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APPENDICES

Appendix A Preparation of chitosan

Table A1 Yields of chitin produced from shrimp shell

Chitin Batch no.	Weight of shrimp shells (g)	Weight of chitin (g)	% Yield
1	1500.14	400.03	26.67
2	1500.53	420.01	27.99

Table A2 Conversion of chitosan from chitin

Chitosan Batch no.	Weight of chitin (g)	Weight of chitosan obtained (g)	Conversion (%w/w)
1	68.54	63.49	92.63
2	53.16	48.31	90.88
3	46.66	41.76	89.50
4	66.14	61.14	92.44
5	56.35	53.36	94.70
6	46.96	42.66	90.84
7	57.36	53.40	93.10
8	51.17	47.18	92.20
9	40.68	37.61	92.45

Appendix B Characterization of chitosan

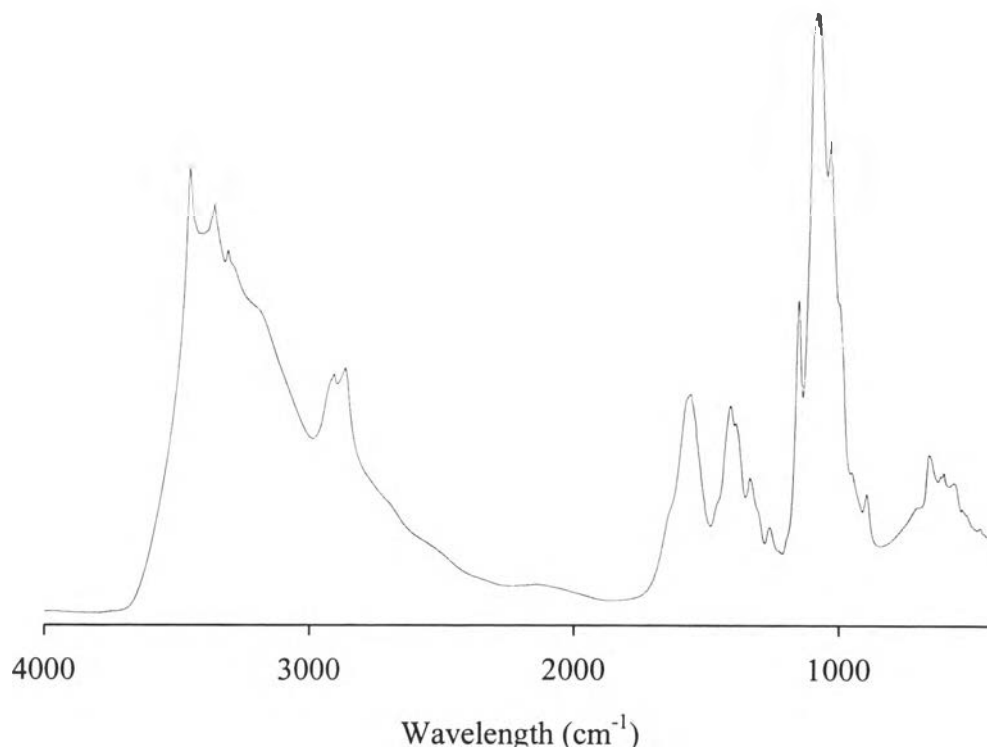


Figure B1 FTIR spectrum of chitosan.

Table B1 FTIR characteristic absorption bands of chitosan

Frequencies (cm ⁻¹)	Assignment and remarks	Reference(s)
1654	C=O stretching	Muzzarelli, 1977
1592	NH bending	Kurita <i>et al.</i> , 1993
1321	CN band and CH ₂ wagging	Kim <i>et al.</i> , 1996
1081 and 1032	C-O stretching vibration	Kim <i>et al.</i> , 1994

Appendix C Determination of molecular weight of chitosan

Table C1 Running time of solvent and chitosan solution

Concentration (g/100 ml)	Time (second)			
	1	2	3	Average
0.0000	99.01	98.53	98.64	98.73
0.0125	107.86	107.95	107.99	107.93
0.0250	117.45	117.27	117.63	117.45
0.0500	138.35	138.52	138.52	138.46
0.0750	161.08	161.26	161.50	161.28
0.1000	188.81	188.98	188.82	188.87

Table C2 Data of relative viscosity (η_{rel}), specific viscosity (η_{sp}), and reduced viscosity (η_{red}) of chitosan solution with various concentrations

Concentration (g/100 ml)	η_{rel}	η_{sp}	η_{red}	$\ln[\eta_{rel}]/c$
0.0000				
0.0125	1.0932	0.0932	7.4547	7.1275
0.0250	1.1896	0.1896	7.5843	6.9450
0.0500	1.4024	0.4024	8.0482	6.7639
0.0750	1.6335	0.6335	8.4473	6.5434
0.1000	1.9130	0.9130	9.1300	6.4867

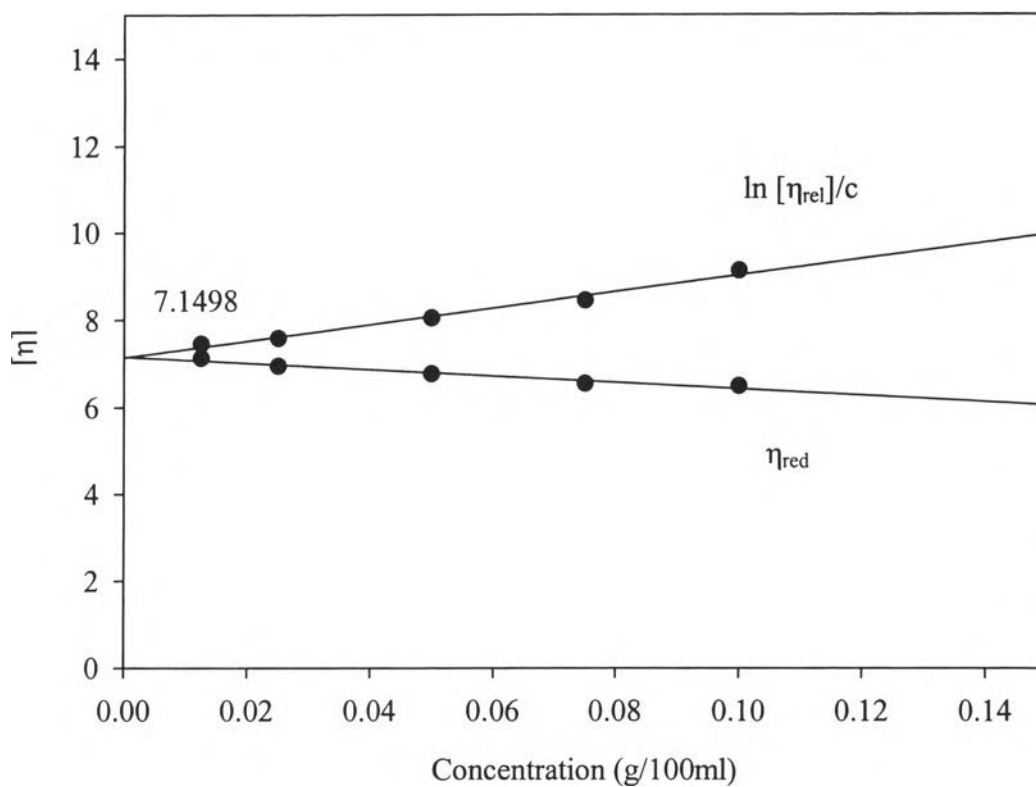


Figure C1 Plot of reduced viscosity (η_{sp}/c) and $\ln((\eta_{rel})/c)$ versus concentration of chitosan solution: ● = (η_{sp}/c) and ○ = $\ln((\eta_{rel})/c)$.

