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APPENDICES

Appendix A Identification of FT-IR Spectrum

Synthesized Polydiphenylamine (PDPA) and De-doped Polydiphenylamine

Polydiphenylamine (PDPA) was synthesized via the oxidative polymerization of diphenylamine (DPA) to obtains doped-PDPA (D-PDPA) (Orlov *et al.*, 2006). The PDPA was dedoped by immersing in ammonium hydroxide solution to become neutral PDPA (De-PDPA). The polymers were first characterized for the functional groups by a FT-IR spectrometer (Thermo Nicolet, Nexus 670) in absorption mode with 32 scans and a resolution of ± 2 cm^{-1}, wavenumbers range of 4000-400 cm^{-1}, and using a deuterated triglycine sulfate as a detector. Optical grade KBr (Carlo Erba Reagent) was used as the background material. De-PDPA and D-PDPA were intimately mixed with dried KBr at a ratio of PDPA: KBr = 1:20.

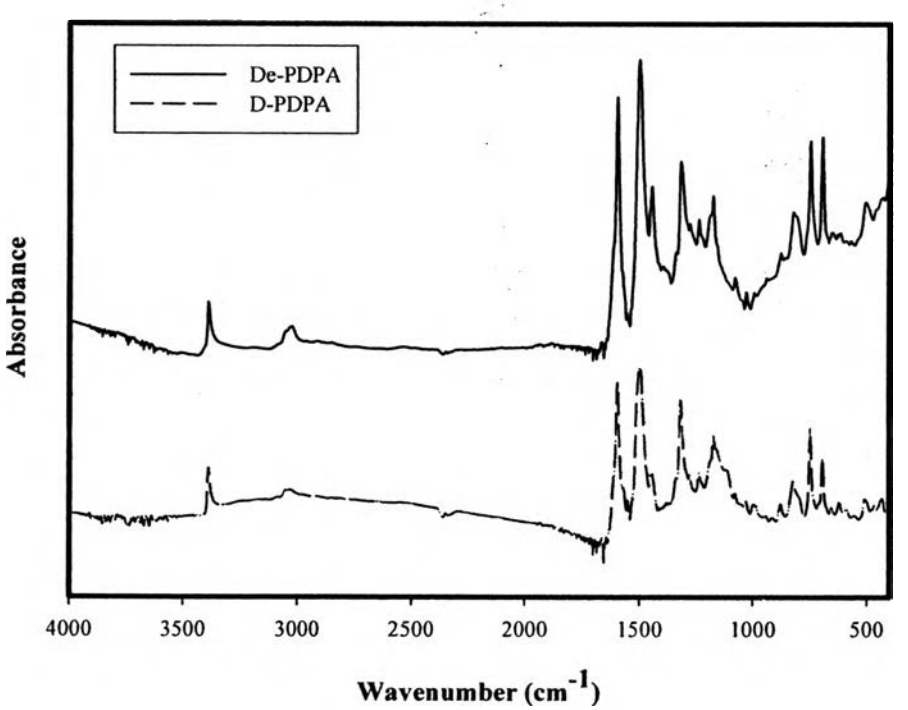


Figure A1 The FT-IR spectrum of dedoped-Polydiphenylamine (De-PDPA) and doped-polydiphenylamine (D-PDPA).

Table A1 The FT-IR Absorption Spectrum of D-PDPA and De-PDPA

Wavenumbers (cm^{-1})				Assignments	References
D-PDPA	De-PDPA	PDPA electrospun fiber	References		
3388	3388	3386	3383	N-H (stretching)	Athawale *et al.*,1999
3053	3027	3133	3100-3000	C-H Aromatic	Santana *et al.*,2003
1594	1595	1595	1595	Quinoid rings (stretching)	Athawale *et al.*,1999
1503	1498	1503	1494	Phenyl hydrogen	Hua *et al.*, 2003
1318	1317	1316	1299	Benzenoid rings (stretching)	Sathiyanarayanan *et al.*,2003
1173	1174	1173	1114	Vibration band of N_2 in quinone	Sathiyanarayanan *et al.*,2003
821	821	820	823	C-H out of plane aromatic	Sathiyanarayanan *et al.*,2003
748	748	747	799	1,4 substitued on aromatic rings	Sathiyanarayanan *et al.*,2003
694-748	694-748	693-747	699-750	C-H out of plane bending vibration	Athawale *et al.*,1999

Variation of Doping Mole Ratio ($N_{HCl}/N_{monomer}$) of PDPA

The dedoped-PDPA was doped with HCl at various doping mole ratios ($N_{HCl}/N_{monomer}$). The mole ratios chosen were 1:1, 10:1, 100:1, 200:1. The dedoped-PDPA powder was stirred with HCl solutions for 24 hrs, filttered, and vacuum dried at 25°C for 24 hrs. To compare peaks intensity of FT-IR spectra of De-PDPA and D-PDPA of various doping mole ratios (PDPA 1:1, 10:1, 100:1, 200:1) polymers were precisely mixed with dried-KBr, and the mixed samples were compressed into sample pellets. The FT-IR spectra of the polymer are compared to each others as in the following Figure A2.

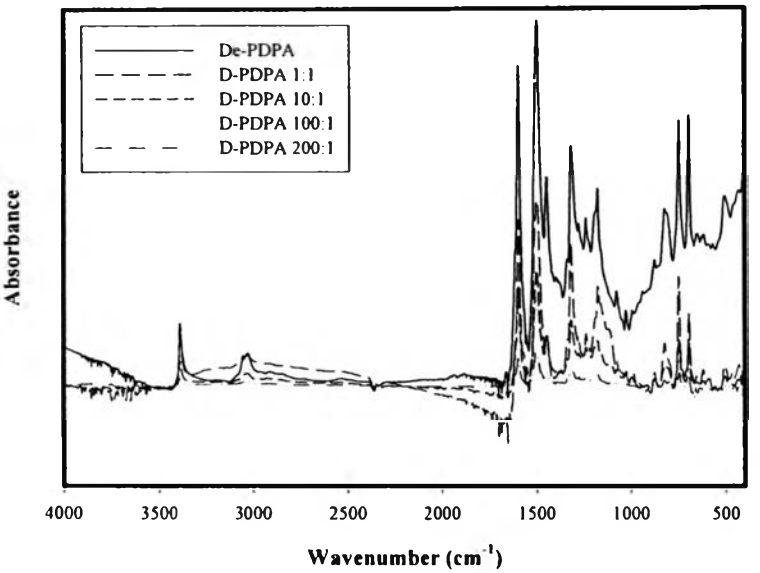


Figure A2 FT-IR spectra of dedoped-Polydiphenylamine (De-PDPA) and doped-polydiphenylamine (D-PDPA) at various doping levels 1:1, 10:1, 100:1, 200:1.

The spectra show above the N-H stretching peaks at 3400 cm^{-1} (Zhao *et al., 2005*); the peak intensity significantly decreases as the doping mole ratio is increased (Figure A3).

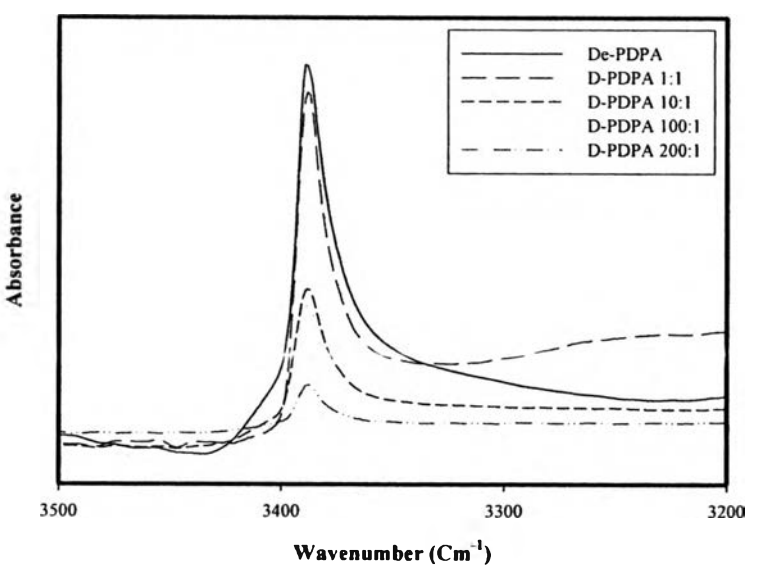


Figure A3 FT-IR spectra of dedoped-Polydiphenylamine (De-PDPA) and doped-Polydiphenylamine (D-PDPA) of various doping levels 1:1, 10:1, 100:1, 200:1.

Polydiphenylamine (PDPA) Electrospun Fiber

First, PDPA was dissolved in dichloromethane (DCM). The PDPA solutions were blended with polyethylene oxide (PEO) at various concentrations; 95:5, 97:3, 98:2 %w/w. The PDPA contents in the solutions were 30% and 50%. Then solutions were stirred and processed in an ultrasonic bath to ensure homogeneous PDPA solutions. Electrospinning of the PDPA solution was performed at a flow rate of 10 mL/h with a potential difference of 10 kV. A distance between the syringe tip and the collector is 15 cm. Membranes were accumulated on the collector (drum) with an aluminium foil laid on the collecting surface (Gopalan *et al.*, 2008).

In a typical electrospinning process, a solution droplet under the needle tip is highly electrified by a strong electric field and the induced charges are distributed over the surface. The droplet experiences two major types of electrostatic force: an electrostatic repulsion between the surface charges and a Coulombic force exerted by the external electric field. Under these electrostatic interactions, the droplet is distorted into a conical object commonly known as Taylor cone. When the intensity of electric field reaches a critical value, the electrostatic forces overcome the surface tension of the solution and an electrified jet is produced. The jet is subsequently stretched by the electric field force to form a continuous and thin fiber.

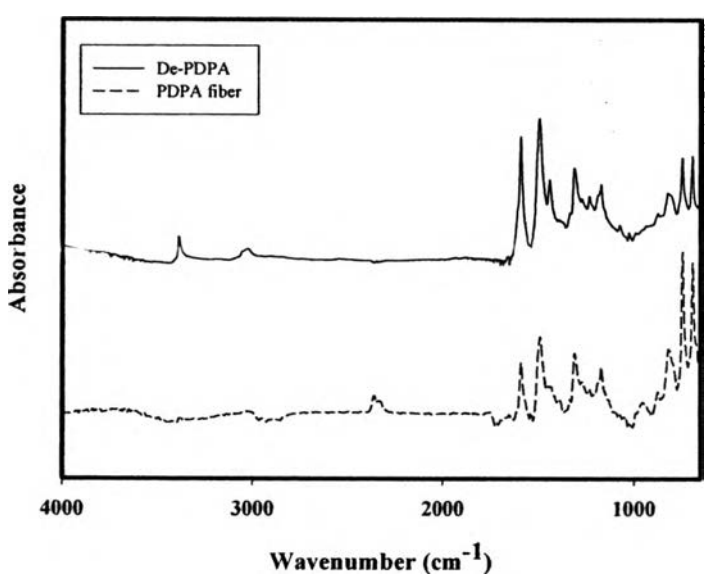


Figure A4 The FT-IR spectrum of de-doped-Polydiphenylamine (De-PDPA) and PDPA electrospun fiber.

Appendix B The Thermogravimetry Analysis

The Thermogravimetry Analysis of De-doped-Polydiphenylamine (De-PDPA)

The thermogravimetric analyzer (Perkin Elmer, TGA7) was used to determine the thermal behavior of polymers. The experiment was carried out by weighting a powder sample of 5-10 mg and placed it in a platinum pan, and then heated it under nitrogen flow with the heating rate 10 °C/min from 30-800°C. From Figure B1, the TGA thermogram of De-PDPA showed two-stage weight changes: 1) The decomposition of De-PDPA main chain around 300°C: 2) The complete degradation of De-PDPA at around 450°C.

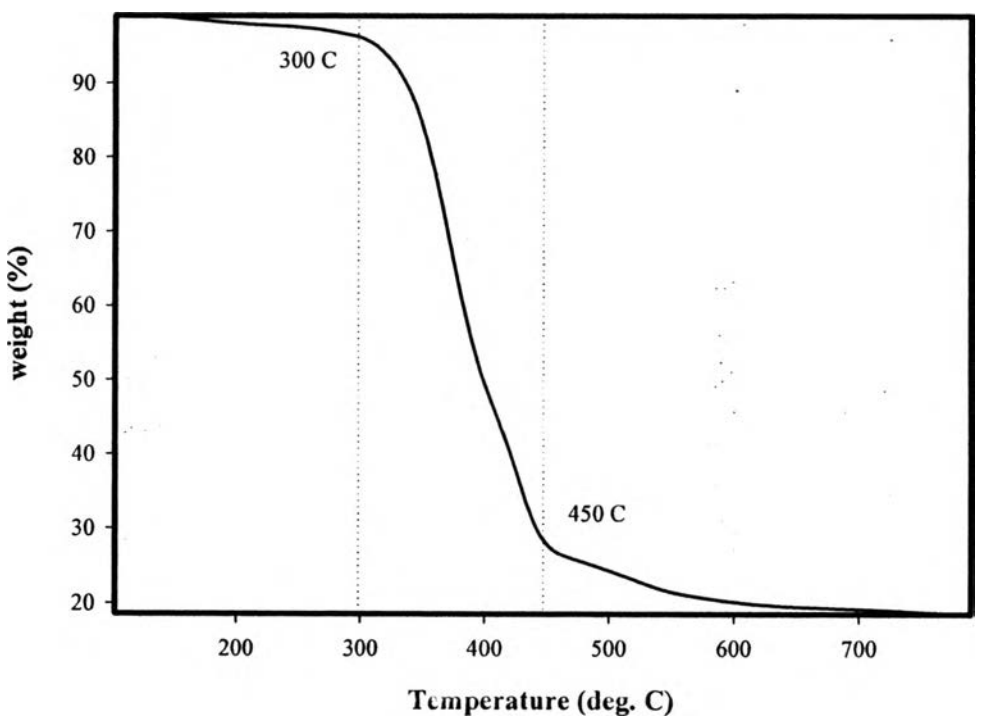


Figure B1 TGA thermogram of De-PDPA.

