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Appendix I

Calculation

A. Calculation of mole fraction in the feed (f_1, f_2)

Let $F_1 = 0.5$ and $F_2 = 0.5$

$r_1 = 1.32$ (PCMSTY) $r_2 = 0.72$ (STY)

$$F_1 = \frac{r_1 f_1^2 + f_1 f_2}{r_1 f_1^2 + 2 f_1 f_2 + r_2 f_2^2} \qquad \text{.....1}$$

$$0.5 = \frac{1.32 f_1^2 + f_1 (1-f_1)}{1.32 f_1^2 + 2 f_1 (1-f_1) + 0.72 (1-f_1)^2}$$

$$= \frac{0.32 f_1^2 + f_1}{0.04 f_1^2 + 0.56 f_1 + 0.72}$$

$$0.6 f_1^2 + 1.44 f_1 - 0.72 = 0$$

$$f_1 = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$= \frac{-1.44 \pm \sqrt{2.07 + 1.73}}{1.2}$$

$f_1 = 0.42$

$f_2 = 1 - 0.42 = 0.58$

the overall mole of monomer was 0.32

So $f_1 = 0.42(0.32) = 0.13$ mole

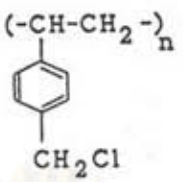
and $f_2 = 0.58(0.32) = 0.19$ mole

the amount of CMSTY = 0.13 x 152 = 19.76 g

the amount of STY = 0.19 x 104 = 19.76 g

B. Calculation of percentage element

1. Poly(p-chloromethylstyrene)

structure 

Formular wt. of polymer

atom	atomic wt.	numbers	atom.wt x numbers
C	12.011	9n	12.011 x 9n
H	1.008	9n	1.008 x 9n
Cl	35.453	n	35.453 x n

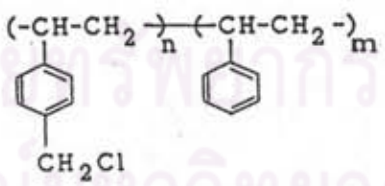
Formula wt. of polymer = 152.624 n

so % C = 70.83 %

% H = 5.94 %

% Cl = 23.23 %

2. Poly(p-chloromethylstyrene-co-styrene)

structure 

Formular wt. of polymer

atom	atomic wt.	number	atom.wt x number
C	12.011	9n + 8m	12.011(9n + 8m)
H	1.008	9n + 8m	1.008(9n + 8m)
Cl	35.453	n	35.453 n

Formular weight of polymer 152.624n + 104.152 m

Let n = 0.5, and m = 0.5

So % C = 79.52 %

% H = 6.67 %

% Cl = 13.81 %

C. Calculation for F_1,F_2, Poly(p-chloromethylstyrene-co-styrene)

Batch C : elemental analysis C = 79.46 % H = 6.62 % and Cl = 14 %

From part B.

$$Cl = 14\% = \frac{35.453n \times 100}{152.624 + 104.152m}$$

$$n = 1.035\ m$$

and, $n + m = 1$

$n = 0.49$ ----> $F_1 = 0.49$

$m = 0.51$ ----> $F_2 = 0.51$

D. Calculation for chlorine of poly (p-chloromethylstyrene-co-styrene) by modified Volhard method.

Cl^- + $AgNO_3$ (excess) ---------> AgCl

$AgNO_3$ + NaSCN ----------> AgSCN

Batch c, weight of sample 0.1008 g.

$AgNO_3$ (excess) = (0.045M)(20ml) = 0.9 mmole

NH_4SCN = (0.075M)(10.88ml) = 0.8167 mmole

Therefore, Cl^- = 0.9 - 0.8167 = 0.0833 mmole/0.1008g.polymer

= 0.8264 mmole/1g.polymer

E. Calculation for epoxide content of poly (p-epoxystyrene-co-styrene) from modified Iodometric method.

Sample weight = 0.1003 g.

