

REFERENCES

- Aiken, G.R., D.M. Mcknight and R.L. Wershaw. 1985. *Humic substances in soil, sediment and water geochemistry isolation and characterization*. John and Wiley & Sons. pp1-12.
- Amy, G.L. and Chadik, A. 1983. Cationic Polyelectrolytes as Primary Coagulants for Removing Trihalomethane Precursors. *J.AWWA*. 75(10):527-536.
- Amy, G.L., Sierka, R.A., Bedessem, J., Price, D., and Tan, L. 1992. Molecular Size Distribution of Dissolve Organic Matter *J.AWWA*, 75 (6): 67-77.
- Amy, G.L., 1993. Using NOM Characterization for the Evaluation of Treatment. Proceedings of the Natural Organic matter (NOM) workshop, *J.AWWA* (11):19-22.
- AWWA and WPCF. 1995. *Standard Methods for the Examination of Water and Wastewater* 19thed., APHA,. Washington, D.C.
- Beller, T.A., Lichtenburg, J.J. and Kroner R.C. 1974. The occurrence of Organohalides in Finish Drinking Water. *J.AWWA*. 66(12):703
- Braul, L., Viraraghavan, T. and Corkal, D. 2001. Cold water effects on enhanced coagulation of high DOC, low turbidity water. *Water Qual. Res. J. Canada*, 36(4), 701-717.
- Carollo Engineers. 2000. Process treatment technology assessment draft-revision 2. Lake pleasant water treatment plant quality testing study-phase 1 Technical memorandum No.2. [Online] Available from :
H:\Client\Phoenix_PHXW\4900a00\Tecmem\Draft2\TM2_Report.wpd.
- Chadik, P.A., and Amy, G.L. 1983. Cationic Polyelectrolytes as Primary Coagulants for Removing Trihalomethane Precursors. *J.AWWA*.(10)- 527-531.
- Cheng, R.C., Krasner, S.W., Green, J.F., and Wattier K.L. 1995. Enhanced Coagulation: a preliminary evaluation. *J.AWWA*. (2): 91-103.
- Copper, W.J. et al. 1985. Bromide-Oxidant Interactions and THM formation. *J.AWWA*. (4): 116-121.
- Crozes, G., White, P., and Marshall M. 1995. Enhanced, Coagulation: Its Effect on NOM Removal and Chemical Costs. *J.AWWA* .(1): 78-89.

- Dempsy, B.A., Ganho, R. M. and O' Melia, C.R. 1984. The Coagulation of Humic Substances by Means of Aluminum Salts. *J.AWWA*. 76(4):141.
- Department of Environmental and Labour. Water Resources Management Division. 2000. Trihalomethanes Level in Public Water Supplies of Newfoundland and Labrador.[Online] Available from: <http://www.hc-sc.gc.ca>[2001 January 25].
- Dryfuse, M.J., Miltner, R.J., and Summers, R.S. 1995. The removal of molecular size and humic/non-humic fractions of DBP precursors by optimized coagulation. *Proceeding of the annual conference of the American water works association*, Anaheim, CA, June 18-22.
- Eaton A. 1995. Measuring UV-Absorbing Organic: A Standard Method. *J.AWWA*. (2): 86-90.
- Edzwald, J.K., Becker, W.C., and Wattier, K. 1985. Surrogate Parameters for Monitoring Organic Matter and THM Precursors. *J.AWWA*. (4):122-132.
- Edzwald, J.K. 1993. Coagulation in Drinking Water Treatment: Particles, Organics and Coagulants. *Water Sci. Technol.* 27(11):21
- El-Shahat, M.F., Abdel-Halim, S.H., and Hassan, G.A. 1998. Evaluation of Trihalomethanes in Water Treatment Plants' Outputs in Cairo, Egypt During 1991-1993, *Bull. Environ. Contam. Toxicol.* 60: 502-506.
- El-Shahat, M.F., Abdel-Halim, S.H., and Hassan, GA. 2001. Factors Influencing the Formation of Trihalomethanes in Drinking Water Treatment Plants. *Bull. Environ. Contam. Toxicol.* 67: 549-553.
- Faust S.D. and Aly O.M. 1998. *Chemistry of water treatment*. 2nd ed. Ann Arbor Press.
- Fettig, J., Ødegaard, H. and Eikebrokk, B. 1998. Humic substance removal by alum coagulation - direct filtration at low pH. In: Hahn,H.H. and Klute,R. (eds): Pretreatment in Chemical Water and Wastewater treatment. Springer Verlag, Berlin/Heidelberg, pp. 55 – 66.
- Freeman, J.K., Maxwell, M., Pohlman, B., Scanlan, P., Harms. L., Mark, J., and Spillman, B. 1997. Pilot evaluation of microfiltration and ultrafiltration treatment at cheyene, wyoming. *Proceedings of the American Water Works Annual Conference*, Atlanta, GA, June 15-19.
- Flaig, W. 1963. The chemistry of humic substances. *Report of the FAO/IAWA Technical Meeting*. pp.103-127.

- Fryters, T. 2001. Tri-Halo Methanes & Their Treatment/Prevention, *2001 Annual Alberta Water and Wastewater Operations Association' Seminar Held in Banff, Alberta.*
- Ghazali, Zainuddin Bin Md. 1989. *Trihalomethane formation in Bangkok Water Treatment Plant, Thailand.* Master's Thesis, Asian Institute of Technology Thailand.
- Hass D.W., Wentzel M.C., and Ekama G.A. 1984. The use of simultaneous chemical precipitation in modified activated sludge system exhibiting biological excess phosphate removal Part 1: Literature review[Online]. Available from: http://www.wrc.org.za/wrc/_derived/1204.pdf[2001 november10].
- Hoehn, R.C., Barnes, D.B., Randall, C.W., Griizzard., T.J., Shapper, J B. 1980. Algae as source of Trihalomethane Precursors. *J.AWWA.* 72(6):344-350.
- Hoehn, R.C., Dixon, K.L. and Randall, C.W. 1984. Biologically Induced Variations In the Nature and Removability of THM Precursors by Alum Treatment. *J.AWWA.* 76(4):134-140.
- Hubel, E.R. and Edward K.J. 1987. Removing Trihalomethanes Precursor by Coagulation. *J.AWWA.* (6): 98-106.
- Jacangelo, J.G. 1995. Mechanism of Cryptosporidium, Giardia, and MS2 Virus Removal by MF and UF. *Journal AWWA.*
- Kavanaugh, M.C. 1978. Modified Coagulation for Improved Removal of Trihalomethane Precursors, *J.AWWA.* 70(11): 613-619.
- Krasner, S.W., Croue, J.P., Buffle, J., and Perdue, E.M. 1996. Three Approaches for Characterizing NOM. *J.AWWA,* (5): 66-79.
- Leenheer, J.A., Noyes, T.I. and Steer, H.A. 1982. Determination of Polar Organic Solute in Oil-Shale Report Water. *Environ. Sci. Technol.* 16(10):714-723.
- Marhaba, T.F., and Washington, M.B. 1998. Drinking Water Disinfection and By-Products: History and Current Practice. *Adv. Environ. Res.* 2(1): 103-115.
- Marhaba, T.F., and Pipada, N.S. 2000. Coagulation: Effectiveness in Removing Dissolved Organic Matter Fractions. *Environ. Eng. Sci.* 17(2): 107-115.
- Morris, R.D. et al. 1992. Chlorination by products and Cancers: A Meta-analysis. *American Journal of Public Health.* 82(7):955-963.

