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APPENDIX A

Effect of pH

Table A 1 The data of degree of swelling of blend films in pH buffer solution pH = 3.

Chitosan content (%)	Degree of swelling (%)			Average	Standard deviation
	X1	X2	X3		
0	44.16	43.75	49.23	45.71	3.05
20	635.42	616.82	616.83	623.02	10.74
40	1960.25	1899.04	1949.21	1936.17	32.62
50	dissolved	dissolved	dissolved	-	-
60	dissolved	dissolved	dissolved	-	-
80	dissolved	dissolved	dissolved	-	-
100	dissolved	dissolved	dissolved	-	-

Table A 2 The data of degree of swelling of blend films in pH buffer solution pH=4.

Chitosan content (%)	Degree of swelling (%)			Average	Standard deviation
	X1	X2	X3		
0	41.01	42.11	44.32	42.48	1.69
20	505.79	498.63	499.79	501.40	3.84
40	1567.05	1432.78	1508.91	1502.91	67.34
50	dissolved	dissolved	dissolved	-	-
60	dissolved	dissolved	dissolved	-	-
80	dissolved	dissolved	dissolved	-	-
100	dissolved	dissolved	dissolved	-	-

Table A 3 The data of degree of swelling of blend films in pH buffer solution pH = 5.

Chitosan content (%)	Degree of swelling (%)			Average	Standard deviation
	X1	X2	X3		
0	50.00	50.66	51.02	50.56	0.52
20	67.80	61.80	76.20	68.60	7.23
40	103.66	99.90	105.61	103.06	2.90
50	105.38	108.41	113.93	109.24	4.34
60	128.07	121.57	115.88	121.84	6.10
80	140.00	145.54	154.55	146.70	7.34
100	158.67	153.85	160.75	157.76	3.54

Table A 4 The data of degree of swelling of blend films in pH buffer solution pH = 6.

Chitosan content (%)	Degree of swelling (%)			Average	Standard deviation
	X1	X2	X3		
0	47.58	48.08	44.52	46.73	1.93
20	65.10	65.68	66.01	65.60	0.46
40	73.40	67.86	70.14	70.47	2.78
50	80.06	76.26	78.65	78.32	1.92
60	72.84	70.83	70.98	71.55	1.12
80	91.47	88.38	93.25	91.03	2.46
100	82.998	74.39	81.09	79.49	4.51

Table A 5 The data of degree of swelling of blend films in pH buffer solution pH = 7.

Chitosan content (%)	Degree of swelling (%)			Average	Standard deviation
	X1	X2	X3		
0	50.75	54.43	52.21	52.06	1.12
20	56.25	50.00	52.01	52.75	1.29
40	72.65	68.66	69.92	70.41	1.73
50	79.83	76.34	76.82	77.66	1.15
60	85.37	80.31	84.99	83.56	1.67
80	85.39	81.26	82.07	82.91	0.84
100	97.01	91.07	93.74	93.94	1.56

Table A 6 The data of degree of swelling of blend films in pH buffer solution pH = 8.

Chitosan content (%)	Degree of swelling (%)			Average	Standard deviation
	X1	X2	X3		
0	43.16	45.31	43.69	44.05	1.12
20	68.93	68.71	66.59	68.08	1.29
40	76.08	79.04	76.01	77.04	1.73
50	70.55	72.66	70.82	71.34	1.15
60	63.43	66.58	65.99	65.33	1.67
80	65.87	66.98	65.33	66.06	0.84
100	57.14	60.25	58.97	58.79	1.56

Table A 7 The data of degree of swelling of blend films in pH buffer solution pH = 9.

Chitosan content (%)	Degree of swelling (%)			Average	Standard deviation
	X1	X2	X3		
0	31.86	31.65	32.44	31.98	0.41
20	31.25	32.86	32.02	32.04	0.81
40	39.84	43.90	41.51	41.75	2.04
50	38.32	41.12	41.20	40.21	1.64
60	39.44	41.71	41.28	40.81	1.21
80	41.86	40.58	42.01	41.15	0.98
100	42.33	43.42	42.87	42.87	0.55

Table A 8 The data of degree of swelling of blend films in pH buffer solution pH = 11.

Chitosan content (%)	Degree of swelling (%)			Average	Standard deviation
	X1	X2	X3		
0	55.86	62.88	65.41	61.38	4.95
20	74.37	72.80	76.29	74.49	1.75
40	71.03	71.84	72.59	71.82	0.78
50	73.91	74.81	73.68	74.13	0.60
60	77.95	74.16	76.99	76.37	1.97
80	76.92	74.26	76.52	76.13	1.56
100	79.02	80.51	79.79	79.77	0.75

Table A 9 The data of degree of swelling of crosslinked blend films in pH buffer solution pH = 3.

