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APPENDICES

Appendix A Characterization of Composite Gel

Table A1 Weight remaining of composite gel at various chitin whisker content after incubated for 6 hours

Formula (% CTW in pluronic)	W_0 (g)	$W_{t=6h}$ (g)	Weight Remaining (%)	Average	SD
0	0.2847	0.1760	61.8846	62.94	2.9238
	0.2842	0.1831	67.2914		
	0.2842	0.1780	66.5171		
0.4	0.2717	0.1788	63.9484	65.67	1.1851
	0.2724	0.1798	62.9992		
	0.2723	0.1777	65.3549		
1	0.2679	0.1757	61.7791	67.08	3.2664
	0.2677	0.1804	66.2991		
	0.2673	0.1823	68.1240		
3	0.2793	0.1878	70.7439	68.56	2.7742
	0.2798	0.1872	65.5921		
	0.2796	0.1902	69.9521		
5	0.2852	0.2145	75.4219	74.53	4.1989
	0.2860	0.2239	82.2859		
	0.2850	0.1998	74.6636		
7	0.2716	0.2190	78.3261	80.14	4.1144
	0.2718	0.2340	81.9901		
	0.2722	0.2006	73.7771		

Table A1 Weight remaining of composite gel at various chitin whisker content after incubated for 12 hours

Formula (% CTW in pluronic)	W_0 (g)	$W_{t=12h}$ (g)	Weight Remaining (%)	Average	SD
0	0.2847	0.1694	59.5640	61.11	3.9340
	0.2842	0.1715	63.0282		
	0.2842	0.1804	67.4140		
0.4	0.2717	0.1689	60.4077	61.67	4.2587
	0.2724	0.1594	55.8514		
	0.2723	0.1750	64.3618		
1	0.2679	0.1756	61.7440	63.71	0.9886
	0.2677	0.1668	61.3009		
	0.2673	0.1691	63.1913		
3	0.2793	0.1893	67.7038	67.02	0.6725
	0.2798	0.1924	67.4141		
	0.2796	0.1806	66.4214		
5	0.2852	0.2055	72.2573	73.51	3.6950
	0.2860	0.2121	77.9492		
	0.2850	0.2119	79.1853		
7	0.2716	0.2182	78.0400	78.37	1.5255
	0.2718	0.2141	75.0175		
	0.2722	0.2071	76.1677		

Appendix B Standard Calibration Curve of Dye Solution

Table B1 Standard calibration of methylene blue solution in phosphate buffer saline (PBS), pH=7.4

Dye Concentration	Absorbance at 664 nm
1	0.158
1.5	0.251
2	0.313
2.5	0.388
3	0.460
3.5	0.550

Figure B1 Standard curve of methylene blue solution in phosphate buffer saline (PBS), pH=7.4

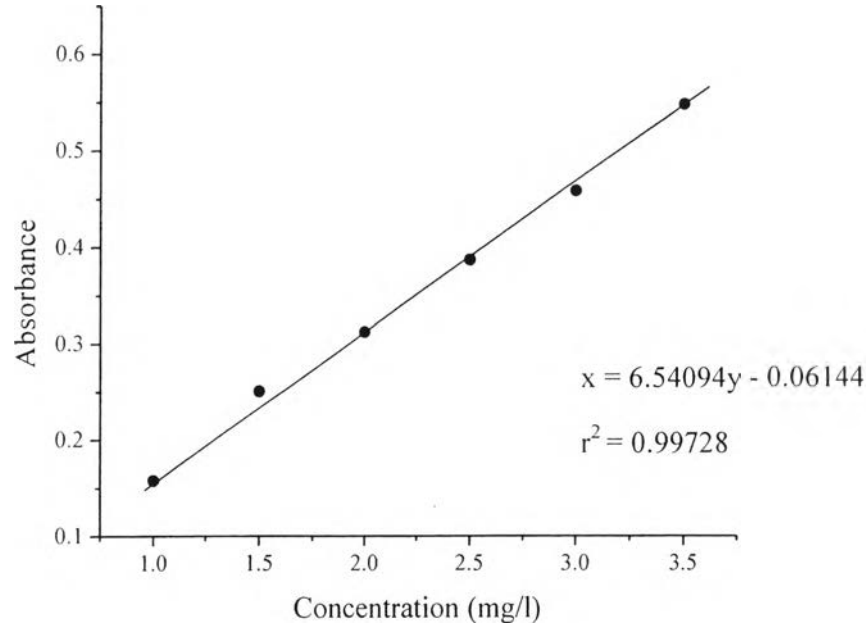


Table B2 Standard calibration of methyl orange solution in phosphate buffer saline (PBS), pH=7.4

Dye Concentration	Absorbance at 465 nm
1	0.081
1.5	0.116
2	0.153
2.5	0.191
3	0.231
3.5	0.271

Figure B2 Standard curve of methyl orange solution in phosphate buffer saline (PBS), pH=7.4.

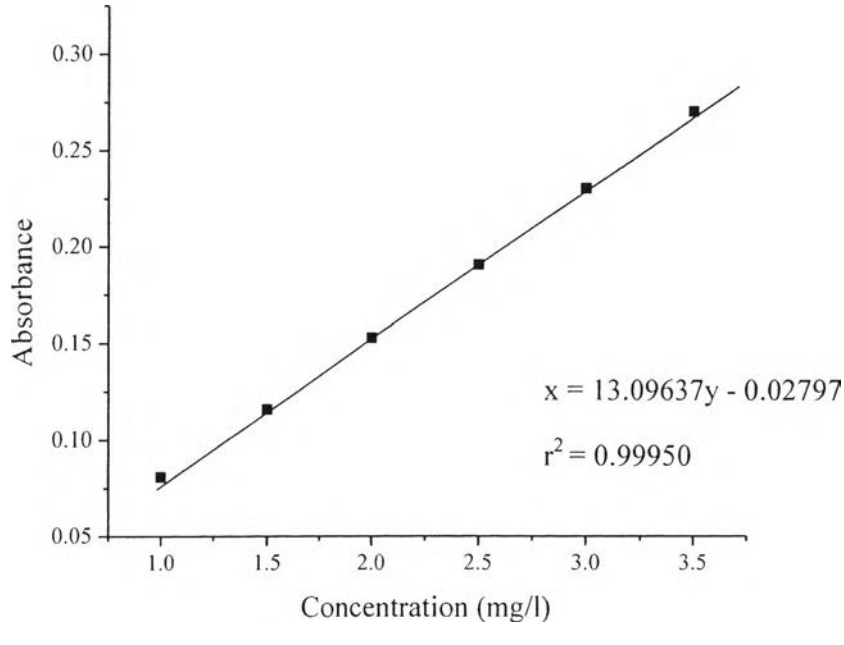
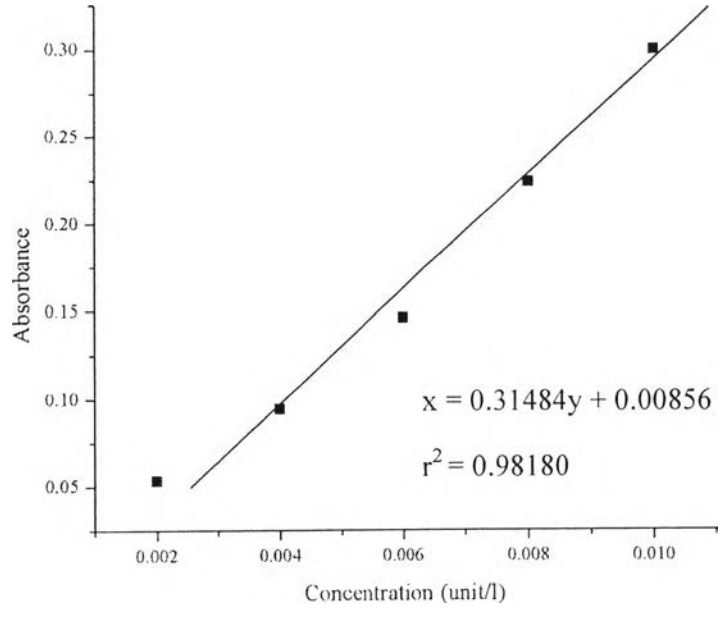


Table B3 Standard calibration of insulin in phosphate buffer saline (PBS), pH=7.4

Dye Concentration	Absorbance at 260 nm
0.002	0.005
0.003	0.006
0.004	0.007
0.005	0.008
0.006	0.010
0.007	0.012

Figure B3 Standard curve of insulin in phosphate buffer saline (PBS), pH=7.4.



Appendix C Model drug release of methylene blue at initial concentration 1000 mg/l

Table C1 The cumulative methylene blue release from the donor of methylene blue solution as a function of releasing time

Time (min)	Absorbance at 664 nm	Dye Concentration (mg/l)	Cumulative Release (%)	Average	SD
30	0.117	0.7038	14.0770	15.5893	1.3143
	0.135	0.8215	16.4563		
	0.133	0.8085	16.2345		
60	0.159	0.9785	19.7121	20.6370	1.1249
	0.163	1.0047	20.3095		
	0.175	1.0832	21.8894		
90	0.200	1.2467	25.2714	26.4719	1.1565
	0.210	1.3121	26.5654		
	0.217	1.3579	27.5789		
120	0.247	1.5541	31.6692	31.5216	1.0532
	0.237	1.4887	30.4022		
	0.252	1.5868	32.4932		
180	0.322	2.0447	41.7915	41.4274	0.3245
	0.318	2.0185	41.3222		
	0.316	2.0054	41.1684		
240	0.362	2.3063	47.4332	46.7015	0.9015
	0.348	2.2148	45.6943		
	0.358	2.2802	46.9769		
300	0.379	2.4175	50.1184	49.2587	0.8093
	0.372	2.3717	49.1463		
	0.366	2.3325	48.5113		
360	0.435	2.7838	57.9277	57.6036	0.4944
	0.428	2.7380	57.0345		
	0.434	2.7773	57.8484		
540	0.557	3.5818	74.4444	72.5264	2.2064
	0.524	3.3660	70.1150		
	0.546	3.5099	73.0197		
720	0.626	4.0331	84.1873	83.2888	2.2026
	0.601	3.8696	80.7790		
	0.631	4.0658	84.9002		
900	0.726	4.6872	98.0758	95.4049	2.4622
	0.703	4.5368	94.9132		
	0.689	4.4452	93.2256		
1080	0.739	4.7723	99.7139	96.9931	2.5288
	0.708	4.5695	96.5511		
	0.693	4.4714	94.7144		

Time (min)	Absorbance at 664 nm	Dye Concentration (mg/l)	Cumulative Release (%)	Average	SD
1260	0.734	4.7396	100.7139	98.2474	2.1374
	0.708	4.5499	97.0934		
	0.703	4.5368	96.9349		
1440	0.727	4.6938	101.0143	99.2500	1.5281
	0.708	4.5699	98.3948		
	0.707	4.5630	98.3409		
1620	0.695	4.4845	101.0465	100.0728	0.9141
	0.708	4.5695	99.2330		
	0.712	4.5957	99.9389		
1800	0.703	4.4452	99.7990	99.7534	0.0663
	0.706	4.5564	99.7839		
	0.703	4.5368	99.6773		
1980	0.706	4.5564	101.0240	100.3091	0.6212
	0.707	4.5630	99.9002		
	0.699	4.5106	100.0033		

Table C2 The cumulative methylene blue release from the donor of methylene blue in neat pluronic as a function of releasing time

Time (min)	Absorbance at 664 nm	Dye Concentration (mg/l)	Cumulative Release (%)	Average	SD
30	0.030	0.1347	2.6957	2.4241	0.3461
	0.025	0.1020	2.0416		
	0.029	0.1282	2.5649		
60	0.038	0.1871	3.7692	3.3305	1.1158
	0.025	0.1020	2.0620		
	0.041	0.2067	4.1604		
90	0.061	0.3375	6.8155	7.0265	0.3861
	0.061	0.3375	6.7919		
	0.066	0.3702	7.4722		
120	0.065	0.3637	7.4063	7.7939	1.9424
	0.055	0.2983	6.0745		
	0.084	0.4879	9.9010		
180	0.077	0.4422	9.0577	9.2689	1.0328
	0.072	0.4095	8.3581		
	0.087	0.5076	10.3910		
240	0.076	0.4356	9.0365	9.3667	0.5570
	0.084	0.4879	10.0098		
	0.076	0.4356	9.0536		
300	0.124	0.7496	15.4030	15.4749	0.3580
	0.128	0.7758	15.8635		
	0.122	0.7365	15.1584		
360	0.133	0.8085	16.7303	16.8822	1.1025
	0.096	0.5664	15.8635		
	0.143	0.8739	18.0529		
540	0.227	1.4233	29.1889	29.5035	2.2921
	0.218	1.3644	31.9367		
	0.213	1.3317	27.3850		
720	0.269	1.6980	34.9680	32.1728	2.6850
	0.201	1.2532	31.9367		
	0.228	1.4298	29.6136		
900	0.298	1.8877	39.1014	37.3638	1.5994
	0.244	1.5345	35.9531		
	0.283	1.7896	37.0368		
1080	0.393	2.5091	51.9067	51.2380	0.5955
	0.357	2.2736	51.0425		
	0.384	2.2867	50.7647		

Time (min)	Absorbance at 664 nm	Dye Concentration (mg/l)	Cumulative Release (%)	Average	SD
1260	0.399	2.5483	53.1934	54.2242	1.5449
	0.392	2.5026	56.0005		
	0.401	2.5614	53.4786		
1440	0.464	2.9735	62.1333	65.6035	3.5172
	0.460	2.9473	65.5113		
	0.517	3.3202	69.1659		
1620	0.531	3.4117	71.4652	69.7861	2.3639
	0.496	3.1828	70.8103		
	0.496	3.1828	67.0828		
1800	0.545	3.5033	73.9790	74.5805	0.5300
	0.523	3.3594	74.9790		
	0.550	3.5360	74.7835		
1980	0.455	2.9146	73.9790	77.4415	3.1823
	0.558	3.5884	80.2384		
	0.570	3.6668	78.1071		
2160	0.524	3.3360	83.5684	81.7392	2.8561
	0.575	3.6996	83.2012		
	0.567	3.6472	78.4481		
2340	0.530	3.4052	85.0686	84.6914	2.8584
	0.601	3.8696	87.3424		
	0.586	3.7715	81.6631		
2520	0.554	3.5622	89.0064	85.3026	3.6720
	0.579	3.7257	85.2384		
	0.670	4.3209	81.6631		
2700	0.574	3.6930	92.5349	93.1971	2.8483
	0.658	4.2424	96.3182		
	0.643	4.1443	90.7383		
2880	0.568	3.6538	92.4886	93.2817	2.8538
	0.446	2.8558	96.3182		
	0.588	3.7846	90.7383		
3240	0.576	3.7061	94.2659	95.0014	4.6744
	0.470	3.0128	100.0000		
	0.571	3.6734	90.7383		
3600	0.670	4.3209	100.3041	97.9475	2.4031
	0.4500	2.8819	98.0381		
	0.602	3.8762	95.5003		
3960	0.653	4.2097	100.9444	100.8273	0.1761
	0.468	2.9997	100.9128		
	0.635	4.0920	100.6247		
4320	0.679	4.3798	100.1876	100.5730	0.3376
	0.462	2.9604	100.7144		
	0.630	4.0593	100.8170		

Table C3 The cumulative methylene blue release from the donor of methylene blue in pluronic/chitin whisker composite gel as a function of releasing time at 0.4% of chitin whisker content

