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APPENDICES

Appendix A The Absorbance at 440nm of Curcumin Loaded on 11 Layered PDADMAC/PSS and CHI/ALG by Varying Solvent Composition during Curcumin Loading

Table A1 The absorbance 440 nm of curcumin loaded on 11 layered PDADMAC/PSS and CHI/ALG with different solvent composition during curcumin loading

%water in ethanol	PEMU type	
	PDADMAC/PSS	CHI/ALG
10	0.039076	0.011649
20	0.022979	0.00904
30	0.029034	0.00846
40	0.049971	0.008092
50	0.048995	0.007491
60	0.068391	0.009257
70	0.145062	0.02658
80	0.384658	0.064577
90	0.504564	0.096073
100	0.72392	0.148722

Appendix B The Effect of Film Thickness at High No. of Layers

Table B1 The absorbance at 440 nm of curcumin loaded on high number of layers PEMU

	PEMU type	
Number of Layers	PDADMAC/PSS	CHI/ALG
10	0.260742	0.032838
20	0.964838	0.034362
30	1.388808	0.06227
40	2.117844	0.345695

Appendix C 0.1% Curcumin Loaded on Various L ayers of PDADMAC/PSS

This experiment corresponds to Figure 4.5 where the loading of 0.1% curcumin was compared with 0.2% curcumin on 5-20 layers of PDADMAC/PSS. The project emphasizes on the highest amount on curcumin which could be loaded on the thin films i.e. 0.2% curcumin. The data below are the absorbance values of 0.1% curcumin loaded on 5-21 layers PDADMAC/PSS. The experiment was repeated 5 times.

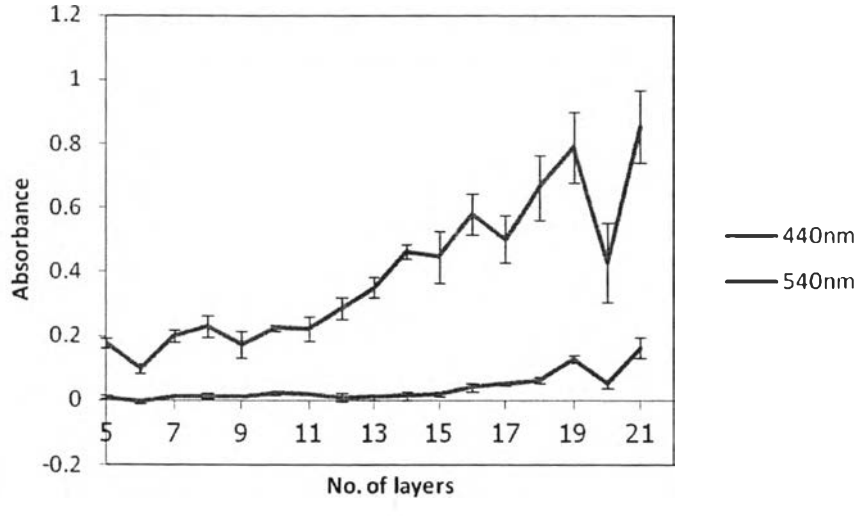


Figure C1 Absorbance at 440 nm and 540 nm of curcumin loaded on 5-21 layers PDADMAC/PSS.

Table C1 The absorbance values at 440 nm of 0.1% curcumin loaded on 5-21 layers PDADMAC/PSS

No. Layers	Trials					Average	STDEV
	1	2	3	4	5		
5	0.174109	0.180367	0.202684	0.173007	0.161112	0.178256	0.015329
6	0.112677	0.075793	0.114858	0.095831	0.09433	0.098698	0.015879
7	0.220797	0.207769	0.179538	0.183983	0.206461	0.19971	0.017388
8	0.212926	0.203707	0.244147	0.282864	0.211381	0.231005	0.03286
9	0.222498	0.216232	0.133313	0.161564	0.139439	0.174609	0.042244
10	0.228277	0.211256	0.224651	0.234175	0.229325	0.225537	0.008677
11	0.266034	0.258777	0.191008	0.182075	0.21146	0.221871	0.038591
12	0.261164	0.280209	0.335239	0.253681	0.301577	0.286374	0.03302
13	0.394385	0.30786	0.361512	0.346453	0.347431	0.351528	0.031169
14	0.456368	0.433292	0.456474	0.475589	0.495895	0.463524	0.023496
15	0.433283	0.531998	0.38542	0.353145	0.5288	0.446529	0.081706
16	0.514914	0.525716	0.572286	0.62121	0.668362	0.580498	0.064706
17	0.559137	0.481472	0.386144	0.540833	0.546073	0.502732	0.071688
18	0.75266	0.655243	0.499525	0.655472	0.743347	0.66125	0.101637
19	0.679458	0.709372	0.759682	0.956711	0.840658	0.789176	0.111798
20	0.57987	0.312459	0.410429	0.536239	0.310913	0.429982	0.124628
21	0.678735	0.812293	0.947873	0.902753	0.93449	0.855229	0.111934

