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## APPENDICES

### Appendix A Polymer Solution Properties

**Table A1** Raw data of electrical conductivity at 25 °C of PBSu-DCH solutions ( Measured 3 times: I = 1<sup>st</sup>, II = 2<sup>nd</sup>, III = 3<sup>rd</sup> )

Solution Concentration (wt.%)	Electrical Conductivity ( s/cm)				
	I	II	III	Average	SD.
18	0.611	0.58	0.578	0.589	0.018
20	0.69	0.687	0.699	0.692	0.006
22	0.748	0.744	0.753	0.748	0.005
24	0.802	0.797	0.812	0.804	0.008

**Table A2** Raw data of viscosity of PBSu-DCH solutions ( Measured 3 times: I = 1<sup>st</sup>, II = 2<sup>nd</sup>, III = 3<sup>rd</sup> )

Solution Concentration (wt.%)	Viscosity (cP)				
	I	II	III	Average	SD.
18	132	127	137	132	5
20	151	158	146	151	6.02
22	165	170	163	166	3.6
24	181	172	175	176	4.58

### Appendix B Average Fiber Diameter of Electrospun PBSu-DCH Fibers

**Table B1** Average fiber diameter of PBS electrospun from 22% w/v PBSu-DCH dissolved in dichloromethane/trifluoroacetic acid (90/10) by using applied electrical potential of 17 kV and collection distance of 20 cm

Point	Fiber diameter ( $\mu\text{m}$ )				
	Sample 1	Sample 2	Sample 3	Sample 4	Sample 5
1	0.162	0.161	0.174	0.179	0.175
2	0.169	0.164	0.181	0.185	0.173
3	0.147	0.166	0.186	0.16	0.168
4	0.158	0.168	0.17	0.181	0.185
5	0.147	0.164	0.17	0.182	0.185
6	0.18	0.175	0.186	0.167	0.174
7	0.179	0.17	0.167	0.177	0.157
8	0.171	0.17	0.163	0.169	0.183
9	0.171	0.163	0.159	0.153	0.175
10	0.167	0.156	0.175	0.16	0.191
11	0.176	0.17	0.183	0.169	0.185
12	0.167	0.17	0.173	0.175	0.187
13	0.171	0.16	0.184	0.168	0.177
14	0.175	0.192	0.173	0.181	0.178
15	0.186	0.17	0.174	0.18	0.183
16	0.184	0.187	0.165	0.164	0.178
17	0.164	0.168	0.184	0.171	0.174
18	0.168	0.163	0.173	0.175	0.178
19	0.182	0.168	0.165	0.171	0.166
20	0.182	0.17	0.187	0.184	0.178
Average	0.17	0.168	0.175	0.172	0.177
SD	0.011	0.008	0.009	0.009	0.008



### Appendix C Mechanical and Physical Characteristics

**Table C1** Tensile strength at break and tensile strength at yield of solution-cast films of PBSu-DCH

No. of Sample	Tensile strength at break (MPa)	Tensile strength at yield (MPa)
1	2.9	23.749
2	2.896	24.137
3	3.037	25.309
4	2.877	23.983
5	3.098	25.817
6	2.878	23.99
7	2.959	24.666
8	2.815	23.462
9	2.952	24.605
10	2.889	24.078
Average	2.93	24.38
SD	0.08	0.73

**Table C2** Tensile strength at break and tensile strength at yield of electrospun PBSu-DCH scaffolds

No. of Sample	Tensile strength at break (MPa)	Tensile strength at yield (MPa)
1	1.064	9.499
2	1.206	10.985
3	1.241	11.022
4	1.245	11.153
5	1.143	10.374
6	1.169	8.386
7	1.198	9.527
8	1.084	8.789
9	1.154	10.622
10	1.211	11.001
Average	1.17	10.14
SD	0.06	1.01

