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ศูนย์วิทยทรัพยากร
จุฬาลงกรณ์มหาวิทยาลัย



APPENDIX A

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จุฬาลงกรณ์มหาวิทยาลัย

A1 Raw Data

Raw data of the tensile measurement of uncrosslinked and crosslinked chitosan films at various glutaraldehyde concentration, 20 minutes of crosslinking time

Table A1 Raw data of the tensile measurement of uncrosslinked chitosan films

Sample	Thickness (mm.)	Elongation (mm.)	% Elongation	Max.Load (N)	Load at Break (N)	Load at Yield (N)
1	0.058	8.5	85.8	9.94	9.94	0.84
2	0.058	9.1	91.6	10.56	10.56	1.36
3	0.057	4.9	48	9.5	9.48	0.83
4	0.058	7	79	10.71	10.69	1.1
5	0.058	7.7	77.1	10.71	10.7	1
Mean	0.058	7.44	76.3	10.28	10.27	1.03
SD	0	1.63	16.83	0.54	0.54	0.22

Table A2 Raw data of the tensile measurement of crosslinked chitosan films at 0.01% w/w glutaraldehyde concentration, 20 minutes of crosslinking time

Sample	Thickness (mm.)	Elongation (mm.)	% Elongation	Max. Load (N)	Load at Break (N)	Load at Yield (N)
1	0.057	1.6	16.6	8.28	8.28	0.26
2	0.057	1.4	14.1	7.98	7.98	0.29
3	0.058	1.7	17.5	7.52	7.42	0.35
4	0.058	2.4	24.3	8.21	8.21	0.25
5	0.057	2	29	9.29	6.4	0.43
Mean	0.057	1.82	20.3	8.26	7.66	0.32
SD	0	0.39	6.16	0.65	0.78	0.07

Table A3 Raw data of the tensile measurement of crosslinked chitosan films at 0.02% w/w glutaraldehyde concentration, 20 minutes of crosslinking time

Sample	Thickness (mm.)	Elongation (mm.)	% Elongation	Max. Load (N)	Load at Break (N)	Load at Yield (N)
1	0.057	1.7	17.1	9.33	9.33	0.86
2	0.057	1.6	16.5	8.44	8.43	0.96
3	0.058	1.5	15.8	9.11	9.1	0.12
4	0.057	2.1	21.3	9.71	9.71	0.86
5	0.058	2.9	29.8	9.23	9.23	0.71
Mean	0.057	1.96	20.1	9.16	9.16	0.7
SD	0	0.57	5.83	0.46	0.47	0.34

Table A4 Raw data of the tensile measurement of crosslinked chitosan films at 0.04% w/w glutaraldehyde concentration, 20 minutes of crosslinking time

Sample	Thickness (mm.)	Elongation (mm.)	% Elongation	Max. Load (N)	Load at Break (N)	Load at Yield (N)
1	0.056	1.2	12.5	8.44	7.54	1.06
2	0.056	2.1	21.8	9.09	9.09	0.75
3	0.056	2.2	22.3	8.73	8.72	0.83
4	0.057	2.8	28.3	7.88	7.88	0.9
5	0.057	2.5	25.3	9.2	9.18	0.91
Mean	0.056	2.16	22.04	8.67	8.48	0.89
SD	0	0.6	5.94	0.53	0.74	0.11

Table A5 Raw data of the tensile measurement of crosslinked chitosan films at 0.06% w/w glutaraldehyde concentration, 20 minutes of crosslinking time

Sample	Thickness (mm.)	Elongation (mm.)	% Elongation	Max. Load (N)	Load at Break (N)	Load at Yield (N)
1	0.057	1.6	16	8.95	8.91	0.74
2	0.057	1.88	18.83	8.5	8.49	0.8
3	0.058	1.97	19.67	9.03	9.02	0.98
4	0.057	1.78	17.83	9.11	9.11	0.71
5	0.057	2.2	22.6	8.96	8.9	0.72
Mean	0.057	1.89	18.99	8.91	8.89	0.79
SD	0	0.22	2.44	0.24	0.24	0.11

The raw data of the tensile measurement of uncrosslinked chitosan films after soaked the films in various solvents for 24 hours

Table A6 The raw data of the tensile measurement of uncrosslinked chitosan films, used as blank.

Sample No.	Thickness (mm.)	Elongation (mm.)	% Elongation	Max. Load (N)	Load at Break (N)	Load at Yield (N)
1	0.057	6.3	63.6	11.05	11	0.19
2	0.057	7.7	77.1	10.71	10.7	0.3
3	0.057	6.4	64.13	11.08	11.02	0.28
Mean	0.057	6.8	68.28	10.95	10.91	0.27
SD	0	0.78	7.65	0.21	0.18	0.06

Table A7 The raw data of the tensile measurement of uncrosslinked chitosan films after soaked the films in hexane for 24 hours.

Sample	Thickness (mm.)	Elongation (mm.)	% Elongation	Max. Load (N)	Load at Break (N)	Load at Yield (N)
1	0.057	4.8	47	9.8	9.8	0.25
2	0.057	4.5	44	10.09	10.08	0.29
3	0.057	4.9	49.6	10.46	10.24	0.77
Mean	0.057	4.73	46.87	10.12	10.04	0.44
SD	0	0.21	2.8	0.33	0.22	0.29

Table A8 The raw data of the tensile measurement of uncrosslinked chitosan films after soaked the films in methyl isobutyl ketone for 24 hours.

