

REFERENCES

- [1] Brydson, J.A. Plastics Materials. U.K. : Butterworth-Heinemann, 1995.
- [2] Hines, W.W., Montgomery, D.C. Probability and Statistics in Engineering and Management Science. U.S.A. : John Wiley & Sons, 1980.
- [3] Juran, J. M., Gryna, F. M. Quality Planning and Analysis. Singapore : McGraw-Hill, 1993.
- [4] Kume, H. Statistical Methods for Quality Improvement. Japan : 3A corporation, 1992.
- [5] Montgomery, D.C., Runger, G.C. Applied Statistics and Probability for Engineers. U.S.A. : John Wiley & Sons, 1994.
- [6] Montgomery, D.C. Introduction to Statistical Quality Control. U.S.A. : John Wiley & Sons, 1996.
- [7] Montgomery, D.C. Design and Analysis of Experiments. U.S.A. : John Wiley & Sons, 1997.
- [8] Vale, C.P., Taylor, W.G.K. Aminoplastics. U.K. : The Chapel River Press, 1964.
- [9] Krisada Asawarungsaengkul. Quality Improvement of the Slider of a Harddisk by Applying a Design of the Experiment Technique. Master's Thesis, Graduate school, Chulalongkorn University, 1999.
- [10] Songphon Phichatwattana. Apply of the Design of Experiment for Quality Improvement of Pull Strength of Read / Write Head in Hard Disc Drive. Master's Thesis, Graduate school, Chulalongkorn University, 1998.
- [11] Tossapol Kiatcharoenpol. Determination of Suitable Condition for The Lacquering Process on Tin Plate by Design of Experiment Method. Master's Thesis, Graduate school, Chulalongkorn University, 1995.

APPENDICES

APPENDIX 1

Examples of Checksheets for production at the reaction of the company's process show the volume of sodium hydroxide (NaOH) in liters used for the melamine compound product.

REACTION PRODUCTION

| วันที่ | START TIME | FINISH TIME | LOT NO. | MELAMINE (kg) | FORMALINE (L) | PROCESS WATER (l) | NaOH (L) | Tc | pH | DS | OPERATOR | FR lot | PRODUCT | | | |
|----------|------------|-------------|---------|---------------|---------------|-------------------|----------|----|-----|-------|----------|--------|---------|----|----|----|
| | | | | | | | | | | | | | MC | GZ | FG | FR |
| 23/06/43 | 14:35 | 14:40 | Rx1066b | 3000 | 3203 | 1480 | 3.4 | 62 | 8.8 | 1.216 | อลัน | 00363 | ✓ | - | - | - |
| 23/06/43 | 18:00 | 21:00 | Rx1096b | 3000 | 3203 | 1480 | 3.5 | 62 | 8.8 | 1.215 | อลัน | 00363 | ✓ | - | - | - |
| 23/06/43 | 21:35 | 00:50 | Rx1066b | 3000 | 3203 | 1480 | 3.5 | 63 | 8.8 | 1.222 | Yung | 00363 | / | - | - | - |
| 24/06/43 | 01:05 | 03:50 | Rx1076b | 3000 | 3203 | 1410 | 3.3 | 62 | 8.8 | 1.220 | Yung | 00363 | / | - | - | - |
| 24/06/43 | 04:20 | 08:35 | Rx1086b | 3000 | 3203 | 1480 | 3.3 | 62 | 8.8 | 1.216 | อลัน | 00363 | ✓ | - | - | - |
| 24/06/43 | 10:15 | 13:40 | Rx096b | 3000 | 3203 | 1480 | 3.4 | 65 | 9.0 | 1.218 | อลัน | 00363 | ✓ | - | - | - |
| 24/06/43 | 14:50 | 17:50 | Rx1106b | 3000 | 3203 | 1480 | 3.2 | 62 | 8.8 | 1.216 | อลัน | 00363 | ✓ | - | - | - |
| 24/06/43 | 19:30 | 22:15 | Rx1116b | 3000 | 3203 | 1480 | 3.2 | 62 | 8.8 | 1.216 | อลัน | 00363 | ✓ | - | - | - |
| 25/06/43 | 00:40 | 03:30 | Rx1086b | 3000 | 3203 | 1480 | 3.4 | 63 | 8.8 | 1.219 | อลัน | 00363 | ✓ | - | - | - |
| 25/06/43 | 06:15 | 08:50 | Rx1096b | 3000 | 3203 | 1480 | 3.4 | 63 | 8.8 | 1.217 | อลัน | 00363 | ✓ | - | - | - |
| 25/06/43 | 08:45 | 11:40 | Rx1146b | 3000 | 3203 | 1480 | 3.4 | 68 | 8.8 | 1.220 | อลัน | 00363 | ✓ | - | - | - |
| 25/06/43 | 11:55 | 14:50 | Rx1086b | 3000 | 3203 | 1480 | 3.4 | 62 | 8.8 | 1.222 | อลัน | 00363 | - | - | - | ✓ |
| 25/06/43 | 18:05 | 20:50 | Rx1066b | 3000 | 3203 | 1480 | 3.2 | 62 | 8.8 | 1.215 | อลัน | 00363 | ✓ | - | - | - |
| 26/06/43 | 04:00 | 06:10 | Rx1076b | 3000 | 3203 | 1480 | 3.3 | 63 | 8.8 | 1.216 | อลัน | 00363 | ✓ | - | - | - |
| 26/06/43 | 08:40 | 03:30 | Rx1086b | 3000 | 3203 | 1480 | 3.3 | 63 | 8.8 | 1.216 | อลัน | 00363 | ✓ | - | - | - |
| 26/06/43 | 06:10 | 08:55 | Rx1086b | 3000 | 3203 | 1480 | 3.3 | 64 | 8.8 | 1.216 | อลัน | 00363 | ✓ | - | - | - |
| 27/06/43 | 08:05 | 10:30 | Rx1086b | 3000 | 3203 | 1480 | 3.2 | 60 | 9.0 | 1.216 | อลัน | 00363 | ✓ | - | - | ✓ |
| 27/06/43 | 15:10 | 15:55 | Rx1086b | 3000 | 3203 | 1480 | 3.2 | 62 | 8.8 | 1.215 | อลัน | 00363 | ✓ | - | - | - |
| 28/06/43 | 16:10 | 18:55 | Rx1086b | 3000 | 3203 | 1480 | 3.3 | 62 | 8.8 | 1.216 | อลัน | 00363 | ✓ | - | - | - |