- Muttamara, S., Sales, C.I. and Gazali, Z. 1995. The Formation of Trihalomethane from Chemical Disinfectants and Humic Substances in Drinking Water. *Water Supply*.13 (2):105-117.
- Najm, N.I., Patania L.N., Jacangelo, G.J. and Krasner W.S. 1994. Evaluating Surrogates for Disinfection By-Products. *J.AWWA*. (6):98-106.
- National Environment Board Thailand, Environmental Quality Standard Division, Laboratory and Research Section. 1984. *Seminar on Trihalomethane in Drinking Water in Bangkok Metropolitan Area*.
- National cancer institute.1979. Report on Carcinogenesis Bioassay of Chloroform, Bethesda, MD.
- Notification of the Ministry of Industry, No. 332, B.E. 2521(1978), issued under the industrial Product (1968), published in the Royal Government Gazette, vol.95 Part 68, dated July 4, B.E. 2512(1998).
- Norwood, D.L., D.J. Johnson, R.F. Christman, J.R. Hass& M.J. Bobenrieth. 1980. Reactions with selected aromatic models of aquatic humic material. *Environ. Sci. Technol.* 14 : 187.
- Oliver, B. and Lawrence, J. 1979. Haloforms in Drinking Water: A Study of Precursors and Precursor Removal. *J.AWWA*. 71:3:161-163.
- Oliver, B.G., and Shindler, D. B 1980. Trihalomethanes from the Chlorination of Aquatic algae. *Environ. Sci. Technol.* 14 (12):1502.
- Owen, D.M., Amy, G.L., Chowdhury, Z.K. and Viscosil, K. 1995. NOM Characterization and Treatability. *J.AWWA*, 75 (10):46-63.
- Owen, D.M., Pirnie, M., Amy, G.L., and Chowdhury, Z.K.1993. Characterization of Natural Organic Matter and Its Relationship to Treatability, *AWWARF*, order number: 90631.
- Pernitsky D.J. and Edzwald J.K. 1999. Selection of polyaluminum chlorides for water treatment. p. 103-112. In Conference Proceedings of the Western Canada Water and Wastewater Association 51st Annual Conference, Saskatoon, Saskatchewan.
- Pihlaja, K. 1991. *Humic substances in the aquatic and terrestrial environment. In Lecture Note in Earthy Sciences*. Springer, Berlin.113-121.
- Reckhow, D.A., and Singer, P.C. 1990. Chlorination By-Products in Drinking Water: From Formation Potentials to Finish Water Concentration. *J.AWWA*, 82: 173-180.

- Recknow, D.A., Bose, P., Bezbarua, B., Hesse, E.M. and McKnight, A.P. 1992. Transformations of Natural Organic Material During Preozonation. *EPA Report*. USEPA, Drinking Water Research Division, Cincinnati, Ohio.
- Reynolds, D.T. and Richards, A.P. 1996. *Unit Operation and Process in Environmental Engineering*. 2nd Edition. U.S: PWS publishing Company.
- Rook, J.J. 1974. Formation of Haloforms During Chlorination of Natural Water. *Wtr.Trmt & Exam*. 23:234.
- Sakornarun, S. 1987. *A Comparative Study of Trihalomethanes Content in Water as a result of Pre-chlorination and Post-Chlorination*. Master's Thesis, Faculty of Graduate Study, Mahidol University.
- Scanlan, P., Pohlman, B., Freeman, S., Spillman, B., and Jerome, M. 1997. Membrane filtration for the removal of color and TOC from surface water. *American Water Works Association Membrane Technology Conference Proceedings*. February 23-26. New Orleans, LA.
- Sinsabaugh, R.L., Hoehn, R.C., Knocke, W.R., and Linkins, A.E. 1986. Removal of dissolved organic carbon by coagulation with iron sulfate. *J.AWWA*, 78 (5):74.
- Simpson G.D. 1996. Biofilm : Removal and prevention with chlorine dioxide. [Online]. Available from: <http://www.clo2.com>[2002 may 25].
- Stevens, A.A., Slocum, C.R., Seeger, D.R., and Robeck, G.G.1976. Chlorination of Organics in Drinking Water. *J.AWWA*. 615-620.
- Shorney, H.L., Randtke, S.J., Hargette, P.H., Mann, P.D., Hoehn, R> C., Knocke, W.R., Dietrich, A. M., and Long, B.W. 1996. "The influence of Raw water Quality on Enhanced Coagulation and Softening For the removal of NOM and DBP Formation Potential," *J.AWWA*. Doctoral Dissertation, Department of Environmental Engineering, University of Kansas, Lawrence, Kansas.
- Shorney, S. 1998. *The performance of enhanced lime softening and coagulation for disinfection by-product precursor removal*. Doctoral dissertation, Department of Environmental Engineering, University of Kansas, Lawrence, Kansas.
- Stumm, W., and C.R.O'Melia. 1968. Stoichiometry of coagulation. *J. AWWA*, 60(5):514.
- Symon, J.M. et al. 1975. National Organics Reconnaissance Survey for Halogenated Organics. *J.AWWA*. 67:11:634.
- Thurman, E.M.& R.L. Malcolm. 1981. Preparative isolation of aquatic humic substances. *Environ. Sci. Technol*. 15(4) : 463.