Sample	Thickness (mm.)	Elongation (mm.)	% Elongation	Max. Load (N)	Load at Break (N)	Load at Yield (N)
1	0.058	2.2	22.6	10.1	9.84	0.83
2	0.057	3.5	35.5	9.99	9.99	0.27
3	0.057	4.5	44	10.99	10.98	0.42
Mean	0.057	3.4	34.03	10.36	10.27	0.51
SD	0	1.15	10.78	0.55	0.62	0.29

ศูนย์วิทยทรัพยากร
จุฬาลงกรณ์มหาวิทยาลัย

Table A9 The raw data of the tensile measurement of uncrosslinked chitosan films after soaked the films in ethyl acetate for 24 hours.

Sample No.	Thickness (mm.)	Elongation (mm.)	% Elongation	Max. Load (N)	Load at Break (N)	Load at Yield (N)
1	0.057	3.5	35.5	13.19	13.16	1.24
2	0.057	4.1	41.6	13.46	13.43	0.34
3	0.057	3.1	30	13.72	13.35	0.53
Mean	0.057	3.57	35.7	13.46	13.31	0.7
SD	0	0.5	5.8	0.27	0.14	0.47

Table A10 The raw data of the tensile measurement of uncrosslinked chitosan films after soaked the films in 95% aq.ethanol for 24 hours.

Sample	Thickness (mm.)	Elongation (mm.)	% Elongation	Max. Load (N)	Load at Break (N)	Load at Yield (N)
1	0.058	2.5	25.3	5.82	5.81	0.49
2	0.057	4.1	41.3	6.37	6.37	0.43
3	0.057	3.8	38.5	6.61	6.61	0.47
Mean	0.057	3.47	35.03	6.27	6.26	0.46
SD	0	0.85	8.54	0.41	0.41	0.03

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The raw data of the tensile measurement of crosslinked chitosan films at 0.02%w/w glutaraldehyde concentration and 20 minutes of crosslinking time after soaked the films in various solvents for 24 hours.

Table A11 The raw data of the tensile measurement of crosslinked chitosan films at 0.02%w/w glutaraldehyde concentration and 20 minutes of crosslinking time, used as blank

Sample	Thickness (mm.)	Elongation (mm.)	% Elongation	Max. Load (N)	Load at Break (N)	Load at Yield (N)
1	0.057	1.8	18.3	10.52	9.96	0.69
2	0.057	1.5	15.1	10.12	10.12	0.42
3	0.057	1.1	11.5	10.01	10.01	1.33
Mean	0.057	1.47	14.97	10.22	10.03	0.81
SD	0	0.35	3.4	0.27	0.08	0.47

Table A12 The raw data of the tensile measurement of crosslinked chitosan films at 0.02%w/w glutaraldehyde concentration and 20 minutes of crosslinking time after soaked the films in hexane for 24 hours.

Sample	Thickness (mm.)	Elongation (mm.)	% Elongation	Max Load (N)	Load at Break (N)	Load at Yield (N)
1	0.057	8.2	82.5	12.09	12.09	0.79
2	0.057	2.8	27	12.22	12.22	1.16
3	0.058	1.1	11.8	10.77	10.77	1.33
Mean	0.057	4.03	40.43	11.69	11.69	1.09
SD	0	3.71	37.22	0.8	0.8	0.28

Table A13 The raw data of the tensile measurement of crosslinked chitosan films at 0.02%w/w glutaraldehyde concentration and 20 minutes of crosslinking time after soaked films in methyl isobutyl ketone for 24 hours.

Sample	Thickness (mm.)	Elongation (mm.)	% Elongation	Max Load (N)	Load at Break (N)	Load at Yield (N)
1	0.058	1.7	17.1	15.58	15.5	0.39
2	0.057	1.6	16.3	12.25	12.24	0.84
3	0.057	2.1	21.3	13.47	13.47	0.58
Mean	0.057	1.8	18.23	13.77	13.74	0.6
SD	0	0.26	2.69	1.68	1.65	0.23

Table A14 The raw data of the tensile measurement of crosslinked chitosan films at 0.02%w/w glutaraldehyde concentration and 20 minutes of crosslinking time after soaked the films in ethyl acetate for 24 hours.

Sample	Thickness (mm.)	Elongation (mm.)	% Elongation	Max Load (N)	Load at Break (N)	Load at Yield (N)
1	0.058	1.7	17.5	14.78	14.78	0.37
2	0.057	1.9	18	15.62	13.36	0.66
3	0.057	1.6	16.8	14.25	14.25	0.4
Mean	0.057	1.73	17.43	14.88	14.13	0.48
SD	0	0.15	0.6	0.69	0.72	0.16

Table A15 The raw data of the tensile measurement of crosslinked chitosan films at 0.02%w/w glutaraldehyde concentration and 20 minutes of crosslinking time after soaked the films in 95%aq. ethanol for 24 hours.

Sample	Thickness (mm.)	Elongation (mm.)	% Elongation	Max Load (N)	Load at Break (N)	Load at Yield (N)
1	0.057	0.8	8.6	5.98	5.29	0.48
2	0.057	1.8	17	6.33	6.33	0.23
3	0.057	1.5	15.3	6.17	6.14	0.25
Mean	0.057	1.37	13.63	6.16	5.92	0.32
SD	0	0.51	4.44	0.18	0.55	0.14

ศูนย์วิทยทรัพยากร
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Table A16 The percentage of separation (%Sep) of each membranes finished at each solute concentrations.

