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## APPENDIX A

### CALCULATION

#### Calculation of intrinsic viscosity

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##### 1. Relative viscosity (viscosity ratio)

Calculation of the relative viscosity for each concentration is measured from the average efflux time as follows:

$$\eta_r = t/t_o$$

where

$\eta_r$  = relative viscosity

$t$  = average efflux time in seconds of solution

$t_o$  = average efflux time in seconds of pure solvent

##### 2. Inherent viscosity (logarithmic viscosity number)

Calculation of the inherent viscosity for each concentration is measured as follows:

$$\eta_{inh} = \ln \eta_r / C$$

where

$\eta_{inh}$  = inherent viscosity at concentration C

$\ln \eta_r$  = natural logarithm of the relative viscosity

C = concentration in grams/100 ml of solution

### 3. Specific viscosity

$$\eta_{sp} = \eta_r - 1$$

where

$$\eta_{sp} = \text{specific viscosity}$$

### 4. Reduced viscosity (viscosity number)

$$\eta_{red} = \eta_{sp}/C$$

where

$$\eta_{red} = \text{reduced viscosity}$$

### 5. Intrinsic viscosity (limiting viscosity number)

The four logarithmic viscosity numbers are plotted versus their respective concentrations on rectilinear graph paper and then the four reduced viscosity numbers are plotted versus their respective concentrations on the same graph. The slopes of these two lines will not be the same, but they converge to the same value at zero concentration. The intrinsic viscosity,  $[\eta]$ , is the intercept of the line at zero concentration.

APPENDIX B

EXPERIMENTAL DATA

B.1 For outdoor exposure (thickness of film : 0.010 mm.)

Table B.1.1 Viscosity measurement of 0% PPVK for original test sample at 135 °C

Concentration (g.dl <sup>-1</sup> )	t <sub>1</sub>	t <sub>2</sub>	t <sub>3</sub>	t <sub>avg</sub>	η <sub>r</sub>	η <sub>sp</sub>	$\frac{\eta_{sp}}{C}$	$\frac{\ln \eta_r}{C}$
Solvent	71.73	71.72	71.73	71.73				
0.08	88.95	88.99	88.97	88.97	1.24	0.24	3.00	2.69
0.16	108.05	108.02	108.06	108.04	1.51	0.51	3.19	2.58
0.24	133.35	133.43	133.38	133.39	1.86	0.86	3.58	2.58
0.40	191.76	191.70	191.76	191.74	2.67	1.67	4.18	2.46

Table B.1.2 Viscosity measurement of 0% PPVK for 2 weeks at 135 °C

Concentration (g.dl <sup>-1</sup> )	t <sub>1</sub>	t <sub>2</sub>	t <sub>3</sub>	t <sub>avg</sub>	η <sub>r</sub>	η <sub>sp</sub>	$\frac{\eta_{sp}}{C}$	$\frac{\ln \eta_r}{C}$
Solvent	72.40	72.43	72.49	72.44				
0.08	86.56	86.62	86.52	86.57	1.20	0.20	2.50	2.28
0.16	102.77	102.72	102.87	102.79	1.42	0.42	2.62	2.19
0.24	121.66	121.56	121.62	121.61	1.68	0.68	2.83	2.16
0.40	169.58	169.20	169.49	169.53	2.34	1.34	3.35	2.12

**Table B.1.3** Viscosity measurement of 0% PPVK for 4 weeks at 135 °C

Concentration (g.dl <sup>-1</sup> )	t <sub>1</sub>	t <sub>2</sub>	t <sub>3</sub>	t <sub>avg</sub>	η <sub>r</sub>	η <sub>sp</sub>	$\frac{\eta_{sp}}{C}$	$\frac{\ln\eta_r}{C}$
Solvent	72.88	72.86	72.91	72.88				
0.07	83.98	83.79	83.90	83.89	1.15	0.15	2.14	1.80
0.15	97.51	97.62	97.70	97.61	1.34	0.34	2.27	1.95
0.22	114.04	114.03	114.08	114.05	1.56	0.56	2.54	2.02
0.37	143.84	143.82	143.85	143.84	1.97	0.97	2.62	1.83

**Table B.1.4** Viscosity measurement of 0% PPVK for 8 weeks at 135 °C

Concentration (g.dl <sup>-1</sup> )	t <sub>1</sub>	t <sub>2</sub>	t <sub>3</sub>	t <sub>avg</sub>	η <sub>r</sub>	η <sub>sp</sub>	$\frac{\eta_{sp}}{C}$	$\frac{\ln\eta_r}{C}$
Solvent	72.07	72.03	72.16	72.09				
0.07	81.63	81.63	81.63	81.63	1.13	0.13	1.86	1.74
0.14	91.51	91.58	91.51	91.54	1.27	0.27	1.93	1.71
0.21	103.43	103.36	103.41	103.40	1.43	0.43	2.05	1.70
0.35	129.59	129.65	129.59	129.61	1.80	0.80	2.28	1.68

**Table B.1.5** Viscosity measurement of 0% PPVK for 12 weeks at 135 °C

Concentration (g.dl <sup>-1</sup> )	t <sub>1</sub>	t <sub>2</sub>	t <sub>3</sub>	t <sub>avg</sub>	η <sub>r</sub>	η <sub>sp</sub>	$\frac{\eta_{sp}}{C}$	$\frac{\ln \eta_r}{C}$
Solvent	72.23	72.31	72.28	72.31				
0.08	81.84	81.87	81.79	81.83	1.13	0.13	1.62	1.53
0.15	91.19	91.17	91.26	91.21	1.26	0.26	1.73	1.54
0.23	102.48	102.51	102.43	102.47	1.42	0.42	1.83	1.52
0.38	127.07	127.03	127.08	127.06	1.76	0.76	2.00	1.49

**Table B.1.6** Viscosity measurement of 0% PPVK for 16 weeks at 135 °C

Concentration (g.dl <sup>-1</sup> )	t <sub>1</sub>	t <sub>2</sub>	t <sub>3</sub>	t <sub>avg</sub>	η <sub>r</sub>	η <sub>sp</sub>	$\frac{\eta_{sp}}{C}$	$\frac{\ln \eta_r}{C}$
Solvent	72.34	72.27	72.24	72.28				
0.08	80.70	80.74	80.70	80.71	1.12	0.12	1.50	1.42
0.17	90.91	90.91	90.87	90.90	1.26	0.26	1.53	1.36
0.25	101.99	101.91	101.95	101.95	1.41	0.41	1.64	1.37
0.42	128.38	128.29	128.22	128.30	1.78	0.78	1.86	1.37



**Table B.1.7** Viscosity measurement of 1.0% PPVK for original test sample at 135 °C

Concentration (g.dl <sup>-1</sup> )	t <sub>1</sub>	t <sub>2</sub>	t <sub>3</sub>	t <sub>avg</sub>	η <sub>r</sub>	η <sub>sp</sub>	$\frac{\eta_{sp}}{C}$	$\frac{\ln\eta_r}{C}$
Solvent	72.37	72.35	72.38	72.37				
0.08	89.56	89.44	89.56	89.52	1.24	0.24	3.00	2.69
0.16	109.386	109.94	109.88	109.89	1.52	0.52	3.25	2.62
0.24	133.14	133.16	133.07	133.12	1.84	0.84	3.50	2.54
0.40	191.08	191.03	191.07	191.06	2.64	1.64	4.10	2.43

**Table B.1.8** Viscosity measurement of 1.0% PPVK for 2 weeks at 135 °C

Concentration (g.dl <sup>-1</sup> )	t <sub>1</sub>	t <sub>2</sub>	t <sub>3</sub>	t <sub>avg</sub>	η <sub>r</sub>	η <sub>sp</sub>	$\frac{\eta_{sp}}{C}$	$\frac{\ln\eta_r}{C}$
Solvent	72.29	72.16	72.26	72.24				
0.08	85.03	85.09	85.11	85.08	1.18	0.18	2.25	2.07
0.16	100.07	100.01	100.17	100.08	1.38	0.38	2.38	2.04
0.24	116.19	116.03	116.07	116.10	1.61	0.61	2.54	1.98
0.40	154.52	154.44	154.46	154.47	2.14	1.14	2.85	1.90