After doped De-PDPA with 5M HCl solution, 24 hr. The thermograms ship around 100-150°C, due to the chemi-absorb of HCl and PDPA main chain.

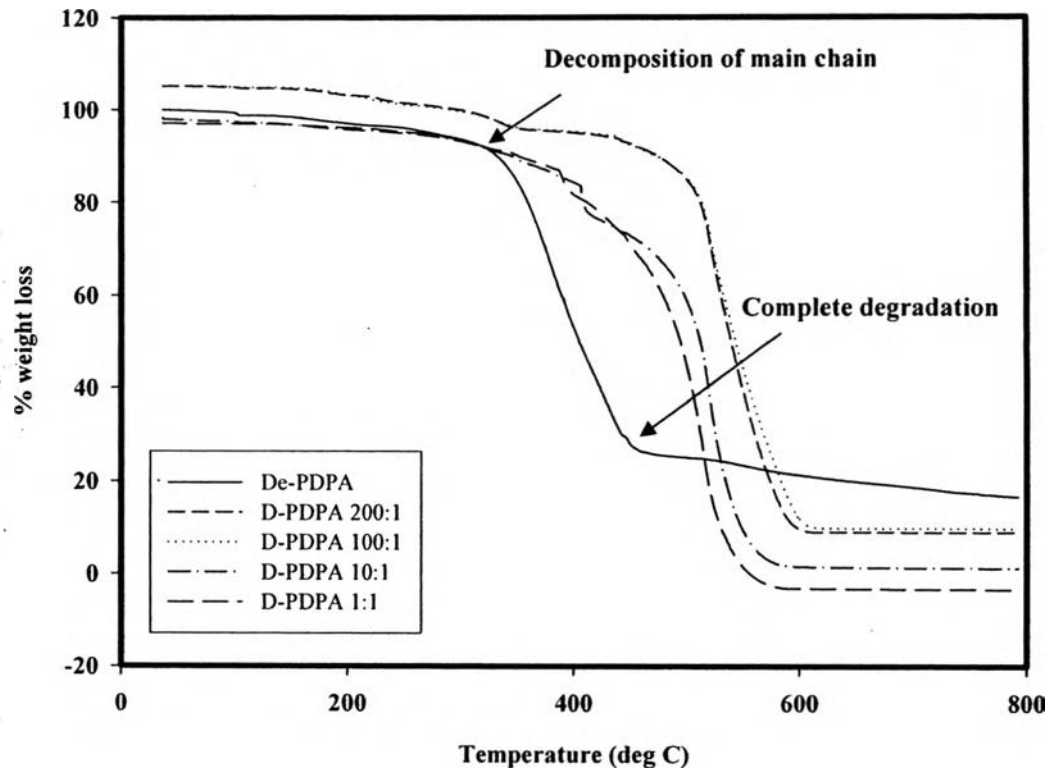


Figure B2 TGA thermograms of De-PDPA, D-PDPA 200:1, 100:1, 10:1, 1:1.

Polydiphenylamine (PDPA) Electrospun Fiber

The thermograms of De-PDPA and D-PDPA_100:1 electrospun fibers show two transition temperatures at 330, 295°C and 410, 342°C (fig. 2(b)). It is unambiguously observed that the De-PDPA electrospun fiber are highly stable than the D-PDPA electrospun fiber.

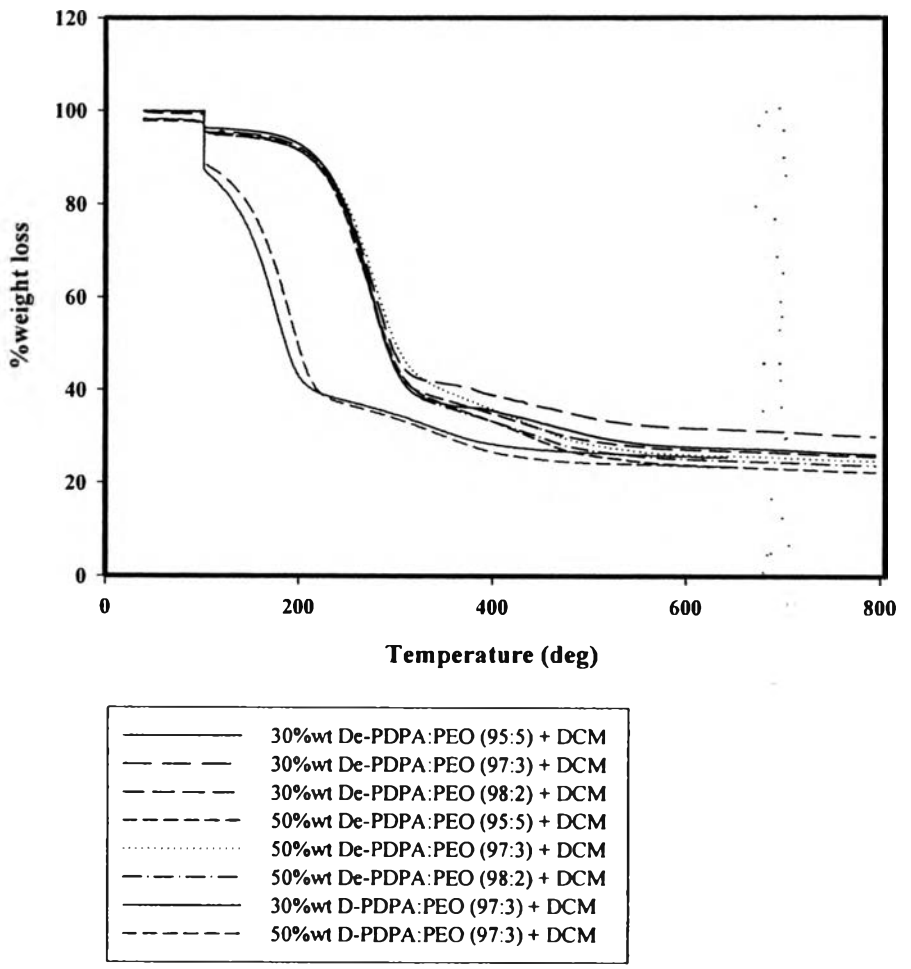


Figure B3 PDPA electrospun fibers at various PDPA:PEO contents.

Appendix C Determination of Particle Sizes of De-doped Polydiphenylamine (De-PDPA)

Table C1 Particle diameters of De-PDPA

Sample	Particle diameter (μm)			Average	STD (μm)
	1	2	3		
De-PDPA	122.65	122.91	132.31	125.96	5.5095

Table C2 The raw data from particle size analysis of De-PDPA

Size		De-PDPA					
Low (μm)	High (μm)	1		2		3	
		In%	Under%	In%	Under%	In%	Under%
0.05	1.32	0.59	0.59	1.08	1.08	0.68	0.69
1.32	1.60	1.39	1.98	2.44	3.53	1.62	2.30
1.60	1.95	1.77	3.75	3.03	6.55	2.07	4.37
1.95	2.38	1.64	5.39	2.68	9.23	1.92	6.29
2.38	2.90	1.21	6.60	1.78	11.01	1.42	7.70
2.90	3.53	0.79	7.39	0.89	11.90	0.91	8.61
3.53	4.30	0.60	7.99	0.40	12.29	0.67	9.28
4.30	5.24	0.74	8.74	0.44	12.74	0.79	10.08
5.24	6.39	1.15	9.88	0.93	13.67	1.20	11.28
6.39	7.78	1.60	11.48	1.54	15.20	1.63	12.91
7.78	9.48	1.88	13.36	1.91	17.12	1.85	14.76
9.48	11.55	2.11	15.47	2.21	19.32	1.98	16.74
11.55	14.08	2.43	17.90	2.62	21.95	2.16	18.90
14.08	17.15	2.88	20.78	3.24	25.19	2.42	21.31
17.15	20.90	3.39	24.18	3.93	29.13	2.66	23.98
20.90	25.46	3.83	28.01	4.37	33.50	2.79	26.77

25.46	31.01	4.18	32.19	4.38	37.88	2.85	29.62
31.01	37.79	4.61	36.80	4.13	42.01	3.10	32.72
37.79	46.03	5.14	41.94	3.81	45.82	3.66	36.38
46.03	56.09	5.57	47.50	3.53	49.35	4.43	40.81
56.09	68.33	5.63	53.13	3.36	52.71	5.16	45.97
68.33	83.26	5.07	58.20	3.24	55.95	5.46	51.42
83.26	101.44	3.93	62.13	3.07	59.02	5.01	56.43
101.44	123.59	2.62	64.75	2.85	61.88	3.96	60.39
123.59	150.58	1.88	66.64	2.84	64.72	3.05	63.44
150.57	183.44	2.50	69.13	3.55	68.27	3.32	66.77
183.44	223.51	4.65	73.79	5.32	73.60	5.22	71.99
223.51	272.31	7.73	81.52	7.91	81.51	8.27	80.26
272.31	331.77	9.55	91.06	9.53	91.03	10.19	90.44
331.77	404.21	7.22	98.25	7.26	98.26	7.72	98.13
404.21	429.47	1.72	99.98	1.71	99.98	1.84	99.98
492.47	600.00	0.00	100.00	0.00	100.00	0.00	100.00

Appendix D XRD Patterns of De-doped and Doped Polydiphenylamine (De-PDPA, D-PDPA)

The XRD patterns of De-PDPA and D-PDPA at various doping mole ratios (1:1, 10:1, 100:1, 200:1) were recorded on a X-ray diffractometer (Rigaku D/MAX 2200) operated at scan range 5-90 degree, scan step 0.05 degree, scan speed 5 degree/min 30MA and 40 KVP. From Figure E1, the XRD peaks of D-PDPA are sharper than that of De-PDPA, so the crystalline phase of D-PDPA is higher than that of De-PDPA. The doping level has no effect on the crystalline phase of polydiphenylamine, as shown in Figure E2 and E3.

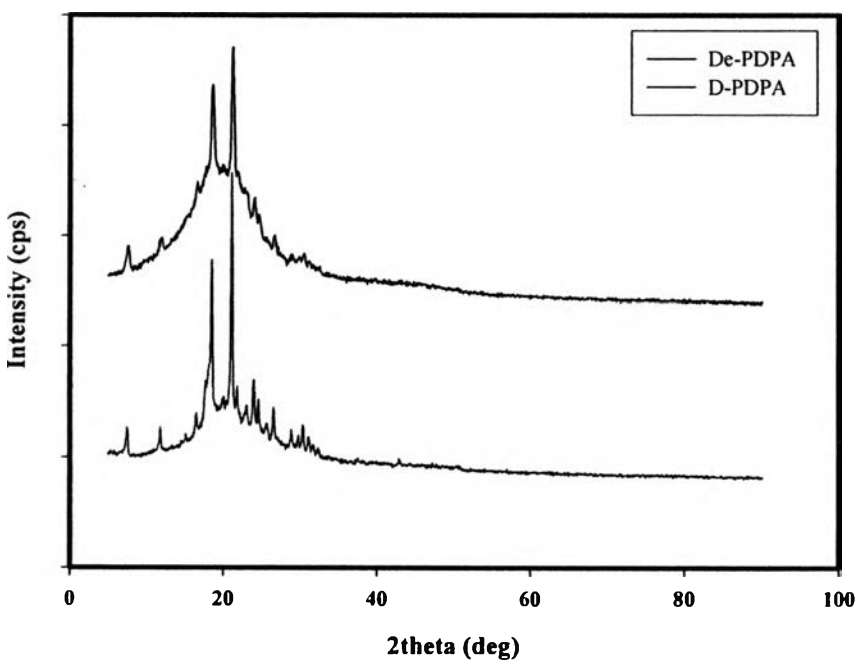


Figure D1 XRD patterns of de-doped-polydiphenylamine (De-PDPA) and doped-polydiphenylamine (D-PDPA).