COUPON	%Sep	%Sep	%Sep	%Sep	%Sep	%Sep	%Sep	%Sep	%Sep	%Sep
	600	1500	6000	12000	35000	35000	100000	200000	300000	600000
a	53.0	64.0	72.0	70.0	70.0	63.0	99.0	99.0	99.0	99.0
b	4.0	4.0	3.0	5.0	1.0	6.0	10.0	1.0	2.0	0.0
c	0.0	-1.0	-4.0	-1.0	1.0	6.0	57.0	69.0	83.0	94.0
d	-2.0	-1.0	-3.0	-2.0	3.0	6.0	59.0	72.0	87.0	95.0
e	-1.0	-1.0	-6.0	-2.0	2.0	6.0	50.0	64.0	76.0	89.0
f	-1.0	-2.0	-4.0	3.0	1.0	6.0	63.0	75.0	91.0	98.0

a: 14%w/w polyacrylonitrile/chitosan membrane

b: 14%w/w polyacrylonitrile/chitosan membrane crosslinked with 0.02% glutaraldehyde for 20 minutes

c,d,e,f : 14%w/w polyacrylonitrile membrane



APPENDIX B

ศูนย์วิทยทรัพยากร
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B1 Figures

The IR spectrum of crosslinked chitosan films at various concentration and 20 and 40 minutes of crosslinking time

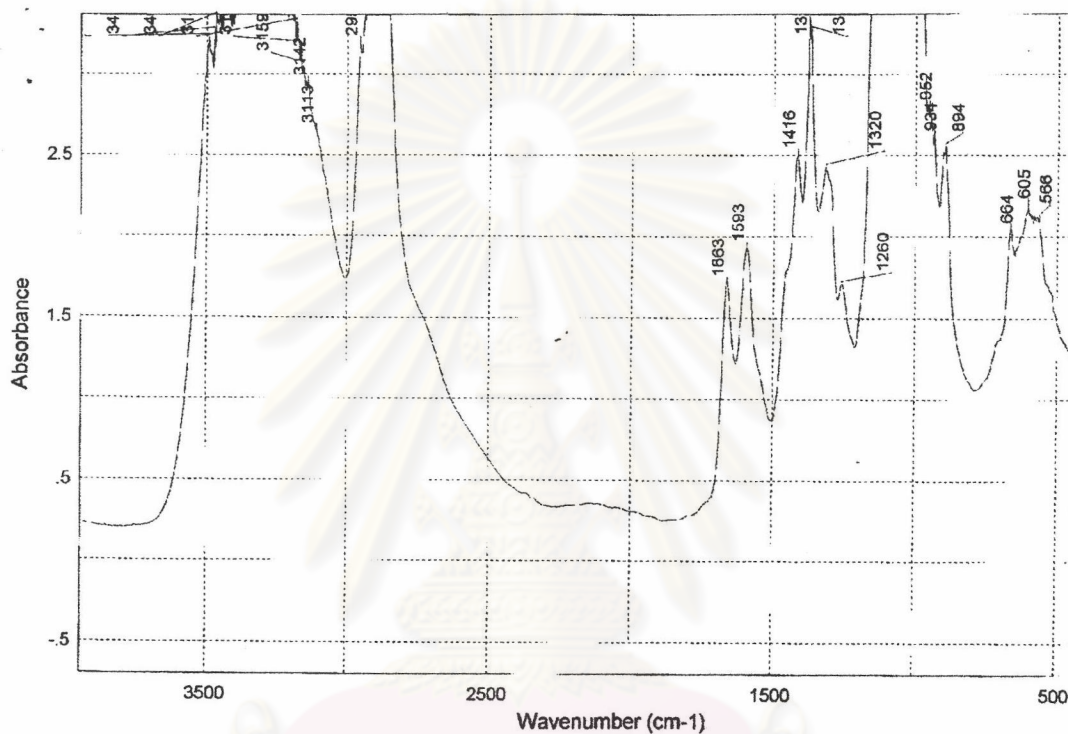


Figure B1 The IR spectrum of crosslinked film at 0.02% w/w glutaraldehyde concentration, 20 minutes

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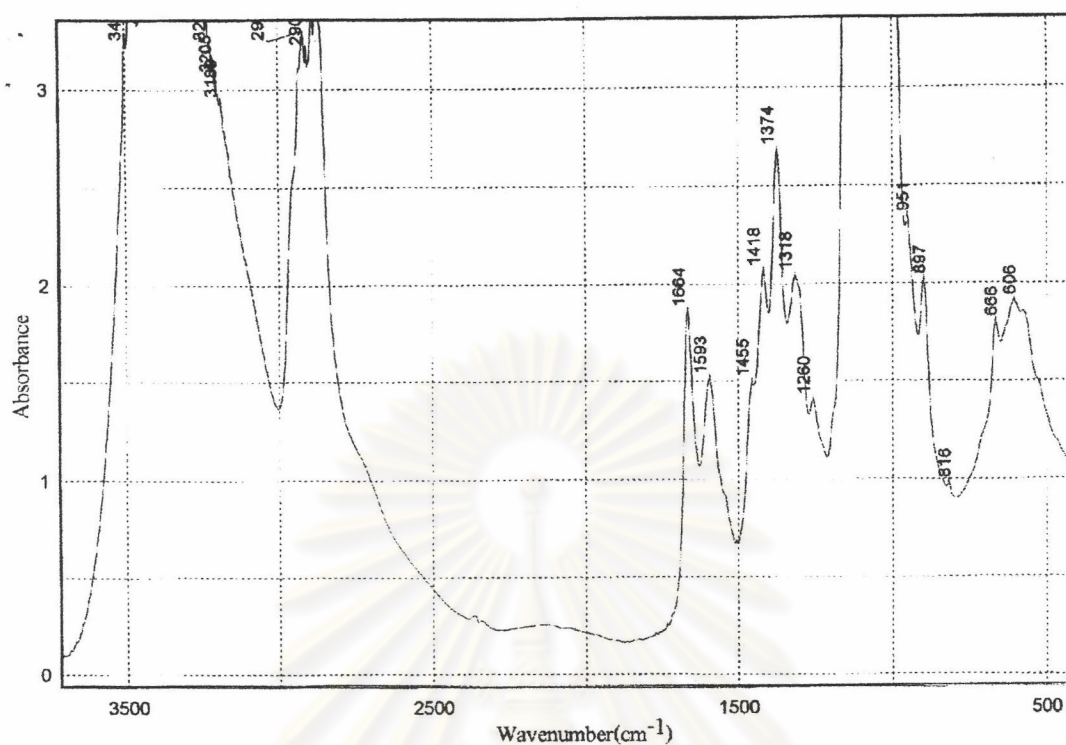