หมายเหตุ : 1. MC = MELAMINE MOULDING COMPOUND 3. FG = FIGHTING GRADE
2. GZ = GLAZING OR WHITE COATING 4. FR = FOIL RESIN

REACTION PRODUCTION

| วันที่ | START TIME | FINISH TIME | LOT NO. | MELAMINE (kg) | FORMALINE (L) | PROCESS WATER (l) | NaOH (L) | Tc | pH | DS | OPERATOR | FR lot | PRODUCT | | | |
|----------|------------|-------------|---------|---------------|---------------|-------------------|----------|----|-----|-------|----------|--------|---------|----|----|----|
| | | | | | | | | | | | | | MC | GZ | FG | FR |
| 30/06/43 | 08:45 | 11:10 | Rx1206b | 3000 | 3203 | 1480 | 3.5 | 62 | 8.8 | 1.216 | อลัน | 00463 | ✓ | - | - | - |
| 30/06/43 | 11:10 | 15:00 | Rx1216b | 2000 | 1922 | 1480 | 1.8 | 64 | 8.8 | 1.238 | อลัน | 00463 | - | - | - | ✓ |
| 30/06/43 | 17:45 | 20:30 | Rx1216b | 3000 | 3203 | 1410 | 3.3 | 63 | 8.8 | 1.220 | Yung | 00463 | / | - | - | - |
| 30/06/43 | 20:40 | 23:30 | Rx1216b | 3000 | 3203 | 1410 | 3.4 | 64 | 8.8 | 1.220 | Yung | 00463 | / | - | - | - |
| 01/07/43 | 01:15 | 04:00 | Rx00173 | 3000 | 3203 | 1490 | 3.2 | 63 | 8.8 | 1.218 | อลัน | 00463 | ✓ | - | - | - |
| 01/07/43 | 08:25 | 08:45 | Rx00273 | 3000 | 3203 | 1480 | 3.2 | 66 | 8.8 | 1.219 | อลัน | 00463 | ✓ | - | - | - |
| 01/07/43 | 09:00 | 11:40 | Rx00373 | 3000 | 3203 | 1480 | 3.5 | 62 | 8.8 | 1.216 | อลัน | 00463 | ✓ | - | - | - |
| 01/07/43 | 13:10 | 15:40 | Rx00473 | 3000 | 3203 | 1480 | 3.5 | 62 | 8.8 | 1.216 | อลัน | 00463 | ✓ | - | - | - |
| 01/07/43 | 17:05 | 21:25 | Rx00573 | 3000 | 3203 | 1480 | 3.4 | 63 | 8.8 | 1.212 | Yung | 00463 | / | - | - | - |
| 01/07/43 | 22:15 | 01:05 | Rx00673 | 3000 | 3203 | 1480 | 3.4 | 63 | 8.8 | 1.218 | Yung | 00463 | / | - | - | - |
| 02/07/43 | 01:45 | 05:10 | Rx00773 | 3000 | 3203 | 1480 | 3.2 | 64 | 8.8 | 1.220 | Yung | 00463 | / | - | - | - |
| 02/07/43 | 08:15 | 11:30 | Rx00873 | 2000 | 1922 | 1480 | 1.8 | 63 | 8.8 | 1.236 | อลัน | 00463 | - | - | - | ✓ |
| 03/07/43 | 20:50 | 23:30 | Rx00973 | 3000 | 3203 | 1490 | 3.4 | 66 | 8.8 | 1.220 | อลัน | 00463 | ✓ | - | - | - |
| 06/07/43 | 23:35 | 02:30 | Rx01073 | 3000 | 3203 | 1480 | 3.4 | 66 | 8.8 | 1.216 | อลัน | 00463 | ✓ | - | - | - |
| 06/07/43 | 02:55 | 05:30 | Rx01173 | 3000 | 3203 | 1480 | 3.5 | 66 | 9.0 | 1.216 | อลัน | 00463 | ✓ | - | - | - |
| 06/07/43 | 05:15 | 07:10 | Rx01273 | 3000 | 3203 | 1480 | 3.4 | 63 | 8.8 | 1.216 | อลัน | 00463 | ✓ | - | - | - |
| 06/07/43 | 08:10 | 10:50 | Rx01373 | 2000 | 1922 | 1480 | 1.8 | 60 | 9.0 | 1.238 | Yung | 00463 | - | / | - | - |
| 06/07/43 | 11:10 | 14:10 | Rx01373 | 3000 | 3203 | 1480 | 3.4 | 63 | 8.8 | 1.220 | Yung | 00463 | / | - | - | - |
| 06/07/43 | 15:00 | 17:50 | Rx01473 | 3000 | 3203 | 1490 | 3.3 | 65 | 8.8 | 1.216 | อลัน | 00463 | ✓ | - | - | - |