Chitosan content (%)	Degree of swelling (%)			Average	Standard deviation
	X1	X2	X3		
0	44.16	43.75	49.23	45.71	3.05
20	376.05	380.95	390.31	382.44	7.25
40	759.85	767.76	811.83	779.81	28.01
50	742.42	761.74	780.89	761.68	19.24
60	973.96	1016.78	997.92	996.22	21.46
80	1046.67	1047.75	1131.18	1068.07	42.08
100	940.54	1090.79	1120.54	1050.62	96.49

Table A 10 The data of degree of swelling of crosslinked blend films in pH buffer solution pH = 4.

Chitosan content (%)	Degree of swelling (%)			Average	Standard deviation
	X1	X2	X3		
0	41.01	42.11	44.32	42.48	1.69
20	356.35	389.86	365.87	370.69	17.27
40	691.95	810.44	771.01	757.80	60.34
50	647.06	714.86	729.63	697.18	44.03
60	827.78	813.19	822.27	821.08	7.37
80	1711.32	1671.28	1599.71	1660.77	56.54
100	1119.28	1069.33	1200.41	1129.67	66.16

Table A 11 The data of degree of swelling of crosslinked blend films in pH buffer solution pH=5.

Chitosan content (%)	Degree of swelling (%)			Average	Standard deviation
	X1	X2	X3		
0	50.00	50.66	51.02	50.56	0.52
20	102.25	89.33	94.74	95.44	6.49
40	135.62	119.77	125.30	126.90	8.04
50	135.44	120.19	134.20	129.94	8.47
60	150.91	139.46	148.27	146.21	6.00
80	149.23	150.79	151.79	150.60	1.29
100	154.90	164.18	159.26	159.45	4.64

Table A 12 The data of degree of swelling of crosslinked blend films in pH buffer solution pH = 6.

Chitosan content (%)	Degree of swelling (%)			Average	Standard deviation
	X1	X2	X3		
0	47.58	48.08	44.52	46.73	1.93
20	66.16	65.12	67.04	66.12	0.96
40	82.91	90.87	88.53	87.44	4.09
50	100.77	105.28	102.43	102.83	2.28
60	98.52	110.89	108.78	106.06	6.62
80	113.68	110.29	109.85	111.27	2.10
100	127.54	132.52	124.48	128.18	4.06

Table A 13 The data of degree of swelling of crosslinked blend films in pH buffer solution pH = 7.

Chitosan content (%)	Degree of swelling (%)			Average	Standard deviation
	X1	X2	X3		
0	50.75	54.43	52.21	52.46	1.85
20	62.23	75.00	68.58	68.60	6.39
40	76.74	81.82	79.93	79.50	2.57
50	87.01	88.52	89.69	88.41	1.34
60	81.91	77.97	78.55	79.48	2.13
80	83.87	90.51	88.47	87.62	3.40
100	87.04	81.48	89.26	85.93	4.01

Table A 14 The data of degree of swelling of crosslinked blend films in pH buffer solution pH = 8.

Chitosan content (%)	Degree of swelling (%)			Average	Standard deviation
	X1	X2	X3		
0	43.16	45.31	43.69	44.05	1.12
20	74.65	75.12	75.48	75.08	0.42
40	72.99	74.98	75.96	74.64	1.51
50	73.51	72.01	70.89	72.14	1.31
60	73.48	73.59	74.24	73.77	0.41
80	69.74	74.82	73.26	72.61	2.60
100	61.36	68.59	69.58	66.51	4.49

Table A 15 The data of degree of swelling of crosslinked blend films in pH buffer solution pH = 9.

Chitsan content (%)	Degree of swelling (%)			Average	Standard deviation
	X1	X2	X3		
0	31.86	31.65	32.44	31.98	0.41
20	44.07	36.76	43.57	41.47	4.08
40	43.04	43.84	43.02	43.30	0.47
50	47.22	44.54	44.58	45.45	1.54
60	53.13	56.76	54.27	54.72	1.86
80	48.28	47.44	46.59	47.44	0.85
100	45.58	41.58	44.05	43.74	2.02

Table A 16 The data of degree of swelling of crosslinked blend films in pH buffer solution pH = 11.