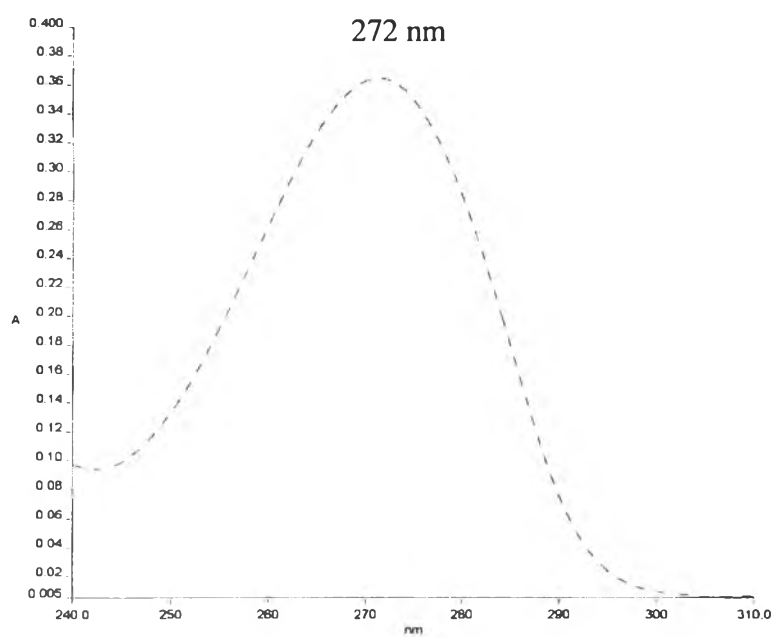
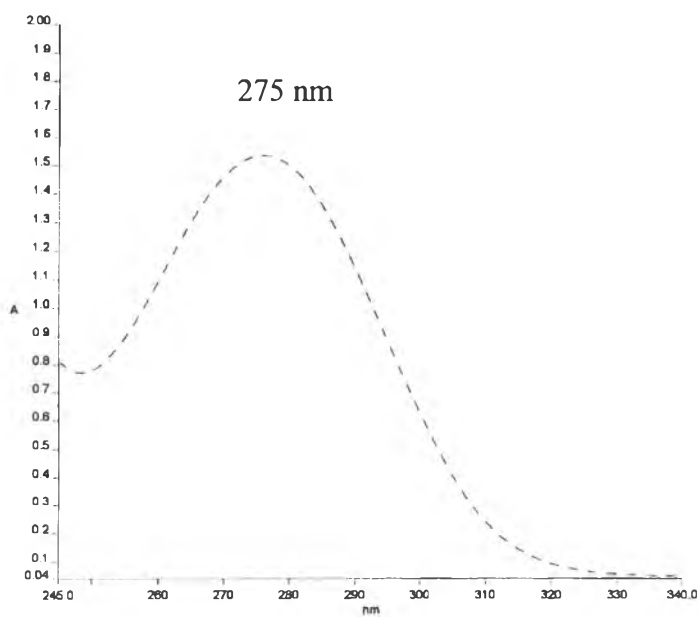
$$[\eta] = kM^a = (7.52 \times 10^{-4})M^{1.0016}$$

$$M^{1.0016} = [\eta] / k = 9.508 \times 10^3$$

$$1.0016 \log M = \log[9.508 \times 10^3]$$

$$\log M = 3.9781$$

$$M = 9.51 \times 10^5$$

Appendix D UV Spectrum of model drugs and glutaraldehyde**Figure D1** UV spectrum of theophylline.**Figure D2** UV spectrum of diclofenac sodium.

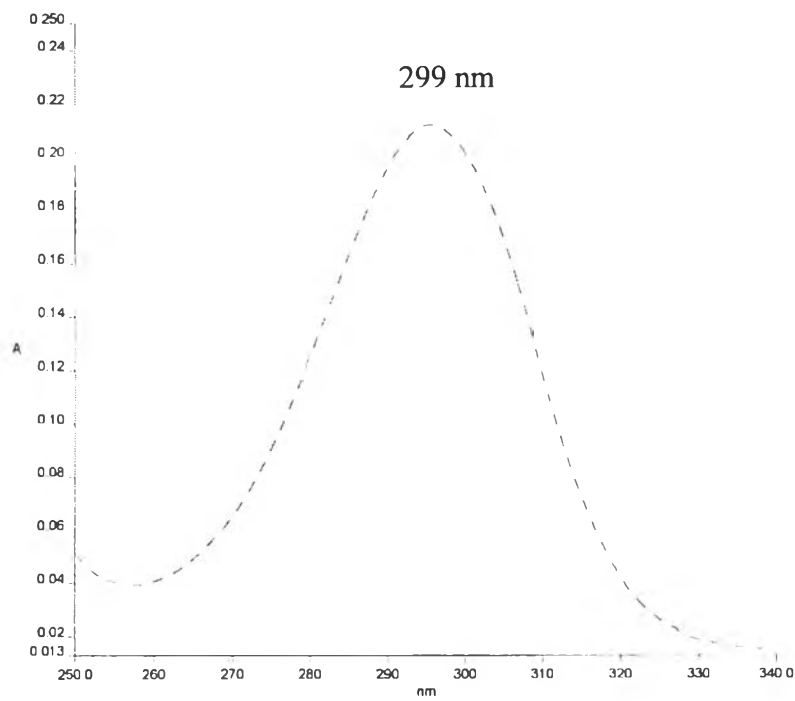


Figure D3 UV spectrum of salicylic acid.

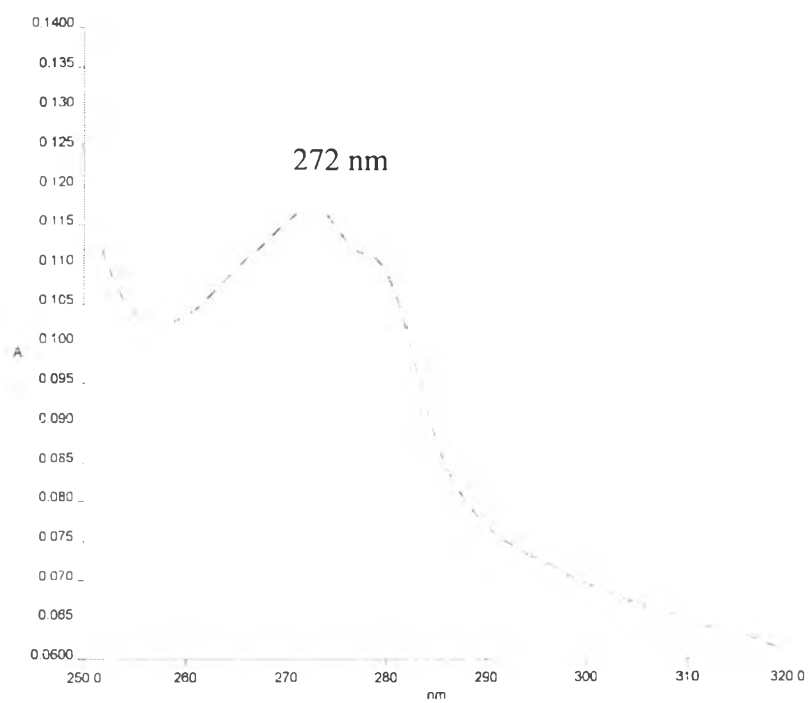


Figure D4 UV spectrum of amoxicillin trihydrate.

