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APPENDIX A

Test Results of Chitosan

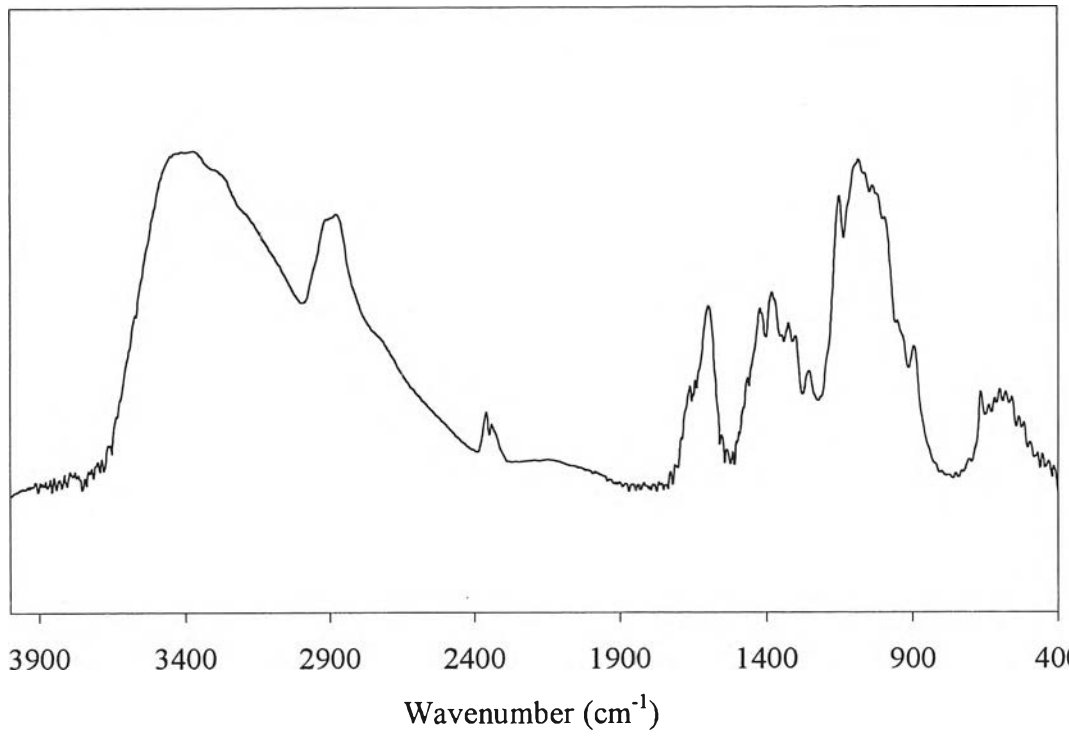

Figure A1 FTIR spectrum of chitosan.

Table A1 Intrinsic viscosity measurement of chitosan

Conc. (g/dL)	Time (s)						η_{red} (dL/g)	η_{inh} (dL/g)
	1	2	3	4	5	Avg		
0.00	97.86	97.77	97.88	97.82	97.85	97.84	-	-
0.01	102.78	102.73	102.69	102.69	102.69	102.72	4.99	4.87
0.02	107.71	107.63	107.71	107.73	107.60	107.68	5.03	4.79
0.03	112.82	112.65	112.65	112.82	112.65	112.72	5.07	4.72
0.05	123.19	123.30	123.21	123.23	123.15	123.22	5.19	4.61
0.10	152.63	152.82	152.83	152.77	152.74	152.76	5.61	4.46

Table A2 Solution viscosity at room temperature of chitosan solutions in 4% (v/v) aqueous acetic acid

Chitosan concentration (% w/v)	Solution viscosity (poises)*
5	13.21
6	31.82
7	83.00
8	272.50
9	951.00
10	EEEE

* Measured after aging overnight at room temperature.

APPENDIX B

Test Results of Atomic Absorption Spectroscopic Measurement

Table B1 Atomic absorption spectroscopic test results of Ca content in chitosan fiber prepared by using $CaCl_2$ saturated 50% aqueous methanol as the first coagulant

Spinning condition	Weight of sample per 50-mL stock solution (g)	Ca content in final solution* (mg/L)†	Ca content in stock solution (mg/L)	Ca content in sample‡ (mg)	Ca content§ (mg/100 g fiber)
A	0.1593	0.66	0.66	0.033	20.72
B	0.1514	2.01	20.1	1.005	663.80
C	0.1556	0.50	5.0	0.25	160.67
D	0.1560	0.54	5.4	0.27	173.08

* The stock solution was diluted 10 times except sample A.

† Measured using atomic absorption spectrophotometer (Varian SpectrAA 300P); wavelength = 422.7 nm; nitrous oxide-acetylene flame; a calibration curve created from 1, 2, and 3 ppm standard Ca solutions.

‡ Ca content in sample (mg) = Ca content in stock solution (mg/L) x 50 mL.

§ Ca content (mg/100 g fiber) = Ca content in sample (mg)/Weight of sample (g) x 100.

APPENDIX C

Test Results of Chitosan Fibers Prepared from Spinning Condition A, B, C, D, E, F, and G (Table 4.1)

Table C1 Weight of 15-cm chitosan fibers prepared from spinning condition A, B, C, D, E, F, and G

Sample no.	Weight of chitosan fiber (g)						
	A	B	C	D	E	F	G
1	0.0067	0.0059	0.0062	0.0057	0.0038	0.0045	0.0042
2	0.0071	0.0060	0.0070	0.0057	0.0044	0.0044	0.0043
3	0.0068	0.0061	0.0060	0.0061	0.0045	0.0043	0.0042
4	0.0068	0.0060	0.0061	0.0059	0.0038	0.0045	0.0043
5	0.0064	0.0060	0.0066	0.0059	0.0044	0.0043	0.0044
6	0.0072	0.0059	0.0061	0.0066	0.0037	0.0043	0.0042
7	0.0072	0.0059	0.0055	0.0053	0.0045	0.0044	0.0041
8	0.0069	0.0060	0.0066	0.0065	0.0044	0.0045	0.0044
9	0.0070	0.0061	0.0061	0.0061	0.0044	0.0044	0.0042
10	0.0068	0.0061	0.0065	0.0068	0.0046	0.0044	0.0042
11	0.0072	0.0062	0.0057	0.0067	0.0044	0.0043	0.0040
12	0.0064	0.0061	0.0063	0.0063	0.0044	0.0045	0.0044
13	0.0064	0.0061	0.0061	0.0074	0.0044	0.0043	0.0042
14	0.0072	0.0059	0.0063	0.0065	0.0038	0.0044	0.0043
15	0.0069	0.0060	0.0055	0.0062	0.0044	0.0046	0.0042
16	0.0066	0.0060	0.0064	0.0064	0.0045	0.0043	0.0043
17	0.0073	0.0060	0.0066	0.0057	0.0046	0.0045	0.0043
18	0.0071	0.0061	0.0062	0.0058	0.0045	0.0046	0.0042
19	0.0070	0.0061	0.0063	0.0055	0.0045	0.0045	0.0044
20	0.0068	0.0062	0.0063	0.0059	0.0045	0.0045	0.0041
21	0.0071	0.0060	0.0065	0.0067	0.0039	0.0045	0.0040
22	0.0064	0.0061	0.0069	0.0052	0.0044	0.0045	0.0043
23	0.0070	0.0062	0.0071	0.0056	0.0038	0.0044	0.0043
24	0.0064	0.0060	0.0069	0.0061	0.0039	0.0044	0.0041
25	0.0068	0.0062	0.0058	0.0067	0.0044	0.0046	0.0040

Cont.....

Table C1 (Continued)

Sample no.	Weight of chitosan fiber (g)						
	A	B	C	D	E	F	G
26	0.0067	0.0061	0.0069	0.0073	0.0045	0.0045	0.0041
27	0.0070	0.0062	0.0060	0.0069	0.0038	0.0044	0.0041
28	0.0072	0.0060	0.0066	0.0057	0.0043	0.0045	0.0042
29	0.0067	0.0061	0.0059	0.0061	0.0045	0.0044	0.0042
30	0.0073	0.0060	0.0064	0.0075	0.0043	0.0046	0.0042
31	0.0065	0.0061	0.0059	0.0063	0.0038	0.0044	0.0043
32	0.0070	0.0060	0.0065	0.0062	0.0044	0.0045	0.0043
33	0.0067	0.0061	0.0063	0.0068	0.0044	0.0044	0.0041
34	0.0073	0.0060	0.0071	0.0066	0.0037	0.0045	0.0042
35	0.0069	0.0061	0.0065	0.0074	0.0044	0.0043	0.0043
36	0.0070	0.0059	0.0068	0.0052	0.0039	0.0045	0.0041
37	0.0066	0.0062	0.0069	0.0060	0.0042	0.0044	0.0043
38	0.0067	0.0059	0.0064	0.0056	0.0041	0.0045	0.0042
39	0.0067	0.0060	0.0063	0.0052	0.0045	0.0045	0.0041
40	0.0072	0.0059	0.0062	0.0061	0.0038	0.0045	0.0041
41	0.0071	0.0061	0.0072	0.0057	0.0045	0.0045	0.0043
42	0.0067	0.0060	0.0063	0.0074	0.0043	0.0045	0.0041
43	0.0070	0.0059	0.0068	0.0069	0.0041	0.0045	0.0041
44	0.0068	0.0060	0.0072	0.0072	0.0037	0.0045	0.0043
45	0.0071	0.0062	0.0070	0.0060	0.0040	0.0043	0.0042
46	0.0068	0.0059	0.0069	0.0063	0.0042	0.0044	0.0041
47	0.0065	0.0059	0.0064	0.0058	0.0043	0.0044	0.0041
48	0.0066	0.0059	0.0064	0.0063	0.0044	0.0045	0.0041
49	0.0066	0.0060	0.0067	0.0064	0.0037	0.0044	0.0041
50	0.0069	0.0059	0.0059	0.0061	0.0041	0.0044	0.0041
Avg (g)	0.0069	0.0060	0.0064	0.0062	0.0042	0.0044	0.0042
SD	0.0003	0.0001	0.0004	0.0006	0.0003	0.0001	0.0001
L.D.* (tex)	45.7	40.2	42.8	41.6	28.1	29.6	28.0
SD	1.8	0.7	2.8	4.1	2.0	0.6	0.7

* Linear density (tex) = (Average weight in gram per 15-cm length x 1000)/0.15.

Tensile Strength and Elongation at Break of Chitosan Fibers Prepared from Spinning Condition A, B, C, D, E, F, and G (Table 4.1)

Table C2 Tensile strength and elongation at break of chitosan fiber prepared from spinning condition A

Sample no.	Weight (g/15 cm)	Linear density* (tex)	Max. load (N)	Tensile strength† (cN/tex)	Elongation at break (%)
1	0.0071	47.3	3.635	7.68	6.911
2	0.0068	45.3	3.431	7.57	5.580
3	0.0060	40.0	3.252	8.13	6.511
4	0.0072	48.0	3.707	7.72	6.178
5	0.0072	48.0	4.040	8.42	7.611
6	0.0069	46.0	3.668	7.97	7.029
7	0.0070	46.7	3.236	6.93	5.796
8	0.0064	42.7	3.389	7.94	6.777
9	0.0072	48.0	3.833	7.99	6.629
10	0.0069	46.0	3.542	7.70	6.429
11	0.0060	40.0	3.375	8.44	7.162
12	0.0070	46.7	3.184	6.82	5.313
13	0.0071	47.3	3.705	7.83	6.265
14	0.0064	42.7	3.270	7.66	7.198
15	0.0064	42.7	3.063	7.18	5.998
16	0.0068	45.3	3.272	7.22	7.128
17	0.0070	46.7	3.714	7.96	7.798
18	0.0075	50.0	3.999	8.00	6.579
19	0.0073	48.7	4.089	8.40	6.729
20	0.0067	44.7	3.691	8.26	5.044
Avg	-	-	-	7.79	6.533
SD	-	-	-	0.47	0.729

* Linear density (tex) = (Weight of fiber in gram per 15-cm length x 1000)/0.15.