Chitosan content (%)	Degree of swelling (%)			Average	Standard deviation
	X1	X2	X3		
0	55.86	62.88	65.41	61.38	4.95
20	86.31	85.69	86.97	86.32	0.64
40	70.34	79.58	80.24	76.72	5.54
50	68.75	76.52	72.51	72.59	3.89
60	76.62	75.82	80.09	77.51	2.27
80	74.56	78.92	75.37	76.28	2.32
100	81.91	79.56	80.07	80.51	1.24

APPENDIX B

Effect of salt type

Table B 1 The data of degree of swelling of blend films in 0.25 M LiCl solution.

Chitosan content (%)	Degree of swelling (%)			Average	Standard deviation
	X1	X2	X3		
0	50.60	47.14	44.26	47.33	3.17
20	50.57	41.84	49.46	47.29	4.75
40	61.95	55.88	62.35	60.06	3.63
50	52.09	57.75	53.38	54.41	2.97
60	61.14	78.91	79.43	73.16	10.41
80	93.69	78.81	65.98	79.49	13.87
100	63.49	67.61	65.31	65.47	2.06

Table B 2 The data of degree of swelling of crosslinked blend films in 0.25 M NaCl solution.

Chitosan content (%)	Degree of swelling (%)			Average	Standard deviation
	X1	X2	X3		
0	38.12	36.52	38.24	37.63	0.96
20	47.29	50.89	46.27	48.15	2.43
40	62.15	63.29	62.28	62.57	0.62
50	64.92	65.71	60.99	63.87	2.53
60	79.17	80.24	79.05	79.49	0.66
80	83.75	80.63	83.86	82.75	1.83
100	65.55	70.51	68.84	68.30	2.52

Table B 3 The data of degree of swelling of blend films in 0.25 M CaCl₂ solution.

Chitosan content (%)	Degree of swelling (%)			Average	Standard deviation
	X1	X2	X3		
0	38.62	34.44	36.52	36.53	2.09
20	54.32	56.11	53.25	54.56	1.45
40	63.96	63.28	65.77	64.34	1.29
50	71.54	73.19	73.27	68.50	4.68
60	70.59	73.58	72.01	72.06	1.50
80	66.67	68.29	69.08	68.01	1.23
100	83.75	87.32	88.23	86.43	2.37

Table B 4 The data of degree of swelling of blend films in 0.25 M AlCl₃ solution.

Chitosan content (%)	Degree of swelling (%)			Average	Standard deviation
	X1	X2	X3		
0	43.62	38.84	43.62	42.03	2.76
20	200.83	199.57	210.39	203.60	5.92
40	435.06	480.83	458.21	458.03	22.89
50	696.40	691.8	725.14	704.45	18.07
60	-	-	-	-	-
80	-	-	-	-	-
100	-	-	-	-	-

Table B 5 The data of degree of swelling of blend films in 0.25 M FeCl₃ solution.

Chitosan content (%)	Degree of swelling (%)			Average	Standard deviation
	X1	X2	X3		
0	37.27	32.08	34.02	34.68	3.67
20	150.23	148.32	143.36	147.30	3.55
40	370.69	395.20	371.24	379.04	19.99
50	690.85	701.25	679.58	690.56	10.84
60	-	-	-	-	-
80	-	-	-	-	-
100	-	-	-	-	-

Table B 6 The data of degree of swelling of crosslinked blend films in 0.25 M LiCl solution.

Chitosan content (%)	Degree of swelling (%)			Average	Standard deviation
	X1	X2	X3		
0	50.60	40.14	44.26	45.00	5.27
20	66.13	70.22	74.31	70.22	4.09
40	65.06	68.33	70.37	67.92	2.68
50	69.70	75.00	72.09	72.22	2.17
60	86.24	88.64	87.50	87.46	1.20
80	81.25	91.55	93.90	88.90	6.73
100	76.56	81.19	79.25	79.00	2.33

Table B 7 The data of degree of swelling of crosslinked blend films in 0.25 M NaCl solution.

Chitosan content (%)	Degree of swelling (%)			Average	Standard deviation
	X1	X2	X3		
0	38.52	37.25	39.41	38.39	1.09
20	69.50	68.86	64.83	67.73	2.53
40	75.90	74.51	76.25	75.55	0.92
50	74.55	74.23	75.36	74.71	0.58
60	76.63	78.59	77.52	77.58	0.98
80	68.75	72.14	73.19	71.36	2.32
100	71.697	73.26	73.95	72.97	1.16

Table B 8 The data of degree of swelling of crosslinked blend films in 0.25M CaCl_2 solution.