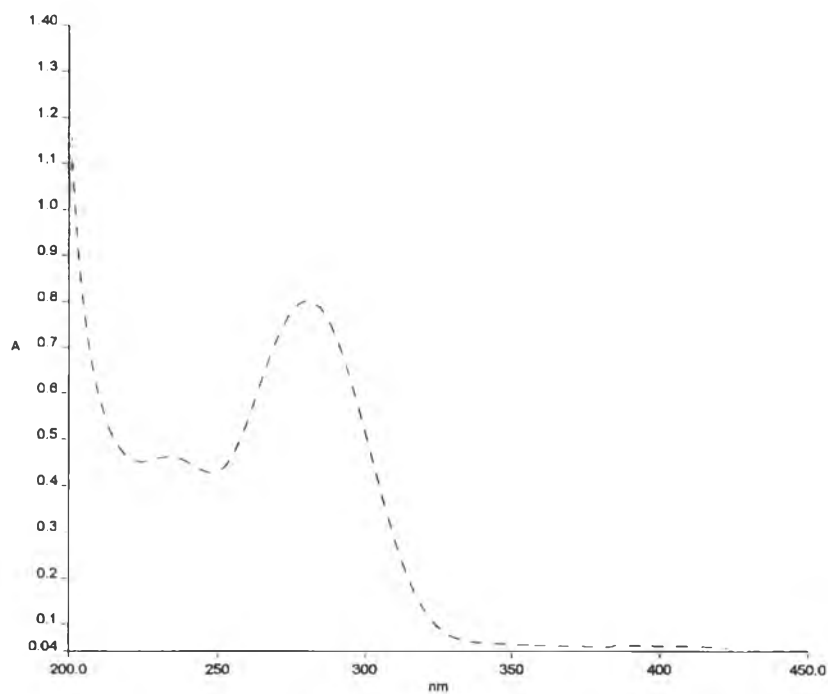


Figure D5 UV spectrum of glutaraldehyde.

Table D1 Summary of maximum wavelength (λ_{\max}) of each type of model drugs and glutaraldehyde

Model drug	λ_{\max} (nm)
Theophylline	272
Diclofenac sodium	275
Salicylic acid	299
Amoxicillin trihydrate	272
Glutaraldehyde	No observed

Appendix E Calibration curve of model drugs

Table E1 Data of calibration curve of theophylline solution

Concentration (mg/100 ml)	Absorbance at 272 nm (A_{272})			Average	Standard deviation
	X1	X2	X3		
0.0	0.0000	0.0000	0.0000	0.0000	0.0000
0.1	0.1194	0.1193	0.1192	0.1193	0.0001
0.2	0.2415	0.2416	0.2418	0.2416	0.0002
0.3	0.3601	0.3600	0.3602	0.3601	0.0001
0.4	0.4703	0.4704	0.4704	0.4704	0.0001
0.5	0.5829	0.5831	0.5832	0.5831	0.0002
0.6	0.6937	0.6938	0.6938	0.6938	0.0001
0.7	0.8158	0.8161	0.8162	0.8160	0.0002
0.8	0.9155	0.9154	0.9157	0.9155	0.0002

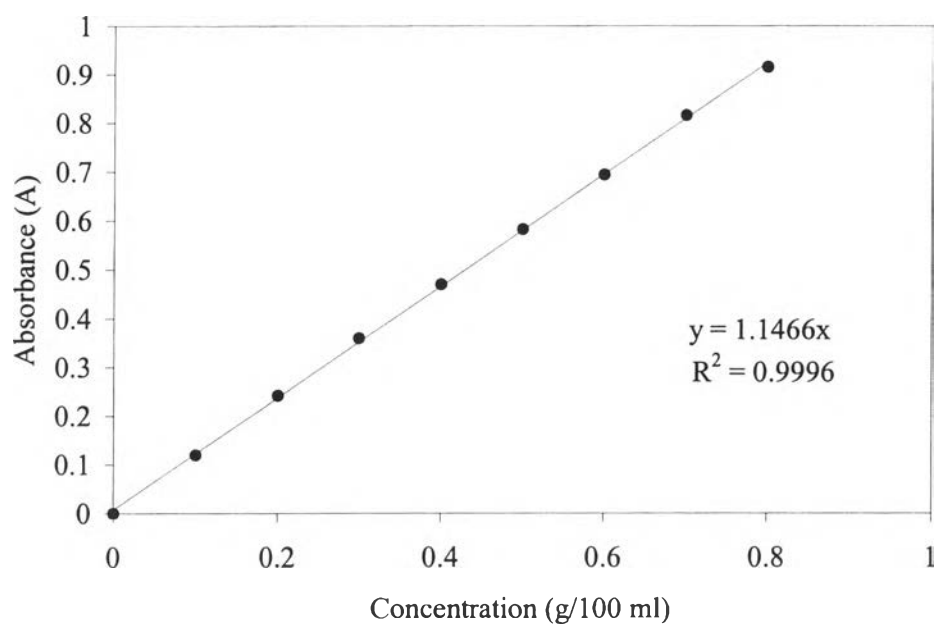


Figure E1 Calibration curve of theophylline solution.

Table E2 Data of calibration curve of diclofenac sodium solution

Concentration (mg/100 ml)	Absorbance at 275 nm (A_{275})			Average	Standard deviation
	X1	X2	X3		
0.0	0.0000	0.0000	0.0000	0.0000	0.0000
0.1	0.0624	0.0622	0.0623	0.0623	0.0001
0.2	0.1195	0.1194	0.1194	0.1194	0.0001
0.3	0.1712	0.1714	0.1714	0.1713	0.0001
0.4	0.2318	0.2317	0.2316	0.2317	0.0001
0.5	0.2788	0.2789	0.2789	0.2789	0.0001
0.6	0.3375	0.3376	0.3373	0.3375	0.0002
0.7	0.4116	0.4115	0.4116	0.4116	0.0001
0.8	0.4488	0.449	0.4491	0.4490	0.0002
0.9	0.5082	0.5081	0.5083	0.5082	0.0001
1.0	0.5295	0.5292	0.5293	0.5293	0.0002

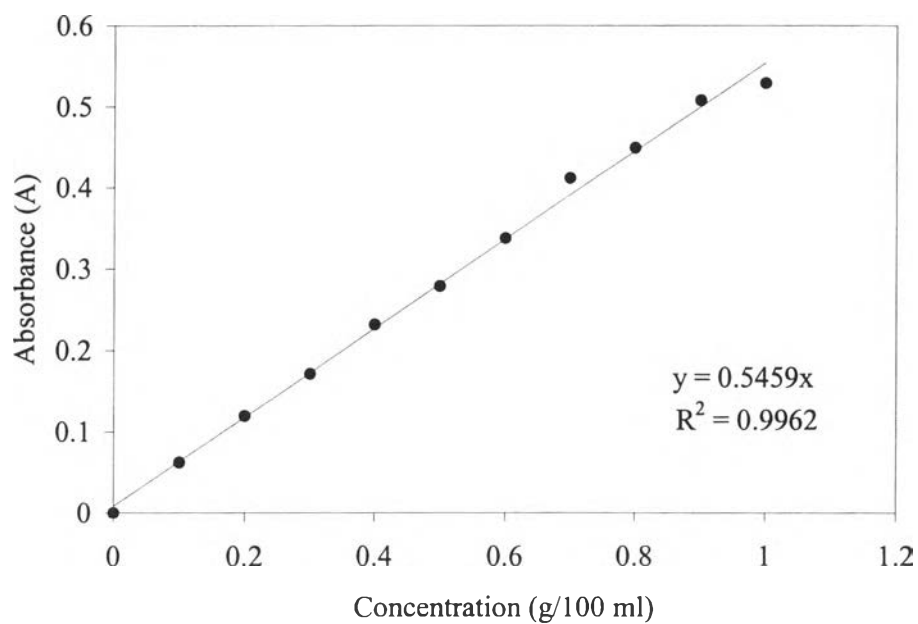
**Figure E2** Calibration curve of diclofenac sodium solution.