† Tensile strength (cN/tex) = (Max. load in Newton x 100)/Linear density in tex.

Table C3 Tensile strength and elongation at break of chitosan fiber prepared from spinning condition B

Sample no.	Weight (g/15 cm)	Linear density* (tex)	Max. load (N)	Tensile strength† (cN/tex)	Elongation at break (%)
1	0.0059	39.3	4.178	10.62	6.511
2	0.0061	40.7	4.395	10.81	6.295
3	0.0060	40.0	4.243	10.61	6.198
4	0.0061	40.7	4.306	10.59	6.031
5	0.0062	41.3	4.451	10.77	7.113
6	0.0061	40.7	4.400	10.82	6.610
7	0.0059	39.3	4.238	10.77	5.965
8	0.0060	40.0	4.334	10.84	6.744
9	0.0060	40.0	4.346	10.87	6.410
10	0.0060	40.0	4.414	11.04	6.965
11	0.0062	41.3	4.438	10.74	6.978
12	0.0060	40.0	4.379	10.95	7.111
13	0.0062	41.3	4.451	10.77	6.245
14	0.0059	39.3	4.300	10.93	7.113
15	0.0056	37.3	4.094	10.97	6.062
16	0.0059	39.3	4.407	11.20	6.413
17	0.0060	40.0	4.248	10.62	6.080
18	0.0061	40.7	4.277	10.52	6.098
19	0.0061	40.7	4.522	11.12	6.281
20	0.0065	43.3	4.738	10.93	7.162
Avg	-	-	-	10.82	6.519
SD	-	-	-	0.18	0.421

* Linear density (tex) = (Weight of fiber in gram per 15-cm length x 1000)/0.15.

† Tensile strength (cN/tex) = (Max. load in Newton x 100)/Linear density in tex.

Table C4 Tensile strength and elongation at break of chitosan fiber prepared from spinning condition C

Sample no.	Weight (g/15 cm)	Linear density* (tex)	Max. load (N)	Tensile strength† (cN/tex)	Elongation at break (%)
1	0.0062	41.3	3.211	7.77	7.263
2	0.0076	50.7	3.998	7.89	6.579
3	0.0061	40.7	3.403	8.37	6.495
4	0.0055	36.7	2.933	8.00	7.496
5	0.0061	40.7	3.591	8.83	5.746
6	0.0061	40.7	3.582	8.81	6.564
7	0.0065	43.3	3.883	8.96	5.931
8	0.0057	38.0	2.860	7.53	6.180
9	0.0063	42.0	3.808	9.07	7.128
10	0.0061	40.7	3.337	8.21	5.498
11	0.0063	42.0	3.366	8.01	7.210
12	0.0055	36.7	2.852	7.78	6.298
13	0.0064	42.7	3.198	7.50	5.728
14	0.0066	44.0	3.466	7.88	5.480
15	0.0062	41.3	3.687	8.92	6.495
16	0.0063	42.0	3.765	8.96	7.413
17	0.0058	38.7	3.372	8.72	7.095
18	0.0070	46.7	3.679	7.88	6.431
19	0.0066	44.0	3.976	9.04	6.479
20	0.0072	48.0	4.163	8.67	6.179
Avg	-	-	-	8.34	6.484
SD	-	-	-	0.55	0.626

* Linear density (tex) = (Weight of fiber in gram per 15-cm length x 1000)/0.15.

† Tensile strength (cN/tex) = (Max. load in Newton x 100)/Linear density in tex.

Table C5 Tensile strength and elongation at break of chitosan fiber prepared from spinning condition D

Sample no.	Weight (g/15 cm)	Linear density* (tex)	Max. load (N)	Tensile strength† (cN/tex)	Elongation at break (%)
1	0.0061	40.7	2.979	7.33	6.865
2	0.0059	39.3	3.236	8.23	5.665
3	0.0075	50.0	3.684	7.37	5.913
4	0.0066	44.0	3.741	8.50	6.480
5	0.0045	30.0	2.171	7.24	5.977
6	0.0061	40.7	3.326	8.18	6.198
7	0.0068	45.3	3.420	7.54	5.510
8	0.0050	33.3	2.590	7.77	5.762
9	0.0074	49.3	3.979	8.07	5.365
10	0.0065	43.3	3.404	7.86	5.498
11	0.0062	41.3	3.500	8.47	6.280
12	0.0055	36.7	3.084	8.41	5.313
13	0.0059	39.3	3.252	8.27	6.098
14	0.0057	38.0	2.945	7.75	5.598
15	0.0067	44.7	3.697	8.28	6.880
16	0.0063	42.0	3.534	8.41	6.810
17	0.0038	25.3	1.984	7.83	6.098
18	0.0043	28.7	2.082	7.26	6.362
19	0.0067	44.7	3.208	7.18	6.310
20	0.0061	40.7	3.154	7.76	5.331
Avg	-	-	-	7.89	6.016
SD	-	-	-	0.45	0.509

* Linear density (tex) = (Weight of fiber in gram per 15-cm length x 1000)/0.15.

† Tensile strength (cN/tex) = (Max. load in Newton x 100)/Linear density in tex.

Table C6 Tensile strength and elongation at break of chitosan fiber prepared from spinning condition E

Sample no.	Weight (g/15 cm)	Linear density* (tex)	Max. load (N)	Tensile strength† (cN/tex)	Elongation at break (%)
1	0.0032	21.3	2.342	10.98	9.513
2	0.0045	30.0	3.289	10.96	12.70
3	0.0038	25.3	3.111	12.28	10.10
4	0.0044	29.3	3.554	12.12	13.61
5	0.0044	29.3	3.166	10.79	11.13
6	0.0044	29.3	3.058	10.43	11.86
7	0.0045	30.0	3.092	10.31	12.98
8	0.0045	30.0	3.468	11.56	13.51
9	0.0045	30.0	3.375	11.25	11.46
10	0.0045	30.0	3.100	10.33	12.28
11	0.0039	26.0	3.002	11.55	9.865
12	0.0039	26.0	3.087	11.87	10.01
13	0.0044	29.3	3.323	11.33	14.00
14	0.0045	30.0	3.400	11.33	11.91
15	0.0046	30.7	3.759	12.26	9.528
16	0.0038	25.3	2.629	10.38	15.05
17	0.0044	29.3	3.127	10.66	13.70
18	0.0046	30.7	3.449	11.25	13.20
19	0.0038	25.3	2.780	10.97	11.36
20	0.0046	30.7	3.328	10.85	10.47
Avg	-	-	-	11.17	11.91
SD	-	-	-	0.62	1.66

* Linear density (tex) = (Weight of fiber in gram per 15-cm length x 1000)/0.15.

† Tensile strength (cN/tex) = (Max. load in Newton x 100)/Linear density in tex.

Table C7 Tensile strength and elongation at break of chitosan fiber prepared from spinning condition F

Sample no.	Weight (g/15 cm)	Linear density* (tex)	Max. load (N)	Tensile strength† (cN/tex)	Elongation at break (%)
1	0.0044	29.3	2.597	8.85	7.465
2	0.0043	28.7	2.336	8.15	5.995
3	0.0044	29.3	2.964	10.10	9.662
4	0.0044	29.3	2.593	8.84	7.265
5	0.0044	29.3	2.603	8.87	7.064
6	0.0043	28.7	2.754	9.61	8.912
7	0.0044	29.3	2.613	8.91	8.546
8	0.0046	30.7	2.785	9.08	9.564
9	0.0047	31.3	2.768	8.83	9.413
10	0.0045	30.0	2.819	9.40	9.446
11	0.0046	30.7	2.600	8.48	8.331
12	0.0045	30.0	2.892	9.64	9.512
13	0.0045	30.0	2.492	8.31	5.598
14	0.0045	30.0	2.712	9.04	7.298
15	0.0044	29.3	2.985	10.18	9.665
16	0.0046	30.7	2.623	8.55	8.031
17	0.0045	30.0	3.064	10.21	5.798
18	0.0045	30.0	2.954	9.85	10.15
19	0.0043	28.7	2.572	8.97	8.631
20	0.0044	29.3	2.735	9.32	5.932
Avg	-	-	-	9.16	8.114
SD	-	-	-	0.61	1.477

* Linear density (tex) = (Weight of fiber in gram per 15-cm length x 1000)/0.15.

† Tensile strength (cN/tex) = (Max. load in Newton x 100)/Linear density in tex.

Table C8 Tensile strength and elongation at break of chitosan fiber prepared from spinning condition G

Sample no.	Weight (g/15 cm)	Linear density* (tex)	Max. load (N)	Tensile strength† (cN/tex)	Elongation at break (%)
1	0.0043	28.7	2.189	7.64	7.031
2	0.0042	28.0	2.738	9.78	9.943
3	0.0043	28.7	2.437	8.50	7.347
4	0.0044	29.3	2.583	8.81	9.229
5	0.0042	28.0	2.624	9.37	10.03
6	0.0044	29.3	2.843	9.69	8.346
7	0.0042	28.0	2.461	8.79	9.595
8	0.0040	26.7	2.330	8.74	7.664
9	0.0044	29.3	2.264	7.72	6.498
10	0.0042	28.0	2.814	10.05	9.177
11	0.0043	28.7	2.414	8.42	7.613
12	0.0045	30.0	2.429	8.10	7.665
13	0.0043	28.7	2.672	9.32	8.895
14	0.0043	28.7	2.537	8.85	6.765
15	0.0044	29.3	2.424	8.26	7.680
16	0.0041	27.3	2.745	10.04	9.865
17	0.0041	27.3	2.745	10.04	9.596
18	0.0041	27.3	2.065	7.55	6.395
19	0.0042	28.0	2.236	7.99	9.098
20	0.0042	28.0	2.399	8.57	10.50
Avg	-	-	-	8.81	8.447
SD	-	-	-	0.82	1.297

* Linear density (tex) = (Weight of fiber in gram per 15-cm length x 1000)/0.15.

† Tensile strength (cN/tex) = (Max. load in Newton x 100)/Linear density in tex.

Knot Strength of Chitosan Fibers Prepared from Spinning Condition A, B, C, D, E, F, and G (Table 4.1)

Table C9 Knot strength of chitosan fiber prepared from spinning condition A

Sample no.	Weight (g/15 cm)	Linear density* (tex)	Max. load (N)	Knot strength† (cN/tex)
1	0.0072	48.0	0.4452	0.93
2	0.0067	44.7	0.7492	1.68
3	0.0065	43.3	0.3590	0.83
4	0.0070	46.7	0.2452	0.53
5	0.0073	48.7	0.2537	0.52
6	0.0073	48.7	0.4043	0.83
7	0.0074	49.3	0.8415	1.71
8	0.0070	46.7	0.3501	0.75
9	0.0066	44.0	0.4017	0.91
10	0.0064	42.7	0.2821	0.66
11	0.0078	52.0	0.8585	1.65
12	0.0070	46.7	0.4820	1.03
13	0.0068	45.3	0.3139	0.69
14	0.0071	47.3	0.2298	0.49
15	0.0056	37.3	0.2037	0.55
16	0.0068	45.3	0.4691	1.03
17	0.0065	43.3	0.2736	0.63
18	0.0066	44.0	0.4277	0.97
19	0.0061	40.7	0.3385	0.83
20	0.0069	46.0	0.7752	1.69
Avg	-	-	-	0.95
SD	-	-	-	0.41

* Linear density (tex) = (Weight of fiber in gram per 15-cm length x 1000)/0.15.