Time (min)	Absorbance at 664 nm	Dye Concentration (mg/l)	Cumulative Release (%)	Average	SD
30	0.018	0.0562	1.1259	1.0767	0.8430
	0.011	0.0759	0.2102		
	0.023	0.0890	1.8940		
60	0.027	0.1151	2.3145	2.0482	0.4570
	0.021	0.0759	1.5204		
	0.027	0.1151	2.3096		
90	0.051	0.2721	5.4772	5.6178	0.1557
	0.052	0.2786	5.5910		
	0.053	0.2852	5.7853		
120	0.057	0.3113	6.3165	6.3133	0.1416
	0.056	0.3048	6.1700		
	0.058	0.3179	6.4532		
180	0.079	0.4552	9.2568	8.8827	0.3247
	0.075	0.4291	8.7166		
	0.074	0.4225	8.6747		
240	0.136	0.8281	16.8056	14.4962	2.1828
	0.103	0.6122	12.4653		
	0.116	0.6973	14.2188		
300	0.120	0.7234	14.8771	15.2706	0.3408
	0.125	0.7561	15.4658		
	0.125	0.7561	15.4691		
360	0.156	0.9589	19.7313	18.3592	1.3389
	0.136	0.8281	17.0560		
	0.145	0.8869	18.2903		
540	0.171	1.0570	21.8853	20.2055	2.1778
	0.140	0.8542	17.7449		
	0.164	1.0112	20.9863		
720	0.204	1.2729	26.4138	25.4687	0.8186
	0.194	1.2075	24.9800		
	0.194	1.2075	25.0123		
900	0.268	1.6915	35.0408	30.7471	4.1350
	0.206	1.2859	26.7913		
	0.233	1.4625	30.4093		
1080	0.280	1.7700	36.9489	33.2449	4.3279
	0.217	1.3579	28.4875		
	0.260	1.6392	34.2984		

Time (min)	Absorbance at 664 nm	Dye Concentration (mg/l)	Cumulative Release (%)	Average	SD
1260	0.294	1.8615	39.1344	40.0523	0.8771
	0.304	1.9270	40.1403		
	0.308	1.9531	40.8821		
1440	0.289	1.8288	38.8526	42.1593	2.6197
	0.328	2.0839	43.6654		
	0.327	2.0774	43.6783		
1620	0.345	2.1951	46.5442	45.1663	1.4433
	0.292	1.8485	43.6654		
	0.336	2.1363	45.2893		
1800	0.342	2.1755	46.5908	49.3242	2.4889
	0.337	2.1428	49.9220		
	0.379	2.4175	51.4598		
1980	0.376	2.3979	51.4737	51.1819	0.4934
	0.339	2.1559	50.6122		
	0.375	2.3914	51.4598		
2160	0.379	2.4175	52.3458	51.5120	2.0169
	0.325	2.0643	49.2119		
	0.383	2.4437	52.9784		
2340	0.356	2.2671	49.8205	52.4332	2.2706
	0.355	2.2605	53.5493		
	0.387	2.4699	53.9297		
2520	0.394	2.5156	55.2450	56.2272	1.5859
	0.386	2.4633	58.0568		
	0.394	2.5156	55.3799		
2700	0.390	2.4895	55.2249	57.7515	2.8072
	0.403	2.5745	60.7734		
	0.405	2.5876	57.2562		
2880	0.435	2.7838	61.6096	62.3575	0.8300
	0.418	2.6726	63.2506		
	0.439	2.8100	62.2122		
3240	0.460	2.9473	65.4369	64.1455	1.1290
	0.417	2.6661	63.6543		
	0.443	2.8361	63.3452		
3600	0.488	3.1305	69.6893	66.2378	3.1096
	0.408	2.6072	63.6543		
	0.454	2.9081	65.3699		
3960	0.494	3.1697	71.1003	67.5630	3.7368
	0.403	2.5745	63.6543		
	0.470	3.0128	67.9345		
4320	0.490	3.1436	71.1100	67.5051	3.8073
	0.396	2.5287	63.6543		
	0.464	2.9735	67.8819		

Table C4 The cumulative methylene blue release from the donor of methylene blue in pluronic/chitin whisker composite gel as a function of releasing time at 3 % of chitin whisker content

Time (min)	Absorbance at 664 nm	Dye Concentration (mg/l)	Cumulative Release (%)	Average	SD
30	0.021	0.0759	1.5183	1.6492	0.1308
	0.022	0.0824	1.6492		
	0.023	0.0890	1.7800		
60	0.042	0.2132	4.2807	3.8896	0.3918
	0.036	0.1740	3.4971		
	0.039	0.1936	3.8909		
90	0.053	0.2852	5.7624	5.1929	0.5317
	0.045	0.2329	4.7093		
	0.048	0.2525	5.1070		
120	0.057	0.3113	6.3427	6.2036	0.1349
	0.056	0.3048	6.1949		
	0.055	0.2983	6.0732		
180	0.060	0.3310	6.7974	6.7006	0.0839
	0.059	0.3244	6.6483		
	0.059	0.3244	6.6562		
240	0.069	0.3898	8.0410	8.0306	0.1272
	0.070	0.3964	8.1522		
	0.068	0.3833	7.8984		
300	0.100	0.5926	12.1744	12.0331	0.1399
	0.098	0.5795	11.8944		
	0.099	0.5861	12.0305		
360	0.109	0.6515	13.4703	13.1969	0.3504
	0.108	0.6449	13.3185		
	0.104	0.6188	12.8018		
540	0.143	0.8739	18.0484	17.2055	1.5549
	0.144	0.8804	18.1570		
	0.123	0.7430	15.4111		
720	0.189	1.1747	24.2409	22.6920	3.2465
	0.194	1.2075	24.8740		
	0.149	0.9131	18.9610		
900	0.200	1.2467	25.9148	25.1356	2.0534
	0.206	1.2859	26.6854		
	0.177	1.0963	22.8066		
1080	0.224	1.4037	29.3038	27.5578	1.7657
	0.211	1.3186	27.5966		
	0.198	1.2336	25.7730		

Time (min)	Absorbance at 664 nm	Dye Concentration (mg/l)	Cumulative Release (%)	Average	SD
1260	0.233	1.4625	30.7619	31.4845	1.0594
	0.248	1.5607	32.7007		
	0.236	1.4822	30.9909		
1440	0.263	1.6588	34.9790	35.0553	0.2819
	0.266	1.6784	35.3676		
	0.263	1.6588	34.8194		
1620	0.269	1.6980	36.0957	37.6123	1.7302
	0.295	1.8681	39.4970		
	0.279	1.7634	37.2443		
1800	0.276	1.7438	37.3511	39.3194	1.7051
	0.298	1.8877	40.2631		
	0.300	1.9008	40.3442		
1980	0.290	1.8354	39.5313	41.6506	1.9021
	0.310	1.9662	42.2105		
	0.319	2.0251	43.2099		
2160	0.305	1.9335	41.8607	43.4780	1.8184
	0.314	1.9924	43.1270		
	0.333	2.1166	45.4464		
2340	0.322	2.0447	44.4713	45.3199	1.8478
	0.318	2.0185	44.0487		
	0.345	2.1951	47.4396		
2520	0.335	2.1297	46.5809	46.6528	1.7142
	0.322	2.0447	44.9757		
	0.349	2.2213	48.4019		
2700	0.355	2.2605	49.6232	48.6491	1.3678
	0.335	2.1297	47.0853		
	0.352	2.2409	49.2386		
2880	0.373	2.3783	52.4301	51.4023	1.4567
	0.352	2.2409	49.7352		
	0.370	2.3587	52.0415		
3240	0.396	2.5287	55.9146	54.8763	2.6315
	0.365	2.3260	51.8840		
	0.403	2.5745	56.8303		
3600	0.400	2.5549	56.9436	57.1595	1.9184
	0.388	2.4764	55.3581		
	0.417	2.6661	59.1767		
3960	0.414	2.6465	59.2860	59.1116	1.3480
	0.402	2.5680	57.6848		
	0.422	2.6988	60.3640		
4320	0.436	2.7904	62.6934	61.6451	0.9580
	0.422	2.6988	60.8148		
	0.426	2.7250	61.4270		

Table C5 The cumulative methylene blue release from the donor of methylene blue in pluronic/chitin whisker composite gel as a function of releasing time at 7 % of chitin whisker content

Time (min)	Absorbance at 664 nm	Dye Concentration (mg/l)	Cumulative Release (%)	Average	SD
30	0.025	0.1020	2.0416	1.9108	0.1308
	0.023	0.0890	1.7800		
	0.024	0.0955	1.9108		
60	0.030	0.1347	2.7161	2.7584	0.1989
	0.032	0.1478	2.9752		
	0.029	0.1282	2.5840		
90	0.042	0.2132	4.3129	5.3150	0.3306
	0.050	0.2656	5.3595		
	0.047	0.2459	4.9644		
120	0.051	0.2721	5.5329	6.5450	0.3300
	0.056	0.3048	6.1975		
	0.059	0.3244	6.5834		
180	0.072	0.4095	8.3346	8.9206	1.0680
	0.067	0.3768	7.6975		
	0.080	0.4618	9.3955		
240	0.089	0.5207	10.6404	11.1449	1.1261
	0.083	0.4814	9.8659		
	0.092	0.5403	11.0577		
300	0.101	0.5991	12.3144	12.6493	1.1530
	0.094	0.5534	11.4012		
	0.102	0.6057	12.4739		
360	0.106	0.6318	13.0883	13.6443	0.8209
	0.104	0.6188	12.8201		
	0.108	0.6449	13.3800		
540	0.127	0.7692	15.9619	15.7382	0.2630
	0.124	0.7496	15.5602		
	0.124	0.7496	15.6021		
720	0.160	0.9851	20.4327	19.5523	1.2078
	0.143	0.8739	18.1957		
	0.156	0.9589	19.9382		
900	0.196	1.2205	25.3392	25.1038	0.3186
	0.192	1.1944	24.7806		
	0.194	1.2075	25.1011		
1080	0.200	1.2467	26.1066	25.9994	0.1905
	0.198	1.2336	25.8044		
	0.199	1.2402	25.9967		

Time (min)	Absorbance at 664 nm	Dye Concentration (mg/l)	Cumulative Release (%)	Average	SD
1260	0.229	1.4364	30.1497	28.8638	1.6946
	0.205	1.2794	26.9669		
	0.223	1.3971	29.3844		
1440	0.258	1.6261	34.2307	32.9317	1.5342
	0.236	1.4822	31.2782		
	0.250	1.5737	33.1960		
1620	0.260	1.6392	34.8176	34.6393	0.6225
	0.254	1.5999	33.9294		
	0.262	1.6522	35.0806		
1800	0.271	1.7111	36.5845	36.3172	0.4420
	0.266	1.6784	35.8192		
	0.270	1.7046	36.4576		
1980	0.293	1.8550	39.8047	39.1423	0.7524
	0.283	1.7896	38.3788		
	0.288	1.8223	39.1532		
2160	0.319	2.0251	43.5770	42.2976	1.4160
	0.299	1.8943	40.8298		
	0.310	1.9662	42.3957		
2340	0.331	2.1036	45.5519	44.6087	1.5885
	0.311	1.9727	42.7785		
	0.330	2.0970	45.4053		
2520	0.335	2.1297	46.4959	45.9360	0.8249
	0.325	2.0643	45.0045		
	0.333	2.1166	46.2172		
2700	0.336	2.1363	47.0526	47.2724	0.8875
	0.333	2.1166	46.4639		
	0.345	2.1951	48.2104		
2880	0.341	2.1690	48.1340	47.9639	0.2727
	0.339	2.1559	47.6722		
	0.340	2.1624	47.9953		
3240	0.344	2.1886	48.9602	48.8761	0.1457
	0.344	2.1886	48.7575		
	0.343	2.1821	48.8203		
3600	0.355	2.2605	50.8370	50.3163	0.7633
	0.346	2.2017	49.4568		
	0.353	2.2475	50.5649		
3960	0.356	2.2671	51.4199	51.1125	0.6006
	0.350	2.2278	50.4205		
	0.356	2.2671	51.4068		
4320	0.359	2.2867	52.2658	52.3046	0.1157
	0.360	2.2932	52.1742		
	0.360	2.2932	52.3835		

Appendix D Model drug release of methylene blue at initial concentration 500 mg/l

Table D1 The cumulative methylene blue release from the donor of methylene blue solution as a function of releasing time

Time (min)	Absorbance at 664 nm	Dye Concentration (mg/l)	Cumulative Release (%)	Average	SD
30	0.053	0.2852	11.4091	10.5370	1.5105
	0.043	0.2198	8.7928		
	0.053	0.2852	11.4091		
60	0.090	0.5272	21.2038	21.1951	2.6294
	0.080	0.4618	18.5613		
	0.100	0.5926	23.8202		
90	0.103	0.6122	24.8160	27.3365	2.3825
	0.114	0.6842	27.6417		
	0.121	0.7300	29.5517		
120	0.146	0.8935	36.3113	34.1476	4.0412
	0.120	0.7234	29.4852		
	0.147	0.9000	36.6462		
180	0.209	1.3056	53.1519	56.5480	3.1378
	0.233	1.4625	59.3397		
	0.224	1.4037	57.1524		
240	0.261	1.6457	67.2793	68.5291	2.7650
	0.278	1.7569	71.6984		
	0.258	1.6261	66.6095		
300	0.327	2.0774	85.2057	84.0257	4.7743
	0.338	2.1493	88.0994		
	0.302	1.9139	78.7720		
360	0.327	2.0774	86.0367	85.2806	4.6265
	0.340	2.1624	89.4825		
	0.305	1.9335	80.3225		
540	0.330	2.0970	87.6526	92.0341	3.9986
	0.350	2.2278	92.9638		
	0.360	2.2932	95.4860		
720	0.351	2.2344	93.9858	95.9690	2.1797
	0.367	2.3390	98.3028		
	0.357	2.2736	95.6184		
900	0.363	2.3129	98.0192	98.8879	0.8712
	0.369	2.3521	99.7617		
	0.366	2.3325	98.8826		
1080	0.366	2.3325	99.7293	99.8209	0.3225
	0.367	2.3390	100.1793		
	0.365	2.3260	99.5540		

Time (min)	Absorbance at 664 nm	Dye Concentration (mg/l)	Cumulative Release (%)	Average	SD
1260	0.365	2.3260	100.4007	100.8411	0.4948
	0.368	2.3456	101.3766		
	0.366	2.3325	100.7460		

Table D2 The cumulative methylene blue release from the donor of methylene blue in neat pluronic as a function of releasing time

Time (min)	Absorbance at 664 nm	Dye Concentration (mg/l)	Cumulative Release (%)	Average	SD
30	0.033	0.1544	6.1764	5.4787	0.6584
	0.028	0.1217	4.8682		
	0.030	0.1347	5.3915		
60	0.056	0.3048	12.2558	10.5046	1.5394
	0.045	0.2329	9.3647		
	0.047	0.2459	9.8932		
90	0.098	0.5795	23.3665	21.5979	1.5547
	0.087	0.5076	20.4467		
	0.089	0.5207	20.9804		
120	0.104	0.6188	25.1682	24.0798	0.9761
	0.099	0.5861	23.7894		
	0.097	0.5730	23.2818		
180	0.157	0.9654	39.2825	34.1719	6.0956
	0.112	0.6711	27.4251		
	0.144	0.8804	35.8080		
240	0.158	0.9720	39.9303	39.4786	2.9511
	0.145	0.8869	36.3276		
	0.167	1.0308	42.1778		
300	0.164	1.0112	41.8890	41.9570	1.9082
	0.158	0.9720	40.0837		
	0.172	1.0636	43.8984		
360	0.171	1.0570	44.1250	45.6773	1.4297
	0.179	1.1093	45.9669		
	0.182	1.1290	46.9402		
540	0.182	1.1290	47.4258	48.5587	0.9860
	0.189	1.1747	49.0270		
	0.189	1.1747	49.2232		
720	0.193	1.2009	50.7554	50.5051	0.2379
	0.192	1.1944	50.2818		
	0.192	1.1944	50.4781		
900	0.222	1.3906	58.8233	57.0886	1.5026
	0.213	1.3317	56.2540		
	0.212	1.3252	56.1886		
1080	0.225	1.4102	60.1645	60.4191	0.2408
	0.227	1.4233	60.4496		
	0.227	1.4233	60.6433		