**Table C3** % Elongation at break of solution-cast films of PBSu-DCH

No. of Sample	% Elongation at break
1	42.86
2	48.19
3	43.91
4	41.97
5	68.97
6	50.5
7	41.74
8	26.08
9	53.54
10	51.74
Average	46.95
SD	10.95

**Table C4** % Elongation at break of electrospun PBSu-DCH scaffolds

No. of Sample	% Elongation at break
1	112.13
2	116.11
3	128.27
4	127.68
5	139.21
6	130.02
7	139.22
8	111.73
9	98.83
10	113.92
Average	121.71
SD	13.19

**Table C5** Young's Modulus of solution-cast films of PBSu-DCH

No. of Sample	Young's Modulus(MPa)
1	592.113
2	649.48
3	666.387
4	674.942
5	559.292
6	576.82
7	626.207
8	578.97
9	635.051
10	610.371
Average	616.96
SD	39.88

**Table C6** Young's Modulus of eletrospun PBSu-DCH scaffolds

No. of Sample	Young's Modulus(MPa)
1	55.799
2	48.594
3	37.182
4	31.55
5	37.226
6	52.112
7	35.051
8	50.417
9	38.558
10	47.855
Average	43.434
SD	8.4

**Table C7** Raw data of density of film scaffolds of PBSu-DCH

No. of Sample	Weight in air (mg)	G (mg)	Density (g/cm <sup>3</sup> )
1	33.09	-25	1.324
2	24.86	-16.58	1.499
3	29.04	-20.18	1.439
4	26.07	-19.29	1.351
5	25.57	-17.18	1.488
Average	28.44	-19.65	1.42
SD	3.45	3.33	0.08

**Table C8** Raw data of density of electrospun PBSu-DCH scaffolds

No. of Sample	Weight in air (mg)	G (mg)	Density (g/cm <sup>3</sup> )
1	15.75	-42.15	0.374
2	15.52	-31.12	0.498
3	15.63	-32.76	0.477
4	17.89	-50.54	0.354
5	22.26	-67.65	0.329
Average	17.41	-44.84	0.406
SD	2.88	14.95	0.07

**Table C9** % Porosity and Pore volume of electrospun PBSu-DCH scaffolds

No. of Sample	Density (g/cm <sup>3</sup> )	% Porosity	Pore Volume
1	0.3736	71.26	1.9075
2	0.4987	66.64	1.236
3	0.4771	63.3	1.3268
4	0.3539	72.78	2.0564
5	0.329	74.69	2.2703
Average	0.406	68.73	1.76
SD	0.07	5.87	0.46

## Appendix D Thermal Characteristics

**Table D1** The apparent melting temperature ( $T_m$ ) of the as-spun fiber mats, the solution-cast films, and the as-received pellets of PBSu-DCH ( Measured 3 times: I = 1<sup>st</sup>, II = 2<sup>nd</sup>, III = 3<sup>rd</sup> )

Measurement	Melting Temperature, $T_m$ ( °C)		
	Electrospun scaffolds	Solution-cast films	Raw materials
I	113.67	110.33	113.5
II	113.67	111.5	114.5
III	113.5	111.75	114.17
Average	113.61	111.19	114.06
SD.	0.1	0.76	0.51

**Table D2** The apparent crystallization temperature ( $T_c$ ) of the as-spun fiber mats, the solution-cast films, and the as-received pellets of PBSu-DCH ( Measured 3 times: I = 1<sup>st</sup>, II = 2<sup>nd</sup>, III = 3<sup>rd</sup> )

Measurement	Crystallization Temperature, $T_c$ ( °C)		
	Electrospun scaffolds	Solution-cast films	Raw materials
I	76.47	83.47	84.63
II	76.13	82.98	84.63
III	76.47	83.47	84.47
Average	76.36	83.31	84.58
SD.	0.19	0.28	0.09