**Table B.1.9** Viscosity measurement of 1.0% PPVK for 4 weeks at 135 °C

Concentration (g.dl <sup>-1</sup> )	t <sub>1</sub>	t <sub>2</sub>	t <sub>3</sub>	t <sub>avg</sub>	$\eta_r$	$\eta_{sp}$	$\frac{\eta_{sp}}{C}$	$\frac{\ln\eta_r}{C}$
Solvent	72.29	72.06	72.07	72.07				
0.09	84.72	84.70	84.76	84.73	1.18	0.18	2.00	2.84
0.18	99.19	99.30	99.21	99.23	1.38	0.38	2.11	1.79
0.27	115.35	115.24	115.41	115.33	1.60	0.60	2.22	1.74
0.45	154.83	154.80	154.81	154.81	2.15	1.15	2.56	1.70

**Table B.1.10** Viscosity measurement of 1.0% PPVK for 8 weeks at 135 °C

Concentration (g.dl <sup>-1</sup> )	t <sub>1</sub>	t <sub>2</sub>	t <sub>3</sub>	t <sub>avg</sub>	$\eta_r$	$\eta_{sp}$	$\frac{\eta_{sp}}{C}$	$\frac{\ln\eta_r}{C}$
Solvent	72.50	72.44	72.46	72.47				
0.09	83.08	83.14	83.05	83.09	1.15	0.15	1.67	1.55
0.17	94.49	94.56	94.44	94.50	1.30	0.30	1.56	1.54
0.25	108.02	108.00	108.02	108.01	1.49	0.49	1.76	1.60
0.42	139.02	139.08	139.13	139.08	1.92	0.92	2.19	1.55

**Table B.1.11** Viscosity measurement of 1.0% PPVK for 12 weeks at 135 °C

Concentration (g.dl <sup>-1</sup> )	t <sub>1</sub>	t <sub>2</sub>	t <sub>3</sub>	t <sub>avg</sub>	η <sub>r</sub>	η <sub>sp</sub>	$\frac{\eta_{sp}}{C}$	$\frac{\ln \eta_r}{C}$
Solvent	72.19	72.20	72.24	72.21				
0.09	81.38	81.43	81.42	81.41	1.13	0.13	1.44	1.36
0.18	92.45	92.49	92.45	92.46	1.28	0.28	1.56	1.37
0.26	104.84	104.74	104.80	104.79	1.45	0.45	1.73	1.43
0.44	131.75	131.66	131.74	131.72	1.82	0.82	1.86	1.36

**Table B.1.12** Viscosity measurement of 1.0% PPVK for 16 weeks at 135 °C

Concentration (g.dl <sup>-1</sup> )	t <sub>1</sub>	t <sub>2</sub>	t <sub>3</sub>	t <sub>avg</sub>	η <sub>r</sub>	η <sub>sp</sub>	$\frac{\eta_{sp}}{C}$	$\frac{\ln \eta_r}{C}$
Solvent	72.26	72.27	72.24	72.26				
0.09	80.30	80.31	80.28	80.30	1.11	0.11	1.22	1.16
0.17	89.04	89.02	89.14	89.06	1.23	0.23	1.35	1.22
0.25	98.41	98.34	98.40	98.38	1.36	0.36	1.44	1.23
0.42	120.46	120.50	120.49	120.48	1.67	0.67	1.60	1.22

## B.2 For irradiation with medium pressure mercury lamp

B.2.1 Thickness of film : 0.010 mm.

**Table B.2.1.1** Viscosity measurement of 1.0% PPVK for 4 hours at 135 °C

Concentration (g.dl <sup>-1</sup> )	t <sub>1</sub>	t <sub>2</sub>	t <sub>3</sub>	t <sub>avg</sub>	η <sub>r</sub>	η <sub>sp</sub>	$\frac{\eta_{sp}}{C}$	$\frac{\ln \eta_r}{C}$
Solvent	72.32	72.39	72.31	72.34				
0.08	83.38	83.31	83.38	83.36	1.15	0.15	1.88	1.75
0.16	95.77	95.81	95.73	95.77	1.32	0.328	2.00	1.74
0.24	109.19	109.11	109.11	109.14	1.51	0.51	2.12	1.71
0.40	146.65	146.58	146.65	146.63	2.02	1.02	2.55	1.76

**Table B.2.1.2** Viscosity measurement of 1.0% PPVK for 8 hours at 135 °C

Concentration (g.dl <sup>-1</sup> )	t <sub>1</sub>	t <sub>2</sub>	t <sub>3</sub>	t <sub>avg</sub>	η <sub>r</sub>	η <sub>sp</sub>	$\frac{\eta_{sp}}{C}$	$\frac{\ln \eta_r}{C}$
Solvent	71.86	71.83	71.84	71.84				
0.08	81.29	81.20	81.38	81.29	1.13	0.13	1.62	1.53
0.16	91.42	91.41	91.43	91.42	1.27	0.27	1.69	1.49
0.24	101.13	101.18	101.18	101.16	1.41	0.41	1.71	1.43
0.40	127.52	127.45	127.37	127.45	1.77	0.77	1.92	1.43

**Table B.2.1.3** Viscosity measurement of 1.0% PPVK for 12 hours at 135 °C

Concentration (g.dl <sup>-1</sup> )	t <sub>1</sub>	t <sub>2</sub>	t <sub>3</sub>	t <sub>avg</sub>	η <sub>r</sub>	η <sub>sp</sub>	$\frac{\eta_{sp}}{C}$	$\frac{\ln \eta_r}{C}$
Solvent	72.06	71.98	72.01	72.02				
0.08	80.57	80.48	80.53	80.53	1.12	0.12	1.50	1.42
0.16	90.25	90.20	90.20	90.22	1.25	0.25	1.56	1.39
0.24	100.21	100.30	100.28	100.26	1.39	0.39	1.62	1.37
0.40	124.87	124.94	124.95	124.92	1.73	0.73	1.82	1.37

**Table B.2.1.4** Viscosity measurement of 1.0% PPVK for 16 hours at 135 °C

Concentration (g.dl <sup>-1</sup> )	t <sub>1</sub>	t <sub>2</sub>	t <sub>3</sub>	t <sub>avg</sub>	η <sub>r</sub>	η <sub>sp</sub>	$\frac{\eta_{sp}}{C}$	$\frac{\ln \eta_r}{C}$
Solvent	72.31	72.32	72.34	72.32				
0.08	79.41	79.31	79.39	79.37	1.10	0.10	1.25	1.19
0.16	87.45	87.47	87.33	87.42	1.21	0.21	1.31	1.19
0.24	95.97	95.87	95.92	95.92	1.33	0.33	1.38	1.19
0.40	120.45	120.47	120.53	120.48	1.66	0.66	1.65	1.27

**Table B.2.1.5** Viscosity measurement of 1.0% PPVK for 20 hours at 135 °C

Concentration (g.dl <sup>-1</sup> )	t <sub>1</sub>	t <sub>2</sub>	t <sub>3</sub>	t <sub>avg</sub>	η <sub>r</sub>	η <sub>sp</sub>	$\frac{\eta_{sp}}{C}$	$\frac{\ln \eta_r}{C}$
Solvent	72.73	72.70	72.80	72.74				
0.08	79.06	79.02	79.04	79.04	1.09	0.09	1.12	1.08
0.16	86.43	86.38	86.40	86.41	1.19	0.19	1.19	1.09
0.24	94.73	94.69	94.65	94.69	1.30	0.30	1.25	1.09
0.40	112.70	112.83	112.78	112.77	1.55	0.55	1.38	1.10

**Table B.2.1.6** Viscosity measurement of 1.0% PPVK for 4 hours at 135 °C

Concentration (g.dl <sup>-1</sup> )	t <sub>1</sub>	t <sub>2</sub>	t <sub>3</sub>	t <sub>avg</sub>	η <sub>r</sub>	η <sub>sp</sub>	$\frac{\eta_{sp}}{C}$	$\frac{\ln \eta_r}{C}$
Solvent	72.65	72.70	72.71	72.69				
0.08	82.90	82.96	82.87	82.91	1.14	0.14	1.75	1.64
0.16	96.41	96.34	96.36	96.37	1.32	0.32	2.00	1.74
0.24	108.84	108.83	108.86	108.83	1.50	0.50	2.08	1.69
0.40	143.01	143.01	143.06	143.06	1.97	0.97	2.42	1.70