† Knot strength (cN/tex) = (Max. load in Newton x 100)/Linear density in tex.

Table C10 Knot strength of chitosan fiber prepared from spinning condition B

Sample no.	Weight (g/15 cm)	Linear density* (tex)	Max. load (N)	Knot strength† (cN/tex)
1	0.0055	36.7	0.7636	2.08
2	0.0062	41.3	0.4848	1.17
3	0.0060	40.0	1.056	2.64
4	0.0061	40.7	0.5837	1.44
5	0.0060	40.0	0.5258	1.31
6	0.0061	40.7	0.8186	2.01
7	0.0060	40.0	0.9460	2.37
8	0.0061	40.7	0.9340	2.30
9	0.0060	40.0	0.5640	1.41
10	0.0059	39.3	0.8713	2.22
11	0.0060	40.0	0.9972	2.49
12	0.0061	40.7	1.159	2.85
13	0.0060	40.0	0.6412	1.60
14	0.0064	42.7	0.8596	2.01
15	0.0060	40.0	1.093	2.73
16	0.0059	39.3	1.101	2.80
17	0.0059	39.3	0.7230	1.84
18	0.0062	41.3	1.182	2.86
19	0.0060	40.0	0.9608	2.40
20	0.0059	39.3	0.8283	2.11
Avg	-	-	-	2.13
SD	-	-	-	0.53

* Linear density (tex) = (Weight of fiber in gram per 15-cm length x 1000)/0.15.

† Knot strength (cN/tex) = (Max. load in Newton x 100)/Linear density in tex.

Table C11 Knot strength of chitosan fiber prepared from spinning condition C

Sample no.	Weight (g/15 cm)	Linear density* (tex)	Max. load (N)	Knot strength† (cN/tex)
1	0.0060	40.0	1.203	3.01
2	0.0059	39.3	0.5866	1.49
3	0.0064	42.7	0.7415	1.74
4	0.0059	39.3	0.6690	1.70
5	0.0065	43.3	0.8690	2.01
6	0.0053	35.3	0.8852	2.51
7	0.0071	47.3	1.132	2.39
8	0.0065	43.3	1.134	2.62
9	0.0069	46.0	1.163	2.53
10	0.0063	42.0	0.9804	2.33
11	0.0062	41.3	0.6598	1.60
12	0.0072	48.0	1.311	2.73
13	0.0063	42.0	1.054	2.51
14	0.0068	45.3	1.260	2.78
15	0.0054	36.0	0.9775	2.72
16	0.0077	51.3	1.245	2.43
17	0.0064	42.7	1.325	3.11
18	0.0067	44.7	0.6595	1.48
19	0.0076	50.7	1.209	2.39
20	0.0059	39.3	1.255	3.19
Avg	-	-	-	2.36
SD	-	-	-	0.53

* Linear density (tex) = (Weight of fiber in gram per 15-cm length x 1000)/0.15.

† Knot strength (cN/tex) = (Max. load in Newton x 100)/Linear density in tex.

Table C12 Knot strength of chitosan fiber prepared from spinning condition D

Sample no.	Weight (g/15 cm)	Linear density* (tex)	Max. load (N)	Knot strength† (cN/tex)
1	0.0067	44.7	0.5632	1.26
2	0.0073	48.7	1.079	2.22
3	0.0075	50.0	1.211	2.42
4	0.0063	42.0	0.8358	1.99
5	0.0066	44.0	0.4362	0.99
6	0.0074	49.3	1.234	2.50
7	0.0052	34.7	0.4184	1.21
8	0.0060	40.0	0.3984	1.00
9	0.0056	37.3	0.6055	1.62
10	0.0052	34.7	0.7696	2.22
11	0.0061	40.7	0.6939	1.71
12	0.0046	30.7	0.6890	2.25
13	0.0057	38.0	0.9156	2.41
14	0.0082	54.7	1.187	2.17
15	0.0069	46.0	0.8412	1.83
16	0.0072	48.0	1.164	2.43
17	0.0041	27.3	0.3233	1.18
18	0.0058	38.7	0.5902	1.53
19	0.0063	42.0	1.046	2.49
20	0.0064	42.7	0.8052	1.89
Avg	-	-	-	1.87
SD	-	-	-	0.52

* Linear density (tex) = (Weight of fiber in gram per 15-cm length x 1000)/0.15.

† Knot strength (cN/tex) = (Max. load in Newton x 100)/Linear density in tex.

Table C13 Knot strength of chitosan fiber prepared from spinning condition E

Sample no.	Weight (g/15 cm)	Linear density* (tex)	Max. load (N)	Knot strength† (cN/tex)
1	0.0045	30.0	1.975	6.58
2	0.0046	30.7	2.151	7.01
3	0.0044	29.3	2.329	7.94
4	0.0035	23.3	1.540	6.60
5	0.0044	29.3	1.823	6.21
6	0.0039	26.0	2.132	8.20
7	0.0042	28.0	2.303	8.23
8	0.0041	27.3	2.100	7.68
9	0.0046	30.7	2.254	7.35
10	0.0037	24.7	1.358	5.51
11	0.0045	30.0	1.809	6.03
12	0.0037	24.7	1.771	7.18
13	0.0045	30.0	2.011	6.70
14	0.0043	28.7	1.730	6.03
15	0.0041	27.3	1.745	6.38
16	0.0037	24.7	1.697	6.88
17	0.0040	26.7	2.124	7.97
18	0.0042	28.0	1.585	5.66
19	0.0037	24.7	1.773	7.19
20	0.0041	27.3	1.710	6.26
Avg	-	-	-	6.88
SD	-	-	-	0.83

* Linear density (tex) = (Weight of fiber in gram per 15-cm length x 1000)/0.15.

† Knot strength (cN/tex) = (Max. load in Newton x 100)/Linear density in tex.

Table C14 Knot strength of chitosan fiber prepared from spinning condition F

Sample no.	Weight (g/15 cm)	Linear density* (tex)	Max. load (N)	Knot strength† (cN/tex)
1	0.0045	30.0	1.857	6.19
2	0.0044	29.3	1.845	6.29
3	0.0046	30.7	1.655	5.40
4	0.0044	29.3	1.697	5.79
5	0.0045	30.0	1.580	5.27
6	0.0044	29.3	1.536	5.24
7	0.0043	28.7	1.623	5.66
8	0.0047	31.3	1.944	6.20
9	0.0045	30.0	1.399	4.66
10	0.0044	29.3	1.692	5.77
11	0.0045	30.0	1.390	4.63
12	0.0045	30.0	1.528	5.09
13	0.0045	30.0	1.483	4.94
14	0.0045	30.0	1.721	5.74
15	0.0045	30.0	1.535	5.12
16	0.0045	30.0	1.796	5.99
17	0.0046	30.7	1.489	4.86
18	0.0043	28.7	1.548	5.40
19	0.0044	29.3	1.465	4.99
20	0.0044	29.3	1.752	5.97
Avg	-	-	-	5.51
SD	-	-	-	0.48

* Linear density (tex) = (Weight of fiber in gram per 15-cm length x 1000)/0.15.

† Knot strength (cN/tex) = (Max. load in Newton x 100)/Linear density in tex.

Table C15 Knot strength of chitosan fiber prepared from spinning condition G

Sample no.	Weight (g/15 cm)	Linear density* (tex)	Max. load (N)	Knot strength† (cN/tex)
1	0.0042	28.0	1.254	4.48
2	0.0045	30.0	1.126	3.75
3	0.0043	28.7	1.086	3.79
4	0.0046	30.7	1.280	4.17
5	0.0043	28.7	1.332	4.65
6	0.0041	27.3	1.384	5.06
7	0.0042	28.0	1.472	5.26
8	0.0041	27.3	1.385	5.07
9	0.0043	28.7	1.346	4.70
10	0.0042	28.0	1.378	4.92
11	0.0041	27.3	1.313	4.80
12	0.0041	27.3	1.280	4.68
13	0.0041	27.3	1.095	4.01
14	0.0044	29.3	1.581	5.39
15	0.0042	28.0	1.049	3.75
16	0.0041	27.3	1.027	3.76
17	0.0039	26.0	0.9216	3.54
18	0.0038	25.3	1.179	4.65
19	0.0041	27.3	1.061	3.88
20	0.0041	27.3	0.9506	3.48
Avg	-	-	-	4.39
SD	-	-	-	0.61

* Linear density (tex) = (Weight of fiber in gram per 15-cm length x 1000)/0.15.

† Knot strength (cN/tex) = (Max. load in Newton x 100)/Linear density in tex.

APPENDIX D

Test Results of Citrate-Crosslinked Chitosan Fibers Prepared by the Addition of Citric Acid to Chitosan Dope

Table D1 Weight of 15-cm citrate-crosslinked chitosan fibers prepared by using citric acid concentrations of 0.025, 0.125, 0.25, and 0.5% (w/v) in chitosan dope

Sample no.	Weight of citrate-crosslinked chitosan fiber (g)			
	0.025%*	0.125%*	0.25%*	0.5%*
1	0.0046	0.0043	0.0054	0.0061
2	0.0046	0.0042	0.0053	0.0060
3	0.0046	0.0043	0.0053	0.0059
4	0.0047	0.0042	0.0052	0.0061
5	0.0046	0.0043	0.0052	0.0060
6	0.0045	0.0043	0.0054	0.0062
7	0.0046	0.0043	0.0051	0.0064
8	0.0046	0.0044	0.0053	0.0064
9	0.0046	0.0043	0.0052	0.0061
10	0.0044	0.0043	0.0053	0.0062
11	0.0044	0.0041	0.0054	0.0060
12	0.0045	0.0041	0.0052	0.0062
13	0.0047	0.0044	0.0053	0.0061
14	0.0046	0.0042	0.0051	0.0061
15	0.0045	0.0042	0.0053	0.0063
16	0.0044	0.0043	0.0051	0.0059
17	0.0045	0.0043	0.0054	0.0060
18	0.0044	0.0041	0.0054	0.0059
19	0.0045	0.0042	0.0052	0.0060
20	0.0046	0.0041	0.0052	0.0061
21	0.0046	0.0042	0.0053	0.0059
22	0.0046	0.0041	0.0054	0.0058
23	0.0044	0.0041	0.0054	0.0061
24	0.0046	0.0041	0.0053	0.0059
25	0.0045	0.0041	0.0053	0.0062

Cont.....

Table D1 (Continued)

Sample no.	Weight of citrate-crosslinked chitosan fiber (g)			
	0.025%*	0.125%*	0.25%*	0.5%*
26	0.0045	0.0044	0.0052	0.0064
27	0.0045	0.0042	0.0052	0.0064
28	0.0045	0.0043	0.0052	0.0060
29	0.0047	0.0044	0.0053	0.0061
30	0.0045	0.0043	0.0052	0.0060
31	0.0045	0.0042	0.0053	0.0060
32	0.0045	0.0041	0.0054	0.0063
33	0.0046	0.0043	0.0051	0.0060
34	0.0045	0.0043	0.0054	0.0059
35	0.0045	0.0045	0.0054	0.0060
36	0.0045	0.0041	0.0052	0.0059
37	0.0045	0.0043	0.0052	0.0062
38	0.0047	0.0042	0.0054	0.0062
39	0.0045	0.0045	0.0053	0.0060
40	0.0046	0.0041	0.0054	0.0060
41	0.0047	0.0043	0.0052	0.0059
42	0.0045	0.0043	0.0052	0.0061
43	0.0045	0.0043	0.0054	0.0059
44	0.0046	0.0044	0.0052	0.0058
45	0.0044	0.0042	0.0053	0.0062
46	0.0047	0.0044	0.0052	0.0061
47	0.0046	0.0042	0.0053	0.0058
48	0.0046	0.0043	0.0052	0.0059
49	0.0045	0.0045	0.0053	0.0058
50	0.0046	0.0043	0.0052	0.0058
Avg (g)	0.0045	0.0043	0.0053	0.0061
SD	0.0001	0.0001	0.0001	0.0002
L.D.† (tex)	30.3	28.4	35.2	40.3
SD	0.6	0.8	0.6	1.1

* Citric acid concentration in chitosan dope.