Table E3 Data of calibration curve of salicylic acid solution

Concentration (mg/100ml)	Absorbance at 299 nm (A_{299})			Average	Standard deviation
	X1	X2	X3		
0.0	0.0000	0.0000	0.0000	0.0000	0.0000
0.1	0.0812	0.0814	0.0815	0.0814	0.0002
0.2	0.1128	0.113	0.1129	0.1129	0.0001
0.3	0.1425	0.1427	0.1427	0.1426	0.0001
0.4	0.1696	0.1698	0.1697	0.1697	0.0001
0.5	0.2129	0.2131	0.2133	0.2131	0.0002
0.6	0.2447	0.2452	0.2453	0.2451	0.0003
0.7	0.2626	0.2625	0.2628	0.2626	0.0002
0.8	0.3101	0.3103	0.3104	0.3103	0.0002
0.9	0.3285	0.3287	0.3289	0.3287	0.0002
1.0	0.3575	0.3577	0.3578	0.3577	0.0002

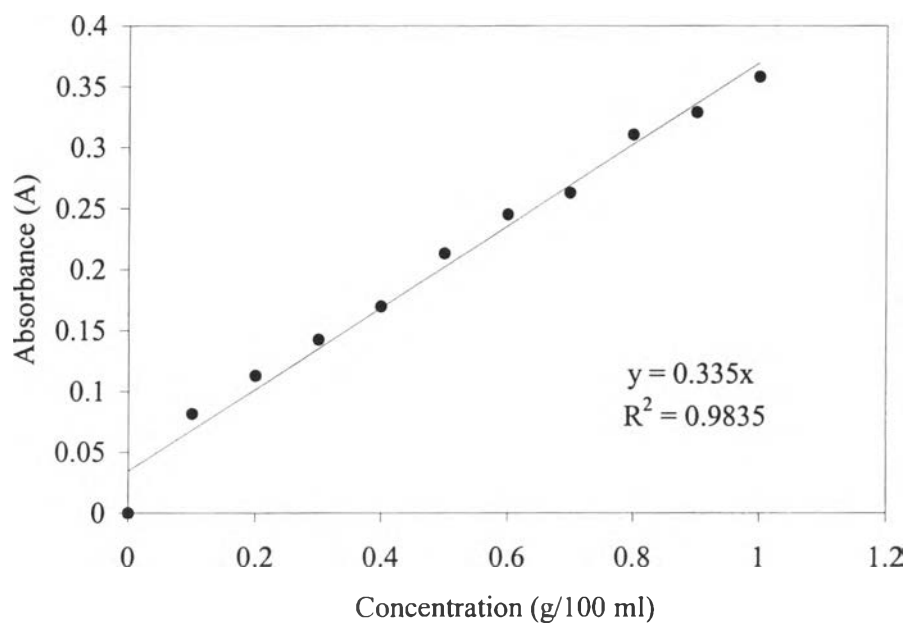
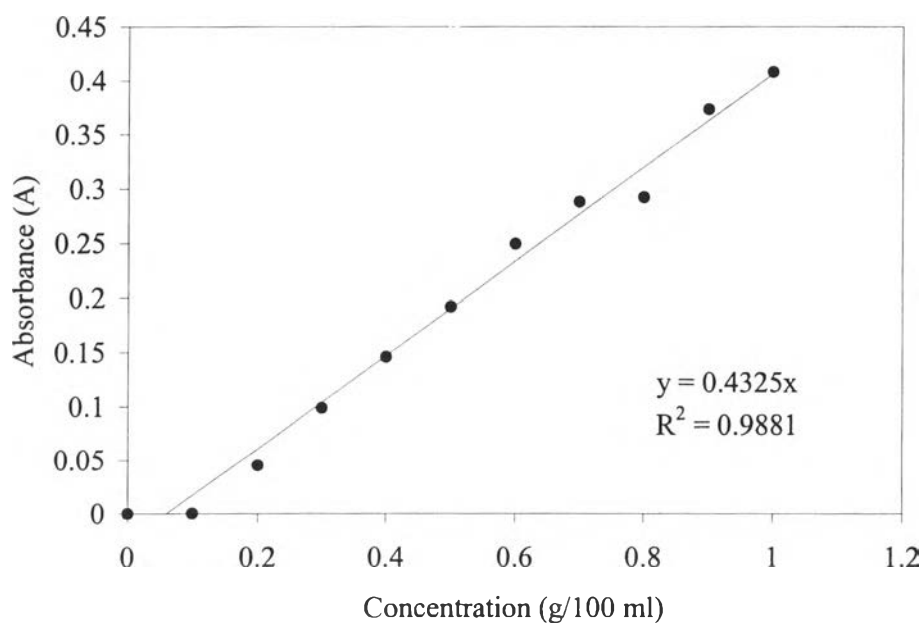
**Figure E3** Calibration curve of salicylic acid solution.

Table E4 Data of calibration curve of amoxicillin trihydrate solution

Concentration (mg/100 ml)	Absorbance at 272 nm (A_{272})			Average	Standard deviation
	X1	X2	X3		
0.0	0.0000	0.0000	0.0000	0.0000	0.0000
0.1	0.0002	0.0004	0.0005	0.0004	0.0002
0.2	0.0453	0.0452	0.0455	0.0453	0.0002
0.3	0.0988	0.0986	0.0984	0.0986	0.0002
0.4	0.146	0.1459	0.1461	0.1460	0.0001
0.5	0.1921	0.192	0.1922	0.1921	0.0001
0.6	0.2491	0.2493	0.2494	0.2493	0.0002
0.7	0.288	0.2882	0.2882	0.2881	0.0001
0.8	0.2921	0.2922	0.2923	0.2922	0.0001
0.9	0.3737	0.3736	0.3739	0.3737	0.0002
1.0	0.4082	0.4083	0.4084	0.4083	0.0001

**Figure E4** Calibration curve of amoxicillin trihydrate solution.

Appendix F Data of drug release

Table F1 Release of theophylline from the blend films with 100% chitosan content at 37°C, pH 5.5

Time (minutes)	Amount of drug release (%)			Average	Standard deviation
	X1	X2	X3		
0	0.00	0.00	0.00	0.00	0.000
15	0.36	0.36	0.36	0.36	0.000
30	0.63	0.63	0.62	0.63	0.005
45	0.79	0.79	0.78	0.78	0.006
60	1.13	1.13	1.12	1.12	0.004
90	2.04	2.04	2.05	2.05	0.002
120	2.80	2.81	2.81	2.81	0.004
150	3.50	3.50	3.50	3.50	0.004
180	4.37	4.37	4.36	4.37	0.005
240	5.16	5.17	5.18	5.17	0.006
300	7.81	7.82	7.82	7.82	0.008
360	9.49	9.52	9.47	9.49	0.024
480	18.03	18.08	18.07	18.06	0.024
600	20.77	20.81	20.84	20.81	0.034
720	27.38	27.46	27.46	27.43	0.046
840	33.35	33.49	33.55	33.46	0.104
960	45.71	45.85	45.87	45.81	0.085
1080	55.52	55.61	55.65	55.59	0.066
1200	58.71	58.86	58.90	58.82	0.103
1320	65.02	65.16	65.20	65.13	0.092
1440	66.15	66.30	66.32	66.26	0.095

