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APPENDICES

Appendix A Determination of Molecular Weight of Chitosan

Table A1 Running time of solvent and chitosan solution

Concentration (g/100ml)	Time (second)			
	1	2	3	Average
0.0000	97.48	97.63	97.91	97.67
0.0125	113.50	113.50	113.52	113.50
0.0250	130.72	130.72	130.59	130.67
0.0500	168.84	168.75	168.78	168.79
0.0750	214.75	214.56	214.62	214.64
0.1000	270.22	270.18	270.41	270.27

Table A2 Data of relative viscosity (η_{rel}), specific viscosity (η_{sp}), and reduced viscosity (η_{red}) of chitosan solution with various concentrations

Concentration (g/100 ml)	η_{rel}	η_{sp}	η_{red}	$\ln[\eta_{rel}]/c$
0.0000	1.0000	0	-	-
0.0125	1.1621	0.1621	12.9716	12.0183
0.0250	1.3379	0.3379	13.5176	11.6440
0.0500	1.7281	0.7281	14.5633	10.9405
0.0750	2.1976	1.1976	15.9685	10.4982
0.1000	2.7672	1.7672	17.6718	10.1784

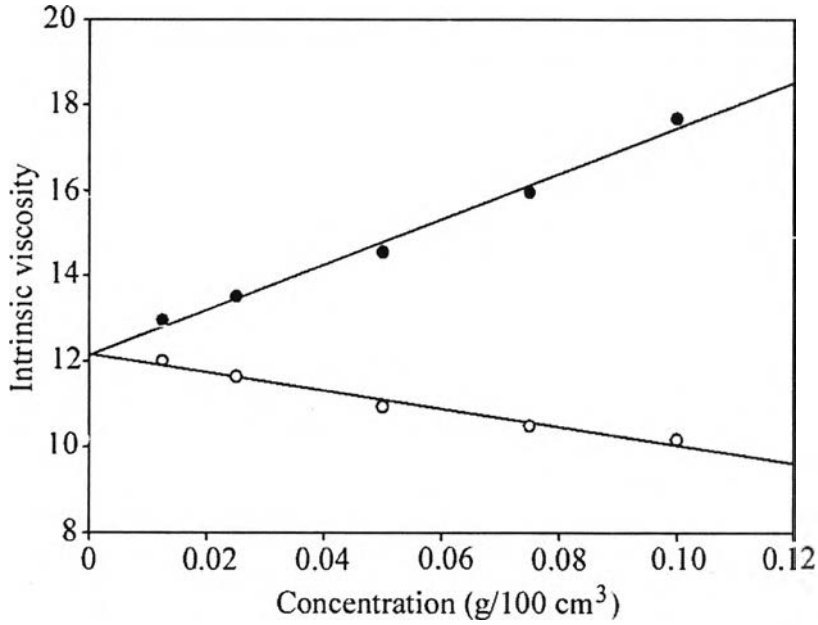

Figure A1 Plot of reduced viscosity (η_{sp}/c) and $\ln((\eta_{rel})/c)$ versus concentration of chitosan solution: • = (η_{sp}/c) and o = $\ln((\eta_{rel})/c)$.

The viscosity-average molecular weight of chitosan was determined base on Mark-Houwink equation. The K and a values were according to Wang *et al.* (1997).

$$[\eta] = (6.59 \times 10^{-5})M^{0.88}$$

where $[\eta]$ = intrincsic viscosity

M = viscosity-average molecular weight

Interception: $[\eta] = 12.161$

From calculation;

$$M^{0.88} = (12.161)/6.59 \times 10^{-5} = 1.85 \times 10^{5}$$

$$0.88 \log M = \log[1.85 \times 10^{5}]$$

$$\log M = 5.99$$

$$M = 9.67 \times 10^{5}$$

The viscosity-average molecular weight of chitosan obtained from calculation was 9.67×10^{5} g/mol.

Appendix B Mechanical Properties of PANI/Chitosan Blend Film

Table B1 Raw data of mechanical properties of the pure chitosan films

Sample	Young's modulus (MPa)	Tensile strength (MPa)	Elongation at break (%)
Chitosan film (CS)	2304.65	60.67	14.36
	4060.66	65.12	18.28
	2364.97	67.90	17.70
	2631.30	60.77	15.35
	2763.15	69.79	19.49
	3105.25	68.99	16.61
	2728.68	70.90	18.27
	3707.84	71.12	17.76
	2549.17	73.87	15.84
	2912.82	73.96	16.51
Average	2912.85	68.31	17.02
Std	570.03	4.78	1.56

Table B2 Raw data of mechanical properties of PANI/CS blend films with 10 wt% PANI content

Sample	Young's modulus (MPa)	Tensile strength (MPa)	Elongation at break (%)
PANI/CS (10/90)	3233.12	57.96	8.42
	2812.98	53.04	7.33
	2512.61	57.07	7.35
	2857.72	60.33	5.65
	2893.06	60.96	9.09
	2955.06	60.02	6.89
	2655.68	50.09	6.47
	2866.04	61.29	8.83
	2268.79	60.21	7.33
	3233.12	62.55	8.42
Average	2828.82	58.35	7.58
Std	296.84	3.97	1.09

Table B3 Raw data of mechanical properties of PANI/CS blend films with 20 wt% PANI content

Sample	Young's modulus (MPa)	Tensile strength (MPa)	Elongation at break (%)
PANI/CS (20/80)	3086.18	71.42	6.94
	2922.27	74.72	7.60
	2823.76	77.85	7.32
	3371.53	76.52	6.23
	3546.92	81.08	7.70
	3178.32	77.42	7.18
	2467.00	71.48	8.45
	2528.55	77.85	9.34
	3148.70	71.52	7.42
	2632.96	75.04	7.22
Average	2970.62	75.49	7.54
Std	360.25	3.27	0.84

Table B4 Raw data of mechanical properties of PANI/CS blend films with 30 wt% PANI content

Sample	Young's modulus (MPa)	Tensile strength (MPa)	Elongation at break (%)
PANI/CS (30/70)	3013.44	84.62	6.49
	3223.28	82.01	7.29
	3412.82	78.98	6.32
	2950.53	85.10	7.11
	3286.46	78.64	8.81
	2975.35	78.24	6.53
	3587.31	84.81	7.77
	3545.17	82.37	8.58
	2956.19	78.98	6.97
	3177.70	83.84	6.97
Average	3212.83	81.76	7.29
Std	242.27	2.80	0.85

Table B5 Raw data of mechanical properties of PANI/CS blend films with 40 wt% PANI content

Sample	Young's modulus (MPa)	Tensile strength (MPa)	Elongation at break (%)
PANI/CS (40/60)	3984.31	85.36	7.86
	2956.26	84.15	7.55
	3472.37	80.49	8.01
	2959.22	85.20	6.26
	2362.58	82.50	6.07
	3210.42	83.98	5.71
	2760.73	82.03	6.26
	3872.27	81.85	8.01
	2950.06	87.62	7.83
	2859.08	86.67	6.49
Average	3138.73	83.99	7.00
Std	504.88	2.27	0.92

Table B6 Raw data of mechanical properties of PANI/CS blend films with 50 wt% PANI content

Sample	Young's modulus (MPa)	Tensile strength (MPa)	Elongation at break (%)
PANI/CS (50/50)	2763.92	74.12	6.89
	3415.49	79.34	7.45
	2907.58	76.61	6.25
	2534.05	78.85	7.43
	2811.39	67.41	5.04
	2094.95	74.03	6.22
	2223.80	78.42	5.20
	2393.42	66.46	7.89
	2900.06	78.96	7.14
	2849.63	76.63	7.82
Average	2689.43	75.08	6.74
Std	386.89	4.69	1.02

Appendix C Mechanical Properties of PANI/Chitosan Blend Film Doped with 0.5 M HCl for 2 h

Table C1 Raw data of mechanical properties of the pure chitosan films doped with 0.5 M HCl for 2h

Sample	Young's modulus (MPa)	Tensile strength (MPa)	Elongation at break (%)
Chitosan film (CS)	2153.80	42.01	5.96
	2144.46	44.65	6.50
	1804.85	36.21	5.34
	2307.28	37.29	7.64
	1762.91	37.10	5.72
	1450.68	38.75	7.03
	2384.88	37.02	5.77
	2699.39	42.98	4.32
	1878.24	46.38	5.67
	2046.55	47.82	5.59
Average	2063.30	41.02	5.96
Std	357.33	4.30	0.92

Table C2 Raw data of mechanical properties of PANI/CS blend films with 10 wt% PANI content doped with 0.5 M HCl for 2 h

Sample	Young's modulus (MPa)	Tensile strength (MPa)	Elongation at break (%)
PANI/CS (10/90)	1625.14	39.97	5.76
	2008.41	33.85	5.07
	1506.53	34.02	8.35
	2108.76	35.03	6.67
	1383.40	28.06	8.27
	1274.38	30.46	9.16
	2243.78	28.03	9.99
	1776.34	31.87	5.50
	1482.25	29.25	5.81
	1390.53	32.57	7.84
Average	1679.95	32.31	7.23
Std	337.85	3.66	1.71

Table C3 Raw data of mechanical properties of PANI/CS blend films with 20 wt% PANI content doped with 0.5 M HCl for 2 h

Sample	Young's modulus (MPa)	Tensile strength (MPa)	Elongation at break (%)
PANI/CS (20/80)	2385.21	48.27	5.34
	1933.18	52.61	6.02
	2435.25	44.62	5.97
	2459.59	42.69	8.25
	2549.80	50.86	7.54
	1687.85	47.67	5.30
	2159.21	44.45	4.94
	2546.69	50.26	7.83
	1628.58	38.00	5.29
	1953.59	47.43	5.64
Average	2173.90	46.69	6.21
Std	352.00	4.34	1.20

Table C4 Raw data of mechanical properties of PANI/CS blend films with 30 wt% PANI content doped with 0.5 M HCl for 2 h

Sample	Young's modulus (MPa)	Tensile strength (MPa)	Elongation at break (%)
PANI/CS (30/70)	2071.55	55.49	7.28
	2244.74	51.04	6.46
	2575.48	46.80	5.55
	1876.20	46.84	6.92
	2139.20	47.15	6.21
	2284.89	44.31	5.50
	2014.82	45.22	4.33
	2068.57	58.27	4.50
	2253.64	48.24	6.80
	2267.01	47.91	4.64
Average	2179.61	49.13	5.82
Std	191.49	4.51	1.08

Table C5 Raw data of mechanical properties of PANI/CS blend films with 40 wt% PANI content doped with 0.5 M HCl for 2 h

Sample	Young's modulus (MPa)	Tensile strength (MPa)	Elongation at break (%)
PANI/CS (40/60)	2239.46	44.29	7.85
	2635.99	55.69	8.17
	1870.95	52.51	7.67
	3290.28	42.54	8.25
	2312.73	59.85	9.56
	2103.15	47.56	8.95
	3010.30	53.42	8.20
	2288.21	54.79	6.92
	2136.12	58.60	7.10
	2420.26	52.20	8.57
Average	2430.74	52.15	8.13
Std	434.00	5.74	0.79

Table C6 Raw data of mechanical properties of PANI/CS blend films with 50 wt% PANI content doped with 0.5 M HCl for 2 h