HCl = (0.957N)(0.07ml) = 0.067 mmole

Therefore, Epoxide content = 0.067 mmole/0.1006 g.polymer

= 0.6657 mmole/1g.polymer

Appendix II

The IR spectra

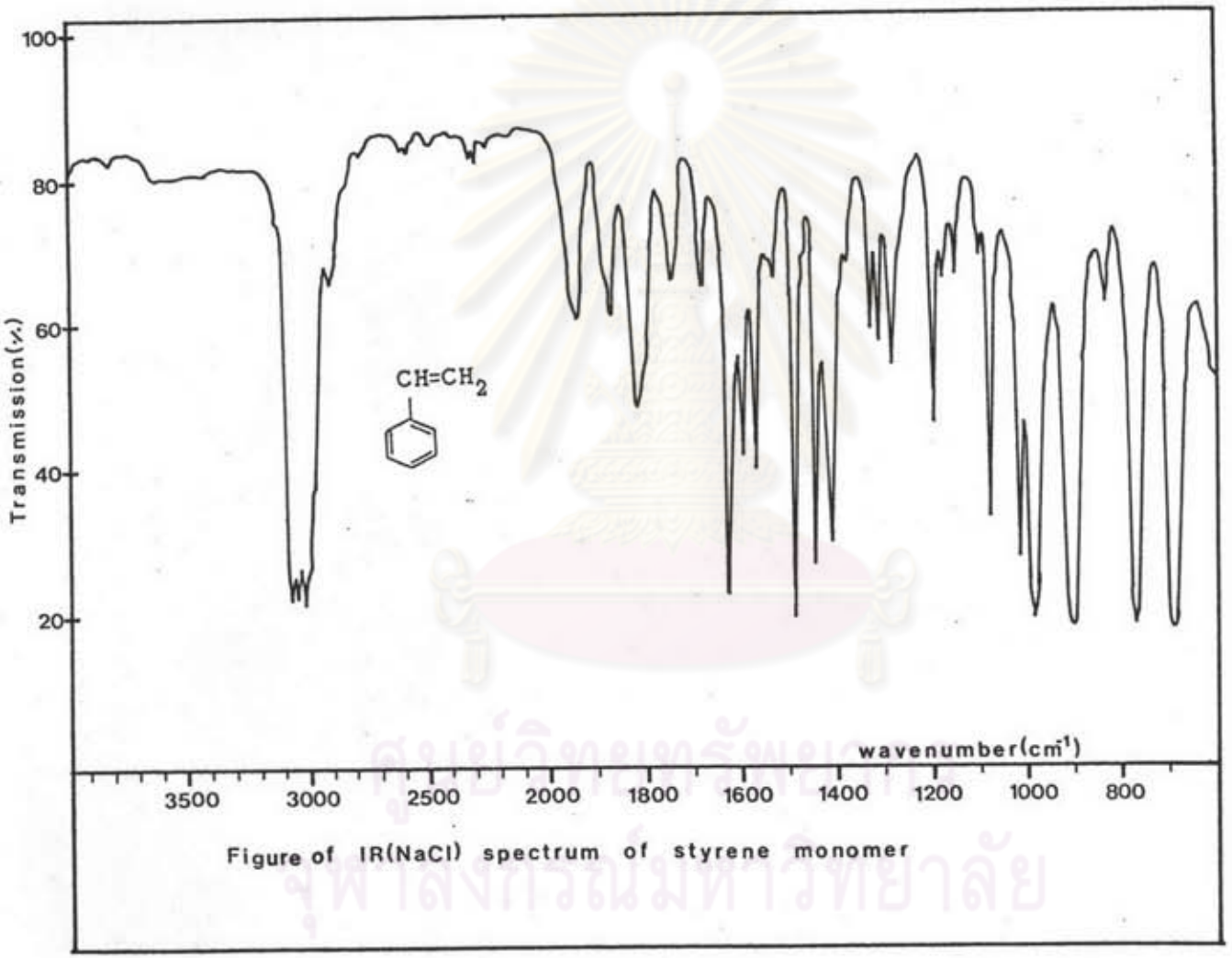


Figure of IR(NaCl) spectrum of styrene monomer

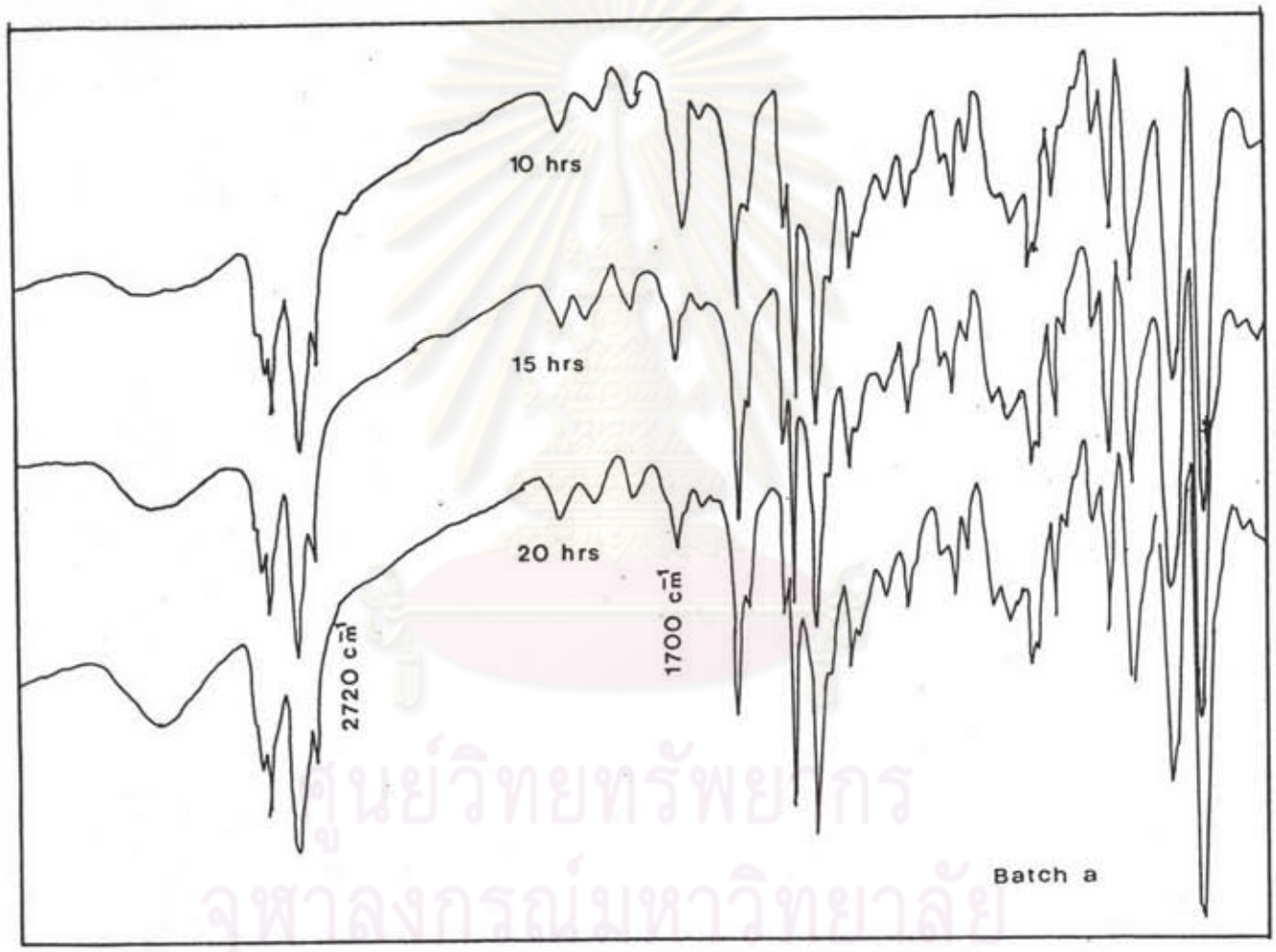