**Table B.2.1.7** Viscosity measurement of 1.0% PPVK for 8 hours at 135 °C

Concentration (g.dl <sup>-1</sup> )	t <sub>1</sub>	t <sub>2</sub>	t <sub>3</sub>	t <sub>avg</sub>	η <sub>r</sub>	η <sub>sp</sub>	$\frac{\eta_{sp}}{C}$	$\frac{\ln \eta_r}{C}$
Solvent	72.78	72.70	72.72	72.73				
0.08	83.48	80.58	80.45	80.50	1.11	0.11	1.38	1.30
0.16	91.77	94.69	91.74	91.73	1.26	0.26	1.62	1.44
0.24	102.70	102.69	102.69	102.69	1.41	0.41	1.71	1.43
0.40	130.81	130.75	130.84	130.86	1.80	0.80	2.00	1.47

**Table B.2.1.8** Viscosity measurement of 1.0% PPVK for 12 hours at 135 °C

Concentration (g.dl <sup>-1</sup> )	t <sub>1</sub>	t <sub>2</sub>	t <sub>3</sub>	t <sub>avg</sub>	η <sub>r</sub>	η <sub>sp</sub>	$\frac{\eta_{sp}}{C}$	$\frac{\ln \eta_r}{C}$
Solvent	72.99	72.85	72.95	72.93				
0.08	80.51	80.42	80.56	80.50	1.10	0.10	1.25	1.19
0.16	92.64	92.84	92.77	92.75	1.27	0.27	1.69	1.49
0.24	100.08	100.13	100.02	100.08	1.37	0.37	1.54	1.31
0.40	127.06	127.18	127.99	127.08	1.74	0.74	1.85	1.38

**Table B.2.1.9** Viscosity measurement of 1.0% PPVK for 16 hours at 135 °C

Concentration (g.dl <sup>-1</sup> )	t <sub>1</sub>	t <sub>2</sub>	t <sub>3</sub>	t <sub>avg</sub>	η <sub>r</sub>	η <sub>sp</sub>	$\frac{\eta_{sp}}{C}$	$\frac{\ln \eta_r}{C}$
Solvent	73.77	73.72	73.69	73.73				
0.08	80.59	80.57	80.54	80.57	1.09	0.09	1.12	0.08
0.16	87.62	87.64	87.62	87.63	1.19	0.19	1.19	1.09
0.24	95.42	95.57	95.51	95.50	1.30	0.30	1.25	1.09
0.40	117.44	117.49	117.39	117.44	1.59	0.59	1.48	1.16

**Table B.2.1.10** Viscosity measurement of 1.0% PPVK for 20 hours at 135 °C

Concentration (g.dl <sup>-1</sup> )	t <sub>1</sub>	t <sub>2</sub>	t <sub>3</sub>	t <sub>avg</sub>	η <sub>r</sub>	η <sub>sp</sub>	$\frac{\eta_{sp}}{C}$	$\frac{\ln \eta_r}{C}$
Solvent	72.96	72.99	72.94	72.96				
0.08	78.83	78.84	78.85	78.84	1.08	0.08	1.00	0.96
0.16	86.09	86.09	86.12	86.10	1.18	0.18	1.12	1.03
0.24	93.74	93.75	93.71	93.73	1.28	0.28	1.17	1.03
0.40	114.34	114.52	114.48	114.45	1.57	0.57	1.42	1.13



**Table B.2.1.11** Viscosity measurement of 0.5% PPVK for original test sample at 135 °C

Concentration (g.dl <sup>-1</sup> )	t <sub>1</sub>	t <sub>2</sub>	t <sub>3</sub>	t <sub>avg</sub>	η <sub>r</sub>	η <sub>sp</sub>	$\frac{\eta_{sp}}{C}$	$\frac{\ln \eta_r}{C}$
Solvent	72.28	72.20	72.26	72.25				
0.08	89.38	89.49	89.41	89.43	1.24	0.24	3.00	2.69
0.16	109.68	109.64	109.74	109.69	1.52	0.52	3.25	2.62
0.24	133.45	133.45	133.50	133.47	1.85	0.85	3.54	2.56
0.40	192.63	192.59	192.71	192.64	2.67	1.67	4.18	2.46

**Table B.2.1.12** Viscosity measurement of 0.5% PPVK for 4 hours at 135 °C

Concentration (g.dl <sup>-1</sup> )	t <sub>1</sub>	t <sub>2</sub>	t <sub>3</sub>	t <sub>avg</sub>	η <sub>r</sub>	η <sub>sp</sub>	$\frac{\eta_{sp}}{C}$	$\frac{\ln \eta_r}{C}$
Solvent	72.54	72.56	72.62	72.57				
0.08	83.06	83.04	83.05	83.05	1.14	0.14	1.75	1.64
0.16	96.16	96.10	96.17	96.14	1.32	0.32	2.00	1.74
0.24	109.92	109.94	109.99	109.95	1.52	0.52	2.17	1.74
0.40	147.14	147.13	147.16	147.14	2.03	1.03	2.58	1.77

**Table B.2.1.13** Viscosity measurement of 0.5% PPVK for 8 hours at 135 °C

Concentration (g.dl <sup>-1</sup> )	t <sub>1</sub>	t <sub>2</sub>	t <sub>3</sub>	t <sub>avg</sub>	η <sub>r</sub>	η <sub>sp</sub>	$\frac{\eta_{sp}}{C}$	$\frac{\ln \eta_r}{C}$
Solvent	72.72	72.84	72.77	72.78				
0.08	81.89	81.97	81.94	81.93	1.12	0.12	1.50	1.42
0.16	91.62	91.64	91.57	91.61	1.26	0.26	1.62	1.44
0.24	103.87	103.82	103.86	103.85	1.43	0.43	1.79	1.49
0.40	131.52	131.56	131.53	131.54	1.81	0.81	2.02	1.48

**Table B.2.1.14** Viscosity measurement of 0.5% PPVK for 12 hours at 135 °C

Concentration (g.dl <sup>-1</sup> )	t <sub>1</sub>	t <sub>2</sub>	t <sub>3</sub>	t <sub>avg</sub>	η <sub>r</sub>	η <sub>sp</sub>	$\frac{\eta_{sp}}{C}$	$\frac{\ln \eta_r}{C}$
Solvent	72.91	72.84	72.88	72.88				
0.08	80.82	80.84	80.80	80.82	1.11	0.11	1.38	1.30
0.16	90.74	90.77	90.68	90.73	1.24	0.24	1.50	1.34
0.24	102.11	102.13	102.15	102.13	1.40	0.40	1.67	1.40
0.40	131.60	131.58	131.60	131.59	1.81	0.81	2.02	1.48

**Table B.2.1.15** Viscosity measurement of 0.5% PPVK (the middle film) for 16 hours at 135 °C

Concentration (g.dl <sup>-1</sup> )	t <sub>1</sub>	t <sub>2</sub>	t <sub>3</sub>	t <sub>avg</sub>	η <sub>r</sub>	η <sub>sp</sub>	$\frac{\eta_{sp}}{C}$	$\frac{\ln \eta_r}{C}$
Solvent	72.87	72.81	72.77	72.82				
0.08	79.67	79.76	79.70	79.71	1.09	0.09	1.12	1.08
0.16	87.13	87.05	87.06	87.08	1.20	0.20	1.25	1.14
0.24	96.33	96.41	96.37	96.37	1.32	0.32	1.33	1.16
0.40	119.19	119.02	119.14	119.12	1.64	0.64	1.60	1.24