Sample	Young's modulus (MPa)	Tensile strength (MPa)	Elongation at break (%)
PANI/CS (50/50)	2263.22	45.39	5.65
	2182.69	44.63	4.19
	2511.25	46.51	4.14
	2285.16	37.26	3.63
	1935.66	40.34	4.62
	2398.56	46.84	3.59
	2089.79	39.26	6.26
	2654.56	43.00	3.54
	2194.34	45.17	5.93
Average	2279.47	43.16	4.75
Std	217.85	3.42	1.09

Appendix D Mechanical Properties of PANI/Chitosan Blend Film Doped with Different HCl Concentration for 2 h

Table D1 Raw data of mechanical properties of PANI/CS blend films with 40 wt% PANI content doped with 0.1 M HCl for 2 h

HCl concentration (M)	Young's modulus (MPa)	Tensile strength (MPa)	Elongation at break (%)
0.1	2536.46	55.94	13.07
	2697.01	55.09	12.18
	2792.85	51.25	10.51
	2100.55	51.80	12.26
	2199.01	49.42	12.65
	2796.99	52.02	10.26
	2615.32	59.44	13.35
	2005.12	51.24	9.07
	2568.52	51.59	9.57
	2037.47	54.54	10.5
Average	2434.93	53.23	11.35
Std	316.00	2.97	1.53

Table D2 Raw data of mechanical properties of PANI/CS blend films with 40 wt% PANI content doped with 0.5 M HCl for 2 h

HCl concentration (M)	Young's modulus (MPa)	Tensile strength (MPa)	Elongation at break (%)
0.5	2239.46	44.29	7.85
	2635.99	55.69	8.17
	1870.95	52.51	7.67
	3290.28	42.54	8.25
	2312.73	59.85	9.56
	2103.15	47.56	8.95
	3010.30	53.42	8.20
	2288.21	54.79	6.92
	2136.12	58.60	7.10
	2420.26	52.20	8.57
Average	2430.74	52.15	8.13
Std	434.00	5.74	0.79

Table D3 Raw data of mechanical properties of PANI/CS blend films with 40 wt% PANI content doped with 1.0 M HCl for 2 h

HCl concentration (M)	Young's modulus (MPa)	Tensile strength (MPa)	Elongation at break (%)
1.0	1777.26	49.48	7.85
	2212.78	56.59	8.17
	2186.48	50.15	7.67
	2282.76	47.15	6.92
	2180.88	50.68	7.62
	2850.96	56.14	5.59
	1897.60	51.02	8.20
	1942.62	47.34	8.96
	2299.45	48.13	6.24
	1860.65	57.97	8.57
Average	2149.15	51.46	7.58
Std	310.35	3.99	1.05

Table D4 Raw data of mechanical properties of PANI/CS blend films with 40 wt% PANI content doped with 2.0 M HCl for 2 h

HCl concentration (M)	Young's modulus (MPa)	Tensile strength (MPa)	Elongation at break (%)
2.0	2151.75	55.40	6.28
	1978.90	54.37	7.20
	2330.60	46.06	5.10
	2102.36	45.31	8.00
	1888.16	46.84	8.55
	2138.70	47.32	7.40
	2320.88	50.23	6.64
	2185.26	45.39	5.74
	2426.26	52.11	7.30
	2085.36	51.25	6.00
Average	2160.82	49.43	6.82
Std	164.18	3.75	1.06

Table D5 Raw data of mechanical properties of PANI/CS blend films with 40 wt% PANI content doped with 3.0 M HCl for 2 h

HCl concentration (M)	Young's modulus (MPa)	Tensile strength (MPa)	Elongation at break (%)
3.0	1959.05	52.70	7.31
	2385.26	53.14	5.29
	2455.41	50.33	5.22
	2313.48	50.50	5.08
	1874.77	48.29	5.90
	2012.50	51.87	6.92
	1989.71	42.03	6.60
	2026.28	45.79	7.60
	2203.17	53.80	5.50
	2436.62	51.15	6.59
Average	2199.77	49.22	6.08
Std	209.19	3.76	0.89

Table D6 Raw data of mechanical properties of PANI/CS blend films with 40 wt% PANI content doped with 4.0 M HCl for 2 h

HCl concentration (M)	Young's modulus (MPa)	Tensile strength (MPa)	Elongation at break (%)
4.0	2202.24	50.44	6.81
	1984.29	51.65	7.42
	1861.47	55.56	5.03
	2094.74	40.12	7.13
	2473.18	47.11	5.38
	1900.49	45.80	5.26
	1843.33	52.28	7.51
	2126.72	46.12	5.86
	1644.70	40.77	6.19
	2097.11	54.79	6.28
Average	2022.83	48.46	6.29
Std	229.53	5.39	0.90

Table D7 Raw data of mechanical properties of PANI/CS blend films with 40 wt% PANI content doped with 6.0 M HCl for 2 h

HCl concentration (M)	Young's modulus (MPa)	Tensile strength (MPa)	Elongation at break (%)
6.0	2174.17	49.62	5.64
	2356.49	43.65	3.55
	2204.57	52.33	3.24
	2305.56	41.32	3.27
	1876.62	46.59	4.90
	2053.83	41.719	3.83
	2281.82	47.62	3.81
	1863.46	53.89	3.05
	2262.09	44.65	4.92
	1634.42	41.96	4.78
Average	2101.30	46.33	4.10
Std	237.70	4.48	0.89

Appendix E Mechanical Properties of PANI/Chitosan Blend Film Doped with 1M HCl Concentration at Different Time

Table E1 Raw data of mechanical properties of PANI/CS blend films with 40 wt% PANI content doped with 1.0 M HCl for 0.5 h

Doping time (h)	Young's modulus (MPa)	Tensile strength (MPa)	Elongation at break (%)
0.5	2452.04	48.05	5.47
	2501.04	46.88	5.09
	2005.15	52.60	5.85
	1993.07	58.84	5.82
	2179.99	57.13	6.04
	1947.11	55.28	7.17
	2616.11	50.53	5.82
	2451.15	57.38	5.94
	2313.09	53.87	5.75
	1908.85	49.79	6.29
Average	2236.76	53.04	5.92
Std	262.37	4.15	0.54

Table E2 Raw data of mechanical properties of PANI/CS blend films with 40 wt% PANI content doped with 1.0 M HCl for 2.0 h

Doping time (h)	Young's modulus (MPa)	Tensile strength (MPa)	Elongation at break (%)
2.0	1777.26	49.48	7.85
	2212.78	56.59	8.17
	2186.48	50.15	7.67
	2282.76	47.15	6.92
	2180.88	50.68	7.62
	2850.96	56.14	5.59
	1897.60	51.02	8.20
	1942.62	47.34	8.96
	2299.45	48.13	6.24
	1860.65	57.97	8.57
Average	2149.15	51.46	7.58
Std	310.35	3.99	1.05

Table E3 Raw data of mechanical properties of PANI/CS blend films with 40 wt% PANI content doped with 1.0 M HCl for 5.0 h

Doping time (h)	Young's modulus (MPa)	Tensile strength (MPa)	Elongation at break (%)
5.0	2023.91	52.12	7.07
	2160.22	49.41	7.45
	1856.87	48.11	7.16
	1759.10	50.14	8.14
	1554.36	54.46	6.31
	2139.89	42.81	6.55
	2199.62	53.11	6.04
	2080.29	44.97	7.21
	2122.80	54.74	5.61
	2660.39	55.66	5.38
Average	2055.75	50.55	6.69
Std	296.14	4.30	0.86

Table E4 Raw data of mechanical properties of PANI/CS blend films with 40 wt% PANI content doped with 1.0 M HCl for 8.0 h

Doping time (h)	Young's modulus (MPa)	Tensile strength (MPa)	Elongation at break (%)
8.0	1823.05	50.92	6.05
	1726.15	48.19	7.22
	2007.52	44.65	6.09
	2452.56	51.25	6.42
	2094.39	45.52	6.51
	2156.11	46.56	6.32
	2264.24	49.95	5.74
	2403.04	44.06	5.47
	1849.76	56.93	6.35
	1895.25	53.53	6.43
Average	2067.21	49.16	6.26
Std	250.57	4.14	0.47

Table E5 Raw data of mechanical properties of PANI/CS blend films with 40 wt% PANI content doped with 1.0 M HCl for 10.0 h.

Doping time (h)	Young's modulus (MPa)	Tensile strength (MPa)	Elongation at break (%)
10.0	2000.74	53.09	6.03
	2009.98	46.81	4.68
	2244.66	52.78	7.46
	2110.32	47.96	7.181
	1587.39	41.73	5.73
	2313.53	48.20	7.35
	1558.64	46.20	6.3
	1974.55	47.91	7.08
	1733.90	51.98	7.03
	1785.35	54.93	7.54
Average	1948.19	48.52	6.54
Std	259.62	3.98	0.92

Table E6 Raw data of mechanical properties of PANI/CS blend films with 40 wt% PANI content doped with 1.0 M HCl for 15.0 h.

Doping time (h)	Young's modulus (MPa)	Tensile strength (MPa)	Elongation at break (%)
15.0	1694.32	42.05	9.20
	2264.25	42.88	6.54
	1762.88	40.53	6.02
	1833.53	47.06	7.45
	1603.73	38.88	5.94
	1780.93	38.89	7.79
	2135.25	46.66	6.53
	2295.58	48.45	8.25
	1888.03	40.82	5.29
			7.01
Average	1881.47	42.35	7.00
Std	263.92	3.85	1.18

Table E7 Raw data of mechanical properties of PANI/CS blend films with 40 wt% PANI content doped with 1.0 M HCl for 24.0 h.