Fig. A Comparison of IR spectra: conversion of formyl gr. into epoxide gr. at various times 10, 15 and 20 hours.

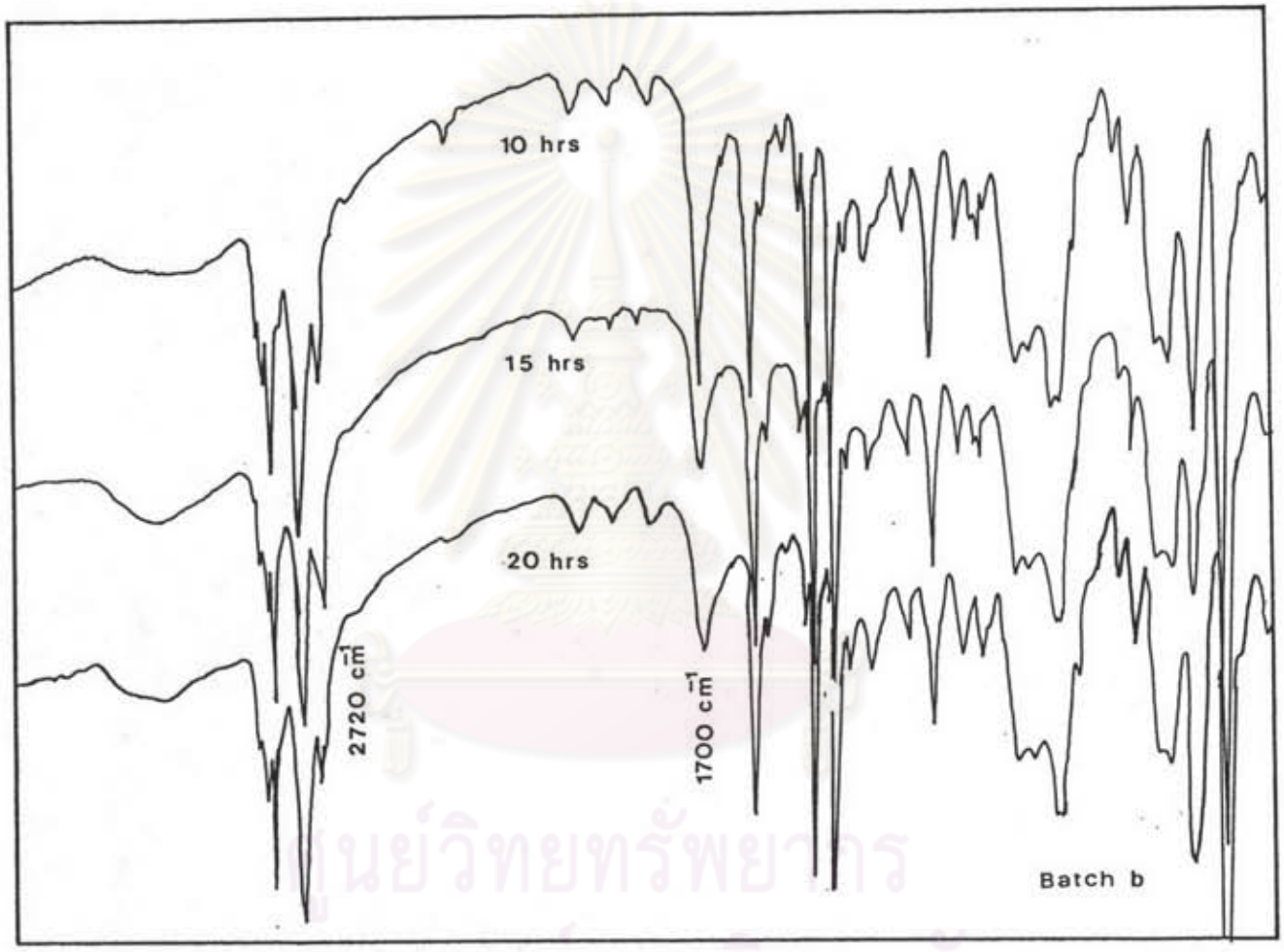


Fig. B Comparison of IR spectra: conversion of formyl gr. into epoxide gr. at various times 10, 15 and 20 hours.