- Thurman, E.M. 1985. *Organic Geochemistry of Natural Waters*. Marinus Nijhoff/Dr.W.Junk, Dordrecht. The Netherlands.
- Trussell, R.R., and Umphres, M.D. 1978. The Formation of Trihalomethanes. *J.AWWA*. 70 (11): 604-611.
- US.EPA.1994 National Primary Drinking Water Regulation: Disinfectants And Disinfection Byproducts(D/DBP), Notice of Data Availability; Proposed Rule. *Fed.Reg.*, 59:145:38668.
- US.EPA.1997 National Primary Drinking Water Regulation: Disinfectants And Disinfection Byproducts(D/DBP), Notice of Data Availability; Proposed Rule. *Fed.Reg.*, 62:212:59388.
- US.EPA. 1998.National Primary Drinking Water Regulation: Disinfectants And Disinfection Byproducts(D/DBP), Final Rule. *Fed. Register*. 63:69389-69476.
- US.EPA.1999.Enhanced Coagulation and Enhanced Precipitative Softening Guidance Manual. Office of water (4607)[Online]. Available from: <http://www.epa.gov>[2001 november10].
- Vilage, A., Rose, J., Masion, A., Laine, F., and Bottero, F. 1997. Advanced coagulation of natural organic matter mechanism of interaction between NOM and Al and Fe. *Proceeding of the annual conference of the American water works association*, Atlanta, GA, June 15-19.
- Visvanathan, C and Cippe, A. 2001. Strategies for Development of Industrial Wastewater Reuse in Thailand. *Water Sci. Technol.* 43:10:59-66.
- Young, J.S. and Singer, P.C. 1979. Chloroform Formation in Public Water Supplies: A Case Study. *J.AWWA*.71:2:87.

APPENDICES

APPENDIX A

Table A-1 Calibration data of UV-254

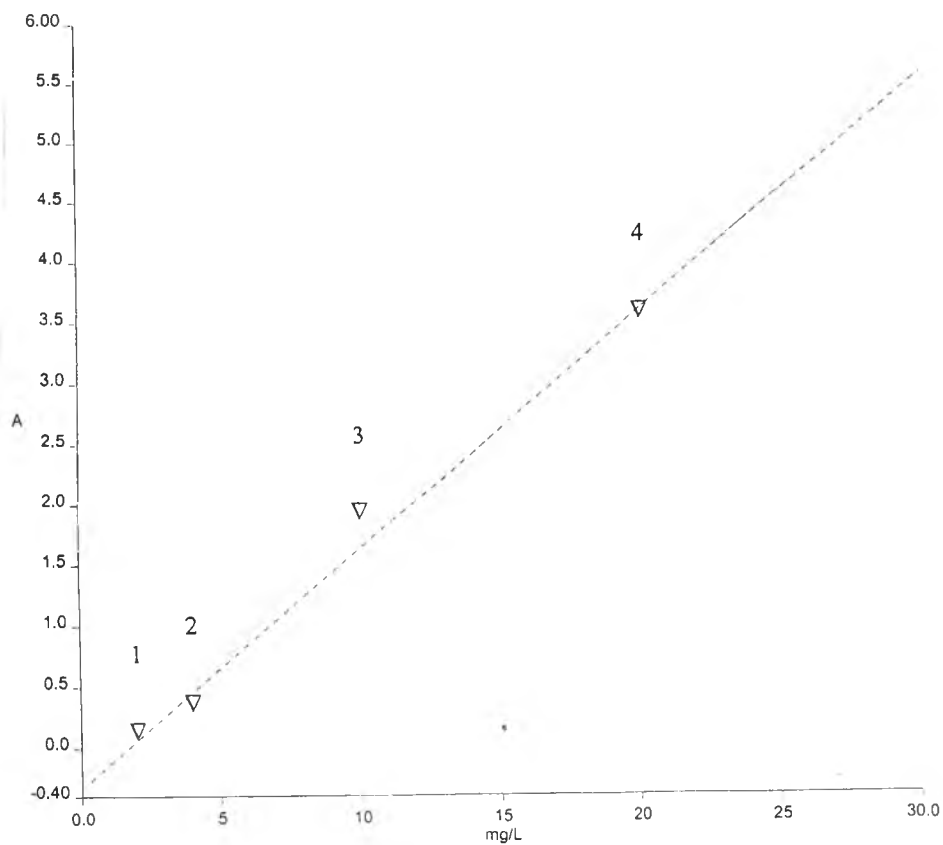
Method: JIM03
 Ordinate mode: Single wavelength
 Baseline: No correction (0.00 0.00)
 Analyst:

Wavelength(s)	Sample ID	Concentration	Ord. value	Comment
253.7	0.0 KHP.A01	2.0000 mg/L	0.0686	
253.7	0.0 KHP.A02	4.0000 mg/L	0.2981	
253.7	0.0 KHP.A03	10.000 mg/L	1.8620	
253.7	0.0 KHP.A04	20.000 mg/L	3.5054	

Equation: $y = -3.320644e-01 + 1.961783e-01 * x$

Residual error: 0.206556

Correlation coefficient: 0.994391



JIM03 - 22/1/03 - $y = -3.320644e-01 + 1.961783e-01 * x$

Figure A-1 Calibration data of UV-254

Table A-2 Calibration data of free chlorine residual

CALIBRATION

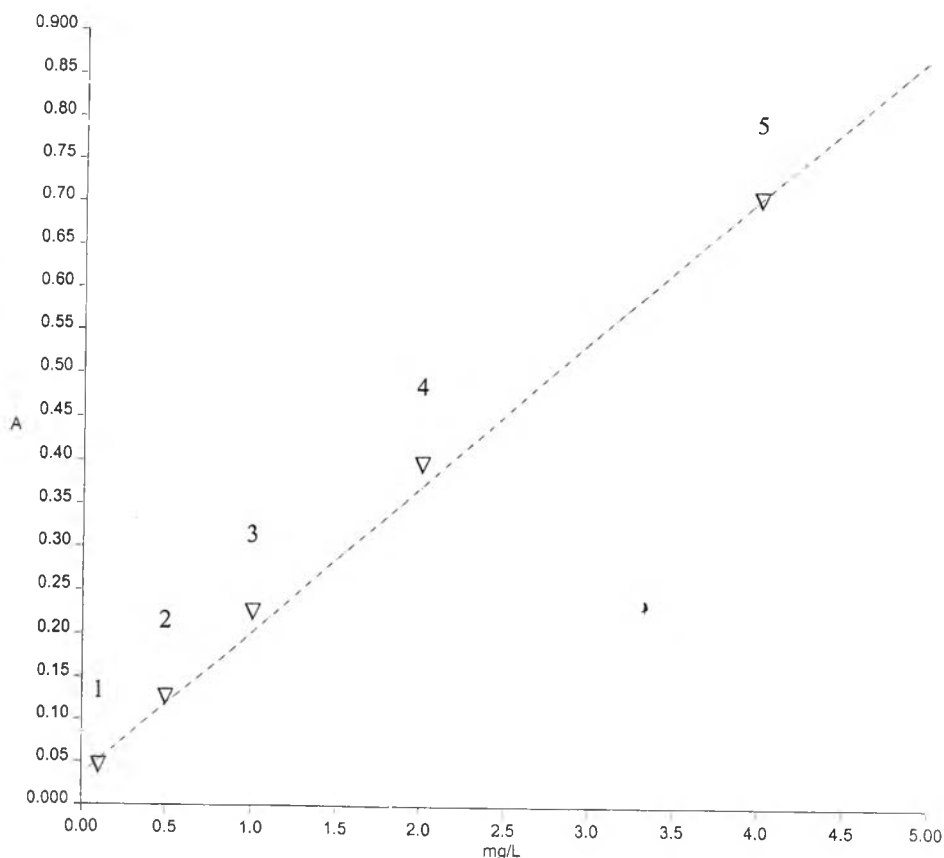
Date: 27/3/03 Time: 15:11:09 AM
 Instrument: PerkinElmer Lambda 25 Serial No: 101N2020507
 Method: JIMCHLO
 Ordinate mode: Single wavelength
 Baseline: No correction (0.00 0.00)
 Analyst:

Wavelength(s)	Sample ID	Concentration	Ord. value	Comment
515.0	0.0	JIMCHLO.A01	0.1000 mg/L	0.0348
515.0	0.0	JIMCHLO.A02	0.5000 mg/L	0.1169
515.0	0.0	JIMCHLO.A03	1.0000 mg/L	0.2159
515.0	0.0	JIMCHLO.A04	2.0000 mg/L	0.3865
515.0	0.0	JIMCHLO.A05	4.0000 mg/L	0.6966

Equation: $y = 3.454865e-02 + 1.681325e-01 * x$

Residual error: 0.016409

Correlation coefficient: 0.998532



JIMCHLO - 30/1/03 - $y = 3.454865e-02 + 1.681325e-01 * x$

Figure A-2 Calibration data of free chlorine residual

Table A-3: Calibration data of TTHM

Calib. Data Modified : Saturday, March 01, 2003 5:53:25 PM

Calculate : Internal Standard
Based on : Peak Area

Rel. Reference Window : 5.000 %
Abs. Reference Window : 0.000 min
Rel. Non-ref. Window : 5.000 %
Abs. Non-ref. Window : 0.000 min
Uncalibrated Peaks : not reported
Partial Calibration : Yes, identified peaks are recalibrated
Correct All Ret. Times: No, only for identified peaks

Curve Type : Linear
Origin : Included
Weight : Equal

Recalibration Settings:
Average Response : Average all calibrations
Average Retention Time: Floating Average New 75%

Calibration Report Options :
Printout of recalibrations within a sequence:
Calibration Table after Recalibration
Normal Report after Recalibration
If the sequence is done with bracketing:
Results of first cycle (ending previous bracket)

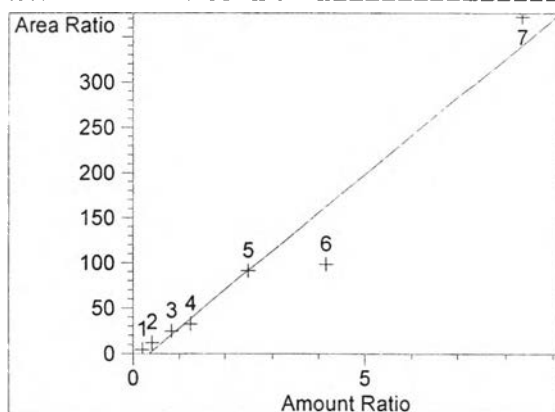
Default Sample ISTD Information (if not set in sample table):

ISTD #	ISTD Amount [ug/l]	Name
1	120.00000	Bromofluorobenzene

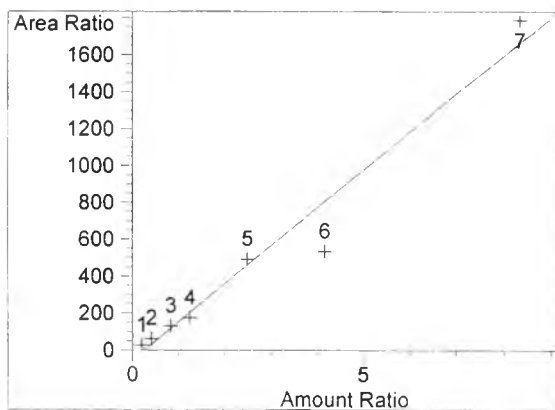
Signal 1: ECD1 A,

RetTime [min]	Lvl Sig	Amount [ug/l]	Area	Amt/Area	Ref Grp	Name
3.047	1	25.00000	70.26765	3.55783e-1	1	Chloroform
		50.00000	194.30823	2.57323e-1		
		100.00000	376.51529	2.65593e-1		
		150.00000	535.45782	2.80134e-1		
		300.00000	1203.70593	2.49230e-1		
		500.00000	1824.96387	2.73978e-1		
		1000.00000	4791.05078	2.08722e-1		
4.172	1	25.00000	420.71561	5.94226e-2	1	Bromodichloroform
		50.00000	1021.71686	4.89372e-2		
		100.00000	1987.70300	5.03093e-2		
		150.00000	2871.34253	5.22404e-2		
		300.00000	6490.45410	4.62217e-2		
		500.00000	9840.81250	5.08088e-2		
		1000.00000	2.30107e4	4.34580e-2		
5.567	1	25.00000	437.79565	5.71043e-2	1	Chlorodibromoform
		50.00000	991.57202	5.04250e-2		
		100.00000	1959.43726	5.10351e-2		
		150.00000	2851.71777	5.25999e-2		
		300.00000	6082.31250	4.93233e-2		
		500.00000	9262.31543	5.39822e-2		
		1000.00000	1.99652e4	5.00871e-2		
7.253	1	25.00000	218.35396	1.14493e-1	1	Bromoform
		50.00000	455.68271	1.09725e-1		
		150.00000	1246.77893	1.20310e-1		
		300.00000	2510.93774	1.19477e-1		
		500.00000	3839.49585	1.30225e-1		
		1000.00000	7807.56934	1.28081e-1		
7.671	1	120.00000	15.80028	7.59480	+I1	Bromofluorobenzene
		120.00000	16.23931	7.38948		
		120.00000	15.29917	7.84356		
		120.00000	16.39823	7.31786		
		120.00000	13.17189	9.11031		
		120.00000	18.47002	6.49702		
		120.00000	12.85622	9.33400		