Doping time (h)	Young's modulus (MPa)	Tensile strength (MPa)	Elongation at break (%)
24.0	1497.38	40.38	7.64
	1667.93	44.10	6.12
	1269.51	39.68	10.91
	1445.03	38.85	6.65
	1215.71	37.51	9.78
	1973.30	38.52	9.77
	1823.67	39.25	7.24
	2194.14	49.42	6.52
	1863.13	43.16	8.95
	2137.48	42.73	9.55
Average	1708.73	41.36	8.31
Std	346.14	3.57	1.67

Appendix F Mechanical Properties of PANI/Chitosan Blend Film Doped with 1M of different type of acid for 10.0 h

Table F1 Raw data of mechanical properties of PANI/CS blend films with 40 wt% PANI content doped with 1.0 M of acetic acid for 10.0 h

Type of Acid dopant	Young's modulus (MPa)	Tensile strength (MPa)	Elongation at break (%)
Acetic acid	2951.78	69.88	12.83
	2774.93	59.25	10.01
	2851.71	56.01	12.17
	3471.25	68.75	11.56
	2437.05	65.64	10.82
	2525.43	60.69	11.08
	2885.73	55.01	10.86
	2521.78	64.22	8.05
	3608.74	59.71	8.66
	3256.49	59.08	11.32
Average	2928.49	61.82	10.74
Std	403.61	5.09	1.47

Table F2 Raw data of mechanical properties of PANI/CS blend films with 40 wt% PANI content doped with 1.0 M of formic acid for 10.0 h

Type of Acid dopant	Young's modulus (MPa)	Tensile strength (MPa)	Elongation at break (%)
Formic acid	2149.81	56.31	14.37
	1855.73	65.94	12.62
	2321.68	59.92	14.56
	2390.31	56.09	13.46
	2064.15	54.19	15.96
	1963.15	58.17	12.50
	2631.40	59.98	11.30
	1697.84	70.84	16.72
	2436.25	68.15	11.87
	2838.34	57.26	13.79
Average	2234.86	60.69	13.71
Std	355.28	5.65	1.67

Table F3 Raw data of mechanical properties of PANI/CS blend films with 40 wt% PANI content doped with 1.0 M of perchloric acid for 10.0 h

Type of Acid dopant	Young's modulus (MPa)	Tensile strength (MPa)	Elongation at break (%)
Perchloric acid	2202.63	33.32	5.26
	1542.86	34.57	5.04
	1714.75	46.66	8.38
	2820.24	47.71	8.56
	2264.69	35.45	7.79
	2653.14	40.56	6.42
	2315.67	48.00	9.10
	2166.99	44.75	9.91
	2542.12	38.00	5.74
	2446.74	38.52	5.75
Average	2266.98	40.75	7.20
Std	395.67	5.63	1.75

Table F4 Raw data of mechanical properties of PANI/CS blend films with 40 wt% PANI content doped with 1.0 M of nitric acid for 10.0 h

Type of Acid dopant	Young's modulus (MPa)	Tensile strength (MPa)	Elongation at break (%)
Nitric acid	2750.40	46.60	7.393
	2340.46	55.77	8.81
	2560.82	51.85	7.28
	1972.50	46.64	6.61
	2277.52	54.37	8.04
	2634.67	47.91	7.88
	2654.82	56.06	9.11
	2244.33	52.53	7.32
	2514.54	50.24	9.20
	2796.44	54.86	8.93
Average	2474.65	51.68	8.06
Std	260.07	3.67	0.91

Table F5 Raw data of mechanical properties of PANI/CS blend films with 40 wt% PANI content doped with 1.0 M of sulfuric acid for 10.0 h

Type of Acid dopant	Young's modulus (MPa)	Tensile strength (MPa)	Elongation at break (%)
Sulfuric acid	2653.63	47.98	7.96
	2759.63	46.81	7.59
	2050.55	51.78	8.04
	2711.48	52.74	6.15
	2491.97	50.54	7.85
	2701.82	43.76	5.48
	2247.58	48.53	6.84
	2683.66	53.90	9.43
	2564.23	45.32	6.89
	2875.16	41.17	5.24
Average	2573.97	48.25	7.15
Std	250.80	4.09	1.28

Table F6 Raw data of mechanical properties of PANI/CS blend films with 40 wt% PANI content doped with 1.0 M of p-toluene sulfonic acid for 10.0 h

Type of Acid dopant	Young's modulus (MPa)	Tensile strength (MPa)	Elongation at break (%)
p-toluene sulfonic acid	2801.46	50.16	6.32
	3083.15	40.59	6.68
	3005.14	48.93	7.33
	2338.99	47.83	5.84
	1947.2	53.33	9.53
	2709.18	50.78	7.69
	1960.22	43.58	6.82
	2090.23	41.33	7.52
	2628.50	48.21	6.32
	2405.95	48.20	6.49
Average	2497.00	47.29	7.05
Std	414.44	4.15	1.04

Table F7 Raw data of mechanical properties of PANI/CS blend films with 40 wt% PANI content doped with 1.0 M of ascorbic acid for 10.0 h

Type of Acid dopant	Young's modulus (MPa)	Tensile strength (MPa)	Elongation at break (%)
Ascorbic acid	2631.91	70.68	5.14
	2456.57	69.89	7.26
	2467.89	71.80	6.09
	2504.42	77.70	5.46
	2222.59	79.24	7.57
	3384.85	75.23	4.87
	3707.53	73.52	6.21
	2691.05	74.94	5.36
	3059.08	75.50	5.49
	2497.17	83.34	7.61
Average	2762.30	75.19	6.11
Std	471.33	4.11	1.02

Appendix G Determination of Ohmic Linear Regime.

Linear regime or ohmic regime is the regime that applied voltage depends directly on the apply current according to ohmic law in equation (1G)

In this work, linear regime was determined by ploting applied voltage (V_a) versus current (I). The range that gives the straight line is acceptable for using in conductivity measurement. Figure G1 is the plot between V_a and I of the PANI/chitosan blend film with 40 wt% PANI content as the standard material using custom built two-point probe. This experiment was carried out under 1 atm, 50% relative humidity, at 28 °C.

$$V = IR \tag{G1}$$

where V = applied voltage (V)

I = current (A)

R = resistance (Ω)

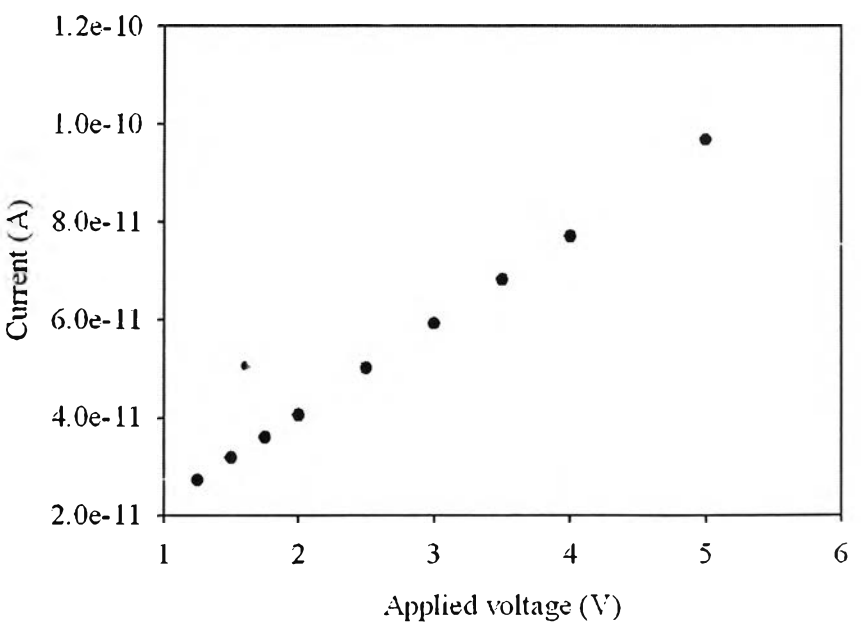

Figure G1 Linear regime of V_a and I of the PANI/chitosan blend film with 40 wt% PANI content obtained by the custom built two-point probe.

According to Figure G1, straight line is indicated the range of applied voltage and current corresponding to the ohmic law. The accepted range of those for using in conductivity measurement are 1.25 to 5 V and 2.74×10^{-11} to 9.68×10^{-11} A, respectively.

Table G1 Raw data of determination of linear regime from PANI/chitosan blend film with 40 wt% PANI content using custom built two-point probe

Applied voltage (V)	Current ($\times 10^{11}$) (A)
1.25	2.74
1.50	3.19
1.75	3.61
2.00	4.05
2.50	5.02
3.00	5.93
3.50	6.82
4.00	7.71
5.00	9.68

Appendix H Determination of Geometric Correlation Factor (K) of Custom Built Two-Point Probe

Geometric correction factor (K) is a correction that takes into account of geometric effects. It depends on the configuration and probe tip spacing. K factor can be determined by using the following equation (K1).

$$K = \frac{\rho_{ref} \times I}{t \times V} \qquad \text{(H1)}$$

where K = geometric correction factor

ρ_{ref} = resistivity of standard material (Ω.cm)

R = resistivity (Ω)

t = sheet thickness (cm)

V = applied voltage (V)

I = current (A)

In this experiment, the PANI/chitosan blend film with 40 wt% PANI content was used as a standard material for the determination of K factor. The Resistivities of standard materials were measured followed the ohmic law by using the Resistivity Test Figure (Keithley model 8009). The equation used to measure the resistivity of standard material is shown as followed (H2).

$$\rho = \frac{22.9 \times I}{t \times V} \qquad \text{(H2)}$$

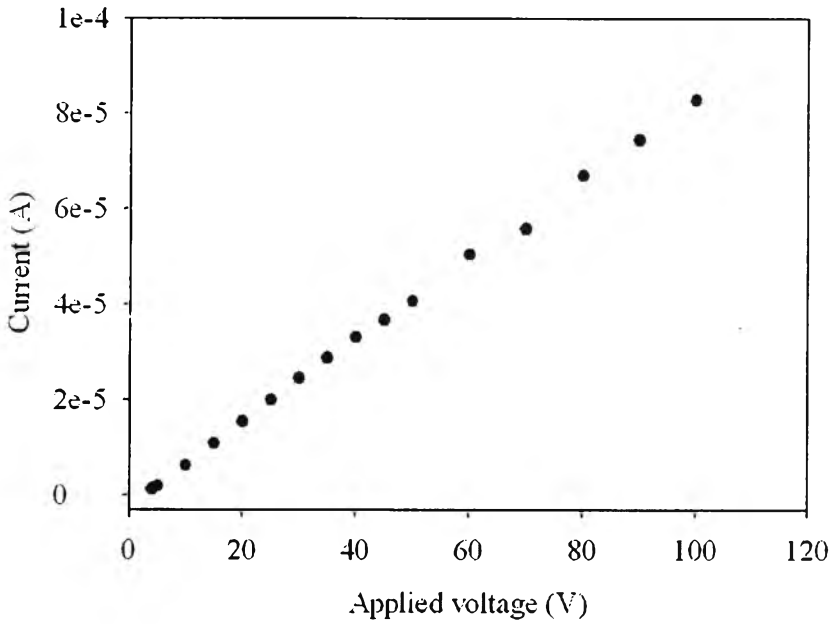

Figure H1 Linear regime of V_a and I of the PANI/chitosan blend film with 40 wt% PANI content obtained by the Resistivity Test Figure.

Table H1 Raw data of determination of linear regime from PANI/chitosan blend film with 40 wt% PANI content using the Resistivity Test Figure

Applied voltage (V)	Current ($\times 10^5$) (A)
4	0.130
5	0.197
10	0.627
15	1.090
20	1.550
25	2.000
30	2.460
35	2.880
40	3.320
45	3.680
50	4.080
60	5.050
70	5.580
80	6.700
90	7.450
100	8.280

According to Figure H1, the accepted range for using in conductivity measurement are 4 to 60 V and 0.13×10^{-5} to 5.05×10^{-5} A, respectively.

$$\rho = \frac{(22.9 \times 40)}{(1.96 \times 10^{-3}) \times (3.32 \times 10^{-5})}$$

$$\rho = 1.41 \times 10^{10} \text{ ohm/cm}$$

The resistivity of the PANI/chitosan blend film with 40 wt% PANI content used as the standard material is 1.41×10^{10} ohm/cm.

Calculation from eq. H1;

$$K = \frac{(1.41 \times 10^{10}) \times (7.71 \times 10^{-11})}{(1.96 \times 10^{-3}) \times (4)}$$

$$K = 138.66$$

Therefore, the geometric correction factor (K) of custom built two-point probe is 138.66.