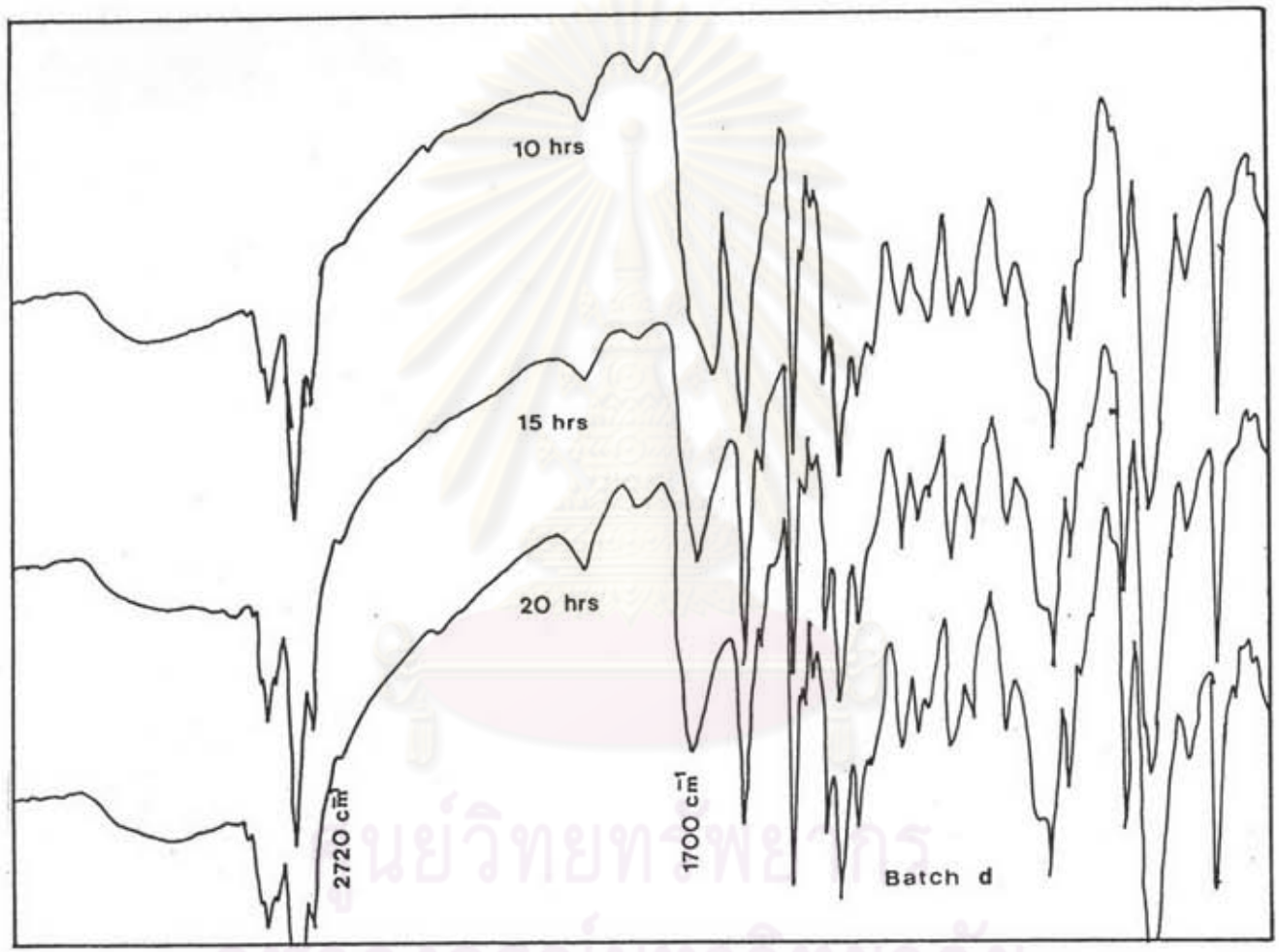


Fig. D Comparison of IR spectra: conversion of formyl gr. into epoxide gr. at various times 10, 15 and 20 hours.