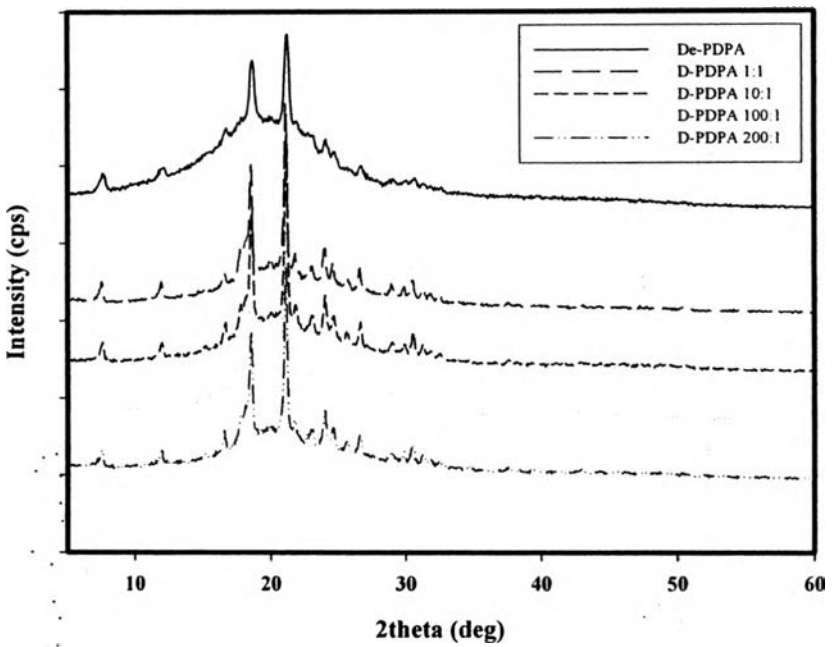


Figure D2 XRD patterns of de-doped-polydiphenylamine (De-PDPA) and doped-polydiphenylamine (D-PDPA) of various doping levels 1:1, 10:1, 100:1, 200:1.

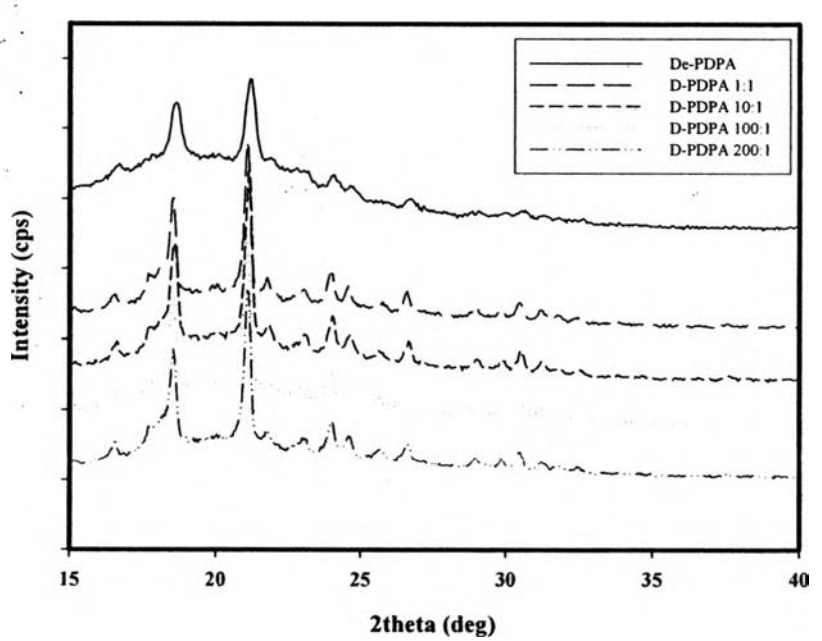


Figure D3 XRD patterns of dedoped-polydiphenylamine (De-PDPA) and doped-polydiphenylamine (D-PDPA) of various doping levels 1:1, 10:1, 100:1, 200:1.

The XRD pattern of the De-PDPA electrospun fiber shows two peaks at 18.6 and 21.2 Å for De-PDPA fiber. The D-PDPA fiber has the peaks as those of the De-PDPA fiber as can be seen in Figure D4. This can be attributed to the fact that the electrospinning process does not interrupt the orientation of PDPA molecules.

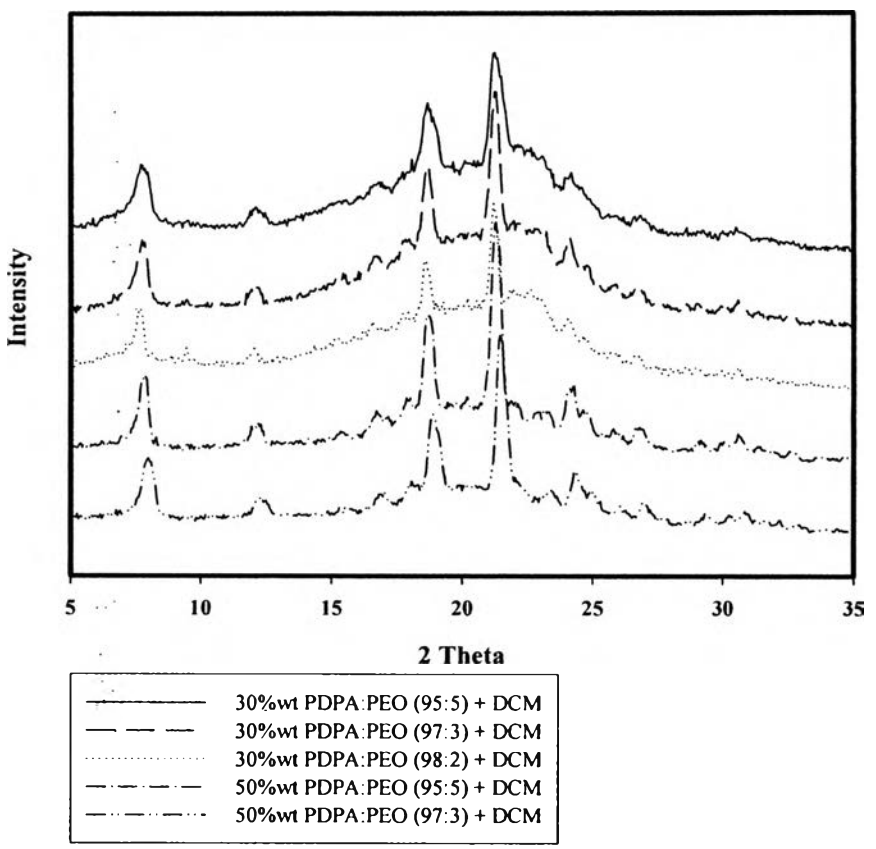


Figure D4 XRD patterns of PDPA electrospun fiber as various PEO content.

Appendix E Correction Factor (K) Measurement

A two point probe meter connected with a source power supplier (Keithley/ Model 6517A) was employed to determine the electrical conductivity of materials. A constant voltage was applied and the current was simultaneously measured.

According to the geometric effects of the probe, the geometrical correction factor depends on the configuration and probe tip spacing:

$$K = w/l \tag{E.1}$$

Where, K is the geometric correction factor, w is the probe width or the tip spacing (cm), and l is the probe length (cm).

The geometric correction factor can be determined by using standard materials whose specific resistivity values are known. In our case, silicon wafer chips were used as the standard materials. The resistance was measured by using our custom-made two-point probe, obtained by applying various voltages and simultaneously measuring currents. The geometric correction factor was calculated via the equation:

$$K = \rho/R \times t = I \times \rho/V \times t \tag{E.2}$$

Where, ρ is the resistivity of a standard silicon wafer (Ω.cm), R is the resistance of film (Ω), t is the film thickness (cm), I is the measured current (A) and V is the applied voltage (V).

Table E1 Voltage-current data of the probe number 1 calibration with Si-wafer whose sheet resistivity of 107.373 Ω/sq, 25°C, 60-65 %RH

V			I			K=I/V*ρ/t		
1	2	3	1	2	3	1	2	3
6	6	6	3.95133E-05	3.98508E-05	3.94E-05	0.000707	0.00071315	0.000706
5	5	5	3.24104E-05	3.20105E-05	3.22E-05	0.000696	0.000687413	0.000692
4	4	4	2.69673E-05	2.68025E-05	2.65E-05	0.000724	0.000719465	0.00071
3	3	3	2.13034E-05	2.11894E-05	2.15E-05	0.000762	0.000758388	0.000769
2	2	2	1.63918E-05	1.61998E-05	1.62E-05	0.00088	0.00086971	0.000872
1	1	1	8.27043E-06	8.2819E-06	8.22E-06	0.000888	0.000889252	0.000883
0.9	0.9	0.9	7.01924E-06	7.0205E-06	7E-06	0.000837	0.000837569	0.000836
0.7	0.7	0.7	4.52863E-06	4.53443E-06	4.5E-06	0.000695	0.000695536	0.00069
0.5	0.5	0.5	2.46653E-06	2.46679E-06	2.47E-06	0.00053	0.000529734	0.000529

Correction factor (K)				
1	2	3	Avg.	SD
0.000747	0.000744469	0.000743	0.000744651	8.09136E-05

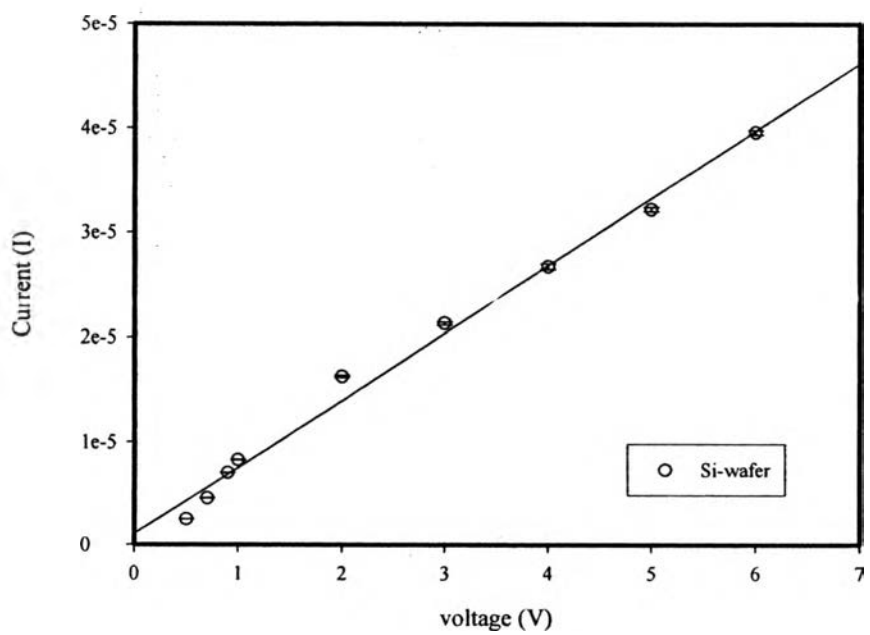


Figure E1 Voltage vs. current data of the probe number 1 calibration with Si-wafer whose sheet resistivity of 107.373 Ω/sq, 25°C, 60-65 %RH.

Appendix F Conductivity Measurement

The electrical conductivity (σ) can be measured by using the two-point probe mater connected with a voltage supplier (Keithley, 6517A) whose constant voltage can be varied and the current is measured. The conductivity measurement was performed under atmospheric pressure, 40-70 %RH and at 25-27°C. The regime where responsive current is linearly proportional to the applied voltage is called the linear Ohmic regime which can be identified by plotting the applied voltage against with the current. The voltage and the current in the regime were converted to the electrical conductivity by following equation:

$$\sigma = 1/\rho = 1/R \times t = I/(R_s \times V \times t) \qquad \text{(F.1)}$$

where, σ is the specific conductivity (S/cm), ρ is the specific resistivity (Ω.cm), R_s is the sheet resistance (Ω/sq), t is the thickness of sample pellet (cm), V is the applied voltage (Voltage drop)(V), I is the measured current (A), and K is the geometric correction factor of the two-point probe meter. All sample thicknesses were measured by using a thickness gauge.