Appendix I Conductivity Measurement of PANI/Chitosan Blend Film

Table I1 Raw data of conductivity measurement of pure chitosan film under the condition of 1 atm, 50% relative humidity and 28 °C

Sample	Thickness (cm)	Applied voltage (V)	Current (A)	Conductivity (S/cm)
Chitosan (CS)	2.10E-3	0.25	3.22E-11	4.42E-10
	2.10E-3	0.5	6.39E-11	4.39E-10
	2.10E-3	0.75	9.67E-11	4.43E-10
	2.10E-3	1	1.26E-10	4.33E-10
	2.10E-3	1.25	1.51E-10	4.15E-10
Average				4.34E-10
Chitosan (CS)	1.80E-3	0.75	6.31E-11	3.37E-10
	1.80E-3	1	8.84E-11	3.54E-10
	1.80E-3	1.25	1.11E-10	3.56E-10
	1.80E-3	1.5	1.33E-10	3.55E-10
	1.80E-3	1.75	1.61E-10	3.69E-10
Average				3.54E-10
Chitosan (CS)	2.25E-3	0.75	9.16E-11	3.91E-10
	2.25E-3	1	1.15E-10	3.69E-10
	2.25E-3	1.25	1.45E-10	3.72E-10
	2.25E-3	1.5	1.77E-10	3.78E-10
	2.25E-3	1.75	2.02E-10	3.70E-10
Average				3.76E-10

Average conductivity 3.88E-10
STD 4.14E-11

Table I2 Raw data of conductivity measurement of PANI/CS film with 10 wt% PANI content under the condition of 1 atm., 50% relative humidity and 28 °C

Sample	Thickness (cm)	Applied voltage (V)	Current (A)	Conductivity (S/cm)
PANI/CS 10/90	1.65E-3	0.75	4.81E-11	2.80E-10
	1.65E-3	1	6.53E-11	2.85E-10
	1.65E-3	1.25	8.11E-11	2.84E-10
	1.65E-3	1.5	9.41E-11	2.74E-10
	1.65E-3	1.75	1.08E-10	2.70E-10
Average				2.79E-10
PANI/CS 10/90	1.50E-3	0.75	4.21E-11	2.70E-10
	1.50E-3	1	5.32E-11	2.56E-10
	1.50E-3	1.25	6.72E-11	2.58E-10
	1.50E-3	1.5	8.05E-11	2.58E-10
	1.50E-3	1.75	9.02E-11	2.48E-10
Average				2.58E-10
PANI/CS 10/90	1.55E-3	0.75	4.05E-11	2.51E-10
	1.55E-3	1	5.10E-11	2.37E-10
	1.55E-3	1.25	6.58E-11	2.45E-10
	1.55E-3	1.5	7.89E-11	2.45E-10
	1.55E-3	1.75	8.96E-11	2.38E-10
Average				2.43E-10

Average conductivity 2.60E-10
STD 1.78E-11

Table I3 Raw data of conductivity measurement of PANI/CS film with 20 wt% PANI content under the condition of 1 atm., 50% relative humidity and 28 °C

Sample	Thickness (cm)	Applied voltage (V)	Current (A)	Conductivity (S/cm)
PANI/CS 20/80	2.33E-3	1	5.89E-11	1.82E-10
	2.33E-3	1.25	6.95E-11	1.72E-10
	2.33E-3	1.5	8.03E-11	1.66E-10
	2.33E-3	1.75	9.09E-11	1.61E-10
	2.33E-3	2	1.02E-10	1.58E-10
Average				1.68E-10
PANI/CS 20/80	2.02E-3	0.75	3.28E-11	1.56E-10
	2.02E-3	1	4.35E-11	1.55E-10
	2.02E-3	1.25	5.60E-11	1.60E-10
	2.02E-3	1.5	6.75E-11	1.61E-10
	2.02E-3	1.75	7.80E-11	1.59E-10
Average				1.58E-10
PANI/CS 20/80	2.13E-2	0.75	3.15E-11	1.42E-10
	2.13E-2	1	4.18E-11	1.42E-10
	2.13E-2	1.25	5.36E-11	1.45E-10
	2.13E-2	1.5	6.51E-11	1.47E-10
	2.13E-2	1.75	7.69E-11	1.49E-10
Average				1.45E-10

Average conductivity 2.57E-10
STD 1.15E-11

Table I4 Raw data of conductivity measurement of PANI/CS film with 30 wt% PANI content under the condition of 1 atm., 50% relative humidity and 28 °C

Sample	Thickness (cm)	Applied voltage (V)	Current (A)	Conductivity (S/cm)
PANI/CS 30/70	1.83E-3	0.75	2.52E-11	1.32E-10
	1.83E-3	1	3.21E-11	1.27E-10
	1.83E-3	1.25	3.87E-11	1.22E-10
	1.83E-3	1.5	4.54E-11	1.19E-10
	1.83E-3	1.75	5.16E-11	1.16E-10
Average				1.23E-10
PANI/CS 30/70	1.75E-3	1	2.54E-11	1.05E-10
	1.75E-3	1.25	3.09E-11	1.02E-10
	1.75E-3	1.5	3.67E-11	1.01E-10
	1.75E-3	1.75	4.26E-11	1.00E-10
	1.75E-3	2	4.80E-11	9.89E-11
Average				1.01E-10
PANI/CS 30/70	1.83E-3	1	2.65E-11	1.04E-10
	1.83E-3	1.25	3.18E-11	1.00E-10
	1.83E-3	1.5	3.85E-11	1.01E-10
	1.83E-3	1.75	4.44E-11	1.00E-10
	1.83E-3	2	4.99E-11	9.83E-11
Average				1.01E-10

Average conductivity 1.08E-10
STD 1.28E-11

Table I5 Raw data of conductivity measurement of PANI/CS film with 40 wt% PANI content under the condition of 1 atm., 50% relative humidity and 28 °C

Sample	Thickness (cm)	Applied voltage (V)	Current (A)	Conductivity (S/cm)
PANI/CS 40/60	1.80E-3	1.25	2.74E-11	8.07E-11
	1.80E-3	1.5	3.19E-11	7.83E-11
	1.80E-3	1.75	3.61E-11	7.59E-11
	1.80E-3	2	4.05E-11	7.45E-11
	1.80E-3	2.5	5.02E-11	7.39E-11
Average				7.66E-11
PANI/CS 40/60	1.56E-3	1.5	2.47E-11	7.61E-11
	1.56E-3	1.75	2.89E-11	7.63E-11
	1.56E-3	2	3.25E-11	7.51E-11
	1.56E-3	2.5	4.02E-11	7.43E-11
	1.56E-3	3	4.85E-11	7.47E-11
Average				7.53E-11
PANI/CS 40/60	1.55E-3	3	5.93E-11	9.20E-11
	1.55E-3	3.5	6.82E-11	9.07E-11
	1.55E-3	4	7.71E-11	8.97E-11
	1.55E-3	4.5	8.66E-11	8.95E-11
	1.55E-3	5	9.84E-11	9.16E-11
Average				9.07E-11

Average conductivity 8.09E-11
STD 8.51E-12

Table I6 Raw data of conductivity measurement of PANI/CS film with 50 wt% PANI content under the condition of 1 atm., 50% relative humidity and 28 °C

Sample	Thickness (cm)	Applied voltage (V)	Current (A)	Conductivity (S/cm)
PANI/CS 50/50	1.75E-3	1.75	2.95E-11	6.95E-11
	1.75E-3	2	3.35E-11	6.90E-11
	1.75E-3	2.5	4.15E-11	6.84E-11
	1.75E-3	3	4.83E-11	6.63E-11
	1.75E-3	3.5	5.62E-11	6.62E-11
Average				6.79E-11
PANI/CS 50/50	1.75E-3	1.75	3.07E-11	7.23E-11
	1.75E-3	2	3.44E-11	7.09E-11
	1.75E-3	2.5	4.25E-11	7.01E-11
	1.75E-3	3	5.08E-11	6.98E-11
	1.75E-3	3.5	5.90E-11	6.95E-11
Average				7.05E-11
PANI/CS 50/50	1.68E-3	3.5	5.85E-11	7.18E-11
	1.68E-3	4	6.61E-11	7.09E-11
	1.68E-3	4.5	7.35E-11	7.01E-11
	1.68E-3	5	8.15E-11	7.00E-11
	1.68E-3	5.5	8.99E-11	7.02E-11
Average				7.06E-11

Average conductivity 6.97E-11
STD 1.53E-12

Table I7 Raw data of conductivity measurement of PANI powder under the condition of 1 atm., 50% relative humidity and 28 °C

Sample	Thickness (cm)	Applied voltage (V)	Current (A)	Conductivity (S/cm)
Polyaniline (PANI)	1.354E-2	1.25	9.80E-11	4.18E-11
	1.354E-2	1.5	1.16E-10	4.12E-11
	1.354E-2	1.75	1.34E-10	4.08E-11
	1.354E-2	2	1.51E-10	4.02E-11
	1.354E-2	2.5	1.90E-10	4.05E-11
Average				4.09E-11
Polyaniline (PANI)	1.354E-2	1	7.67E-11	4.09E-11
	1.354E-2	1.25	9.36E-11	3.99E-11
	1.354E-2	1.5	1.10E-10	3.91E-11
	1.354E-2	1.75	1.27E-10	3.87E-11
	1.354E-2	2	1.44E-10	3.83E-11
Average				3.94E-11
Polyaniline (PANI)	1.453E-2	0.25	2.29E-11	4.55E-11
	1.453E-2	0.5	4.44E-11	4.41E-11
	1.453E-2	0.75	6.32E-11	4.18E-11
	1.453E-2	1	8.05E-11	4.00E-11
	1.453E-2	1.25	1.02E-10	4.05E-11
Average				4.24E-11

Average conductivity 4.09E-11
STD 1.50E-12

Appendix J Conductivity Measurement of PANI/Chitosan Blend Film Doped with 0.5 M HCl for 2 h

Table J1 Raw data of conductivity measurement of pure chitosan film doped with 0.5 M HCl for 2 h under the condition of 1 atm., 50% relative humidity and 28 °C

Sample	Thickness (cm)	Applied voltage (V)	Current (A)	Conductivity (S/cm)
Chitosan	4.54E-3	1	4.56E-8	7.24E-8
	4.54E-3	1.5	6.26E-8	6.63E-8
	4.54E-3	1.75	7.47E-8	6.78E-8
	4.54E-3	2	9.40E-8	7.47E-8
	4.54E-3	3	1.13E-7	5.98E-8
Average				6.82E-8
Chitosan	4.70E-3	0.5	2.19E-8	6.72E-8
	4.70E-3	1	5.19E-8	7.96E-8
	4.70E-3	1.5	8.43E-8	8.62E-8
	4.70E-3	2	1.07E-7	8.21E-8
	4.70E-3	2.5	1.21E-7	7.43E-8
Average				7.79E-8
Chitosan	4.36E-3	0.5	2.86E-8	9.46E-8
	4.36E-3	1	4.90E-8	8.11E-8
	4.36E-3	1.5	6.75E-8	7.44E-8
	4.36E-3	2	9.49E-8	7.85E-8
	4.36E-3	2.5	1.13E-7	7.48E-8
Average				8.07E-8

Average conductivity 7.56E-8
STD 1.26E-9

Table J2 Raw data of conductivity measurement of PANI/CS film with 10 wt% PANI content doped with 0.5 M HCl for 2 h under the condition of 1 atm., 50% relative humidity and 28 °C