† Linear density (tex) = (Average weight in gram per 15-cm length x 1000)/0.15.

Tensile Strength and Elongation at Break of Citrate-Crosslinked Chitosan Fibers Prepared by the Addition of Citric Acid to Chitosan Dope

Table D2 Tensile strength and elongation at break of citrate-crosslinked chitosan fiber prepared by using citric acid concentration of 0.025% (w/v) in chitosan dope

Sample no.	Weight (g/15 cm)	Linear density* (tex)	Max. load (N)	Tensile strength† (cN/tex)	Elongation at break (%)
1	0.0046	30.7	3.049	9.94	13.50
2	0.0047	31.3	3.180	10.15	14.40
3	0.0045	30.0	3.176	10.59	13.25
4	0.0046	30.7	3.021	9.85	13.33
5	0.0045	30.0	3.006	10.02	14.15
6	0.0044	29.3	2.942	10.03	12.86
7	0.0045	30.0	3.146	10.49	11.84
8	0.0046	30.7	3.060	9.98	13.13
9	0.0046	30.7	3.107	10.13	13.14
10	0.0046	30.7	2.980	9.72	11.95
11	0.0045	30.0	3.001	10.00	11.75
12	0.0045	30.0	3.099	10.33	12.80
13	0.0045	30.0	2.930	9.77	12.06
14	0.0047	31.3	3.323	10.61	14.70
15	0.0046	30.7	3.223	10.51	12.51
16	0.0044	29.3	3.095	10.55	14.40
17	0.0044	29.3	2.917	9.94	12.76
18	0.0047	31.3	3.134	10.00	12.53
19	0.0044	29.3	2.974	10.14	11.84
20	0.0045	30.0	2.996	9.99	14.68
Avg	-	-	-	10.14	13.08
SD	-	-	-	0.28	0.98

* Linear density (tex) = (Weight of fiber in gram per 15-cm length x 1000)/0.15.

† Tensile strength (cN/tex) = (Max. load in Newton x 100)/Linear density in tex.

Table D3 Tensile strength and elongation at break of citrate-crosslinked chitosan fiber prepared by using citric acid concentration of 0.125% (w/v) in chitosan dope

Sample no.	Weight (g/15 cm)	Linear density* (tex)	Max. load (N)	Tensile strength† (cN/tex)	Elongation at break (%)
1	0.0043	28.7	2.703	9.43	10.91
2	0.0042	28.0	2.821	10.08	11.00
3	0.0043	28.7	2.638	9.20	9.544
4	0.0042	28.0	2.864	10.23	12.87
5	0.0043	28.7	3.098	10.81	13.66
6	0.0043	28.7	3.045	10.62	13.70
7	0.0043	28.7	3.103	10.82	14.30
8	0.0044	29.3	3.116	10.62	14.51
9	0.0043	28.7	2.663	9.29	10.14
10	0.0041	27.3	2.598	9.50	8.996
11	0.0044	29.3	2.817	9.60	10.28
12	0.0042	28.0	2.876	10.27	11.86
13	0.0042	28.0	2.910	10.39	11.33
14	0.0041	27.3	2.954	10.81	12.33
15	0.0041	27.3	2.767	10.12	11.26
16	0.0041	27.3	2.894	10.59	11.26
17	0.0040	26.7	2.568	9.63	14.63
18	0.0043	28.7	3.082	10.75	10.10
19	0.0041	27.3	2.518	9.21	14.10
20	0.0042	28.0	2.885	10.30	14.53
Avg	-	-	-	10.11	12.07
SD	-	-	-	0.58	1.84

* Linear density (tex) = (Weight of fiber in gram per 15-cm length x 1000)/0.15.

† Tensile strength (cN/tex) = (Max. load in Newton x 100)/Linear density in tex.

Table D4 Tensile strength and elongation at break of citrate-crosslinked chitosan fiber prepared by using citric acid concentration of 0.25% (w/v) in chitosan dope

Sample no.	Weight (g/15 cm)	Linear density* (tex)	Max. load (N)	Tensile strength† (cN/tex)	Elongation at break (%)
1	0.0052	34.7	3.041	8.77	11.70
2	0.0052	34.7	3.035	8.75	9.198
3	0.0054	36.0	3.373	9.37	14.50
4	0.0053	35.3	2.976	8.42	11.94
5	0.0052	34.7	3.008	8.68	12.06
6	0.0053	35.3	3.372	9.54	14.90
7	0.0051	34.0	3.215	9.46	11.41
8	0.0053	35.3	2.996	8.48	11.13
9	0.0051	34.0	2.933	8.63	12.16
10	0.0054	36.0	3.589	9.97	15.11
11	0.0053	35.3	2.869	8.12	11.67
12	0.0054	36.0	3.273	9.09	14.46
13	0.0055	36.7	3.662	9.99	15.23
14	0.0053	35.3	2.995	8.48	11.44
15	0.0052	34.7	2.836	8.18	9.914
16	0.0052	34.7	3.395	9.79	14.78
17	0.0054	36.0	3.459	9.61	13.80
18	0.0053	35.3	3.372	9.54	11.05
19	0.0052	34.7	3.428	9.89	9.398
20	0.0054	36.0	3.401	9.45	11.03
Avg	-	-	-	9.11	12.34
SD	-	-	-	0.62	1.95

* Linear density (tex) = (Weight of fiber in gram per 15-cm length x 1000)/0.15.

† Tensile strength (cN/tex) = (Max. load in Newton x 100)/Linear density in tex.

Table D5 Tensile strength and elongation at break of citrate-crosslinked chitosan fiber prepared by using citric acid concentration of 0.5% (w/v) in chitosan dope

Sample no.	Weight (g/15 cm)	Linear density* (tex)	Max. load (N)	Tensile strength† (cN/tex)	Elongation at break (%)
1	0.0059	39.3	3.834	9.75	12.57
2	0.0061	40.7	3.837	9.44	11.91
3	0.0062	41.3	3.666	8.87	12.87
4	0.0061	40.7	3.509	8.63	10.50
5	0.0062	41.3	3.810	9.22	14.36
6	0.0060	40.0	3.238	8.10	10.80
7	0.0062	41.3	3.864	9.35	14.24
8	0.0061	40.7	3.855	9.48	13.23
9	0.0061	40.7	3.462	8.51	12.20
10	0.0063	42.0	3.737	8.90	12.57
11	0.0059	39.3	3.822	9.72	10.73
12	0.0060	40.0	3.200	8.00	9.245
13	0.0059	39.3	3.852	9.79	12.13
14	0.0067	44.7	3.534	7.91	9.611
15	0.0058	38.7	3.158	8.17	9.314
16	0.0061	40.7	3.210	7.89	12.08
17	0.0059	39.3	3.326	8.46	9.914
18	0.0061	40.7	4.012	9.87	10.27
19	0.0064	42.7	3.988	9.35	14.04
20	0.0060	40.0	3.850	9.63	9.665
Avg	-	-	-	8.95	11.61
SD	-	-	-	0.69	1.68

* Linear density (tex) = (Weight of fiber in gram per 15-cm length x 1000)/0.15.

† Tensile strength (cN/tex) = (Max. load in Newton x 100)/Linear density in tex.

Knot Strength of Citrate-Crosslinked Chitosan Fibers Prepared by the Addition of Citric Acid to Chitosan Dope

Table D6 Knot strength of citric acid-crosslinked chitosan fiber prepared by using citric acid concentration of 0.025% (w/v) in chitosan dope

Sample no.	Weight (g/15 cm)	Linear density* (tex)	Max. load (N)	Knot strength† (cN/tex)
1	0.0045	30.0	1.183	3.94
2	0.0048	32.0	1.274	3.98
3	0.0045	30.0	1.039	3.46
4	0.0045	30.0	1.116	3.72
5	0.0045	30.0	1.227	4.09
6	0.0044	29.3	1.046	3.57
7	0.0045	30.0	1.062	3.54
8	0.0047	31.3	1.297	4.14
9	0.0048	32.0	1.089	3.40
10	0.0047	31.3	1.427	4.55
11	0.0044	29.3	1.142	3.89
12	0.0046	30.7	1.315	4.29
13	0.0048	32.0	1.452	4.54
14	0.0047	31.3	1.354	4.32
15	0.0047	31.3	1.335	4.26
16	0.0046	30.7	1.192	3.89
17	0.0045	30.0	1.410	4.70
18	0.0040	26.7	1.168	4.38
19	0.0041	27.3	1.106	4.05
20	0.0046	30.7	1.273	4.15
Avg	-	-	-	4.04
SD	-	-	-	0.37

* Linear density (tex) = (Weight of fiber in gram per 15-cm length x 1000)/0.15.

† Knot strength (cN/tex) = (Max. load in Newton x 100)/Linear density in tex.

Table D7 Knot strength of citrate-crosslinked chitosan fiber prepared by using citric acid concentration of 0.125% (w/v) in chitosan dope

Sample no.	Weight (g/15 cm)	Linear density* (tex)	Max. load (N)	Knot strength† (cN/tex)
1	0.0043	28.7	1.423	4.96
2	0.0043	28.7	1.278	4.46
3	0.0042	28.0	1.562	5.58
4	0.0043	28.7	1.539	5.37
5	0.0047	31.3	1.540	4.91
6	0.0043	28.7	1.489	5.19
7	0.0043	28.7	1.411	4.92
8	0.0042	28.0	1.491	5.33
9	0.0045	30.0	1.486	4.95
10	0.0041	27.3	1.271	4.65
11	0.0043	28.7	1.186	4.14
12	0.0041	27.3	1.385	5.07
13	0.0045	30.0	1.287	4.29
14	0.0043	28.7	1.194	4.17
15	0.0044	29.3	1.397	4.76
16	0.0045	30.0	1.361	4.54
17	0.0044	29.3	1.313	4.48
18	0.0046	30.7	1.281	4.18
19	0.0045	30.0	1.447	4.82
20	0.0043	28.7	1.455	5.08
Avg	-	-	-	4.79
SD	-	-	-	0.42

* Linear density (tex) = (Weight of fiber in gram per 15-cm length x 1000)/0.15.

† Knot strength (cN/tex) = (Max. load in Newton x 100)/Linear density in tex.

Table D8 Knot strength of citrate-crosslinked chitosan fiber prepared by using citric acid concentration of 0.25% (w/v) in chitosan dope

Sample no.	Weight (g/15 cm)	Linear density* (tex)	Max. load (N)	Knot strength† (cN/tex)
1	0.0052	34.7	1.652	4.77
2	0.0053	35.3	1.440	4.08
3	0.0054	36.0	1.671	4.64
4	0.0051	34.0	1.357	3.99
5	0.0054	36.0	1.453	4.04
6	0.0052	34.7	1.815	5.24
7	0.0052	34.7	1.462	4.22
8	0.0054	36.0	2.011	5.59
9	0.0053	35.3	1.472	4.17
10	0.0051	34.0	1.722	5.06
11	0.0054	36.0	1.716	4.77
12	0.0052	34.7	1.731	4.99
13	0.0053	35.3	1.680	4.75
14	0.0058	38.7	1.943	5.03
15	0.0051	34.0	1.694	4.98
16	0.0055	36.7	1.476	4.03
17	0.0055	36.7	1.584	4.32
18	0.0052	34.7	1.447	4.17
19	0.0052	34.7	1.906	5.50
20	0.0052	34.7	1.403	4.05
Avg	-	-	-	4.62
SD	-	-	-	0.52

* Linear density (tex) = (Weight of fiber in gram per 15-cm length x 1000)/0.15.