Time (min)	Absorbance at 664 nm	Dye Concentration (mg/l)	Cumulative Release (%)	Average	SD
1260	0.230	1.4429	62.0368	62.3821	0.4205
	0.234	1.4691	62.8504		
	0.231	1.4495	62.2591		
1440	0.234	1.4691	63.6605	65.0568	1.4213
	0.240	1.5083	65.0079		
	0.245	1.5410	66.5019		
1620	0.235	1.4756	64.5098	66.6186	1.8913
	0.246	1.5476	67.1811		
	0.249	1.5672	68.1649		
1800	0.244	1.5345	67.4548	68.4516	0.8694
	0.250	1.5737	68.8467		
	0.250	1.5737	69.0534		
1980	0.268	1.6915	74.3479	73.6110	1.0937
	0.261	1.6457	72.3542		
	0.267	1.6849	74.1308		
2160	0.279	1.7634	77.9026	76.7226	2.5489
	0.264	1.6653	73.7975		
	0.281	1.7765	78.4677		
2340	0.290	1.8354	81.4860	80.6435	2.2190
	0.278	1.7569	78.1265		
	0.293	1.8550	82.3180		
2520	0.309	1.9597	87.1912	85.0327	2.9222
	0.289	1.8288	81.7073		
	0.305	1.9335	86.1996		
2700	0.311	1.9727	88.4984	87.8888	1.8219
	0.302	1.9139	85.8402		
	0.314	1.9924	89.3278		
2880	0.326	2.0709	93.2121	92.0740	2.2486
	0.313	1.9858	89.4837		
	0.327	2.0774	93.5261		
3240	0.342	2.1755	98.2266	97.1653	2.5998
	0.328	2.0839	94.2027		
	0.345	2.1951	99.0665		
3600	0.344	2.1886	99.6201	98.4620	2.0606
	0.332	2.1101	96.0828		
	0.344	2.1886	99.6829		

Table D3 The cumulative methylene blue release from the donor of methylene blue in pluronic/chitin whisker composite gel as a function of releasing time at 0.4% of chitin whisker content

Time (min)	Absorbance at 664 nm	Dye Concentration (mg/l)	Cumulative Release (%)	Average	SD
30	0.019	0.0628	2.5135	2.6007	0.3996
	0.018	0.0562	2.2518		
	0.021	0.0759	3.0367		
60	0.026	0.1086	4.3701	4.3709	0.2655
	0.025	0.1020	4.1058		
	0.027	0.1151	4.6369		
90	0.026	0.1086	4.4135	4.7632	0.3029
	0.028	0.1217	4.9316		
	0.028	0.1217	4.9446		
120	0.043	0.2198	8.9048	9.0836	0.1549
	0.044	0.2263	9.1664		
	0.044	0.2263	9.1795		
180	0.054	0.2917	11.8707	12.1385	0.2630
	0.056	0.3048	12.3966		
	0.055	0.2983	12.1481		
240	0.066	0.3702	15.1271	14.3509	1.5835
	0.067	0.3768	15.3966		
	0.056	0.3048	12.5290		
300	0.067	0.3768	15.2752	15.1889	0.6674
	0.068	0.3833	15.8089		
	0.063	0.3506	14.4824		
360	0.078	0.4487	18.2255	18.2507	0.5171
	0.080	0.4618	18.7801		
	0.076	0.4356	17.7467		
540	0.102	0.6057	24.6843	25.7561	1.3998
	0.104	0.6188	25.2442		
	0.112	0.6711	27.3399		
720	0.105	0.6253	25.7115	26.9682	1.5180
	0.108	0.6449	26.5382		
	0.116	0.6973	28.6549		
900	0.128	0.7758	31.9793	32.2889	0.3087
	0.129	0.7823	32.2906		
	0.130	0.7888	32.5967		
1080	0.132	0.8019	33.3361	34.1716	0.8346
	0.135	0.8215	34.1734		
	0.138	0.8412	35.0054		

Time	Absorbance	Dye	Cumulative	Average	SD

(min)	at 664 nm	Concentration (mg/l)	Release (%)		
1260	0.156	0.9589	39.9362	40.4307	0.4565
	0.158	0.9720	40.5197		
	0.159	0.9785	40.8363		
1440	0.164	1.0112	42.4129	42.7373	0.3231
	0.165	1.0178	42.7400		
	0.166	1.0243	43.0592		
1620	0.174	1.0766	45.4338	45.0631	0.9420
	0.175	1.0832	45.7635		
	0.168	1.0374	43.9922		
1800	0.179	1.1093	47.1727	46.9721	0.4101
	0.179	1.1093	47.2433		
	0.176	1.0897	46.5002		
1980	0.183	1.1355	48.6630	48.1981	0.6468
	0.182	1.1290	48.4720		
	0.178	1.1028	47.4594		
2160	0.185	1.1486	49.6405	49.9553	0.2975
	0.187	1.1617	50.2318		
	0.186	1.1551	49.9937		
2340	0.191	1.1878	51.6697	52.1616	0.4487
	0.193	1.2009	52.2663		
	0.194	1.2075	52.5488		
2520	0.199	1.2402	54.2380	54.2110	0.1213
	0.199	1.2402	54.3165		
	0.198	1.2336	54.0784		
2700	0.207	1.2925	56.8272	55.5783	1.0882
	0.200	1.2467	55.0742		
	0.199	1.2402	54.8335		
2880	0.208	1.2990	57.6058	57.2160	1.7428
	0.199	1.2402	55.3113		
	0.212	1.3252	58.7309		
3240	0.222	1.3906	61.7884	59.9988	2.3203
	0.205	1.2794	57.3772		
	0.218	1.3644	60.8308		
3600	0.225	1.4102	63.1296	62.6298	1.1725
	0.218	1.3644	61.2902		
	0.226	1.4168	63.4697		
3960	0.233	1.4625	65.7868	65.0202	0.6683
	0.229	1.4364	64.7140		
	0.228	1.4298	64.5597		
4320	0.243	1.5280	68.9882	67.5160	1.2773
	0.235	1.4756	66.8584		
	0.234	1.4691	66.7015		

Table D4 The cumulative methylene blue release from the donor of methylene blue in pluronic/chitin whisker composite gel as a function of releasing time at 3 % of chitin whisker content

Time (min)	Absorbance at 664 nm	Dye Concentration (mg/l)	Cumulative Release (%)	Average	SD
30	0.011	0.0105	0.4204	0.8564	0.5446
	0.012	0.0170	0.6820		
	0.015	0.0366	1.4669		
60	0.012	0.0170	0.6862	1.3011	0.6638
	0.014	0.0301	1.2121		
	0.017	0.0497	2.0049		
90	0.020	0.0693	2.7861	3.1454	0.4116
	0.021	0.0759	3.0556		
	0.023	0.0890	3.5946		
120	0.021	0.0759	3.0755	3.7872	0.6163
	0.025	0.1020	4.1325		
	0.025	0.1020	4.1535		
180	0.027	0.1151	4.6757	5.0455	0.3204
	0.029	0.1282	5.2199		
	0.029	0.1282	5.2408		
240	0.035	0.1674	6.8149	6.7521	0.3858
	0.036	0.1740	7.1027		
	0.033	0.1544	6.3387		
300	0.045	0.2329	9.4982	9.6962	0.1715
	0.046	0.2394	9.7887		
	0.046	0.2394	9.8017		
360	0.067	0.3768	15.6850	16.1210	0.3947
	0.069	0.3898	16.2239		
	0.070	0.3964	16.4542		
540	0.073	0.4160	17.4055	17.5843	0.1555
	0.074	0.4225	17.6881		
	0.074	0.4225	17.6593		
720	0.083	0.4814	20.1883	20.1072	0.6721
	0.085	0.4945	20.7351		
	0.080	0.4618	19.3981		
900	0.087	0.5076	21.4274	21.3454	0.1675
	0.087	0.5076	21.4562		
	0.086	0.5010	21.1527		
1080	0.104	0.6188	26.0783	25.7338	1.1096
	0.106	0.6318	26.6304		
	0.098	0.5795	24.4928		

Time (min)	Absorbance at 664 nm	Dye Concentration (mg/l)	Cumulative Release (%)	Average	SD
1260	0.112	0.6711	28.4189	28.4198	0.5559
	0.114	0.6842	28.9762		
	0.110	0.6580	27.8643		
1440	0.114	0.6842	29.2107	29.6476	1.0259
	0.120	0.7234	30.8197		
	0.113	0.6776	28.9124		
1620	0.130	0.7888	33.6706	33.3270	1.1334
	0.132	0.8019	34.2488		
	0.124	0.7496	32.0615		
1800	0.142	0.8673	37.1258	39.1334	2.1326
	0.158	0.9720	41.3721		
	0.149	0.9131	38.9023		
1980	0.159	0.9785	41.9206	42.6401	0.7055
	0.164	1.0112	43.3308		
	0.162	0.9981	42.6688		
2160	0.161	0.9916	42.8353	44.9571	1.8676
	0.174	1.0766	46.3517		
	0.172	1.0636	45.6845		
2340	0.173	1.0701	46.3716	48.4272	1.8404
	0.186	1.1551	49.9220		
	0.183	1.1355	48.9880		
2520	0.183	1.1355	49.4160	51.4045	1.8241
	0.196	1.2205	53.0004		
	0.192	1.1944	51.7969		
2700	0.183	1.1355	49.8702	51.8779	1.9435
	0.197	1.2271	53.7503		
	0.191	1.1878	52.0130		
2880	0.193	1.2009	52.9408	53.5722	1.0330
	0.199	1.2402	54.7644		
	0.193	1.2009	53.0115		
3240	0.194	1.2075	53.6828	54.7556	1.0511
	0.201	1.2532	55.7838		
	0.198	1.2336	54.8000		
3600	0.205	1.2794	57.0439	56.6436	0.5033
	0.203	1.2663	56.8084		
	0.201	1.2532	56.0784		
3960	0.207	1.2925	58.0789	57.6734	0.3668
	0.204	1.2729	57.5766		
	0.204	1.2729	57.3646		
4320	0.208	1.2990	58.8576	58.2724	0.6260
	0.205	1.2794	58.3474		
	0.203	1.2663	57.6122		

Table D5 The cumulative methylene blue release from the donor of methylene blue in pluronic/chitin whisker composite gel as a function of releasing time at 7 % of chitin whisker content

Time (min)	Absorbance at 664 nm	Dye Concentration (mg/l)	Cumulative Release (%)	Average	SD
30	0.009	0.0000	0.0000	0.0529	0.0916
	0.008	0.0000	0.0000		
	0.010	0.0039	0.1587		
60	0.013	0.0235	0.9426	1.1170	0.1510
	0.014	0.0301	1.2016		
	0.014	0.0301	1.2069		
90	0.020	0.0693	2.7835	2.6108	0.1495
	0.019	0.0628	2.5219		
	0.019	0.0628	2.5271		
120	0.025	0.1020	4.1194	4.0322	0.4022
	0.023	0.0890	3.5936		
	0.026	0.1086	4.3837		
180	0.032	0.1478	5.9917	5.7292	0.2656
	0.030	0.1347	5.4606		
	0.031	0.1413	5.7353		
240	0.040	0.2001	8.1440	8.0533	0.4079
	0.038	0.1871	7.6076		
	0.041	0.2067	8.4082		
300	0.045	0.2329	9.5323	8.9174	0.5512
	0.041	0.2067	8.4674		
	0.042	0.2132	8.7526		
360	0.055	0.2983	12.2418	11.4464	1.1563
	0.047	0.2459	10.1199		
	0.054	0.2917	11.9775		
540	0.064	0.3571	14.7159	14.1743	0.5482
	0.060	0.3310	13.6196		
	0.062	0.3440	14.1874		
720	0.069	0.3898	16.1669	15.3585	0.7081
	0.065	0.3637	15.0602		
	0.064	0.3571	14.8483		
900	0.074	0.4225	17.6311	17.7741	0.1260
	0.075	0.4291	17.8221		
	0.075	0.4291	17.8692		
1080	0.088	0.5141	21.4630	21.3462	0.4281
	0.086	0.5010	20.8717		
	0.089	0.5207	21.7037		

Time (min)	Absorbance at 664 nm	Dye Concentration (mg/l)	Cumulative Release (%)	Average	SD
1260	0.092	0.5403	22.7152	23.8185	0.9610
	0.099	0.5861	24.4734		
	0.098	0.5795	24.2668		
1440	0.102	0.6057	25.5477	26.6623	0.9610
	0.108	0.6449	27.0626		
	0.109	0.6515	27.3766		
1620	0.118	0.7103	29.9762	29.0091	1.0460
	0.115	0.6907	29.1521		
	0.110	0.6580	27.8988		
1800	0.123	0.7430	31.5686	30.9407	1.5187
	0.125	0.7561	32.0448		
	0.114	0.6842	29.2086		
1980	0.133	0.8085	34.4822	34.0226	0.9925
	0.134	0.8150	34.7020		
	0.127	0.7692	32.8836		
2160	0.145	0.8869	37.9453	37.0452	1.3070
	0.144	0.8804	37.6444		
	0.136	0.8281	35.5460		
2340	0.150	0.9197	39.6082	38.8739	1.0204
	0.149	0.9131	39.3047		
	0.143	0.8739	37.7088		
2520	0.150	0.9197	39.9761	40.3686	0.7186
	0.150	0.9197	39.9316		
	0.155	0.9524	41.1980		
2700	0.155	0.9524	41.6522	41.6129	0.2495
	0.154	0.9458	41.3461		
	0.156	0.9589	41.8406		
2880	0.159	0.9785	43.0797	43.0405	0.2521
	0.158	0.9720	42.7710		
	0.160	0.9851	43.2707		
3240	0.160	0.9851	43.7328	43.7807	0.3855
	0.159	0.9785	43.4214		
	0.162	0.9981	44.1880		
3600	0.163	1.0047	44.9117	44.7861	0.1661
	0.162	0.9981	44.5978		
	0.163	1.0047	44.8489		
3960	0.174	1.0766	48.1916	47.8908	0.2898
	0.172	1.0636	47.6134		
	0.173	1.0701	47.8672		
4320	0.173	1.0701	48.3607	48.2316	0.1740
	0.173	1.0701	48.3005		
	0.172	1.0636	48.0336		

Appendix E Model drug release of methyl orange at initial concentration 1000 mg/l

Table E1 The cumulative methyl orange release from the donor of methyl orange solution as a function of releasing time

Time (min)	Absorbance at 465 nm	Dye Concentration (mg/l)	Cumulative Release (%)	Average	SD
30	0.042	0.5220	10.0399	9.4473	0.5371
	0.047	0.5607	9.3096		
	0.045	0.5406	8.9924		
60	0.064	0.8101	15.6811	15.5981	0.2557
	0.101	0.9425	15.8021		
	0.097	0.9137	15.3112		
90	0.087	1.1114	21.6295	20.7159	1.1753
	0.144	1.2511	21.1282		
	0.130	1.1506	19.3899		
120	0.101	1.2947	25.3692	24.9920	0.6017
	0.177	1.4879	25.3089		
	0.169	1.4305	24.2981		
180	0.125	1.6090	31.6627	30.4715	1.1688
	0.209	1.7175	29.3264		
	0.219	1.7893	30.4253		
240	0.147	1.8971	37.5129	37.7785	0.7330
	0.273	2.1768	37.2154		
	0.276	2.1984	38.6073		
300	0.168	2.1722	43.1666	42.8404	1.2576
	0.305	2.4065	41.4518		
	0.326	2.5572	43.9029		
360	0.186	2.4079	48.1177	49.1401	0.9894
	0.366	2.8443	49.2097		
	0.374	2.9017	50.0930		
540	0.225	2.9187	58.4031	58.6488	0.6009
	0.438	3.3610	58.2097		
	0.447	3.4256	59.3336		
720	0.260	3.3770	67.7792	68.7361	1.1300
	0.531	4.0284	69.9828		
	0.518	3.9351	68.4464		
900	0.294	3.8223	76.9917	77.8350	1.2772
	0.586	4.4232	77.2088		
	0.604	4.5523	79.3045		
1080	0.330	4.2938	86.7935	87.6022	0.7804
	0.673	5.0475	88.3509		
	0.667	5.0045	87.6623		