Sample	Thickness (cm)	Applied voltage (V)	Current (A)	Conductivity (S/cm)
PANI/CS 10/90	2.22E-3	0.5	1.23E-7	8.78E-7
	2.22E-3	1	2.30E-7	8.21E-7
	2.22E-3	1.5	3.22E-7	7.66E-7
	2.22E-3	2	4.16E-7	7.43E-7
	2.22E-3	2.5	4.85E-7	6.93E-7
Average				7.80E-7
PANI/CS 10/90	8.3E-4	0.5	5.32E-8	9.25E-7
	8.3E-4	1	8.93E-8	7.76E-7
	8.3E-4	1.5	1.24E-7	7.18E-7
	8.3E-4	2	1.64E-7	7.12E-7
	8.3E-4	3	2.50E-7	7.24E-7
Average				7.71E-7
PANI/CS 10/90	1.95E-3	2	4.08E-7	8.41E-7
	1.95E-3	2.5	4.75E-7	7.83E-7
	1.95E-3	3	5.24E-7	7.20E-7
	1.95E-3	3.5	6.10E-7	7.18E-7
	1.95E-3	4	7.00E-7	7.21E-7
Average				7.57E-7

Average conductivity 7.69E-7
STD 1.75E-8

Table J3 Raw data of conductivity measurement of PANI/CS film with 20 wt% PANI content doped with 0.5 M HCl for 2 h under the condition of 1 atm., 50% relative humidity and 28 °C

Sample	Thickness (cm)	Applied voltage (V)	Current (A)	Conductivity (S/cm)
PANI/CS 20/80	1.40E-3	0.5	2.56E-6	1.78E-5
	1.40E-3	1	4.71E-6	1.63E-5
	1.40E-3	1.5	6.45E-6	1.49E-5
	1.40E-3	2	9.59E-6	1.66E-5
	1.40E-3	2.5	1.32E-5	1.83E-5
Average				1.68E-5
PANI/CS 20/80	1.63E-3	1	8.84E-6	2.86E-5
	1.63E-3	1.5	1.21E-5	2.61E-5
	1.63E-3	2	1.54E-5	2.49E-5
	1.63E-3	2.5	1.78E-5	2.30E-5
	1.63E-3	5	4.29E-5	2.77E-5
Average				2.61E-5
PANI/CS 20/80	1.93E-3	0.5	3.30E-6	2.44E-5
	1.93E-3	1	6.78E-6	2.67E-5
	1.93E-3	1.5	7.65E-6	1.92E-5
	1.93E-3	2	9.13E-6	1.80E-5
	1.93E-3	2.5	1.24E-5	1.95E-5
Average				2.16E-5

Average conductivity 2.15E-5
STD 4.64E-6

Table J4 Raw data of conductivity measurement of PANI/CS film with 30 wt% PANI content doped with 0.5 M HCl for 2 h under the condition of 1 atm., 50% relative humidity and 28 °C

Sample	Thickness (cm)	Applied voltage (V)	Current (A)	Conductivity (S/cm)
PANI/CS 30/70	2.12E-3	1.5	1.53E-5	3.47E-5
	2.12E-3	2	2.22E-5	3.78E-5
	2.12E-3	2.5	2.96E-5	4.03E-5
	2.12E-3	3	3.86E-5	4.38E-5
	2.12E-3	3.5	4.03E-5	3.92E-5
Average				3.91E-5
PANI/CS 30/70	2.03E-3	1	1.03E-5	3.85E-5
	2.03E-3	1.5	1.69E-5	4.21E-5
	2.03E-3	2	2.40E-5	4.48E-5
	2.03E-3	2.5	3.20E-5	4.78E-5
	2.03E-3	3	3.65E-5	4.55E-5
Average				4.37E-5
PANI/CS 30/70	1.78E-3	0.5	4.46E-6	4.42E-5
	1.78E-3	1	1.10E-5	4.46E-5
	1.78E-3	1.5	1.68E-5	4.54E-5
	1.78E-3	2	2.28E-5	4.62E-5
	1.78E-3	2.5	2.86E-5	4.64E-5
Average				4.53E-5

Average conductivity 4.27E-5
STD 1.46E-6

Table J5 Raw data of conductivity measurement of PANI/CS film with 40 wt% PANI content doped with 0.5 M HCl for 2 h under the condition of 1 atm., 50% relative humidity and 28 °C

Sample	Thickness (cm)	Applied voltage (V)	Current (A)	Conductivity (S/cm)
PANI/CS 40/60	1.77E-3	0.5	2.02E-5	1.74E-4
	1.77E-3	1	2.88E-5	1.24E-4
	1.77E-3	1.5	4.05E-5	1.17E-4
	1.77E-3	2	4.86E-5	1.05E-4
	1.77E-3	2.5	5.32E-5	9.19E-5
Average				1.22E-4
PANI/CS 40/60	1.96E-3	0.5	2.43E-5	1.99E-4
	1.96E-3	1	3.73E-5	1.53E-4
	1.96E-3	1.5	4.68E-5	1.28E-4
	1.96E-3	2	5.52E-5	1.13E-4
	1.96E-3	2.5	5.92E-5	1.13E-4
Average				1.41E-4
PANI/CS 40/60	1.88E-3	1	2.83E-5	1.29E-4
	1.88E-3	1.5	3.77E-5	1.15E-4
	1.88E-3	2	4.57E-5	1.04E-4
	1.88E-3	3	6.04E-5	9.19E-5
	1.88E-3	4	7.31E-5	8.34E-5
Average				1.05E-4

Average conductivity 1.23E-4
STD 9.37E-6

Table J6 Raw data of conductivity measurement of PANI/CS film with 50 wt% PANI content doped with 0.5 M HCl for 2 h under the condition of 1 atm., 50% relative humidity and 28 °C

Sample	Thickness (cm)	Applied voltage (V)	Current (A)	Conductivity (S/cm)
PANI/CS 50/50	1.81E-3	0.5	5.82E-5	4.64E-4
	1.81E-3	1	8.03E-5	3.20E-4
	1.81E-3	1.5	1.55E-4	4.12E-4
	1.81E-3	2	1.69E-4	3.37E-4
	1.81E-3	2.5	2.03E-4	3.24E-4
Average				3.71E-4
PANI/CS 50/50	1.77E-3	0.5	6.10E-5	4.97E-4
	1.77E-3	1	1.21E-4	4.93E-4
	1.77E-3	1.5	1.75E-4	4.75E-4
	1.77E-3	2	2.35E-4	4.79E-4
	1.77E-3	2.5	2.86E-4	4.66E-4
Average				4.82E-4
PANI/CS 50/50	2.01E-3	0.5	5.22E-5	3.75E-4
	2.01E-3	1	1.02E-4	3.66E-4
	2.01E-3	1.5	1.73E-4	4.14E-4
	2.01E-3	2	2.24E-4	4.02E-4
	2.01E-3	2.5	2.89E-4	4.15E-4
Average				3.94E-4

Average conductivity 4.16E-4
STD 5.85E-5

Table J7 Raw data of conductivity measurement of PANI powder doped with 0.5 M HCl for 2 h under the condition of 1 atm., 50% relative humidity and 28 °C

Sample	Thickness (cm)	Applied voltage (V)	Current (A)	Conductivity (S/cm)
Polyaniline (PANI)	1.42E-2	0.5	5.86E-5	5.92E-5
	1.42E-2	1	1.20E-4	6.06E-5
	1.42E-2	1.5	1.82E-4	6.13E-5
	1.42E-2	2	2.51E-4	6.34E-5
	1.42E-2	2.5	3.24E-4	6.55E-5
Average				6.20E-5
Polyaniline (PANI)	1.42E-2	0.5	5.95E-5	6.01E-5
	1.42E-2	1	1.28E-4	6.46E-5
	1.42E-2	1.5	1.97E-4	6.63E-5
	1.42E-2	2	2.72E-4	6.87E-5
	1.42E-2	2.5	3.34E-4	6.75E-5
Average				6.54E-5
Polyaniline (PANI)	1.42E-2	0.5	5.64E-5	5.70E-5
	1.42E-2	1	1.15E-4	5.81E-5
	1.42E-2	1.5	1.85E-4	6.23E-5
	1.42E-2	2	2.64E-4	6.67E-5
	1.42E-2	2.5	3.20E-4	6.46E-5
Average				6.17E-5

Average conductivity	6.31E-5
STD	8.49E-7

Appendix K Conductivity Measurement of PANI/Chitosan Blend Film Doped with Different HCl Concentration for 2 h

Table K1 Raw data of conductivity measurement of PANI/CS film with 40 wt% PANI content doped with 0.1 M HCl for 2 h under the condition of 1 atm., 50% relative humidity and 28 °C

HCl concentration (M)	Thickness (cm)	Applied voltage (V)	Current (A)	Conductivity (S/cm)
0.1	2.76E-3	0.5	1.26E-5	6.58E-5
	2.76E-3	0.75	1.95E-5	6.79E-5
	2.76E-3	1	2.62E-5	6.85E-5
	2.76E-3	1.25	3.54E-5	7.40E-5
	2.76E-3	1.5	5.06E-5	8.81E-5
Average				7.28E-5
0.1	2.96E-3	0.5	1.90E-5	9.26E-5
	2.96E-3	0.75	2.95E-5	9.58E-5
	2.96E-3	1	3.98E-5	9.70E-5
	2.96E-3	1.25	5.12E-5	9.98E-5
	2.96E-3	1.5	6.67E-5	1.08E-4
Average				9.87E-5
0.1	3.26E-3	0.5	1.63E-5	7.30E-5
	3.26E-3	1	3.76E-5	8.42E-5
	3.26E-3	1.5	5.28E-5	7.88E-5
	3.26E-3	2	8.04E-5	9.00E-5
	3.26E-3	2.5	1.02E-4	9.14E-5
Average				8.35E-5

Average conductivity	8.50E-5
STD	1.30E-5

Table K2 Raw data of conductivity measurement of PANI/CS film with 40 wt% PANI content doped with 0.5 M HCl for 2 h under the condition of 1 atm., 50% relative humidity and 28 °C

HCl concentration (M)	Thickness (cm)	Applied voltage (V)	Current (A)	Conductivity (S/cm)
0.5	1.77E-3	0.5	2.02E-5	1.74E-4
	1.77E-3	1	2.88E-5	1.24E-4
	1.77E-3	1.5	4.05E-5	1.17E-4
	1.77E-3	2	4.86E-5	1.05E-4
	1.77E-3	2.5	5.32E-5	9.19E-5
Average				1.22E-4
0.5	1.96E-3	0.5	2.43E-5	1.99E-4
	1.96E-3	1	3.73E-5	1.53E-4
	1.96E-3	1.5	4.68E-5	1.28E-4
	1.96E-3	2	5.52E-5	1.13E-4
	1.96E-3	2.5	5.92E-5	1.13E-4
Average				1.41E-4
0.5	1.88E-3	1	2.83E-5	1.29E-4
	1.88E-3	1.5	3.77E-5	1.15E-4
	1.88E-3	2	4.57E-5	1.04E-4
	1.88E-3	3	6.04E-5	9.19E-5
	1.88E-3	4	7.31E-5	8.34E-5
Average				1.05E-4