Table C2 The absorbance values at 540 nm of 0.1% curcumin loaded on 5-21 layers PDADMAC/PSS

No. Layers	Trials					Average	STDEV
	1	2	3	4	5		
5	0.011054	0.008138	0.016682	0.005458	0.005907	0.009448	0.004612
6	0.003255	-0.01213	-0.00396	-0.00475	-0.00509	-0.00453	0.005455
7	0.015641	0.011591	0.007849	0.008716	0.012836	0.011327	0.003157
8	0.007959	0.004134	0.019473	0.026434	0.008453	0.013291	0.009309
9	0.016568	0.016928	0.007456	0.007763	0.01197	0.012137	0.004573
10	0.024703	0.026492	0.013012	0.021298	0.025517	0.022205	0.005498
11	0.026866	0.017118	0.02408	0 016749	0.016886	0.02034	0.00479
12	0.010953	0.024728	0.022572	-0.00989	0.001607	0.009995	0.014507
13	0.02039	-0.00212	0.009004	0 007864	0.019788	0.010985	0.009373
14	0.032883	0.01952	-0.00124	0.007514	0.01312	0.014359	0.012861
15	0.017311	0.026875	0.022022	0.009534	0.025393	0.020227	0.007017
16	0.060439	0.038705	0.031955	0.043131	0.029461	0.040738	0.012271
17	0.055935	0.043399	0.047163	0.058939	0.054207	0.051929	0.006439
18	0.073056	0.072276	0.052908	0.058285	0.055905	0.062486	0.00949
19	0.142805	0.136239	0.119793	0.129274	0.113648	0.128352	0.011847
20	0.058399	0.043329	0.048945	0.068381	0.039474	0.051706	0.011729
21	0.161537	0.20326	0.183614	0.120886	0.146003	0.16306	0.032056

Appendix D 0.2% Curcumin Loaded on PDADMAC/PSS

Table D1 The absorbance values at 440 nm and 540 nm of 0.2% curcumin loaded on 5-20 layers PDADMAC/PSS

Number of Layers	Wavelength	
	440nm	540nm
5	0.193331	-0.00012
6	0.178111	-0.02089
7	0.328682	0.054908
8	0.290072	0.016509
9	0.419227	0.037983
10	0.390069	0.037922
11	0.532323	0.063865
12	0.486677	0.010677
13	0.671288	0.132642
14	0.752165	0.058519
15	0.83777	0.173264
16	0.989826	0.126292
17	0.914194	0.340362
18	1.241162	0.303347
19	1.127183	0.402273
20	1.850563	0.40239

Appendix E Varying Loading Time of Curcumin on PDADMAC/PSS Thin Films

The table below shows the actual absorbance values of curcumin loaded on PDADMAC/PSS thin films with varying loading time from 0 to 4 hours.

Table E1 Absorbance values at 440 nm and 540 nm of curcumin loaded on 11 and 12 layered PDADMAC/PSS with varying loading time

Loading Time (Hours)	11 Layers		12 Layers	
	440 nm	540nm	440 nm	540 nm
0	0.011478	-0.0069	0.015395	0.003015
0.25	0.171302	0.023978	0.232577	0.004449
0.5	0.253387	0.042837	0.288807	0.003501
1	0.366636	0.075954	0.357083	0.006122
1.5	0.383404	0.085742	0.346731	0.006858
2	0.471614	0.100121	0.348713	0.006183
2.5	0.474528	0.113148	0.319047	0.00519
3	0.471972	0.108965	0.332556	0.00335
4	0.467433	0.118039	0.336539	0.004298

Appendix F The Effect of Curcumin Concentration loaded on PDADMAC/PSS Thin Films

The effect of curcumin concentration was studied to observe the maximum amount of curcumin which could be loaded on the thin films.

