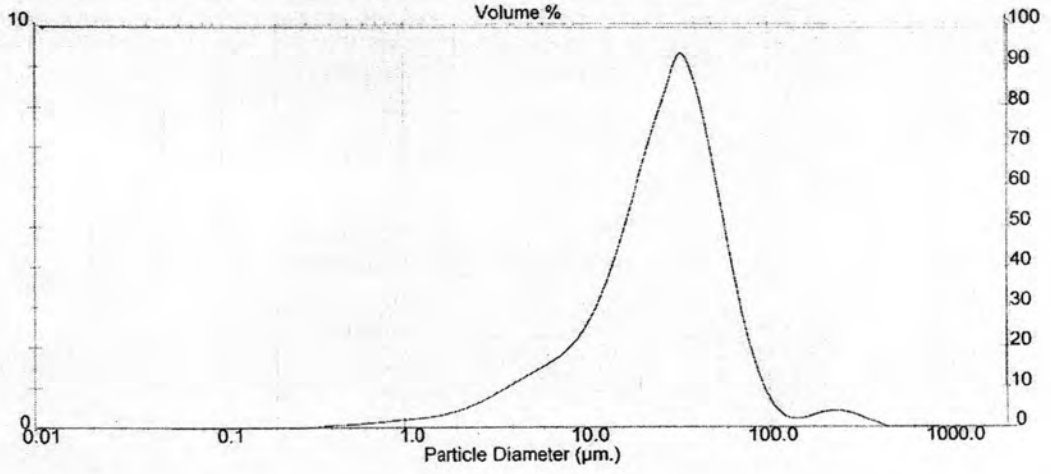


Figure 15A Size and size distribution of formulation 15

Result Statistics

Distribution Type: Volume	Concentration = 0.0094 %Vol	Density = 1.000 g / cub. cm	Specific S.A. = 25.5075 sq. m / g
Mean Diameters:	D (v, 0.1) = 0.07 um	D (v, 0.5) = 15.44 um	D (v, 0.9) = 116.40 um
D [4, 3] = 38.79 um	D [3, 2] = 0.24 um	Span = 7.537E+00	Uniformity = 2.312E+00

Size_Low (um)	In %	Size_High (um)	Under%	Size_Low (um)	In %	Size_High (um)	Under%
0.05	3.83	0.06	3.83	6.63	1.37	7.72	39.40
0.06	6.18	0.07	10.01	7.72	1.72	9.00	41.11
0.07	6.81	0.08	16.82	9.00	2.09	10.48	43.20
0.08	5.98	0.09	22.81	10.48	2.45	12.21	45.66
0.09	4.38	0.11	27.19	12.21	2.77	14.22	48.42
0.11	2.75	0.13	29.94	14.22	2.98	16.57	51.41
0.13	1.55	0.15	31.49	16.57	3.08	19.31	54.49
0.15	0.82	0.17	32.31	19.31	3.06	22.49	57.54
0.17	0.42	0.20	32.73	22.49	2.94	26.20	60.49
0.20	0.21	0.23	32.94	26.20	2.80	30.53	63.29
0.23	0.11	0.27	33.06	30.53	2.69	35.56	65.97
0.27	0.07	0.31	33.12	35.56	2.64	41.43	68.62
0.31	0.05	0.36	33.17	41.43	2.69	48.27	71.30
0.36	0.04	0.42	33.20	48.27	2.82	56.23	74.12
0.42	0.03	0.49	33.23	56.23	3.02	65.51	77.15
0.49	0.03	0.58	33.26	65.51	3.27	76.32	80.42
0.58	0.03	0.67	33.29	76.32	3.48	88.91	83.90
0.67	0.03	0.78	33.32	88.91	3.52	103.58	87.42
0.78	0.05	0.91	33.37	103.58	3.34	120.67	90.76
0.91	0.08	1.06	33.45	120.67	2.93	140.58	93.69
1.06	0.11	1.24	33.56	140.58	2.35	163.77	96.05
1.24	0.12	1.44	33.68	163.77	1.72	190.80	97.77
1.44	0.14	1.68	33.82	190.80	1.14	222.28	98.90
1.68	0.17	1.95	33.98	222.28	0.66	258.95	99.56
1.95	0.20	2.28	34.18	258.95	0.32	301.68	99.88
2.28	0.23	2.65	34.41	301.68	0.12	351.46	100.00
2.65	0.29	3.09	34.70	351.46	0.00	409.45	100.00
3.09	0.36	3.60	35.06	409.45	0.00	477.01	100.00
3.60	0.46	4.19	35.52	477.01	0.00	555.71	100.00
4.19	0.61	4.88	36.13	555.71	0.00	647.41	100.00
4.88	0.82	5.69	36.95	647.41	0.00	754.23	100.00
5.69	1.07	6.63	38.02	754.23	0.00	878.67	100.00

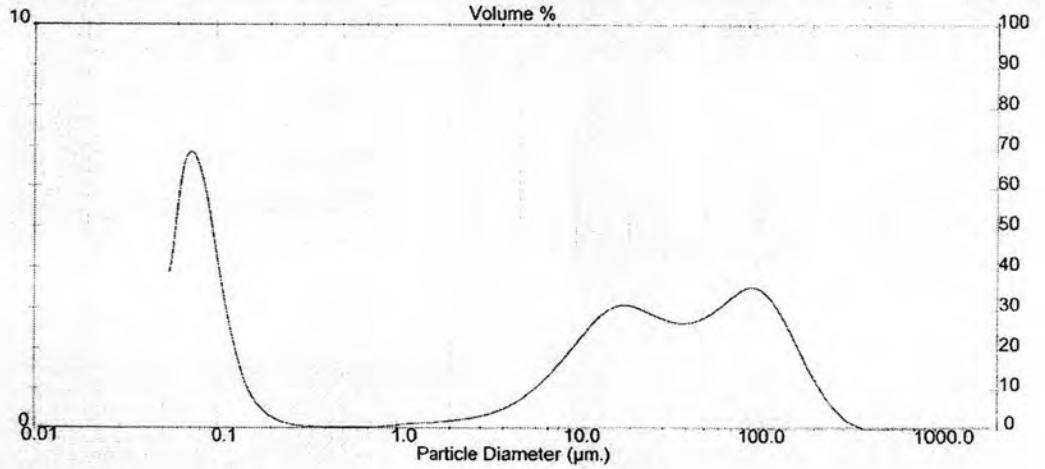
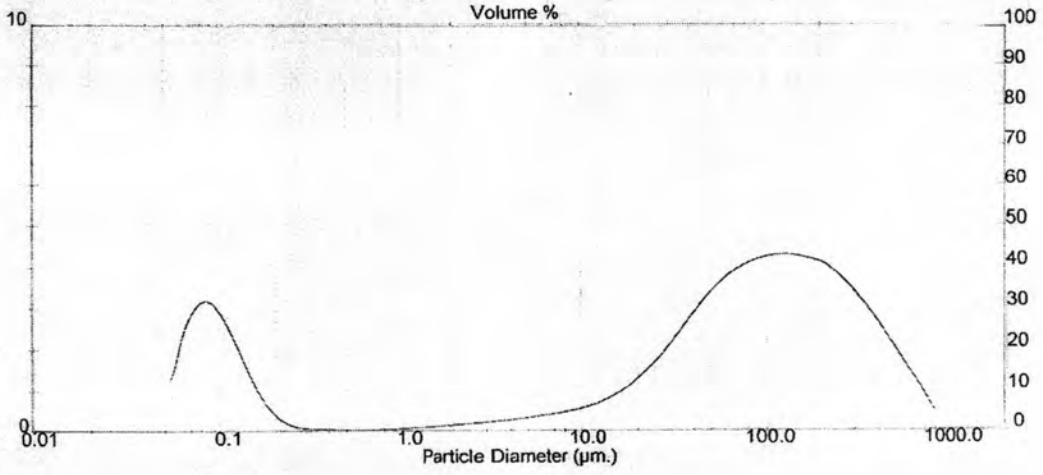