**Table D3** The apparent degradation temperature ( $T_d$ ) of the as-spun fiber mats, the solution-cast films, and the as-received pellets of PBSu-DCH ( Measured 3 times: I = 1<sup>st</sup>, II = 2<sup>nd</sup>, III = 3<sup>rd</sup> )

Measurement	Degradation Temperature, $T_d$ ( °C)		
	Electrospun scaffolds	Solution-cast films	Raw materials
I	381.27	379.28	380.95
II	382.06	378.84	379.97
III	381.1	379.11	380.63
Average	381.47	379.07	380.51
SD.	0.51	0.22	0.49

**Table D4** The apparent enthalpy of fusion ( $\Delta H_f$ ) of the as-spun fiber mats, the solution-cast films, and the as-received pellets of PBSu-DCH ( Measured 3 times: I = 1<sup>st</sup>, II = 2<sup>nd</sup>, III = 3<sup>rd</sup> )

Measurement	Apparent enthalpy of fusion, $\Delta H_f$ (J/g)		
	Electrospun scaffolds	Solution-cast films	Raw materials
I	75.6781	95.9716	86.0717
II	73.4914	98.6274	87.1702
III	72.6089	96.0296	82.1061
Average	73.93	96.87	85.12
SD.	1.58	1.51	2.66

**Table D5** The apparent degree of crystallinity of the as-spun fiber mats, the solution-cast films, and the as-received pellets of PBSu-DCH ( Measured 3 times: I = 1<sup>st</sup>, II = 2<sup>nd</sup>, III = 3<sup>rd</sup> )

Measurement	Degree of crystallinity, %		
	Electrospun scaffolds	Solution-cast films	Raw materials
I	68.486	86.8521	77.8929
II	66.508	85.2556	78.8871
III	65.7094	86.9046	74.3042
Average	66.9	86.38	77.03
SD.	1.42	0.94	2.41



## Appendix E Cell Study

**Table E1** Raw data of Indirect Cytotoxicity of fibrous scaffolds from electrospun mats of PBSu-DCH based on viability of human osteoblasts (SaOS-2) ( Measured 3 times: I = 1<sup>st</sup>, II = 2<sup>nd</sup>, III = 3<sup>rd</sup> )

No.	Absorbance								
	Control (DMEM)			Fibrous scaffolds of PBS			Film scaffolds of PBS		
	I	II	III	I	II	III	I	II	III
1	0.422	0.433	0.442	0.459	0.48	0.475	0.466	0.447	0.509
2	0.415	0.445	0.42	0.45	0.502	0.48	0.457	0.478	0.458
3	0.458	0.399	0.429	0.471	0.511	0.469	0.454	0.433	0.463
Average	0.432	0.426	0.43	0.46	0.497	0.475	0.459	0.452	0.476
SD	0.023	0.023	0.011	0.01	0.015	0.005	0.006	0.023	0.028

**Table E2** Raw data of Indirect Cytotoxicity of fibrous scaffolds from electrospun mats of PBSu-DCH based on viability of mouse fibroblasts (L929) ( Measured 3 times: I = 1<sup>st</sup>, II = 2<sup>nd</sup>, III = 3<sup>rd</sup> )

No.	Absorbance								
	Control (DMEM)			Fibrous scaffolds of PBS			Film scaffolds of PBS		
	I	II	III	I	II	III	I	II	III
1	0.57	0.594	0.55	0.623	0.619	0.635	0.649	0.574	0.599
2	0.587	0.578	0.596	0.641	0.583	0.601	0.625	0.591	0.57
3	0.602	0.557	0.548	0.627	0.608	0.613	0.632	0.611	0.608
Average	0.586	0.576	0.564	0.63	0.603	0.616	0.635	0.592	0.592
SD	0.016	0.018	0.027	0.009	0.018	0.017	0.012	0.018	0.019