Table F2 Release of theophylline from the blend films with 80% chitosan content at 37°C, pH 5.5

Time (minutes)	Amount of drug release (%)			Average	Standard deviation
	X1	X2	X3		
0	0.00	0.00	0.00	0.00	0.000
15	0.99	0.98	0.97	0.98	0.009
30	1.78	1.78	1.78	1.78	0.001
45	1.36	1.36	1.36	1.36	0.001
60	3.74	3.74	3.75	3.75	0.005
90	6.34	6.35	6.35	6.34	0.005
120	8.31	8.33	8.33	8.32	0.013
150	11.01	11.02	11.02	11.02	0.009
180	14.04	14.05	14.05	14.05	0.006
240	17.17	17.21	17.22	17.20	0.028
300	24.61	24.64	24.67	24.64	0.026
360	29.23	29.27	29.28	29.26	0.023
480	36.70	36.80	36.83	36.78	0.070
600	42.08	42.16	42.19	42.14	0.059
720	51.76	51.95	52.04	51.92	0.142
840	57.06	57.17	57.24	57.16	0.090
960	62.76	62.90	62.92	62.86	0.089
1080	65.58	65.82	65.93	65.78	0.182
1200	74.20	74.36	74.43	74.33	0.121
1320	75.08	75.20	75.12	75.13	0.059
1440	77.29	77.47	77.56	77.44	0.138

Table F3 Release of theophylline from the blend films with 60% chitosan content at 37°C, pH 5.5

Time (minutes)	Amount of drug release (%)			Average	Standard deviation
	X1	X2	X3		
0	0.00	0.00	0.00	0.00	0.000
15	0.22	0.23	0.23	0.23	0.004
30	0.34	0.34	0.35	0.35	0.006
45	0.75	0.76	0.75	0.75	0.006
60	1.17	1.18	1.18	1.18	0.003
90	1.90	1.91	1.91	1.91	0.004
120	3.05	3.05	3.05	3.05	0.002
150	4.08	4.09	4.10	4.09	0.006
180	5.91	5.92	5.92	5.91	0.006
240	9.59	9.61	9.61	9.60	0.013
300	12.79	12.81	12.82	12.81	0.013
360	15.47	15.51	15.42	15.47	0.042
480	21.17	21.22	21.24	21.21	0.035
600	26.51	26.55	26.53	26.53	0.021
720	31.67	31.74	31.78	31.73	0.060
840	39.46	39.52	39.55	39.51	0.047
960	42.57	42.66	42.68	42.64	0.059
1080	44.48	44.54	44.58	44.54	0.051
1200	49.95	50.04	50.09	50.03	0.075
1320	53.79	53.80	53.85	53.81	0.031
1440	58.26	58.40	58.44	58.37	0.093

Table F4 Release of theophylline from the blend films with 50% chitosan content at 37°C, pH 5.5

Time (minutes)	Amount of drug release (%)			Average	Standard deviation
	X1	X2	X3		
0	0.00	0.00	0.00	0.00	0.000
15	0.39	0.39	0.39	0.39	0.001
30	0.45	0.45	0.45	0.45	0.001
45	0.46	0.46	0.46	0.46	0.003
60	0.63	0.63	0.64	0.63	0.002
90	1.25	1.25	1.25	1.25	0.003
120	2.07	2.07	2.06	2.07	0.006
150	2.91	2.91	2.92	2.91	0.006
180	3.68	3.69	3.69	3.68	0.005
240	5.80	5.82	5.82	5.81	0.014
300	6.68	6.71	6.73	6.70	0.023
360	7.84	7.87	7.88	7.86	0.022
480	9.57	9.61	9.63	9.60	0.031
600	14.12	14.17	14.20	14.16	0.042
720	17.68	17.82	17.85	17.78	0.091
840	23.71	23.99	24.04	23.92	0.179
960	29.78	30.01	30.04	29.94	0.143
1080	33.54	33.86	33.97	33.79	0.225
1200	37.47	37.80	37.88	37.71	0.218
1320	46.33	46.58	46.67	46.53	0.176
1440	48.56	48.83	48.92	48.77	0.188

Table F5 Release of theophylline from the blend films with 40% chitosan content at 37°C, pH 5.5

Time (minutes)	Amount of drug release (%)			Average	Standard deviation
	X1	X2	X3		
0	0.00	0.00	0.00	0.00	0.000
15	0.54	0.65	0.70	0.63	0.078
30	1.35	1.42	1.43	1.40	0.046
45	1.45	1.53	1.54	1.51	0.054
60	2.31	2.40	2.45	2.39	0.069
90	4.23	4.29	4.34	4.29	0.053
120	10.32	10.46	10.47	10.41	0.086
150	12.65	12.72	12.77	12.71	0.057
180	17.78	17.90	17.95	17.88	0.087
240	19.82	19.94	19.99	19.92	0.087
300	21.50	21.47	21.58	21.52	0.054
360	24.53	24.67	24.71	24.64	0.096
480	26.26	26.20	26.27	26.24	0.037
600	28.66	28.84	28.89	28.80	0.119
720	29.54	29.69	29.71	29.65	0.092
840	30.87	30.79	30.67	30.78	0.099
960	32.19	32.35	32.41	32.32	0.110
1080	32.19	32.35	32.41	32.32	0.110
1200	36.86	36.95	37.00	36.94	0.073
1320	36.95	37.11	37.16	37.07	0.112
1440	39.87	40.03	40.21	40.04	0.170

Table F6 Release of diclofenac sodium from the blend films with 100% chitosan content at 37°C, pH 5.5

Time (minutes)	Amount of drug release (%)			Average	Standard deviation
	X1	X2	X3		
0	0.00	0.00	0.00	0.00	0.000
15	12.79	13.05	12.79	12.88	0.151
30	13.45	14.03	13.80	13.76	0.292
45	16.25	15.98	16.14	16.12	0.136
60	18.56	19.02	17.05	18.21	1.031
90	20.89	20.12	21.42	20.81	0.654
120	23.50	23.20	23.49	23.40	0.171
150	24.36	24.06	24.25	24.22	0.152
180	29.36	27.94	26.78	28.03	1.292
240	30.46	30.89	29.31	30.22	0.817
300	32.19	32.05	32.09	32.11	0.072
360	34.06	33.43	34.48	33.99	0.530
480	36.49	36.83	36.15	36.49	0.340
600	40.28	40.74	40.09	40.37	0.334
720	44.56	44.03	44.16	44.25	0.276
840	49.99	47.45	48.39	48.61	1.284
960	51.75	52.46	50.95	51.72	0.755
1080	55.86	55.36	55.11	55.44	0.382
1200	58.49	58.62	58.51	58.54	0.071
1320	61.45	61.12	63.37	61.98	1.215
1440	63.45	63.11	63.19	63.25	0.178

Table F7 Release of diclofenac sodium from the blend films with 80% chitosan content at 37°C, pH 5.5