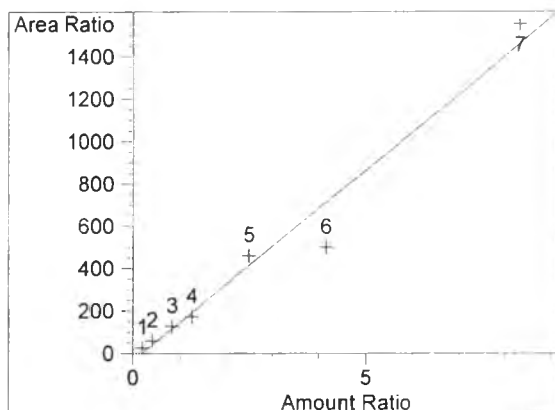
=====
Peak Sum Table
=====

=====
=====
Calibration Curves
=====

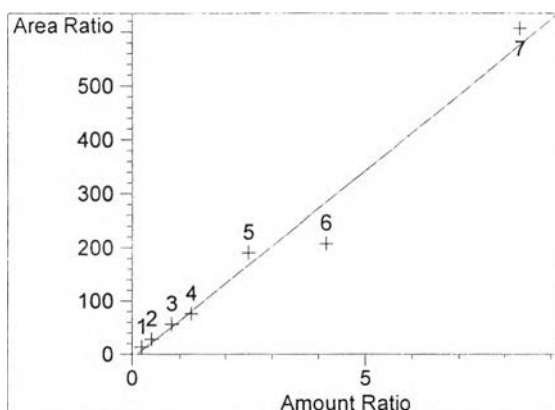
Chloroform at exp. RT: 3.047
ECD1 A,
Correlation: 0.97381
Residual Std. Dev.: 30.53080
Formula: $y = mx + b$
m: 42.67493
b: -14.89632
x: Amount Ratio
y: Area Ratio



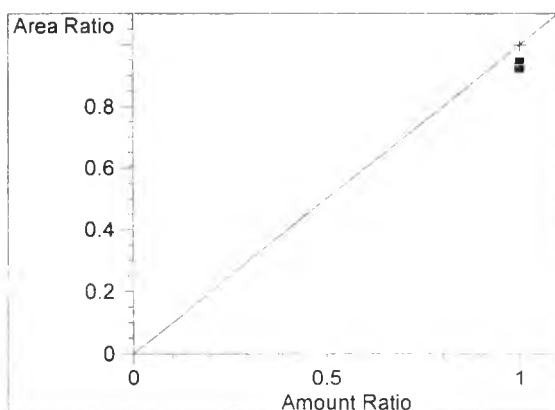
Bromodichloroform at exp. RT: 4.172
ECD1 A,
Correlation: 0.98033
Residual Std. Dev.: 127.25739
Formula: $y = mx + b$
m: 206.29386
b: -55.39399
x: Amount Ratio
y: Area Ratio



Chlorodibromoform at exp. RT: 5.567
 ECD1 A,
 Correlation: 0.98432
 Residual Std. Dev.: 98.51357
 Formula: $y = mx + b$
 m: 179.40129
 b: -33.74318
 x: Amount Ratio
 y: Area Ratio



Bromoform at exp. RT: 7.253
 ECD1 A,
 Correlation: 0.98664
 Residual Std. Dev.: 35.44777
 Formula: $y = mx + b$
 m: 70.07260
 b: -7.53633
 x: Amount Ratio
 y: Area Ratio



Bromofluorobenzene at exp. RT: 7.671
 ECD1 A,
 Correlation: 1.00000
 Residual Std. Dev.: 0.00000
 Formula: $y = mx + b$
 m: 1.00000
 b: 0.00000
 x: Amount Ratio
 y: Area Ratio

APPENDIX B

Table B-1 The characteristics of raw water in Aung-Kaew reservoir between October 2002 and February 2003

Sampling Date	pH	Alkalinity mg/L as CaCO ₃	Residual Turbidity NTU	THM ₀ (ug/L)	THM ₇ ug/L	THMFP ug/L	TOC (mg/L)	DOC (mg/L)	UV-254 cm-1	Free Chlorine (mg/L)
19-Oct-02	6.6	40.7	80.4	0.0	NT	NT	NT	NT	0.2559	NT
26-Oct-02	6.7	32.1	78.8	0.0	NT	NT	NT	NT	0.2738	NT
23-Oct-02	6.6	38.6	60.3	0.0	NT	NT	NT	NT	0.2463	NT
16-Nov-02	6.4	34.2	55.4	0.0	NT	NT	NT	NT	0.2365	NT
23-Nov-02	6.2	32.1	46.0	0.0	NT	NT	NT	NT	0.1556	NT
30-Nov-02	6.4	28.0	42.4	0.0	NT	NT	4.40	1.05	0.1532	NT
10-Dec-02	6.5	32.1	41.7	0.0	NT	NT	4.22	0.95	0.1459	NT
17-Dec-02	6.4	27.8	38.0	0.0	NT	NT	3.57	0.66	0.1232	NT
27-Dec-02	6.5	34.3	35.5	0.0	NT	NT	4.69	1.20	0.1536	NT
3-Jan-03	6.3	32.1	18.6	0.0	NT	NT	5.24	1.67	0.1834	NT
10-Jan-03	6.6	32.9	11.2	0.0	228.2	228.2	2.26	0.44	0.1253	2.8
17-Jan-03	6.5	31.8	12.6	0.0	281.1	281.1	2.96	0.55	0.1360	2.2
30-Jan-03	6.5	34.3	8.1	0.0	218.1	218.1	2.01	0.37	0.1097	2.8
15-Feb-03	6.3	30.0	9.3	0.0	285.7	285.7	3.39	0.59	0.1432	2.5
28-Feb-03	6.7	32.2	10.2	0.0	253.5	253.5	2.42	0.48	0.1247	2.6
Average	6.5	32.9	36.6	0.0	253.3	253.3	2.61	0.49	0.1278	2.6
SD	0.14	3.4	24.74	0.00	30.38	30.38	0.56	0.09	0.0127	0.2

Table B-2 The characteristics of raw water in Mae-Hia reservoir between October 2002 and February 2003