Figure 16A Size and size distribution of formulation 16

Result Statistics

Distribution Type: Volume	Concentration = 0.0119 %Vol	Density = 1.000 g / cub. cm	Specific S.A. = 12.8359 sq. m / g
Mean Diameters:	D (v, 0.1) = 0.09 um	D (v, 0.5) = 75.15 um	D (v, 0.9) = 347.44 um
D [4, 3] = 130.34 um	D [3, 2] = 0.47 um	Span = 4.622E+00	Uniformity = 1.422E+00

Size_Low (um)	In %	Size_High (um)	Under%
0.05	1.28	0.06	1.28
0.06	2.31	0.07	3.58
0.07	2.96	0.08	6.54
0.08	3.17	0.09	9.71
0.09	2.92	0.11	12.63
0.11	2.35	0.13	14.98
0.13	1.65	0.15	16.63
0.15	1.02	0.17	17.65
0.17	0.55	0.20	18.20
0.20	0.27	0.23	18.47
0.23	0.13	0.27	18.60
0.27	0.07	0.31	18.67
0.31	0.05	0.36	18.72
0.36	0.04	0.42	18.76
0.42	0.03	0.49	18.80
0.49	0.03	0.58	18.82
0.58	0.03	0.67	18.85
0.67	0.03	0.78	18.88
0.78	0.04	0.91	18.92
0.91	0.05	1.06	18.97
1.06	0.07	1.24	19.04
1.24	0.09	1.44	19.13
1.44	0.10	1.68	19.23
1.68	0.12	1.95	19.35
1.95	0.15	2.28	19.50
2.28	0.17	2.65	19.67
2.65	0.20	3.09	19.86
3.09	0.23	3.60	20.09
3.60	0.26	4.19	20.35
4.19	0.30	4.88	20.64
4.88	0.34	5.69	20.98
5.69	0.38	6.63	21.35
6.63	0.42	7.72	21.77
7.72	0.47	9.00	22.24
9.00	0.53	10.48	22.77
10.48	0.62	12.21	23.39
12.21	0.73	14.22	24.12
14.22	0.89	16.57	25.01
16.57	1.09	19.31	26.10
19.31	1.34	22.49	27.44
22.49	1.65	26.20	29.09
26.20	1.99	30.53	31.08
30.53	2.37	35.56	33.45
35.56	2.75	41.43	36.21
41.43	3.12	48.27	39.32
48.27	3.44	56.23	42.77
56.23	3.71	65.51	46.48
65.51	3.92	76.32	50.40
76.32	4.08	88.91	54.48
88.91	4.19	103.58	58.68
103.58	4.25	120.67	62.93
120.67	4.27	140.58	67.20
140.58	4.23	163.77	71.43
163.77	4.16	190.80	75.58
190.80	4.06	222.28	79.64
222.28	3.84	258.95	83.48
258.95	3.55	301.68	87.03
301.68	3.20	351.46	90.23
351.46	2.80	409.45	93.03
409.45	2.35	477.01	95.39
477.01	1.87	555.71	97.26
555.71	1.39	647.41	98.65
647.41	0.91	754.23	99.57
754.23	0.43	878.67	100.00



APPENDIX B

In vitro Release Data

Table 1B Percentage of doxycycline hyclate release from chitosan microspheres optimal formulation

Time (hr)	% Cumulative release			Mean (%)	SD
	n1	n2	n3		
0	0	0	0	0	0
1	9.24	9.50	8.78	9.17	0.36
2	11.08	11.79	10.64	11.17	0.58
3	11.92	12.82	11.69	12.14	0.60
4	12.05	12.96	11.90	12.30	0.58
6	12.26	13.20	12.28	12.58	0.54
8	12.34	13.29	12.61	12.75	0.49
12	12.41	13.47	12.95	12.94	0.53
24	12.37	13.55	13.36	13.09	0.64
48	12.52	13.74	13.73	13.33	0.70
69	12.52	13.78	13.74	13.35	0.72
96	12.44	13.70	13.65	13.26	0.72
120	12.63	13.89	13.84	13.45	0.71

Table 2B Percentage of doxycycline hyclate release from chitosan microspheres formulation 11

Time (hr)	% Cumulative release			Mean	SD
	n1	n2	n3		
0	0	0	0	0	0
1	7.22	6.61	6.92	6.91	0.30
2	7.15	7.48	7.36	7.33	0.17
3	7.52	8.26	8.43	8.07	0.48
4	7.94	9.00	8.57	8.50	0.54
6	8.06	9.17	8.64	8.62	0.55
8	8.46	9.35	8.82	8.88	0.45
12	8.86	9.52	9.06	9.15	0.34
24	9.09	9.59	9.28	9.32	0.25
48	9.30	9.84	9.55	9.57	0.27
69	9.37	9.92	9.65	9.64	0.28
96	9.29	9.89	9.62	9.60	0.30
120	9.50	10.12	9.87	9.83	0.31