**Table E3** Raw data of SaOS-2 cells adhesion on TCPS, and film and fibrous scaffolds of PBSu-DCH at 1 hr in culture. (Measured 3 times: I = 1<sup>st</sup>, II = 2<sup>nd</sup>, III = 3<sup>rd</sup>)

No.	Absorbance								
	Control (TCPS)			Fibrous scaffolds of PBS			Film scaffolds of PBS		
	I	II	III	I	II	III	I	II	III
1	0.147	0.153	0.159	0.656	0.665	0.673	0.138	0.145	0.135
2	0.15	0.147	0.162	0.657	0.654	0.68	0.144	0.137	0.142
3	0.159	0.155	0.149	0.663	0.663	0.678	0.136	0.142	0.139
Average	0.152	0.151	0.156	0.659	0.661	0.677	0.139	0.141	0.138
SD	0.006	0.004	0.006	0.003	0.005	0.003	0.004	0.004	0.003

**Table E4** Raw data of SaOS-2 cells adhesion on TCPS, and film and fibrous scaffolds of PBSu-DCH at 4 hr in culture. (Measured 3 times: I = 1<sup>st</sup>, II = 2<sup>nd</sup>, III = 3<sup>rd</sup>)

No.	Absorbance								
	Control (TCPS)			Fibrous scaffolds of PBS			Film scaffolds of PBS		
	I	II	III	I	II	III	I	II	III
1	0.201	0.195	0.217	0.713	0.711	0.705	0.158	0.163	0.156
2	0.195	0.193	0.21	0.715	0.716	0.713	0.16	0.16	0.158
3	0.197	0.19	0.211	0.722	0.715	0.703	0.15	0.156	0.16
Average	0.197	0.192	0.212	0.717	0.714	0.709	0.156	0.159	0.158
SD	0.003	0.002	0.003	0.004	0.002	0.005	0.005	0.003	0.002

**Table E5** Raw data of SaOS-2 cells adhesion on TCPS, and film and fibrous scaffolds of PBSu-DCH at 16 hr in culture. (Measured 3 times: I = 1<sup>st</sup>, II = 2<sup>nd</sup>, III = 3<sup>rd</sup>)

No.	Absorbance								
	Control (TCPS)			Fibrous scaffolds of PBS			Film scaffolds of PBS		
	I	II	III	I	II	III	I	II	III
1	0.327	0.321	0.334	1.075	1.067	1.061	0.233	0.235	0.23
2	0.332	0.32	0.33	1.07	1.066	1.065	0.229	0.233	0.236
3	0.328	0.327	0.328	1.073	1.07	1.068	0.227	0.236	0.238
Average	0.329	0.323	0.33	1.072	1.068	1.065	0.229	0.235	0.235
SD	0.002	0.003	0.003	0.002	0.002	0.003	0.003	0.001	0.004

**Table E6** Raw data of SaOS-2 cells proliferation on TCPS, and film and fibrous scaffolds of PBSu-DCH at 24 hr in culture. (Measured 3 times: I = 1<sup>st</sup>, II = 2<sup>nd</sup>, III = 3<sup>rd</sup>)

No.	Absorbance								
	Control (TCPS)			Fibrous scaffolds of PBS			Film scaffolds of PBS		
	I	II	III	I	II	III	I	II	III
1	0.426	0.449	0.455	1.186	1.18	1.195	0.292	0.281	0.29
2	0.423	0.453	0.451	1.191	1.184	1.191	0.296	0.283	0.287
3	0.423	0.448	0.45	1.19	1.178	1.19	0.295	0.287	0.292
Average	0.424	0.45	0.452	1.189	1.181	1.192	0.294	0.284	0.29
SD	0.002	0.003	0.003	0.003	0.003	0.003	0.002	0.003	0.002

**Table E7** Raw data of SaOS-2 cells proliferation on TCPS, and film and fibrous scaffolds of PBSu-DCH at 48 hr in culture. (Measured 3 times: I = 1<sup>st</sup>, II = 2<sup>nd</sup>, III = 3<sup>rd</sup>)