Chitosan content (%)	Degree of swelling (%)			Average	Standard deviation
	X1	X2	X3		
0	38.51	34.52	37.74	36.92	2.12
20	54.12	55.69	53.35	54.39	1.19
40	63.96	60.28	59.67	61.30	2.32
50	71.54	68.52	70.24	70.10	1.51
60	70.59	73.98	70.99	71.85	1.85
80	66.67	70.28	69.64	68.86	1.93
100	83.75	80.32	79.65	81.24	2.20

Table 9 The data of degree of swelling of crosslinked blend films in 0.25 M AlCl_3 solution.

Chitosan content (%)	Degree of swelling (%)			Average	Standard deviation
	X1	X2	X3		
0	43.62	38.84	43.62	42.03	2.76
20	196.23	193.05	190.83	193.37	2.71
40	333.15	299.38	286.48	306.34	24.10
50	398.73	372.00	351.38	374.04	23.74
60	370.09	406.79	394.94	390.61	18.73
80	597.72	565.04	566.67	576.48	18.42
100	402.63	416.41	429.29	416.11	13.33

Table B 10 The data of degree of swelling of crosslinked blend films in 0.25 M FeCl₃ solution.

Chitosan content (%)	Degree of swelling (%)			Average	Standard deviation
	X1	X2	X3		
0	37.27	32.08	34.02	34.46	2.62
20	116.55	115.23	115.94	115.91	0.66
40	236.51	240.29	239.58	238.79	2.01
50	284.21	288.38	288.78	287.12	2.53
60	440.66	451.21	444.47	445.45	5.34
80	490.28	500.25	495.57	495.37	4.99
100	450.19	461.27	455.53	455.66	5.54

APPENDIX C

Effect of AlCl₃ concentration

Table C 1 The data of degree of swelling of crosslinked blend films in 0.5 M AlCl₃ solution.

Chitosan content (%)	Degree of swelling (%)			Average	Standard deviation
	X1	X2	X3		
0	34.52	34.06	34.20	34.29	0.0325
20	131.19	128.57	130.36	130.04	1.34
40	139.53	133.73	134.92	136.06	3.06
50	165.48	151.69	164.04	160.40	7.58
60	158.33	148.89	151.52	152.91	4.87
80	187.10	187.72	192.73	189.18	3.09
100	181.03	179.75	166.67	175.82	7.95

Table C 2 The data of degree of swelling of crosslinked blend films in 0.25 M AlCl_3 solution.

Chitosan content (%)	Degree of swelling (%)			Average	Standard deviation
	X1	X2	X3		
0	43.62	38.84	43.62	42.03	2.76
20	196.23	193.05	190.83	193.37	2.71
40	333.15	299.38	286.48	306.34	24.10
50	398.73	372.00	351.38	374.04	23.74
60	370.09	406.79	394.94	390.61	18.73
80	597.72	565.04	566.67	576.48	18.42
100	402.63	416.41	429.29	416.11	13.33

Table C 3 The data of degree of swelling of crosslinked blend films in 0.1 M AlCl_3 solution.

Chitosan content (%)	Degree of swelling (%)			Average	Standard deviation
	X1	X2	X3		
0	35.85	37.31	37.10	36.75	0.79
20	300.00	270.08	286.90	285.66	14.99
40	492.86	485.00	487.37	488.41	4.03
50	590.10	529.76	529.03	549.63	35.05
60	547.22	529.75	514.74	530.57	16.25
80	678.57	649.23	621.52	649.77	28.53
100	819.35	811.43	842.57	824.45	16.18

Table C 4 The data of degree of swelling of crosslinked blend films in 0.01 M AlCl_3 solution.

Chitosan content (%)	Degree of swelling (%)			Average	Standard deviation
	X1	X2	X3		
0	35.62	36.36	37.93	36.64	1.18
20	291.21	298.72	283.67	291.20	7.53
40	716.81	661.90	647.62	675.44	36.53
50	877.5	820.00	887.04	861.51	36.27
60	854.90	847.25	858.06	853.40	5.56
80	1364.86	1300.00	1485.53	1383.46	94.15
100	804.76	813.91	861.22	826.63	30.30

Table C 5 The data of degree of swelling of crosslinked blend films in 0.001 M AlCl_3 solution.