Table F1 Absorbance values at 440 nm and 540 nm of various curcumin concentrations loaded on 11 and 12 layered PDADMAC/PSS

Curcumin concentration	11 Layers		12 Layers	
	440 nm	540nm	440 nm	540 nm
0.01%	0.020712	0.029214	0.065513	0.007483
0.05%	0.177901	0.11572	0.217214	0.007349
0.10%	0.288402	0.173018	0.33138	0.014063
0.20%	0.451259	0.183492	0.376976	0.018836

Appendix G Absorbance at 540 nm of Curcumin Loaded on 11 and 12 Layers PDADMAC/PSS with Varying Buffer pH

Curcumin loaded on 11 and 12 layered PDADMAC/PSS thin films were immersed in phosphate buffer adjusted to various pH. The absorbance at 540 nm was observed since it corresponds to the orange color when curcumin changes from yellow to orange.

Table G1 Absorbance values at 540 nm of curcumin loaded on 11 and 12 layered PDADMAC/PSS dipped in various pH

	pH						
	6	7	8	8.5	9	9.5	10
11 Layers	0.031117	0.062983	0.146548	0.181583	0.19228	0.244892	0.275249
12 Layers	0.006312	0.01096	0.001488	0.003374	0.011051	0.017916	0.043921

Appendix H The Effect of Phosphate Buffer Concentration

This part consists of the data invclving the variation of phosphate buffer concentration. It was used to verify the best buffer concentration to be applied for further experiments.

Table H1 The absorbance values at 540 nm of curcumin loaded on 11 layered PDADMAC/PSS dipped in various phosphate buffer concentrations

Phosphate buffer concentration	pH				
	6	7	8	9	10
10mM	0.0764	0.20974	0.32719	0.35615	0.38309
100mM	0.03235	0.08712	0.23457	0.33253	0.37962
1M	0.0182	0.04183	0.15406	0.31013	0.38267

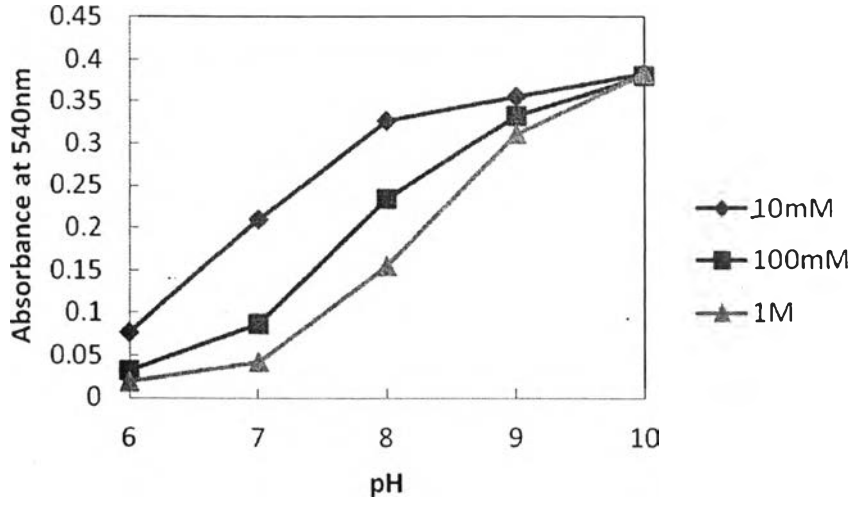


Figure H1 Absorbance at 540 nm of curcumin loaded on 11 layered PDADMAC/PSS dipped in various phosphate buffer concentrations.

Appendix I Absorbance at 440 nm of Curcumin Loaded on 11 and 12 Layers CHI/ALG with Varying Buffer pH

The effects of pH on curcumin loaded on CHI/ALG were studied. Curcumin loaded on CHI/ALG thin films has different pH sensitivity when compared to curcumin loaded on PDADMAC/PSS thin films where it did not appear orange but becomes yellow when exposed to phosphate buffer at high pH.