หมายเหตุ : 1. MC = MELAMINE MOULDING COMPOUND 3. FG = FIGHTING GRADE
2. GZ = GLAZING OR WHITE COATING 4. FR = FOIL RESIN

REACTION PRODUCTION

| วันที่ | START TIME | FINISH TIME | LOT NO. | MELAMINE (kg) | FORMALINE (L) | PROCESS WATER (L) | NaOH (L) | Tc | pH | DS | OPERATOR | FR lot | PRODUCT | | | |
|----------|------------|-------------|---------|---------------|---------------|-------------------|----------|----|-----|-------|----------|--------|---------|----|----|----|
| | | | | | | | | | | | | | MC | GZ | FG | FR |
| 17/04/43 | 18:50 | 19:00 | RX091A3 | 3000 | 3203 | 1480 | 3.3 | 63 | 8.8 | 1.218 | อึ้ง | 002A3 | ✓ | - | - | - |
| 18/04/43 | 01:15 | 01:35 | P1072A3 | 3000 | 3203 | 1495 | 6.0 | 62 | 8.2 | 1.220 | อึ้ง | 002A3 | - | - | ✓ | - |
| 18/04/43 | 08:00 | 08:20 | RF004A3 | 2000 | 1905 | 774 | 2.8 | 60 | 8.8 | 1.244 | อึ้ง | 002A3 | ✓ | ✓ | - | - |
| 18/04/43 | 12:00 | 11:45 | RX091A3 | 3000 | 3203 | 1480 | 3.0 | 62 | 8.8 | 1.215 | อึ้ง | 002A3 | ✓ | - | - | - |
| 18/04/43 | 12:00 | 12:10 | R2072A3 | 3000 | 3203 | 1480 | 3.2 | 64 | 8.8 | 1.220 | อึ้ง | 002A3 | ✓ | - | - | - |
| 18/04/43 | 16:30 | 17:10 | RX075A3 | 3000 | 3203 | 1480 | 3.1 | 66 | 8.8 | 1.215 | อึ้ง | 003A3 | ✓ | - | - | - |
| 18/04/43 | 19:25 | 22:25 | P1076A3 | 3000 | 3203 | 1480 | 3.1 | 65 | 7.8 | 1.212 | อึ้ง | 003A3 | ✓ | - | - | - |
| 18/04/43 | 23:50 | 01:50 | R2077A3 | 3000 | 3203 | 1480 | 3.1 | 62 | 8.8 | 1.218 | อึ้ง | 003A3 | ✓ | - | - | - |
| 19/04/43 | 06:50 | 10:05 | RX078A3 | 3000 | 3203 | 1480 | 3.2 | 64 | 8.8 | 1.220 | อึ้ง | 003A3 | ✓ | - | - | - |
| 19/04/43 | 10:30 | 12:40 | RX079A3 | 3000 | 3203 | 1480 | 3.3 | 64 | 8.8 | 1.220 | อึ้ง | 003A3 | ✓ | - | - | - |
| 19/04/43 | 16:20 | 17:10 | RX080A3 | 3000 | 3203 | 1480 | 3.0 | 63 | 8.8 | 1.224 | อึ้ง | 003A3 | - | - | ✓ | - |
| 20/04/43 | 05:40 | 05:15 | RX081A3 | 3000 | 3203 | 1480 | 3.0 | 63 | 8.8 | 1.220 | อึ้ง | 003A3 | ✓ | - | - | - |
| 20/04/43 | 09:00 | 12:10 | RX082A3 | 3000 | 3203 | 1480 | 3.0 | 68 | 8.8 | 1.215 | อึ้ง | 003A3 | ✓ | - | - | - |
| 20/04/43 | 05:50 | 08:40 | RX083A3 | 3000 | 3203 | 1480 | 3.0 | 68 | 8.8 | 1.218 | อึ้ง | 003A3 | ✓ | - | - | - |
| 20/04/43 | 08:00 | 12:40 | RX084A3 | 3000 | 3203 | 1480 | 3.0 | 68 | 8.8 | 1.215 | อึ้ง | 003A3 | ✓ | - | - | - |
| 20/04/43 | 14:50 | 20:10 | RX085A3 | 3000 | 3203 | 1480 | 3.0 | 68 | 8.8 | 1.220 | อึ้ง | 003A3 | ✓ | - | - | - |
| 20/04/43 | 21:05 | 01:05 | RX086A3 | 3000 | 3203 | 1480 | 3.0 | 63 | 8.8 | 1.218 | อึ้ง | 003A3 | ✓ | - | - | - |
| 20/04/43 | 01:05 | 07:00 | RX087A3 | 3000 | 3203 | 1480 | 3.1 | 68 | 8.8 | 1.217 | อึ้ง | 003A3 | ✓ | - | - | - |
| 21/04/43 | 08:05 | 11:40 | RX088A3 | 3000 | 3203 | 1480 | 3.8 | 68 | 8.8 | 1.215 | อึ้ง | 003A3 | ✓ | - | - | - |