Table F1 The specific conductivity (S/cm) of De-PDPA, D-PDPA with various doping levels

Samples	Specific conductivity(S/cm)
De-PDPA	1.52×10^{-6}
D-PDPA 1:1	1.26×10^{-5}
D-PDPA 10:1	1.31×10^{-4}
D-PDPA 100:1	9.80×10^{-4}
D-PDPA 200:1	3.15×10^{-5}
D-PDPA 300:1	1.04×10^{-6}

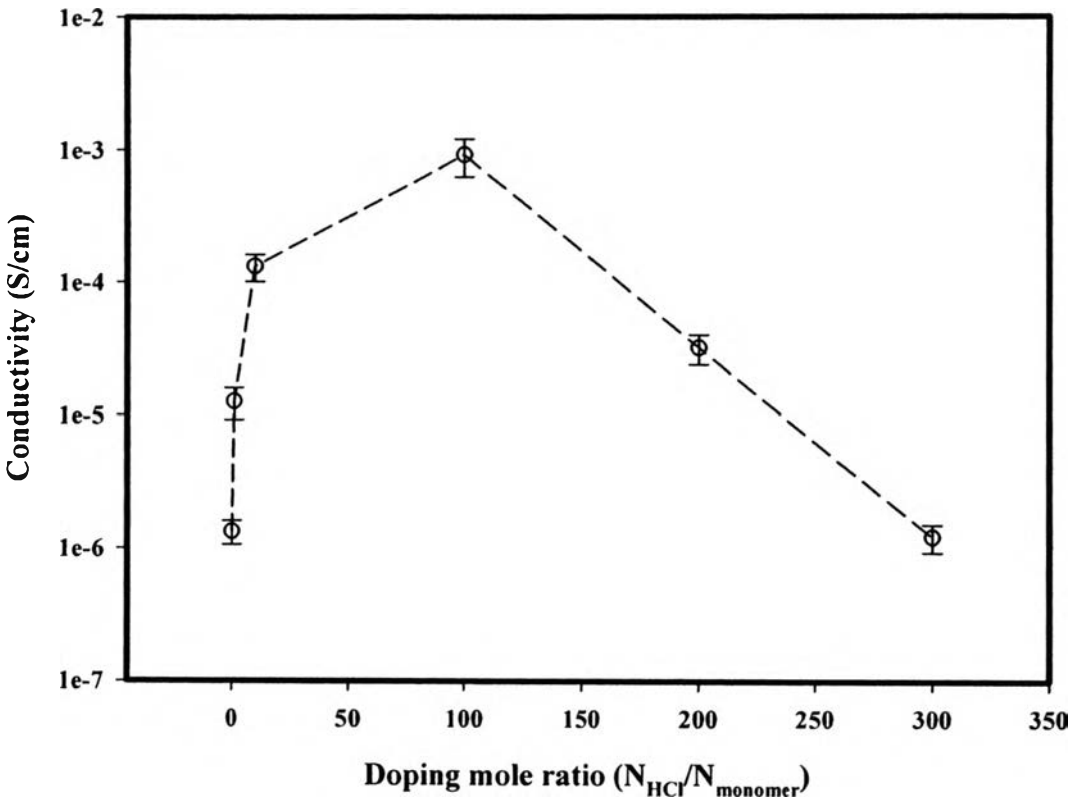
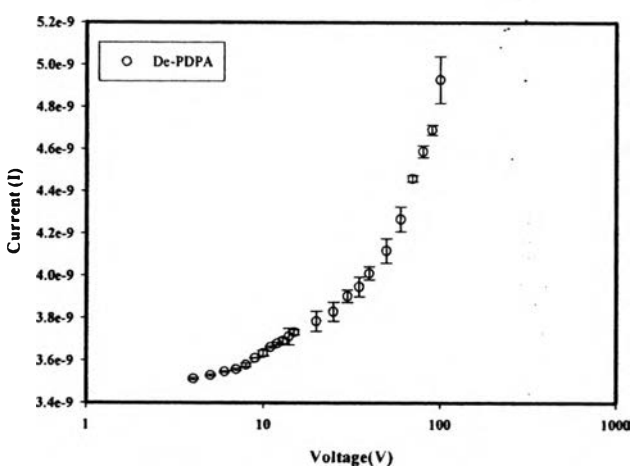


Figure F1 Specific conductivity versus doping moles ratio ($N_{HCl}/N_{monomer}$) of PDPA.

Table F2 Voltage-current data in linear regime of De-PDPA at 25°C, 70 %RH

V			I			I,avg
1	2	3	1	2	3	
15	15	15	3.72E-09	3.74E-09	3.74E-09	3.73E-09
14	14	14	3.75E-09	3.68E-09	3.71E-09	3.71E-09
13	13	13	3.69E-09	3.71E-09	3.68E-09	3.69E-09
12	12	12	3.68E-09	3.67E-09	3.68E-09	3.68E-09
11	11	11	3.67E-09	3.66E-09	3.66E-09	3.66E-09
10	10	10	3.64E-09	3.62E-09	3.64E-09	3.63E-09
9	9	9	3.61E-09	3.61E-09	3.61E-09	3.61E-09
8	8	8	3.58E-09	3.59E-09	3.57E-09	3.58E-09
7	7	7	3.56E-09	3.56E-09	3.55E-09	3.56E-09
6	6	6	3.54E-09	3.55E-09	3.55E-09	3.55E-09
5	5	5	3.53E-09	3.53E-09	3.52E-09	3.53E-09
4	4	4	3.52E-09	3.51E-09	3.51E-09	3.51E-09



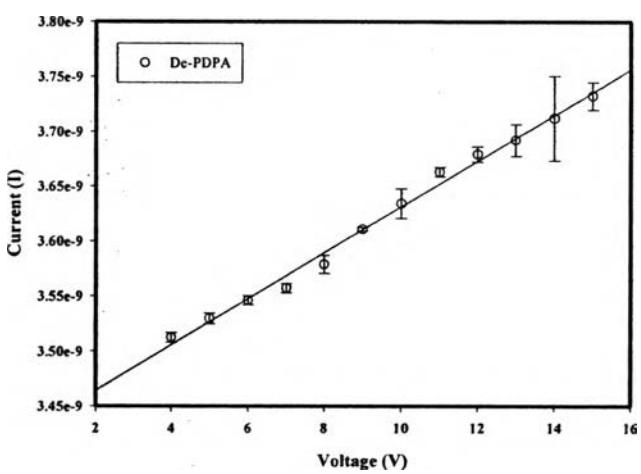


Figure F2 The Ohmic regime of De-PDPA at thickness = 0.0177 cm, 25°C, 70 %RH.

K = 7.45E-04

Thickness (t) = 0.0177 cm

I/V (slope) = 2.00E-11

Thickness (cm)			avg
0.0177	0.0170	0.0185	0.0177

Specific conductivity (σ) = I/(V*K*t)

σ = 2.00E-11/(7.45E-04*0.0177) = 1.52E-06 S/cm

Table F3 Voltage-current data in linear regime of D-PDPA 1:1 at 25°C, 70 %RH

V			I			I,avg
1	2	3	1	2	3	
15	15	15	6.51E-09	6.46E-09	6.40E-09	6.45E-09
14	14	14	6.19E-09	6.32E-09	6.28E-09	6.26E-09
13	13	13	6.00E-09	5.96E-09	5.94E-09	5.96E-09
12	12	12	5.75E-09	5.74E-09	5.58E-09	5.69E-09
11	11	11	5.58E-09	5.49E-09	5.51E-09	5.53E-09
10	10	10	5.29E-09	5.27E-09	5.29E-09	5.28E-09
9	9	9	5.10E-09	5.06E-09	5.09E-09	5.08E-09
8	8	8	4.92E-09	4.89E-09	4.89E-09	4.90E-09
7	7	7	4.58E-09	4.56E-09	4.59E-09	4.58E-09
6	6	6	4.42E-09	4.4E-09	4.45E-09	4.42E-09
5	5	5	4.26E-09	4.24E-09	4.14E-09	4.21E-09

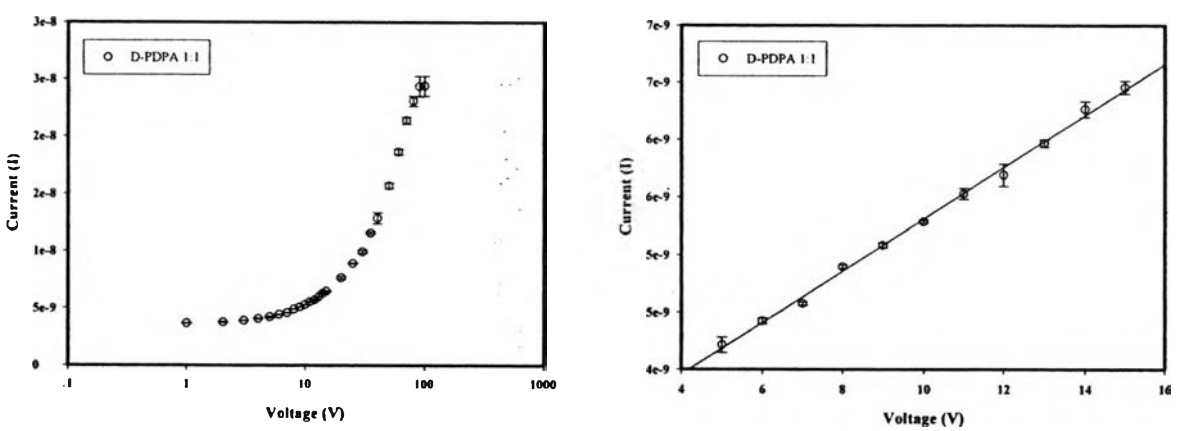


Figure F3 The Ohmic regime of D_PDPA 1:1 at thickness = 0.0213 cm, 25°C, 70 %RH.

Thickness (cm)			avg
0.0225	0.0228	0.0187	0.0213

K = 7.45E-04

Thickness (t) = 0.0213 cm

I/V (slope) = 2.00E-10

Specific conductivity (σ) = I/(V*K*t)

σ = 2.00E-10/(7.45E-04*0.0213) = 1.26E-05 S/cm

Table F4 Voltage-current data in linear regime of D_PDPA 10:1 at 25°C, 70 %RH

V			I			I,avg
1	2	3	1	2	3	
8	8	8	2.18E-08	2.13E-08	2.07E-08	2.12E-08
7	7	7	2.03E-08	2.01E-08	1.97E-08	2.00E-08
6	6	6	1.76E-08	1.71E-08	1.67E-08	1.71E-08
5	5	5	1.53E-08	1.52E-08	1.47E-08	1.51E-08
4	4	4	1.29E-08	1.33E-08	1.30E-08	1.31E-08
3	3	3	1.02E-08	1.05E-08	1.04E-08	1.04E-08
2	2	2	7.42E-09	7.51E-09	7.53E-09	7.49E-09
1	1	1	5.07E-09	5.12E-09	5.19E-09	5.13E-09

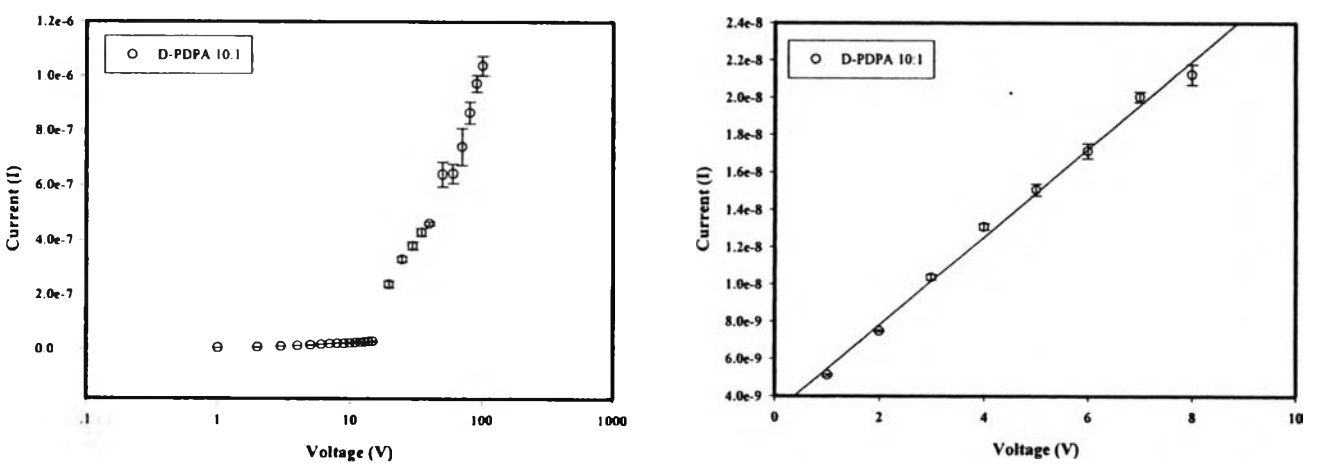


Figure F4 The Ohmic regime of D-PDPA 10:1 at thickness = 0.0205 cm, 25°C, 70 %RH.