Table I1 Absorbance values at 440 nm of curcumin loaded on CHI/ALG thin films dipped in various phosphate buffer pH

	pH				
	7	8	9	10	11
11 layers	0.068515	0.079895	0.055279	0.018807	0.005653
12 layers	0.016769	0.032608	0.02422	0.015727	0.009506

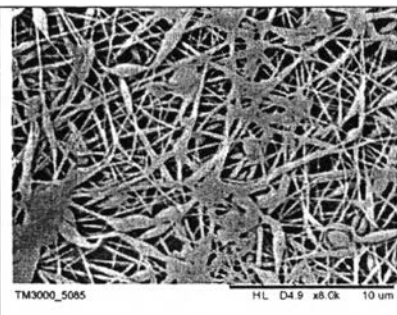
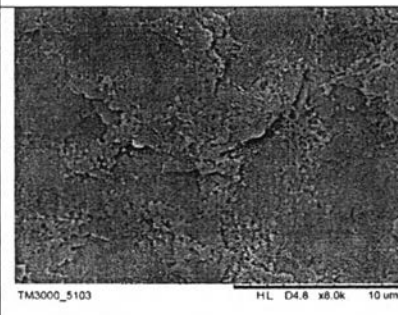
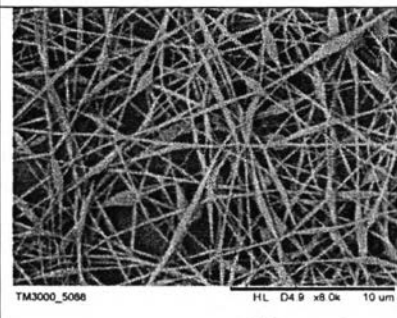
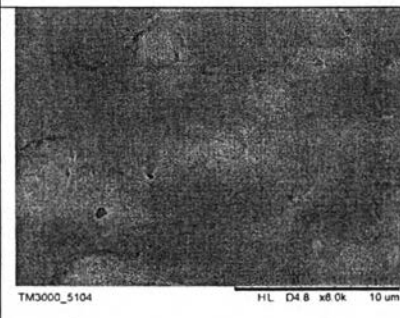
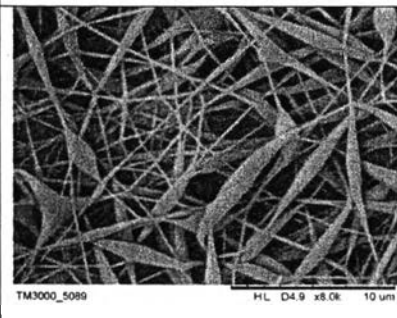
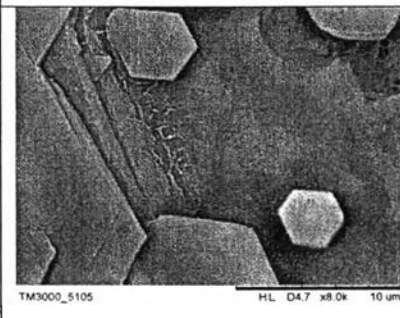
Appendix J The Effect of Curcumin Concentration towards PVA/Curcumin Electro-spun Fibers