† Knot strength (cN/tex) = (Max. load in Newton x 100)/Linear density in tex.

Table D9 Knot strength of citrate-crosslinked chitosan fiber prepared by using citric acid concentration of 0.5% (w/v) in chitosan dope

Sample no.	Weight (g/15 cm)	Linear density* (tex)	Max. load (N)	Knot strength† (cN/tex)
1	0.0064	42.7	2.602	6.10
2	0.0064	42.7	2.288	5.36
3	0.0061	40.7	1.942	4.78
4	0.0060	40.0	2.528	6.32
5	0.0065	43.3	2.769	6.39
6	0.0059	39.3	2.195	5.58
7	0.0060	40.0	1.896	4.74
8	0.0059	39.3	2.012	5.12
9	0.0062	41.3	2.170	5.25
10	0.0062	41.3	2.207	5.34
11	0.0060	40.0	2.480	6.20
12	0.0059	39.3	1.901	4.83
13	0.0061	40.7	1.982	4.87
14	0.0059	39.3	2.204	5.60
15	0.0058	38.7	2.068	5.35
16	0.0056	37.3	1.937	5.19
17	0.0053	35.3	1.701	4.81
18	0.0058	38.7	1.721	4.45
19	0.0058	38.7	1.829	4.73
20	0.0058	38.7	2.090	5.41
Avg	-	-	-	5.32
SD	-	-	-	0.57

* Linear density (tex) = (Weight of fiber in gram per 15-cm length x 1000)/0.15.

† Knot strength (cN/tex) = (Max. load in Newton x 100)/Linear density in tex.

APPENDIX E

Test Results of Citrate-Crosslinked Chitosan Fibers Prepared by the Addition of Citric Acid to the First Coagulation Bath

Table E1 Weight of 15-cm citrate-crosslinked chitosan fibers prepared by using citric acid concentrations of 0.025, 0.125, 0.25, 0.5, 1.25, 2.5, 3.75, and 5% (w/v) in the first coagulation bath

No.	Weight of citrate-crosslinked chitosan fiber (g)							
	0.025*	0.125*	0.25*	0.5*	1.25*	2.5*	3.75*	5*
1	0.0056	0.0044	0.0053	0.0046	0.0041	0.0058	0.0047	0.0054
2	0.0060	0.0050	0.0053	0.0049	0.0041	0.0052	0.0047	0.0054
3	0.0048	0.0048	0.0055	0.0046	0.0041	0.0057	0.0059	0.0054
4	0.0058	0.0050	0.0052	0.0047	0.0041	0.0061	0.0051	0.0053
5	0.0058	0.0049	0.0053	0.0047	0.0041	0.0055	0.0055	0.0055
6	0.0053	0.0046	0.0052	0.0047	0.0041	0.0057	0.0056	0.0054
7	0.0050	0.0049	0.0054	0.0047	0.0041	0.0061	0.0048	0.0053
8	0.0060	0.0052	0.0052	0.0047	0.0041	0.0056	0.0048	0.0053
9	0.0056	0.0049	0.0052	0.0046	0.0041	0.0057	0.0053	0.0053
10	0.0060	0.0048	0.0052	0.0046	0.0040	0.0057	0.0054	0.0054
11	0.0059	0.0050	0.0053	0.0046	0.0041	0.0061	0.0055	0.0055
12	0.0054	0.0049	0.0051	0.0048	0.0041	0.0057	0.0053	0.0056
13	0.0051	0.0049	0.0055	0.0047	0.0042	0.0057	0.0055	0.0054
14	0.0057	0.0049	0.0053	0.0049	0.0041	0.0057	0.0055	0.0056
15	0.0057	0.0050	0.0050	0.0048	0.0041	0.0058	0.0050	0.0056
16	0.0057	0.0050	0.0054	0.0045	0.0040	0.0058	0.0056	0.0056
17	0.0058	0.0049	0.0050	0.0048	0.0041	0.0057	0.0050	0.0056
18	0.0052	0.0046	0.0052	0.0047	0.0041	0.0056	0.0053	0.0054
19	0.0051	0.0047	0.0053	0.0047	0.0041	0.0057	0.0053	0.0057
20	0.0056	0.0049	0.0052	0.0046	0.0042	0.0056	0.0057	0.0055
21	0.0053	0.0045	0.0050	0.0046	0.0040	0.0058	0.0055	0.0054
22	0.0057	0.0048	0.0054	0.0047	0.0041	0.0060	0.0055	0.0052
23	0.0059	0.0050	0.0054	0.0049	0.0040	0.0056	0.0057	0.0055
24	0.0053	0.0051	0.0050	0.0046	0.0042	0.0055	0.0056	0.0055
25	0.0059	0.0049	0.0052	0.0048	0.0042	0.0056	0.0057	0.0053

Cont.....

Table E1 (Continued)

No.	Weight of citrate-crosslinked chitosan fiber (g)							
	0.025*	0.125*	0.25*	0.5*	1.25*	2.5*	3.75*	5*
26	0.0051	0.0046	0.0050	0.0048	0.0041	0.0057	0.0054	0.0055
27	0.0060	0.0048	0.0053	0.0045	0.0041	0.0057	0.0057	0.0052
28	0.0053	0.0050	0.0055	0.0046	0.0040	0.0057	0.0053	0.0052
29	0.0053	0.0050	0.0051	0.0046	0.0041	0.0057	0.0054	0.0055
30	0.0059	0.0047	0.0054	0.0045	0.0040	0.0054	0.0056	0.0054
31	0.0052	0.0050	0.0055	0.0047	0.0040	0.0057	0.0055	0.0056
32	0.0051	0.0048	0.0053	0.0045	0.0042	0.0057	0.0054	0.0057
33	0.0051	0.0048	0.0055	0.0046	0.0041	0.0054	0.0055	0.0053
34	0.0057	0.0050	0.0053	0.0045	0.0040	0.0057	0.0056	0.0057
35	0.0046	0.0049	0.0054	0.0046	0.0041	0.0057	0.0050	0.0056
36	0.0059	0.0049	0.0055	0.0048	0.0040	0.0056	0.0056	0.0053
37	0.0060	0.0052	0.0054	0.0047	0.0042	0.0060	0.0056	0.0054
38	0.0057	0.0050	0.0055	0.0048	0.0041	0.0059	0.0054	0.0054
39	0.0054	0.0048	0.0053	0.0047	0.0040	0.0058	0.0055	0.0056
40	0.0053	0.0048	0.0052	0.0045	0.0042	0.0054	0.0055	0.0055
41	0.0058	0.0048	0.0051	0.0045	0.0042	0.0053	0.0056	0.0052
42	0.0056	0.0050	0.0054	0.0045	0.0041	0.0058	0.0058	0.0055
43	0.0051	0.0050	0.0053	0.0047	0.0040	0.0055	0.0053	0.0057
44	0.0055	0.0044	0.0051	0.0045	0.0040	0.0057	0.0056	0.0054
45	0.0059	0.0051	0.0055	0.0048	0.0040	0.0053	0.0054	0.0054
46	0.0057	0.0047	0.0053	0.0046	0.0040	0.0055	0.0054	0.0053
47	0.0057	0.0046	0.0054	0.0048	0.0040	0.0057	0.0047	0.0053
48	0.0045	0.0048	0.0052	0.0047	0.0040	0.0053	0.0055	0.0055
49	0.0057	0.0048	0.0053	0.0048	0.0040	0.0056	0.0054	0.0054
50	0.0051	0.0047	0.0052	0.0047	0.0040	0.0056	0.0056	0.0054
Avg	0.0055	0.0049	0.0053	0.0047	0.0041	0.0057	0.0054	0.0054
SD	0.0004	0.0002	0.0002	0.0001	0.0001	0.0002	0.0003	0.0001
L.D.† (tex)	36.7	32.4	35.2	31.1	27.2	37.8	36.0	36.3
SD	2.5	1.2	1.0	0.8	0.5	1.3	1.9	0.9

* Citric acid concentration (% w/v) in chitosan dope.

† Linear density (tex) = (Average weight in gram per 15-cm length x 1000)/0.15.

Tensile Strength and Elongation at Break of Citrate-Crosslinked Chitosan Fibers Prepared by the Addition of Citric Acid to the First Coagulation Bath

Table E2 Tensile strength and elongation at break of citrate-crosslinked chitosan fiber prepared by using citric acid concentration of 0.025% (w/v) in the first coagulation bath

Sample no.	Weight (g/15 cm)	Linear density* (tex)	Max. load (N)	Tensile strength† (cN/tex)	Elongation at break (%)
1	0.0060	40.0	3.304	8.26	9.611
2	0.0048	32.0	2.674	8.36	8.032
3	0.0058	38.7	3.190	8.25	8.629
4	0.0035	23.3	2.010	8.61	11.43
5	0.0050	33.3	3.268	9.80	10.98
6	0.0060	40.0	3.368	8.42	9.763
7	0.0059	39.3	3.334	8.48	10.06
8	0.0051	34.0	2.986	8.78	7.196
9	0.0058	38.7	3.509	9.08	11.76
10	0.0052	34.7	3.236	9.33	11.63
11	0.0056	37.3	3.560	9.54	12.43
12	0.0045	30.0	2.700	9.00	8.448
13	0.0057	38.0	3.281	8.63	9.099
14	0.0059	39.3	3.239	8.23	8.547
15	0.0031	20.7	1.950	9.44	9.744
16	0.0059	39.3	3.289	8.36	7.644
17	0.0045	30.0	2.524	8.41	10.53
18	0.0053	35.3	3.449	9.76	7.314
19	0.0060	40.0	3.672	9.18	12.48
20	0.0057	38.0	3.606	9.49	9.399
Avg	-	-	-	8.87	9.736
SD	-	-	-	0.54	1.655

* Linear density (tex) = (Weight of fiber in gram per 15-cm length x 1000)/0.15.

† Tensile strength (cN/tex) = (Max. load in Newton x 100)/Linear density in tex.

Table E3 Tensile strength and elongation at break of citrate-crosslinked chitosan fiber prepared by using citric acid concentration of 0.125% (w/v) in the first coagulation bath

Sample no.	Weight (g/15 cm)	Linear density* (tex)	Max. load (N)	Tensile strength† (cN/tex)	Elongation at break (%)
1	0.0050	33.3	3.169	9.51	9.611
2	0.0048	32.0	2.986	9.33	7.145
3	0.0050	33.3	3.032	9.10	8.511
4	0.0049	32.7	3.236	9.91	10.64
5	0.0029	19.3	1.773	9.17	5.463
6	0.0048	32.0	3.172	9.91	9.299
7	0.0050	33.3	2.928	8.78	7.547
8	0.0049	32.7	3.073	9.41	8.463
9	0.0050	33.3	3.464	10.39	9.181
10	0.0046	30.7	2.672	8.71	5.963
11	0.0047	31.3	2.741	8.75	5.847
12	0.0049	32.7	3.286	10.06	8.932
13	0.0048	32.0	3.077	9.62	8.411
14	0.0049	32.7	3.358	10.28	8.999
15	0.0023	15.3	1.306	8.52	9.926
16	0.0049	32.7	3.371	10.32	6.396
17	0.0052	34.7	3.146	9.08	5.399
18	0.0049	32.7	3.341	10.23	7.496
19	0.0049	32.7	3.221	9.86	6.099
20	0.0050	33.3	3.244	9.73	5.596
Avg	-	-	-	9.53	7.746
SD	-	-	-	0.59	1.666

* Linear density (tex) = (Weight of fiber in gram per 15-cm length x 1000)/0.15.