Chitosan content (%)	Degree of swelling (%)			Average	Standard deviation
	X1	X2	X3		
0	32.67	34.72	38.01	35.13	2.69
20	187.37	214.58	191.94	197.96	14.57
40	271.43	305.56	327.14	301.38	28.09
50	626.32	578.65	588.54	597.84	25.16
60	462.50	592.41	553.77	536.23	66.71
80	565.75	518.31	569.86	551.31	28.65
100	510.33	514.29	501.43	508.68	6.59

Table C 6 The data of degree of swelling of crosslinked blend films in 0.0001M AlCl₃ solution.

Chitosan content (%)	Degree of swelling (%)			Average	Standard deviation
	X1	X2	X3		
0	36.36	37.41	35.94	36.57	0.76
20	71.92	92.59	78.26	80.92	10.59
40	62.69	92.17	94.17	83.01	17.62
50	76.60	72.17	79.17	75.98	3.54
60	101.49	100.00	87.14	96.21	7.89
80	108.97	115.19	115.67	113.28	3.74
100	95.56	86.76	98.57	93.63	6.14

APPNDIX D

Effect of FeCl₃ concentration

Table D 1 The data of degree of swelling of crosslinked blend films in 0.5 M FeCl₃ solution.

Chitosan content (%)	Degree of swelling (%)			Average	Standard deviation
	X1	X2	X3		
0	42.42	40.74	33.33	38.83	4.84
20	62.02	62.02	68.47	64.17	3.72
40	111.29	107.09	124.10	114.16	8.86
50	128.32	111.63	113.04	117.66	9.26
60	147.79	147.06	151.75	148.87	2.52
80	194.79	177.55	189.02	187.12	8.78
100	217.57	215.00	207.25	213.27	5.37

Table D 2 The data of degree of swelling of crosslinked blend films in 0.25 M FeCl₃ solution.

Chitosan content (%)	Degree of swelling (%)			Average	Standard deviation
	X1	X2	X3		
0	37.27	32.08	34.02	34.46	2.62
20	116.55	115.23	115.94	115.91	0.66
40	236.51	240.29	239.58	238.79	2.01
50	284.21	288.38	288.78	287.12	2.53
60	440.66	451.21	444.47	445.45	5.34
80	490.28	500.25	495.57	495.37	4.99
100	450.19	461.27	455.53	455.66	5.54

Table D 3 The data of degree of swelling of crosslinked blend films in 0.1 M FeCl₃ solution.

Chitosan content (%)	Degree of swelling (%)			Average	Standard deviation
	X1	X2	X3		
0	35.59	39.31	39.67	38.19	2.26
20	216.57	187.38	197.26	200.40	14.85
40	343.68	340.0	359.02	347.57	10.09
50	442.03	430.43	444.30	438.92	7.44
60	721.05	681.12	663.33	688.50	29.56
80	980.95	887.30	948.44	938.90	47.55
100	585.71	579.52	596.51	587.25	8.60

Table D 4 The data of degree of swelling of crosslinked blend films in 0.01 M FeCl₃ solution.

Chitosan content (%)	Degree of swelling (%)			Average	Standard deviation
	X1	X2	X3		
0	35.94	32.61	34.65	34.40	1.68
20	156.25	153.85	150.00	153.37	3.15
40	727.97	742.34	762.50	744.27	17.35
50	748.68	711.94	828.33	762.98	59.50
60	928.89	1063.25	1069.83	1020.66	79.54
80	1639.71	1689.33	1730.08	1686.37	45.26
100	859.72	872.22	804.61	845.52	35.97

Table D 5 The data of degree of swelling of crosslinked blend films in 0.001 M FeCl₃ solution.

Chitosan content (%)	Degree of swelling (%)			Average	Standard deviation
	X1	X2	X3		
0	38.46	38.30	42.67	39.81	2.48
20	153.06	155.65	136.91	148.54	10.15
40	578.52	578.17	564.29	573.66	8.12
50	674.38	657.38	619.74	650.50	27.96
60	824.46	895.56	872.22	864.08	36.24
80	1170.67	1112.20	1272.22	1185.03	80.97
100	689.29	635.84	628.04	651.06	33.34

Table D 6 The data of degree of swelling of crosslinked blend films in 0.0001 M FeCl₃ solution.

Chitosan content (%)	Degree of swelling (%)			Average	Standard deviation
	X1	X2	X3		
0	37.21	38.00	37.36	37.52	0.42
20	54.37	56.45	52.59	54.47	1.93
40	72.22	72.79	74.67	73.23	1.28
50	92.12	87.67	90.91	90.23	2.30
60	104.82	106.47	106.90	106.06	1.10
80	113.51	114.06	110.61	112.73	1.85
100	103.45	111.11	109.76	108.11	4.09

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