Thickness (cm)			avg
0.0201	0.0207	0.0207	0.0205

K = 7.45E-04

Thickness (t) = 0.0205 cm

I/V (slope) = 2.00E-9

Specific conductivity (σ) = I/(V*K*t)

σ = 2.00E-9/(7.45E-04*0.0205) = 1.31E-04 S/cm

Table F5 Voltage-current data in linear regime of D-PDPA 100:1 at 25°C, 70 %RH

V			I			I,avg
1	2	3	1	2	3	
15	15	15	3.69E-07	3.68E-07	3.63E-07	3.67E-07
14	14	14	3.57E-07	3.53E-07	3.46E-07	3.52E-07
13	13	13	3.50E-07	3.28E-07	3.24E-07	3.34E-07
12	12	12	3.18E-07	3.13E-07	3.16E-07	3.15E-07
11	11	11	2.75E-07	2.77E-07	2.87E-07	2.80E-07
10	10	10	2.56E-07	2.49E-07	2.65E-07	2.57E-07
9	9	9	2.38E-07	2.53E-07	2.48E-07	2.47E-07
8	8	8	2.08E-07	2.24E-07	2.09E-07	2.14E-07
7	7	7	2.05E-07	2.01E-07	2.02E-07	2.03E-07
6	6	6	1.98E-07	1.91E-07	1.87E-07	1.92E-07

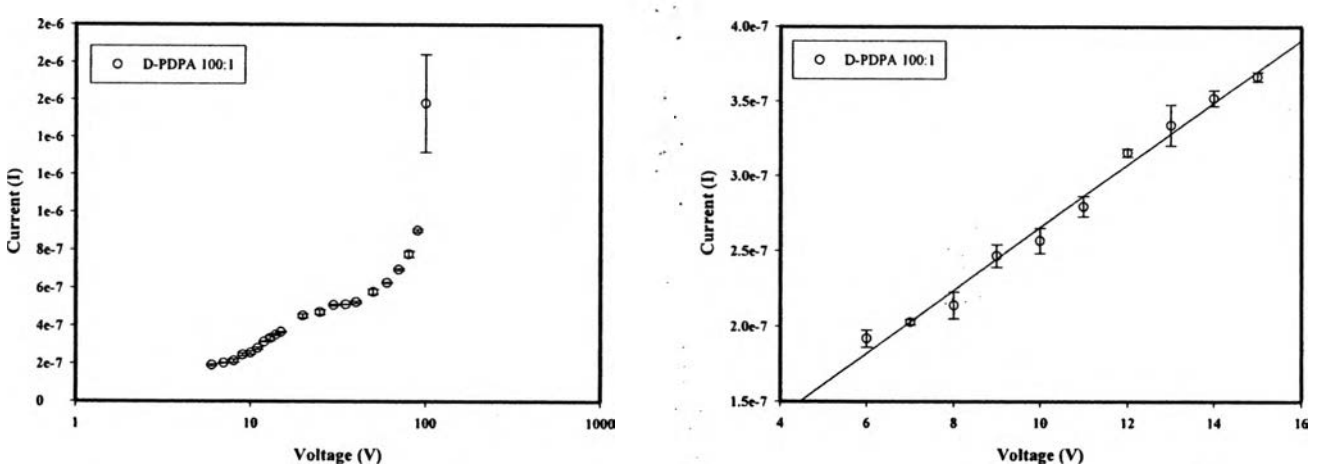


Figure F5 The Ohmic regime of D-PDPA 100:1 at thickness = 0.0274 cm, 25°C, 70 %RH.

Thickness (cm)			avg
0.0287	0.0300	0.0234	0.0274

K = 7.45E-04

Thickness (t) = 0.0274 cm

I/V (slope) = 2.00E-8

Specific conductivity (σ) = I/(V*K*t)

σ = 2.00E-8/(7.45E-04*0.0274) = 9.80E-04 S/cm

Table F6 Voltage-current data in linear regime of D-PDPA 200:1 at 25°C, 70 %RH

V			I			I,avg
1	2	3	1	2	3	
15	15	15	1.53E-08	1.55E-08	1.58E-08	1.55E-08
14	14	14	1.53E-08	1.5E-08	1.52E-08	1.52E-08
13	13	13	1.51E-08	1.49E-08	1.47E-08	1.49E-08
12	12	12	1.35E-08	1.42E-08	1.47E-08	1.41E-08
11	11	11	1.37E-08	1.35E-08	1.32E-08	1.35E-08
10	10	10	1.38E-08	1.31E-08	1.25E-08	1.31E-08
9	9	9	1.28E-08	1.26E-08	1.25E-08	1.26E-08
8	8	8	1.21E-08	1.20E-08	1.23E-08	1.21E-08
7	7	7	1.21E-08	1.12E-08	1.19E-08	1.17E-08
6	6	6	1.14E-08	1.11E-08	1.10E-08	1.11E-08
5	5	5	1.07E-08	1.05E-08	1.02E-08	1.05E-08

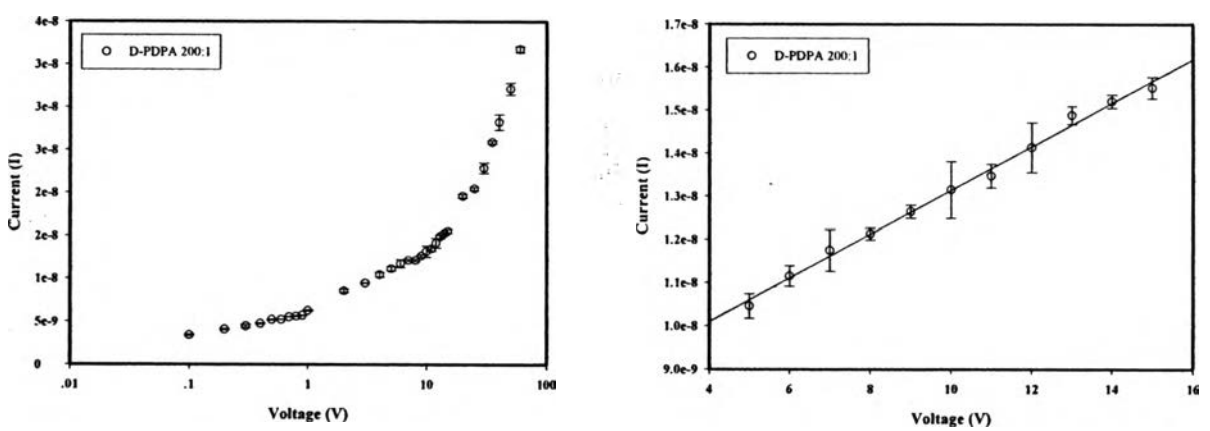


Figure F6 The Ohmic regime of D-PDPA 200:1 at thickness = 0.0213 cm, 25°C, 70 %RH.

Thickness (cm)			avg
0.0226	0.0202	0.0211	0.0213

K = 7.45E-04

Thickness (t) = 0.0213 cm

I/V (slope) = 5.00E-10

Specific conductivity (σ) = I/(V*K*t)

σ = 5.00E-10/(7.45E-04*0.0213) = 3.15E-05 S/cm

Appendix G Sensitivity Measurements when Exposed to Methanol

Sensitivity measurements of dedoped-polydiphenylamine (De-PDPA) doped-polydiphenylamine (D-PDPA), and polydiphrnylamine electrospun fiber were carried out by using the two point probe at the 10% v/v methanol (CH_3OH) vapor of 1 atm, 60-70% relative humidity and 25±2°C. The electrical response of sample was calculated from the difference between the equilibrium conductivity of sample upon exposed to CH_3OH vapor and the steady state of final conductivity of sample in N_2 (Densakulprasert *et al*., 2003).

$$\Delta\sigma = \sigma_{CH_3OH} - \sigma_{N_2 initial} \tag{G.1}$$

The sensitivity is defined as the electrical response divided by it's conductivity at the final N_2 (Densakulprasert *et al*., 2003).

$$sensitivity = \Delta\sigma / \sigma_{N_2 initial} \tag{G.2}$$

Table G1 The electrical conductivity (σ), response (Δσ), sensitivity ($\Delta\sigma/\sigma_i$), the induction time (t_i) and the recovery time (t_r) for 10%v/v of methanol absorbed on dedoped PDPA, doped PDPA pellet, doped PDPA film and PDPA electrospun fibers. Measurements were made under chamber temperature of 25±1 °C and at atmospheric pressure

Materials	t_i(min)	t_r (min)	σ (S/cm)				Response (Δσ S/cm)	Sensitivity ($\Delta\sigma/\sigma_i$)	Recovery (Δσ, S/cm)
			Air	N_2(initial)	Methanol	N_2(final)			
De-PDPA	-	-	$(2.82 \pm 0.06)\times10^{-5}$	$(2.77 \pm 0.02)\times10^{-5}$	$(2.78 \pm 0.02)\times10^{-5}$	$(2.75 \pm 0.03)\times10^{-5}$	$(1.29 \pm 3.18)\times10^{-7}$	0.0046 ± 0.012	$(-3.33 \pm 0.09)\times10^{-7}$
D-PDPA 1:1	30	27	$(3.34 \pm 0.05)\times10^{-5}$	$(2.26 \pm 0.02)\times10^{-5}$	$(2.71 \pm 0.02)\times10^{-5}$	$(2.29 \pm 0.004)\times10^{-5}$	$(4.48 \pm 0.33)\times10^{-6}$	0.198 ± 0.016	$(-4.20 \pm 0.18)\times10^{-6}$
D-PDPA 10:1	20	67	$(1.57 \pm 0.01)\times10^{-4}$	$(9.01 \pm 0.14)\times10^{-5}$	$(1.08 \pm 0.004)\times10^{-4}$	$(7.99 \pm 0.03)\times10^{-5}$	$(1.80 \pm 0.18)\times10^{-5}$	0.200 ± 0.023	$(-2.83 \pm 0.07)\times10^{-5}$
D-PDPA 100:1	30	17	$(1.79 \pm 0.04)\times10^{-4}$	$(1.94 \pm 0.002)\times10^{-5}$	$(2.51 \pm 0.02)\times10^{-5}$	$(1.86 \pm 0.007)\times10^{-5}$	$(5.71 \pm 0.02)\times10^{-6}$	0.294 ± 0.009	$(-6.42 \pm 0.23)\times10^{-6}$
D-PDPA 200:1	29	34	$(5.43 \pm 0.02)\times10^{-5}$	$(2.41 \pm 0.02)\times10^{-5}$	$(2.55 \pm 0.01)\times10^{-5}$	$(2.34 \pm 0.001)\times10^{-5}$	$(1.43 \pm 0.11)\times10^{-6}$	0.059 ± 0.005	$(-2.13 \pm 0.07)\times10^{-6}$
30% wt De-PDPA:PEO (95:5) fiber	20	15	$(3.58 \pm 2.16)\times10^{-5}$	$(3.33 \pm 1.98)\times10^{-5}$	$(3.62 \pm 1.79)\times10^{-5}$	$(3.41 \pm 2.04)\times10^{-5}$	$(2.95 \pm 0.21)\times10^{-6}$	0.0886 ± 0.056	$(-2.15 \pm 0.5)\times10^{-7}$
30% wt De-PDPA:PEO (97:3) fiber	33	30	$(2.18 \pm 0.14)\times10^{-5}$	$(2.05 \pm 0.28)\times10^{-5}$	$(2.42 \pm 0.30)\times10^{-5}$	$(2.32 \pm 0.26)\times10^{-5}$	$(4.50 \pm 3.11)\times10^{-6}$	0.178 ± 0.165	$(-9.50 \pm 4.64)\times10^{-7}$
30% wt De-PDPA:PEO (98:2) fiber	25	33	$(3.79 \pm 1.14)\times10^{-5}$	$(3.60 \pm 0.84)\times10^{-5}$	$(3.76 \pm 0.93)\times10^{-5}$	$(3.60 \pm 0.86)\times10^{-5}$	$(1.62 \pm 0.45)\times10^{-6}$	0.0451 ± 0.16	$(-1.59 \pm 0.69)\times10^{-6}$
50% wt De-PDPA:PEO (95:5) fiber	27	18	$(2.10 \pm 0.01)\times10^{-5}$	$(2.04 \pm 0.04)\times10^{-5}$	$(2.08 \pm 0.06)\times10^{-5}$	$(2.03 \pm 0.06)\times10^{-5}$	$(4.00 \pm 1.41)\times10^{-7}$	0.0196 ± 0.01	$(-5.00 \pm 0.01)\times10^{-7}$
50% wt De-PDPA:PEO (97:3) fiber	26	22	$(9.45 \pm 0.29)\times10^{-6}$	$(8.72 \pm 0.54)\times10^{-6}$	$(9.56 \pm 0.14)\times10^{-6}$	$(8.80 \pm 0.60)\times10^{-6}$	$(8.39 \pm 0.40)\times10^{-7}$	0.0962 ± 0.051	$(-7.61 \pm 4.54)\times10^{-7}$
50% wt De-PDPA:PEO (98:2) fiber	30	29	$(2.35 \pm 1.79)\times10^{-5}$	$(2.39 \pm 1.91)\times10^{-5}$	$(2.44 \pm 1.85)\times10^{-5}$	$(2.29 \pm 1.71)\times10^{-5}$	$(5.01\pm 5.68)\times10^{-7}$	0.021 ± 0.059	$(-1.5 \pm 1.43)\times10^{-6}$
30% wt D-PDPA(100:1):PEO (97:3) fiber	25	20	$(1.06 \pm 0.69)\times10^{-4}$	$(5.62 \pm 3.08)\times10^{-5}$	$(5.88 \pm 3.07)\times10^{-5}$	$(5.39 \pm 3.18)\times10^{-5}$	$(2.59 \pm 0.13)\times10^{-6}$	0.0461 ± 0.032	$(-4.89 \pm 1.12)\times10^{-6}$
50% wt D-PDPA(100:1):PEO (97:3) fiber	26	28	$(6.37 \pm 1.45)\times10^{-5}$	$(4.45 \pm 0.45)\times10^{-5}$	$(4.61 \pm 0.39)\times10^{-5}$	$(4.43 \pm 0.45)\times10^{-5}$	$(1.61 \pm 0.55)\times10^{-6}$	0.0362 ± 0.016	$(-1.76 \pm 0.61)\times10^{-6}$
30% wt PDPA(100:1):PEO(97:3) film	33	15	$(3.76 \pm 0.5)\times10^{-4}$	$(8.52 \pm 0.14)\times10^{-5}$	$(1.92 \pm 0.14)\times10^{-4}$	$(7.88 \pm 0.58)\times10^{-5}$	$(1.07 \pm 0.13)\times10^{-4}$	1.25 ± 0.13	$(-1.13 \pm 0.20)\times10^{-4}$
50% wt PDPA(100:1):PEO(97:3) film	30	20	$(8.59 = 0.74)\times10^{-5}$	$(7.48 \pm 0.98)\times10^{-5}$	$(1.54 \pm 1.07)\times10^{-4}$	$(5.48 \pm 1.77)\times10^{-5}$	$(7.88 \pm 9.69)\times10^{-5}$	1.05 ± 1.169	$(-9.88 \pm 8.90)\times10^{-5}$

Table G2 The conductivity response of De-PDPA exposed to MetOH

Sample name : De-PDPA_1

Room Temperature : 25°C Humidity : 70 % thickness : 0.0177 cm.