Figure B2 The IR spectrum of crosslinked film at 0.02% w/w glutaraldehyde concentration, 40 minutes

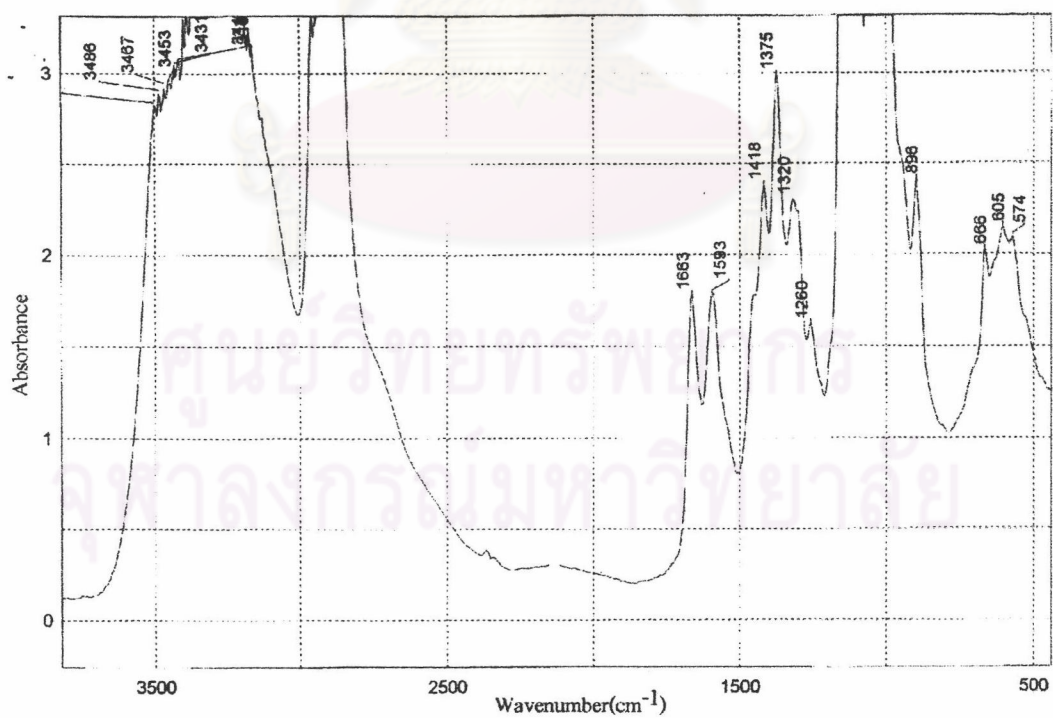


Figure B3 The IR spectrum of crosslinked film at 0.04% w/w glutaraldehyde concentration, 20 minutes

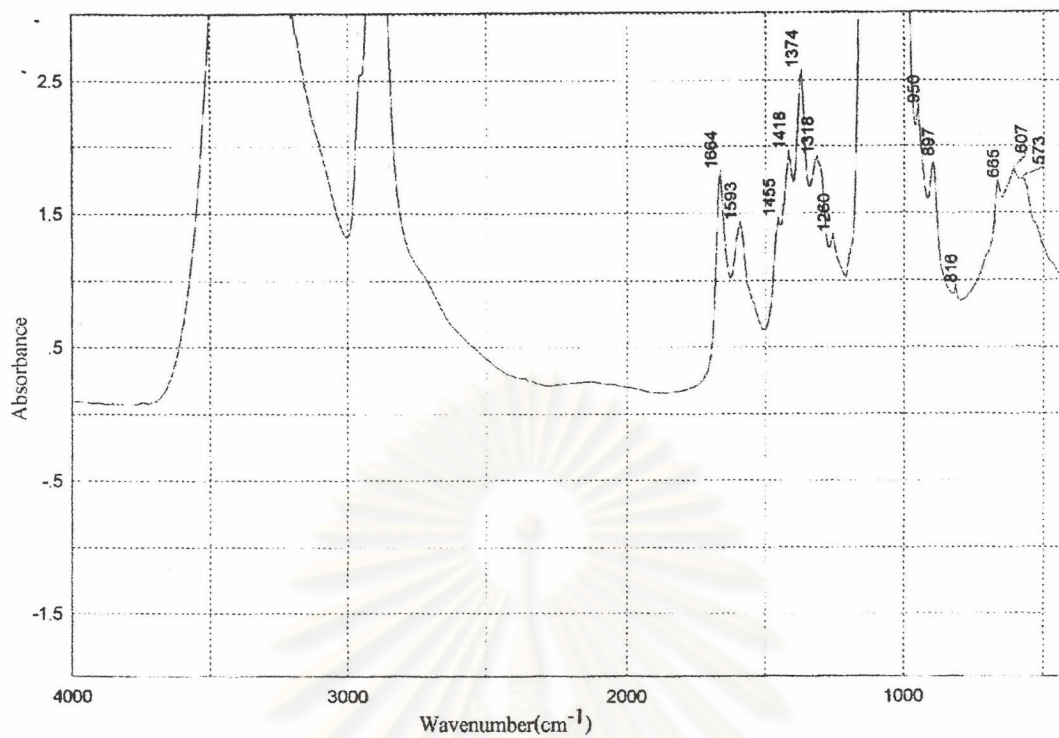


Figure B4 The IR spectrum of crosslinked film at 0.04% w/w glutaraldehyde concentration, 40 minutes