หมายเหตุ : 1. MC = MELAMINE MOULDING COMPOUND 3. FG = FIGHTING GRADE
 2. GZ = GLAZING OR WHITE COATING 4. FR = FOIL RESIN

REACTION PRODUCTION

| วันที่ | START TIME | FINISH TIME | LOT NO. | MELAMINE (kg) | FORMALINE (L) | PROCESS WATER (L) | NaOH (L) | Tc | pH | DS | OPERATOR | FR lot | PRODUCT | | | |
|----------|------------|-------------|---------|---------------|---------------|-------------------|----------|----|-----|-------|----------|--------|---------|----|----|----|
| | | | | | | | | | | | | | MC | GZ | FG | FR |
| 27/04/43 | 19:10 | 00:50 | RX106A3 | 3000 | 3203 | 1495 | 5.9 | 68 | 8.8 | 1.230 | อึ้ง | 004A3 | - | - | ✓ | - |
| 28/04/43 | 23:20 | 03:30 | RF004A3 | 2000 | 1905 | 774 | 1.4 | 62 | 9.0 | 1.240 | อึ้ง | 004A3 | - | ✓ | - | - |
| 28/04/43 | 04:00 | 06:45 | RX107A3 | 3000 | 3203 | 1480 | 2.9 | 62 | 8.6 | 1.216 | อึ้ง | 004A3 | ✓ | - | - | - |
| 28/04/43 | 06:55 | 09:55 | RX108A3 | 3000 | 3203 | 1480 | 3.3 | 63 | 8.8 | 1.216 | อึ้ง | 004A3 | ✓ | - | - | - |
| 28/04/43 | 09:25 | 13:10 | RX109A3 | 3000 | 3203 | 1480 | 3.1 | 68 | 8.8 | 1.220 | อึ้ง | 004A3 | ✓ | - | - | - |
| 28/04/43 | 15:35 | 16:50 | RX110A3 | 3000 | 3203 | 1480 | 3.3 | 62 | 8.8 | 1.215 | อึ้ง | 004A3 | ✓ | - | - | - |
| 28/04/43 | 17:10 | 20:10 | RX111A3 | 3000 | 3203 | 1480 | 3.5 | 64 | 8.8 | 1.217 | อึ้ง | 004A3 | ✓ | - | - | - |
| 28/04/43 | 20:25 | 23:15 | RX112A3 | 3000 | 3203 | 1480 | 3.4 | 60 | 8.9 | 1.210 | อึ้ง | 004A3 | ✓ | - | - | - |
| 29/04/43 | 04:10 | 09:20 | RX113A3 | 3000 | 3203 | 1480 | 3.3 | 65 | 8.8 | 1.246 | อึ้ง | 004A3 | ✓ | - | - | - |
| 29/04/43 | 10:50 | 14:15 | RX114A3 | 3000 | 3203 | 1480 | 3.6 | 65 | 9.0 | 1.220 | อึ้ง | 004A3 | ✓ | - | - | - |
| 29/04/43 | 14:35 | 17:50 | RX115A3 | 3000 | 3203 | 1480 | 3.6 | 62 | 9.0 | 1.220 | อึ้ง | 004A3 | ✓ | - | - | - |
| 29/04/43 | 18:10 | 21:00 | RX116A3 | 3000 | 3203 | 1480 | 3.2 | 66 | 8.8 | 1.218 | อึ้ง | 004A3 | ✓ | - | - | - |
| 30/04/43 | 00:50 | 03:50 | RX117A3 | 3000 | 3203 | 1480 | 3.2 | 66 | 8.8 | 1.219 | อึ้ง | 004A3 | ✓ | - | - | - |
| 30/04/43 | 06:05 | 09:10 | RX118A3 | 3000 | 3203 | 1480 | 3.4 | 64 | 8.8 | 1.215 | อึ้ง | 004A3 | ✓ | - | - | - |
| 30/04/43 | 10:10 | 12:50 | RX119A3 | 3000 | 3203 | 1480 | 3.4 | 69 | 8.8 | 1.214 | อึ้ง | 004A3 | ✓ | - | - | - |
| 30/04/43 | 14:35 | 18:10 | RX120A3 | 3000 | 3203 | 1480 | 3.3 | 63 | 8.8 | 1.218 | อึ้ง | 004A3 | ✓ | - | - | - |
| 30/04/43 | 18:50 | 21:00 | RX121A3 | 3000 | 3203 | 1480 | 3.1 | 62 | 8.8 | 1.218 | อึ้ง | 004A3 | ✓ | - | - | - |
| 01/05/43 | 00:45 | 04:00 | RX001A3 | 3000 | 3203 | 1480 | 3.2 | 65 | 8.8 | 1.220 | อึ้ง | 004A3 | ✓ | - | - | - |
| 01/05/43 | 07:00 | 10:00 | RX002A3 | 3000 | 3203 | 1480 | 3.3 | 63 | 8.8 | 1.216 | อึ้ง | 004A3 | ✓ | - | - | - |