Table 3B Percentage of doxycycline hyclate release from chitosan microspheres formulation 15

Time (hr)	% Cumulative release			Mean	SD
	n1	n2	n3		
0	0	0	0	0	0
1	13.07	12.90	14.62	13.53	0.95
2	14.86	14.31	15.92	15.03	0.82
3	15.82	14.91	17.01	15.91	1.05
4	16.29	16.75	17.36	16.80	0.54
6	16.72	17.27	17.78	17.26	0.53
8	17.94	18.21	18.35	18.17	0.21
12	19.21	19.16	19.69	19.35	0.29
24	20.01	19.67	20.21	19.96	0.27
48	21.02	20.53	21.31	20.95	0.39
69	21.46	20.84	21.62	21.31	0.41
96	21.58	20.95	21.68	21.40	0.40
120	21.91	21.27	22.00	21.73	0.40

Table 4B Percentage of doxycycline hyclate release from glyceryl monooleate-based drug delivery system (control)

Time (hr)	% Cumulative release			Mean	SD
	n1	n2	n3		
0	0	0	0	0	0
2	8.82	8.81	8.92	8.85	0.06
4	16.19	16.31	15.73	16.08	0.31
6	20.76	21.40	20.29	20.82	0.56
8	23.76	25.07	23.07	23.97	1.02
10	26.65	28.10	25.67	26.81	1.22
12	28.84	30.55	28.16	29.18	1.23
24	38.12	40.24	37.91	38.76	1.29
48	45.60	47.94	45.87	46.47	1.28
72	47.85	51.52	48.72	49.36	1.91
96	49.36	52.11	49.90	50.46	1.46
120	50.87	53.81	50.24	51.64	1.90

Table 5B Percentage of doxycycline hyclate release from chitosan microspheres optimal formulation in glyceryl monooleate-based delivery system

Time (hr)	% Cumulative release			Mean	SD
	n1	n2	n3		
0	0	0	0	0	0
2	0.82	0.86	0.94	0.87	0.06
4	1.63	1.88	1.72	1.74	0.12
6	2.42	2.79	2.55	2.59	0.19
8	3.17	3.45	3.24	3.29	0.15
10	3.73	3.94	3.87	3.84	0.10
12	4.27	4.28	4.33	4.29	0.03
24	6.26	5.66	5.88	5.93	0.30
48	7.01	6.07	6.63	6.57	0.47
72	7.37	6.65	7.00	7.01	0.36
96	7.61	6.85	7.24	7.23	0.38
120	7.76	7.04	7.56	7.45	0.38

Table 6B Percentage of doxycycline hyclate release from chitosan microspheres formulation 11 in glyceryl monooleate-based delivery system

Time (hr)	% Cumulative release			Mean	SD
	n1	n2	n3		
0	0	0	0	0	0
2	0.53	0.53	0.47	0.51	0.04
4	0.88	0.90	0.82	0.87	0.04
6	1.17	1.19	1.04	1.13	0.08
8	1.39	1.39	1.22	1.33	0.10
10	1.56	1.57	1.35	1.50	0.12
12	1.68	1.72	1.45	1.62	0.15
24	2.12	2.24	1.80	2.05	0.23
48	2.59	2.85	2.22	2.55	0.31
72	2.90	3.04	2.37	2.77	0.35
96	3.20	3.19	2.48	2.96	0.41
120	3.44	3.39	2.67	3.17	0.43

Table 7B Percentage of doxycycline hyclate release from chitosan microspheres formulation 15 in glyceryl monooleate-based delivery system

Time (hr)	% Cumulative release			Mean	SD
	n1	n2	n3		
0	0.00	0	0	0	0
2	4.53	3.70	3.83	4.02	0.44
4	7.19	5.95	6.83	6.66	0.64
6	9.28	7.78	9.31	8.79	0.87
8	10.88	8.97	11.89	10.58	1.49
10	12.22	10.14	13.68	12.01	1.78
12	13.23	11.25	14.76	13.08	1.76
24	19.50	18.82	21.64	19.99	1.47
48	16.03	14.46	17.79	16.10	1.66
72	17.24	16.32	18.99	17.52	1.36
96	18.01	17.11	19.56	18.22	1.24
120	18.40	17.61	19.99	18.67	1.21

APPENDIX C

Data of Ternary Phase Diagram

Table 1C Data of ternary phase diagram from glyceryl monooleate-sesame oil-water system

No.	Sesame oil	Water	Glyceryl monooleate	Phase	Description
1	2	0	98	1	isotropic
2	2	5	93	1	isotropic
3	2	10	88	1	isotropic
4	2	15	83	1	isotropic
5	2	20	78	1	lamellar
6	2	25	73	1	lamellar
7	2	30	68	2	isotropic
8	2	35	63	2	isotropic
9	2	40	58	2	isotropic
10	4	0	96	1	isotropic
11	4	5	91	1	isotropic
12	4	10	86	1	lamellar
13	4	15	81	1	lamellar
14	4	20	76	1	reversed hexagonal
15	4	25	71	2	reversed hexagonal
16	4	30	66	2	reversed hexagonal
17	4	35	61	2	reversed hexagonal
18	4	40	56	2	reversed hexagonal
19	6	0	94	1	isotropic
20	6	5	89	1	isotropic
21	6	10	84	1	reversed hexagonal
22	6	15	79	1	reversed hexagonal
23	6	20	74	1	reversed hexagonal
24	6	25	69	1	reversed hexagonal
25	6	30	64	1	reversed hexagonal
26	6	35	59	2	reversed hexagonal
27	6	40	54	2	reversed hexagonal

Table 1C Data of ternary phase diagram from glyceryl monooleate-sesame oil-water system (continued)

No.	Sesame oil	Water	Glyceryl monooleate	Phase	Description
28	8	0	92	1	isotropic
29	8	5	87	1	isotropic
30	8	10	82	1	reversed hexagonal
31	8	15	77	1	reversed hexagonal
32	8	20	72	1	reversed hexagonal
33	8	25	67	1	reversed hexagonal
34	8	30	62	1	reversed hexagonal
35	8	35	57	2	reversed hexagonal
36	8	40	52	2	reversed hexagonal
37	10	0	90	1	isotropic
38	10	5	85	1	isotropic
39	10	10	80	1	reversed hexagonal
40	10	15	75	1	reversed hexagonal
41	10	20	70	2	reversed hexagonal
42	10	25	65	2	reversed hexagonal
43	10	30	60	2	reversed hexagonal
44	10	35	55	1	isotropic
45	10	40	50	1	isotropic
46	12	0	88	1	isotropic
47	12	5	83	1	isotropic
48	12	10	78	1	reversed hexagonal
49	12	15	73	1	reversed hexagonal
50	12	20	68	1	reversed hexagonal
51	12	25	63	2	reversed hexagonal
52	12	30	58	2	reversed hexagonal
53	12	35	53	2	reversed hexagonal
54	12	40	48	2	reversed hexagonal