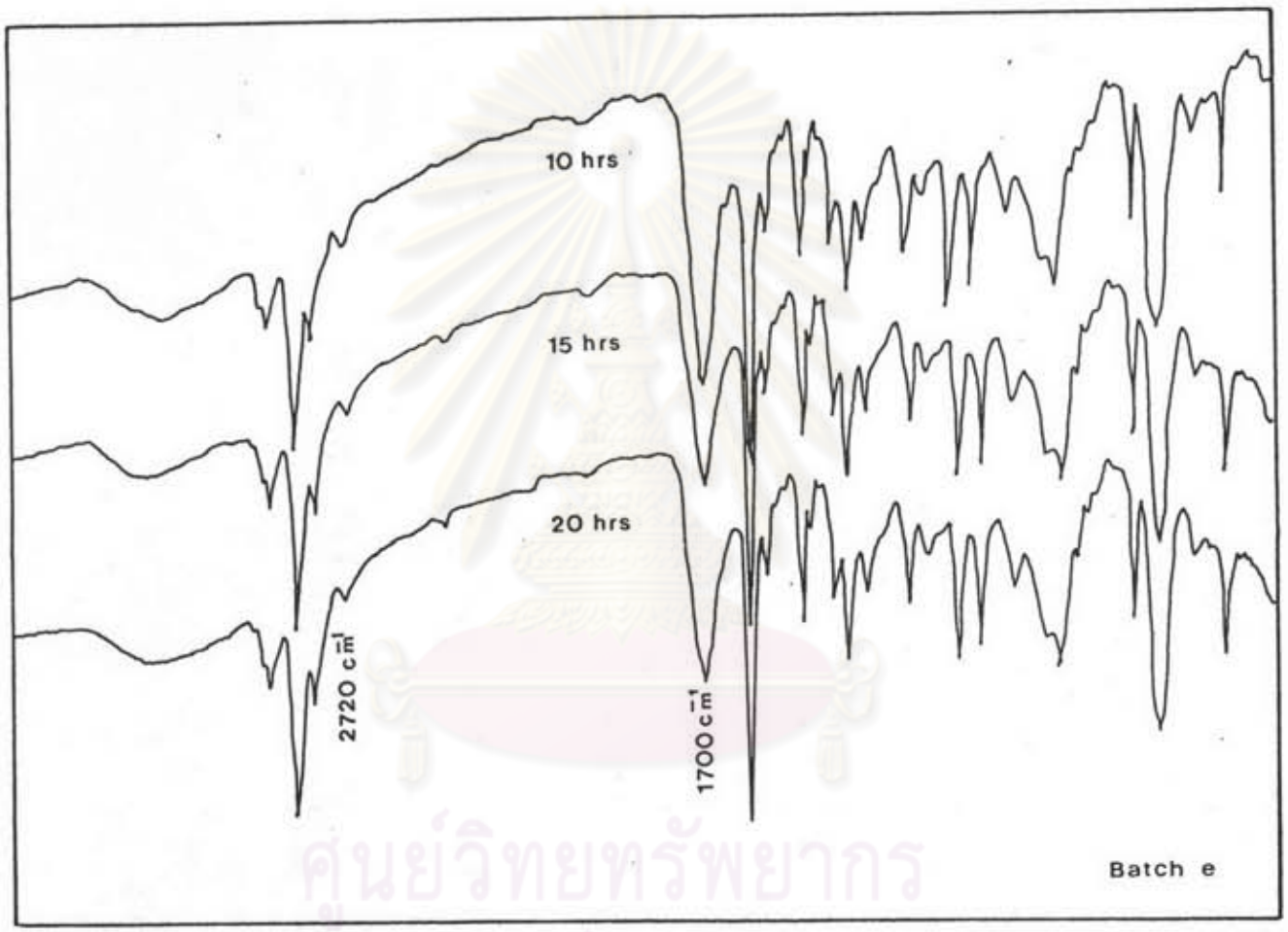


Fig. E Comparison of IR spectra: conversion of formyl gr. into epoxide gr. at various times 10, 15 and 20 hours.