หมายเหตุ : 1. MC = MELAMINE MOULDING COMPOUND 3. FG = FIGHTING GRADE
 2. GZ = GLAZING OR WHITE COATING 4. FR = FOIL RESIN

APPENDIX 2

Data of most melamine crystals used in the company's process.

| Melamine Crystal | pH | Quantity used (as % of total) | | | |
|------------------|---------|-------------------------------|-----------|-----------|---------|
| | | Year 1998 | Year 1999 | Year 2000 | Average |
| Brand 1 | 8.7-9.5 | 62.64% | 58.49% | 52.85% | 57.99% |
| Brand 2 | 8.0-8.7 | 22.58% | 25.23% | 24.43% | 24.08% |
| Other brands | 8.0-8.7 | 14.78% | 16.28% | 22.72% | 17.93% |

APPENDIX 3

The pH of formalin in the formalin tank of the company is measured from August to December 2000 as follows.

| pH of formalin | | | | | |
|----------------|--------|-----------|---------|----------|----------|
| Year 2000 | | | | | |
| Date | August | September | October | November | December |
| 1 | 4.72 | 4.69 | - | 4.63 | 4.69 |
| 2 | 4.75 | - | 4.60 | 4.54 | 4.75 |
| 3 | 4.67 | - | 4.60 | 4.60 | - |
| 4 | 4.65 | 4.68 | 4.66 | 4.57 | - |
| 5 | 4.58 | 4.57 | 4.71 | - | - |
| 6 | - | 4.61 | 4.68 | 4.63 | 4.78 |
| 7 | 4.52 | 4.53 | 4.61 | 4.68 | 4.73 |
| 8 | 4.63 | 4.56 | - | 4.62 | 4.68 |
| 9 | 4.65 | 4.60 | 4.69 | 4.60 | 4.59 |
| 10 | 4.68 | - | 4.69 | 4.56 | - |
| 11 | 4.60 | 4.68 | 4.73 | 4.52 | 4.67 |
| 12 | 4.57 | 4.67 | 4.73 | - | 4.61 |
| 13 | - | 4.58 | 4.64 | 4.61 | 4.56 |
| 14 | - | 4.61 | 4.77 | 4.61 | 4.62 |
| 15 | 4.74 | 4.52 | - | 4.64 | 4.57 |
| 16 | 4.77 | - | 4.65 | 4.73 | 4.53 |
| 17 | 4.68 | - | 4.76 | 4.78 | - |
| 18 | 4.75 | 4.62 | 4.73 | 4.76 | 4.58 |
| 19 | 4.72 | 4.71 | 4.71 | - | 4.64 |
| 20 | - | 4.63 | 4.64 | 4.67 | 4.66 |



| pH of formalin | | | | | |
|----------------|--------|-----------|---------|----------|----------|
| Year 2000 | | | | | |
| Date | August | September | October | November | December |
| 21 | 4.59 | 4.61 | - | 4.63 | 4.70 |
| 22 | 4.56 | 4.72 | - | 4.68 | 4.72 |
| 23 | 4.61 | 4.72 | - | 4.59 | 4.75 |
| 24 | 4.69 | - | 4.53 | 4.57 | - |
| 25 | 4.57 | 4.78 | 4.53 | 4.63 | 4.77 |
| 26 | - | 4.75 | 4.57 | - | 4.68 |
| 27 | - | 4.70 | 4.63 | 4.70 | 4.64 |
| 28 | 4.66 | 4.69 | 4.60 | 4.77 | 4.65 |
| 29 | 4.62 | 4.66 | - | 4.67 | 4.60 |
| 30 | 4.67 | 4.58 | 4.56 | 4.73 | - |

Remark : A sign of (-) means no measuring the pH on that day, especially on sunday.

APPENDIX 4

The pH of water for the production of reactor is measured from August to December 2000 as follows.