Sampling Date	pH	Alkalinity mg/L as CaCO ₃	Residual Turbidity (NTU)	THM ₀ ug/L	THM ₇ ug/L	THMFP ug/L	TOC (mg/L)	DOC (mg/L)	UV-254 (cm-1)	Free Chlorine (mg/L)
19-Oct-02	6.6	36.5	45.80	0.0	NT	NT	NT	NT	0.2056	NT
26-Oct-02	6.4	42.9	37.96	0.0	NT	NT	NT	NT	0.1829	NT
23-Oct-02	6.6	34.5	36.80	0.0	NT	NT	NT	NT	0.1785	NT
16-Nov-02	6.4	36.8	35.20	0.0	NT	NT	NT	NT	0.1393	NT
23-Nov-02	6.4	37.7	33.40	0.0	NT	NT	NT	NT	0.1535	NT
30-Nov-02	6.6	32.0	30.40	0.0	NT	NT	3.60	0.44	0.1313	NT
10-Dec-02	6.4	30.0	26.80	0.0	NT	NT	3.20	0.65	0.1561	NT
17-Dec-02	6.9	34.3	34.50	0.0	NT	NT	3.48	0.60	0.1485	NT
27-Dec-02	6.5	32.1	23.50	0.0	NT	NT	2.46	0.34	0.1253	NT
03-Jan-03	6.4	27.9	16.40	0.0	NT	NT	3.00	0.60	0.1468	NT
10-Jan-03	6.6	40.7	11.15	0.0	256.0	256	2.14	0.40	0.1253	2.8
17-Jan-03	6.5	31.8	12.60	0.0	260.0	260	2.22	0.29	0.1242	2.6
30-Jan-03	6.5	34.3	8.10	0.0	220.7	220.7	1.83	0.18	0.1097	2.8
15-Feb-03	6.3	25.7	9.80	0.0	272.5	272.5	1.74	0.35	0.1195	2.5
28-Feb-03	6.7	32.2	10.16	0.0	248.4	248.4	2.32	0.30	0.1247	2.4
Average	6.5	34.0	24.84	0.0	251.5	251.5	2.05	0.41	0.1447	2.6
SD	0.1	4.6	12.52	0.0	19.3	19.3	0.25	0.16	0.0270	0.2

Table B-3The characteristics of water supply in Aung-Kaew waterwork between October 2002 and February 2003

Sampling Date	pH	Alkalinity mg/L as CaCO ₃	Residual Turbidity (NTU)	THM ₀ ug/L	THM ₇ ug/L	THMFP ug/L	TOC mg/L	DOC mg/L	UV-254 cm-1	Free Chlorine (mg/L)
19-Oct-02	6.6	20.4	0.45	67.6	NT	NT	NT	NT	0.0860	NT
26-Oct-02	6.7	23.6	0.15	74.5	NT	NT	NT	NT	0.0862	NT
23-Oct-02	6.6	22.1	0.58	63.7	NT	NT	NT	NT	0.0780	NT
16-Nov-02	6.5	23.6	0.43	59.8	NT	NT	NT	NT	0.0703	NT
23-Nov-02	7.0	21.5	0.58	55.4	NT	NT	NT	NT	0.0662	NT
30-Nov-02	6.7	15.0	0.29	81.3	NT	NT	3.21	0.73	0.0798	NT
10-Dec-02	7.1	26.1	0.60	84.3	NT	NT	3.86	0.97	0.0847	NT
17-Dec-02	6.8	17.2	0.43	71.4	NT	NT	2.90	0.61	0.0685	NT
27-Dec-02	6.5	19.3	0.14	62.0	NT	NT	2.43	0.66	0.0641	NT
03-Jan-02	6.7	15.0	0.16	48.4	NT	NT	1.71	0.41	0.0624	NT
10-Jan-02	6.8	15.0	0.03	39.3	78.6	39.3	0.31	0.20	0.0631	2.3
17-Jan-03	6.8	17.2	0.02	42.0	77.2	35.2	0.94	0.29	0.0543	2.5
30-Jan-03	6.7	16.1	0.35	37.4	74.8	37.4	0.27	0.10	0.0597	2.8
15-Feb-03	6.8	15.0	0.52	48.1	90.6	42.5	0.92	0.29	0.0554	2.4
28-Feb-03	7.0	10.7	0.56	65.1	112	46.9	1.86	0.53	0.0748	2.6
Average	6.7	18.5	0.35	60.0	100.3	40.3	1.84	0.48	0.0702	2.5
SD	0.2	4.3	0.21	14.7	19.3	4.6	1.24	0.27	0.0108	0.2

Table B-4 The characteristics of water supply in Mae-Hia waterwork between October 2002 and February 2003

Sampling Date	pH	Alkalinity mg/L as CaCO ₃	Residual Turbidity (NTU)	THM ₀ ug/L	THM ₇ ug/L	THMFP ug/L	TOC mg/L	DOC mg/L	UV-254 cm-1	Free Chlorine (mg/L)
19-Oct-02	6.7	28.5	1.40	56.6	NT	NT	NT	NT	0.0953	NT
26-Oct-02	6.7	32.1	1.65	44.5	NT	NT	NT	NT	0.0912	NT
23-Oct-02	6.7	21.8	1.03	75.3	NT	NT	NT	NT	0.0957	NT
16-Nov-02	6.8	21.8	0.68	68.3	NT	NT	NT	NT	0.0781	NT
23-Nov-02	7.1	27.7	0.79	61.3	NT	NT	NT	NT	0.0655	NT
30-Nov-02	6.8	28.0	0.68	78.5	NT	NT	2.30	0.49	0.0675	NT
10-Dec-02	6.5	26.2	0.54	106.4	NT	NT	2.60	0.50	0.0927	NT
17-Dec-02	6.9	17.2	0.84	80.6	NT	NT	2.06	0.46	0.0785	NT
27-Dec-02	6.7	34.3	0.68	75.2	NT	NT	2.04	0.34	0.0613	NT
03-Jan-02	6.7	34.8	0.17	52.4	NT	NT	2.04	0.54	0.0724	NT
10-Jan-02	6.9	19.3	0.10	35.2	70.4	35.2	0.35	0.14	0.0631	2.1
17-Jan-03	6.9	17.2	0.04	48.7	97.4	48.7	0.55	0.18	0.0683	2.3
30-Jan-03	6.7	20.4	0.03	36.0	81.8	45.8	0.51	0.16	0.0697	2.7
15-Feb-03	7.1	15.0	0.02	49.8	99.6	49.8	0.52	0.18	0.0594	2.4
28-Feb-03	6.9	10.7	0.05	69.2	121.5	52.3	0.55	0.20	0.0585	2.8
Average	6.8	23.7	0.58	62.5	94.1	46.4	1.35	0.32	0.0745	2.5
SD	0.2	7.3	0.52	19.2	38.5	6.7	0.92	0.17	0.0134	0.3

APPENDIX C

Table C-1 THMFP and percent reduction of THMFP in coagulated water as a function of PACl dosages at the controlled pH of 6 for Aung-Keaw water source