Time (minutes)	Amount of drug release (%)			Average	Standard deviation
	X1	X2	X3		
0	0.00	0.00	0.00	0.00	0.000
15	8.46	8.76	8.49	8.57	0.165
30	9.46	9.52	9.46	9.48	0.035
45	11.59	11.46	11.66	11.57	0.101
60	13.25	14.22	14.45	13.97	0.637
90	18.45	18.00	17.92	18.12	0.284
120	20.90	20.45	21.08	20.81	0.324
150	23.60	23.45	23.69	23.58	0.122
180	29.86	29.40	30.03	29.76	0.326
240	36.49	36.37	36.52	36.46	0.079
300	43.45	42.92	43.11	43.16	0.269
360	47.69	45.58	49.41	47.56	1.918
480	54.69	54.99	54.90	54.86	0.154
600	58.64	58.13	58.46	58.41	0.259
720	59.99	60.12	59.83	59.98	0.145
840	62.79	62.91	62.82	62.84	0.062
960	65.00	65.66	64.73	65.13	0.478
1080	66.56	67.16	67.22	66.98	0.365
1200	69.01	68.45	69.03	68.83	0.330
1320	70.96	70.86	70.91	70.91	0.050
1440	73.20	73.46	72.61	73.09	0.437

Table F8 Release of diclofenac sodium from the blend films with 60% chitosan content at 37°C, pH 5.5

Time (minutes)	Amount of drug release (%)			Average	Standard deviation
	X1	X2	X3		
0	0.00	0.00	0.00	0.00	0.000
15	6.53	6.90	6.66	6.70	0.187
30	7.69	7.42	7.39	7.50	0.167
45	8.88	8.45	8.43	8.59	0.256
60	8.95	8.12	9.09	8.72	0.525
90	10.86	10.22	10.72	10.60	0.336
120	12.75	12.31	12.32	12.46	0.250
150	13.69	13.58	13.62	13.63	0.056
180	16.44	15.45	16.09	15.99	0.502
240	18.45	19.11	18.75	18.77	0.330
300	21.44	21.43	21.39	21.42	0.026
360	24.06	24.03	24.01	24.03	0.026
480	26.84	26.88	26.89	26.87	0.026
600	29.15	29.15	29.15	29.15	0.000
720	32.10	32.14	32.09	32.11	0.026
840	35.38	35.36	35.37	35.37	0.010
960	38.60	38.62	38.61	38.61	0.010
1080	43.21	43.21	43.24	43.22	0.017
1200	46.52	46.52	46.50	46.51	0.014
1320	48.75	48.79	48.77	48.77	0.020
1440	50.75	50.76	50.71	50.74	0.026

Table F9 Release of diclofenac sodium from the blend films with 50% chitosan content at 37°C, pH 5.5

Time (minutes)	Amount of drug release (%)			Average	Standard deviation
	X1	X2	X3		
0	0.00	0.00	0.00	0.00	0.000
15	8.63	8.66	8.66	8.65	0.017
30	8.90	8.88	8.89	8.89	0.010
45	9.60	9.61	9.61	9.61	0.006
60	10.92	10.91	10.91	10.91	0.005
90	13.41	13.42	13.41	13.41	0.005
120	15.02	15.00	15.01	15.01	0.010
150	16.06	16.08	16.07	16.07	0.010
180	16.20	16.20	16.17	16.19	0.015
240	17.19	17.18	17.20	17.19	0.011
300	17.69	17.71	17.70	17.70	0.010
360	18.32	18.31	18.30	18.31	0.010
480	19.60	19.59	19.58	19.59	0.010
600	20.65	20.63	20.64	20.64	0.010
720	22.18	22.16	22.15	22.16	0.014
840	22.46	22.47	22.45	22.46	0.010
960	23.16	23.03	23.25	23.15	0.112
1080	23.88	23.78	23.74	23.80	0.072
1200	24.75	24.76	24.71	24.74	0.027
1320	25.79	25.77	25.78	25.78	0.010
1440	27.00	27.01	27.00	27.00	0.006

Table F10 Release of diclofenac sodium from the blend films with 40% chitosan content at 37°C, pH 5.5

Time (minutes)	Amount of drug release (%)			Average	Standard deviation
	X1	X2	X3		
0	0.00	0.00	0.00	0.00	0.000
15	2.53	2.51	2.51	2.52	0.011
30	2.61	2.64	2.63	2.63	0.015
45	3.99	3.97	3.99	3.98	0.011
60	5.08	5.06	5.02	5.05	0.030
90	5.17	5.15	5.16	5.16	0.010
120	6.28	6.22	6.25	6.25	0.030
150	8.60	8.58	8.60	8.59	0.011
180	8.82	8.85	8.84	8.84	0.016
240	11.32	11.35	11.33	11.33	0.015
300	12.49	12.56	12.47	12.51	0.049
360	13.65	13.63	13.64	13.64	0.010
480	14.90	14.95	14.94	14.93	0.026
600	15.22	15.20	15.21	15.21	0.010
720	15.90	15.88	15.89	15.89	0.010
840	16.15	16.13	16.14	16.14	0.010
960	17.34	17.32	17.33	17.33	0.010
1080	17.63	17.61	17.62	17.62	0.010
1200	18.09	18.09	18.06	18.08	0.018
1320	18.12	18.14	18.13	18.13	0.010
1440	18.59	18.57	18.57	18.58	0.011

Table F11 Release of salicylic acid from the blend films with 100% chitosan content at 37°C, pH 5.5

Time (minutes)	Amount of drug release (%)			Average	Standard deviation
	X1	X2	X3		
0	0.00	0.00	0.00	0.00	0.000
15	2.23	2.27	2.28	2.26	0.026
30	3.20	2.91	2.79	2.97	0.213
45	3.14	3.13	3.14	3.13	0.004
60	4.75	4.78	4.80	4.78	0.025
90	6.68	6.74	6.76	6.73	0.043
120	10.21	10.27	10.30	10.26	0.045
150	12.21	12.26	12.29	12.26	0.041
180	15.59	15.66	15.67	15.64	0.044
240	20.17	20.26	20.34	20.26	0.081
300	23.83	23.81	23.85	23.83	0.020
360	27.85	27.87	27.88	27.87	0.015
480	33.33	33.46	33.52	33.43	0.097
600	43.76	43.96	44.03	43.92	0.140
720	54.22	54.24	54.25	54.24	0.015
840	63.22	63.71	63.92	63.61	0.357
960	71.57	71.59	71.61	71.59	0.020
1080	77.42	77.45	77.47	77.45	0.025
1200	83.02	83.49	83.81	83.44	0.397
1320	86.32	86.34	86.41	86.36	0.047
1440	86.93	87.43	87.56	87.31	0.335

Table F12 Release of salicylic acid from the blend films with 80% chitosan content at 37°C, pH 5.5

Time (minutes)	Amount of drug release (%)			Average	Standard deviation
	X1	X2	X3		
0	0.00	0.00	0.00	0.00	0.000
15	0.11	0.12	0.12	0.12	0.010
30	0.21	0.23	0.24	0.23	0.016
45	0.63	0.65	0.66	0.65	0.015
60	9.29	9.33	9.36	9.33	0.035
90	17.80	18.07	18.15	18.01	0.183
120	32.39	32.41	32.42	32.41	0.015
150	44.44	47.15	48.87	46.82	2.231
180	49.52	50.66	50.79	50.32	0.700
240	55.42	55.46	55.46	55.45	0.023
300	60.85	60.85	60.87	60.86	0.012
360	64.60	64.59	64.03	64.41	0.326
480	67.31	68.19	68.57	68.02	0.643
600	73.19	73.29	73.35	73.28	0.081
720	76.38	76.43	76.53	76.45	0.076
840	79.20	80.09	80.32	79.87	0.593
960	82.80	83.75	84.12	83.56	0.681
1080	85.64	85.72	86.01	85.79	0.195
1200	88.59	88.64	88.65	88.63	0.032
1320	90.01	90.11	90.23	90.12	0.110
1440	91.42	92.28	92.73	92.14	0.667