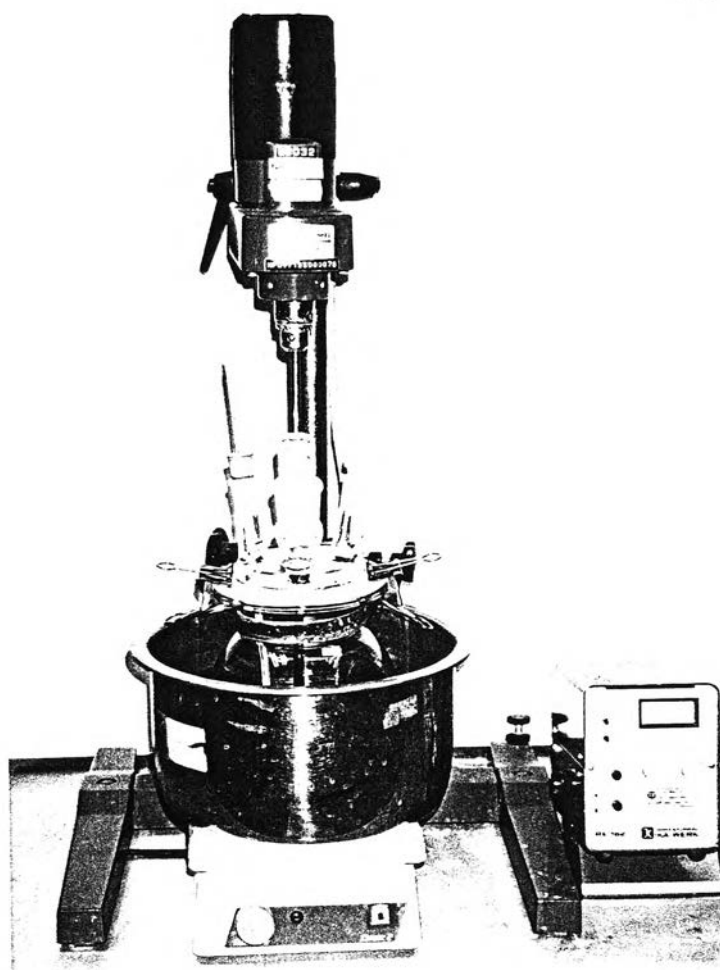
| pH of water | | | | | |
|-------------|--------|-----------|---------|----------|----------|
| Year 2000 | | | | | |
| Date | August | September | October | November | December |
| 1 | 7.67 | 7.59 | - | 7.56 | 7.61 |
| 2 | 7.78 | - | 7.77 | 7.51 | 7.65 |
| 3 | 7.83 | - | 7.80 | 7.66 | - |
| 4 | 7.69 | 7.51 | 7.88 | 7.73 | - |
| 5 | 7.51 | 7.43 | 7.73 | - | - |
| 6 | - | 7.50 | 7.67 | 7.62 | 7.77 |
| 7 | 7.52 | 7.34 | 7.66 | 7.68 | 7.84 |
| 8 | 7.63 | 7.61 | - | 7.66 | 7.75 |
| 9 | 7.58 | 7.61 | 7.63 | 7.54 | 7.62 |
| 10 | 7.51 | - | 7.58 | 7.66 | - |
| 11 | 7.46 | 7.75 | 7.62 | 7.73 | 7.86 |
| 12 | 7.37 | 7.68 | 7.75 | - | 7.73 |
| 13 | - | 7.67 | 7.64 | 7.86 | 7.58 |
| 14 | - | 7.62 | 7.78 | 7.88 | 7.64 |
| 15 | 7.68 | 7.54 | - | 7.76 | 7.63 |
| 16 | 7.77 | - | 7.84 | 7.61 | 7.59 |
| 17 | 7.66 | - | 7.87 | 7.64 | - |
| 18 | 7.75 | 7.61 | 7.75 | 7.60 | 7.56 |
| 19 | 7.86 | 7.83 | 7.59 | - | 7.38 |
| 20 | - | 7.87 | 7.62 | 7.53 | 7.43 |

| pH of water | | | | | |
|-------------|--------|-----------|---------|----------|----------|
| Year 2000 | | | | | |
| Date | August | September | October | November | December |
| 21 | 7.88 | 7.82 | - | 7.47 | 7.33 |
| 22 | 7.83 | 7.74 | - | 7.44 | 7.36 |
| 23 | 7.83 | 7.79 | - | 7.53 | 7.54 |
| 24 | 7.74 | - | 7.55 | 7.67 | - |
| 25 | 7.71 | 7.74 | 7.58 | 7.67 | 7.63 |
| 26 | - | 7.80 | 7.46 | - | 7.71 |
| 27 | - | 7.76 | 7.32 | 7.62 | 7.62 |
| 28 | 7.63 | 7.83 | 7.41 | 7.69 | 7.58 |
| 29 | 7.52 | 7.87 | - | 7.74 | 7.53 |
| 30 | 7.48 | 7.87 | 7.35 | 7.68 | - |