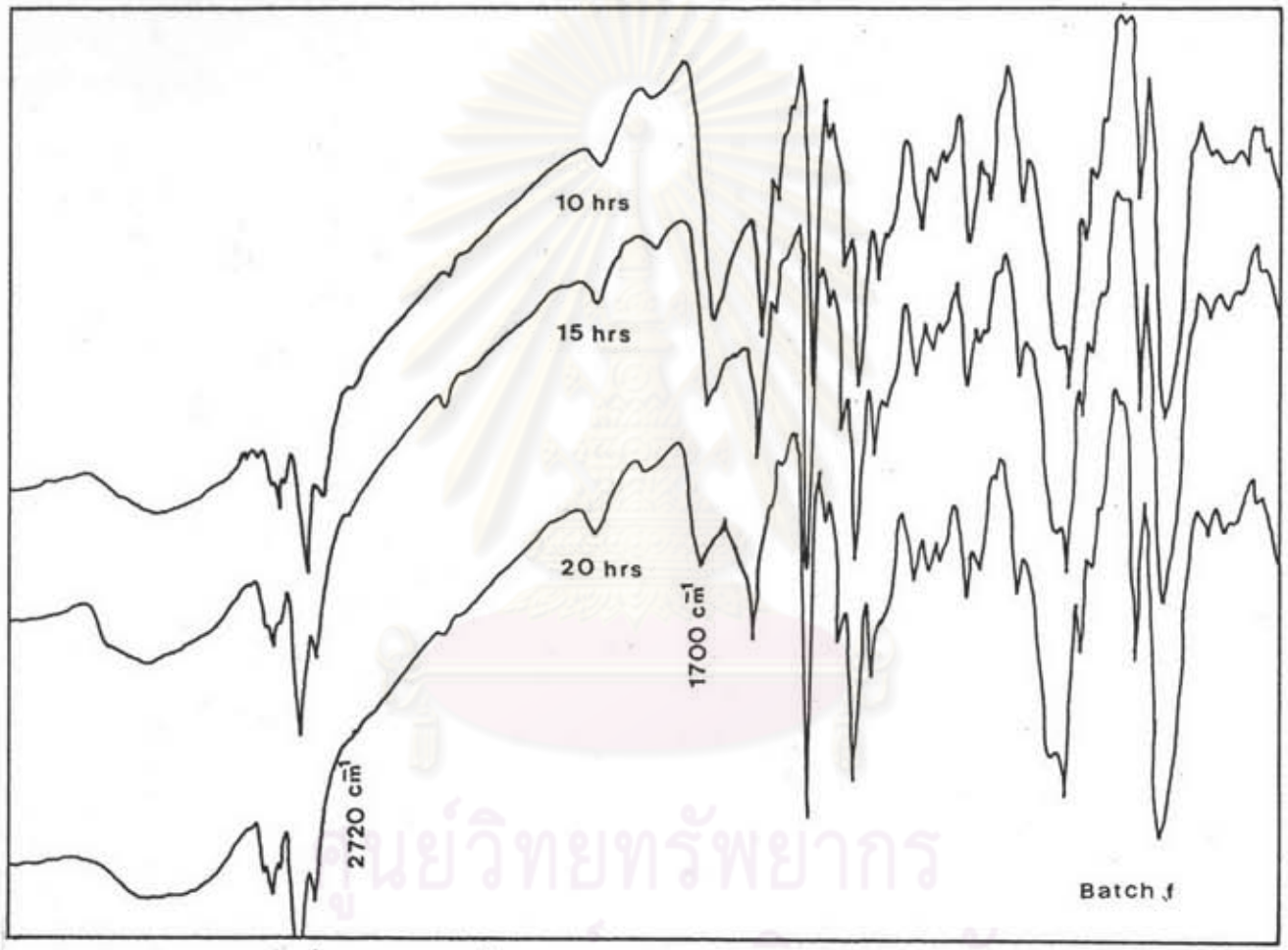
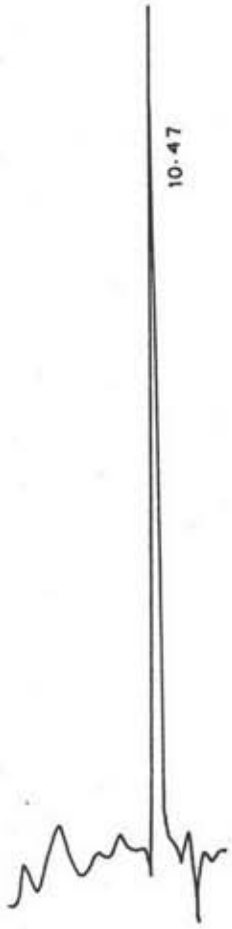


Fig. F Comparison of IR spectra: conversion of formyl gr. into epoxide gr. at various times 10, 15 and 20 hours.

Appendix III

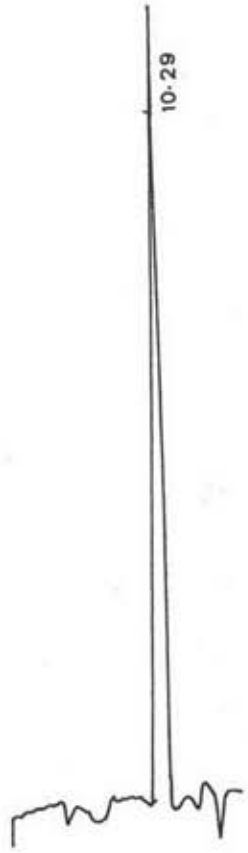
Chromatogram of polystyrene standards and samples