† Tensile strength (cN/tex) = (Max. load in Newton x 100)/Linear density in tex.

Table E4 Tensile strength and elongation at break of citrate-crosslinked chitosan fiber prepared by using citric acid concentration of 0.25% (w/v) in the first coagulation bath

Sample no.	Weight (g/15 cm)	Linear density* (tex)	Max. load (N)	Tensile strength† (cN/tex)	Elongation at break (%)
1	0.0053	35.3	3.313	9.38	15.24
2	0.0053	35.3	3.094	8.76	13.14
3	0.0052	34.7	3.296	9.51	13.31
4	0.0052	34.7	3.399	9.80	14.56
5	0.0052	34.7	3.058	8.82	10.51
6	0.0051	34.0	3.130	9.21	11.06
7	0.0053	35.3	3.030	8.58	10.90
8	0.0050	33.3	3.103	9.31	9.796
9	0.0053	35.3	2.949	8.35	11.54
10	0.0050	33.3	3.192	9.58	11.33
11	0.0054	36.0	3.052	8.48	10.07
12	0.0054	36.0	3.148	8.74	11.84
13	0.0050	33.3	2.894	8.68	10.76
14	0.0052	34.7	3.500	10.10	14.38
15	0.0057	38.0	3.119	8.21	12.44
16	0.0053	35.3	2.926	8.28	11.66
17	0.0054	36.0	3.494	9.71	10.13
18	0.0052	34.7	3.509	10.12	8.547
19	0.0055	36.7	3.425	9.34	10.80
20	0.0052	34.7	3.396	9.80	9.895
Avg	-	-	-	9.14	11.60
SD	-	-	-	0.61	1.76

* Linear density (tex) = (Weight of fiber in gram per 15-cm length x 1000)/0.15.

† Tensile strength (cN/tex) = (Max. load in Newton x 100)/Linear density in tex.

Table E5 Tensile strength and elongation at break of citrate-crosslinked chitosan fiber prepared by using citric acid concentration of 0.5% (w/v) in the first coagulation bath

Sample no.	Weight (g/15 cm)	Linear density* (tex)	Max. load (N)	Tensile strength† (cN/tex)	Elongation at break (%)
1	0.0046	30.7	3.261	10.63	9.962
2	0.0047	31.3	3.356	10.71	11.18
3	0.0047	31.3	3.296	10.52	11.33
4	0.0047	31.3	3.089	9.86	7.665
5	0.0047	31.3	3.509	11.20	12.40
6	0.0050	33.3	3.635	10.91	12.60
7	0.0046	30.7	3.073	10.02	8.665
8	0.0048	32.0	3.397	10.62	11.66
9	0.0049	32.7	3.376	10.33	9.047
10	0.0048	32.0	3.482	10.88	11.28
11	0.0048	32.0	3.308	10.34	11.64
12	0.0047	31.3	3.195	10.20	9.013
13	0.0046	30.7	3.129	10.20	8.428
14	0.0044	29.3	2.815	9.60	8.913
15	0.0046	30.7	3.451	11.25	11.60
16	0.0049	32.7	3.543	10.85	11.89
17	0.0046	30.7	2.851	9.30	8.428
18	0.0048	32.0	3.017	9.43	7.364
19	0.0049	32.7	3.662	11.21	6.664
20	0.0047	31.3	2.961	9.45	7.098
Avg	-	-	-	10.38	9.841
SD	-	-	-	0.61	1.921

* Linear density (tex) = (Weight of fiber in gram per 15-cm length x 1000)/0.15.

† Tensile strength (cN/tex) = (Max. load in Newton x 100)/Linear density in tex.

Table E6 Tensile strength and elongation at break of citrate-crosslinked chitosan fiber prepared by using citric acid concentration of 1.25% (w/v) in the first coagulation bath

Sample no.	Weight (g/15 cm)	Linear density* (tex)	Max. load (N)	Tensile strength† (cN/tex)	Elongation at break (%)
1	0.0039	26.0	2.789	10.73	12.48
2	0.0041	27.3	2.947	10.78	14.24
3	0.0041	27.3	2.876	10.52	11.86
4	0.0041	27.3	3.027	11.07	13.81
5	0.0041	27.3	3.104	11.36	14.06
6	0.0041	27.3	2.912	10.65	12.34
7	0.0041	27.3	3.051	11.16	14.74
8	0.0041	27.3	3.037	11.11	13.96
9	0.0041	27.3	2.887	10.56	13.56
10	0.0042	28.0	3.074	10.98	14.08
11	0.0041	27.3	3.053	11.17	15.90
12	0.0041	27.3	3.142	11.50	15.36
13	0.0040	26.7	3.023	11.34	15.14
14	0.0041	27.3	3.007	11.00	15.38
15	0.0041	27.3	3.048	11.15	15.78
16	0.0042	28.0	3.009	10.75	12.83
17	0.0041	27.3	3.047	11.15	14.48
18	0.0041	27.3	3.086	11.29	14.20
19	0.0043	28.7	3.254	11.35	13.48
20	0.0042	28.0	3.090	11.04	14.48
Avg	-	-	-	11.03	14.11
SD	-	-	-	0.28	1.13

* Linear density (tex) = (Weight of fiber in gram per 15-cm length x 1000)/0.15.

† Tensile strength (cN/tex) = (Max. load in Newton x 100)/Linear density in tex.

Table E7 Tensile strength and elongation at break of citrate-crosslinked chitosan fiber prepared by using citric acid concentration of 2.5% (w/v) in the first coagulation bath

Sample no.	Weight (g/15 cm)	Linear density* (tex)	Max. load (N)	Tensile strength† (cN/tex)	Elongation at break (%)
1	0.0058	38.7	3.540	9.16	8.860
2	0.0062	41.3	3.684	8.91	8.096
3	0.0057	38.0	3.861	10.16	12.68
4	0.0061	40.7	3.433	8.44	9.262
5	0.0057	38.0	3.676	9.67	9.480
6	0.0061	40.7	3.329	8.19	7.828
7	0.0061	40.7	3.541	8.71	9.014
8	0.0057	38.0	3.572	9.40	9.311
9	0.0057	38.0	3.173	8.35	8.999
10	0.0058	38.7	3.879	10.03	11.61
11	0.0058	38.7	3.682	9.52	9.432
12	0.0057	38.0	3.129	8.23	8.478
13	0.0050	33.3	2.972	8.92	7.212
14	0.0056	37.3	3.870	10.37	13.10
15	0.0057	38.0	3.264	8.59	7.329
16	0.0056	37.3	3.475	9.31	10.20
17	0.0060	40.0	3.588	8.97	9.111
18	0.0055	36.7	3.118	8.50	7.999
19	0.0057	38.0	3.230	8.50	12.86
20	0.0056	37.3	3.066	8.21	8.930
Avg	-	-	-	9.01	9.490
SD	-	-	-	0.68	1.759

* Linear density (tex) = (Weight of fiber in gram per 15-cm length x 1000)/0.15.

† Tensile strength (cN/tex) = (Max. load in Newton x 100)/Linear density in tex.

Table E8 Tensile strength and elongation at break of citrate-crosslinked chitosan fiber prepared by using citric acid concentration of 3.75% (w/v) in the first coagulation bath

Sample no.	Weight (g/15 cm)	Linear density* (tex)	Max. load (N)	Tensile strength† (cN/tex)	Elongation at break (%)
1	0.0025	16.7	1.587	9.52	10.16
2	0.0033	22.0	1.946	8.85	11.01
3	0.0038	25.3	2.076	8.19	12.41
4	0.0045	30.0	2.787	9.29	13.80
5	0.0056	37.3	3.085	8.26	11.56
6	0.0054	36.0	3.126	8.68	10.93
7	0.0055	36.7	3.493	9.53	11.77
8	0.0042	28.0	2.454	8.76	10.60
9	0.0055	36.7	3.367	9.18	12.00
10	0.0050	33.3	3.001	9.00	10.80
11	0.0056	37.3	3.551	9.51	13.67
12	0.0050	33.3	2.911	8.73	9.565
13	0.0053	35.3	3.003	8.50	9.196
14	0.0042	28.0	2.623	9.37	11.20
15	0.0053	35.3	3.123	8.84	11.33
16	0.0055	36.7	3.333	9.09	13.28
17	0.0037	24.7	2.407	9.76	12.20
18	0.0059	39.3	3.714	9.44	12.97
19	0.0048	32.0	2.768	8.65	12.10
20	0.0057	38.0	3.648	9.60	14.20
Avg	-	-	-	9.04	11.74
SD	-	-	-	0.46	1.38

* Linear density (tex) = (Weight of fiber in gram per 15-cm length x 1000)/0.15.

† Tensile strength (cN/tex) = (Max. load in Newton x 100)/Linear density in tex.

Table E9 Tensile strength and elongation at break of citrate-crosslinked chitosan fiber prepared by using citric acid concentration of 5% (w/v) in the first coagulation bath

Sample no.	Weight (g/15 cm)	Linear density* (tex)	Max. load (N)	Tensile strength† (cN/tex)	Elongation at break (%)
1	0.0054	36.0	2.661	7.39	12.68
2	0.0054	36.0	2.627	7.30	12.33
3	0.0053	35.3	2.687	7.60	13.23
4	0.0054	36.0	2.725	7.57	13.80
5	0.0053	35.3	2.695	7.63	13.94
6	0.0054	36.0	2.705	7.51	15.48
7	0.0055	36.7	2.708	7.39	12.15
8	0.0054	36.0	2.698	7.49	15.30
9	0.0056	37.3	2.706	7.25	15.24
10	0.0055	36.7	2.814	7.67	13.51
11	0.0053	35.3	2.588	7.32	12.57
12	0.0055	36.7	2.666	7.27	13.58
13	0.0052	34.7	2.628	7.58	12.38
14	0.0052	34.7	2.620	7.56	12.44
15	0.0055	36.7	2.721	7.42	13.13
16	0.0055	36.7	2.811	7.67	12.74
17	0.0053	35.3	2.602	7.36	13.24
18	0.0053	35.3	2.635	7.46	12.10
19	0.0056	37.3	2.746	7.36	12.43
20	0.0056	37.3	2.714	7.27	14.76
Avg	-	-	-	7.45	13.35
SD	-	-	-	0.14	1.09

* Linear density (tex) = (Weight of fiber in gram per 15-cm length x 1000)/0.15.

† Tensile strength (cN/tex) = (Max. load in Newton x 100)/Linear density in tex.

Knot Strength of Citrate-Crosslinked Chitosan Fibers Prepared by the Addition of Citric Acid to the First Coagulation Bath

Table E10 Knot strength of citric acid-crosslinked chitosan fiber prepared by using citric acid concentration of 0.025% (w/v) in the first coagulation bath

Sample no.	Weight (g/15 cm)	Linear density* (tex)	Max. load (N)	Knot strength† (cN/tex)
1	0.0051	34.0	1.712	5.04
2	0.0042	28.0	1.588	5.67
3	0.0032	21.3	1.440	6.75
4	0.0059	39.3	2.641	6.71
5	0.0052	34.7	2.116	6.10
6	0.0051	34.0	1.863	5.48
7	0.0046	30.7	1.980	6.46
8	0.0059	39.3	2.471	6.28
9	0.0060	40.0	2.536	6.34
10	0.0057	38.0	2.489	6.55
11	0.0054	36.0	1.794	4.98
12	0.0058	38.7	2.666	6.89
13	0.0056	37.3	2.107	5.64
14	0.0051	34.0	1.977	5.81
15	0.0055	36.7	1.924	5.25
16	0.0059	39.3	2.477	6.30
17	0.0057	38.0	2.652	6.98
18	0.0057	38.0	1.973	5.19
19	0.0045	30.0	1.730	5.77
20	0.0057	38.0	1.950	5.13
Avg	-	-	-	5.97
SD	-	-	-	0.65

* Linear density (tex) = (Weight of fiber in gram per 15-cm length x 1000)/0.15.