Time (min)	Absorbance at 465 nm	Dye Concentration (mg/l)	Cumulative Release (%)	Average	SD
1260	0.350	4.5557	92.6563	93.6829	0.8949
	0.716	5.3561	94.2981		
	0.714	5.3418	94.0944		
1440	0.357	4.6474	95.2953	96.3287	0.9885
	0.726	5.4279	96.4254		
	0.733	5.4781	97.2653		
1620	0.357	4.6474	96.1891	97.3077	1.1275
	0.726	5.4279	97.2900		
	0.735	5.4925	98.4439		
1800	0.360	4.6867	97.8384	98.4871	0.7372
	0.727	5.4351	98.3340		
	0.735	5.4925	99.2889		
1980	0.365	4.7522	99.9989	99.7189	0.3143
	0.728	5.4422	99.3789		
	0.731	5.4638	99.7789		
2160	0.357	4.6474	99.8980	99.8750	0.1015
	0.724	5.4135	99.7638		
	0.725	5.4207	99.9630		
2340	0.356	4.6343	99.5399	99.8771	0.2953
	0.719	5.3777	100.0015		
	0.718	5.3705	100.0899		
2520	0.361	4.6998	100.6904	100.1145	0.2931
	0.715	5.3490	100.4976		
	0.711	5.3202	100.1145		
2700	0.354	4.6081	100.8312	100.6118	0.2455
	0.709	5.3059	100.6577		
	0.706	5.2844	100.3466		
2880	0.350	4.5557	100.7100	100.3726	0.3016
	0.697	5.2198	100.1290		
	0.698	5.2269	100.2788		
3240	0.345	4.4902	100.3305	100.2954	0.0304
	0.691	5.1767	100.2778		
	0.690	5.1695	100.2777		

Table E2 The cumulative methyl orange release from the donor of methyl orange in neat pluronic as a function of releasing time

Time (min)	Absorbance at 465 nm	Dye Concentration (mg/l)	Cumulative Release (%)	Average	SD
30	0.003	0.0113	0.2263	0.2527	0.0316
	0.003	0.0113	0.2438		
	0.003	0.0113	0.2878		
60	0.008	0.0768	1.5382	1.4835	0.2280
	0.008	0.0768	1.6793		
	0.008	0.0768	1.2331		
90	0.011	0.1160	2.3394	2.3014	0.1661
	0.010	0.1029	2.1196		
	0.013	0.1422	2.4453		
120	0.013	0.1422	2.8864	2.8671	0.1220
	0.013	0.1422	2.7365		
	0.015	0.1684	2.9783		
180	0.020	0.2339	4.7484	4.1079	0.6256
	0.015	0.1684	3.4982		
	0.020	0.2339	4.0772		
240	0.029	0.3518	7.1525	6.4189	0.6397
	0.025	0.2994	5.9772		
	0.030	0.3649	6.1269		
300	0.031	0.3780	7.7468	6.9318	0.7376
	0.027	0.3256	6.7388		
	0.030	0.3649	6.3099		
360	0.033	0.4042	8.3462	8.0556	0.4814
	0.033	0.4042	8.3206		
	0.035	0.4304	7.4999		
540	0.053	0.6661	13.6656	12.5421	1.3251
	0.050	0.6268	12.8799		
	0.051	0.6399	11.0807		
720	0.060	0.7578	15.6323	14.7007	0.9744
	0.057	0.7185	14.7812		
	0.063	0.7971	13.6885		
900	0.071	0.9018	18.6651	17.2075	1.3582
	0.065	0.8232	16.9803		
	0.073	0.9280	15.9773		
1080	0.081	1.0328	21.4647	20.2824	1.0280
	0.074	0.9411	19.5993		
	0.089	1.1376	19.7833		

Time (min)	Absorbance at 465 nm	Dye Concentration (mg/l)	Cumulative Release (%)	Average	SD
1260	0.092	1.1768	24.5525	22.8414	1.4860
	0.083	1.0590	22.0978		
	0.098	1.2554	21.8740		
1440	0.095	1.2161	25.5737	24.8766	0.7518
	0.089	1.1376	24.0800		
	0.112	1.4388	24.9763		
1620	0.100	1.2816	27.1265	26.9445	0.5677
	0.101	1.2947	27.3989		
	0.117	1.5043	26.3080		
1800	0.106	1.3602	28.9544	28.7252	0.5137
	0.107	1.3733	29.0844		
	0.124	1.5959	28.1367		
1980	0.114	1.4650	31.3219	31.1597	0.2018
	0.114	1.4650	31.2237		
	0.135	1.7400	30.9336		
2160	0.118	1.5174	32.6626	32.8981	0.2450
	0.120	1.5435	33.1517		
	0.143	1.8448	32.8799		
2340	0.127	1.6352	35.3234	35.1360	0.8663
	0.129	1.6614	35.8933		
	0.147	1.8971	34.1912		
2520	0.131	1.6876	36.6982	36.3226	0.3278
	0.129	1.6614	36.0939		
	0.155	2.0019	36.1756		
2700	0.136	1.7531	38.3454	37.5336	0.7086
	0.131	1.6876	37.0390		
	0.158	2.0412	37.2164		
2880	0.138	1.7793	39.2199	38.8209	0.6367
	0.134	1.7269	38.0866		
	0.166	2.1460	39.1564		
3240	0.148	1.9102	42.1950	42.1397	0.1334
	0.148	1.9102	41.9875		
	0.178	2.3031	42.2367		
3600	0.159	2.0543	45.4583	44.6799	0.6835
	0.155	2.0019	44.1773		
	0.186	2.4079	44.4042		
3960	0.167	2.1591	47.9645	47.2101	0.8222
	0.161	2.0805	46.3337		
	0.198	2.5651	47.3322		
4320	0.173	2.2377	49.9679	49.3244	0.8697
	0.167	2.1591	48.3349		
	0.207	2.6829	49.6704		

Table E3 The cumulative methyl orange release from the donor of methyl orange in pluronic/chitin whisker composite gel as a function of releasing time at 0.4% of chitin whisker content

Time (min)	Absorbance at 465 nm	Dye Concentration (mg/l)	Cumulative Release (%)	Average	SD
30	0.000	0.0000	0.0000	0.0000	-
	0.000	0.0000	0.0000		
	0.000	0.0000	0.0000		
60	0.001	0.0130	0.2563	0.2910	0.0414
	0.001	0.0130	0.2799		
	0.001	0.0130	0.3369		
90	0.005	0.0375	0.7472	0.7200	0.0325
	0.004	0.0244	0.6840		
	0.004	0.0244	0.7290		
120	0.004	0.0244	0.7472	0.7635	0.0160
	0.005	0.0375	0.7793		
	0.005	0.0375	0.7639		
180	0.007	0.0637	1.5379	1.4536	0.0895
	0.007	0.0637	1.3596		
	0.008	0.0768	1.4633		
240	0.011	0.1160	2.5983	2.6438	0.2300
	0.012	0.1291	2.4398		
	0.013	0.1422	2.8932		
300	0.014	0.1553	3.4073	3.4983	0.2574
	0.016	0.1815	3.7890		
	0.014	0.1553	3.2987		
360	0.015	0.1684	3.7003	3.8331	0.1154
	0.017	0.1946	3.9099		
	0.016	0.1815	3.8892		
540	0.022	0.2601	5.5675	5.2021	0.3406
	0.020	0.2339	4.8933		
	0.022	0.2601	5.1456		
720	0.029	0.3518	7.4530	6.9407	0.7916
	0.025	0.2994	6.0289		
	0.029	0.3518	7.3401		
900	0.032	0.3911	8.3092	8.2755	0.7053
	0.036	0.4434	8.9633		
	0.030	0.3649	7.5539		
1080	0.038	0.4696	9.9590	9.7723	0.5829
	0.040	0.4958	10.2390		
	0.036	0.4434	9.1190		

Time (min)	Absorbance at 465 nm	Dye Concentration (mg/l)	Cumulative Release (%)	Average	SD
1260	0.041	0.5089	10.8387	11.0218	0.2022
	0.042	0.5220	10.9878		
	0.043	0.5351	11.2388		
1440	0.045	0.5613	11.9882	12.0975	0.1762
	0.047	0.5875	12.3009		
	0.046	0.5744	12.0035		
1620	0.048	0.6006	12.8863	13.0003	0.1812
	0.049	0.6137	12.9054		
	0.050	0.6268	13.2094		
1800	0.051	0.6399	13.7922	13.7043	0.4580
	0.050	0.6268	13.2088		
	0.053	0.6661	14.1121		
1980	0.052	0.6530	14.1821	14.2547	0.1739
	0.052	0.6530	14.1288		
	0.054	0.6792	14.4532		
2160	0.056	0.7054	15.3604	15.1427	0.2477
	0.055	0.6923	14.8731		
	0.056	0.7054	15.1945		
2340	0.059	0.7447	16.2873	16.1128	0.1710
	0.059	0.7447	15.9453		
	0.059	0.7447	16.1057		
2520	0.062	0.7840	17.2220	17.2787	0.0660
	0.063	0.7971	17.2628		
	0.063	0.7971	17.3512		
2700	0.063	0.7971	17.6407	17.7545	0.3587
	0.063	0.7971	17.4664		
	0.066	0.8363	18.1564		
2880	0.068	0.8625	19.1098	19.2265	0.4708
	0.068	0.8625	18.8249		
	0.071	0.9018	19.7447		
3240	0.070	0.8887	19.8062	19.8789	0.0680
	0.071	0.9018	19.9411		
	0.071	0.9018	19.8893		
3600	0.074	0.9411	21.0316	20.9786	0.1716
	0.074	0.9411	20.7867		
	0.075	0.9542	21.1174		
3960	0.078	0.9935	22.2676	22.0037	0.2302
	0.077	0.9804	21.8435		
	0.078	0.9935	21.9002		
4320	0.082	1.0459	23.5140	23.3751	0.4210
	0.081	1.0328	22.9022		
	0.084	1.0721	23.7092		

Table E4 The cumulative methyl orange release from the donor of methyl orange in pluronic/chitin whisker composite gel as a function of releasing time at 3 % of chitin whisker content

Time (min)	Absorbance at 465 nm	Dye Concentration (mg/l)	Cumulative Release (%)	Average	SD
30	0.004	0.0244	0.4883	0.4754	0.1279
	0.003	0.0113	0.3415		
	0.004	0.0244	0.5965		
60	0.006	0.0506	1.0170	1.0123	0.0893
	0.005	0.0375	0.9207		
	0.006	0.0506	1.0992		
90	0.008	0.0768	1.5510	1.5121	0.1731
	0.007	0.0637	1.3228		
	0.008	0.0768	1.6625		
120	0.008	0.0768	1.5663	1.6308	0.1191
	0.008	0.0768	1.5577		
	0.009	0.0898	1.7683		
180	0.013	0.1422	2.8913	2.7267	0.2935
	0.011	0.1160	2.3878		
	0.013	0.1422	2.9009		
240	0.018	0.2077	4.2294	3.9016	0.5668
	0.014	0.1553	3.2471		
	0.018	0.2077	4.2282		
300	0.018	0.2077	4.2710	4.3862	0.1564
	0.018	0.2077	4.3233		
	0.019	0.2208	4.5643		
360	0.02	0.2339	4.8364	4.8276	0.0506
	0.02	0.2339	4.7731		
	0.02	0.2339	4.8733		
540	0.028	0.3387	6.9786	6.3454	0.7380
	0.023	0.2732	5.5349		
	0.026	0.3125	6.5228		
720	0.033	0.4042	8.3560	8.2066	0.6415
	0.03	0.3649	7.5035		
	0.034	0.4173	8.7603		
900	0.037	0.4565	9.4845	9.5840	0.1157
	0.037	0.4565	9.5563		
	0.038	0.4696	9.7111		
1080	0.041	0.5089	10.6236	10.4593	0.1459
	0.040	0.4958	10.3445		
	0.040	0.4958	10.4099		

Time (min)	Absorbance at 465 nm	Dye Concentration (mg/l)	Cumulative Release (%)	Average	SD
1260	0.044	0.5482	11.5111	11.4146	0.2749
	0.043	0.5351	11.1044		
	0.045	0.5613	11.6284		
1440	0.048	0.6006	12.6685	12.5257	0.1314
	0.047	0.5875	12.4988		
	0.047	0.5875	12.4099		
1620	0.052	0.6530	13.8363	13.9893	0.3198
	0.052	0.6530	13.7746		
	0.054	0.6792	14.3569		
1800	0.058	0.7316	15.5385	15.0696	0.5706
	0.054	0.6792	14.4342		
	0.057	0.7185	15.2362		
1980	0.057	0.7185	15.4229	15.5085	0.2374
	0.057	0.7185	15.3256		
	0.058	0.7316	15.7769		
2160	0.059	0.7447	16.0905	16.2885	0.1806
	0.060	0.7578	16.4442		
	0.060	0.7578	16.3309		
2340	0.061	0.7709	16.7633	16.7845	0.3035
	0.060	0.7578	16.4922		
	0.062	0.7840	17.0982		
2520	0.065	0.8232	17.9652	17.7279	0.3636
	0.063	0.7971	17.3093		
	0.065	0.8232	17.9093		
2700	0.066	0.8363	18.3917	18.4163	0.4041
	0.065	0.8232	18.0249		
	0.068	0.8625	18.8322		
2880	0.067	0.8494	18.8210	18.9031	0.1833
	0.067	0.8494	18.7753		
	0.068	0.8625	19.1132		
3240	0.070	0.8887	19.7766	19.8652	0.3281
	0.069	0.8756	19.5903		
	0.072	0.9149	20.2285		
3600	0.076	0.9673	21.5260	21.0284	0.6414
	0.072	0.9149	20.3045		
	0.075	0.9542	21.2548		
3960	0.079	1.0066	22.5052	22.0984	0.8311
	0.074	0.9411	21.1422		
	0.079	1.0066	22.6477		
4320	0.083	1.0590	23.7542	23.3588	0.8941
	0.078	0.9935	22.3351		
	0.084	1.0721	23.9870		

Table E5 The cumulative methyl orange release from the donor of methyl orange in pluronic/chitin whisker composite gel as a function of releasing time at 7 % of chitin whisker content

Time (min)	Absorbance at 465 nm	Dye Concentration (mg/l)	Cumulative Release (%)	Average	SD
30	0.002	0.0261	0.5238	0.5136	0.0456
	0.002	0.0261	0.4637		
	0.002	0.0261	0.5533		
60	0.007	0.0637	1.2793	1.2632	0.0345
	0.007	0.0637	1.2236		
	0.007	0.0637	1.2869		
90	0.007	0.0637	1.2920	1.3573	0.0714
	0.007	0.0637	1.3463		
	0.008	0.0768	1.4337		
120	0.010	0.1029	2.0905	2.1813	0.1452
	0.010	0.1029	2.1045		
	0.011	0.1160	2.3487		
180	0.011	0.1160	2.3731	2.4734	0.1400
	0.012	0.1291	2.6334		
	0.011	0.4618	2.4137		
240	0.013	0.1422	2.9201	2.8650	0.0862
	0.013	0.1422	2.9093		
	0.012	0.1291	2.7656		
300	0.015	0.1684	3.4725	3.3536	0.2914
	0.015	0.1684	3.5668		
	0.013	0.1422	3.0216		
360	0.015	0.1684	3.5061	3.5444	0.1548
	0.016	0.1815	3.7147		
	0.015	0.1684	3.4122		
540	0.020	0.2339	4.8495	4.7085	0.3270
	0.018	0.2077	4.3346		
	0.020	0.2339	4.9413		
720	0.024	0.2863	5.9440	5.6293	0.2902
	0.022	0.2601	5.3721		
	0.023	0.2732	5.5717		
900	0.033	0.4042	8.3586	7.9506	0.4316
	0.030	0.3649	7.4987		
	0.032	0.3911	7.9944		
1080	0.034	0.4173	8.7014	8.5292	0.1802
	0.033	0.4042	8.3417		
	0.033	0.4042	8.5443		