Average conductivity 1.23E-4
STD 9.37E-6

Table K3 Raw data of conductivity measurement of PANI/CS film with 40 wt% PANI content doped with 1.0 M HCl for 2 h under the condition of 1 atm., 50% relative humidity and 28 °C

HCl concentration (M)	Thickness (cm)	Applied voltage (V)	Current (A)	Conductivity (S/cm)
1.0	1.85E-3	0.5	1.81E-5	1.41E-04
	1.85E-3	0.75	2.45E-5	1.27E-04
	1.85E-3	1	3.25E-5	1.27E-04
	1.85E-3	1.25	4.05E-5	1.26E-04
	1.85E-3	1.5	5.20E-5	1.35E-04
Average				1.31E-4
1.0	3.50E-3	0.5	2.65E-5	1.09E-04
	3.50E-3	1	5.98E-5	1.23E-04
	3.50E-3	1.5	1.06E-4	1.46E-04
	3.50E-3	2	1.61E-4	1.66E-04
	3.50E-3	2.5	2.28E-4	1.88E-04
Average				1.46E-4
1.0	1.85E-3	0.5	1.68E-5	1.31E-04
	1.85E-3	0.75	2.25E-5	1.17E-04
	1.85E-3	1	3.00E-5	1.17E-04
	1.85E-3	1.25	3.86E-5	1.20E-04
	1.85E-3	1.5	5.06E-5	1.32E-04
Average				1.23E-4

Average conductivity 1.34E-4
STD 1.17E-5

Table K4 Raw data of conductivity measurement of PANI/CS film with 40 wt% PANI content doped with 2.0 M HCl for 2 h under the condition of 1 atm., 50% relative humidity and 28 °C

HCl concentration (M)	Thickness (cm)	Applied voltage (V)	Current (A)	Conductivity (S/cm)
2.0	2.59E-3	0.5	2.08E-5	1.16E-4
	2.59E-3	1	3.29E-5	9.16E-5
	2.59E-3	1.5	4.60E-5	8.54E-5
	2.59E-3	2	8.48E-5	1.18E-4
	2.59E-3	2.5	1.31E-4	1.46E-4
Average				1.11E-4
2.0	2.13E-3	0.5	1.91E-5	1.29E-4
	2.13E-3	1	3.29E-5	1.11E-4
	2.13E-3	1.5	4.00E-5	9.03E-5
	2.13E-3	2	4.79E-5	8.11E-5
	2.13E-3	2.5	5.50E-5	7.45E-5
Average				9.73E-5
2.0	2.30E-3	0.5	2.05E-5	1.29E-4
	2.30E-3	1	3.45E-5	1.08E-4
	2.30E-3	1.5	4.16E-5	8.70E-5
	2.30E-3	2	4.87E-5	7.64E-5
	2.30E-3	2.5	5.72E-5	7.17E-5
Average				9.43E-5

Average conductivity 1.01E-4
STD 9.08E-6

Table K5 Raw data of conductivity measurement of PANI/CS film with 40 wt% PANI content doped with 3.0 M HCl for 2 h under the condition of 1 atm., 50% relative humidity and 28 °C

HCl concentration (M)	Thickness (cm)	Applied voltage (V)	Current (A)	Conductivity (S/cm)
3.0	3.25E-3	0.5	2 00E-5	8.88E-5
	3.25E-3	1	4.68E-5	1.04E-4
	3.25E-3	1.5	7.80E-5	1.15E-4
	3.25E-3	2	9.75E-5	1.08E-4
	3.25E-3	2.5	1.30E-5	1.15E-5
Average				8.55E-5
3.0	3.20E-3	0.5	1.95E-5	8.79E-5
	3.20E-3	1	4.45E-5	1.00E-4
	3.20E-3	1.5	7.72E-5	1.16E-4
	3.20E-3	2	9.55E-5	1.08E-4
	3.20E-3	2.5	1.20E-4	1.08E-4
Average				1.04E-4
3.0	2.63E-3	0.5	1.58E-5	8.67E-5
	2.63E-3	1	3.60E-5	9.87E-5
	2.63E-3	1.5	5.44E-5	9.94E-5
	2.63E-3	2	7.22E-5	9.90E-5
	2.63E-3	2.5	9.56E-5	1.05E-4
Average				9.77E-5

Average conductivity 9.58E-5
STD 9.38E-6

Table K6 Raw data of conductivity measurement of PANI/CS film with 40 wt% PANI content doped with 4.0 M HCl for 2 h under the condition of 1 atm., 50% relative humidity and 28 °C

HCl concentration (M)	Thickness (cm)	Applied voltage (V)	Current (A)	Conductivity (S/cm)
4.0	2.61E-3	0.5	1.18E-5	6.52E-5
	2.61E-3	0.75	2.20E-5	8.11E-5
	2.61E-3	1	2.88E-5	7.96E-5
	2.61E-3	1.25	4.53E-5	1.00E-4
	2.61E-3	1.5	5.98E-5	1.10E-4
Average				8.72E-5
4.0	2.80E-3	0.5	2.17E-5	1.12E-4
	2.80E-3	0.75	2.84E-5	9.75E-5
	2.80E-3	1	3.94E-5	1.01E-4
	2.80E-3	1.25	4.58E-5	9.44E-5
	2.80E-3	1.5	5.08E-5	8.72E-5
Average				9.85E-5
4.0	2.70E-3	0.5	2.30E-5	1.23E-4
	2.70E-3	1	3.90E-5	1.04E-4
	2.70E-3	1.25	4.68E-5	1.00E-4
	2.70E-3	1.5	5.43E-5	9.67E-5
	2.70E-3	2	7.32E-5	9.78E-5
Average				1.04E-4

Average conductivity 9.67E-5
STD 8.68E-6

Table K7 Raw data of conductivity measurement of PANI/CS film with 40 wt% PANI content doped with 6.0 M HCl for 2 h under the condition of 1 atm., 50% relative humidity and 28 °C

HCl concentration (M)	Thickness (cm)	Applied voltage (V)	Current (A)	Conductivity (S/cm)
6.0	3.01E-3	0.075	2.17E-6	6.96E-5
	3.01E-3	0.1	3.59E-6	8.63E-5
	3.01E-3	0.25	8.47E-6	8.14E-5
	3.01E-3	0.5	1.68E-5	8.08E-5
	3.01E-3	0.75	2.44E-5	7.82E-5
Average				7.93E-5
6.0	3.02E-3	0.075	2.10E-6	6.69E-5
	3.02E-3	0.1	3.45E-6	8.24E-5
	3.02E-3	0.25	8.27E-6	7.90E-5
	3.02E-3	0.5	1.59E-5	7.59E-5
	3.02E-3	0.75	2.35E-5	7.48E-5
Average				7.58E-5
6.0	2.96E-3	0.075	2.65E-6	8.61E-5
	2.96E-3	0.1	3.86E-6	9.40E-5
	2.96E-3	0.25	8.97E-6	8.74E-5
	2.96E-3	0.5	1.78E-5	8.67E-5
	2.96E-3	0.75	2.49E-5	8.09E-5
Average				8.70E-5

Average conductivity 8.07E-5
STD 5.75E-6

Appendix L Conductivity Measurement of PANI/Chitosan Blend Film Doped with 1 M HCl at Different Time

Table L1 Raw data of conductivity measurement of PANI/CS film with 40 wt% PANI content doped with 1.0 M HCl for 0.5 h under the condition of 1 atm., 50% relative humidity and 28 °C

Doping time (h.)	Thickness (cm)	Applied voltage (V)	Current (A)	Conductivity (S/cm)
0.5	2.47E-3	0.25	3.34E-6	3.90E-5
	2.47E-3	0.5	8.56E-6	5.00E-5
	2.47E-3	0.75	1.53E-5	5.96E-5
	2.47E-3	1	2.05E-5	5.99E-5
	2.47E-3	1.25	2.56E-5	5.98E-5
Average				5.36E-5
0.5	2.31E-3	0.25	3.55E-6	4.43E-5
	2.31E-3	0.5	9.11E-6	5.69E-5
	2.31E-3	0.75	1.64E-5	6.83E-5
	2.31E-3	1	2.15E-5	6.71E-5
	2.31E-3	1.25	2.78E-5	6.94E-5
Average				6.12E-5
0.5	2.51E-3	0.25	3.86E-6	4.44E-5
	2.51E-3	0.5	8.80E-6	5.06E-5
	2.51E-3	0.75	1.49E-5	5.71E-5
	2.51E-3	1	2.06E-5	5.92E-5
	2.51E-3	1.25	2.68E-5	6.16E-5
Average				5.46E-5

Average conductivity	5.65E-5
STD	4.13E-6

Table L2 Raw data of conductivity measurement of PANI/CS film with 40 wt% PANI content doped with 1.0 M HCl for 2.0 h under the condition of 1 atm., 50% relative humidity and 28 °C

Doping time (h.)	Thickness (cm)	Applied voltage (V)	Current (A)	Conductivity (S/cm)
2.0	2.05E-3	0.5	1.81E-5	1.27E-4
	2.05E-3	0.75	2.45E-5	1.15E-4
	2.05E-3	1	3.25E-5	1.14E-4
	2.05E-3	1.25	4.05E-5	1.14E-4
	2.05E-3	1.5	5.20E-5	1.22E-4
Average				1.19E-4
2.0	2.90E-3	0.5	2.65E-5	1.32E-4
	2.90E-3	1	5.98E-5	1.49E-4
	2.90E-3	1.5	1.06E-4	1.76E-4
	2.90E-3	2	1.61E-4	2.00E-4
	2.90E-3	2.5	2.28E-4	2.27E-4
Average				1.77E-4
2.0	2.15E-3	0.5	1.68E-5	1.13E-4
	2.15E-3	0.75	2.25E-5	1.01E-4
	2.15E-3	1	3.00E-5	1.01E-4
	2.15E-3	1.25	3.86E-5	1.04E-4
	2.15E-3	1.5	5.06E-5	1.13E-4
Average				1.06E-04

Average conductivity 1.34E-4
STD 1.17E-5

Table L3 Raw data of conductivity measurement of PANI/CS film with 40 wt% PANI content doped with 1.0 M HCl for 5.0 h under the condition of 1 atm., 50% relative humidity and 28 °C

Doping time (h.)	Thickness (cm)	Applied voltage (V)	Current (A)	Conductivity (S/cm)
5.0	2.74E-3	0.25	1.54E-05	1.62E-4
	2.74E-3	0.5	2.71E-05	1.43E-4
	2.74E-3	0.75	3.96E-05	1.39E-4
	2.74E-3	1	5.46E-05	1.44E-4
	2.74E-3	1.25	6.54E-05	1.38E-4
Average				1.45E-4
5.0	2.86E-3	0.25	1.40E-05	1.41E-4
	2.86E-3	0.5	2.58E-05	1.30E-4
	2.86E-3	0.75	3.92E-05	1.32E-4
	2.86E-3	1	5.47E-05	1.38E-4
	2.86E-3	1.25	6.65E-05	1.34E-4
Average				1.35E-4
5.0	3.00E-3	0.25	1.58E-05	1.52E-4
	3.00E-3	0.5	2.99E-05	1.44E-4
	3.00E-3	0.75	4.26E-05	1.37E-4
	3.00E-3	1	5.68E-05	1.37E-4
	3.00E-3	1.25	7.03E-05	1.35E-4
Average				1.41-4