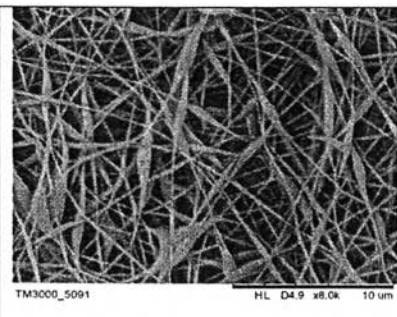
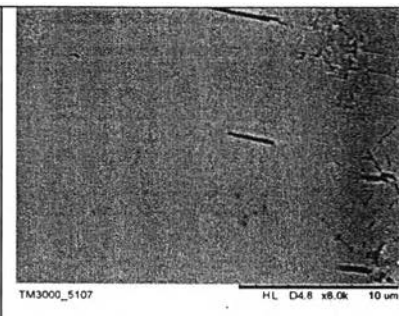
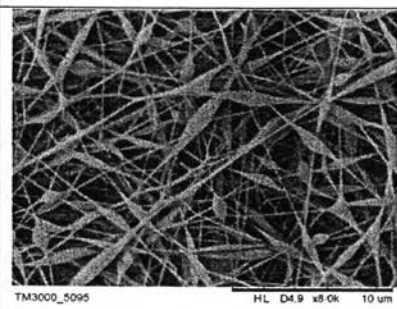
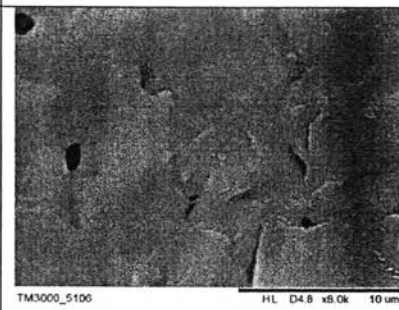
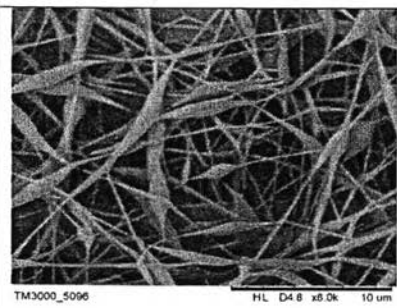
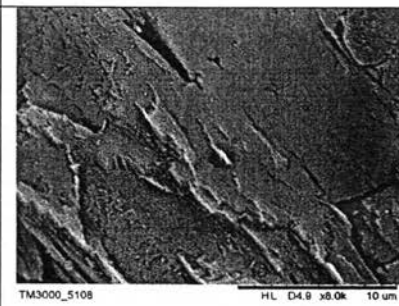
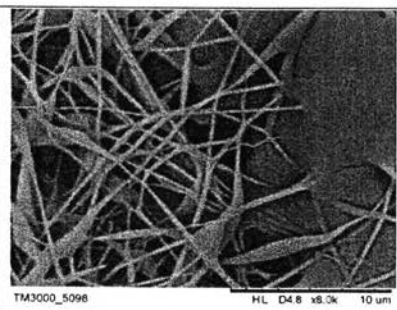
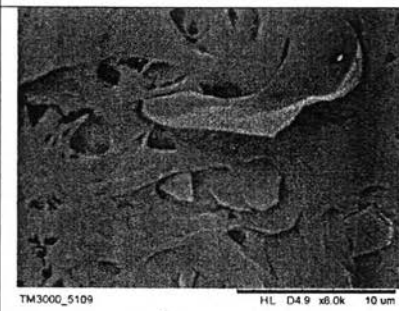
Table J1 Absorbance values at 440 nm of PVA/curcumin electro-spun fibers with various curcumin concentration

Curcumin concentration (%)	Trials					Average	STDEV
	1	2	3	4	5		
0	0.088629	-0.23737	-0.13549	0.023595	-0.16231	-0.08459	0.13572
0.05	0.032125	0.026097	0.012433	-0.00424	0.048506	0.022983	0.019983
0.1	0.186313	0.119143	0.064809	0.127596	0.054323	0.110437	0.053287
0.15	0.145891	0.110817	0.112212	0.199406	0.052842	0.124233	0.053715
0.2	0.204081	0.219222	0.248466	0.100578	0.212372	0.196944	0.056405
0.25	0.147156	0.250651	0.212588	0.291403	0.269708	0.234301	0.056673
0.3	0.379628	0.465646	0.422133	0.536488	0.356418	0.432062	0.071768

Appendix K SEM of Fibers with Various Curcumin Concentrations

Table K1 The SEM images of PVA/curcurmin electro-spun fibers with and without crosslinking with boric acid

Curcumin concentration (%)	Fiber	Fiber crosslinked with boric acid
0		
0.05		
0.1		

0.15	 TM3000_5091 HL D4.9 x8.0k 10 um	 TM3000_5107 HL D4.8 x8.0k 10 um
0.2	 TM3000_5095 HL D4.9 x8.0k 10 um	 TM3000_5106 HL D4.8 x8.0k 10 um
0.25	 TM3000_5096 HL D4.8 x8.0k 10 um	 TM3000_5108 HL D4.9 x8.0k 10 um
0.3	 TM3000_5098 HL D4.8 x8.0k 10 um	 TM3000_5109 HL D4.9 x8.0k 10 um

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Proceedings:

1. Bijaisoradat, O., and Dubas S. T. (2015,April 21st) Development of curcumin loaded on chitosan/alginate polyelectrolyte multilayers for smart packaging applications. Proceedings of the 21st PPC Symposium on Petroleum, Petrochemicals and Polymers, Bangkok, Thailand.

Presentations:

1. Bijaisoradat, O., and Dubas S. T. (2015,April 21st) Development of curcumin loaded on chitosan/alginate polyelectrolyte multilayers for smart packaging applications. Paper presented at the 21st PPC Symposium on Petroleum, Petrochemicals and Polymers, Bangkok, Thailand.