† Knot strength (cN/tex) = (Max. load in Newton x 100)/Linear density in tex.

Table E11 Knot strength of citrate-crosslinked chitosan fiber prepared by using citric acid concentration of 0.125% (w/v) in the first coagulation bath

Sample no.	Weight (g/15 cm)	Linear density* (tex)	Max. load (N)	Knot strength† (cN/tex)
1	0.0046	30.7	1.405	4.58
2	0.0048	32.0	1.357	4.24
3	0.0050	33.3	1.414	4.24
4	0.0050	33.3	1.557	4.67
5	0.0047	31.3	1.327	4.24
6	0.0050	33.3	1.188	3.56
7	0.0034	22.7	0.9782	4.32
8	0.0048	32.0	1.247	3.90
9	0.0050	33.3	1.639	4.92
10	0.0049	32.7	1.744	5.34
11	0.0052	34.7	1.359	3.92
12	0.0050	33.3	1.619	4.86
13	0.0038	25.3	1.217	4.80
14	0.0048	32.0	1.808	5.65
15	0.0050	33.3	1.718	5.15
16	0.0050	33.3	1.322	3.97
17	0.0051	34.0	1.447	4.26
18	0.0046	30.7	1.675	5.46
19	0.0048	32.0	1.201	3.75
20	0.0048	32.0	1.672	5.23
Avg	-	-	-	4.55
SD	-	-	-	0.61

* Linear density (tex) = (Weight of fiber in gram per 15-cm length x 1000)/0.15.

† Knot strength (cN/tex) = (Max. load in Newton x 100)/Linear density in tex.

Table E12 Knot strength of citrate-crosslinked chitosan fiber prepared by using citric acid concentration of 0.25% (w/v) in the first coagulation bath

Sample no.	Weight (g/15 cm)	Linear density* (tex)	Max. load (N)	Knot strength† (cN/tex)
1	0.0051	34.0	1.611	4.74
2	0.0054	36.0	1.285	3.57
3	0.0055	36.7	1.899	5.18
4	0.0053	35.3	1.291	3.65
5	0.0054	36.0	1.572	4.37
6	0.0055	36.7	1.754	4.78
7	0.0054	36.0	1.766	4.91
8	0.0058	38.7	1.811	4.68
9	0.0055	36.7	1.411	3.85
10	0.0056	37.3	1.824	4.89
11	0.0054	36.0	1.857	5.16
12	0.0048	32.0	1.387	4.33
13	0.0051	34.0	1.515	4.46
14	0.0057	38.0	1.886	4.96
15	0.0056	37.3	1.886	5.05
16	0.0053	35.3	1.737	4.92
17	0.0054	36.0	1.688	4.69
18	0.0050	33.3	1.522	4.57
19	0.0052	34.7	1.566	4.52
20	0.0052	34.7	1.829	5.28
Avg	-	-	-	4.63
SD	-	-	-	0.48

* Linear density (tex) = (Weight of fiber in gram per 15-cm length x 1000)/0.15.

† Knot strength (cN/tex) = (Max. load in Newton x 100)/Linear density in tex.

Table E13 Knot strength of citrate-crosslinked chitosan fiber prepared by using citric acid concentration of 0.5% (w/v) in the first coagulation bath

Sample no.	Weight (g/15 cm)	Linear density* (tex)	Max. load (N)	Knot strength† (cN/tex)
1	0.0046	30.7	1.378	4.49
2	0.0047	31.3	1.299	4.15
3	0.0046	30.7	1.016	3.31
4	0.0045	30.0	1.053	3.51
5	0.0044	29.3	0.9978	3.40
6	0.0046	30.7	1.167	3.81
7	0.0047	31.3	1.273	4.06
8	0.0048	32.0	1.296	4.05
9	0.0047	31.3	1.068	3.41
10	0.0044	29.3	1.098	3.74
11	0.0045	30.0	1.411	4.70
12	0.0045	30.0	1.110	3.70
13	0.0045	30.0	1.217	4.06
14	0.0049	32.7	1.397	4.28
15	0.0045	30.0	1.251	4.17
16	0.0048	32.0	1.274	3.98
17	0.0049	32.7	1.150	3.52
18	0.0048	32.0	1.211	3.78
19	0.0048	32.0	1.395	4.36
20	0.0047	31.3	1.463	4.67
Avg	-	-	-	3.96
SD	-	-	-	0.42

* Linear density (tex) = (Weight of fiber in gram per 15-cm length x 1000)/0.15.

† Knot strength (cN/tex) = (Max. load in Newton x 100)/Linear density in tex.

Table E14 Knot strength of citrate-crosslinked chitosan fiber prepared by using citric acid concentration of 1.25% (w/v) in the first coagulation bath

Sample no.	Weight (g/15 cm)	Linear density* (tex)	Max. load (N)	Knot strength† (cN/tex)
1	0.0041	27.3	0.9590	3.51
2	0.0041	27.3	1.019	3.73
3	0.0040	26.7	0.9552	3.58
4	0.0042	28.0	1.047	3.74
5	0.0041	27.3	1.240	4.54
6	0.0040	26.7	1.156	4.34
7	0.0041	27.3	1.075	3.93
8	0.0040	26.7	1.412	5.30
9	0.0042	28.0	1.206	4.31
10	0.0044	29.3	1.500	5.11
11	0.0042	28.0	1.315	4.70
12	0.0041	27.3	1.030	3.77
13	0.0040	26.7	0.9366	3.51
14	0.0040	26.7	1.378	5.17
15	0.0040	26.7	1.055	3.96
16	0.0039	26.0	1.104	4.25
17	0.0042	28.0	1.271	4.54
18	0.0040	26.7	0.9800	3.68
19	0.0040	26.7	1.160	4.35
20	0.0040	26.7	1.269	4.76
Avg	-	-	-	4.24
SD	-	-	-	0.57

* Linear density (tex) = (Weight of fiber in gram per 15-cm length x 1000)/0.15.

† Knot strength (cN/tex) = (Max. load in Newton x 100)/Linear density in tex.

Table E15 Knot strength of citrate-crosslinked chitosan fiber prepared by using citric acid concentration of 2.5% (w/v) in the first coagulation bath

Sample no.	Weight (g/15 cm)	Linear density* (tex)	Max. load (N)	Knot strength† (cN/tex)
1	0.0057	38.0	1.654	4.35
2	0.0057	38.0	1.937	5.10
3	0.0057	38.0	1.777	4.68
4	0.0062	41.3	1.493	3.61
5	0.0054	36.0	1.132	3.14
6	0.0057	38.0	1.245	3.28
7	0.0057	38.0	1.521	4.00
8	0.0057	38.0	1.981	5.21
9	0.0056	37.3	1.282	3.43
10	0.0059	39.3	1.419	3.61
11	0.0053	35.3	1.625	4.60
12	0.0058	38.7	1.779	4.60
13	0.0055	36.7	1.894	5.17
14	0.0052	34.7	1.270	3.66
15	0.0057	38.0	1.581	4.16
16	0.0049	32.7	1.159	3.55
17	0.0053	35.3	1.392	3.94
18	0.0057	38.0	1.941	5.11
19	0.0053	35.3	1.502	4.25
20	0.0056	37.3	1.489	3.99
Avg	-	-	-	4.17
SD	-	-	-	0.66

* Linear density (tex) = (Weight of fiber in gram per 15-cm length x 1000)/0.15.

† Knot strength (cN/tex) = (Max. load in Newton x 100)/Linear density in tex.

Table E16 Knot strength of citrate-crosslinked chitosan fiber prepared by using citric acid concentration of 3.75% (w/v) in the first coagulation bath

Sample no.	Weight (g/15 cm)	Linear density* (tex)	Max. load (N)	Knot strength† (cN/tex)
1	0.0055	36.7	1.524	4.16
2	0.0057	38.0	1.229	3.23
3	0.0056	37.3	1.592	4.26
4	0.0053	35.3	1.325	3.75
5	0.0056	37.3	1.846	4.94
6	0.0055	36.7	1.331	3.63
7	0.0054	36.0	1.171	3.25
8	0.0056	37.3	1.146	3.07
9	0.0050	33.3	1.342	4.03
10	0.0056	37.3	1.416	3.79
11	0.0054	36.0	1.328	3.69
12	0.0055	36.7	1.843	5.03
13	0.0055	36.7	1.434	3.91
14	0.0056	37.3	1.936	5.19
15	0.0053	35.3	1.987	5.62
16	0.0054	36.0	1.623	4.51
17	0.0047	31.3	0.8807	2.81
18	0.0055	36.7	1.700	4.64
19	0.0054	36.0	1.714	4.76
20	0.0056	37.3	1.857	4.97
Avg	-	-	-	4.16
SD	-	-	-	0.78

* Linear density (tex) = (Weight of fiber in gram per 15-cm length x 1000)/0.15.

† Knot strength (cN/tex) = (Max. load in Newton x 100)/Linear density in tex.

Table E17 Knot strength of citrate-crosslinked chitosan fiber prepared by using citric acid concentration of 5% (w/v) in the first coagulation bath

Sample no.	Weight (g/15 cm)	Linear density* (tex)	Max. load (N)	Knot strength† (cN/tex)
1	0.0051	34.0	0.8899	2.62
2	0.0054	36.0	1.242	3.45
3	0.0056	37.3	0.8609	2.31
4	0.0058	38.7	0.7336	1.90
5	0.0053	35.3	0.8718	2.47
6	0.0057	38.0	0.6271	1.65
7	0.0056	37.3	0.9144	2.45
8	0.0053	35.3	0.8483	2.40
9	0.0057	38.0	0.8631	2.27
10	0.0057	38.0	1.302	3.43
11	0.0054	36.0	0.6189	1.72
12	0.0055	36.7	0.7420	2.02
13	0.0052	34.7	0.7511	2.17
14	0.0055	36.7	0.8431	2.30
15	0.0057	38.0	0.8786	2.31
16	0.0054	36.0	0.6212	1.73
17	0.0053	35.3	1.090	3.08
18	0.0053	35.3	0.6442	1.82
19	0.0055	36.7	0.8929	2.44
20	0.0054	36.0	1.171	3.25
Avg	-	-	-	2.39
SD	-	-	-	0.55

* Linear density (tex) = (Weight of fiber in gram per 15-cm length x 1000)/0.15.

† Knot strength (cN/tex) = (Max. load in Newton x 100)/Linear density in tex.

APPENDIX F

Test Results of Glutaraldehyde-Crosslinked Chitosan Fibers

Table F1 Weight of 15-cm glutaraldehyde-crosslinked chitosan fibers prepared by using glutaraldehyde concentrations of 0.0005, 0.001, and 0.002% in chitosan dope

Sample no.	Weight of glutaraldehyde-crosslinked chitosan fiber (g)		
	By using 0.0005% glutaraldehyde	By using 0.001% glutaraldehyde	By using 0.002% glutaraldehyde
1	0.0052	0.0039	0.0039
2	0.0052	0.0039	0.0038
3	0.0053	0.0035	0.0041
4	0.0051	0.0033	0.0037
5	0.0050	0.0034	0.0037
6	0.0051	0.0032	0.0040
7	0.0052	0.0039	0.0041
8	0.0051	0.0033	0.0042
9	0.0053	0.0041	0.0041
10	0.0051	0.0031	0.0040
11	0.0051	0.0032	0.0041
12	0.0053	0.0039	0.0041
13	0.0050	0.0041	0.0040
14	0.0051	0.0037	0.0040
15	0.0051	0.0042	0.0041
16	0.0051	0.0042	0.0039
17	0.0051	0.0037	0.0039
18	0.0051	0.0032	0.0039
19	0.0051	0.0041	0.0038
20	0.0052	0.0040	0.0040
21	0.0051	0.0041	0.0038
22	0.0053	0.0037	0.0040
23	0.0052	0.0038	0.0037
24	0.0051	0.0042	0.0038
25	0.0051	0.0040	0.0042

Cont.....