$\bar{M}p$ 580

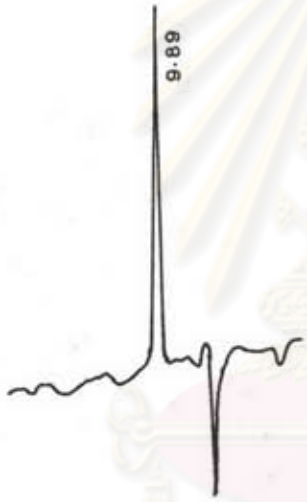
$\bar{M}p$ 1250

$\bar{M}p$ 1320

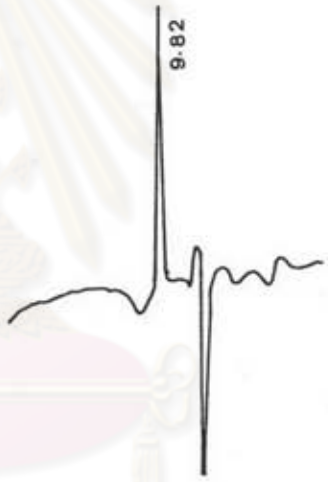


$\bar{M}p$ 1800

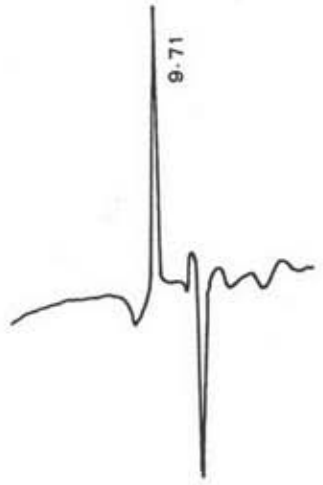
$\bar{M}p$ 2500



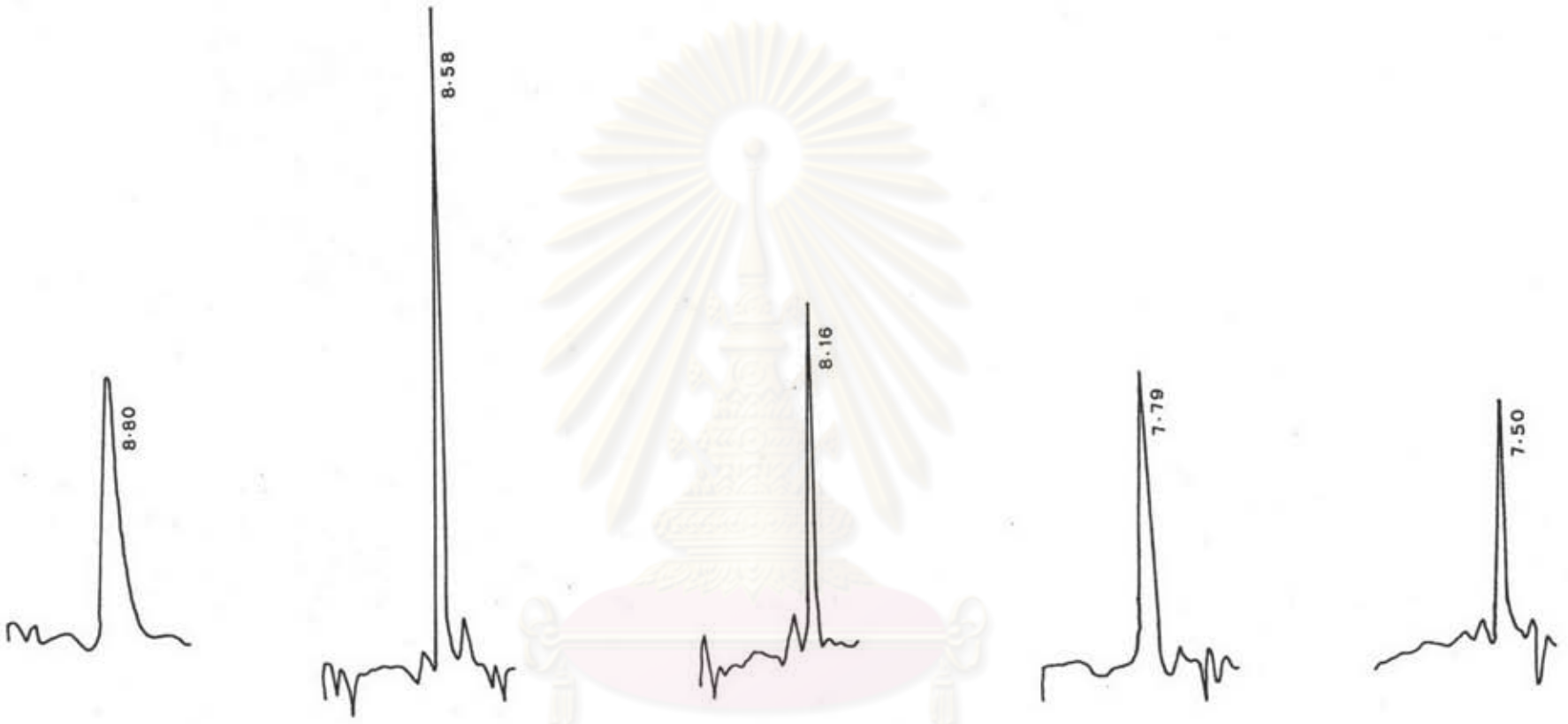
$\bar{M}p$ 3250



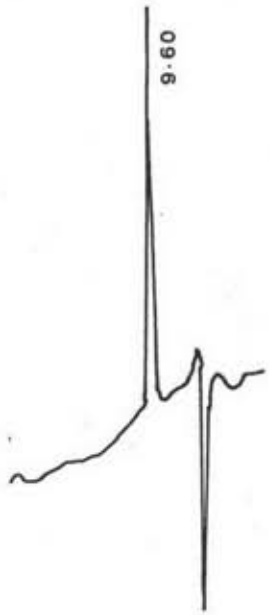
$\bar{M}p$ 3600



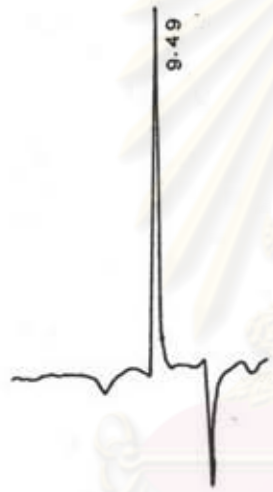
$\bar{M}p$ 5000



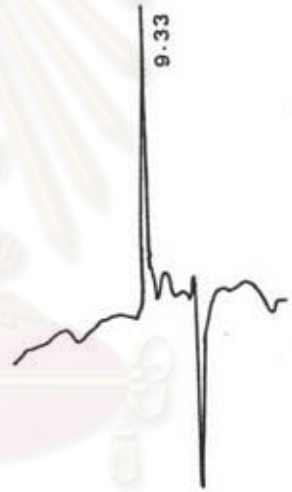
$\bar{M}_p$ 28500 $\bar{M}_p$ 66000 $\bar{M}_p$ 156000 $\bar{M}_p$ 435500 $\bar{M}_p$ 1030000