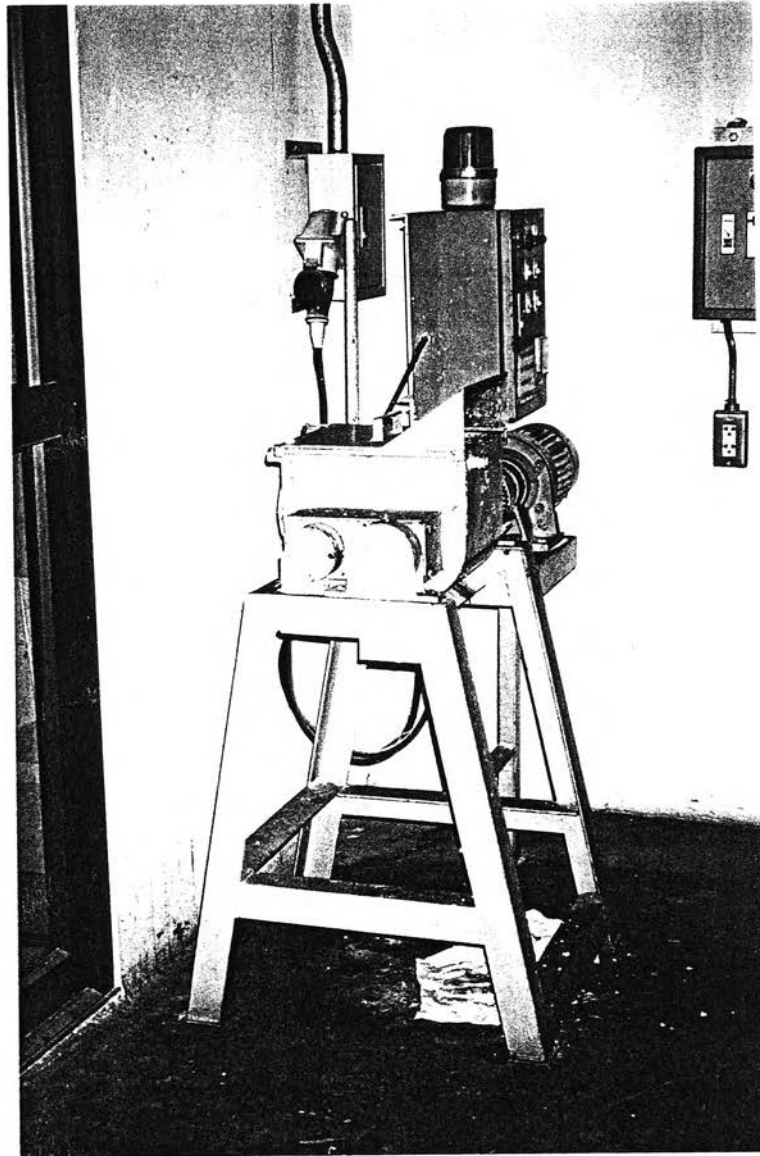
Remark : A sign of (-) means no measuring the pH on that day, especially on sunday.

APPENDIX 5

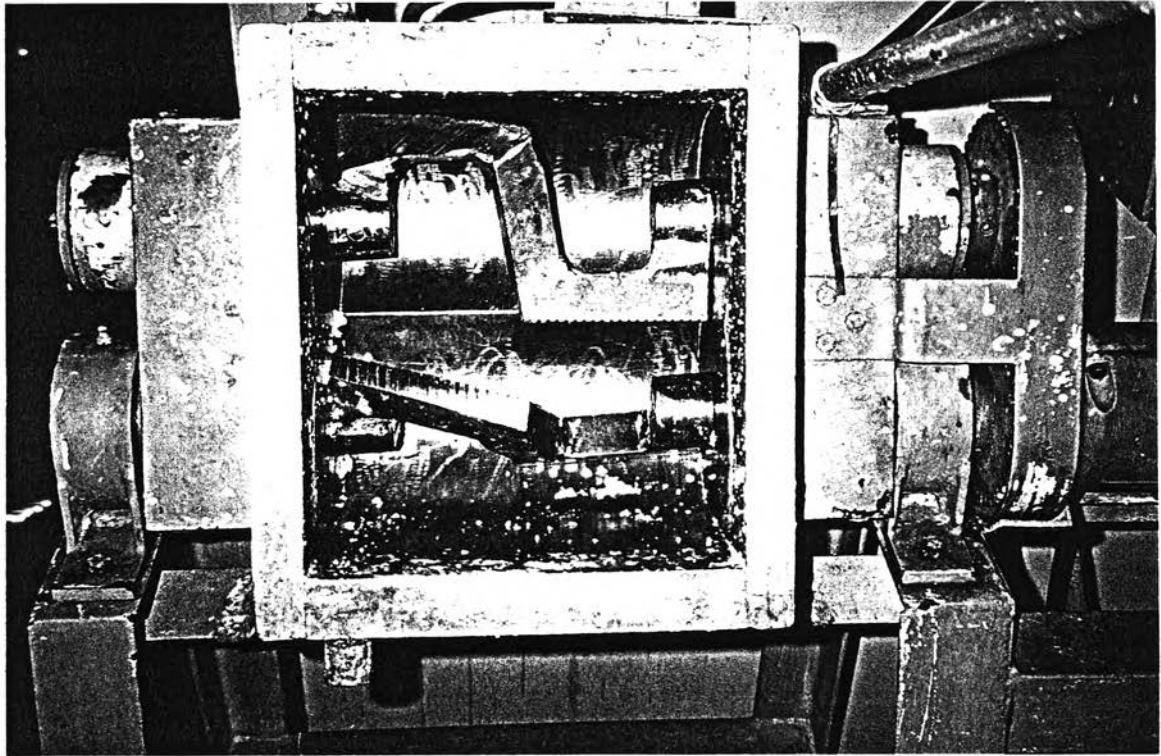
The equipments for experiments and the measuring equipments.