Table F1 (Continued)

Sample no.	Weight of glutaraldehyde-crosslinked chitosan fiber (g)		
	By using 0.0005% glutaraldehyde	By using 0.001% glutaraldehyde	By using 0.002% glutaraldehyde
26	0.0051	0.0038	0.0038
27	0.0051	0.0039	0.0041
28	0.0050	0.0030	0.0037
29	0.0050	0.0040	0.0038
30	0.0051	0.0037	0.0040
31	0.0051	0.0041	0.0042
32	0.0051	0.0034	0.0038
33	0.0052	0.0034	0.0039
34	0.0053	0.0033	0.0041
35	0.0051	0.0040	0.0038
36	0.0050	0.0034	0.0039
37	0.0053	0.0035	0.0039
38	0.0051	0.0033	0.0042
39	0.0051	0.0041	0.0041
40	0.0052	0.0038	0.0039
41	0.0050	0.0031	0.0039
42	0.0051	0.0038	0.0038
43	0.0053	0.0034	0.0040
44	0.0053	0.0032	0.0040
45	0.0053	0.0039	0.0038
46	0.0051	0.0040	0.0038
47	0.0053	0.0034	0.0037
48	0.0051	0.0034	0.0038
49	0.0053	0.0037	0.0042
50	0.0051	0.0040	0.0041
Avg (g)	0.0051	0.0037	0.0039
SD	0.0001	0.0004	0.0002
L.D.* (tex)	34.3	24.6	26.3
SD	0.6	2.3	1.0

* Linear density (tex) = (Average weight in gram per 15-cm length x 1000)/0.15.

Tensile Strength and Elongation at Break of Glutaraldehyde-Crosslinked Chitosan Fibers

Table F2 Tensile strength and elongation at break of glutaraldehyde-crosslinked chitosan fiber prepared by using glutaraldehyde concentration of 0.0005% in chitosan dope

Sample no.	Weight (g/15 cm)	Linear density* (tex)	Max. load (N)	Tensile strength† (cN/tex)	Elongation at break (%)
1	0.0052	34.7	3.534	10.19	14.45
2	0.0053	35.3	3.623	10.25	15.91
3	0.0051	34.0	3.630	10.68	17.07
4	0.0050	33.3	3.453	10.36	14.50
5	0.0051	34.0	3.452	10.15	12.98
6	0.0052	34.7	3.619	10.44	16.85
7	0.0051	34.0	3.322	9.77	13.10
8	0.0053	35.3	3.503	9.91	14.46
9	0.0050	33.3	3.356	10.07	13.81
10	0.0051	34.0	3.548	10.44	16.41
11	0.0049	32.7	3.343	10.23	13.23
12	0.0051	34.0	3.537	10.40	15.70
13	0.0051	34.0	3.573	10.51	16.51
14	0.0051	34.0	3.397	9.99	13.53
15	0.0051	34.0	3.522	10.36	14.40
16	0.0053	35.3	3.586	10.15	14.45
17	0.0051	34.0	3.510	10.32	15.37
18	0.0053	35.3	3.660	10.36	15.38
19	0.0051	34.0	3.669	10.79	14.60
20	0.0051	34.0	3.389	9.97	14.68
Avg	-	-	-	10.27	14.87
SD	-	-	-	0.25	1.24

* Linear density (tex) = (Weight of fiber in gram per 15-cm length x 1000)/0.15.

† Tensile strength (cN/tex) = (Max. load in Newton x 100)/Linear density in tex.

Table F3 Tensile strength and elongation at break of glutaraldehyde-crosslinked chitosan fiber prepared by using glutaraldehyde concentration of 0.001% in chitosan dope

Sample no.	Weight (g/15 cm)	Linear density* (tex)	Max. load (N)	Tensile strength† (cN/tex)	Elongation at break (%)
1	0.0021	14.0	1.557	11.12	13.54
2	0.0035	23.3	2.447	10.49	13.40
3	0.0034	22.7	2.486	10.97	12.30
4	0.0039	26.0	2.813	10.82	13.15
5	0.0041	27.3	2.965	10.85	15.40
6	0.0028	18.7	1.995	10.69	13.20
7	0.0031	20.7	2.334	11.29	12.94
8	0.0041	27.3	2.829	10.35	13.67
9	0.0037	24.7	2.753	11.16	11.70
10	0.0041	27.3	2.885	10.55	14.48
11	0.0040	26.7	2.673	10.02	11.36
12	0.0037	24.7	2.735	11.09	13.34
13	0.0038	25.3	2.652	10.47	14.18
14	0.0025	16.7	1.880	11.28	15.18
15	0.0025	16.7	1.674	10.04	14.96
16	0.0027	18.0	1.913	10.63	15.38
17	0.0032	21.3	2.407	11.28	13.70
18	0.0039	26.0	2.620	10.08	11.78
19	0.0032	21.3	2.235	10.48	14.73
20	0.0041	27.3	2.870	10.50	12.18
Avg	-	-	-	10.71	13.53
SD	-	-	-	0.42	1.25

* Linear density (tex) = (Weight of fiber in gram per 15-cm length x 1000)/0.15.

† Tensile strength (cN/tex) = (Max. load in Newton x 100)/Linear density in tex.

Table F4 Tensile strength and elongation at break of glutaraldehyde-crosslinked chitosan fiber prepared by using glutaraldehyde concentration of 0.002% in chitosan dope

Sample no.	Weight (g/15 cm)	Linear density* (tex)	Max. load (N)	Tensile strength† (cN/tex)	Elongation at break (%)
1	0.0039	26.0	2.896	11.14	14.40
2	0.0038	25.3	2.490	9.83	10.83
3	0.0041	27.3	2.647	9.68	11.00
4	0.0037	24.7	2.647	10.73	9.611
5	0.0040	26.7	2.638	9.89	12.10
6	0.0040	26.7	2.497	9.36	10.20
7	0.0041	27.3	2.619	9.58	11.70
8	0.0040	26.7	2.631	9.87	10.47
9	0.0039	26.0	2.788	10.72	13.57
10	0.0039	26.0	2.952	11.35	12.63
11	0.0039	26.0	2.548	9.80	11.57
12	0.0038	25.3	2.676	10.56	12.43
13	0.0040	26.7	2.399	9.00	9.477
14	0.0040	26.7	2.398	8.99	9.865
15	0.0036	24.0	2.505	10.44	11.76
16	0.0046	30.7	2.890	9.42	12.30
17	0.0041	27.3	2.508	9.18	11.56
18	0.0041	27.3	3.112	11.39	10.60
19	0.0044	29.3	2.745	9.36	8.281
20	0.0041	27.3	2.831	10.36	14.06
Avg	-	-	-	10.03	11.42
SD	-	-	-	0.76	1.58

* Linear density (tex) = (Weight of fiber in gram per 15-cm length x 1000)/0.15.

† Tensile strength (cN/tex) = (Max. load in Newton x 100)/Linear density in tex.

Knot Strength of Glutaraldehyde-Crosslinked Chitosan Fibers

Table F5 Knot strength of glutaraldehyde-crosslinked chitosan fiber prepared by using glutaraldehyde concentration of 0.0005% in chitosan dope

Sample no.	Weight (g/15 cm)	Linear density* (tex)	Max. load (N)	Knot strength† (cN/tex)
1	0.0051	34.0	1.899	5.59
2	0.0051	34.0	1.582	4.65
3	0.0050	33.3	1.642	4.93
4	0.0050	33.3	1.508	4.52
5	0.0051	34.0	1.821	5.36
6	0.0053	35.3	1.840	5.21
7	0.0051	34.0	2.121	6.24
8	0.0050	33.3	1.478	4.43
9	0.0051	34.0	1.887	5.55
10	0.0051	34.0	2.100	6.18
11	0.0047	31.3	1.929	6.16
12	0.0051	34.0	1.637	4.81
13	0.0053	35.3	2.118	5.99
14	0.0053	35.3	2.468	6.98
15	0.0053	35.3	2.288	6.48
16	0.0051	34.0	1.684	4.95
17	0.0053	35.3	1.843	5.22
18	0.0051	34.0	1.687	4.96
19	0.0051	34.0	2.277	6.70
20	0.0054	36.0	1.668	4.63
Avg	-	-	-	5.48
SD	-	-	-	0.78

* Linear density (tex) = (Weight of fiber in gram per 15-cm length x 1000)/0.15.

† Knot strength (cN/tex) = (Max. load in Newton x 100)/Linear density in tex.

Table F6 Knot strength of glutaraldehyde-crosslinked chitosan fiber prepared by using glutaraldehyde concentration of 0.001% in chitosan dope

Sample no.	Weight (g/15 cm)	Linear density* (tex)	Max. load (N)	Knot strength† (cN/tex)
1	0.0027	18.0	0.8005	4.45
2	0.0040	26.7	1.538	5.77
3	0.0039	26.0	1.612	6.20
4	0.0030	20.0	1.120	5.60
5	0.0040	26.7	1.702	6.38
6	0.0037	24.7	1.453	5.89
7	0.0034	22.7	1.158	5.11
8	0.0033	22.0	1.011	4.60
9	0.0040	26.7	1.473	5.52
10	0.0034	22.7	1.029	4.54
11	0.0035	23.3	1.069	4.58
12	0.0033	22.0	0.8826	4.01
13	0.0038	25.3	1.471	5.81
14	0.0038	25.3	1.247	4.92
15	0.0032	21.3	0.9053	4.24
16	0.0040	26.7	1.774	6.65
17	0.0034	22.7	1.372	6.05
18	0.0025	16.7	0.6872	4.12
19	0.0034	22.7	1.378	6.08
20	0.0037	24.7	0.9908	4.02
Avg	-	-	-	5.23
SD	-	-	-	0.86

* Linear density (tex) = (Weight of fiber in gram per 15-cm length x 1000)/0.15.

† Knot strength (cN/tex) = (Max. load in Newton x 100)/Linear density in tex.

Table F7 Knot strength of glutaraldehyde-crosslinked chitosan fiber prepared by using glutaraldehyde concentration of 0.002% in chitosan dope

Sample no.	Weight (g/15 cm)	Linear density* (tex)	Max. load (N)	Knot strength† (cN/tex)
1	0.0038	25.3	0.8020	3.17
2	0.0041	27.3	1.206	4.41
3	0.0038	25.3	0.7911	3.12
4	0.0040	26.7	0.9401	3.53
5	0.0043	28.7	1.543	5.38
6	0.0041	27.3	0.8853	3.24
7	0.0038	25.3	1.127	4.45
8	0.0039	26.0	1.592	6.12
9	0.0039	26.0	1.483	5.70
10	0.0042	28.0	1.148	4.10
11	0.0039	26.0	1.287	4.95
12	0.0039	26.0	1.457	5.60
13	0.0038	25.3	0.9111	3.60
14	0.0040	26.7	0.8243	3.09
15	0.0038	25.3	1.522	6.01
16	0.0038	25.3	1.103	4.35
17	0.0042	28.0	1.514	5.41
18	0.0041	27.3	1.481	5.42
19	0.0037	24.7	1.073	4.35
20	0.0035	23.3	0.7988	3.42
Avg	-	-	-	4.47
SD	-	-	-	1.04

* Linear density (tex) = (Weight of fiber in gram per 15-cm length x 1000)/0.15.

† Knot strength (cN/tex) = (Max. load in Newton x 100)/Linear density in tex.

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