Table F13 Release of salicylic acid from the blend films with 60% chitosan content at 37°C, pH 5.5

Time (minutes)	Amount of drug release (%)			Average	Standard deviation
	X1	X2	X3		
0	0.00	0.00	0.00	0.00	0.000
15	0.41	0.39	0.33	0.38	0.042
30	0.51	0.53	0.57	0.54	0.031
45	0.45	0.97	1.10	0.84	0.344
60	1.54	1.66	1.69	1.63	0.079
90	2.68	3.01	2.51	2.73	0.254
120	3.76	3.84	3.88	3.83	0.061
150	6.46	6.37	6.48	6.44	0.059
180	10.32	10.44	10.48	10.41	0.083
240	15.02	15.30	15.71	15.34	0.347
300	20.32	20.45	20.49	20.42	0.089
360	25.32	25.57	25.62	25.50	0.161
480	37.34	37.45	37.61	37.47	0.136
600	45.32	45.39	45.42	45.38	0.051
720	47.46	47.58	47.61	47.55	0.079
840	51.42	51.49	51.52	51.48	0.051
960	56.26	56.34	56.48	56.36	0.111
1080	61.04	61.31	61.38	61.24	0.180
1200	64.47	64.55	64.58	64.53	0.057
1320	66.60	66.69	66.71	66.67	0.059
1440	69.16	69.25	67.13	68.51	1.199

Table F14 Release of salicylic acid from the blend films with 50% chitosan content at 37°C, pH 5.5

Time (minutes)	Amount of drug release (%)			Average	Standard deviation
	X1	X2	X3		
0	0.00	0.00	0.00	0.00	0.000
15	0.15	0.25	0.22	0.21	0.051
30	0.83	0.89	0.89	0.87	0.035
45	1.26	1.31	1.34	1.30	0.040
60	1.29	1.31	1.35	1.32	0.031
90	1.91	2.08	2.37	2.12	0.233
120	2.82	2.92	2.99	2.91	0.085
150	3.16	5.31	5.39	4.62	1.265
180	7.41	7.60	7.64	7.55	0.123
240	10.01	10.15	10.18	10.11	0.091
300	17.08	17.20	17.23	17.17	0.079
360	26.67	26.74	26.76	26.72	0.047
480	36.19	36.27	36.33	36.26	0.070
600	40.59	40.59	40.78	40.65	0.110
720	42.32	44.10	45.04	43.82	1.381
840	46.93	46.95	47.08	46.99	0.081
960	53.26	52.76	53.75	53.26	0.495
1080	57.14	57.28	57.82	57.41	0.359
1200	61.47	62.03	61.14	61.55	0.450
1320	64.79	63.16	64.74	64.23	0.927
1440	65.06	65.21	65.33	65.20	0.135

Table F15 Release of salicylic acid from the blend films with 40% chitosan content at 37°C, pH 5.5

Time (minutes)	Amount of drug release (%)			Average	Standard deviation
	X1	X2	X3		
15	0.52	0.54	0.54	0.53	0.012
30	1.15	1.26	1.44	1.28	0.146
45	1.36	1.47	1.52	1.45	0.082
60	1.79	1.82	1.97	1.86	0.096
90	2.22	2.23	2.35	2.27	0.074
120	4.13	4.26	4.30	4.23	0.089
150	6.99	7.08	7.25	7.11	0.132
180	8.89	8.97	9.09	8.98	0.101
240	11.59	11.64	11.73	11.65	0.071
300	14.52	14.67	14.69	14.63	0.093
360	17.55	17.61	17.65	17.60	0.050
480	23.46	23.59	23.88	23.64	0.215
600	27.15	27.65	27.98	27.59	0.418
720	31.08	31.31	31.31	31.23	0.133
840	36.42	36.56	36.87	36.62	0.230
960	40.16	40.04	39.83	40.01	0.167
1080	45.49	45.60	45.65	45.58	0.082
1200	47.05	47.46	47.56	47.36	0.270
1320	48.97	49.16	49.28	49.14	0.156
1440	49.45	49.89	49.87	49.74	0.248

Table F16 Release of amoxicillin from the blend films with 100% chitosan content at 37°C, pH 5.5

Time (minutes)	Amount of drug release (%)			Average	Standard deviation
	X1	X2	X3		
0	0.00	0.00	0.00	0.00	0.000
15	0.20	0.20	0.19	0.20	0.003
30	1.10	1.12	1.11	1.11	0.010
45	1.98	1.98	1.98	1.98	0.000
60	2.86	2.88	2.87	2.87	0.010
90	3.51	3.49	3.51	3.50	0.012
120	4.82	4.80	4.81	4.81	0.010
150	6.39	6.41	6.39	6.40	0.011
180	7.49	7.46	7.50	7.48	0.022
240	9.03	9.08	9.11	9.07	0.040
300	10.15	10.18	10.15	10.16	0.017
360	12.91	12.96	12.96	12.94	0.029
480	14.56	14.59	14.53	14.56	0.030
600	16.31	16.35	16.36	16.34	0.028
720	18.44	18.46	18.39	18.43	0.036
840	20.50	20.56	20.50	20.52	0.035
960	23.04	23.00	23.03	23.02	0.020
1080	25.10	25.16	25.07	25.11	0.046
1200	27.18	27.19	27.16	27.18	0.013
1320	27.96	27.95	27.91	27.94	0.026
1440	28.85	28.81	28.84	28.83	0.020

Table F17 Release of amoxicillin from the blend films with 80% chitosan content at 37°C, pH 5.5

Time (minutes)	Amount of drug release (%)			Average	Standard deviaton
	X1	X2	X3		
0	0.00	0.00	0.00	0.00	0.000
15	0.07	0.07	0.06	0.07	0.005
30	2.99	2.99	2.98	2.99	0.007
45	4.01	4.01	4.01	4.01	0.001
60	4.35	4.36	4.34	4.35	0.010
90	5.05	5.08	5.04	5.06	0.019
120	6.16	6.18	6.18	6.17	0.011
150	7.36	7.34	7.36	7.35	0.011
180	9.08	9.10	9.09	9.09	0.010
240	10.47	10.45	10.46	10.46	0.010
300	12.20	12.18	12.18	12.19	0.010
360	13.49	13.47	13.48	13.48	0.010
480	15.55	15.57	15.56	15.56	0.010
600	18.84	18.82	18.83	18.83	0.010
720	20.36	20.38	20.36	20.37	0.012
840	21.90	21.93	21.93	21.92	0.017
960	24.20	24.20	24.20	24.20	0.000
1080	26.64	26.65	26.66	26.65	0.010
1200	28.92	28.93	28.92	28.92	0.007
1320	31.27	31.25	31.26	31.26	0.010
1440	32.00	32.00	31.99	32.00	0.004

Table F18 Release of amoxicillin from the blend films with 60% chitosan content at 37°C, pH 5.5

Time (minutes)	Amount of drug release (%)			Average	Standard deviation
	X1	X2	X3		
0	0.00	0.00	0.00	0.00	0.000
15	1.13	1.11	1.11	1.12	0.013
30	1.60	1.59	1.57	1.59	0.017
45	1.94	1.92	1.93	1.93	0.010
60	2.21	2.23	2.22	2.22	0.010
90	2.87	2.89	2.85	2.87	0.021
120	3.20	3.19	3.17	3.19	0.013
150	3.29	3.31	3.27	3.29	0.022
180	3.50	3.52	3.52	3.51	0.012
240	3.63	3.62	3.64	3.63	0.008
300	4.21	4.24	4.27	4.24	0.030
360	4.79	4.77	4.78	4.78	0.010
480	5.53	5.51	5.48	5.51	0.027
600	6.39	6.37	6.39	6.38	0.012
720	8.36	8.35	8.33	8.35	0.014
840	10.49	10.46	10.47	10.47	0.016
960	12.84	12.89	12.88	12.87	0.026
1080	15.41	15.42	15.43	15.42	0.010
1200	17.63	17.61	17.62	17.62	0.010
1320	20.84	20.86	20.85	20.85	0.010
1440	21.57	21.54	21.60	21.57	0.029