Chamber Temperature : 25°C Applied Voltage : 10 V K : 7.45E-4

Sample name : De-PDPA_2

Room Temperature : 25°C Humidity : 70 % thickness : 0.0176 cm.

Chamber Temperature : 25°C Applied Voltage : 10 V K : 7.45E-4

Sample	σ_{air}	$\sigma_{N2\ initial}$	σ_{MetOH}	$\sigma_{N2\ final}$	$\Delta\sigma_{response}$	$\Delta\sigma/\sigma_i$	$\Delta\sigma_{recoery}$
De-PDPA_1	2.78E-05	2.78E-05	2.77E-05	2.73E-05	-1.00E-7	-3.60E-03	-4.00E-07
De-PDPA_2	2.86E-05	2.76E-05	2.79E-05	2.77E-05	3.50E-07	1.27E-02	-2.66E-07

Table G3 The conductivity response of D-PDPA 1:1 exposed to MetOH

Sample name : D-PDPA 1:1_1

Room Temperature : 25°C Humidity : 70 % thickness : 0.0213 cm.

Chamber Temperature : 25°C Applied Voltage : 10 V K : 7.45E-4

Sample name : D-PDPA 1:1_2

Room Temperature : 25°C Humidity : 70 % thickness : 0.0214 cm.

Chamber Temperature : 25°C Applied Voltage : 10 V K : 7.45E-4

Sample	σ_{air}	$\sigma_{N2\ initial}$	σ_{MetOH}	$\sigma_{N2\ final}$	$\Delta\sigma_{response}$	$\Delta\sigma/\sigma_i$	$\Delta\sigma_{recoery}$
De-PDPA 1:1_1	3.31E-05	2.27E-05	2.70E-05	2.29E-05	4.24E-06	1.87E-01	-4.07E-06
De-PDPA 1:1_2	3.37E-05	2.25E-05	2.72E-05	2.29E-05	4.71E-06	2.09E-01	-4.32E-06

Table G4 The conductivity response of D-PDPA 10:1 exposed to MetOH

Sample name : D-PDPA 10:1_1

Room Temperature : 25°C Humidity : 70 % thickness : 0.0205 cm.

Chamber Temperature : 26°C Applied Voltage : 5 V K : 7.45E-4

Sample name : D-PDPA 10:1_2

Room Temperature : 25°C Humidity : 70 % thickness : 0.021 cm.

Chamber Temperature : 26°C Applied Voltage : 5 V K : 7.45E-4

Sample	σ_{air}	$\sigma_{N2\ initial}$	σ_{MetOH}	$\sigma_{N2\ final}$	$\Delta\sigma_{response}$	$\Delta\sigma/\sigma_i$	$\Delta\sigma_{recoery}$
De-PDPA 10:1_1	1.56E-04	9.11E-05	1.08E-04	8.00E-05	1.68E-05	1.84E-01	-3.78E-05
De-PDPA 10:1_2	1.57E-04	8.92E-05	1.08E-04	7.97E-05	1.93E-05	2.16E-01	-2.88E-05

Table G5 The conductivity response of D-PDPA 100:1 exposed to MetOH

Sample name : D-PDPA 100:1_1

Room Temperature : 25°C Humidity : 70 % thickness : 0.0274 cm.

Chamber Temperature : 26°C Applied Voltage : 10 V K : 7.45E-4

Sample name : D-PDPA 100:1_2

Room Temperature : 25°C Humidity : 70 % thickness : 0.0 cm.

Chamber Temperature : 26°C Applied Voltage : 10 V K : 7.45E-4

Sample	σ_{air}	$\sigma_{N2\ initial}$	σ_{MetOH}	$\sigma_{N2\ final}$	$\Delta\sigma_{response}$	$\Delta\sigma/\sigma_i$	$\Delta\sigma_{recoery}$
D-PDPA 100:1_1	1.77E-04	1.94E-05	2.50E-05	1.87E-05	5.59E-06	2.88E-01	-6.26E-06
D-PDPA 100:1_2	1.82E-04	1.93E-05	2.52E-05	1.86E-05	5.83E-06	3.01E-01	-6.58E-06

Table G6 The conductivity response of D-PDPA 200:1 exposed to MetOH

Sample name : D-PDPA 200:1_1

Room Temperature : 25°C Humidity : 70 % thickness : 0.0213 cm.

Chamber Temperature : 26°C Applied Voltage : 10 V K : 7.45E-4

Sample name : D-PDPA 200:1_2

Room Temperature : 25°C Humidity : 70 % thickness : 0.0212 cm.

Chamber Temperature : 26°C Applied Voltage : 10 V K : 7.45E-4

Sample	σ_{air}	$\sigma_{N2\ initial}$	σ_{MetOH}	$\sigma_{N2\ final}$	$\Delta\sigma_{response}$	$\Delta\sigma/\sigma_i$	$\Delta\sigma_{recoery}$
D-PDPA 200:1_1	5.42E-05	2.42E-05	2.55E-05	2.34E-05	1.35E-06	5.59E-02	-2.18E-06
D-PDPA 200:1_2	5.45E-05	2.39E-05	2.55E-05	2.34E-05	1.51E-06	6.32E-02	-2.07E-06

Table G7 The conductivity response of 30% wt De-PDPA:PEO (95:5) fiber exposed to MetOH

Sample name : 30% wt De-PDPA:PEO (95:5) electrosun fiber_1

Room Temperature : 25°C Humidity : 70 % thickness : 0.0196 cm.

Chamber Temperature : 25°C Applied Voltage : 5 V K : 7.45E-4

Sample name : 30% wt De-PDPA:PEO (95:5) electrosun fiber_2

Room Temperature : 25°C Humidity : 70 % thickness : 0.0 cm.

Chamber Temperature : 25°C Applied Voltage : 5 V K : 7.45E-4

Sample	σ_{air}	$\sigma_{N2\ initial}$	σ_{MetOH}	$\sigma_{N2\ final}$	$\Delta\sigma_{response}$	$\Delta\sigma/\sigma_i$	$\Delta\sigma_{recoery}$
30% wt PDPA:PEO (95:5) fiber_1	5.11E-05	4.72E-05	5.03E-05	4.85E-06	3.10E-06	6.57E-02	-1.80E-07
30% wt PDPA:PEO (95:5) fiber_2	2.05E-05	1.93E-05	2.21E-05	1.96E-06	2.80E-06	1.45E-01	-2.50E-07

Table G8 The conductivity response of 30% wt De-PDPA:PEO (97:3) electrosun fiber exposed to MetOH

Sample name : 30% wt De-PDPA:PEO (97:3) electrosun fiber_1

Room Temperature : 25°C Humidity : 70 % thickness : 0.0196 cm.

Chamber Temperature : 25°C Applied Voltage : 10 V K : 7.45E-4

Sample name : 30% wt De-PDPA:PEO (97:3) electrosun fiber_2

Room Temperature : 25°C Humidity : 70 % thickness : 0.0220 cm.

Chamber Temperature : 25°C Applied Voltage : 10 V K : 7.45E-4

Sample	σ_{air}	$\sigma_{N2\ initial}$	σ_{MetOH}	$\sigma_{N2\ final}$	$\Delta\sigma_{response}$	$\Delta\sigma/\sigma_i$	$\Delta\sigma_{recoery}$
30% wt PDPA:PEO (97:3) fiber_1	2.17E-05	2.03E-05	2.63E-05	2.50E-06	6.00E-06	2.96E-01	-1.30E-07
30% wt PDPA:PEO (97:3) fiber_2	2.19E-05	2.07E-05	2.20E-05	2.14E-06	1.50E-06	6.28E-02	-6.00E-07

Table G9 The conductivity response of 30% wt De-PDPA:PEO (98:2) electrosun fiber exposed to MetOH

Sample name : 30% wt De-PDPA:PEO (98:2) electrosun fiber_1

Room Temperature : 25°C Humidity : 70 % thickness : 0.0134 cm.

Chamber Temperature : 25°C Applied Voltage : 10 V K : 7.45E-4

Sample name : 30% wt De-PDPA:PEO (98:2) electrosun fiber_2

Room Temperature : 25°C Humidity : 70 % thickness : 0.0162 cm.

Chamber Temperature : 25°C Applied Voltage : 10 V K : 7.45E-4

Sample	σ_{air}	$\sigma_{N2\ initial}$	σ_{MetOH}	$\sigma_{N2\ final}$	$\Delta\sigma_{response}$	$\Delta\sigma/\sigma_i$	$\Delta\sigma_{recoery}$
30% wt PDPA:PEO (98:2) fiber_1	4.60E-05	4.22E-05	4.41E-05	4.21E-05	1.94E-06	4.60E-02	-2.07E-06
30% wt PDPA:PEO (98:2) fiber_2	2.99E-05	2.97E-05	3.10E-05	2.99E-05	1.30E-06	4.38E-02	-1.1E-06

Table G10 The conductivity response of 50% wt De-PDPA:PEO (95:5) electrosun fiber exposed to MetOH

Sample name : 50% wt De-PDPA:PEO (95:5) electrosun fiber_1

Room Temperature : 25°C Humidity : 70 % thickness : 0.0238cm.

Chamber Temperature : 25°C Applied Voltage : 10 V K : 7.45E-4

Sample name : 50% wt De-PDPA:PEO (95:5) electrosun fiber_2

Room Temperature : 25°C Humidity : 70 % thickness : 0.0227 cm.

Chamber Temperature : 25°C Applied Voltage : 10 V K : 7.45E-4

Sample	σ_{air}	$\sigma_{N2\ initial}$	σ_{MetOH}	$\sigma_{N2\ final}$	$\Delta\sigma_{response}$	$\Delta\sigma/\sigma_i$	$\Delta\sigma_{recoery}$
50% wt PDPA:PEO (95:5) fiber_1	2.11E-05	2.01E-05	2.04E-05	1.99E-05	3.00E-07	1.49E-02	-5.00E-07
50% wt PDPA:PEO (95:5) fiber_2	2.09E-05	2.07E-05	2.12E-05	2.07E-05	5.00E-07	2.42E-02	-5.00E-07

Table G11 The conductivity response of 50% wt De-PDPA:PEO (97:3) electrosun fiber exposed to MetOH

Sample name : 50% wt De-PDPA:PEO (97:3) electrosun fiber_1

Room Temperature : 25°C Humidity : 70 % thickness : 0.0584 cm.

Chamber Temperature : 25°C Applied Voltage : 10 V K : 7.45E-4

Sample name : 50% wt De-PDPA:PEO (97:3) electrosun fiber_2

Room Temperature : 25°C Humidity : 70 % thickness : 0.0531 cm.

Chamber Temperature : 25°C Applied Voltage : 10 V K : 7.45E-4

Sample	σ_{air}	$\sigma_{N2\ initial}$	σ_{MetOH}	$\sigma_{N2\ final}$	$\Delta\sigma_{response}$	$\Delta\sigma/\sigma_i$	$\Delta\sigma_{recoery}$
50% wt PDPA:PEO (95:5) fiber_1	9.10E-06	8.34E-06	9.46E-06	8.37E-06	1.12E-06	1.34E-01	-1.08E-06
50% wt PDPA:PEO (95:5) fiber_2	9.80E-06	9.10E-06	9.66E-06	9.22E-06	5.60E-07	6.15E-02	-4.4E-07

Table G12 The conductivity response of 50% wt De-PDPA:PEO (98:2) electrosun fiber exposed to MetOH

Sample name : 50% wt De-PDPA:PEO (98:2) electrosun fiber_1

Room Temperature : 25°C Humidity : 70 % thickness : 0.0148 cm.

Chamber Temperature : 25°C Applied Voltage : 10 V K : 7.45E-4

Sample name : 50% wt De-PDPA:PEO (98:2) electrosun fiber_2

Room Temperature : 25°C Humidity : 70 % thickness : 0.0457 cm.

Chamber Temperature : 25°C Applied Voltage : 10 V K : 7.45E-4

Sample	σ_{air}	$\sigma_{N2\ initial}$	σ_{MetOH}	$\sigma_{N2\ final}$	$\Delta\sigma_{response}$	$\Delta\sigma/\sigma_i$	$\Delta\sigma_{recoery}$
50% wt PDPA:PEO (95:5) fiber_1	3.62E-05	3.74E-05	3.75E-05	3.50E-05	1.00E-07	2.67E-03	-2.51E-06
50% wt PDPA:PEO (95:5) fiber_2	1.09E-05	1.04E-05	1.13E-05	1.08E-05	9.03E-07	8.68E-02	-4.87E-07

Table G13 The conductivity response of 30% wt D-PDPA(100:1):PEO (97:3)belectrosun fiber exposed to MetOH

Sample name : 30% wt D-PDPA(100:1):PEO (97:3) electrosun fiber_1

Room Temperature : 25°C Humidity : 70 % thickness : 0.0156cm.