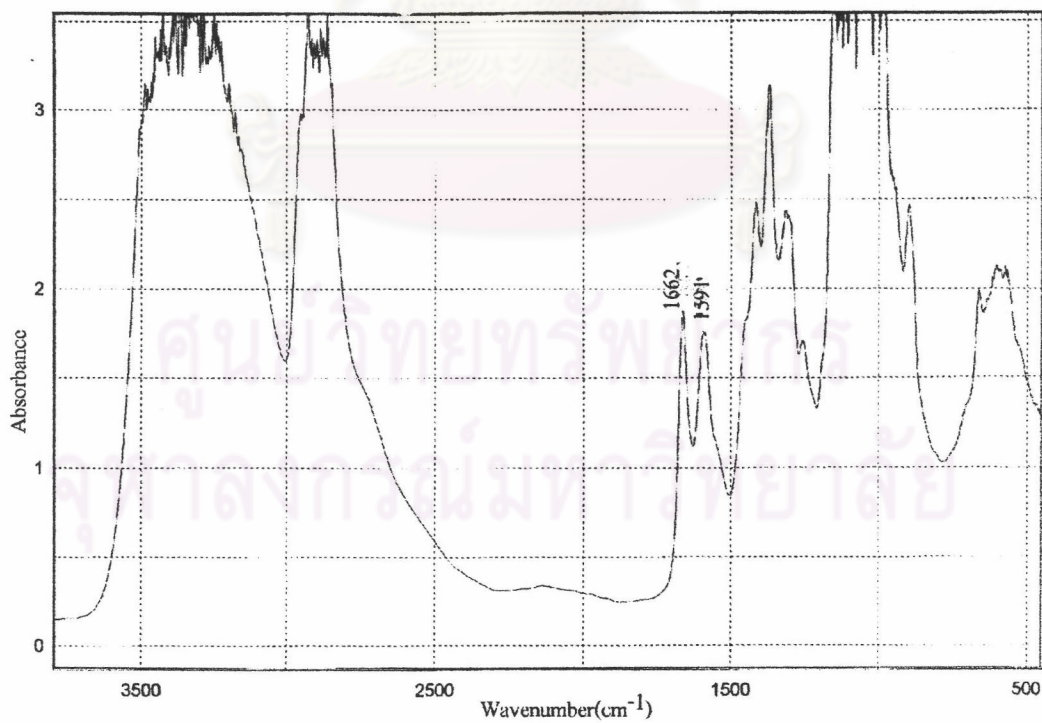


Figure B5 The IR spectrum of crosslinked film at 0.06% w/w glutaraldehyde concentration, 20 minutes

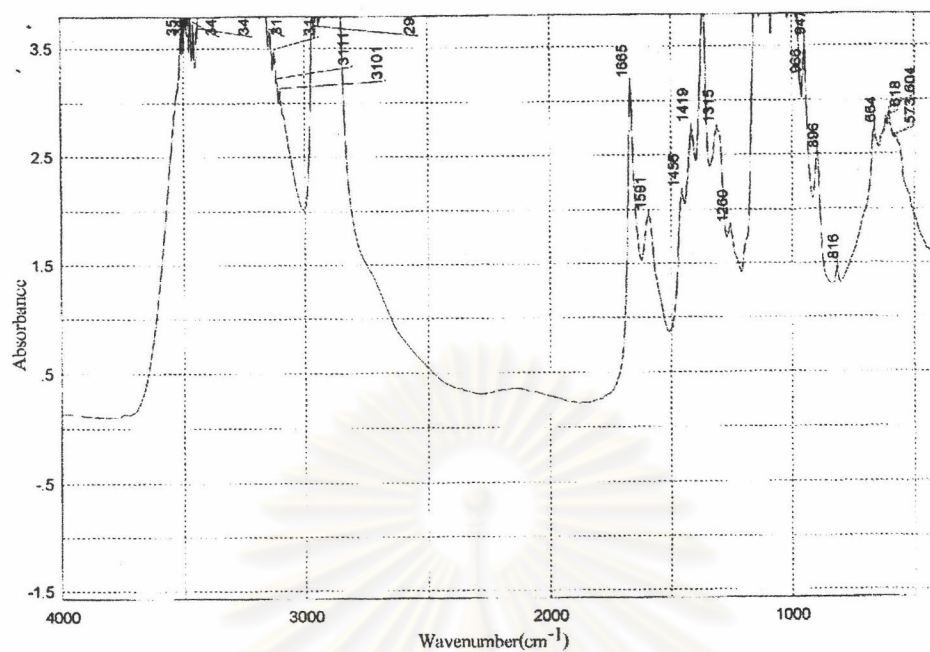


Figure B6 The IR spectrum of crosslinked film at 0.06% w/w glutaraldehyde concentration, 40 minutes

The IR spectrums of the standard solution at various concentration and dichloromethane solvent.