Average conductivity 1.40E-4
STD 5.02E-6

Table L4 Raw data of conductivity measurement of PANI/CS film with 40 wt% PANI content doped with 1.0 M HCl for 8.0 h under the condition of 1 atm., 50% relative humidity and 28 °C

Doping time (h.)	Thickness (cm)	Applied voltage (V)	Current (A)	Conductivity (S/cm)
8.0	2.56E-3	0.5	3.08E-5	1.74E-4
	2.56E-3	0.75	3.84E-5	1.44E-4
	2.56E-3	1	4.46E-5	1.26E-4
	2.56E-3	1.5	6.34E-5	1.19E-4
	2.56E-3	2	7.97E-5	1.12E-4
Average				1.35E-4
8.0	2.63E-3	0.25	1.24E-5	1.36E-4
	2.63E-3	0.5	2.66E-5	1.46E-4
	2.63E-3	0.75	3.97E-5	1.45E-4
	2.63E-3	1	5.57E-5	1.53E-4
	2.63E-3	1.25	7.05E-5	1.55E-4
Average				1.47E-4
8.0	2.76E-3	0.25	1.35E-5	1.41E-4
	2.76E-3	0.5	2.76E-5	1.44E-4
	2.76E-3	0.75	4.05E-5	1.41E-4
	2.76E-3	1	5.74E-5	1.50E-4
	2.76E-3	1.25	7.33E-5	1.53E-4
Average				1.46E-4

Average conductivity	1.43E-4
STD	6.63E-6

Table L5 Raw data of conductivity measurement of PANI/CS film with 40 wt% PANI content doped with 1.0 M HCl for 10.0 h under the condition of 1 atm., 50% relative humidity and 28 °C

Doping time (h.)	Thickness (cm)	Applied voltage (V)	Current (A)	Conductivity (S/cm)
10.0	2.53E-3	0.5	3.20E-05	1.82E-4
	2.53E-3	0.75	4.28E-05	1.63E-4
	2.53E-3	1	5.53E-05	1.58E-4
	2.53E-3	1.5	8.34E-05	1.58E-4
	2.53E-3	2	1.12E-04	1.60E-4
Average				1.64E-4
10.0	2.28E-3	0.25	1.48E-05	1.87E-4
	2.28E-3	0.5	2.90E-05	1.83E-4
	2.28E-3	0.75	4.35E-05	1.83E-4
	2.28E-3	1	5.68E-05	1.80E-4
	2.28E-3	1.25	7.17E-05	1.81E-4
Average				1.83E-4
10.0	2.46E-3	0.25	1.36E-05	1.59E-4
	2.46E-3	0.5	2.64E-05	1.55E-4
	2.46E-3	0.75	4.08E-05	1.59E-4
	2.46E-3	1	5.39E-05	1.58E-4
	2.46E-3	1.25	6.85E-05	1.61E-4
Average				1.58E-4

Average conductivity	1.69E-4
STD	1.29E-5

Table L6 Raw data of conductivity measurement of PANI/CS film with 40 wt% PANI content doped with 1.0 M HCl for 15.0 h under the condition of 1 atm., 50% relative humidity and 28 °C

Doping time (h.)	Thickness (cm)	Applied voltage (V)	Current (A)	Conductivity (S/cm)
15.0	2.93E-3	0.1	4.33E-6	1.07E-4
	2.93E-3	0.25	1.26E-5	1.24E-4
	2.93E-3	0.75	4.08E-5	1.34E-4
	2.93E-3	1	6.04E-5	1.49E-4
	2.93E-3	1.5	9.39E-5	1.54E-4
Average				1.46E-4
15.0	2.53E-3	0.25	1.05E-5	1.20E-4
	2.53E-3	0.5	2.21E-5	1.26E-4
	2.53E-3	0.75	3.21E-5	1.22E-4
	2.53E-3	1	4.45E-5	1.27E-4
	2.53E-3	1.25	5.46E-5	1.25E-4
Average				1.24E-4
15.0	2.79E-3	0.25	9.86E-6	1.02E-4
	2.79E-3	0.5	2.05E-5	1.06E-4
	2.79E-3	0.75	3.16E-5	1.09E-4
	2.79E-3	1	4.31E-5	1.11E-4
	2.79E-3	1.25	5.16E-5	1.07E-4
Average				1.07E-4

Average conductivity 1.25E-4
STD 1.93E-5

Table L7 Raw data of conductivity measurement of PANI/CS film with 40 wt% PANI content doped with 1.0 M HCl for 24.0 h under the condition of 1 atm., 50% relative humidity and 28 °C.

Doping time (h.)	Thickness (cm)	Applied voltage (V)	Current (A)	Conductivity (S/cm)
24.0	2.78E-3	0.25	1.20E-5	1.25E-4
	2.78E-3	0.5	2.30E-5	1.19E-4
	2.78E-3	0.75	3.86E-5	1.34E-4
	2.78E-3	1	4.87E-5	1.26E-4
	2.78E-3	1.25	6.43E-5	1.33E-4
Average				1.27E-4
24.0	2.79E-3	0.25	9.63E-6	9.96E-5
	2.79E-3	0.5	1.79E05	9.25E-5
	2.79E-3	0.75	3.55E-5	1.22E-4
	2.79E-3	1	4.66E-5	1.20E-4
	2.79E-3	1.25	6.05E-5	1.25E-4
Average				1.12E-4
24.0	2.58E-3	0.25	8.63E-6	9.65E-5
	2.58E-3	0.5	1.58E-5	8.83E-5
	2.58E-3	0.75	2.46E-5	9.17E-5
	2.58E-3	1	3.45E-5	9.64E-5
	2.58E-3	1.25	4.96E-5	1.11E-4
Average				1.12E-4

Average conductivity 1.12E-4
STD 1.53E-5

Appendix M Conductivity Measurement of PANI/Chitosan Blend Film Doped with 1 M of Different Type of Acid for 10.0 h

Table M1 Raw data of conductivity measurement of PANI/CS film with 40 wt% PANI content doped with 1.0 M of ascorbic acid for 10.0 h under the condition of 1 atm., 50% relative humidity and 28 °C

Doping time (h.)	Thickness (cm)	Applied voltage (V)	Current (A)	Conductivity (S/cm)
Ascorbic acid	2.20E-3	0.751	5.93E-11	2.59E-10
	2.20E-3	1	7.90E-11	2.59E-10
	2.20E-3	1.5	1.14E-10	2.49E-10
	2.20E-3	1.75	1.36E-10	2.55E-10
	2.20E-3	2	1.49E-10	2.44E-10
Average				2.53E-10
Ascorbic acid	2.22E-3	1.5	9.60E-11	2.08E-10
	2.22E-3	1.75	1.19E-10	2.21E-10
	2.22E-3	2	1.49E-10	2.42E-10
	2.22E-3	2.25	1.80E-10	2.60E-10
	2.22E-3	2.5	1.97E-10	2.56E-10
Average				2.37E-10
Ascorbic acid	2.36E-3	1.5	1.00E-10	2.04E-10
	2.36E-3	1.75	1.27E-10	2.22E-10
	2.36E-3	2	1.40E-10	2.14E-10
	2.36E-3	2.25	1.62E-10	2.20E-10
	2.36E-3	2.5	1.89E-10	2.31E-10
Average				2.18E-10

Average conductivity	2.36E-10
STD	1.76E-11

Table M2 Raw data of conductivity measurement of PANI/CS film with 40 wt% PANI content doped with 1.0 M of formic acid for 10.0 h under the condition of 1 atm., 50% relative humidity and 28 °C

Doping time (h.)	Thickness (cm)	Applied voltage (V)	Current (A)	Conductivity (S/cm)
Formic acid	2.54E-3	0.25	5.77E-9	6.55E-8
	2.54E-3	0.5	1.21E-8	6.87E-8
	2.54E-3	0.75	1.87E-8	7.08E-8
	2.54E-3	1	2.30E-8	6.53E-8
	2.54E-3	1.25	2.65E-8	6.02E-8
Average				6.61E-8
Formic acid	2.82E-3	2.25	6.22E-8	7.07E-8
	2.82E-3	2.5	6.77E-8	6.93E-8
	2.82E-3	2.75	7.25E-8	6.74E-8
	2.82E-3	3	7.57E-8	6.45E-8
	2.82E-3	3.5	8.43E-8	6.16E-8
Average				6.67E-8
Formic acid	1.38E-3	5	4.71E-8	4.92E-8
	1.38E-3	5.5	5.29E-8	5.03E-8
	1.38E-3	6	6.05E-8	5.27E-8
	1.38E-3	7	7.59E-8	5.67E-8
	1.38E-3	8	9.16E-8	5.98E-8
Average				5.37E-8

Average conductivity	6.22E-8
STD	3.93E-10

Table M3 Raw data of conductivity measurement of PANI/CS film with 40 wt% PANI content doped with 1.0 M of p-toluene sulfonic acid for 10.0 h under the condition of 1 atm., 50% relative humidity and 28 °C

Doping time (h.)	Thickness (cm)	Applied voltage (V)	Current (A)	Conductivity (S/cm)
p-toluene sulfonic acid	3.00E-3	0.5	2.16E-6	1.04E-5
	3.00E-3	0.75	3.52E-6	1.13E-5
	3.00E-3	1	5.04E-6	1.21E-5
	3.00E-3	1.25	6.75E-6	1.30E-5
	3.00E-3	1.5	8.38E-6	1.34E-5
Average				1.20E-5
p-toluene sulfonic acid	3.88E-3	0.1	9.75E-7	1.81E-5
	3.88E-3	0.25	1.84E-6	1.37E-5
	3.88E-3	0.5	4.13E-6	1.54E-5
	3.88E-3	0.75	6.25E-6	1.55E-5
	3.88E-3	1	9.16E-6	1.70E-5
Average				1.59E-5
p-toluene sulfonic acid	3.50E-3	1.75	1.02E-5	1.20E-5
	3.50E-3	2	1.21E-5	1.25E-5
	3.50E-3	2.5	1.70E-5	1.40E-5
	3.50E-3	3	2.39E-5	1.64E-5
	3.50E-3	4	3.49E-5	1.80E-5
Average				1.46E-5

Average conductivity	1.42E-5
STD	6.73E-7

Table M4 Raw data of conductivity measurement of PANI/CS film with 40 wt% PANI content doped with 1.0 M of nitric acid for 10.0 h under the condition of 1 atm., 50% relative humidity and 28 °C

Doping time (h.)	Thickness (cm)	Applied voltage (V)	Current (A)	Conductivity (S/cm)
Nitric acid HNO_3	2.54E-3	0.05	1.92E-6	1.09E-4
	2.54E-3	0.075	2.88E-6	1.09E-4
	2.54E-3	0.1	3.68E-6	1.04E-4
	2.54E-3	0.25	8.29E-6	9.42E-5
	2.54E-3	0.5	1.57E-5	8.92E-5
Average				1.01E-4
Nitric acid HNO_3	2.98E-3	0.05	2.59E-6	1.25E-4
	2.98E-3	0.075	3.97E-6	1.28E-4
	2.98E-3	0.1	5.35E-6	1.29E-4
	2.98E-3	0.25	1.35E-5	1.31E-4
	2.98E-3	0.5	2.65E-5	1.28E-4
Average				1.28E-4
Nitric acid HNO_3	2.02E-3	0.05	1.22E-6	8.71E-5
	2.02E-3	0.075	1.73E-6	8.24E-5
	2.02E-3	0.1	2.31E-6	8.25E-5
	2.02E-3	0.25	4.57E-6	6.53E-5
	2.02E-3	0.5	8.46E-6	6.04E-5
Average				7.55E-4