Chamber Temperature : 25°C Applied Voltage : 10 V K : 7.45E-4

Sample name : 30% wt D-PDPA(100:1):PEO (97:3) electrosun fiber_2

Room Temperature : 25°C Humidity : 70 % thickness : 0.0119 cm.

Chamber Temperature : 25°C Applied Voltage : 5 V K : 7.45E-4

Sample	σ_{air}	$\sigma_{N2\ initial}$	σ_{MetOH}	$\sigma_{N2\ final}$	$\Delta\sigma_{response}$	$\Delta\sigma/\sigma_i$	$\Delta\sigma_{recoery}$
30% wt D-PDPA(100:1):PEO (97:3) fiber_1	5.78E-05	3.44E-05	3.71E-05	3.14E-05	2.68E-06	7.79E-02	-5.68E-06
30% wt D-PDPA(100:1):PEO (95:5) fiber_2	1.55E-04	7.80E-05	8.05E-05	7.64E-05	2.50E-06	3.21E-02	-4.1E-06

Table G14 The conductivity response of 50% wt D-PDPA(100:1):PEO (97:3) electrosun fiber exposed to MetOH

Sample name : 50% wt D-PDPA(100:1):PEO (97:3) electrosun fiber_1

Room Temperature : 25°C Humidity : 70 % thickness : 0.0118cm.

Chamber Temperature : 25°C Applied Voltage : 10 V K : 7.45E-4

Sample name : 50% wt D-PDPA(100:1):PEO (97:3) electrosun fiber_2

Room Temperature : 25°C Humidity : 70 % thickness : 0.0104 cm.

Chamber Temperature : 25°C Applied Voltage : 10 V K : 7.45E-4

Sample	σ_{air}	$\sigma_{N2\ initial}$	σ_{MetOH}	$\sigma_{N2\ final}$	$\Delta\sigma_{response}$	$\Delta\sigma/\sigma_i$	$\Delta\sigma_{recoery}$
50% wt D-PDPA(100:1):PEO (97:3) fiber_1	5.34E-05	4.13E-05	4.33E-05	4.11E-05	2.00E-06	4.84E-02	-2.19E-06
50% wt D-PDPA(100:1):PEO (95:5) fiber2	7.40E-05	4.76E-05	4.88E-05	4.75E-05	1.22E-06	2.57E-02	-1.33E-06

Table G15 The conductivity response of 30% wt D-PDPA(100:1):PEO (97:3) film exposed to MetOH

Sample name : 30% wt D-PDPA(100:1):PEO (97:3) film_1

Room Temperature : 25°C Humidity : 70 % thickness : 0.0165cm.

Chamber Temperature : 25°C Applied Voltage : 10 V K : 7.45E-4

Sample name : 30% wt D-PDPA(100:1):PEO (97:3) film_2

Room Temperature : 25°C Humidity : 70 % thickness : 0.0212 cm.

Chamber Temperature : 25°C Applied Voltage : 10 V K : 7.45E-4

Sample	σ_{air}	$\sigma_{N2\ initial}$	σ_{MetOH}	$\sigma_{N2\ final}$	$\Delta\sigma_{response}$	$\Delta\sigma/\sigma_i$	$\Delta\sigma_{recoery}$
30% wt D-PDPA(100:1):PEO (97:3) film_1	4.11E-04	8.42E-05	1.82E-04	8.29E-05	9.78E-05	1.16E+00	-9.91E-05
30% wt D-PDPA(100:1):PEO (95:5) film_2	3.41E-04	8.62E-05	2.02E-04	7.47E-05	1.16E-04	1.34E+00	-1.27E-04

Table G16 The conductivity response of 50% wt D-PDPA(100:1):PEO (97:3) film exposed to MetOH

Sample name : 50% wt D-PDPA(100:1):PEO (97:3) film_1

Room Temperature : 25°C Humidity : 70 % thickness : 0.039cm.

Chamber Temperature : 25°C Applied Voltage : 10 V K : 7.45E-4

Sample name : 50% wt D-PDPA(100:1):PEO (97:3) film_2

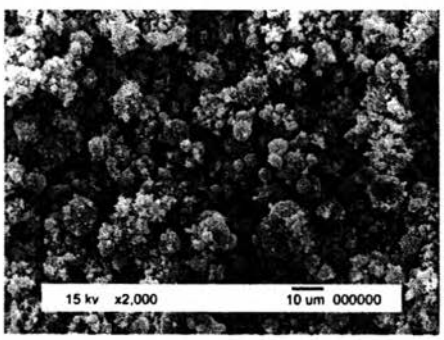
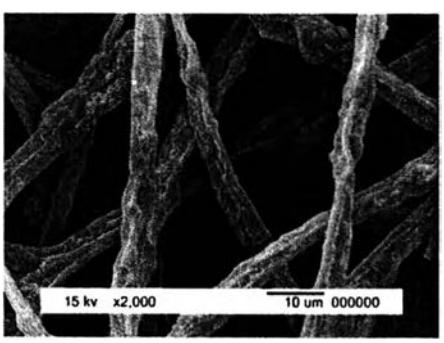
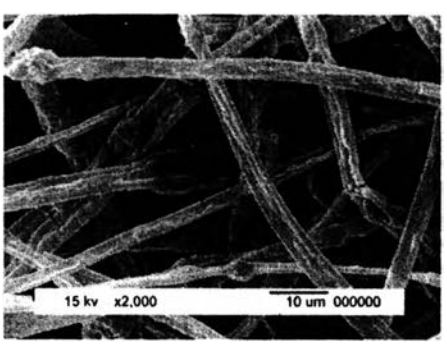
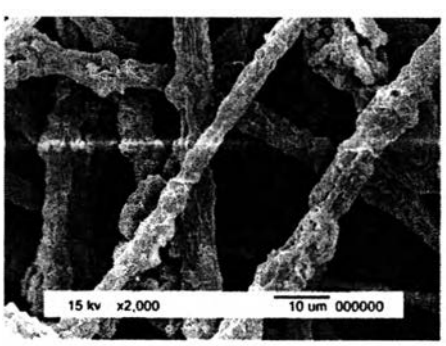
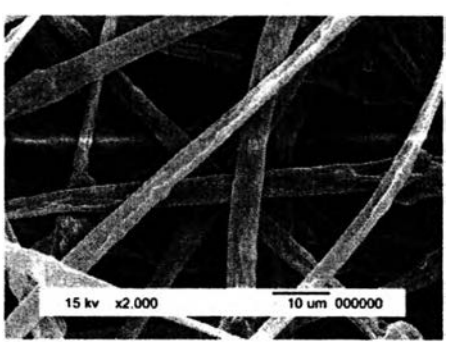
Room Temperature : 25°C Humidity : 70 % thickness : 0.0196 cm.

Chamber Temperature : 25°C Applied Voltage : 10 V K : 7.45E-4

Sample	σ_{air}	$\sigma_{N2\ initial}$	σ_{MetOH}	$\sigma_{N2\ final}$	$\Delta\sigma_{response}$	$\Delta\sigma/\sigma_i$	$\Delta\sigma_{recoery}$
50% wt D-PDPA(100:1):PEO (97:3) film_1	9.11E-05	6.79E-05	7.81E-05	4.23E-05	1.02E-05	1.50E-01	-3.58E-05
50% wt D-PDPA(100:1):PEO (95:5) film_2	8.06E-05	8.17E-05	2.29E-04	6.73E-05	1.47E-04	1.80E+00	-1.62E-04

Appendix H Scanning Electron Microscope (SEM)

Table H1 Scanning Electron Microscope (SEM) of Pure PDPA, electrospun 30% and 50% wt at various PDPA:PEO ratios

Materials	Not sonicated	Sonicated
1). Pure PDPA		
2). 30% wt PDPA:PEO (95:5) + DCM		
3). 30% wt PDPA:PEO (97:3) + DCM		

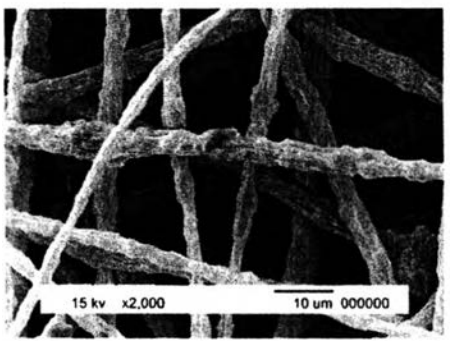
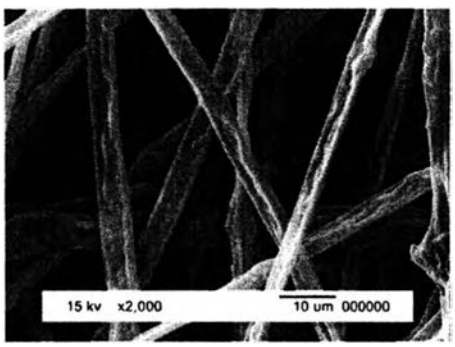
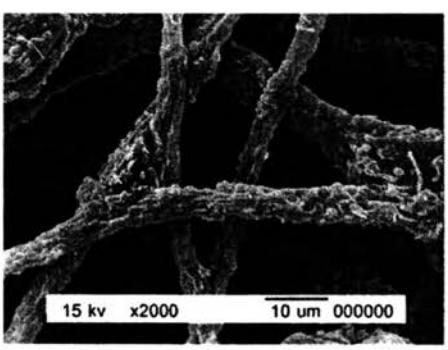
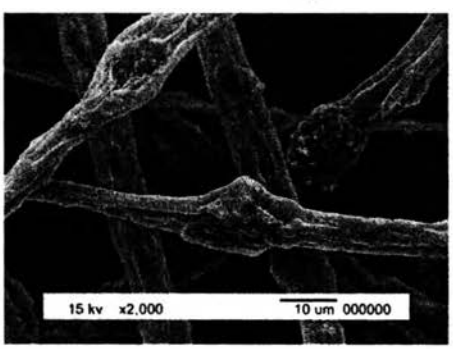
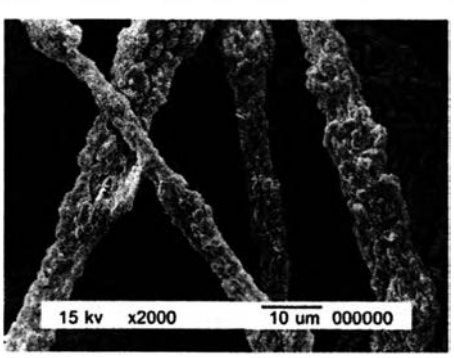
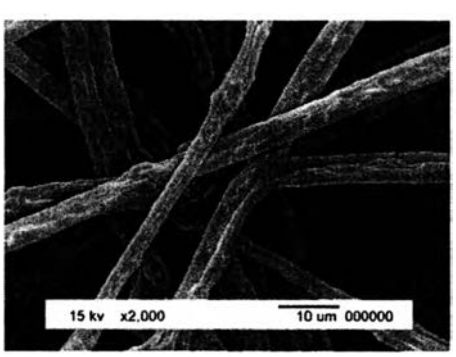
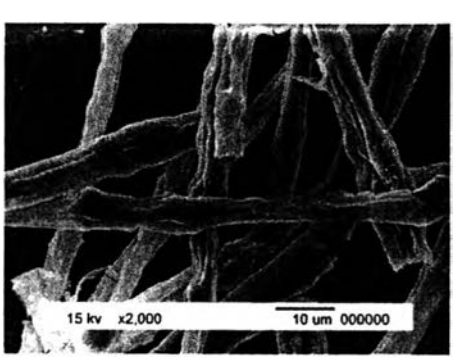
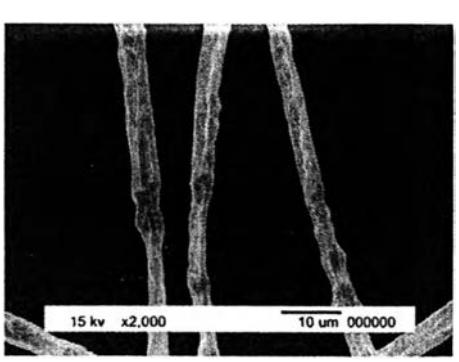
Materials	Not sonicated	Sonicated
4). 30% wt PDPA:PEO (98:2) + DCM		
5). 50% wt PDPA:PEO (95:5) + DCM		
6). 50% wt PDPA:PEO (97:3) + DCM		
7). 50% wt PDPA:PEO (98:2) + DCM		

Table H2 The diameter of electrospun 30% and 50% at various PDPA:PEO ratios

materials	diameter (μm)							
	not sonicated				Sonicated			
	1	2	3	average	1	2	3	average
30% wt PDPA:PEO 95:5 + DCM	4.48	3.73	4.28	4.16	2.04	2.23	2.4	2.22
30% wt PDPA:PEO 97:3 + DCM	4.73	4.38	4.75	4.62	3.08	2.48	2.34	2.63
30% wt PDPA:PEO 98:2 + DCM	6.12	4.43	5.49	5.35	2.43	2.18	2.44	2.35
50% wt PDPA:PEO 95:5 + DCM	9.23	9.35	9.35	9.31	4.59	3.95	4.46	4.33
50% wt PDPA:PEO 97:3 + DCM	6.65	5.61	5.43	5.89	4.35	3.97	4.05	4.12
50% wt PDPA:PEO 98:2 + DCM	6.16	6.07	6.13	6.12	3.37	3.28	2.99	3.21

SEM micrographs show that pure PDPA cannot be processed into fibers. Added PEO to increase the processibility of the electrospinnig process. The average diameter of the electrospun PDPA is in the range of 2-3 μm (Table H2) and increased with increasing PDPA concentration. It is also evident that decreasing the PEO content also decreass the diameter of the fibers. Without the addition of PEO to PDPA dissolved in DCM, no fiber formation occurs, as the viscosity and surface tension of the solution were not high enough to maintain a stable drop at the end of the capillary tip (Norris *et al.*, 2000). With high PEO content, the solution has a higher surface tension, so bigger drop occurred at the end of the tips, the diameters of fiber were increased (Norris *et al.*, 2000). The size of the electrospun fiber was affected by the ratio of the PDPA/PEO content (Chronakis *et al.*, 2006).