Table 1C Data of ternary phase diagram from glyceryl monooleate-sesame oil-water system (continued)

No.	Sesame oil	Water	Glyceryl monooleate	Phase	Description
55	15	0	85	1	isotropic
56	15	5	80	1	isotropic
57	15	10	75	1	reversed hexagonal
58	15	15	70	1	reversed hexagonal
59	15	20	65	1	reversed hexagonal
60	15	25	60	1	reversed hexagonal
61	15	30	55	1	isotropic
62	15	35	50	2	isotropic
63	15	40	45	2	isotropic
64	20	0	80	1	isotropic
65	20	5	75	1	isotropic
66	20	10	70	1	reversed hexagonal
67	20	15	65	1	reversed hexagonal
68	20	20	60	2	isotropic
69	20	25	55	2	isotropic
70	20	30	50	2	isotropic
71	20	35	45	2	isotropic
72	20	40	40	2	isotropic

APPENDIX D

Stability Data

Table 1D Percent remaining of doxycycline hyclate in chitosan microspheres optimal formulation at 40±1°C

Time(day)	%remaining of doxycycline			average	SD
	n1	n2	n3		
0	100	100	100	100.00	0.05
14	91.46	83.77	89.21	88.14	3.95
21	81.70	81.35	84.95	82.67	1.99
28	85.11	81.22	83.56	82.39	1.65
56	82.57	81.47	81.63	81.55	0.11
$k_{obs}(\%day^{-1})$	-0.2834	-0.2692	-0.2973	-0.2919	0.1187

Table 2D Percent remaining of doxycycline hyclate in chitosan microspheres optimal formulation at 50±1°C

Time(day)	%remaining			average	SD
	n1	n2	n3		
0	100	100	100	100.00	0.00
14	84.27	83.89	86.18	84.78	1.23
21	82.83	79.41	80.37	80.87	1.76
28	82.18	78.21	79.28	78.74	0.76
35	82.45	77.57	81.34	79.46	2.67
42	75.53	75.59	75.36	75.48	0.16
56	73.27	77.22	72.88	75.05	3.06
$k_{obs}(\%day^{-1})$	-0.4243	-0.3727	-0.4392	-0.4075	0.0349

Table 3D Percent remaining of doxycycline hyclate in chitosan microspheres optimal formulation at 60±1°C

Time(day)	%remaining			average	SD
	n1	n2	n3		
0	100	100	100	100.00	0.00
14	82.28	82.83	82.17	82.43	0.35
21	79.64	78.12	81.16	79.64	1.52
28	90.65	90.65	85.37	88.01	3.74
35	81.65	77.94	68.99	73.46	6.33
42	73.70	77.30	75.68	76.49	1.15
$k_{obs}(\%day^{-1})$	-0.4685	-0.4490	-0.5892	-0.5185	0.0759

Table 4D Percent remaining of doxycycline hyclate in chitosan microspheres optimal formulation at 70±1°C

Time(day)	%remaining			average	SD
	n1	n2	n3		
0	100	100	100	100.00	0.00
7	80.52	82.99	81.36	81.62	1.26
14	71.38	76.08	76.60	74.69	2.88
21	70.45	74.62	71.22	72.92	2.40
28	68.28	70.57	70.06	70.32	0.36
35	68.60	71.98	69.23	70.61	1.95
42	67.14	70.43	69.18	69.81	0.88
k_{obs}(%day^{-1})	-0.6404	-0.5930	-0.6289	-0.5969	0.0247

Table 5D Percent remaining of doxycycline hyclate in chitosan microspheres formulation 11 at 40±1°C

Time(day)	%remaining			average	SD
	n1	n2	n3		
0	100	100	100	100.00	0.04
14	84.88	85.16	90.23	86.76	3.01
21	84.83	82.12	79.32	82.09	2.76
28	85.38	86.29	88.30	87.30	1.42
56	78.91	78.48	85.58	82.03	5.02
k_{obs}(%day^{-1})	-0.3188	-0.3218	-0.2087	-0.2621	0.2093

Table 6D Percent remaining of doxycycline hyclate in chitosan microspheres formulation 11 at 50±1°C

Time(day)	%remaining			average	SD
	n1	n2	n3		
0	100	100	100	100.00	0.00
14	84.42	84.21	82.04	83.56	1.31
21	78.13	78.31	74.92	77.12	1.91
28	85.67	85.25	82.54	83.89	1.92
35	73.40	71.36	71.28	71.32	0.06
42	82.24	79.49	82.42	80.95	2.07
56	69.85	64.75	64.86	64.80	0.08
k_{obs}(%day^{-1})	-0.4412	-0.5354	-0.4879	-0.5163	0.0471

Table 7D Percent remaining of doxycycline hyclate in chitosan microspheres formulation 11 at 60±1°C

Time(day)	%remaining			average	SD
	n1	n2	n3		
0	100	100	100	100.00	0.00
14	80.58	78.11	78.65	79.11	1.30
21	63.73	64.21	74.21	67.38	5.92
28	69.02	66.96	65.46	66.21	1.06
35	60.45	56.01	61.30	58.65	3.74
42	58.44	56.34	63.28	59.81	4.90
56	50.63	49.75	52.73	51.24	2.11
k_{obs}(%day^{-1})	-0.8335	-0.8596	-0.7917	-0.9789	0.0343

Table 8D Percent remaining of doxycycline hyclate in chitosan microspheres formulation 11 at 70±1°C

Time(day)	%remaining			average	SD
	n1	n2	n3		
0	100	100	100	100.00	0.00
7	73.94	72.97	72.87	73.26	0.20
14	61.80	61.44	59.08	60.78	1.48
21	59.93	48.77	53.71	54.14	5.59
28	53.38	45.55	49.25	49.39	3.20
35	46.61	46.17	46.64	46.48	0.22
42	45.90	40.24	41.07	42.40	2.50
k_{obs}(%day^{-1})	-1.1499	-1.2693	-1.2198	-1.2130	0.0600