**Table B.2.1.16** Viscosity measurement of 0.5% PPVK (the beginning film) for 16 hours at 135 °C

Concentration (g.dl <sup>-1</sup> )	t <sub>1</sub>	t <sub>2</sub>	t <sub>3</sub>	t <sub>avg</sub>	η <sub>r</sub>	η <sub>sp</sub>	$\frac{\eta_{sp}}{C}$	$\frac{\ln \eta_r}{C}$
Solvent	72.13	72.16	72.15	72.15				
0.08	79.55	79.59	79.66	79.60	1.10	0.10	1.25	1.19
0.16	87.90	87.71	87.86	87.82	1.22	0.22	1.38	1.24
0.24	96.63	96.79	96.71	96.71	1.34	0.34	1.42	1.22
0.40	118.66	118.77	118.70	118.71	1.64	0.64	1.60	1.24

**Table B.2.1.17** Viscosity measurement of 0.5% PPVK (the end film)  
for 16 hours at 135 °C

Concentration (g.dl <sup>-1</sup> )	t <sub>1</sub>	t <sub>2</sub>	t <sub>3</sub>	t <sub>avg</sub>	η <sub>r</sub>	η <sub>sp</sub>	$\frac{\eta_{sp}}{C}$	$\frac{\ln \eta_r}{C}$
Solvent	72.14	72.13	72.15	72.14				
0.08	79.74	79.56	79.69	79.66	1.10	0.10	1.25	1.19
0.16	87.38	87.48	87.43	87.43	1.21	0.21	1.31	1.19
0.24	96.52	96.69	96.57	96.59	1.34	0.34	1.42	1.22
0.40	118.13	118.17	118.20	118.18	1.64	0.64	1.60	1.24

**Table B.2.1.18** Viscosity measurement of 0.5% PPVK for 20 hours  
at 135 °C

Concentration (g.dl <sup>-1</sup> )	t <sub>1</sub>	t <sub>2</sub>	t <sub>3</sub>	t <sub>avg</sub>	η <sub>r</sub>	η <sub>sp</sub>	$\frac{\eta_{sp}}{C}$	$\frac{\ln \eta_r}{C}$
Solvent	72.22	72.25	72.26	72.24				
0.08	78.13	78.16	78.15	78.15	1.08	0.08	1.00	0.96
0.16	84.99	84.88	84.9	84.93	1.18	0.18	1.12	1.03
0.24	93.39	93.32	93.38	93.36	1.29	0.29	1.21	1.06
0.40	110.21	110.24	110.23	110.23	1.53	0.53	1.32	1.06

**Table B.2.1.19** Viscosity measurement of 0.1% PPVK for original test sample at 135 °C

Concentration (g.dl <sup>-1</sup> )	t <sub>1</sub>	t <sub>2</sub>	t <sub>3</sub>	t <sub>avg</sub>	η <sub>r</sub>	η <sub>sp</sub>	$\frac{\eta_{sp}}{C}$	$\frac{\ln \eta_r}{C}$
Solvent	71.91	71.98	71.95	71.95				
0.08	89.06	89.05	89.09	89.071	1.24	0.24	3.00	2.69
0.16	109.30	109.24	109.23	109.26	1.52	0.52	3.25	2.62
0.24	133.78	133.86	133.84	133.83	1.86	0.86	3.58	2.58
0.40	190.77	190.80	190.72	190.76	2.65	1.65	4.12	2.44

**Table B.2.1.20** Viscosity measurement of 0.1% PPVK for 4 hours at 135 °C

Concentration (g.dl <sup>-1</sup> )	t <sub>1</sub>	t <sub>2</sub>	t <sub>3</sub>	t <sub>avg</sub>	η <sub>r</sub>	η <sub>sp</sub>	$\frac{\eta_{sp}}{C}$	$\frac{\ln \eta_r}{C}$
Solvent	72.33	72.30	72.35	72.33				
0.08	83.48	83.42	83.51	83.47	1.15	0.15	1.88	1.75
0.16	95.84	95.76	95.81	95.80	1.32	0.32	2.00	1.74
0.24	110.34	110.27	110.37	110.33	1.52	0.52	2.17	1.74
0.40	147.95	147.94	147.86	147.92	2.04	1.04	2.60	1.78

**Table B.2.1.21** Viscosity measurement of 0.1% PPVK for 8 hours  
at 135 °C

Concentration (g.dl <sup>-1</sup> )	t <sub>1</sub>	t <sub>2</sub>	t <sub>3</sub>	t <sub>avg</sub>	η <sub>r</sub>	η <sub>sp</sub>	$\frac{\eta_{sp}}{C}$	$\frac{\ln\eta_r}{C}$
Solvent	72.07	72.01	72.11	72.09				
0.08	81.14	81.19	81.24	81.19	1.13	0.13	1.62	1.53
0.16	92.64	92.63	92.67	92.65	1.28	0.28	1.75	1.54
0.24	104.96	104.84	104.99	104.93	1.46	0.46	1.92	1.58
0.40	133.58	133.60	133.59	133.59	1.85	0.85	2.12	1.54

**Table B.2.1.22** Viscosity measurement of 0.1% PPVK for 12 hours  
at 135 °C

Concentration (g.dl <sup>-1</sup> )	t <sub>1</sub>	t <sub>2</sub>	t <sub>3</sub>	t <sub>avg</sub>	η <sub>r</sub>	η <sub>sp</sub>	$\frac{\eta_{sp}}{C}$	$\frac{\ln\eta_r}{C}$
Solvent	72.19	72.18	72.18	72.18				
0.08	80.01	80.02	80.04	80.07	1.11	0.11	1.38	1.30
0.16	90.90	90.52	90.45	90.46	1.25	0.25	1.56	1.39
0.24	100.66	100.61	100.56	100.61	1.39	0.39	1.62	1.37
0.40	128.56	128.52	128.67	128.58	1.78	0.78	1.95	1.44

**Table B.2.1.23** Viscosity measurement of 0.1% PPVK for 16 hours  
at 135 °C

Concentration (g.dl <sup>-1</sup> )	t <sub>1</sub>	t <sub>2</sub>	t <sub>3</sub>	t <sub>avg</sub>	η <sub>r</sub>	η <sub>sp</sub>	$\frac{\eta_{sp}}{C}$	$\frac{\ln \eta_r}{C}$
Solvent	72.09	72.06	72.02	72.06				
0.08	79.28	79.15	79.23	79.22	1.10	0.10	1.25	1.19
0.16	88.52	88.55	88.47	88.51	1.23	0.23	1.44	1.29
0.24	96.73	96.84	96.89	96.82	1.34	0.34	1.42	1.22
0.40	123.88	123.76	123.85	123.83	1.72	0.72	1.80	1.36

**Table B.2.1.24** Viscosity measurement of 0.1% PPVK for 20 hours  
at 135 °C

Concentration (g.dl <sup>-1</sup> )	t <sub>1</sub>	t <sub>2</sub>	t <sub>3</sub>	t <sub>avg</sub>	η <sub>r</sub>	η <sub>sp</sub>	$\frac{\eta_{sp}}{C}$	$\frac{\ln \eta_r}{C}$
Solvent	72.59	72.64	72.55	72.59				
0.08	79.00	79.05	79.07	79.04	1.09	0.09	1.12	1.08
0.16	87.08	87.13	87.00	87.07	1.20	0.20	1.25	1.14
0.24	94.59	94.61	94.62	94.62	1.30	0.30	1.25	1.09
0.40	114.81	114.83	114.88	118.84	1.58	0.58	1.45	1.14

**Table B.2.1.25** Viscosity measurement of 0.5% PPVK (MW  $10^5$ ) for original test sample at 135 °C

Concentration (g.dl <sup>-1</sup> )	$t_1$	$t_2$	$t_3$	$t_{avg}$	$\eta_r$	$\eta_{sp}$	$\frac{\eta_{sp}}{C}$	$\frac{\ln \eta_r}{C}$
Solvent	72.56	72.46	72.49	72.50				
0.08	90.69	90.69	90.71	90.70	1.25	0.25	3.12	2.79
0.16	114.14	114.14	114.00	114.09	1.57	0.57	3.56	2.82
0.24	141.74	141.68	141.70	141.71	1.95	0.95	3.96	2.78
0.40	216.69	216.49	216.56	216.58	2.99	1.99	4.98	2.74