Time (min)	Absorbance at 465 nm	Dye Concentration (mg/l)	Cumulative Release (%)	Average	SD
1260	0.034	0.4173	8.7848	8.8094	0.1571
	0.034	0.4173	8.6659		
	0.035	0.4304	8.9774		
1440	0.036	0.4434	9.3921	9.5291	0.1308
	0.037	0.4565	9.5425		
	0.037	0.4565	9.6528		
1620	0.039	0.4827	10.2666	10.2421	0.1463
	0.039	0.4827	10.3747		
	0.038	0.4696	10.0850		
1800	0.045	0.5613	11.9347	11.8626	0.2780
	0.046	0.5744	12.0976		
	0.044	0.5482	11.5556		
1980	0.044	0.5482	11.7851	11.9786	0.1715
	0.046	0.5744	12.1122		
	0.045	0.5613	12.0385		
2160	0.042	0.5220	11.3709	11.9393	0.4924
	0.046	0.5744	12.2360		
	0.045	0.5613	12.2110		
2340	0.048	0.6006	13.0469	12.6393	0.3660
	0.046	0.5744	12.3385		
	0.046	0.5744	12.5324		
2520	0.048	0.6006	13.1670	12.8737	0.3035
	0.046	0.5744	12.5609		
	0.047	0.5875	12.8933		
2700	0.050	0.6268	13.8110	13.4306	0.3930
	0.049	0.6137	13.4547		
	0.047	0.5875	13.0260		
2880	0.052	0.6530	14.4602	13.8907	0.5183
	0.049	0.6137	13.7655		
	0.048	0.6006	13.4465		
3240	0.057	0.7185	15.9005	14.8906	0.8768
	0.051	0.6399	14.3224		
	0.051	0.6399	14.4489		
3600	0.059	0.7447	16.5680	16.1286	0.3881
	0.057	0.7185	15.9853		
	0.056	0.7054	15.8324		
3960	0.062	0.7840	17.5027	17.1651	0.3080
	0.060	0.7578	16.8994		
	0.060	0.7578	17.0932		
4320	0.065	0.8232	18.4453	17.9374	0.4877
	0.061	0.7709	17.4727		
	0.063	0.7971	17.8943		

Appendix F Model drug release of methyl orange at initial concentration 500 mg/l

Table F1 The cumulative methyl orange release from the donor of methyl orange solution as a function of releasing time

Time (min)	Absorbance at 465 nm	Dye Concentration (mg/l)	Cumulative Release (%)	Average	SD
30	0.015	0.1684	6.4798	6.3119	0.7694
	0.013	0.1422	5.4724		
	0.016	0.1815	6.9835		
60	0.029	0.3518	13.5965	12.7553	1.0550
	0.025	0.2994	11.5716		
	0.028	0.3387	13.0978		
90	0.040	0.4958	19.2726	18.4230	1.0654
	0.036	0.4434	17.2276		
	0.039	0.4827	18.7689		
120	0.050	0.6268	24.5004	24.1461	1.0748
	0.047	0.5875	22.9389		
	0.051	0.6399	24.9991		
180	0.061	0.7709	30.2823	29.5888	0.8052
	0.058	0.7316	28.7057		
	0.060	0.7578	29.7786		
240	0.073	0.9280	36.6232	36.2588	1.0917
	0.070	0.8887	35.0315		
	0.074	0.9411	37.1219		
300	0.088	1.1245	44.5358	42.6569	2.0871
	0.080	1.0197	40.4104		
	0.085	1.0852	43.0247		
360	0.094	1.2030	47.9905	46.5969	1.3322
	0.089	1.1376	45.3360		
	0.091	1.1637	46.4643		
540	0.114	1.4650	58.5274	57.1203	1.3448
	0.109	1.3995	55.8477		
	0.111	1.4257	56.9861		
720	0.142	1.8317	73.1946	71.4383	1.5814
	0.138	1.7793	70.9934		
	0.136	1.7531	70.1271		
900	0.161	2.0805	83.4696	81.6965	1.5968
	0.157	2.0281	81.2482		
	0.155	2.0019	80.3718		
1080	0.175	2.2638	91.3217	90.0355	1.3807
	0.170	2.1984	88.5765		
	0.173	2.2377	90.2085		

Time (min)	Absorbance at 465 nm	Dye Concentration (mg/l)	Cumulative Release (%)	Average	SD
1260	0.178	2.3031	93.7035	91.9019	1.6616
	0.172	2.2246	90.4294		
	0.174	2.2507	91.5728		
1440	0.175	2.2638	93.0782	92.7709	0.8702
	0.173	2.2377	91.7887		
	0.176	2.2769	93.4459		
1620	0.174	2.2507	93.4452	93.6400	0.6081
	0.174	2.2507	93.1531		
	0.176	2.2769	94.3217		
1800	0.175	2.2638	94.8146	94.6769	0.1467
	0.175	2.2638	94.5225		
	0.175	2.2638	94.6937		
1980	0.172	2.2246	94.1742	94.8761	0.6301
	0.175	2.2638	95.3932		
	0.174	2.2507	95.0607		
2160	0.174	2.2507	96.0373	95.9080	0.1394
	0.174	2.2507	95.7602		
	0.174	2.2507	95.9264		
2340	0.169	2.1853	94.3844	94.9267	1.0367
	0.173	2.2377	96.1222		
	0.169	2.1853	94.2736		
2520	0.171	2.2115	96.2323	96.1098	0.4435
	0.172	2.2246	96.4791		
	0.170	2.1984	95.6178		
2700	0.168	2.1722	95.5718	95.4492	0.4484
	0.169	2.1853	95.8236		
	0.167	2.1591	94.9522		
2880	0.167	2.1591	95.9036	95.9489	0.1929
	0.168	2.1722	96.1604		
	0.167	2.1591	95.7827		
3240	0.165	2.1329	95.7266	96.7810	0.9330
	0.169	2.1853	97.4996		
	0.168	2.1722	97.1168		
3600	0.164	2.1198	96.0432	96.7736	0.6615
	0.167	2.1591	97.3327		
	0.166	2.1460	96.9449		
3960	0.163	2.1067	96.3548	97.2615	1.2340
	0.168	2.1722	98.6669		
	0.164	2.1198	96.7628		
4320	0.163	2.1067	97.1651	97.4103	0.9852
	0.166	2.1460	98.4949		
	0.162	2.0936	96.5708		

Table F2 The cumulative methyl orange release from the donor of methyl orange in neat pluronic as a function of releasing time

Time (min)	Absorbance at 465 nm	Dye Concentration (mg/l)	Cumulative Release (%)	Average	SD
30	0.004	0.0523	2.0954	2.9685	1.0904
	0.005	0.0654	2.6192		
	0.008	0.1047	4.1908		
60	0.012	0.1571	6.3072	5.4428	1.0909
	0.008	0.1047	4.2170		
	0.011	0.1440	5.8043		
90	0.023	0.3012	12.1324	11.9578	2.9008
	0.017	0.2226	8.9736		
	0.028	0.3666	14.7674		
120	0.028	0.3666	12.1324	11.9578	2.9008
	0.026	0.3405	8.9736		
	0.032	0.4190	14.7674		
180	0.031	0.3780	12.7319	13.7831	2.8026
	0.033	0.4042	11.6580		
	0.038	0.4696	16.9594		
240	0.036	0.4434	15.5024	16.0454	2.4474
	0.037	0.4565	13.9151		
	0.041	0.5089	18.7188		
300	0.039	0.4827	17.2513	18.1541	1.5727
	0.043	0.5351	17.2408		
	0.043	0.5351	19.9701		
360	0.042	0.5220	19.0160	19.9327	2.0485
	0.045	0.5613	18.5026		
	0.047	0.5875	22.2796		
540	0.044	0.5482	20.2725	21.0286	2.2529
	0.046	0.5744	19.2510		
	0.049	0.6137	23.5623		
720	0.047	0.5875	22.0634	22.8317	2.7685
	0.048	0.6006	20.5285		
	0.053	0.6661	25.9033		
900	0.048	0.6006	22.8223	24.3013	3.4694
	0.050	0.6268	21.8165		
	0.057	0.7185	28.2651		
1080	0.050	0.6268	24.1103	25.6085	3.4926
	0.052	0.6530	23.1149		
	0.059	0.7447	29.6003		

Time (min)	Absorbance at 465 nm	Dye Concentration (mg/l)	Cumulative Release (%)	Average	SD
1260	0.053	0.6661	25.9326	26.9261	3.1200
	0.054	0.6792	24.4239		
	0.060	0.7578	30.4220		
1440	0.054	0.6792	26.7229	28.0797	2.7541
	0.057	0.7185	26.2671		
	0.061	0.7709	31.2490		
1620	0.057	0.7185	28.5661	29.4165	2.8597
	0.058	0.7316	27.0784		
	0.063	0.7971	32.6051		
1800	0.061	0.7709	30.9490	31.2877	2.0121
	0.062	0.7840	29.4665		
	0.064	0.8101	33.4477		
1980	0.065	0.8232	33.3527	33.8731	2.3023
	0.066	0.8363	31.8755		
	0.069	0.8756	36.3911		
2160	0.069	0.8756	35.7775	36.8304	2.2014
	0.072	0.9149	35.3532		
	0.074	0.9411	39.3606		
2340	0.076	0.9673	39.7947	39.9886	1.2346
	0.078	0.9935	38.8623		
	0.077	0.9804	41.3087		
2520	0.077	0.9804	40.7055	41.6031	0.7962
	0.083	1.0590	41.8790		
	0.078	0.9935	42.2247		
2700	0.079	1.0066	42.1454	43.9283	1.5473
	0.088	1.1245	44.9219		
	0.082	1.0459	44.7175		
2880	0.085	1.0852	45.6912	46.7965	0.9644
	0.092	1.1768	47.4671		
	0.086	1.0983	47.2313		
3240	0.090	1.1507	48.7446	48.9908	0.2488
	0.094	1.2030	48.9855		
	0.089	1.1376	49.2422		
3600	0.095	1.2161	51.8241	51.5517	0.9314
	0.096	1.2292	50.5145		
	0.094	1.2030	52.3165		
3960	0.100	1.2816	54.9299	54.3082	0.864
	0.103	1.3209	54.6732		
	0.095	1.2161	53.3216		
4320	0.104	1.3340	57.5380	57.0874	1.0350
	0.108	1.3864	57.8208		
	0.099	1.2685	55.9035		

Table F3 The cumulative methyl orange release from the donor of methyl orange in pluronic/chitin whisker composite gel as a function of releasing time at 0.4% of chitin whisker content

Time (min)	Absorbance at 465 nm	Dye Concentration (mg/l)	Cumulative Release (%)	Average	SD
30	0.012	0.1571	6.2862	6.1116	0.3024
	0.011	0.1440	5.7624		
	0.012	0.1571	6.2862		
60	0.014	0.1553	6.2862	6.6756	0.3372
	0.013	0.1702	6.8677		
	0.013	0.1702	6.8729		
90	0.016	0.1815	7.3961	7.7657	0.3218
	0.015	0.1964	7.9835		
	0.017	0.1946	7.9176		
120	0.026	0.3125	12.7072	11.1361	2.2850
	0.018	0.2077	8.5148		
	0.025	0.2994	12.1864		
180	0.028	0.3387	13.8800	12.9916	1.1145
	0.024	0.2863	11.7411		
	0.027	0.3256	13.3538		
240	0.028	0.3387	14.0155	14.1661	0.3183
	0.028	0.3387	13.9510		
	0.029	0.3518	14.5318		
300	0.032	0.3911	16.2464	16.3988	0.2659
	0.033	0.4042	16.7058		
	0.032	0.3911	16.2441		
360	0.034	0.4173	17.4505	17.6047	0.2689
	0.035	0.4304	17.9152		
	0.034	0.4173	17.4482		
540	0.036	0.4434	18.6652	18.6464	0.4982
	0.037	0.4565	19.1351		
	0.035	0.4304	18.1390		
720	0.036	0.4434	18.8426	19.1731	0.2869
	0.037	0.4565	19.3177		
	0.037	0.4565	19.3589		
900	0.038	0.4696	20.0677	19.8778	0.2920
	0.038	0.4696	20.0242		
	0.037	0.4565	19.5415		
1080	0.040	0.4958	21.3033	21.1116	0.3254
	0.039	0.4827	20.7359		
	0.040	0.4958	21.2957		

Time (min)	Absorbance at 465 nm	Dye Concentration (mg/l)	Cumulative Release (%)	Average	SD
1260	0.042	0.5220	22.5493	22.5306	0.5035
	0.043	0.5351	23.0245		
	0.041	0.5089	22.0179		
1440	0.042	0.5220	22.7581	23.2633	0.5021
	0.044	0.5482	23.7624		
	0.043	0.5351	23.2692		
1620	0.042	0.5220	22.9670	23.8266	0.7850
	0.045	0.5613	24.5055		
	0.044	0.5482	24.0072		
1800	0.043	0.5351	23.6997	24.3934	0.7904
	0.046	0.5744	25.2539		
	0.044	0.5482	24.2265		
1980	0.044	0.5482	24.4376	25.1383	0.7984
	0.047	0.5875	26.0076		
	0.045	0.5613	24.9696		
2160	0.045	0.5613	25.1808	25.8884	0.8064
	0.048	0.6006	26.7665		
	0.046	0.5744	25.7180		
2340	0.048	0.6006	26.9769	26.8184	0.8031
	0.049	0.6137	27.5306		
	0.046	0.5744	25.9478		
2520	0.048	0.6006	27.2171	27.2316	0.5374
	0.049	0.6137	27.7761		
	0.047	0.5875	26.7015		
2700	0.048	0.6006	27.4574	27.8211	0.6273
	0.050	0.6268	28.5454		
	0.048	0.6006	27.4603		
2880	0.049	0.6137	28.2215	28.4140	0.3309
	0.050	0.6268	28.7962		
	0.049	0.6137	28.2245		
3240	0.051	0.6399	29.5147	29.3598	0.3181
	0.051	0.6399	29.5708		
	0.050	0.6268	28.9938		
3600	0.051	0.6399	29.7707	30.1379	0.3193
	0.052	0.6530	30.3506		
	0.052	0.6530	30.2923		
3960	0.056	0.7054	32.6459	31.9689	0.5870
	0.054	0.6792	31.6595		
	0.054	0.6792	31.6012		
4320	0.061	0.7709	35.5474	34.3395	1.0858
	0.058	0.7316	34.0266		
	0.057	0.7185	33.4445		

Table F4 The cumulative methyl orange release from the donor of methyl orange in pluronic/chitin whisker composite gel as a function of releasing time at 3 % of chitin whisker content

Time (min)	Absorbance at 465 nm	Dye Concentration (mg/l)	Cumulative Release (%)	Average	SD
30	0.013	0.1422	5.6913	5.1674	0.5238
	0.011	0.1160	4.6436		
	0.012	0.1291	5.1674		
60	0.015	0.1684	6.7959	6.2668	0.5290
	0.013	0.1422	5.7377		
	0.014	0.1553	6.2668		
90	0.021	0.2470	10.0064	9.1228	0.8104
	0.018	0.2077	8.4139		
	0.019	0.2208	8.9482		
120	0.021	0.2470	10.1052	9.9114	0.3177
	0.020	0.2339	9.5447		
	0.021	0.2470	10.0843		
180	0.021	0.2470	10.2040	10.3577	0.3031
	0.021	0.2470	10.1621		
	0.022	0.2601	10.7069		
240	0.026	0.3125	12.9221	12.2045	0.8213
	0.023	0.2732	11.3087		
	0.025	0.2994	12.3826		
300	0.029	0.3518	14.6187	13.8941	0.8293
	0.026	0.3125	12.9895		
	0.028	0.3387	14.0739		
360	0.029	0.3518	14.7595	14.5517	0.3374
	0.028	0.3387	14.1623		
	0.029	0.3518	14.7333		
540	0.030	0.3649	15.4240	15.0399	0.3337
	0.029	0.3518	14.8216		
	0.029	0.3518	14.8740		
720	0.032	0.3911	16.6177	16.2301	0.3367
	0.031	0.3780	16.0100		
	0.031	0.3780	16.0624		
900	0.033	0.4042	17.2980	16.9069	0.3397
	0.032	0.3911	16.6851		
	0.032	0.3911	16.7375		
1080	0.034	0.4173	17.9836	17.5889	0.3427
	0.033	0.4042	17.3654		
	0.033	0.4042	17.4178		