Table 9D Percent remaining of doxycycline hyclate in chitosan microspheres formulation 15 at 40±1°C

Time(day)	%remaining			average	SD
	n1	n2	n3		
0	100	100	100	100.00	0.09
14	77.58	91.20	87.12	85.30	6.99
21	83.89	86.34	86.68	85.63	1.52
28	78.29	87.35	84.19	85.77	2.24
56	74.43	81.44	80.89	81.17	0.39
k_{obs}(%day^{-1})	-0.3767	-0.3051	-0.3005	-0.2794	0.1228

Table 10D Percent remaining of doxycycline hyclate in chitosan microspheres formulation 15 at 50±1°C

Time(day)	%remaining			average	SD
	n1	n2	n3		
0	100	100	100	100.00	0.00
14	89.57	82.37	93.06	88.33	5.45
21	89.31	80.74	84.73	84.93	4.28
28	83.95	86.92	83.87	85.39	2.15
35	77.91	79.58	75.19	77.39	3.10
42	84.67	82.78	84.76	83.77	1.40
56	80.40	80.26	80.30	80.28	0.02
$k_{obs}(\%day^{-1})$	-0.3388	-0.2697	-0.3570	-0.3250	0.0461

Table 11D Percent remaining of doxycycline hyclate in chitosan microspheres formulation 15 at 60±1°C

Time(day)	%remaining			average	SD
	n1	n2	n3		
0	100	100	100	100.00	0.00
14	93.05	87.02	84.82	88.29	4.26
21	74.56	77.50	77.28	76.45	1.64
28	82.84	79.44	82.71	81.08	2.31
35	80.27	79.05	82.58	80.81	2.50
42	78.21	73.91	75.35	74.63	1.02
56	73.95	67.83	64.03	65.93	2.68
$k_{obs}(\%day^{-1})$	-0.4361	-0.5216	-0.5358	-0.5436	0.0540

Table 12D Percent remaining of doxycycline hyclate in chitosan microspheres formulation 15 at 70±1°C

Time(day)	%remaining			average	SD
	n1	n2	n3		
0	100	100	100	100.00	0.00
7	76.90	72.05	74.30	74.42	1.98
14	69.13	62.96	69.10	67.07	3.56
21	68.40	67.91	65.75	67.35	1.41
28	69.64	69.45	66.95	68.68	1.28
35	56.77	67.50	64.76	63.01	2.27
42	59.39	69.36	62.59	63.78	3.62
$k_{obs}(\%day^{-1})$	-0.8243	-0.4822	-0.6810	-0.6625	0.1718

APPENDIX E

Statistical Analysis Data

Table 1E One-way analysis of variance on the percents of drug release from microspheres optimal formulation, formulation 11 and 15

ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
TIME1	Between Groups	67.809	2	33.905	90.471	.000
	Within Groups	2.249	6	.375		
	Total	70.058	8			
TIME2	Between Groups	88.935	2	44.468	128.979	.000
	Within Groups	2.069	6	.345		
	Total	91.004	8			
TIME3	Between Groups	92.323	2	46.161	81.472	.000
	Within Groups	3.400	6	.567		
	Total	95.722	8			
TIME4	Between Groups	103.495	2	51.747	172.230	.000
	Within Groups	1.803	6	.300		
	Total	105.297	8			
TIME6	Between Groups	112.061	2	56.030	191.521	.000
	Within Groups	1.755	6	.293		
	Total	113.816	8			
TIME8	Between Groups	130.657	2	65.329	405.349	.000
	Within Groups	.967	6	.161		
	Total	131.624	8			
TIME12	Between Groups	159.679	2	79.839	497.855	.000
	Within Groups	.962	6	.160		
	Total	160.641	8			
TIME24	Between Groups	174.715	2	87.358	485.621	.000
	Within Groups	1.079	6	.180		
	Total	175.795	8			

Table 2E Multiple comparisons on the percents of drug release from microspheres optimal formulation, formulation 11 and 15

Multiple Comparisons

LSD

Dependent Variable	(I) RX	(J) RX	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
TIME1	8	11	2.2567(*)	.49984	.004	1.0336	3.4797
		15	-4.3567(*)	.49984	.000	-5.5797	-3.1336
	11	8	-2.2567(*)	.49984	.004	-3.4797	-1.0336
		15	-6.6133(*)	.49984	.000	-7.8364	-5.3903
	15	8	4.3567(*)	.49984	.000	3.1336	5.5797
		11	6.6133(*)	.49984	.000	5.3903	7.8364
TIME2	8	11	3.8400(*)	.47942	.000	2.6669	5.0131
		15	-3.8600(*)	.47942	.000	-5.0331	-2.6869
	11	8	-3.8400(*)	.47942	.000	-5.0131	-2.6669
		15	-7.7000(*)	.47942	.000	-8.8731	-6.5269
	15	8	3.8600(*)	.47942	.000	2.6869	5.0331
		11	7.7000(*)	.47942	.000	6.5269	8.8731
TIME3	8	11	4.0733(*)	.61459	.001	2.5695	5.5772
		15	-3.7700(*)	.61459	.001	-5.2739	-2.2661
	11	8	-4.0733(*)	.61459	.001	-5.5772	-2.5695
		15	-7.8433(*)	.61459	.000	-9.3472	-6.3395
	15	8	3.7700(*)	.61459	.001	2.2661	5.2739
		11	7.8433(*)	.61459	.000	6.3395	9.3472
TIME4	8	11	3.8000(*)	.44755	.000	2.7049	4.8951
		15	-4.4967(*)	.44755	.000	-5.5918	-3.4015
	11	8	-3.8000(*)	.44755	.000	-4.8951	-2.7049
		15	-8.2967(*)	.44755	.000	-9.3918	-7.2015
	15	8	4.4967(*)	.44755	.000	3.4015	5.5918
		11	8.2967(*)	.44755	.000	7.2015	9.3918
TIME6	8	11	3.9567(*)	.44163	.000	2.8760	5.0373
		15	-4.6767(*)	.44163	.000	-5.7573	-3.5960
	11	8	-3.9567(*)	.44163	.000	-5.0373	-2.8760
		15	-8.6333(*)	.44163	.000	-9.7140	-7.5527
	15	8	4.6767(*)	.44163	.000	3.5960	5.7573
		11	8.6333(*)	.44163	.000	7.5527	9.7140
TIME8	8	11	3.8700(*)	.32779	.000	3.0679	4.6721
		15	-5.4200(*)	.32779	.000	-6.2221	-4.6179
	11	8	-3.8700(*)	.32779	.000	-4.6721	-3.0679
		15	-9.2900(*)	.32779	.000	-10.0921	-8.4879
	15	8	5.4200(*)	.32779	.000	4.6179	6.2221
		11	9.2900(*)	.32779	.000	8.4879	10.0921
TIME12	8	11	3.7967(*)	.32697	.000	2.9966	4.5967
		15	-6.4100(*)	.32697	.000	-7.2101	-5.6099
	11	8	-3.7967(*)	.32697	.000	-4.5967	-2.9966
		15	-10.2067(*)	.32697	.000	-11.0067	-9.4066
	15	8	6.4100(*)	.32697	.000	5.6099	7.2101
		11	10.2067(*)	.32697	.000	9.4066	11.0067
TIME24	opt.	11	3.7733(*)	.34630	.000	2.9260	4.6207
		15	-6.8700(*)	.34630	.000	-7.7174	-6.0226
	11	opt.	-3.7733(*)	.34630	.000	-4.6207	-2.9260
		15	-10.6433(*)	.34630	.000	-11.4907	-9.7960
	15	opt.	6.8700(*)	.34630	.000	6.0226	7.7174
		11	10.6433(*)	.34630	.000	9.7960	11.4907

