CHAPTER 7

PRELIMINARY EXPERIMENT

7.1 Experiment and Data Collection

The two factors, each at two levels, in the 2^k factorial experiment are the following.

F/M ratio is represented by factor A, and

F/M ratio of 1.6 is denoted by − (low level).

F/M ratio of 2.0 is denoted by + (high level).

Melamine crystal pH is represented by factor B , and

Melamine crystal pH of 8.0-8.7 is denoted by − (low level).

Melamine crystal pH of 8.7-9.5 is denoted by + (high level).

And the number of replicates of three is selected for this experiment , and the sampling of melemine crystal, formalin, and water in random order is performed to ensure that the effects of treatments are as uniform as possible.

Therefore, the experimental sheet for the four treatments and the three replicates of this experiment are shown in Table 7.1 .

Treatment Combination		Factor		Replicates			Total
		A	B	1	2	3	
1	(1)	—	—				
2	a	+	—				
3	b	—	+				
4	ab	+	+				

Table 7.1 : The Table for Data Collection of Preliminary Experiment.

7.2 Collected Data

The collected data from the preliminary experiment are shown in Table 7.2. In Table 7.2, F/M ratio is represented by factor A, and

F/M ratio of 1.6 is denoted by - (low level).

F/M ratio of 2.0 is denoted by + (high level).

Melamine crystal pH is represented by factor B, and

Melamine crystal pH of 8.0-8.7 is denoted by - (low level).

Melamine crystal pH of 8.7-9.5 is denoted by + (high level).

Curint time (in seconds)

Treatment		Factors		Replicates			Total
		A	B	1	2	3	
1	(1)	-	-	246	238	233	717
2	a	+	-	192	183	196	571
3	b	-	+	211	224	221	656
4	ab	+	+	169	171	181	521

Table 7.2 : The Data of Preliminary Experiment.

Remark : 1) NaOH 2.5 % concentration of 6.2 milliliters used for a batch of reactor in the condition of F/M ratio of 1.6 and melamine crystal pH 8.0-8.7.

2) NaOH 2.5 % concentration of 7.0 milliliters used for a batch of reactor in the condition of F/M ratio of 2.0 and melamine crystal pH 8.0-8.7.

3) NaOH 2.5 % concentration of 5.2 milliliters used for a batch of reactor in the condition of F/M ratio of 1.6 and melamine crystal pH 8.7-9.5.

4) NaOH 2.5 % concentration of 6.2 milliliters used for a batch of reactor in the condition of F/M ratio of 2.0 and melamine crystal pH 8.7-9.5.

The main effects of factors and interaction effect are as follows.

The main effect of F/M ratio (A) is - 46.83 seconds.

The main effect of melamine crystal pH (B) is - 18.50 seconds.

The interaction effect (AB) is 1.83 seconds.

However, these effects will be examined by the analysis of variance in the next topic.

7.3 Data Analysis of Experiment

The analysis of variance for the preliminary experiment is summarized in Table 7.3.

Source of Variation	Sum of Squares	Degrees of Freedom	Mean Square	F_o
F/M ratio (A)	6,580.08	1	6,580.08	150.40
pH of Melamine crystal (B)	1,026.75	1	1,026.75	23.47
Interaction	10.08	1	10.08	0.23
Error	350.00	8	43.75	
Total	7,966.92	11		

Table 7.3 : The Analysis of Variance for Preliminary Experiment.

In Table 7.3, since $F_{0.05,\ 1,\ 8} = 5.32$, we conclude that there is no significant interaction between F/M ratio and melamine crystal pH; however, it is clear that F/M ratio and pH of melamine crystal significantly affect the curing time.

And, in Figure 7.1, 7.2, 7.3, and 7.4, a normal probability plot of the residuals and the three plots of residuals versus F/M ratio, melamine crystal pH, and fitted values. These plots do not reveal any model inadequacy or unusual problem with the assumptions of the analysis of variance for the preliminary experiment.