Time (min)	Absorbance at 465 nm	Dye Concentration (mg/l)	Cumulative Release (%)	Average	SD
1260	0.036	0.4434	19.1982	18.6254	0.5736
	0.034	0.4173	18.0509		
	0.035	0.4304	18.6272		
1440	0.034	0.4173	19.1982	18.6828	0.5824
	0.035	0.4304	18.0509		
	0.035	0.4304	18.7993		
1620	0.035	0.4304	19.8890	19.2025	0.8706
	0.035	0.4304	18.2231		
	0.036	0.4434	19.4954		
1800	0.037	0.4565	21.1088	20.0749	1.0999
	0.036	0.4434	18.9191		
	0.037	0.4565	20.1966		
1980	0.038	0.4696	21.8153	20.9542	1.1713
	0.037	0.4565	19.6204		
	0.039	0.4827	21.4270		
2160	0.040	0.4958	23.0509	21.6660	1.3626
	0.038	0.4696	20.3269		
	0.039	0.4827	21.6201		
2340	0.043	0.5351	24.8208	23.0814	1.9092
	0.039	0.4827	21.0386		
	0.042	0.5220	23.3848		
2520	0.044	0.5482	25.5588	23.9852	1.6436
	0.041	0.5089	22.2794		
	0.043	0.5351	24.1174		
2700	0.046	0.5744	26.8258	24.8960	1.9097
	0.042	0.5220	23.0069		
	0.044	0.5482	24.8554		
2880	0.049	0.6137	28.6271	26.1630	2.4440
	0.043	0.5351	23.7396		
	0.046	0.5744	26.1224		
3240	0.052	0.6530	30.4442	27.4405	2.9835
	0.044	0.5482	24.4775		
	0.048	0.6006	27.3999		
3960	0.052	0.6530	30.7054	28.2046	2.7741
	0.045	0.5613	25.2206		
	0.050	0.6268	28.6879		
3960	0.054	0.6792	32.0143	29.6725	2.5135
	0.048	0.6006	27.0168		
	0.052	0.6530	29.9863		
4320	0.057	0.6661	33.8576	31.6764	2.0178
	0.053	0.6661	29.8763		
	0.054	0.6792	31.2952		

Table 5 The cumulative methyl orange release from the donor of methyl orange in pluronic/chitin whisker composite gel as a function of releasing time at 7 % of chitin whisker content

Time (min)	Absorbance at 465 nm	Dye Concentration (mg/l)	Cumulative Release (%)	Average	SD
30	0.000	0.0000	0.0000	0.3637	0.3150
	0.001	0.0130	0.5456		
	0.001	0.0130	0.5456		
60	0.001	0.0130	0.5238	0.8765	0.3054
	0.002	0.0261	1.0529		
	0.002	0.0261	1.0529		
90	0.002	0.0261	1.0529	1.2345	0.3055
	0.002	0.0261	1.0634		
	0.003	0.0392	1.5872		
120	0.003	0.0113	1.0529	1.2345	0.3055
	0.003	0.0113	1.0634		
	0.003	0.0113	1.5872		
180	0.004	0.0523	2.7001	2.7071	0.5238
	0.003	0.0392	2.1867		
	0.004	0.0523	3.2344		
240	0.005	0.0375	2.7001	2.7071	0.5238
	0.003	0.0113	2.1867		
	0.004	0.0244	3.2344		
300	0.006	0.0506	3.2389	3.2407	0.5264
	0.004	0.0244	2.7151		
	0.005	0.0375	3.7680		
360	0.007	0.0637	3.7830	3.9542	0.8047
	0.005	0.0375	3.2487		
	0.007	0.0637	4.8307		
540	0.008	0.0768	4.3324	4.5000	0.8093
	0.006	0.0506	3.7876		
	0.008	0.0768	5.3801		
720	0.011	0.1160	5.9347	5.7496	0.8173
	0.008	0.0768	4.8555		
	0.010	0.1029	6.4585		
900	0.013	0.1422	7.0288	6.8367	1.3409
	0.009	0.0898	5.4101		
	0.013	0.1422	8.0713		
1080	0.015	0.1684	8.1334	8.1090	1.6031
	0.011	0.1160	6.4938		
	0.016	0.1815	9.6998		

Time (min)	Absorbance at 465 nm	Dye Concentration (mg/l)	Cumulative Release (%)	Average	SD
1260	0.019	0.2208	10.2962	9.9173	2.1649
	0.013	0.1422	7.5879		
	0.020	0.2339	11.8678		
1440	0.020	0.2339	10.9084	10.8700	2.6823
	0.014	0.1553	8.1687		
	0.023	0.2732	13.5329		
1620	0.021	0.2470	11.5259	11.8315	2.1978
	0.017	0.1946	9.8024		
	0.024	0.2863	14.1661		
1800	0.024	0.2863	13.1963	13.3255	1.4188
	0.021	0.2470	11.9757		
	0.025	0.2994	14.8045		
1980	0.025	0.2994	13.8347	13.9604	1.4290
	0.022	0.2601	12.5984		
	0.026	0.3125	15.4481		
2160	0.027	0.3256	15.0021	15.1244	1.4392
	0.024	0.2863	13.7501		
	0.028	0.3387	16.6208		
2340	0.028	0.3387	15.6562	15.7750	0.9277
	0.026	0.3125	14.9124		
	0.028	0.3387	16.7563		
2520	0.031	0.3780	17.3633	17.3039	0.6672
	0.029	0.3518	16.6089		
	0.030	0.3649	17.9395		
2700	0.033	0.4042	18.5622	19.0215	1.0113
	0.032	0.3911	18.3212		
	0.034	0.4173	20.1809		
2880	0.036	0.4434	20.2955	20.0562	0.9577
	0.033	0.4042	19.0015		
	0.035	0.4304	20.8717		
3240	0.038	0.4696	21.5206	21.6236	1.4668
	0.035	0.4304	20.2109		
	0.039	0.4827	23.1393		
3600	0.040	0.4958	22.7562	23.0303	1.2357
	0.038	0.4696	21.9547		
	0.041	0.5089	24.3801		
3960	0.042	0.5220	24.0022	24.1000	1.4849
	0.039	0.4827	22.6664		
	0.043	0.5351	25.6314		
4320	0.044	0.5482	25.2588	25.0038	1.5092
	0.040	0.4958	23.3834		
	0.044	0.5482	26.3693		

Appendix G Model drug release of insulin at initial concentration 20 unit/l

Table G1 The cumulative insulin release from the donor of insulin solution as a function of releasing time

Time (min)	Absorbance at 260 nm	Dye Concentration (mg/l)	Cumulative Release (%)	Average	SD
30	0.117	0.7038	37.2697	38.1093	0.9618
	0.135	0.8215	39.1588		
	0.133	0.8085	37.8994		
60	0.159	0.9785	40.1611	40.5893	0.3708
	0.163	1.0047	40.8097		
	0.175	1.0832	40.7971		
90	0.200	1.2467	44.3371	43.9299	1.9278
	0.210	1.3121	45.6216		
	0.217	1.3579	41.8310		
120	0.247	1.5541	46.6618	45.6207	2.4044
	0.237	1.4887	47.3293		
	0.252	1.5868	42.8711		
180	0.322	2.0447	48.3757	47.1143	2.7888
	0.318	2.0185	49.0495		
	0.316	2.0054	43.9176		
240	0.362	2.3063	48.3757	48.0428	2.2944
	0.348	2.2148	50.1526		
	0.358	2.2802	45.6000		
300	0.379	2.4175	48.1943	48.9171	1.4915
	0.372	2.3717	50.6323		
	0.366	2.3325	47.9247		
360	0.435	2.7838	48.1943	49.2785	1.2411
	0.428	2.7380	50.6323		
	0.434	2.7773	49.0090		
540	0.557	3.5818	54.2908	52.8794	1.4690
	0.524	3.3660	52.9885		
	0.546	3.5099	51.3588		
720	0.626	4.0331	55.4065	54.2029	1.5394
	0.601	3.8696	54.7339		
	0.631	4.0658	52.4683		
900	0.726	4.6872	62.8253	59.3129	3.0480
	0.703	4.5368	57.7513		
	0.689	4.4452	57.3621		
1080	0.739	4.7723	62.8253	60.9236	1.7042
	0.708	4.5695	59.5345		
	0.693	4.4714	60.4109		

Time (min)	Absorbance at 260 nm	Dye Concentration (mg/l)	Cumulative Release (%)	Average	SD
1260	0.734	4.7396	63.3680	62.3079	1.0213
	0.708	4.5499	61.3302		
	0.703	4.5368	62.2256		
1440	0.727	4.6938	63.2811	63.4908	0.4918
	0.708	4.5699	63.1386		
	0.707	4.5630	64.0528		
1620	0.695	4.4845	67.5956	66.3592	1.1725
	0.708	4.5695	66.2189		
	0.712	4.5957	65.2630		
1800	0.703	4.4452	70.0588	68.2011	1.6170
	0.706	4.5564	67.4354		
	0.703	4.5368	67.1092		
1980	0.706	4.5564	71.2816	69.0163	2.1091
	0.707	4.5630	68.6582		
	0.699	4.5106	67.1092		
2160	0.524	3.3360	72.5106	70.8729	1.4918
	0.575	3.6996	70.5169		
	0.567	3.6472	69.5913		
2340	0.530	3.4052	75.0053	73.3719	1.4884
	0.601	3.8696	73.0179		
	0.586	3.7715	72.0923		
2520	0.554	3.5622	76.8893	75.0501	1.5996
	0.579	3.7257	74.2785		
	0.670	4.3209	73.9825		
2700	0.574	3.6930	76.8968	75.8992	0.8759
	0.658	4.2424	75.5453		
	0.643	4.1443	75.2557		
2880	0.568	3.6538	77.5276	76.7505	1.0476
	0.446	2.8558	75.5591		
	0.588	3.7846	77.1648		
3240	0.576	3.7061	78.7882	78.2335	0.6937
	0.470	3.0128	77.4556		
	0.571	3.6734	78.4568		
3600	0.670	4.3209	80.0550	80.3546	1.1688
	0.450	2.8819	79.3647		
	0.602	3.8762	81.6442		
3960	0.653	4.2097	85.1062	84.3795	0.6637
	0.468	2.9997	83.8052		
	0.635	4.0920	84.2270		
4320	0.679	4.3798	87.0531	86.7588	0.4848
	0.462	2.9604	87.0240		
	0.630	4.0593	86.1991		

Table G2 The cumulative insulin release from the donor of insulin in neat pluronic as a function of releasing time

Time (min)	Absorbance at 260 nm	Dye Concentration (mg/l)	Cumulative Release (%)	Average	SD
30	0.030	0.1347	13.0955	13.2529	0.1574
	0.025	0.1020	13.2529		
	0.029	0.1282	13.4103		
60	0.038	0.1871	13.3838	13.5428	0.1589
	0.025	0.1020	13.5428		
	0.041	0.2067	13.7018		
90	0.061	0.3375	14.3035	14.2541	0.2415
	0.061	0.3375	13.9918		
	0.066	0.3702	14.4672		
120	0.065	0.3637	14.3035	14.2541	0.2415
	0.055	0.2983	13.9918		
	0.084	0.4879	14.4672		
180	0.077	0.4422	19.6576	18.5578	2.3259
	0.072	0.4095	20.1299		
	0.087	0.5076	15.8858		
240	0.076	0.4356	14.8314	17.4456	2.9607
	0.084	0.4879	20.6607		
	0.076	0.4356	16.8448		
300	0.124	0.7496	13.4181	17.4223	4.0463
	0.128	0.7758	21.5095		
	0.122	0.7365	17.3394		
360	0.133	0.8085	16.7116	18.8137	2.8439
	0.096	0.5664	22.0497		
	0.143	0.8739	17.6797		
540	0.227	1.4233	19.2495	20.3221	1.6967
	0.218	1.3644	22.2783		
	0.213	1.3317	19.4384		
720	0.269	1.6980	18.3478	20.3218	2.1816
	0.201	1.2532	22.6643		
	0.228	1.4298	19.9535		
900	0.298	1.8877	22.3151	21.9987	0.7882
	0.244	1.5345	22.5795		
	0.283	1.7896	21.1014		
1080	0.393	2.5091	21.2827	21.9586	0.8877
	0.357	2.2736	22.9639		
	0.384	2.2867	21.6290		

Time (min)	Absorbance at 260 nm	Dye Concentration (mg/l)	Cumulative Release (%)	Average	SD
1260	0.399	2.5483	21.4971	22.3356	0.9388
	0.392	2.5026	23.3499		
	0.401	2.5614	22.1598		
1440	0.464	2.9735	22.8134	22.9241	0.1601
	0.460	2.9473	23.1078		
	0.510	3.3202	22.8512		
1620	0.531	3.4117	25.7150	24.6707	0.9486
	0.496	3.1828	24.4351		
	0.496	3.1828	23.8621		
1800	0.545	3.5033	26.2820	25.5405	0.6677
	0.523	3.3594	24.9864		
	0.550	3.5360	25.3532		
1980	0.455	2.9146	24.4908	25.2097	0.6496
	0.558	3.5884	25.3834		
	0.570	3.6668	25.7549		
2160	0.524	3.3360	27.4018	26.5523	0.7465
	0.575	3.6996	26.2542		
	0.567	3.6472	26.0008		
2340	0.530	3.4052	26.4041	26.4891	0.1472
	0.601	3.8696	26.6591		
	0.586	3.7715	26.4041		
2520	0.554	3.5622	27.7550	27.8920	0.1285
	0.579	3.7257	28.0101		
	0.670	4.3209	27.9109		
2700	0.574	3.6930	28.1725	28.3095	0.1285
	0.658	4.2424	28.4275		
	0.643	4.1443	28.3283		
2880	0.568	3.6538	29.8509	29.9878	0.1285
	0.446	2.8558	30.1059		
	0.588	3.7846	30.0067		
3240	0.576	3.7061	32.9602	33.0972	0.1285
	0.470	3.0128	33.2153		
	0.571	3.6734	33.1161		
3600	0.670	4.3209	38.3018	38.4387	0.1285
	0.450	2.8819	38.5568		
	0.602	3.8762	38.4576		
3960	0.653	4.2097	42.7492	41.2070	1.6649
	0.468	2.9997	41.4300		
	0.635	4.0920	39.4418		
4320	0.679	4.3798	44.4040	43.5272	0.7717
	0.462	2.9604	43.2265		
	0.630	4.0593	42.9510		

Table G3 The cumulative insulin release from the donor of insulin in pluronic/chitin whisker composite gel as a function of releasing time at 0.4% of chitin whisker content

Time (min)	Absorbance at 260 nm	Dye Concentration (mg/l)	Cumulative Release (%)	Average	SD
30	0.018	0.0562	7.2709	7.9531	1.0481
	0.011	0.0759	7.4284		
	0.023	0.0890	9.1600		
60	0.027	0.1151	7.5011	9.0296	1.5054
	0.021	0.0759	9.0768		
	0.027	0.1151	10.5109		
90	0.051	0.2721	10.7237	11.0081	0.2542
	0.052	0.2786	11.2133		
	0.053	0.2852	11.0874		
120	0.057	0.3113	11.3018	12.4284	1.1969
	0.056	0.3048	13.6851		
	0.058	0.3179	12.2982		
180	0.079	0.4552	11.3018	12.9328	1.8359
	0.075	0.4291	14.9212		
	0.074	0.4225	12.5756		
240	0.136	0.8281	12.0356	14.0534	1.8111
	0.103	0.6122	15.5385		
	0.116	0.6973	14.5861		
300	0.120	0.7234	12.3036	14.4519	1.8605
	0.125	0.7561	15.5385		
	0.125	0.7561	15.5136		
360	0.156	0.9589	12.8879	15.3217	2.1221
	0.136	0.8281	16.7856		
	0.145	0.8869	16.2916		
540	0.171	1.0570	13.4769	16.0414	2.2575
	0.140	0.8542	17.7288		
	0.164	1.0112	16.9184		
720	0.204	1.2729	13.9133	16.3471	2.1147
	0.194	1.2075	17.7354		
	0.194	1.2075	17.3926		
900	0.268	1.6915	14.3528	16.9692	2.3022
	0.206	1.2859	18.6850		
	0.233	1.4625	17.8698		
1080	0.280	1.7700	15.5825	17.6485	1.8547
	0.217	1.3579	19.1701		
	0.260	1.6392	18.1928		