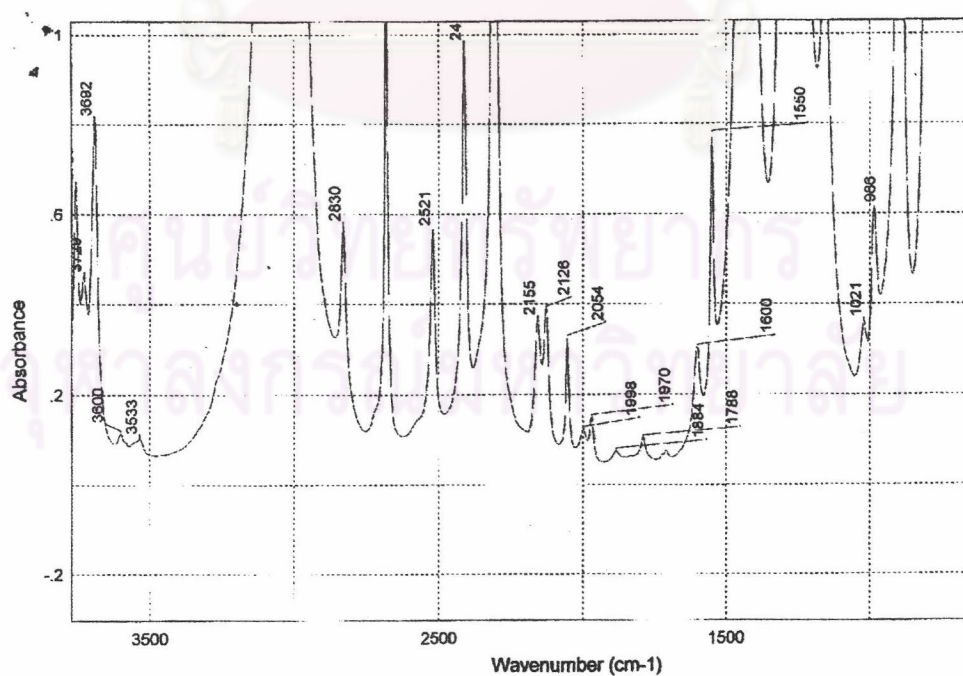


Figure B7 The IR spectrum of dichloromethane solvent

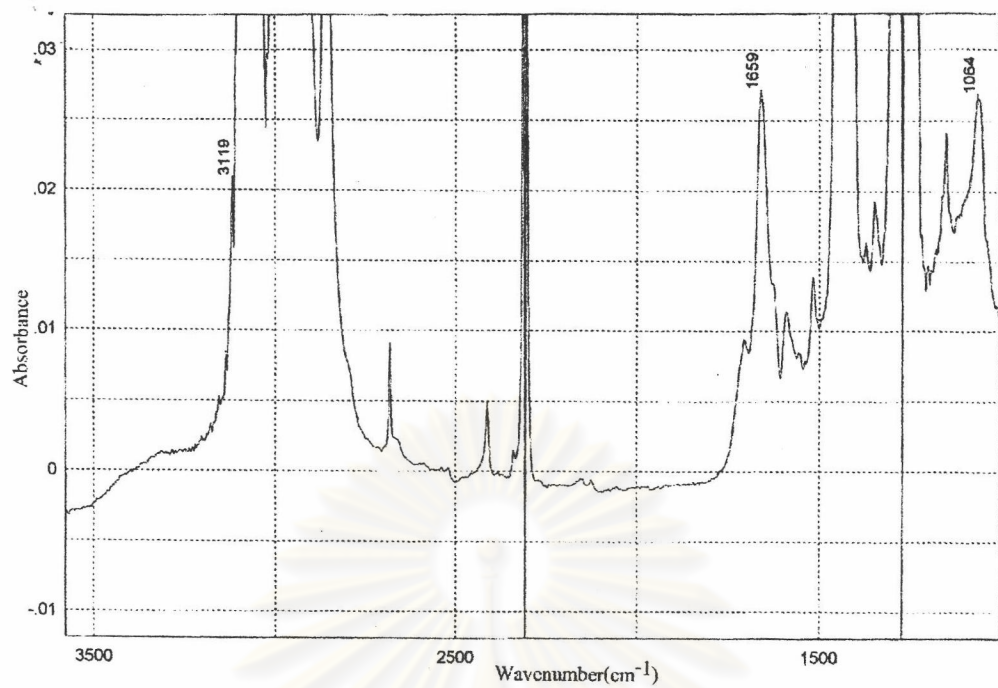


Figure B8 The IR spectrum of the standard solution: A

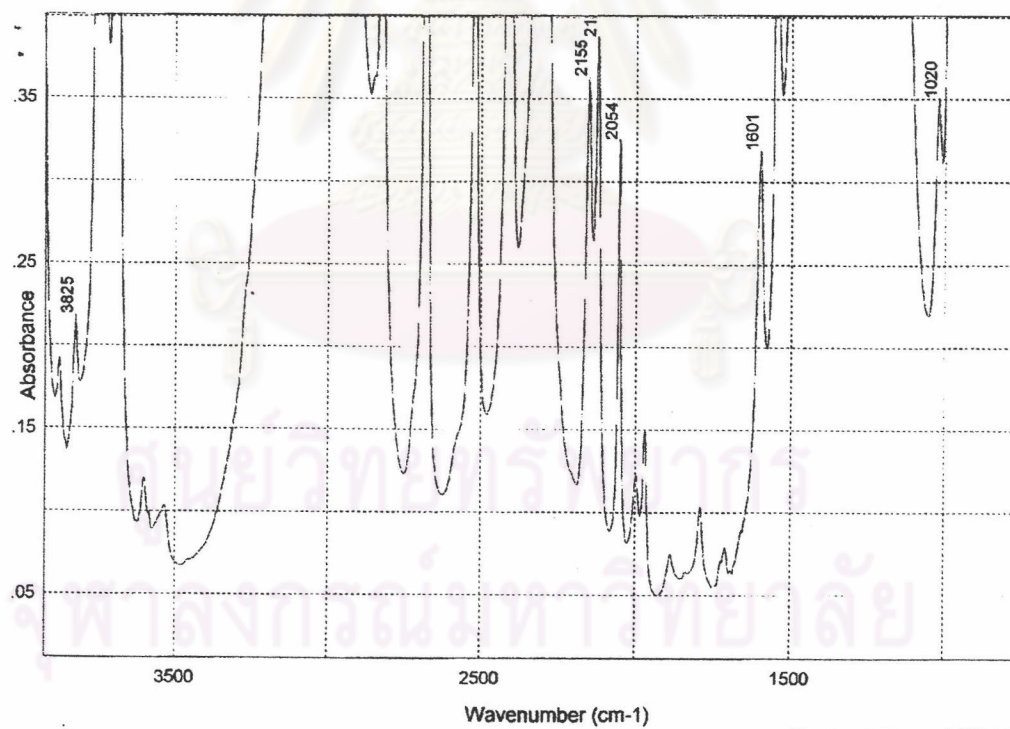


Figure B9 The IR spectrum of the standard solution: B

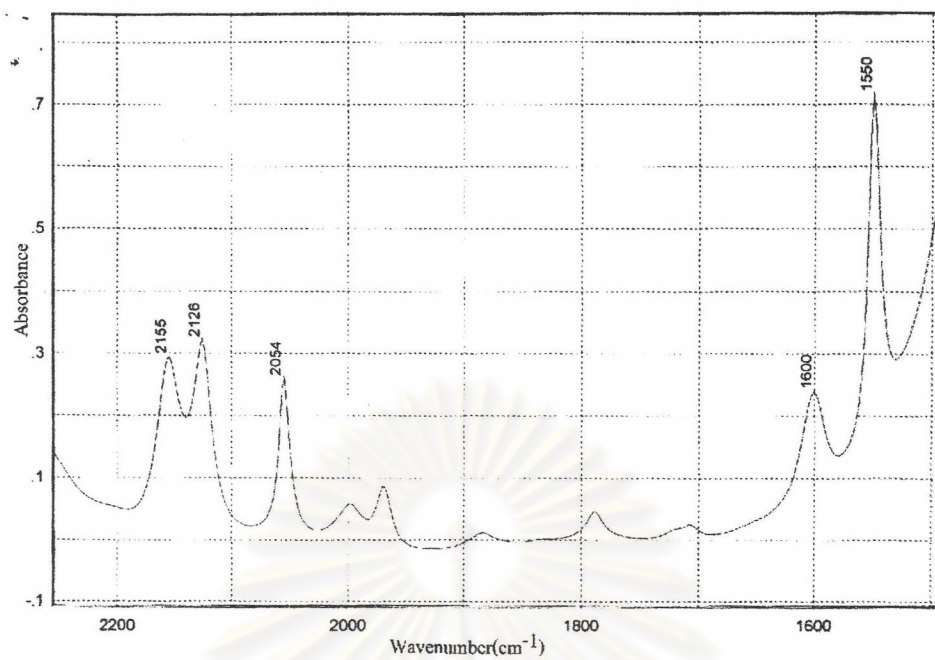