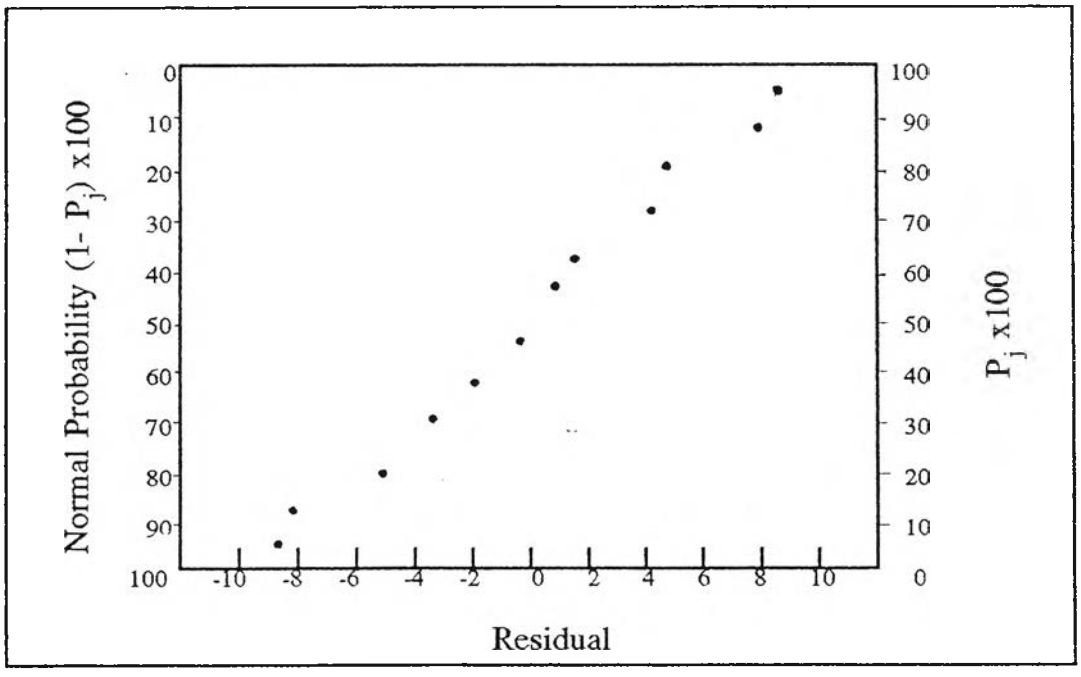

Figure 7.1 : The Normal Probability Plot of Residuals for Preliminary Experiment.

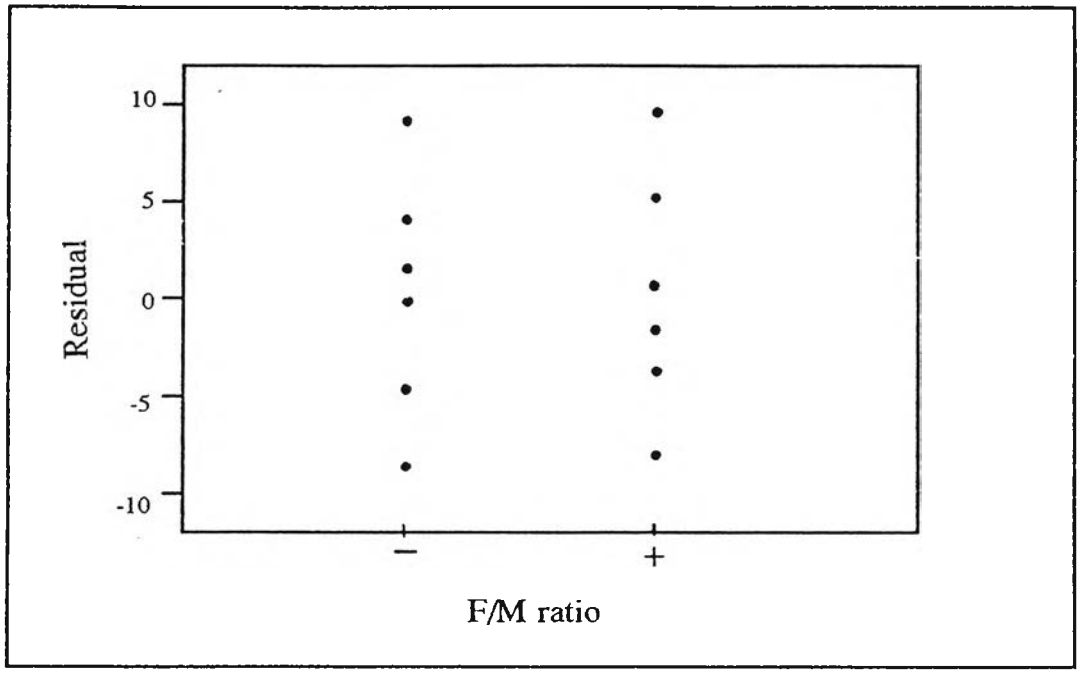

Figure 7.2 : The Plot of Residuals versus F/M ratio

for Preliminary Experiment.