PACl Dosage (mg/L)	Chloroform ($\mu\text{g/L}$)	Bromodichloro-methane ($\mu\text{g/L}$)	THMFP ($\mu\text{g/L}$)	Maximum THMFP Removal (%)	Free Chlorine Residual (mg/L)
0*	379.3	12.7	392.0	0.0	4.9
0.5	143.8	0.0	143.8	63.3	1.8*
0.8	114.3	0.0	114.3	70.8	3.5
1.0	55.1	0.0	55.1	85.9	3.5
3.0	79.4	0.0	79.4	79.7	1.0*
5.0	47.6	0.0	47.6	87.8	5.7

Remarks : 0 = Raw water, * = Free chlorine was not in standard ranged of 3-5 mg/L

Table C-2 THMFP and percent reduction of THMFP in coagulated water as a function of PACl dosages at the controlled pH of 7 for Aung-Keaw water source

PACl Dosage (mg/L)	Chloroform ($\mu\text{g/L}$)	Bromodichloro-methane ($\mu\text{g/L}$)	THMFP ($\mu\text{g/L}$)	Maximum THMFP Removal (%)	Free Chlorine Residual (mg/L)
0.0	379.3	12.7	392.0	0.0	2.4*
0.5	116.5	0.0	116.5	70.2	3.9
0.8	86.1	0.0	86.1	78.0	3.4
1.0	44.8	0.0	44.8	88.7	2.1*
3.0	38.5	0.0	38.5	90.1	4.9
5.0	16.9	0.0	16.9	95.6	3.8

Table C-3 Profiles of THMFP and percent reduction of THMFP in coagulated water as a function of PACl dosages at the controlled pH of 8 for Aung-Keaw water source

PACl Dosage (mg/L)	Chloroform ($\mu\text{g/L}$)	Bromodichloro-methane ($\mu\text{g/L}$)	THMFP ($\mu\text{g/L}$)	Maximum THMFP Removal (%)	Free Chlorine Residual (mg/L)
0.0	379.3	12.7	392.0	0.0	4.9
0.5	79.9	0.0	79.9	79.6	2.7*
0.8	67.5	0.0	67.5	82.7	4.4
1.0	65.5	0.0	65.5	83.2	2.7*
3.0	37.2	0.0	37.2	90.5	3.4
5.0	32.2	0.0	32.2	91.7	3.9

Table C-4 Profiles of THMFP and percent reduction of THMFP in coagulated water as a function of PACl dosages at the controlled pH of 9 for Aung-Keaw water source

PACl Dosage (mg/L)	Chloroform ($\mu\text{g/L}$)	Bromodichloro-methane ($\mu\text{g/L}$)	THMFP ($\mu\text{g/L}$)	Maximum THMFP Removal (%)	Free Chlorine Residual (mg/L)
0.0	379.3	12.7	392.0	0.0	4.9
0.5	98.2	0.0	98.2	74.9	2.8*
0.8	80.5	0.0	80.5	79.4	4.2
1.0	81.7	0.0	81.7	79.1	3.4
3.0	82.5	0.0	82.5	78.9	3.1
5.0	81.3	0.0	81.3	79.2	3.9

Table C-5 THMFP and percent reduction of THMFP in coagulated water as a function of PACl dosages at the controlled pH of 10 for Aung-Keaw water source

PACl Dosage (mg/L)	Chloroform (µg/L)	Bromodichloro-methane (µg/L)	THMFP (µg/L)	Maximum THMFP Removal (%)	Free Chlorine Residual (mg/L)
0.0	379.3	12.7	392.0	0.0	4.9
0.5	195.2	0.0	195.2	50.2	4.2
0.8	130.9	0.0	130.9	66.6	3.0
1.0	98.2	0.0	98.2	74.9	2.8*
3.0	88.6	0.0	88.6	77.3	4.2
5.0	85.1	0.0	85.1	78.2	3.7

Table C-6 Profiles of THMFP and percent reduction of THMFP in coagulated water as a function of PACl dosages at the controlled pH of 6 for Mae-Hia water source

PACl Dosage (mg/L)	Chloroform (µg/L)	Bromodichloro-methane (µg/L)	THMFP (µg/L)	Maximum THMFP Removal (%)	Free Chlorine Residual (mg/L)
0	318.6	10.4	329.0	0.0	4.25
0.5	169.7	0.0	169.7	48.4	3.12
0.8	104.3	0.0	104.3	68.3	2.45*
1.0	66.4	0.0	66.4	79.8	3.44*
3.0	74.1	0.0	74.1	77.4	5.15*
5.0	70.1	0.0	70.1	78.6	5.03*

Table C-7 THMFP and percent reduction of THMFP in coagulated water as a function of PACl dosages at the controlled pH of 7 for Mae-Hia water source

PACl Dosage (mg/L)	Chloroform ($\mu\text{g/L}$)	Bromodichloro-methane ($\mu\text{g/L}$)	THMFP ($\mu\text{g/L}$)	Maximum THMFP Removal (%)	Free Chlorine Residual (mg/L)
0	318.6	10.4	329.0	0.00	4.2
0.5	169.7	0	169.7	48.4	2.1*
0.8	104.3	0	104.3	68.3	3.8
1.0	66.4	0	66.4	79.8	3.6
3.0	74.1	0	74.1	77.4	4.1
5.0	70.1	0	70.1	78.6	2.1*

Table C-8 Profiles of THMFP and percent reduction of THMFP in coagulated water as a function of PACl dosages at the controlled pH of 8 for Mae-Hia water source

PACl Dosage (mg/L)	Chloroform ($\mu\text{g/L}$)	Bromodichloro-methane ($\mu\text{g/L}$)	TTHMs ($\mu\text{g/L}$)	Maximum THMFP Removal (%)	Free Chlorine Residual (mg/L)
0.0	318.6	10.4	329.0	0.0	4.2
0.5	115.3	0.0	115.3	64.9	3.5
0.8	75.9	0.0	75.9	76.9	2.0*
1.0	68.5	0.0	68.5	79.1	1.8*
3.0	58.2	0.0	58.2	82.3	2.7*
5.0	55.3	0.0	55.3	83.1	3.1

Table C-9 THMFP and percent reduction of THMFP in coagulated water as a function of PACl dosages at the controlled pH of 9 for Mae-Hia water source

PACl Dosage (mg/L)	Chloroform (µg/L)	Bromodichloro methane (µg/L)	TTHMs (µg/L)	Maximum THMFP Removal (%)	Free Chlorine Residual (mg/L)
0.0	318.6	10.4	329.0	0.0	4.2*
0.5	138.4	0.0	138.4	57.9	3.8
0.8	114.4	0.0	114.4	65.2	5.2*
1.0	113.8	0.0	113.8	65.4	4.3
3.0	79.2	0.0	79.2	75.9	5.3*
5.0	74.3	0.0	74.3	77.4	2.4*