Figure B10 The IR spectrum of the standard solution: C

The spectral subtractions of the standard solution at various concentration by the IR spectrum of dichloromethane solvent

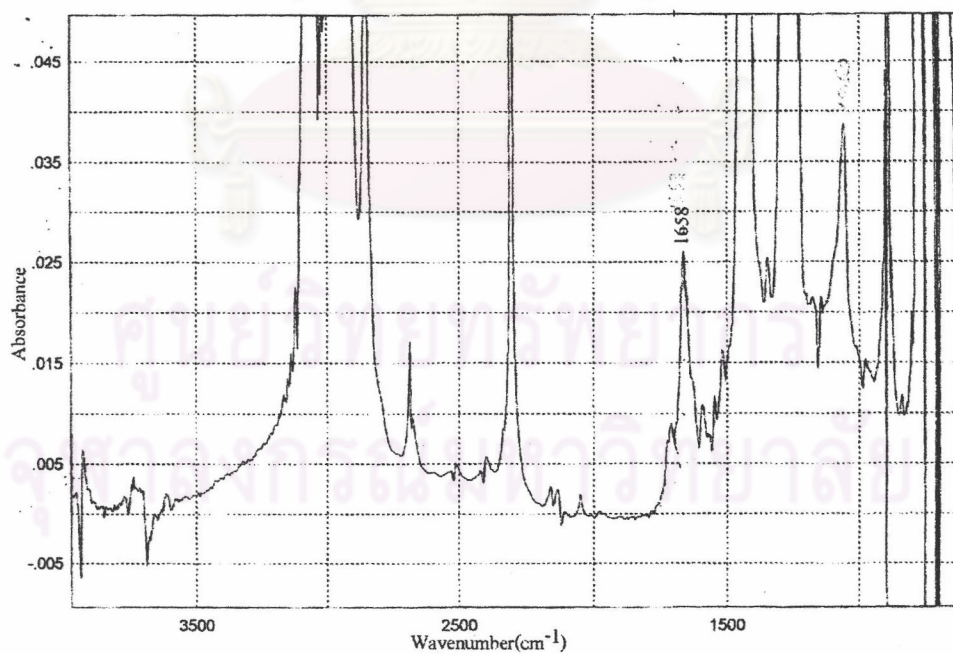


Figure B11 The spectral subtraction of the IR spectrum of the standard solution: A by the IR spectrum of dichloromethane