Time (min)	Absorbance at 260 nm	Dye Concentration (mg/l)	Cumulative Release (%)	Average	SD
1260	0.290	1.8615	16.1936	18.1232	1.7213
	0.304	1.9270	19.5010		
	0.308	1.9531	18.6748		
1440	0.289	1.8288	16.8094	18.6534	1.6501
	0.328	2.0839	19.9909		
	0.327	2.0774	19.1600		
1620	0.345	2.1951	16.9577	18.8201	1.6337
	0.292	1.8485	20.0116		
	0.336	2.1363	19.4909		
1800	0.342	2.1755	18.6802	19.7213	0.9387
	0.337	2.1428	20.5031		
	0.379	2.4175	19.9807		
1980	0.376	2.3979	18.6802	20.0505	1.1913
	0.339	2.1559	20.8403		
	0.375	2.3914	20.6312		
2160	0.379	2.4175	20.7285	20.6888	0.0510
	0.325	2.0643	20.7068		
	0.383	2.4437	20.6312		
2340	0.356	2.2671	20.7285	20.6957	0.0394
	0.355	2.2605	20.7068		
	0.387	2.4699	20.6519		
2520	0.394	2.5156	21.5285	21.2879	0.3979
	0.386	2.4633	21.5067		
	0.394	2.5156	20.8286		
2700	0.390	2.4895	22.6496	22.3041	0.5797
	0.403	2.5745	22.6279		
	0.405	2.5876	21.6348		
2880	0.435	2.7838	22.6496	22.3041	0.5797
	0.418	2.6726	22.6279		
	0.439	2.8100	21.6348		
3240	0.460	2.9473	23.9313	23.4824	0.7587
	0.417	2.6661	23.9096		
	0.443	2.8361	22.6064		
3600	0.488	3.1305	25.0666	24.5133	0.9395
	0.408	2.6072	25.0449		
	0.454	2.9081	23.4285		
3960	0.494	3.1697	28.4152	26.6545	1.5803
	0.403	2.5745	26.1896		
	0.470	3.0128	25.3587		
4320	0.490	3.1436	31.7953	29.8121	1.7202
	0.396	2.5287	28.9180		
	0.464	2.9735	28.7231		

Table G4 The cumulative insulin release from the donor of insulin in pluronic/chitin whisker composite gel as a function of releasing time at 3 % of chitin whisker content

Time (min)	Absorbance at 260 nm	Dye Concentration (mg/l)	Cumulative Release (%)	Average	SD
30	0.021	0.0759	6.0116	6.1165	0.0908
	0.022	0.0824	6.1690		
	0.023	0.0890	6.1690		
60	0.042	0.2132	6.7014	6.7024	0.1574
	0.036	0.1740	6.8604		
	0.039	0.1936	6.5455		
90	0.053	0.2852	8.0271	7.7658	0.2401
	0.045	0.2329	7.7154		
	0.048	0.2525	7.5549		
120	0.057	0.3113	8.0271	7.7658	0.2401
	0.056	0.3048	7.7154		
	0.055	0.2983	7.5549		
180	0.060	0.3310	9.3718	8.9515	0.3975
	0.059	0.3244	8.9011		
	0.059	0.3244	8.5816		
240	0.069	0.3898	10.0994	9.7809	0.3195
	0.070	0.3964	9.7830		
	0.068	0.3833	9.4603		
300	0.100	0.5926	10.5184	10.2503	0.2470
	0.098	0.5795	10.2004		
	0.099	0.5861	10.0320		
360	0.109	0.6515	10.9406	10.7234	0.1882
	0.108	0.6449	10.6210		
	0.104	0.6188	10.6084		
540	0.143	0.8739	11.5233	11.2526	0.2454
	0.144	0.8804	11.0448		
	0.123	0.7430	11.1896		
720	0.189	1.1747	12.2682	11.9959	0.2504
	0.194	1.2075	11.9440		
	0.149	0.9131	11.7755		
900	0.200	1.2467	12.7046	12.4832	0.2441
	0.206	1.2859	12.2213		
	0.177	1.0963	12.5236		
1080	0.224	1.4037	13.7738	13.4463	0.2836
	0.211	1.3186	13.2873		
	0.198	1.2336	13.2779		

Time (min)	Absorbance at 260 nm	Dye Concentration (mg/l)	Cumulative Release (%)	Average	SD
1260	0.233	1.4625	14.0653	13.8407	0.1945
	0.248	1.5607	13.7331		
	0.236	1.4822	13.7237		
1440	0.263	1.6588	14.5158	14.2902	0.1954
	0.266	1.6784	14.1821		
	0.263	1.6588	14.1726		
1620	0.269	1.6980	15.1269	14.9002	0.1963
	0.295	1.8681	14.7916		
	0.279	1.7634	14.7821		
1800	0.276	1.7438	15.7427	15.5150	0.1972
	0.298	1.8877	15.4058		
	0.300	1.9008	15.3964		
1980	0.290	1.8354	16.0484	15.8721	0.1696
	0.310	1.9662	15.7099		
	0.319	2.0251	15.8579		
2160	0.305	1.9335	16.3557	16.2313	0.1875
	0.314	1.9924	16.0156		
	0.333	2.1166	16.3226		
2340	0.322	2.0447	16.9793	16.8025	0.1711
	0.318	2.0185	16.6377		
	0.345	2.1951	16.7904		
2520	0.335	2.1297	17.4503	17.2205	0.1990
	0.322	2.0447	17.1071		
	0.349	2.2213	17.1040		
2700	0.355	2.2605	17.4522	17.3787	0.0999
	0.335	2.1297	17.2649		
	0.352	2.2409	17.4191		
2880	0.373	2.3783	17.6099	17.5894	0.0177
	0.352	2.2409	17.5800		
	0.370	2.3587	17.5784		
3240	0.390	2.5287	17.9250	17.9056	0.0168
	0.365	2.3260	17.8967		
	0.403	2.5745	17.8951		
3600	0.400	2.5549	18.2418	18.2234	0.0159
	0.388	2.4764	18.2150		
	0.417	2.6661	18.2134		
3960	0.414	2.6465	19.5046	19.1724	0.3275
	0.402	2.5680	18.8497		
	0.422	2.6988	19.1630		
4320	0.436	2.7904	19.9913	19.7095	0.2561
	0.422	2.6988	19.6465		
	0.426	2.7250	19.4907		

Table G5 The cumulative insulin release from the donor of insulin in pluronic/chitin whisker composite gel as a function of releasing time at 7 % of chitin whisker content

Time (min)	Absorbance at 260 nm	Dye Concentration (mg/l)	Cumulative Release (%)	Average	SD
30	0.025	0.1020	5.6967	5.5393	0.1574
	0.023	0.0890	5.3819		
	0.024	0.0955	5.5393		
60	0.030	0.1347	6.2260	6.2244	0.1582
	0.032	0.1478	6.0654		
	0.028	0.1282	6.3818		
90	0.040	0.2132	7.0747	7.0207	0.2430
	0.050	0.2656	6.7552		
	0.047	0.2459	7.2322		
120	0.051	0.2721	7.0747	7.5913	0.5080
	0.056	0.3048	7.6087		
	0.059	0.3244	8.0904		
180	0.072	0.4095	7.7803	8.2449	0.5152
	0.067	0.3768	8.1552		
	0.080	0.4618	8.7991		
240	0.080	0.5207	8.3347	8.6419	0.3625
	0.080	0.4814	8.5491		
	0.090	0.5403	9.0418		
300	0.101	0.5991	9.0513	9.5143	0.4355
	0.094	0.5534	9.5758		
	0.102	0.6057	9.9158		
360	0.106	0.6318	9.9315	10.3421	0.5409
	0.104	0.6188	10.1396		
	0.106	0.6449	10.9551		
540	0.120	0.7692	10.5048	10.8099	0.4891
	0.124	0.7496	10.5508		
	0.124	0.7496	11.3741		
720	0.160	0.9851	10.9254	11.2289	0.2814
	0.143	0.8739	11.2799		
	0.156	0.9589	11.4814		
900	0.196	1.2205	11.1918	11.5462	0.3077
	0.192	1.1944	11.7005		
	0.194	1.2075	11.7462		
1080	0.200	1.2467	11.6171	11.9180	0.2796
	0.198	1.2336	11.9669		
	0.199	1.2402	12.1700		

Time (min)	Absorbance at 260 nm	Dye Concentration (mg/l)	Cumulative Release (%)	Average	SD
1260	0.229	1.4364	12.2030	12.5023	0.2786
	0.205	1.2794	12.5496		
	0.223	1.3971	12.7543		
1440	0.258	1.6261	12.7936	12.9864	0.1962
	0.236	1.4822	12.9797		
	0.250	1.5737	13.1859		
1620	0.260	1.6392	13.3890	13.6316	0.2783
	0.254	1.5999	13.5703		
	0.268	1.6522	13.9355		
1800	0.271	1.7111	13.8316	14.1246	0.2747
	0.266	1.6784	14.1657		
	0.270	1.7046	14.3766		
1980	0.293	1.8550	14.4348	14.7263	0.4909
	0.283	1.7896	14.4509		
	0.288	1.8223	15.2931		
2160	0.319	2.0251	15.2002	15.2802	0.4306
	0.299	1.8943	14.8951		
	0.310	1.9662	15.7452		
2340	0.331	2.1036	15.4996	15.6808	0.4567
	0.311	1.9727	15.3425		
	0.330	2.0970	16.2004		
2520	0.335	2.1297	15.8006	16.1891	0.4348
	0.325	2.0643	16.1078		
	0.333	2.1166	16.6588		
2700	0.336	2.1363	16.4179	16.7010	0.4995
	0.333	2.1166	16.4072		
	0.345	2.1951	17.2778		
2880	0.341	2.1690	17.0401	17.3740	0.4621
	0.339	2.1559	17.1805		
	0.340	2.1624	17.9014		
3240	0.344	2.1886	17.3520	17.8423	0.4433
	0.344	2.1886	17.9600		
	0.343	2.1821	18.2150		
3600	0.355	2.2605	17.8230	18.2089	0.3579
	0.346	2.2017	18.2735		
	0.353	2.2475	18.5301		
3960	0.356	2.2671	18.1397	18.5776	0.4323
	0.350	2.2278	18.5887		
	0.356	2.2671	19.0043		
4320	0.359	2.2867	18.6154	18.9483	0.3562
	0.360	2.2932	18.9054		
	0.360	2.2932	19.3241		

Appendix H Model drug release of insulin at initial concentration 40 unit/l

Table H1 The cumulative insulin release from the donor of insulin solution as a function of releasing time

Time (min)	Absorbance at 260 nm	Dye Concentration (mg/l)	Cumulative Release (%)	Average	SD
30	0.117	0.7038	10.7981	11.6376	0.7923
	0.135	0.8215	12.3723		
	0.133	0.8085	11.7426		
60	0.159	0.9785	14.9990	14.2727	0.7019
	0.163	1.0047	13.5979		
	0.175	1.0832	14.2213		
90	0.200	1.2467	16.8795	15.4638	1.2876
	0.210	1.3121	14.3623		
	0.217	1.3579	15.1494		
120	0.247	1.5541	19.8793	17.5311	2.0516
	0.237	1.4887	16.6285		
	0.252	1.5868	16.0854		
180	0.322	2.0447	21.8054	20.7982	1.3139
	0.318	2.0185	21.2773		
	0.316	2.0054	19.3119		
240	0.362	2.3063	22.7257	22.1810	0.5506
	0.348	2.2148	22.1929		
	0.358	2.2802	21.6246		
300	0.379	2.4175	23.6531	23.2871	1.0071
	0.372	2.3717	24.0600		
	0.366	2.3325	22.1481		
360	0.435	2.7838	24.3514	24.0347	0.7791
	0.427	2.7380	24.6056		
	0.434	2.7773	23.1471		
540	0.557	3.5818	24.8970	24.7351	0.5956
	0.524	3.3660	25.2331		
	0.546	3.5099	24.0753		
720	0.626	4.0331	25.7606	25.6501	0.9043
	0.601	3.8696	26.4942		
	0.631	4.0658	24.6956		
900	0.726	4.6872	28.1260	26.7819	1.4067
	0.703	4.5368	26.8997		
	0.689	4.4452	25.3200		
1080	0.739	4.7723	28.7810	28.1586	0.6734
	0.708	4.5695	28.2513		
	0.693	4.4714	27.4437		

Time (min)	Absorbance at 260 nm	Dye Concentration (mg/l)	Cumulative Release (%)	Average	SD
1260	0.734	4.7396	30.6206	29.2581	1.2761
	0.708	4.5499	29.0629		
	0.703	4.5368	28.0908		
1440	0.727	4.6938	32.0824	30.6546	1.2805
	0.708	4.5699	30.2736		
	0.707	4.5630	29.6077		
1620	0.695	4.4845	32.8476	31.8000	1.2414
	0.708	4.5695	32.1235		
	0.712	4.5957	30.4288		
1800	0.703	4.4452	34.3259	33.2688	1.1510
	0.706	4.5564	33.4381		
	0.703	4.5368	32.0425		
1980	0.706	4.5564	34.7928	34.0411	0.7584
	0.707	4.5630	34.0545		
	0.699	4.5106	33.2761		
2160	0.524	3.3360	35.5761	35.0543	0.6817
	0.575	3.6996	35.3038		
	0.567	3.6472	34.2829		
2340	0.530	3.4052	36.4429	36.1270	0.2768
	0.601	3.8696	36.0115		
	0.586	3.7715	35.9265		
2520	0.554	3.5622	37.8661	37.0236	0.7308
	0.579	3.7257	36.6445		
	0.670	4.3209	36.5603		
2700	0.574	3.6930	40.4023	38.3721	1.7650
	0.658	4.2424	37.2019		
	0.643	4.1443	37.5120		
2880	0.568	3.6538	42.4882	39.7308	2.3961
	0.446	2.8558	38.1553		
	0.588	3.7846	38.5488		
3240	0.576	3.7061	44.1193	41.0734	2.7036
	0.470	3.0128	38.9575		
	0.571	3.6734	40.1436		
3600	0.670	4.3209	45.1332	42.1112	2.8588
	0.450	2.8819	39.4495		
	0.602	3.8762	41.7510		
3960	0.653	4.2097	47.4915	44.0742	3.3811
	0.468	2.9997	40.7303		
	0.636	4.0920	44.0007		
4320	0.679	4.3798	49.3185	46.2892	3.2323
	0.462	2.9604	42.8863		
	0.630	4.0593	46.6628		

Table H2 The cumulative insulin release from the donor of insulin in neat pluronic as a function of releasing time