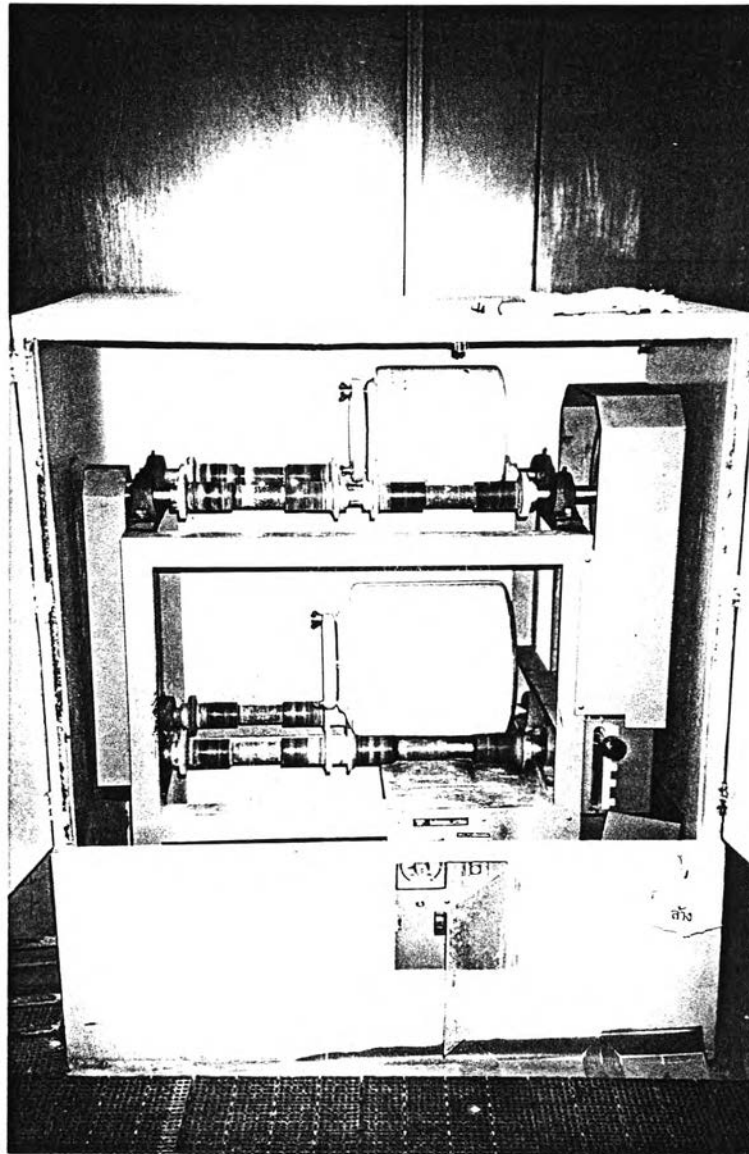
The Laboratory Reactor



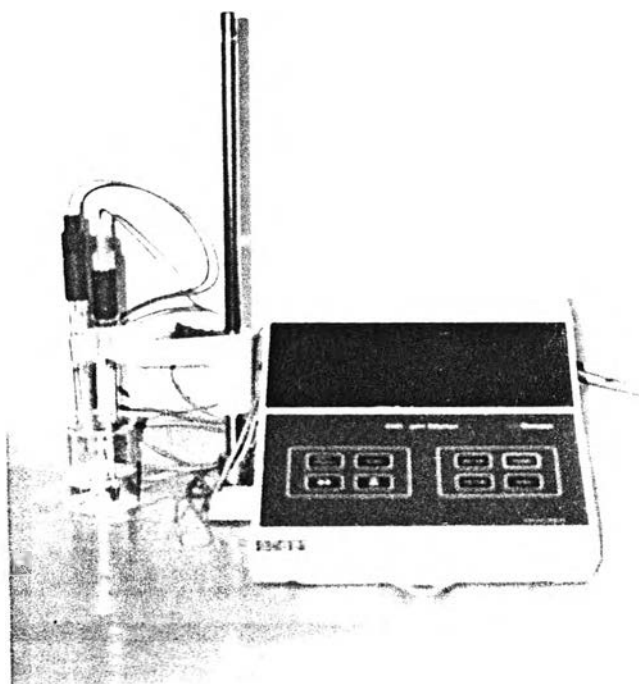
The Laboratory Kneader



The Mechanisms of Kneader



The Pot Mills



The pH Meter



The Rheometer



BIOGRAPHY

Mr. Aik Silavisesrith was born on January 4, 1973 in Bangkok, Thailand. He graduated from Chulalongkorn University with a Bachelor Degree in Mechanical Engineering, in 1995. He has been an engineer at The Siam Cement Public Company Limited since 1995.

In 1998, he continued his education with a Master Degree program in Engineering Management of Chulalongkorn University and University of Warwick.