* The mean difference is significant at the .05 level.

Table 3E One-way analysis of variance on the coefficient of determination of the kinetic models of doxycycline hyclate loaded in chitosan microspheres

ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
RX8	Between Groups	61.608	2	30.804	755.450	.000
	Within Groups	.245	6	.041		
	Total	61.853	8			
RX11	Between Groups	27.464	2	13.732	343.263	.000
	Within Groups	.240	6	.040		
	Total	27.704	8			
RX15	Between Groups	108.526	2	54.263	1445.225	.000
	Within Groups	.225	6	.038		
	Total	108.751	8			

Table 4E Multiple comparisons on the coefficient of determination of the kinetic models of doxycycline hyclate loaded in chitosan microspheres

Multiple Comparisons

LSD

Dependent Variable	(I) KINETIC	(J) KINETIC	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
RX8	1	2	2.787667	.1648751	.000	2.384232	3.191102
		3	-3.603733	.1648751	.000	-4.007168	-3.200298
	2	1	-2.787667	.1648751	.000	-3.191102	-2.384232
		3	-6.391400	.1648751	.000	-6.794835	-5.987965
	3	1	3.603733	.1648751	.000	3.200298	4.007168
		2	6.391400	.1648751	.000	5.987965	6.794835
RX11	1	2	1.834733	.1633082	.000	1.435132	2.234334
		3	-2.430367	.1633082	.000	-2.829968	-2.030766
	2	1	-1.834733	.1633082	.000	-2.234334	-1.435132
		3	-4.265100	.1633082	.000	-4.664701	-3.865499
	3	1	2.430367	.1633082	.000	2.030766	2.829968
		2	4.265100	.1633082	.000	3.865499	4.664701
RX15	1	2	3.638300	.1582115	.000	3.251170	4.025430
		3	-4.839300	.1582115	.000	-5.226430	-4.452170
	2	1	-3.638300	.1582115	.000	-4.025430	-3.251170
		3	-8.477600	.1582115	.000	-8.864730	-8.090470
	3	1	4.839300	.1582115	.000	4.452170	5.226430
		2	8.477600	.1582115	.000	8.090470	8.864730

* The mean difference is significant at the .05 level.
* 1 is the zero-order kinetics
* 2 is the first-order kinetics
* 3 is the Higuchi model

Table 5E One-way analysis of variance on the percents of drug release from microspheres optimal formulation, 11 and 15 in glyceryl monooleate-based drug delivery system

ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
TIME2	Between Groups	134.246	3	44.749	869.372	.000
	Within Groups	.412	opt.	.051		
	Total	134.657	11			
TIME4	Between Groups	437.933	3	145.978	1125.353	.000
	Within Groups	1.038	opt.	.130		
	Total	438.971	11			
TIME6	Between Groups	722.878	3	240.959	862.952	.000
	Within Groups	2.234	opt.	.279		
	Total	725.112	11			
TIME8	Between Groups	946.463	3	315.488	385.865	.000
	Within Groups	6.541	opt.	.818		
	Total	953.004	11			
TIME10	Between Groups	1177.112	3	392.371	334.110	.000
	Within Groups	9.395	opt.	1.174		
	Total	1186.507	11			
TIME12	Between Groups	1390.613	3	463.538	399.969	.000
	Within Groups	9.271	opt.	1.159		
	Total	1399.885	11			
TIME24	Between Groups	2483.224	3	827.741	835.297	.000
	Within Groups	7.928	opt.	.991		
	Total	2491.152	11			
TIME48	Between Groups	3277.695	3	1092.565	238.079	.000
	Within Groups	36.713	opt.	4.589		
	Total	3314.407	11			

Table 6E Multiple comparisons on the percents of drug release from microspheres optimal formulation, formulation 11 and 15 in glyceryl monooleate-based drug delivery system