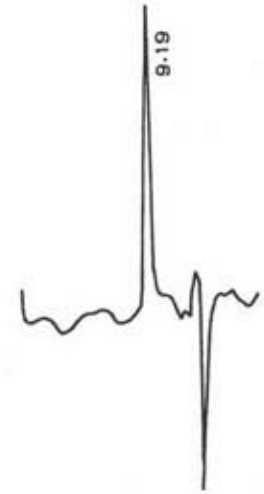
$\bar{M}_p$ 7600



$\bar{M}_p$ 9200



$\bar{M}_p$ 13500

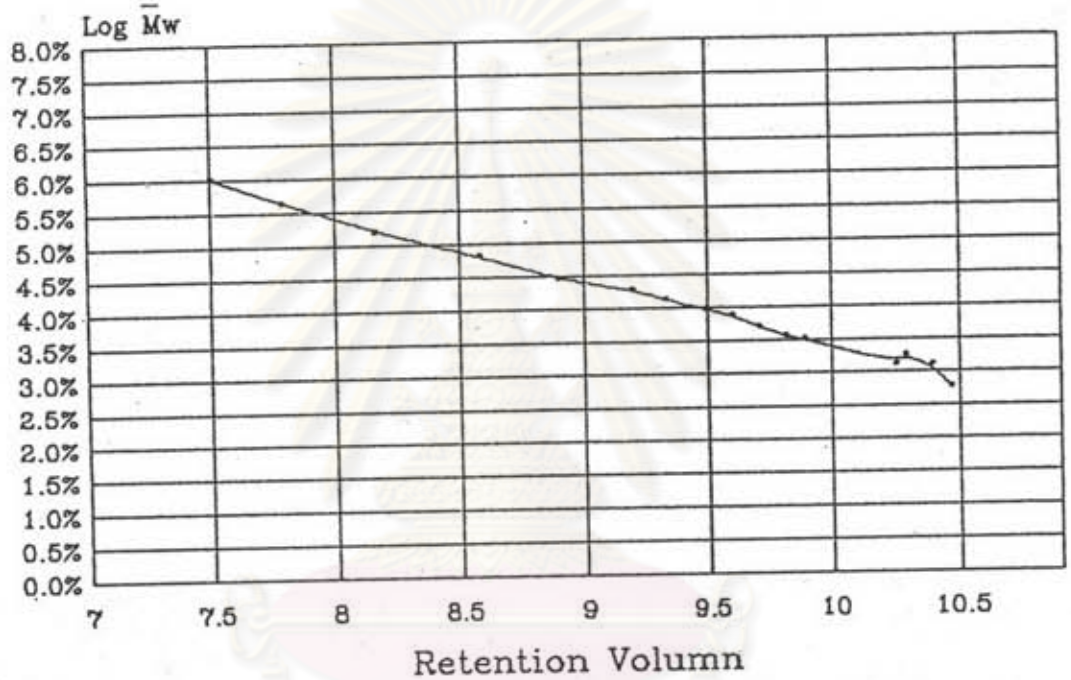


$\bar{M}_p$ 19000

Table A. Experimental data for calibration curve. of polystyrene standards.

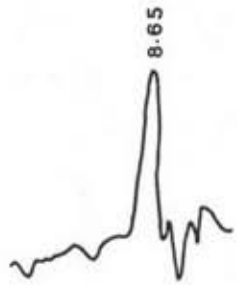
$\bar{M}_w$	$\log \bar{M}_w$	$R_v = R_t \times V$
580	2.763	10.47
1250	3.097	10.39
1320	3.121	10.35
1800	3.255	10.29
2500	3.398	9.98
3250	3.512	9.89
3600	3.556	9.82
5000	3.699	9.71
7600	3.881	9.60
9200	3.964	9.49
13500	4.130	9.33
19000	4.279	9.19
28500	4.455	8.80
66000	4.820	8.58
156000	5.193	8.16
435000	5.639	7.79
1,030,000	6.013	7.50

Molecular weight



Calibration curve of polystyrene standard

($\bar{M}_w$: 580 - 1,030,000)



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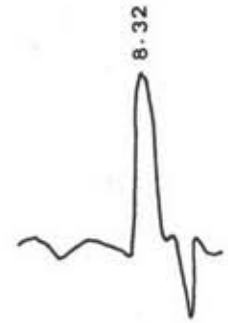
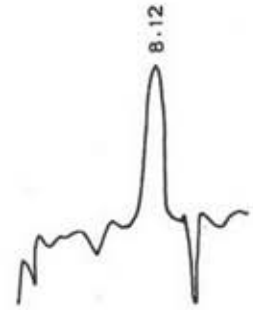
Bat·no·2



Bat·no·3

Bat·no·4

Bat·no·5



Bat·no·6

Chromatograms of samples

VITA

Mr. Pramuel Thongnit was born on October12, 1961 in Bangkok. He recieved a Bachelor's Degree of Science, Chemistry, from Kasetsart University in 1983.He has been a graduate student at The Petroleum and Petrochemical College, Chulalongkorn University, since 1988.