**Table B.2.1.26** Viscosity measurement of 0.5% PPVK (MW  $10^5$ ) for 4 hours at 135 °C

Concentration (g.dl <sup>-1</sup> )	$t_1$	$t_2$	$t_3$	$t_{avg}$	$\eta_r$	$\eta_{sp}$	$\frac{\eta_{sp}}{C}$	$\frac{\ln \eta_r}{C}$
Solvent	72.60	72.63	72.60	72.61				
0.08	84.52	84.56	84.52	84.53	1.16	0.16	2.00	1.86
0.16	99.34	99.46	99.31	99.37	1.37	0.37	2.31	1.97
0.24	115.67	115.53	115.56	115.59	1.59	0.59	2.46	1.93
0.40	164.41	164.43	164.55	164.46	2.26	2.26	3.15	2.04



**Table B.2.1.27** Viscosity measurement of 0.5% PPVK (MW  $10^5$ ) for 8 hours at 135 °C

Concentration (g.dl <sup>-1</sup> )	t <sub>1</sub>	t <sub>2</sub>	t <sub>3</sub>	t <sub>avg</sub>	η <sub>r</sub>	η <sub>sp</sub>	$\frac{\eta_{sp}}{C}$	$\frac{\ln \eta_r}{C}$
Solvent	72.41	72.43	72.41	72.42				
0.08	81.87	81.99	81.88	81.91	1.13	0.13	1.62	1.53
0.16	93.68	93.69	93.74	93.70	1.29	0.29	1.81	1.59
0.24	107.79	107.64	107.74	107.72	1.49	0.49	2.04	1.66
0.40	143.55	143.42	143.45	143.47	1.98	0.98	2.45	1.71

**Table B.2.1.28** Viscosity measurement of 0.5% PPVK (MW  $10^5$ ) for 12 hours at 135 °C

Concentration (g.dl <sup>-1</sup> )	t <sub>1</sub>	t <sub>2</sub>	t <sub>3</sub>	t <sub>avg</sub>	η <sub>r</sub>	η <sub>sp</sub>	$\frac{\eta_{sp}}{C}$	$\frac{\ln \eta_r}{C}$
Solvent	72.63	72.65	72.63	72.64				
0.08	84.65	81.55	81.58	81.59	1.12	0.12	1.50	1.42
0.16	92.57	92.55	92.64	92.59	1.27	0.27	1.69	1.49
0.24	106.06	106.06	106.07	106.06	1.46	0.46	1.92	1.58
137.59	137.59	137.50	137.41	137.50	1.89	0.89	2.22	1.59

**Table B.2.1.29** Viscosity measurement of 0.5% PPVK (MW  $10^5$ ) for 16 hours at 135 °C

Concentration (g.dl <sup>-1</sup> )	$t_1$	$t_2$	$t_3$	$t_{avg}$	$\eta_r$	$\eta_{sp}$	$\frac{\eta_{sp}}{C}$	$\frac{\ln \eta_r}{C}$
Solvent	72.33	72.39	72.34	72.35				
0.08	79.41	79.48	79.34	79.41	1.10	0.10	1.25	1.19
0.16	88.55	88.45	88.49	88.50	1.22	0.22	1.38	1.24
0.24	98.52	98.47	98.51	98.50	1.36	0.36	1.50	1.28
0.40	126.21	126.31	126.30	126.27	1.74	0.74	1.85	1.38

**Table B.2.1.30** Viscosity measurement of 0.5% PPVK (MW  $10^5$ ) for 20 hours at 135 °C

Concentration (g.dl <sup>-1</sup> )	$t_1$	$t_2$	$t_3$	$t_{avg}$	$\eta_r$	$\eta_{sp}$	$\frac{\eta_{sp}}{C}$	$\frac{\ln \eta_r}{C}$
Solvent	72.12	72.10	72.16	72.13				
0.08	78.11	78.03	78.02	78.05	1.08	0.08	1.00	0.96
0.16	85.05	85.17	85.02	85.08	1.18	0.18	1.12	1.03
0.24	92.34	92.30	92.37	92.34	1.28	0.28	1.17	1.03
0.40	114.03	114.03	114.03	114.05	1.58	0.58	1.45	1.14

B.2.2 Thickness of film : 0.020 mm.**Table B.2.2.1** Viscosity measurement of 0% PPVK for original test sample at 135 °C

Concentration (g.dl <sup>-1</sup> )	t <sub>1</sub>	t <sub>2</sub>	t <sub>3</sub>	t <sub>avg</sub>	η <sub>r</sub>	η <sub>sp</sub>	$\frac{\eta_{sp}}{C}$	$\frac{\ln \eta_r}{C}$
Solvent	72.16	72.16	72.19	72.17				
0.08	88.95	88.88	88.95	88.93	1.23	0.23	2.88	2.59
0.16	107.46	107.36	107.43	107.42	1.49	0.49	3.06	2.49
0.24	133.40	133.31	133.38	133.36	1.85	0.85	3.54	2.56
0.40	186.35	186.41	186.38	186.38	2.58	1.58	3.95	2.37

**Table B.2.2.2** Viscosity measurement of 0% PPVK for 4 hours at 135 °C

Concentration (g.dl <sup>-1</sup> )	t <sub>1</sub>	t <sub>2</sub>	t <sub>3</sub>	t <sub>avg</sub>	η <sub>r</sub>	η <sub>sp</sub>	$\frac{\eta_{sp}}{C}$	$\frac{\ln \eta_r}{C}$
Solvent	72.23	72.29	72.33	72.28				
0.08	85.18	85.15	85.13	85.15	1.18	0.18	2.25	2.07
0.15	99.34	99.33	99.37	99.35	1.37	0.37	2.47	2.10
0.23	116.20	116.20	116.28	116.23	1.61	0.61	2.65	2.07
0.38	159.76	159.80	159.78	159.78	2.21	1.21	3.18	2.09

**Table B.2.2.3** Viscosity measurement of 0% PPVK for 8 hours at 135 °C

Concentration (g.dl <sup>-1</sup> )	t <sub>1</sub>	t <sub>2</sub>	t <sub>3</sub>	t <sub>avg</sub>	η <sub>r</sub>	η <sub>sp</sub>	$\frac{\eta_{sp}}{C}$	$\frac{\ln \eta_r}{C}$
Solvent	72.20	72.19	72.26	72.22				
0.07	82.56	82.59	82.61	82.59	1.14	0.14	2.00	1.87
0.13	94.76	94.73	94.74	94.74	1.31	0.31	2.38	2.08
0.20	107.03	107.02	107.08	107.04	1.48	0.48	2.40	1.96
0.33	138.64	138.70	138.63	138.66	1.92	0.92	2.79	1.98

**Table B.2.2.4** Viscosity measurement of 0% PPVK for 12 hours at 135 °C

Concentration (g.dl <sup>-1</sup> )	t <sub>1</sub>	t <sub>2</sub>	t <sub>3</sub>	t <sub>avg</sub>	η <sub>r</sub>	η <sub>sp</sub>	$\frac{\eta_{sp}}{C}$	$\frac{\ln \eta_r}{C}$
Solvent	72.27	72.28	72.25	72.27				
0.06	80.12	80.12	80.07	80.08	1.11	0.11	1.83	1.74
0.13	90.52	90.46	90.52	90.50	1.25	0.25	1.92	1.72
0.19	101.04	101.08	101.12	101.08	1.40	0.40	2.10	1.69
0.32	125.46	125.40	125.52	125.46	1.74	0.74	2.31	1.73

**Table B.2.2.5** Viscosity measurement of 0% PPVK for 16 hours at 135 °C

Concentration (g.dl <sup>-1</sup> )	t <sub>1</sub>	t <sub>2</sub>	t <sub>3</sub>	t <sub>avg</sub>	η <sub>r</sub>	η <sub>sp</sub>	$\frac{\eta_{sp}}{C}$	$\frac{\ln \eta_r}{C}$
Solvent	71.98	71.90	71.95	71.94				
0.08	79.85	79.88	79.89	79.84	1.11	0.11	1.38	1.30
0.16	87.52	87.59	87.62	87.58	1.22	0.22	1.38	1.24
0.24	96.09	96.02	96.01	96.04	1.34	0.34	1.42	1.22
0.40	116.09	116.01	116.05	116.05	1.61	0.61	1.52	1.19