Multiple Comparisons

LSD

Dependent Variable	(I) Formulation	(J) Formulation	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
TIME2	Control	opt.	7.9780(*)	.18524	.000	7.5508	8.4051
		11	8.3441(*)	.18524	.000	7.9169	8.7713
		15	4.8298(*)	.18524	.000	4.4026	5.2569
	opt.	Control	-7.9780(*)	.18524	.000	-8.4051	-7.5508
		11	.3662	.18524	.083	-.0610	.7933
		15	-3.1482(*)	.18524	.000	-3.5754	-2.7210
	11	Control	-8.3441(*)	.18524	.000	-8.7713	-7.9169
		opt.	-.3662	.18524	.083	-.7933	.0610
		15	-3.5143(*)	.18524	.000	-3.9415	-3.0872
	15	Control	-4.8298(*)	.18524	.000	-5.2569	-4.4026
		8	3.1482(*)	.18524	.000	2.7210	3.5754
		11	3.5143(*)	.18524	.000	3.0872	3.9415
TIME4	Control	opt.	14.3322(*)	.29407	.000	13.6541	15.0103
		11	15.2096(*)	.29407	.000	14.5315	15.8878
		15	9.4158(*)	.29407	.000	8.7377	10.0940
	opt.	Control	-14.3322(*)	.29407	.000	-15.0103	-13.6541
		11	.8775(*)	.29407	.017	.1993	1.5556
		15	-4.9163(*)	.29407	.000	-5.5945	-4.2382
	11	Control	-15.2096(*)	.29407	.000	-15.8878	-14.5315
		opt.	-.8775(*)	.29407	.017	-1.5556	-.1993
		15	-5.7938(*)	.29407	.000	-6.4719	-5.1157
	15	Control	-9.4158(*)	.29407	.000	-10.0940	-8.7377
		opt.	4.9163(*)	.29407	.000	4.2382	5.5945
		11	5.7938(*)	.29407	.000	5.1157	6.4719
TIME6	Control	opt.	18.2309(*)	.43145	.000	17.2359	19.2258
		11	19.6863(*)	.43145	.000	18.6914	20.6813
		15	12.0269(*)	.43145	.000	11.0320	13.0218
	opt.	Control	-18.2309(*)	.43145	.000	-19.2258	-17.2359
		11	1.4555(*)	.43145	.010	.4606	2.4504
		15	-6.2039(*)	.43145	.000	-7.1989	-5.2090
	11	Control	-19.6863(*)	.43145	.000	-20.6813	-18.6914
		opt.	-1.4555(*)	.43145	.010	-2.4504	-.4606
		15	-7.6594(*)	.43145	.000	-8.6544	-6.6645
	15	Control	-12.0269(*)	.43145	.000	-13.0218	-11.0320
		opt.	6.2039(*)	.43145	.000	5.2090	7.1989
		11	7.6594(*)	.43145	.000	6.6645	8.6544
TIME8	Control	opt.	20.6832(*)	.73829	.000	18.9807	22.3858
		11	22.6357(*)	.73829	.000	20.9332	24.3382
		15	13.3899(*)	.73829	.000	11.6874	15.0924
	opt.	Control	-20.6832(*)	.73829	.000	-22.3858	-18.9807
		11	1.9525(*)	.73829	.030	.2500	3.6550
		15	-7.2933(*)	.73829	.000	-8.9958	-5.5908
	11	Control	-22.6357(*)	.73829	.000	-24.3382	-20.9332
		opt.	-1.9525(*)	.73829	.030	-3.6550	-.2500
		15	-9.2458(*)	.73829	.000	-10.9483	-7.5433
	15	Control	-13.3899(*)	.73829	.000	-15.0924	-11.6874
		opt.	7.2933(*)	.73829	.000	5.5908	8.9958
		11	9.2458(*)	.73829	.000	7.5433	10.9483

* The mean difference is significant at the .05 level.

Table 6E Multiple comparisons on the percents of drug release from microspheres optimal formulation, formulation 11 and 15 in glyceryl monooleate-based drug delivery system (continued)

Multiple Comparisons

LSD

Dependent Variable	(I) Formulation	(J) Formulation	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
TIME10	Control	opt.	22.9610(*)	.88483	.000	20.9206	25.0014
		11	25.3101(*)	.88483	.000	23.2696	27.3505
		15	14.7929(*)	.88483	.000	12.7525	16.8334
	opt.	Control	-22.9610(*)	.88483	.000	-25.0014	-20.9206
		11	2.3490(*)	.88483	.029	.3086	4.3894
		15	-8.1681(*)	.88483	.000	-10.2085	-6.1277
	11	Control	-25.3101(*)	.88483	.000	-27.3505	-23.2696
		opt.	-2.3490(*)	.88483	.029	-4.3894	-.3086
		15	-10.5171(*)	.88483	.000	-12.5575	-8.4767
	15	Control	-14.7929(*)	.88483	.000	-16.8334	-12.7525
		opt.	8.1681(*)	.88483	.000	6.1277	10.2085
		11	10.5171(*)	.88483	.000	8.4767	12.5575
TIME12	Control	opt.	24.8871(*)	.87899	.000	22.8602	26.9141
		11	27.5638(*)	.87899	.000	25.5369	29.5908
		15	16.0990(*)	.87899	.000	14.0720	18.1259
	opt.	Control	-24.8871(*)	.87899	.000	-26.9141	-22.8602
		11	2.6767(*)	.87899	.016	.6497	4.7037
		15	-8.7882(*)	.87899	.000	-10.8151	-6.7612
	11	Control	-27.5638(*)	.87899	.000	-29.5908	-25.5369
		opt.	-2.6767(*)	.87899	.016	-4.7037	-.6497
		15	-11.4649(*)	.87899	.000	-13.4918	-9.4379
	15	Control	-16.0990(*)	.87899	.000	-18.1259	-14.0720
		opt.	8.7882(*)	.87899	.000	6.7612	10.8151
		11	11.4649(*)	.87899	.000	9.4379	13.4918
TIME24	Control	opt.	32.8244(*)	.81280	.000	30.9501	34.6987
		11	36.7028(*)	.81280	.000	34.8285	38.5772
		15	18.7716(*)	.81280	.000	16.8973	20.6460
	opt.	Control	-32.8244(*)	.81280	.000	-34.6987	-30.9501
		11	3.8784(*)	.81280	.001	2.0041	5.7527
		15	-14.0528(*)	.81280	.000	-15.9271	-12.1785
	11	Control	-36.7028(*)	.81280	.000	-38.5772	-34.8285
		opt.	-3.8784(*)	.81280	.001	-5.7527	-2.0041
		15	-17.9312(*)	.81280	.000	-19.8055	-16.0569
	15	Control	-18.7716(*)	.81280	.000	-20.6460	-16.8973
		opt.	14.0528(*)	.81280	.000	12.1785	15.9271
		11	17.9312(*)	.81280	.000	16.0569	19.8055
TIME48	Control	opt.	35.1622(*)	1.74911	.000	31.1287	39.1957
		11	43.9141(*)	1.74911	.000	39.8807	47.9476
		15	30.3736(*)	1.74911	.000	26.3401	34.4071
	opt.	Control	-35.1622(*)	1.74911	.000	-39.1957	-31.1287
		11	8.7519(*)	1.74911	.001	4.7185	12.7854
		15	-4.7886(*)	1.74911	.026	-8.8221	-.7552
	11	Control	-43.9141(*)	1.74911	.000	-47.9476	-39.8807
		opt.	-8.7519(*)	1.74911	.001	-12.7854	-4.7185
		15	-13.5405(*)	1.74911	.000	-17.5740	-9.5071
	15	Control	-30.3736(*)	1.74911	.000	-34.4071	-26.3401
		opt.	4.7886(*)	1.74911	.026	.7552	8.8221
		11	13.5405(*)	1.74911	.000	9.5071	17.5740

* The mean difference is significant at the .05 level.