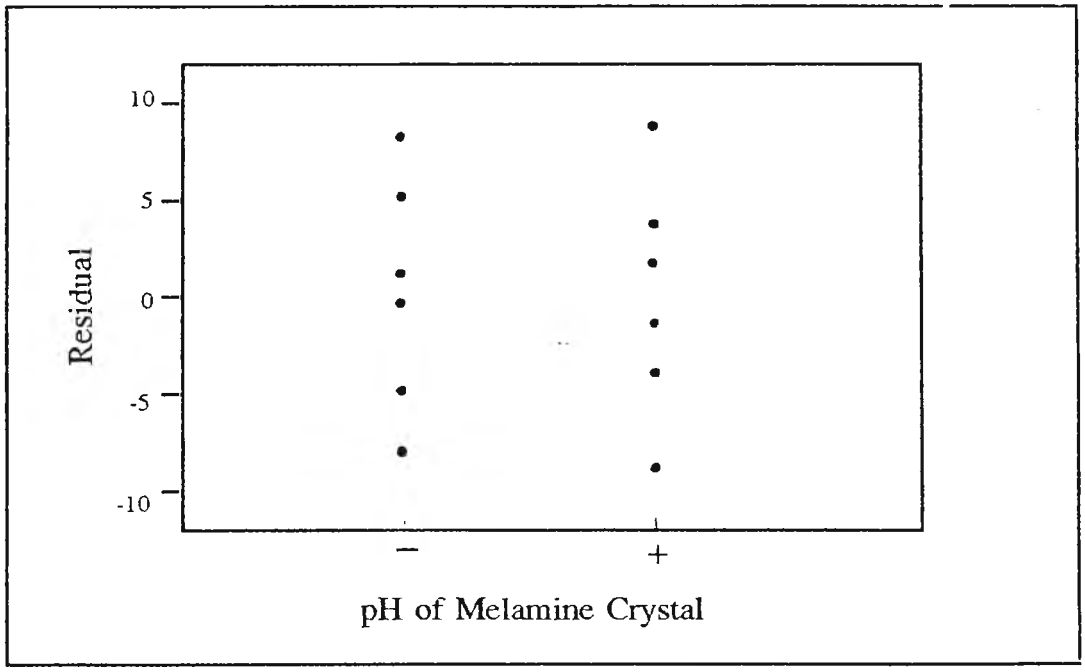

Figure 7.3 : The Plot of Residuals versus pH of Melamine Crystal

for Preliminary Experiment.

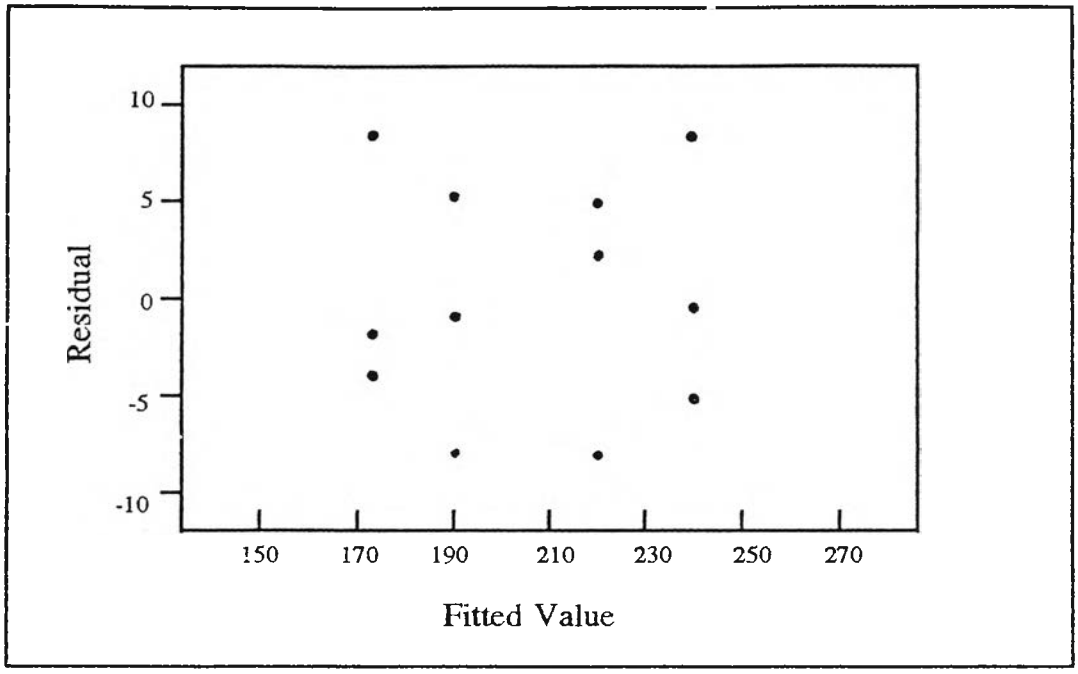

Figure 7.4 : The Plot of Residuals versus Fitted Values for Preliminary Experiment.

In conclusion, the average effect of F/M ratio is the decrease in the curing time of 46.83 seconds, when F/M ratio changes from 1.6 to 2.0. And, the change in pH of melamine crystal from 8.0-8.7 to 8.7-9.5 also leads to the reduction in the average curing time of 18.50 seconds. Finally, there is no a interaction effect between the two factors on the curing time.