**Table B.2.2.6** Viscosity measurement of 0% PPVK for 20 hours at 135 °C

Concentration (g.dl <sup>-1</sup> )	t <sub>1</sub>	t <sub>2</sub>	t <sub>3</sub>	t <sub>avg</sub>	η <sub>r</sub>	η <sub>sp</sub>	$\frac{\eta_{sp}}{C}$	$\frac{\ln \eta_r}{C}$
Solvent	72.51	72.56	72.41	72.57				
0.08	79.38	79.30	79.28	79.32	1.09	0.09	1.12	1.07
0.16	86.53	86.66	86.72	86.64	1.19	0.19	1.19	1.09
0.24	95.15	95.14	95.06	95.12	1.31	0.31	1.29	1.12
0.40	114.88	114.86	114.86	114.87	1.58	0.58	1.45	1.14

**Table B.2.2.7** Viscosity measurement of 2.0% PPVK for original test sample at 135 °C

Concentration (g.dl <sup>-1</sup> )	t <sub>1</sub>	t <sub>2</sub>	t <sub>3</sub>	t <sub>avg</sub>	η <sub>r</sub>	η <sub>sp</sub>	$\frac{\eta_{sp}}{C}$	$\frac{\ln\eta_r}{C}$
Solvent	71.91	71.91	71.91	71.91				
0.08	87.59	87.53	87.66	87.59	1.22	0.22	2.75	2.48
0.16	106.88	106.88	106.87	106.88	1.49	0.49	3.06	2.49
0.24	129.76	129.75	129.86	129.77	1.80	0.80	3.33	2.45
0.40	184.66	184.64	184.67	184.66	2.57	1.57	3.92	2.36

**Table B.2.2.8** Viscosity measurement of 2.0% PPVK for 4 hours at 135 °C

Concentration (g.dl <sup>-1</sup> )	t <sub>1</sub>	t <sub>2</sub>	t <sub>3</sub>	t <sub>avg</sub>	η <sub>r</sub>	η <sub>sp</sub>	$\frac{\eta_{sp}}{C}$	$\frac{\ln\eta_r}{C}$
Solvent	72.13	72.09	72.18	72.13				
0.08	85.62	85.55	85.46	85.54	1.18	0.18	2.25	2.07
0.17	101.93	101.99	101.95	101.96	1.41	0.41	2.41	2.02
0.25	121.98	121.85	121.90	121.91	1.69	0.69	2.76	2.10
0.42	167.49	167.33	167.29	167.37	2.32	1.32	3.14	2.00

**Table B.2.2.9** Viscosity measurement of 2.0% PPVK for 8 hours at 135 °C

Concentration (g.dl <sup>-1</sup> )	t <sub>1</sub>	t <sub>2</sub>	t <sub>3</sub>	t <sub>avg</sub>	η <sub>r</sub>	η <sub>sp</sub>	$\frac{\eta_{sp}}{C}$	$\frac{\ln \eta_r}{C}$
Solvent	72.28	72.32	72.29	72.30				
0.10	85.88	85.82	85.98	85.86	1.19	0.19	1.90	1.74
0.19	101.70	101.71	101.77	101.73	1.41	0.41	2.16	1.81
0.29	120.82	120.84	120.89	120.85	1.67	0.67	2.31	1.77
0.48	165.61	165.41	165.68	165.57	2.29	1.29	2.69	1.73

**Table B.2.2.10** Viscosity measurement of 2.0% PPVK for 12 hours at 135 °C

Concentration (g.dl <sup>-1</sup> )	t <sub>1</sub>	t <sub>2</sub>	t <sub>3</sub>	t <sub>avg</sub>	η <sub>r</sub>	η <sub>sp</sub>	$\frac{\eta_{sp}}{C}$	$\frac{\ln \eta_r}{C}$
Solvent	72.30	72.21	72.21	72.24				
0.09	83.21	83.23	83.21	83.22	1.15	0.15	1.67	1.55
0.19	97.84	94.91	97.87	97.87	1.35	0.35	1.84	1.58
0.28	133.28	133.34	133.26	133.29	1.57	0.57	2.04	1.61
0.47	151.09	151.10	151.13	151.11	2.09	1.09	2.32	1.57

**Table B.2.2.11** Viscosity measurement of 2.0% PPVK for 16 hours at 135 °C

Concentration (g.dl <sup>-1</sup> )	t <sub>1</sub>	t <sub>2</sub>	t <sub>3</sub>	t <sub>avg</sub>	η <sub>r</sub>	η <sub>sp</sub>	$\frac{\eta_{sp}}{C}$	$\frac{\ln\eta_r}{C}$
Solvent	72.25	72.26	72.31	72.27				
0.08	79.08	79.16	79.13	79.12	1.09	0.09	1.12	1.08
0.16	85.93	85.87	85.88	85.89	1.19	0.19	1.19	1.09
0.24	92.81	92.88	92.76	92.82	1.28	0.28	1.17	1.03
0.40	108.28	108.39	108.24	108.30	1.50	0.50	1.25	1.01

**Table B.2.2.12** Viscosity measurement of 2.0% PPVK for 20 hours at 135 °C

Concentration (g.dl <sup>-1</sup> )	t <sub>1</sub>	t <sub>2</sub>	t <sub>3</sub>	t <sub>avg</sub>	η <sub>r</sub>	η <sub>sp</sub>	$\frac{\eta_{sp}}{C}$	$\frac{\ln\eta_r}{C}$
Solvent	72.59	72.60	72.59	72.59				
0.08	78.13	78.08	78.13	78.11	1.08	0.08	1.00	0.96
0.16	84.36	84.32	84.25	84.31	1.16	0.16	1.00	0.93
0.24	92.55	92.53	92.56	92.55	1.27	0.27	1.12	1.00
0.40	108.56	108.60	180.59	180.58	1.50	0.50	1.25	1.01



### B.3 Examples of find intrinsic viscosity

Example B.3.1 Intrinsic viscosity of 0% PPVK for original sample (data from Table B.1.1)

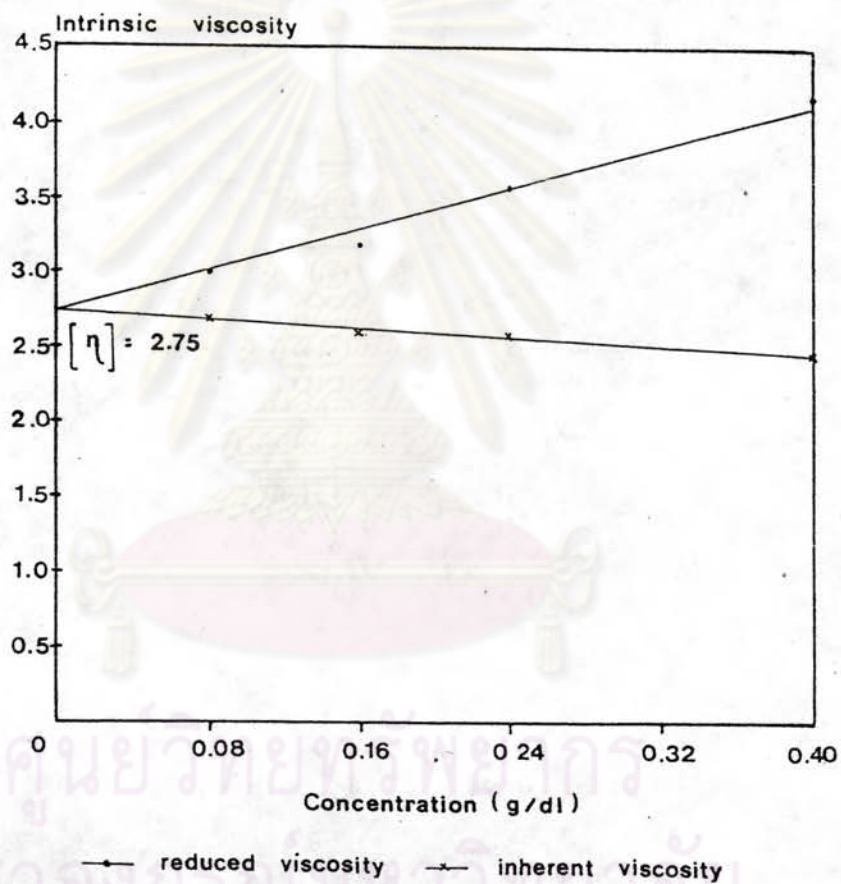


Fig. B.3.1. Intrinsic viscosity of 0% PPVK for original sample

Example B.3.2 Intrinsic viscosity of 1.0% PPVK for original sample (data from Table B.1.7)