Average conductivity	1.02E-4
STD	2.64E-5

Table M5 Raw data of conductivity measurement of PANI/CS film with 40 wt% PANI content doped with 1.0 M of sulfuric acid for 10.0 h under the condition of 1 atm., 50% relative humidity and 28 °C

Doping time (h.)	Thickness (cm)	Applied voltage (V)	Current (A)	Conductivity (S/cm)
Sulfuric acid H_2SO_4	1.60E-3	0.075	2.70E-6	1.62E-4
	1.60E-3	0.1	3.62E-6	1.63E-4
	1.60E-3	0.25	9.53E-6	1.72E-4
	1.60E-3	0.5	1.85E-5	1.67E-4
	1.60E-3	0.75	3.00E-5	1.80E-4
Average				1.69E-4
Sulfuric acid H_2SO_4	2.50E-3	0.075	5.61E-6	2.16E-4
	2.50E-3	0.1	6.94E-6	2.00E-4
	2.50E-3	0.25	1.62E-5	1.87E-4
	2.50E-3	0.5	3.86E-5	2.23E-4
	2.50E-3	0.75	6.11E-5	2.35E-4
Average				2.12E-4
Sulfuric acid H_2SO_4	2.56E-3	0.05	4.21E-6	2.37E-4
	2.56E-3	0.075	5.67E-6	2.13E-4
	2.56E-3	0.1	6.73E-6	1.90E-4
	2.56E-3	0.5	3.40E-6	1.92E-4
	2.56E-3	0.75	4.73E-6	1.77E-4
Average				2.02E-4

Average conductivity	1.94E-4
STD	2.26E-5

Table M6 Raw data of conductivity measurement of PANI/CS film with 40 wt% PANI content doped with 1.0 M of perchloric acid for 10.0 h under the condition of 1 atm., 50% relative humidity and 28 °C

Doping time (h.)	Thickness (cm)	Applied voltage (V)	Current (A)	Conductivity (S/cm)
Perchloric acid $HClO_4$	2.13E-3	0.1	1.30E-6	4.40E-5
	2.13E-3	0.25	3.42E-6	4.63E-5
	2.13E-3	0.5	6.58E-6	4.46E-5
	2.13E-3	0.75	1.09E-5	4.92E-5
	2.13E-3	1	1.34E-5	4.52E-5
Average				4.59E-5
Perchloric acid $HClO_4$	1.88E-3	0.05	4.12-E7	3.54E-5
	1.88E-3	0.1	7.81E-7	3.35E-5
	1.88E-3	0.25	1.96E-6	3.37E-5
	1.88E-3	0.75	5.79E-6	3.31E-5
	1.88E-3	1	7.29E-6	3.13E-5
Average				3.34E-5
Perchloric acid $HClO_4$	1.85E-3	0.75	8.58E-7	4.46E-5
	1.85E-3	0.1	1.07E-6	4.17E-5
	1.85E-3	0.25	2.68E-6	4.18E-5
	1.85E-3	0.5	5.36E-6	4.18E-5
	1.85E-3	0.75	8.66E-6	4.50E-5
Average				4.30E-5

Average conductivity	4.07E-5
STD	6.52E-6

Appendix N UV-Vis Spectrum of Model Drug

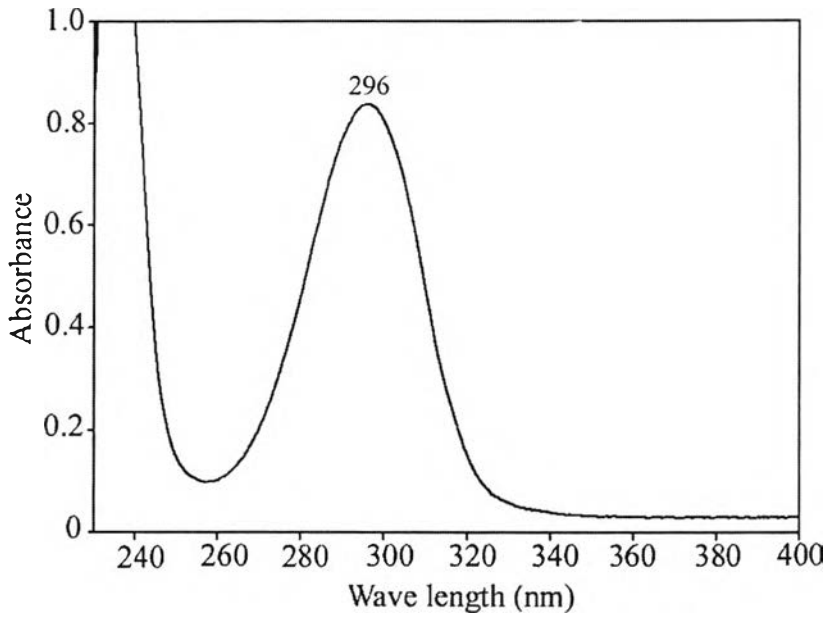

Figure N1 UV-Vis spectrum of salicylic acid.

Appendix O Calibration Curve of Model Drug

Table O1 Raw data of calibration curve of salicylic acid solution

Concentration (mg/ml)	Absorbance at 296 nm (A_{296})			Average	Standard deviation
	X1	X2	X3		
0	0	0	0	0	0
0.004	0.141	0.142	0.141	0.1413	0.0006
0.006	0.198	0.199	0.200	0.1990	0.0010
0.008	0.258	0.259	0.258	0.2583	0.0006
0.01	0.316	0.314	0.315	0.3150	0.0010
0.012	0.371	0.372	0.371	0.3713	0.0006

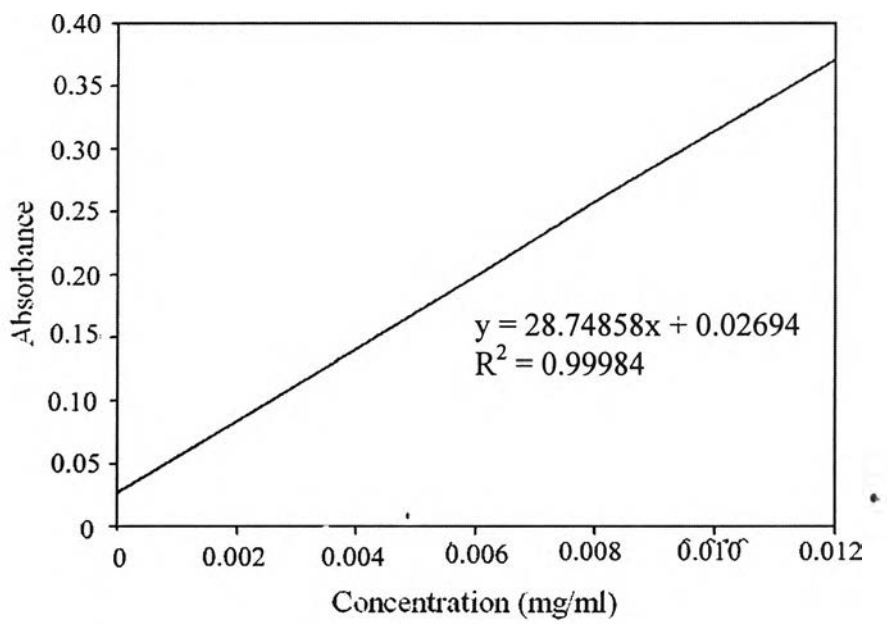

Figure O1 Calibration curve of salicylic acid solution.

Appendix P Data of Drug Release from PANI/Chitosan Blend Film with 40 wt% PANI Content

Table P1 The release of 10 % salicylic acid from PANI/chitosan blend film with 40 % PANI content and 0.01% glutaraldehyde at 37 °C, pH 5.5

Time (min)	Amount of drug release (%)			Average	Standard deviation
	X1	X2	X3		
0	0	0	0	0	0
15	0.000919	0.001062	0.000955	1.910479	0.09355
30	0.000812	0.000884	0.000812	1.632541	0.054031
45	0.000562	0.001027	0.000598	1.715583	0.463201
60	0.000955	0.000955	0.00142	2.166752	0.508868
90	0.000884	0.001277	0.000955	2.022149	0.350733
120	0.001277	0.001134	0.000776	2.081817	0.545428
150	0.001241	0.001706	0.001277	2.742964	0.431464
180	0.00167	0.00142	0.001885	3.243985	0.491741
240	0.00217	0.002135	0.001563	3.82704	0.713661
300	0.003136	0.0031	0.002492	5.690239	0.782678
360	0.003958	0.003457	0.003171	6.91048	0.984504
480	0.004816	0.004637	0.00428	8.952455	0.745275
600	0.006281	0.005638	0.004994	11.03786	1.553556
720	0.007389	0.00671	0.006138	13.20403	1.592264
840	0.008283	0.007532	0.006746	14.72068	1.893178
960	0.010356	0.00789	0.008033	17.1784	3.310727
1080	0.010821	0.009212	0.008855	18.86067	2.662803
1200	0.011035	0.009606	0.009641	19.76229	2.26272
1320	0.013395	0.01007	0.010893	22.45801	4.176033
1440	0.01318	0.01125	0.011071	23.17553	3.060954

Table P2 The release of 10 % salicylic acid from PANI/chitosan blend film with 40 % PANI content, 0.01% glutaraldehyde at 37 °C, pH 5.5, and 1 V of electrical potential

Time (min)	Amount of drug release (%)		Average	Standard deviation
	X1	X2		
0	0	0	0	0
15	2.702967	4.079867	3.391417	0.973616
30	3.79699	4.799209	4.298099	0.708676
45	3.724055	6.537618	5.130837	1.98949
60	4.161664	6.897289	5.529477	1.934379
90	5.255687	8.276028	6.765857	2.135703
120	6.057971	8.695644	7.376807	1.865116
150	7.151994	10.19427	8.673133	2.151216
180	8.100148	10.91361	9.506881	1.989421
240	9.48591	12.3523	10.9191	2.026842
300	10.87167	13.97082	12.42124	2.191426
360	12.33037	15.70923	14.0198	2.389212
480	15.46657	18.88632	17.17644	2.418128
600	18.2381	22.24325	20.24067	2.83207
720	21.22843	27.09881	24.16362	4.150985
840	22.76006	30.15601	26.45803	5.229726
960	25.16691	34.47206	29.81948	6.579734
1080	26.77148	40.04696	33.40922	9.387183
1200	43.10889	46.3412	44.72504	2.285588
1320	42.67128	52.63544	47.65336	7.045725
1440	43.5465	52.93517	48.24083	6.63879

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Publications:

1. Thanpitcha, T., Kritchayanon, N., Pentrakoon, D., and Pimpan, V. (2003). An Initial Study of Starch-g-polystyrene Foam Prepared by a Steaming Process. Journal of Metals, Material and Minerals. Vol. 12(2), pp. 1-6.

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