Table F19 Release of amoxicillin from the blend films with 50% chitosan content at 37°C, pH 5.5

Time (minutes)	Amount of drug release (%)			Average	Standard deviation
	X1	X2	X3		
0	0.00	0.00	0.00	0.00	0.000
15	0.52	0.52	0.51	0.52	0.003
30	0.75	0.76	0.76	0.76	0.007
45	1.11	1.13	1.11	1.12	0.012
60	1.83	1.84	1.83	1.83	0.005
90	2.93	2.95	2.94	2.94	0.010
120	3.16	3.14	3.15	3.15	0.010
150	4.60	4.59	4.57	4.59	0.014
180	5.48	5.46	5.46	5.47	0.013
240	6.75	6.75	6.85	6.78	0.056
300	6.95	6.97	6.97	6.96	0.010
360	7.45	7.43	7.44	7.44	0.010
480	8.94	8.94	8.93	8.94	0.006
600	9.56	9.59	9.59	9.58	0.017
720	10.73	10.75	10.71	10.73	0.018
840	12.26	12.25	12.24	12.25	0.010
960	14.15	14.13	14.11	14.13	0.020
1080	15.63	15.61	15.62	15.62	0.010
1200	16.39	16.41	16.39	16.40	0.012
1320	17.52	17.50	17.51	17.51	0.010
1440	18.85	18.83	18.81	18.83	0.021

Table F20 Release of amoxicillin from the blend films with 40% chitosan content at 37°C, pH 5.5

Time (minutes)	Amount of drug release (%)			Average	Standard deviaton
	X1	X2	X3		
0	0.00	0.00	0.00	0.00	0.000
15	1.58	1.60	1.58	1.59	0.011
30	2.85	2.83	2.84	2.84	0.010
45	3.39	3.39	3.35	3.38	0.026
60	3.42	3.44	3.37	3.41	0.036
90	3.51	3.53	3.55	3.53	0.021
120	3.80	3.82	3.79	3.80	0.017
150	3.82	3.82	3.81	3.82	0.004
180	3.95	3.99	3.97	3.97	0.020
240	4.58	4.57	4.57	4.57	0.007
300	4.95	4.97	4.97	4.96	0.011
360	6.05	6.05	6.06	6.05	0.003
480	7.23	7.25	7.19	7.22	0.032
600	8.16	8.12	8.02	8.10	0.072
720	9.12	9.12	9.12	9.12	0.000
840	9.84	9.86	9.85	9.85	0.010
960	10.40	10.39	10.42	10.40	0.017
1080	11.21	11.23	11.22	11.22	0.010
1200	12.61	12.61	12.61	12.61	0.001
1320	13.11	13.11	13.12	13.11	0.005
1440	14.06	14.11	14.09	14.09	0.025

Appendix G Data of drug release with different thickness

Table G1 Release of theophylline from the 80% chitosan content blend films with the thickness of 20-30 μm at 37°C, pH 5.5

Time (minutes)	Amount of drug release (%)			Average	Standard deviation
	X1	X2	X3		
0	0.00	0.00	0.00	0.00	0.000
15	0.99	0.98	0.97	0.98	0.009
30	1.78	1.78	1.78	1.78	0.001
45	1.36	1.36	1.36	1.36	0.001
60	3.74	3.74	3.75	3.75	0.005
90	6.34	6.35	6.35	6.34	0.005
120	8.31	8.33	8.33	8.32	0.013
150	11.01	11.02	11.02	11.02	0.009
180	14.04	14.05	14.05	14.05	0.006
240	17.17	17.21	17.22	17.20	0.028
300	24.61	24.64	24.67	24.64	0.026
360	29.23	29.27	29.28	29.26	0.023
480	36.70	36.80	36.83	36.78	0.070
600	42.08	42.16	42.19	42.14	0.059
720	51.76	51.95	52.04	51.92	0.142
840	57.06	57.17	57.24	57.16	0.090
960	62.76	62.90	62.92	62.86	0.089
1080	65.58	65.82	65.93	65.78	0.182
1200	74.20	74.36	74.43	74.33	0.121
1320	75.08	75.20	75.12	75.13	0.059
1440	77.29	77.47	77.56	77.44	0.138

Table G2 Release of theophylline from the 80% chitosan content blend films with the thickness of 50-60 μm at 37°C, pH 5.5

Time (minutes)	Amount of drug release (%)			Average	Standard deviation
	X1	X2	X3		
0	0.00	0.00	0.00	0.00	0.000
15	0.05	0.05	0.05	0.05	0.000
30	0.05	0.05	0.05	0.05	0.000
45	0.07	0.06	0.07	0.07	0.0058
60	0.07	0.08	0.08	0.08	0.0058
90	0.12	0.11	0.12	0.12	0.0058
120	0.15	0.16	0.16	0.16	0.0058
150	0.31	0.32	0.3	0.31	0.0100
180	0.46	0.47	0.48	0.47	0.0100
240	0.63	0.63	0.64	0.63	0.0058
300	0.85	0.85	0.84	0.85	0.0058
360	1.37	1.32	1.33	1.34	0.0265
480	1.88	1.87	1.92	1.89	0.0265
600	3.19	3.16	3.18	3.18	0.0153
720	4.54	4.51	4.52	4.52	0.0153
840	6.39	6.42	6.4	6.40	0.0153
960	8.15	8.14	8.17	8.15	0.0153
1080	9.79	9.77	9.81	9.79	0.0200
1200	11.22	11.24	11.23	11.23	0.0100
1320	13.84	13.85	13.81	13.83	0.0208
1440	14.91	14.92	14.92	14.92	0.0058

Table G3 Release of theophylline from the 80% chitosan content blend films with the thickness of 100-120 μm at 37°C, pH 5.5

Time (minutes)	Amount of drug release (%)			Average	Standard deviation
	X1	X2	X3		
0	0.00	0.00	0.00	0.00	0.000
15	0.09	0.08	0.1	0.10	0.010
30	0.09	0.1	0.1	0.09	0.006
45	0.12	0.1	0.1	0.11	0.012
60	0.12	0.1	0.13	0.12	0.015
90	0.12	0.12	0.14	0.14	0.012
120	0.13	0.15	0.15	0.13	0.012
150	0.23	0.21	0.22	0.22	0.010
180	0.24	0.27	0.26	0.26	0.015
240	0.35	0.33	0.31	0.33	0.020
300	0.37	0.38	0.35	0.37	0.015
360	0.55	0.56	0.59	0.57	0.021
480	0.88	0.87	0.84	0.86	0.021
600	1.34	1.33	1.3	1.32	0.021
720	2.1	2.3	1.9	2.10	0.200
840	2.83	2.84	2.84	2.84	0.006
960	4.36	4.34	4.33	4.34	0.015
1080	5.57	5.57	5.59	5.58	0.012
1200	6.88	6.89	6.89	6.89	0.006
1320	9.14	9.15	9.15	9.15	0.006
1440	10.4	10.41	10.41	10.41	0.006

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