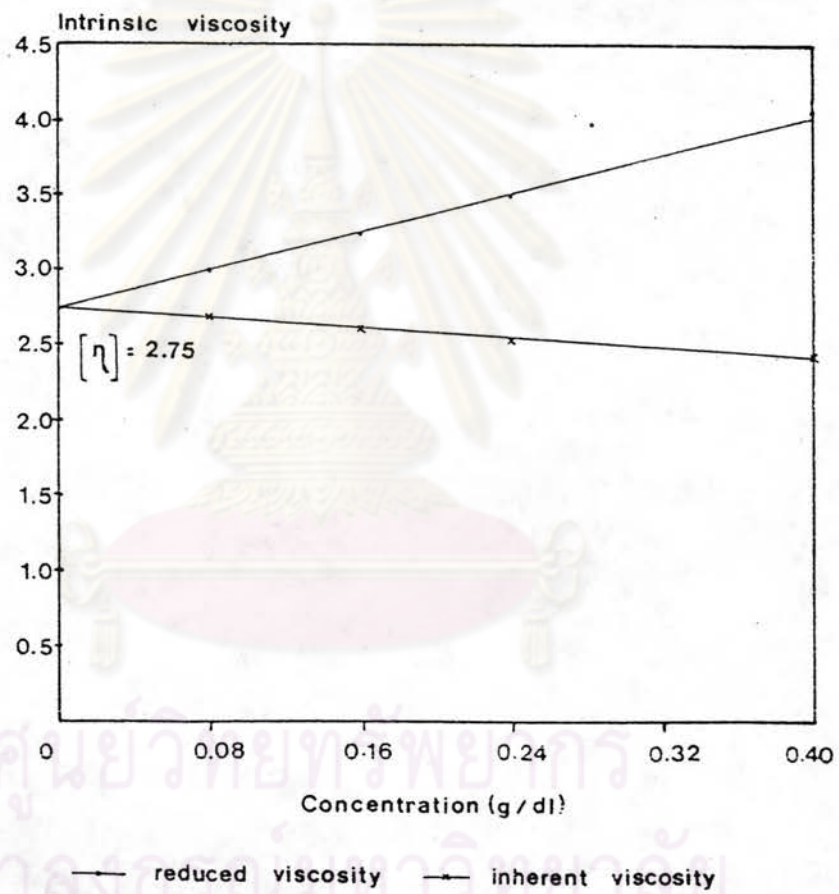
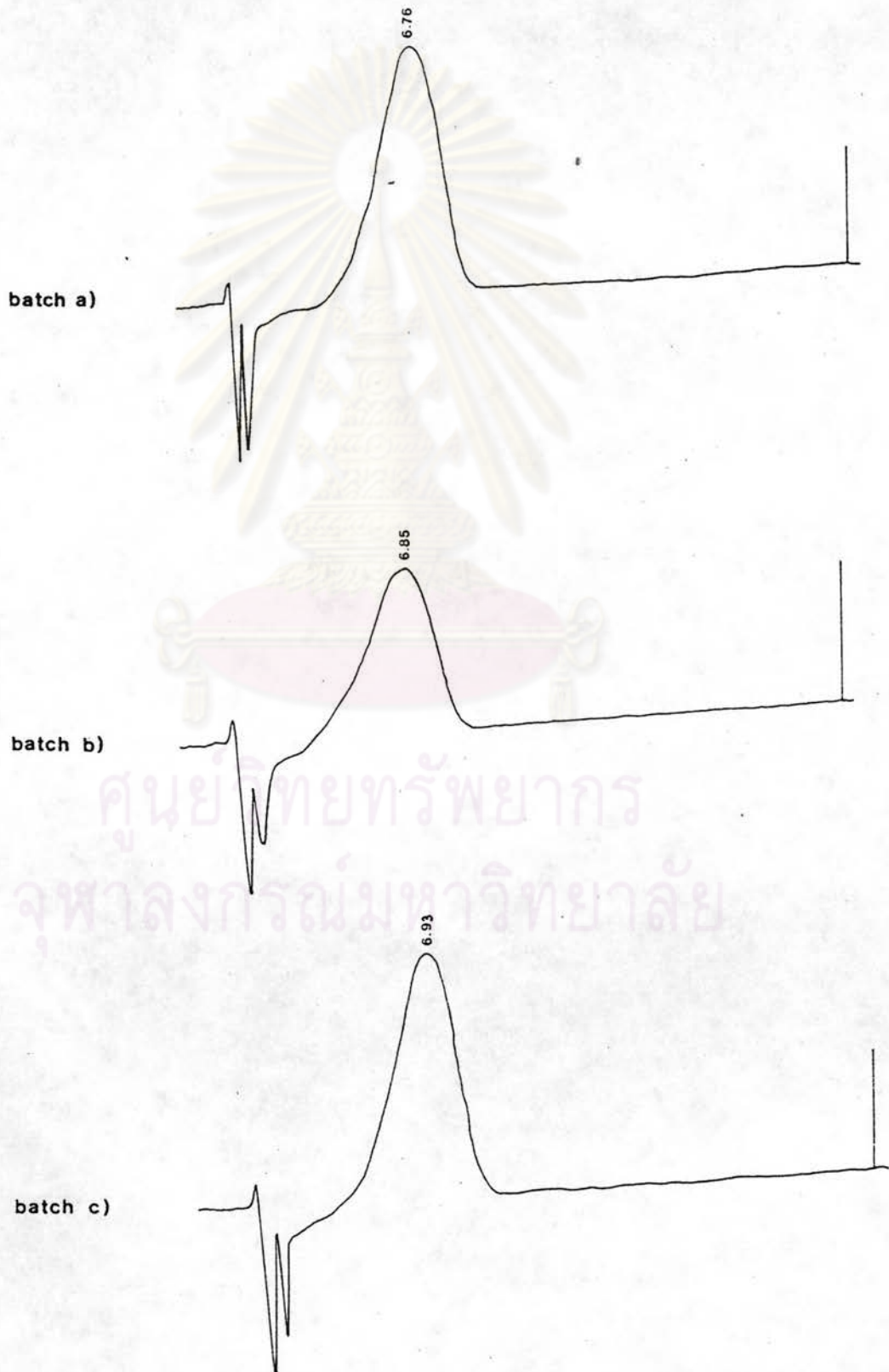