Time (min)	Absorbance at 260 nm	Dye Concentration (mg/l)	Cumulative Release (%)	Average	SD
30	0.030	0.1347	6.9413	6.7838	0.1574
	0.025	0.1020	6.7838		
	0.029	0.1282	6.6264		
60	0.038	0.1871	7.0107	6.9304	0.0802
	0.025	0.1020	6.9304		
	0.041	0.2067	6.8501		
90	0.061	0.3375	7.5523	7.4188	0.1225
	0.061	0.3375	7.3926		
	0.066	0.3702	7.3115		
120	0.065	0.3637	7.7839	7.6490	0.1237
	0.055	0.2983	7.6225		
	0.084	0.4879	7.5407		
180	0.077	0.4422	8.6467	8.3269	0.3195
	0.072	0.4095	8.3264		
	0.087	0.5076	8.0076		
240	0.076	0.4356	8.8090	8.8271	0.1155
	0.084	0.4879	8.7216		
	0.076	0.4356	8.9507		
300	0.124	0.7496	9.1295	9.0954	0.1966
	0.128	0.7758	8.8839		
	0.126	0.7365	9.2728		
360	0.133	0.8085	9.2162	9.2343	0.1970
	0.096	0.5664	9.0470		
	0.143	0.8739	9.4398		
540	0.227	1.4233	9.3817	9.4263	0.2408
	0.218	1.3644	9.2109		
	0.213	1.3317	9.6863		
720	0.269	1.6980	9.5479	9.6193	0.2861
	0.201	1.2532	9.3755		
	0.228	1.4298	9.9344		
900	0.298	1.8877	10.1085	10.0232	0.2916
	0.244	1.5345	9.6984		
	0.283	1.7896	10.2627		
1080	0.393	2.5091	10.2802	10.2204	0.2509
	0.357	2.2736	9.9449		
	0.384	2.2867	10.4360		

Time (min)	Absorbance at 260 nm	Dye Concentration (mg/l)	Cumulative Release (%)	Average	SD
1260	0.399	2.5483	10.6888	10.5498	0.3115
	0.392	2.5026	10.1930		
	0.401	2.5614	10.7676		
1440	0.464	2.9735	11.2581	11.1177	0.1799
	0.460	2.9473	10.9149		
	0.517	3.3202	11.1801		
1620	0.531	3.4117	11.3598	11.3493	0.1734
	0.496	3.1828	11.1709		
	0.496	3.1828	11.5172		
1800	0.546	3.5033	11.6976	11.6084	0.3028
	0.520	3.3594	11.2710		
	0.550	3.5360	11.8566		
1980	0.645	2.9146	11.9590	11.8428	0.3497
	0.558	3.5884	11.4498		
	0.570	3.6668	12.1196		
2160	0.524	3.3360	12.2221	12.1835	0.1451
	0.575	3.6996	12.0229		
	0.567	3.6472	12.3055		
2340	0.530	3.4052	12.5654	12.4741	0.1629
	0.601	3.8696	12.2860		
	0.586	3.7715	12.5709		
2520	0.554	3.5622	12.7537	12.7665	0.3012
	0.579	3.7257	12.4719		
	0.670	4.3209	13.0740		
2700	0.574	3.6930	12.8640	13.0870	0.2423
	0.658	4.2424	13.0521		
	0.643	4.1443	13.3449		
2880	0.568	3.6538	13.4466	13.4621	0.0701
	0.446	2.8558	13.4010		
	0.588	3.7846	13.5387		
3240	0.576	3.7061	14.1914	14.0759	0.3589
	0.470	3.0128	13.6734		
	0.571	3.6734	14.3629		
3600	0.670	4.3209	14.6276	14.5111	0.1505
	0.450	2.8819	14.3410		
	0.602	3.8762	14.5646		
3960	0.653	4.2097	14.7521	14.8182	0.2376
	0.468	2.9997	14.6206		
	0.635	4.0920	15.0819		
4320	0.679	4.3798	15.7424	15.4944	0.3165
	0.462	2.9604	15.1379		
	0.630	4.0593	15.6031		

Table H3 The cumulative insulin release from the donor of insulin in pluronic/chitin whisker composite gel as a function of releasing time at 0.4% of chitin whisker content

Time (min)	Absorbance at 260 nm	Dye Concentration (mg/l)	Cumulative Release (%)	Average	SD
30	0.018	0.0562	3.6354	3.7142	0.0787
	0.011	0.0759	3.7142		
	0.023	0.0890	3.7929		
60	0.027	0.1151	3.7505	3.9087	0.1578
	0.026	0.0759	4.0661		
	0.020	0.1151	3.9095		
90	0.051	0.2721	3.9451	4.0786	0.1222
	0.052	0.2786	4.1851		
	0.053	0.2852	4.1056		
120	0.057	0.3113	4.0625	4.1449	0.0818
	0.056	0.3048	4.2262		
	0.058	0.3179	4.1459		
180	0.079	0.4552	4.1807	4.2901	0.1239
	0.075	0.4291	4.4247		
	0.074	0.4225	4.2649		
240	0.136	0.8281	4.6145	4.6463	0.0496
	0.103	0.6122	4.7035		
	0.116	0.6973	4.6208		
300	0.120	0.7234	4.7375	4.7957	0.0504
	0.125	0.7561	4.8272		
	0.125	0.7561	4.8225		
360	0.156	0.9589	5.0186	5.0249	0.0812
	0.136	0.8281	5.1091		
	0.145	0.8869	4.9470		
540	0.171	1.0570	5.5383	5.4921	0.0401
	0.140	0.8542	5.4721		
	0.164	1.0112	5.4658		
720	0.204	1.2729	5.7478	5.7011	0.0405
	0.194	1.2075	5.6809		
	0.194	1.2075	5.6746		
900	0.268	1.6915	6.2737	6.2002	0.2098
	0.206	1.2859	6.3634		
	0.233	1.4625	5.9636		
1080	0.280	1.7700	6.8044	6.7563	0.2448
	0.217	1.3579	6.9736		
	0.260	1.6392	6.4911		

Time (min)	Absorbance at 260 nm	Dye Concentration (mg/l)	Cumulative Release (%)	Average	SD
1260	0.294	1.8615	6.9462	6.9764	0.1282
	0.304	1.9270	7.1170		
	0.308	1.9531	6.8659		
1440	0.289	1.8288	7.2462	7.2504	0.0874
	0.328	2.0839	7.3399		
	0.327	2.0774	7.1652		
1620	0.345	2.1951	7.5486	7.6053	0.0499
	0.292	1.8485	7.6431		
	0.336	2.1363	7.6242		
1800	0.342	2.1755	8.0108	7.9893	0.1102
	0.337	2.1428	7.8699		
	0.379	2.4175	8.0871		
1980	0.376	2.3979	8.0834	8.1665	0.0784
	0.339	2.1559	8.1770		
	0.375	2.3914	8.2392		
2160	0.379	2.4175	8.2346	8.3186	0.0792
	0.325	2.0643	8.3291		
	0.383	2.4437	8.3920		
2340	0.356	2.2671	8.5441	8.6026	0.0512
	0.355	2.2605	8.6393		
	0.387	2.4699	8.6244		
2520	0.394	2.5156	8.6985	8.8100	0.1199
	0.386	2.4633	8.7945		
	0.394	2.5156	8.9370		
2700	0.390	2.4895	8.9324	9.0712	0.1245
	0.403	2.5745	9.1080		
	0.405	2.5876	9.1733		
2880	0.435	2.7838	9.0105	9.2556	0.2147
	0.418	2.6726	9.3450		
	0.439	2.8100	9.4111		
3240	0.460	2.9473	9.0886	9.3885	0.2618
	0.417	2.6661	9.5050		
	0.443	2.8361	9.5719		
3600	0.488	3.1305	9.9538	9.8892	0.0653
	0.408	2.6072	9.8231		
	0.454	2.9081	9.8908		
3960	0.494	3.1697	10.3545	10.3942	0.1180
	0.403	2.5745	10.3010		
	0.470	3.0128	10.5269		
4320	0.490	3.1436	11.3094	11.1919	0.3647
	0.396	2.5287	10.7829		
	0.464	2.9735	11.4834		

Table H4 The cumulative insulin release from the donor of insulin in pluronic/chitin whisker composite gel as a function of releasing time at 3 % of chitin whisker content

Time (min)	Absorbance at 260 nm	Dye Concentration (mg/l)	Cumulative Release (%)	Average	SD
30	0.021	0.0759	4.1077	4.0028	0.1202
	0.022	0.0824	4.0290		
	0.023	0.0890	3.8716		
60	0.042	0.2132	4.6210	4.3051	0.2735
	0.036	0.1740	4.1480		
	0.039	0.1936	4.1464		
90	0.053	0.2852	5.0604	4.6626	0.3643
	0.045	0.2329	4.5826		
	0.045	0.2525	4.3449		
120	0.050	0.3113	5.2675	4.9970	0.3340
	0.056	0.3048	5.0999		
	0.050	0.2983	4.6237		
180	0.060	0.3310	5.3976	5.2556	0.1734
	0.059	0.3244	5.3070		
	0.059	0.3244	5.0623		
240	0.069	0.3898	5.5284	5.4638	0.1010
	0.070	0.3964	5.5158		
	0.068	0.3833	5.3473		
300	0.100	0.5926	5.6600	5.6211	0.0567
	0.098	0.5795	5.6474		
	0.099	0.5861	5.5561		
360	0.109	0.6515	5.7136	5.7533	0.0920
	0.108	0.6449	5.8585		
	0.104	0.6188	5.6877		
540	0.143	0.8739	5.9247	5.9124	0.0868
	0.144	0.8804	5.9924		
	0.123	0.7430	5.8200		
720	0.189	1.1747	6.0587	6.0464	0.0876
	0.194	1.2075	6.1272		
	0.149	0.9131	5.9532		
900	0.200	1.2467	6.5083	6.4172	0.0925
	0.206	1.2859	6.4201		
	0.177	1.0963	6.3233		
1080	0.224	1.4037	6.8044	6.7125	0.0849
	0.211	1.3186	6.6367		
	0.198	1.2336	6.6965		

Time (min)	Absorbance at 260 nm	Dye Concentration (mg/l)	Cumulative Release (%)	Average	SD
1260	0.233	1.4625	6.9454	6.8790	0.0581
	0.248	1.5607	6.8549		
	0.236	1.4822	6.8368		
1440	0.263	1.6588	7.3234	7.2040	0.1037
	0.266	1.6784	7.1533		
	0.263	1.6588	7.1352		
1620	0.269	1.6980	7.5470	7.5053	0.0604
	0.295	1.8681	7.5329		
	0.279	1.7634	7.4361		
1800	0.276	1.7438	7.8510	7.7566	0.0952
	0.298	1.8877	7.7581		
	0.300	1.9008	7.6605		
1980	0.290	1.8354	8.1573	8.0883	0.0605
	0.310	1.9662	8.0637		
	0.319	2.0251	8.0440		
2160	0.305	1.9335	8.3873	8.3703	0.0897
	0.314	1.9924	8.4503		
	0.333	2.1166	8.2732		
2340	0.322	2.0447	8.8550	8.8380	0.1686
	0.318	2.0185	8.9975		
	0.345	2.1951	8.6614		
2520	0.335	2.1297	8.9331	8.9423	0.1305
	0.322	2.0447	9.0771		
	0.349	2.2213	8.8166		
2700	0.355	2.2605	9.0899	9.1255	0.0971
	0.335	2.1297	9.2355		
	0.352	2.2409	9.0513		
2880	0.373	2.3783	9.3261	9.3361	0.0542
	0.352	2.2409	9.3946		
	0.370	2.3587	9.2876		
3240	0.396	2.5287	9.4066	9.4693	0.0765
	0.365	2.3260	9.5545		
	0.403	2.5745	9.4467		
3600	0.400	2.5549	10.1954	10.1015	0.1991
	0.388	2.4764	9.8727		
	0.417	2.6661	10.2363		
3960	0.414	2.6465	10.7552	10.6080	0.1377
	0.406	2.5680	10.5867		
	0.422	2.6988	10.4820		
4320	0.436	2.7904	10.9261	10.8301	0.0984
	0.422	2.6988	10.8348		
	0.426	2.7250	10.7293		

Table H5 The cumulative insulin release from the donor of insulin in pluronic/chitin whisker composite gel as a function of releasing time at 7 % of chitin whisker content

Time (min)	Absorbance at 260 nm	Dye Concentration (mg/l)	Cumulative Release (%)	Average	SD
30	0.021	0.1020	2.6909	2.6909	0.0787
	0.022	0.0890	2.7696		
	0.023	0.0955	2.6122		
60	0.042	0.1347	3.1901	3.0589	0.1204
	0.036	0.1478	3.0335		
	0.039	0.1282	2.9532		
90	0.053	0.2132	3.6940	3.5615	0.1654
	0.045	0.2656	3.6145		
	0.045	0.2459	3.3760		
120	0.050	0.2721	4.1239	4.0163	0.1234
	0.056	0.3048	4.0436		
	0.050	0.3244	3.8815		
180	0.060	0.4095	4.7939	4.6065	0.1662
	0.059	0.3768	4.4767		
	0.059	0.4618	4.5491		
240	0.069	0.5207	4.9979	4.8874	0.1256
	0.070	0.4814	4.9136		
	0.068	0.5403	4.7507		
300	0.100	0.5991	5.1247	5.0657	0.0968
	0.098	0.5534	5.1184		
	0.099	0.6057	4.9539		
360	0.109	0.6318	5.2524	5.1928	0.0977
	0.108	0.6188	5.2461		
	0.104	0.6449	5.0800		
540	0.143	0.7692	5.3021	5.2945	0.0840
	0.144	0.7496	5.3745		
	0.123	0.7496	5.2069		
720	0.189	0.9851	5.5880	5.4754	0.1290
	0.194	0.8739	5.5038		
	0.149	0.9589	5.3345		
900	0.200	1.2205	5.6401	5.6052	0.0550
	0.206	1.1944	5.6338		
	0.177	1.2075	5.5417		
1080	0.224	1.2467	5.6922	5.7357	0.0383
	0.211	1.2336	5.7646		
	0.198	1.2402	5.7504		

Time (min)	Absorbance at 260 nm	Dye Concentration (mg/l)	Cumulative Release (%)	Average	SD
1260	0.233	1.4364	6.0591	6.0507	0.0719
	0.248	1.2794	5.9749		
	0.236	1.3971	6.1182		
1440	0.263	1.6261	6.1931	6.1847	0.0727
	0.266	1.4822	6.1931		
	0.263	1.5737	6.2529		
1620	0.269	1.6392	6.4065	6.3981	0.1520
	0.295	1.5999	6.2420		
	0.279	1.6522	6.5459		
1800	0.276	1.7111	6.7790	6.7706	0.0751
	0.298	1.6784	6.6916		
	0.300	1.7046	6.8412		
1980	0.290	1.8550	6.9184	6.8838	0.0470
	0.310	1.7896	6.8303		
	0.319	1.8223	6.9027		
2160	0.305	2.0251	7.0587	7.0500	0.0763
	0.314	1.8943	6.9698		
	0.333	1.9662	7.1217		
2340	0.322	2.1036	7.1997	7.1911	0.1556
	0.318	1.9727	7.0313		
	0.345	2.0970	7.3422		
2520	0.335	2.1297	7.4203	7.3854	0.1986
	0.322	2.0643	7.1715		
	0.349	2.1166	7.5643		
2700	0.355	2.1363	7.9572	7.7384	0.3039
	0.335	2.1166	7.3913		
	0.352	2.1951	7.8667		
2880	0.373	2.1690	8.2628	8.0419	0.3069
	0.352	2.1559	7.6913		
	0.370	2.1624	8.1715		
3240	0.396	2.1886	8.7281	8.3477	0.3678
	0.365	2.1886	7.9937		
	0.403	2.1821	8.3212		
3600	0.400	2.2605	9.1186	8.7083	0.4100
	0.388	2.2017	8.2985		
	0.417	2.2475	8.7078		
3960	0.414	2.2671	9.2762	8.9406	0.3807
	0.406	2.2278	8.5269		
	0.422	2.2671	9.0188		
4320	0.436	2.2867	10.0642	9.6468	0.5734
	0.422	2.2932	8.9930		
	0.426	2.2932	9.8832		

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Presentation:

1. Lertrattanakul, K.; and Rujiravanit, R. (2013, April 23 rd) Preparation of Chitin Whisker/Pluronic Thermal Responsive Gel for Injectable Drug Delivery System. Paper presented at the 4th Research Symposium on Petrochemical, and Material Technology and The 19th PPC Symposium on Petroleum, Petrochemicals, and Polymers, Bangkok, Thailand.