No.	Absorbance								
	Control (TCPS)			Fibrous scaffolds of PBS			Film scaffolds of PBS		
	I	II	III	I	II	III	I	II	III
1	0.783	0.787	0.782	1.561	1.558	1.566	0.473	0.485	0.485
2	0.782	0.789	0.786	1.557	1.564	1.564	0.468	0.482	0.491
3	0.778	0.793	0.78	1.564	1.555	1.57	0.47	0.487	0.493
Average	0.781	0.789	0.783	1.56	1.559	1.567	0.47	0.485	0.489
SD	0.003	0.003	0.003	0.004	0.005	0.003	0.003	0.003	0.004

**Table E8** Raw data of SaOS-2 cells proliferation on TCPS, and film and fibrous scaffolds of PBSu-DCH at 72 hr in culture. (Measured 3 times: I = 1<sup>st</sup>, II = 2<sup>nd</sup>, III = 3<sup>rd</sup>)

No.	Absorbance								
	Control (TCPS)			Fibrous scaffolds of PBS			Film scaffolds of PBS		
	I	II	III	I	II	III	I	II	III
1	0.811	0.808	0.809	1.853	1.863	1.86	0.75	0.763	0.752
2	0.814	0.809	0.812	1.856	1.861	1.861	0.743	0.756	0.756
3	0.82	0.813	0.806	1.861	1.857	1.858	0.741	0.757	0.759
Average	0.815	0.81	0.809	1.857	1.86	1.859	0.745	0.758	0.756
SD	0.005	0.003	0.003	0.004	0.003	0.002	0.005	0.004	0.004

**Table E9** Raw data of ALP activity of SaOS-2 cultured on TCPS, and fibrous and film PBSu-DCH scaffolds after 3 days in culture (Measured 3 times: I = 1<sup>st</sup>, II = 2<sup>nd</sup>, III = 3<sup>rd</sup>)

Measurement	ALP activity		
	Control (TCPS)	Fibrous scaffolds of PBS	Film scaffolds of PBS
I	8.765	7.6	5.168
II	8.427	7.746	5.066
III	9.152	7.747	4.964
Average	8.781	7.697	5.066
SD	0.36	0.08	0.1

**Table E10** Raw data of ALP activity of SaOS-2 cultured on TCPS, and fibrous and film PBSu-DCH scaffolds after 5 days in culture (Measured 3 times: I = 1<sup>st</sup>, II = 2<sup>nd</sup>, III = 3<sup>rd</sup>)

Measurement	ALP activity		
	Control (TCPS)	Fibrous scaffolds of PBS	Film scaffolds of PBS
I	10.932	10.067	7.795
II	10.835	10.259	7.405
III	10.547	9.73	7.405
Average	10.771	10.018	7.535
SD	0.2	0.26	0.22

**Table E11** Raw data of ALP activity of SaOS-2 cultured on TCPS, and fibrous and film PBSu-DCH scaffolds after 10 days in culture (Measured 3 times: I = 1<sup>st</sup>, II = 2<sup>nd</sup>, III = 3<sup>rd</sup>)

Measurement	ALP activity		
	Control (TCPS)	Fibrous scaffolds of PBS	Film scaffolds of PBS
I	11.604	11.028	9.537
II	11.844	11.076	9.007
III	11.7	11.076	8.524
Average	11.716	11.06	9.022
SD	0.12	0.02	0.5

## CURRICULUM VITAE

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**Presentations:**

1. Sutthiphong, S., Pavasant, P., and Suphaphol, P., (2008, April 23) Electrospun Poly(1,4-butylene succinate) Extended with 1,6-Diisocyanatohexane Fiber Mats and their Potential Use as Bone Scaffolds. Paper presented at The 14<sup>th</sup> PPC Symposium on Petroleum, Petrochemicals, and Polymers, Bangkok, Thailand.