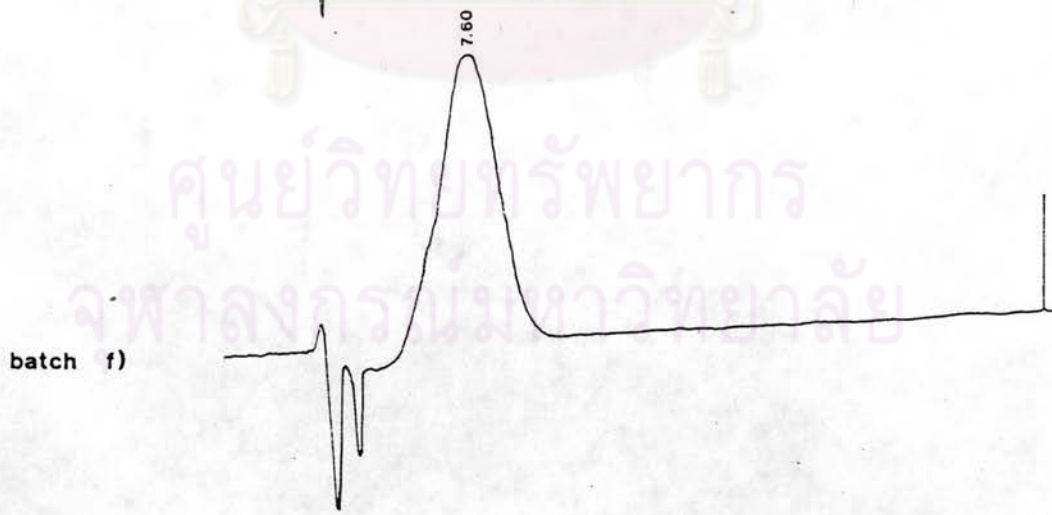
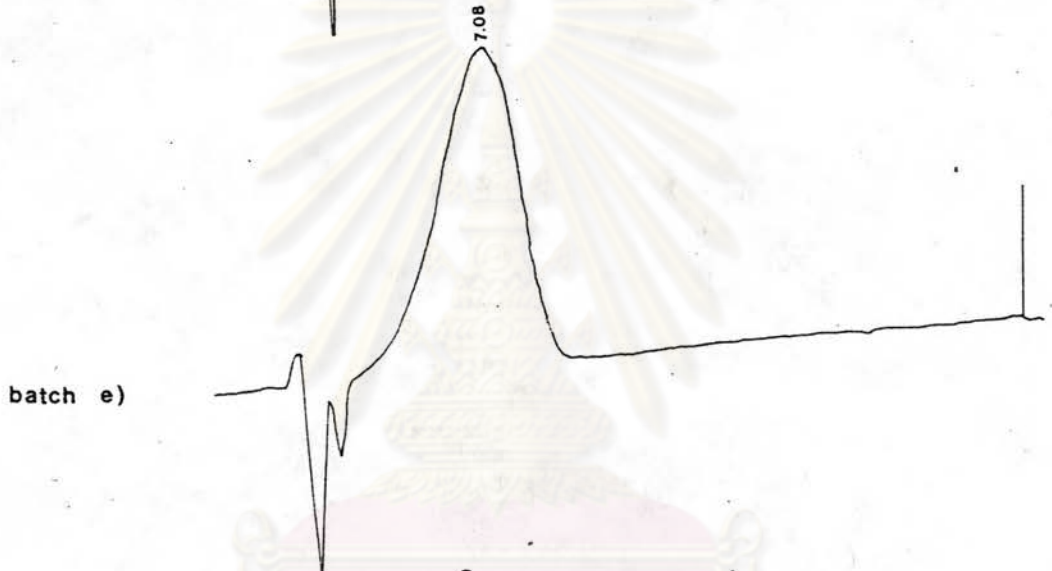
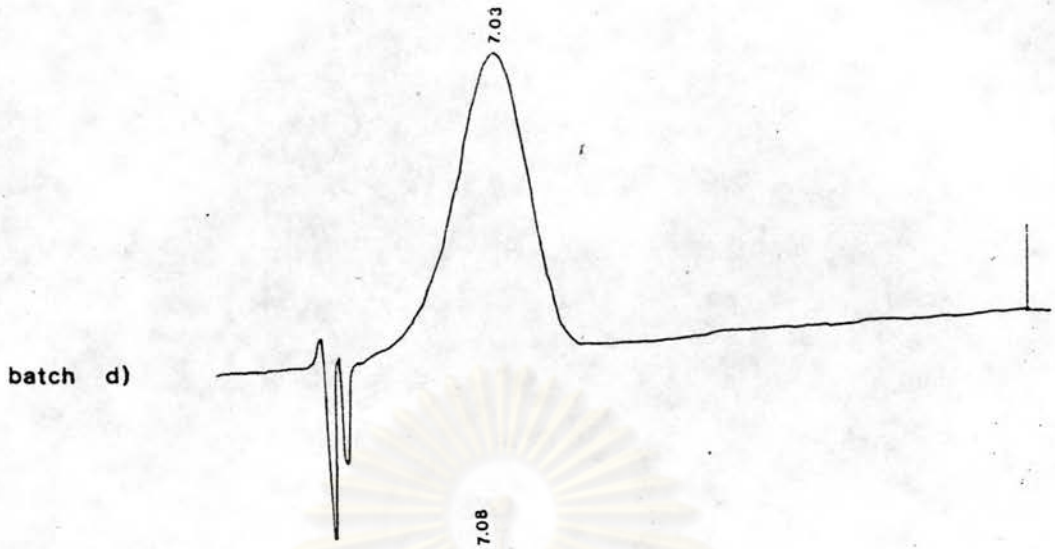
Fig. B.3.2 Intrinsic viscosity of 1.0% PPVK for original sample

APPENDIX C

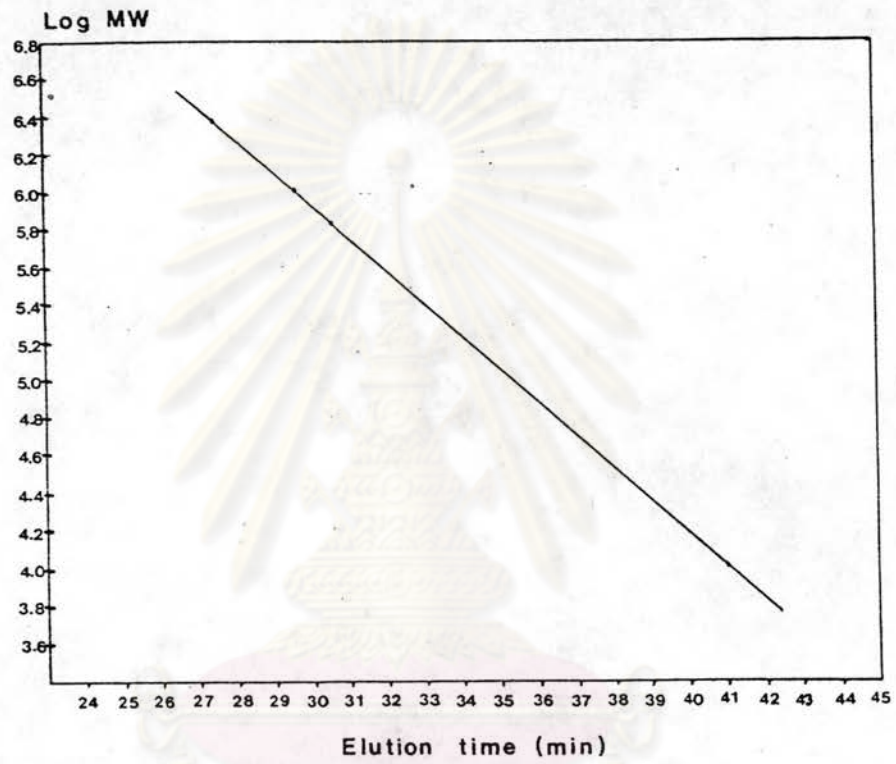
GPC CHROMATOGRAMS OF POLY(PHENYL VINYL KETONE)



ศูนย์วิทยทรัพยากร  
จุฬาลงกรณ์มหาวิทยาลัย



ศูนย์วิทยার্থพยาบาล  
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Calibration curve of polystyrene standard

ศูนย์วิทยาศาสตร์  
จุฬาลงกรณ์มหาวิทยาลัย

APPENDIX D

METEOROLOGICAL DATA

Month 1991	Air Temp. (°C)	Humidity(%)	Rainfall(mm.)	Radiation (MJ/m <sup>2</sup> )
January	27.5	74	0.1	16.67
February	27.9	70	0.2	19.34
March	30.0	76	0.1	23.00
April	30.6	76	1.1	22.48
May	30.6	76	5.1	20.59
June	29.5	76	2.2	17.71
July	29.3	73	6.9	18.02
August	28.7	74	3.8	16.04
September	28.7	76	8.9	16.23
October	27.8	76	5.6	16.81
November	26.4	70	1.2	18.60
December	26.0	71	0.1	16.34

The meteorological data were collected from The Monthly Report of the Climatology Division, Meteorological Department.

## VITA

Miss Paveena Khansawai was born on September 7, 1965 in Kalasin. She received a Bachelor's Degree of Science, Chemistry, from Kasetsart University in 1988. She has been a graduate student at the Petroleum and Petrochemical College, Chulalongkorn University, since 1988.



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