Table 7E One-way analysis of variance on the coefficient of determination of the kinetic models of doxycycline hyclate loaded or unloaded in chitosan microspheres incorporated in glyceryl monooleate

ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
Optimal formulation	Between Groups	2.873	2	1.437	1787.640	.000
	Within Groups	.005	6	.001		
	Total	2.878	8			
Formulation 11	Between Groups	.337	2	.169	211.393	.000
	Within Groups	.005	6	.001		
	Total	.342	8			
Formulation 15	Between Groups	29.038	2	14.519	232.492	.000
	Within Groups	.375	6	.062		
	Total	29.413	8			
Control	Between Groups	116.758	2	58.379	1430.987	.000
	Within Groups	.245	6	.041		
	Total	117.003	8			

Table 8E Multiple comparisons on the coefficient of determination of the kinetic models of doxycycline hyclate loaded or unloaded in chitosan microspheres incorporated in glyceryl monooleate

Multiple Comparisons

LSD

Dependent Variable	(I) KINETIC	(J) KINETIC	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
Optimal formulation	1	2	.242176(*)	.0231473	.000	.185536	.298815
		3	-1.059055(*)	.0231473	.000	-1.115695	-1.002416
	2	1	-.242176(*)	.0231473	.000	-.298815	-.185536
		3	-1.301231(*)	.0231473	.000	-1.357871	-1.244592
	3	1	1.059055(*)	.0231473	.000	1.002416	1.115695
		2	1.301231(*)	.0231473	.000	1.244592	1.357871
Formulation 11	1	2	.078388(*)	.0230570	.015	.021970	.134807
		3	-.365730(*)	.0230570	.000	-.422148	-.309311
	2	1	-.078388(*)	.0230570	.015	-.134807	-.021970
		3	-.444118(*)	.0230570	.000	-.500536	-.387700
	3	1	.365730(*)	.0230570	.000	.309311	.422148
		2	.444118(*)	.0230570	.000	.387700	.500536
Formulation 15	1	2	.772484(*)	.2040420	.009	.273211	1.271757
		3	-3.364955(*)	.2040420	.000	-3.864228	-2.865682
	2	1	-.772484(*)	.2040420	.009	-1.271757	-.273211
		3	-4.137439(*)	.2040420	.000	-4.636712	-3.638166
	3	1	3.364955(*)	.2040420	.000	2.865682	3.864228
		2	4.137439(*)	.2040420	.000	3.638166	4.636712
Control	1	2	1.473041(*)	.1649171	.000	1.069504	1.876579
		3	-6.796859(*)	.1649171	.000	-7.200396	-6.393321
	2	1	-1.473041(*)	.1649171	.000	-1.876579	-1.069504
		3	-8.269900(*)	.1649171	.000	-8.673438	-7.866363
	3	1	6.796859(*)	.1649171	.000	6.393321	7.200396
		2	8.269900(*)	.1649171	.000	7.866363	8.673438

* The mean difference is significant at the .05 level.

* 1 is the zero-order kinetics
* 2 is the first-order kinetics
* 3 is the Higuchi model

Table 9E One-way analysis of variance on the viscosity values of low-viscous state formulation

ANOVA

VICOSITY

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	207759.929	3	69253.310	441.171	.000
Within Groups	1255.809	8	156.976		
Total	209015.738	11			

Table 10E Multiple Comparisons on the viscosity values of low-viscous state formulation

Multiple Comparisons

Dependent Variable: VICOSITY

LSD

(I) Formulation	(J) Formulation	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
1	2	-86.0133(*)	10.22989	.000	-109.6035	-62.4232
	3	-356.5567(*)	10.22989	.000	-380.1468	-332.9665
	4	-143.5633(*)	10.22989	.000	-167.1535	-119.9732
2	1	86.0133(*)	10.22989	.000	62.4232	109.6035
	3	-270.5433(*)	10.22989	.000	-294.1335	-246.9532
	4	-57.5500(*)	10.22989	.000	-81.1402	-33.9598
3	1	356.5567(*)	10.22989	.000	332.9665	380.1468
	2	270.5433(*)	10.22989	.000	246.9532	294.1335
	4	212.9933(*)	10.22989	.000	189.4032	236.5835
4	1	143.5633(*)	10.22989	.000	119.9732	167.1535
	2	57.5500(*)	10.22989	.000	33.9598	81.1402
	3	-212.9933(*)	10.22989	.000	-236.5835	-189.4032

* The mean difference is significant at the .05 level.

*1 is blank glyceryl monooleate-based drug delivery system

* 2 is glyceryl monooleate-based drug delivery system contain chitosan microspheres optimal formulation

* 3 is glyceryl monooleate-based drug delivery system contain chitosan microspheres formulation 11

* 4 is glyceryl monooleate-based drug delivery system contain chitosan microspheres formulation 15

Table 11E One-way analysis of variance on the microbiological test of optimal formulation, formulation 11 and 15 in glycerylmonooleate-based drug delivery system

ANOVA

Inhibition zone

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	12.740	2	6.370	3.884	.083
Within Groups	9.840	6	1.640		
Total	22.580	8			

Table 12E Multiple Comparisons on the microbiological test of optimal formulation, formulation 11 and 15 in glycerylmonooleate-based drug delivery system

Multiple Comparisons

Dependent Variable: inhibition zone

LSD

(I) formulation	(J) formulation	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Opt.	11	2.1000	1.04563	.091	-.4586	4.6586
	15	-.7000	1.04563	.528	-3.2586	1.8586
11	Opt.	-2.1000	1.04563	.091	-4.6586	.4586
	15	-2.8000	1.04563	.037	-5.3586	-.2414
15	Opt.	.7000	1.04563	.528	-1.8586	3.2586
	11	2.8000	1.04563	.037	.2414	5.3586

* The mean difference is significant at the .05 level.

VITA

Miss Khanittha Singhirunnusorn was born on August 16, 1979 in Singburi, Thailand. She received her Bachelor's degree in Pharmacy from the Faculty of Pharmacy, Mahidol University, Bangkok, Thailand in 2002. Before she entered the Master's degree program in Pharmacy at Chulalongkorn University in 2004, she had worked at Bureau of Drug and Narcotic, Department of Medical Sciences, Ministry of Public Health, Nonthaburi, Thailand.