From the picture, we will see the morphology of the fibers which were not sonicated show the rough surface because the particle size of PDPA is bigger than 100 μm. So the aggregation may have occurred. Then we tried to improve this

problem by using the sonicate bath to disperse the PDPA particle into homogeneous solution. The surface of PDPA fibers has smoother surfaces with sonification.

In order to investigated the diffusion of PEO in PDPA particle, the PDPA:PEO fibers were dissolve in water 24 hr to aged the PEO, then dried in vacuum oven, and investigated by using scanning electron microscope. Figure H1 (a) and (b) shows the breach at the surface of the fiber which is cause from the diffusion of PEO out from the PDPA fiber, It can indicate that the PEO particle disperse thoroughly in the PDPA phase.

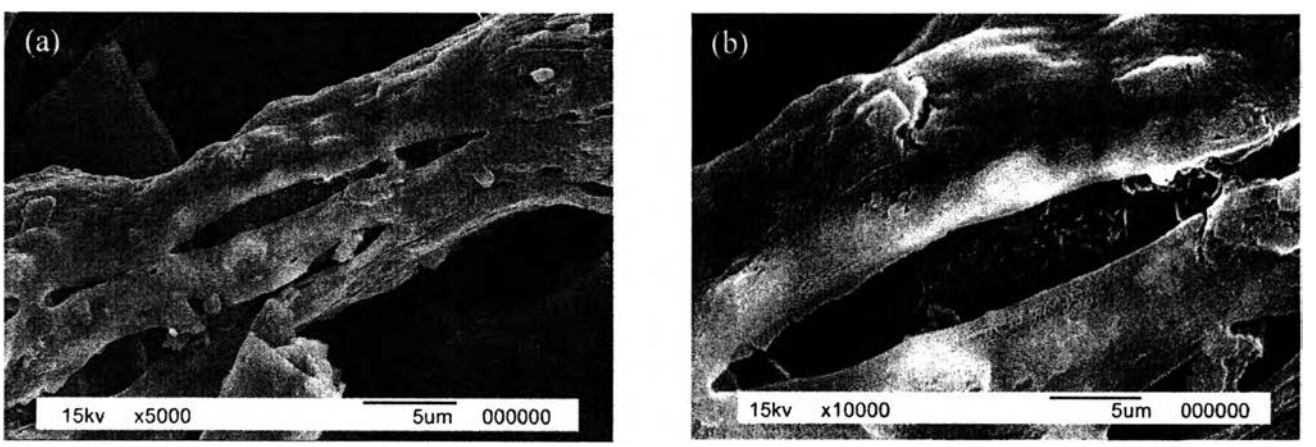


Figure H1 (a) PDPA:PEO fiber at magnification 5000, (b) PDPA:PEO fiber at magnification 10000.

Appendix I FTIR Investigations of Reactions of Adsorbed MetOH

FTIR spectra of D-PDPA_100:1 sample was taken and is shown in Fig. I1. The spectra of sample were collected before, during at 50 minutes interval, and after MetOH exposure, in order to study the interaction between the samples and MetOH. The FTIR spectra of MetOH show the absorbtion bands at 1012 and 1056 cm^{-1} assigned to the C-OH stretching in alcohol, bands at 2868 and 2972 cm^{-1} assigned to the CH_3 stretching, and band at 3705 cm^{-1} assigned to the OH stretching. The IR spectrum shows a peak at 1317 cm^{-1} assigned to the benzenoid structure, a peak at 1500 cm^{-1} assigned to the phenyl H_2, a peak at 1595 cm^{-1} assigned to the quinoid structure, a peak at 3385 cm^{-1} assigned to the N-H stretching; all are PDPA characteristics (Athawale et al., 2000, Hua and Ruckenstein, 2003, and Sathiyanarayanan *et al.*, 2006). The FT-IR spectra of the after exposed samples also shows a peak of the MetOH region. During MetOH exposure, the IR spectrum shows a peak of MetOH and one new peak at 1401 cm^{-1} which can be assigned to the vibration of a oxygen atom of MetOH interacting with imine N_2, and it remains observable after MetOH is removed and replaced with N_2. This indicates that the interaction between MetOH and D-PDPA_100:1 is irreversible. The proposed mechanism of D-PDPA when exposure to MetOH is shown in Fig. I2.

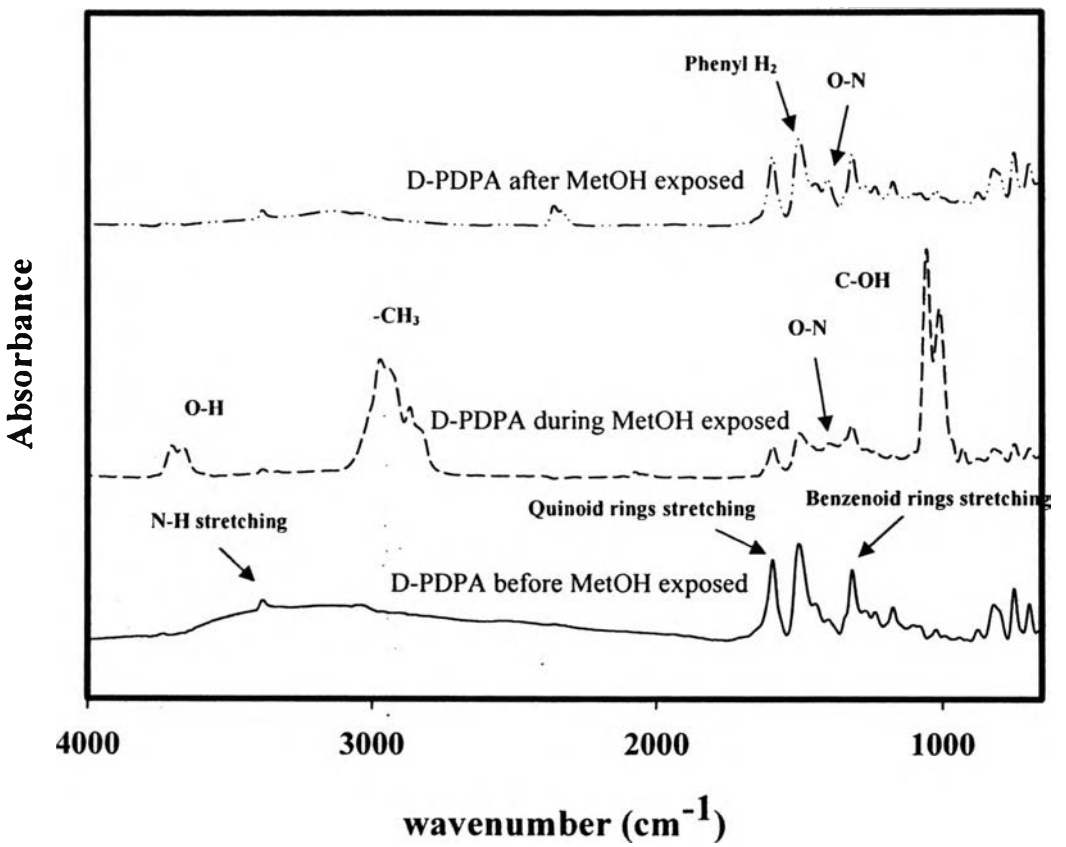


Figure I1 IR spectra of D-PDPA exposed to MetOH (MetOH=10% v/v, pressure at 1 atm and T at =25°C).

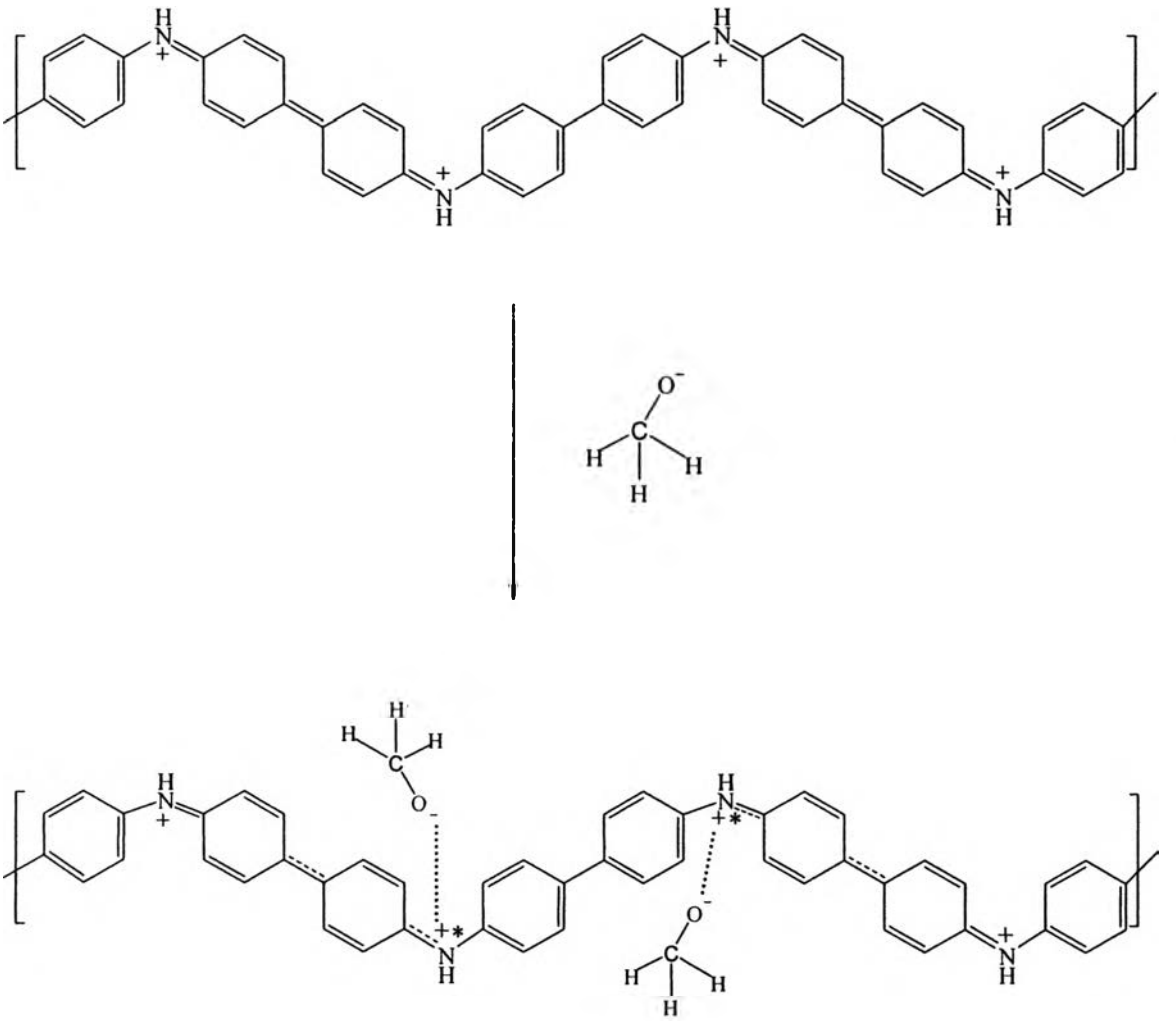


Figure I2 Proposed mechanism of the MetOH-D-PDPA.

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1. Permpool, T.; Sirivat, A.; and Supaphol, P. (2010, April 22) Electrospun Polydiphenylamine-Polyethylene oxide as a Methanol. Proceedings of The 16th PPC Symposium on Petroleum, Petrochemicals, and Polymers 2010, Bangkok, Thailand.

Presentation:

1. Permpool, T.; Sirivat, A.; and Supaphol, P. (2010, April 22) Electrospun Polydiphenylamine-Polyethylene oxide as a Methanol. Paper presented at The 16th PPC Symposium on Petroleum, Petrochemicals, and Polymers 2010, Bangkok, Thailand.