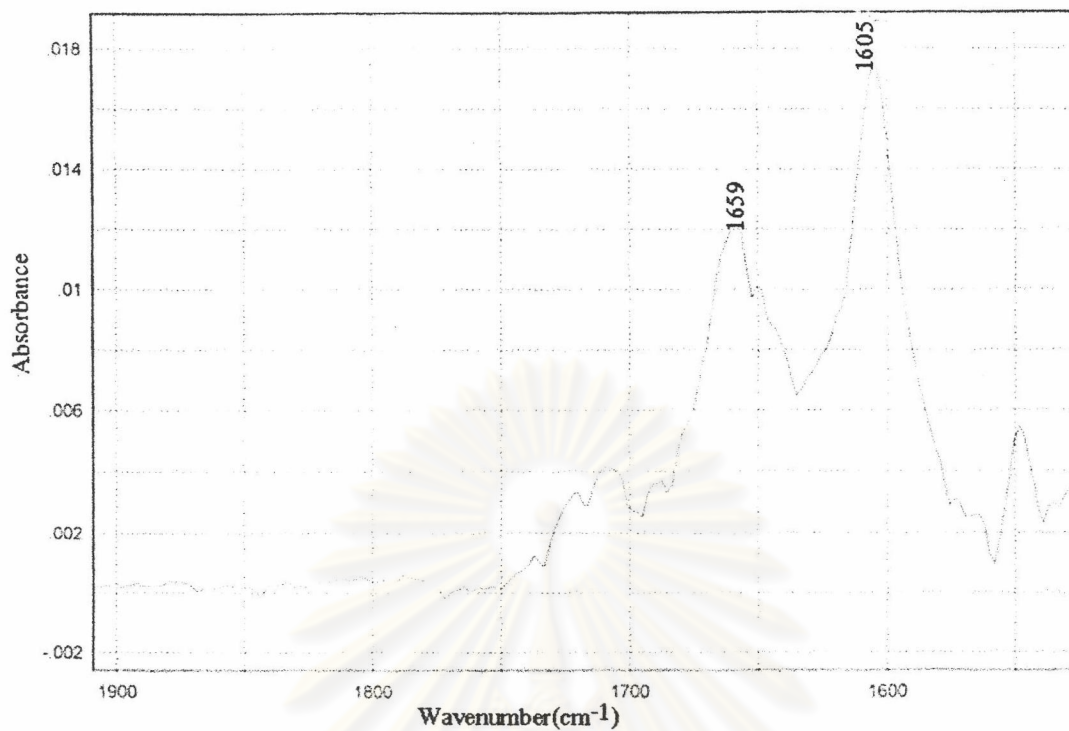


Figure B12 The spectral subtraction of the IR spectrum of the standard solution: B by the IR spectrum of dichloromethane

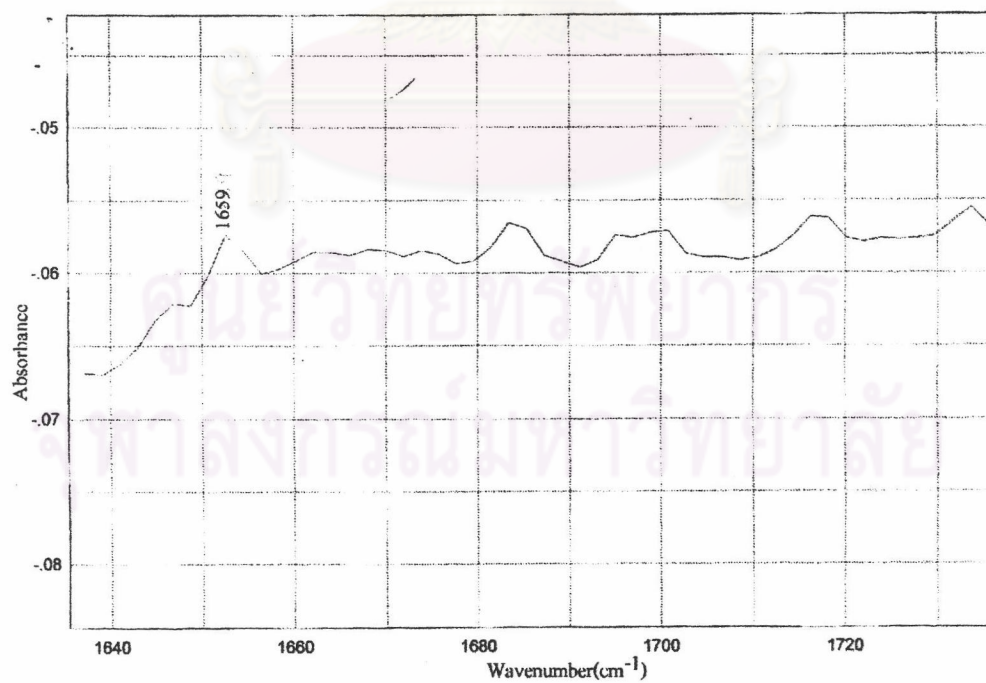


Figure B13 The spectral subtraction of the IR spectrum of the standard solution: C by the IR spectrum of dichloromethane

Curriculum Vitae

Miss Sununta Atsawasuwan was born in Bangkok, Thailand, on September 30, 1977. She received the second honour in Bachelor of Science degree majoring in Polymer Science and Textile from the Department of Materials Science, Chulalongkorn University in 1999. She started as a graduate student with a major in Applied Polymer Science and Textile Technology, Chulalongkorn University in June 1999 and completed the program in September 2001.



ศูนย์วิทยทรัพยากร
จุฬาลงกรณ์มหาวิทยาลัย