Table C-10 Profiles of THMFP and percent reduction of THMFP in coagulated water as a function of PACl dosages at the controlled pH of 10 for Mae-Hia water source

PACl Dosage (mg/L)	Chloroform (µg/L)	Bromodichloro methane (µg/L)	TTHMs (µg/L)	Maximum THMFP Removal (%)	Free Chlorine Residual (mg/L)
0	318.6	10.4	329.0	0.0	4.2
0.5	172.6	0.0	172.6	47.5	3.5
0.8	127.5	0.0	127.5	61.2	2.7*
1.0	122.4	0.0	122.4	62.8	3.1*
3.0	79.1	0.0	79.1	75.9	2.9*
5.0	74.8	00	74.8	77.2	1.9*

Table C-11 Surrogate parameters for NOMs in coagulated water as a function of PACl dosage at the controlled pH of 6 for Aung-Kaew water source

PACl dosage (mg/L)	THMFP (µg/L)	TOC (mg/L)	DOC (mg/L)	UV-254 (1/cm)
0	392	1.63	1.2	0.1132
0.5	143.8	0.69	0.59	0.0104
0.8	114.3	0.6	0.45	0.0091
1	55.1	0.47	0.34	0.0081
3	79.4	0.42	0.28	0.0153
5	47.6	0.38	0.27	0.0114

Remark : 0 = Raw water

Table C-12 Surrogate parameters for NOMs in coagulated water as a function of PACl dosage at the controlled pH of 7 for Aung-Kaew water source

PACl dosage (mg/L)	THMFP (µg/L)	TOC (mg/L)	DOC (mg/L)	UV-254 (1/cm)
0	392	1.63	1.2	0.1532
0.5	116.5	0.59	0.41	2.1986
0.8	86.1	0.44	0.35	2.2679
1	44.8	0.35	0.27	2.1009
3	38.5	0.27	0.22	0.0031
5	16.9	0.22	0.2	0.0907

Table C-13 Surrogate parameters for NOMs in coagulated water as a function of PACl dosage at the controlled pH of 8 for Aung-Kaew water source

PACl dosage (mg/L)	THMFP (ugh/L)	TOC (mg/L)	DOC (mg/L)	UV-254 (1/cm)
0	392	1.63	1.2	0.1532
0.5	79.9	0.65	0.56	2.2361
0.8	67.5	0.54	0.4	2.1594
1	65.5	0.43	0.29	1.7841
3	37.2	0.35	0.26	0.0778
5	32.2	0.29	0.23	0.0081

Table C-14 Surrogate parameters for NOMs in coagulated water as a function of PACl dosage at the controlled pH of 9 for Aung-Kaew water source

PACl dosage (mg/L)	THMFP (µg/L)	TOC (mg/L)	DOC (mg/L)	UV-254 (1/cm)
0	392	1.63	1.2	0.1532
0.5	98.2	0.83	0.63	2.1735
0.8	80.5	0.72	0.49	2.1139
1	81.7	0.61	0.4	1.7926
3	82.5	0.57	0.33	0.0193
5	81.3	0.49	0.32	0.0107

Table C-15 Surrogate parameters for NOMs in coagulated water as a function of PACl dosage at the controlled pH of 10 for Aung-Kaew water source

PACl dosage (mg/L)	THMFP (μ gh/L)	TOC (mg/L)	DOC (mg/L)	UV-254 (1/cm)
0	392	1.62	1.2	0.1532
0.5	195.2	0.95	0.67	1.8131
0.8	130.9	0.82	0.5	2.1435
1	98.2	0.73	0.43	2.3087
3	88.6	0.67	0.39	0.0769
5	85.1	0.65	0.38	0.0124

Table C-15 Surrogate parameters for NOMs in coagulated water as a function of PACl dosage at the controlled pH of 6 for Mae-Hia water source

THMFP (mg/L)	PACl dosage (μ g/L)	TOC (mg/L)	DOC (mg/L)	UV-254 (1/cm)
329	0	1.49	1.16	0.1323
143.8	0.5	0.86	0.69	0.0513
114.3	0.8	0.67	0.45	0.0835
55.1	1	0.53	0.37	0.0675
79.4	3	0.41	0.31	0.1005
47.6	5	0.39	0.28	0.0123

Table C-16 Surrogate parameters for NOMs in coagulated water as a function of PACl dosage at the controlled pH of 7 for Mae-Hia water source

PACl dosage (mg/L)	THMFP ($\mu\text{g/L}$)	TOC (mg/L)	DOC (mg/L)	UV-254 (1/cm)
0	329	1.49	1.16	0.1323
0.5	116.5	0.63	0.51	1.9421
0.8	86.1	0.50	0.35	2.1284
1	44.8	0.39	0.26	1.6753
3	38.5	0.36	0.22	0.0128
5	16.9	0.25	0.24	0.0107

Table C-17 Surrogate parameters for NOMs in coagulated water as a function of PACl dosage at the controlled pH of 8 for Mae-Hia water source

PACl dosage (mg/L)	THMFP ($\mu\text{g/L}$)	TOC (mg/L)	DOC (mg/L)	UV-254 (1/cm)
0	329	1.49	1.16	0.1323
0.5	79.9	0.72	0.48	2.3168
0.8	67.5	0.53	0.31	2.1465
1	65.5	0.43	0.24	1.6954
3	37.2	0.35	0.26	0.0735
5	32.2	0.35	0.23	0.0141

Table C-18 Surrogate parameters for NOMs in coagulated water as a function of PACl dosage at the controlled pH of 9 for Mae-Hia water source

PACl dosage (mg/L)	THMFP ($\mu\text{g/L}$)	TOC (mg/L)	DOC (mg/L)	UV-254 (1/cm)
0	329	1.49	1.16	0.1323
0.5	98.2	1.01	0.77	2.0705
0.8	80.5	0.74	0.61	1.9882
1	81.7	0.63	0.46	1.6815
3	82.5	0.61	0.43	0.0126
5	81.3	0.56	0.37	0.0114

Table C-19 Surrogate parameters for NOMs in coagulated water as a function of PACl dosage at the controlled pH of 10 for Mae-Hia water source

PACl dosage (mg/L)	THMFP ($\mu\text{g/L}$)	TOC (mg/L)	DOC (mg/L)	UV-254 (1/cm)
0	329	1.49	1.16	0.1323
0.5	195.2	1.08	0.75	2.4831
0.8	130.9	0.87	0.68	2.2679
1	98.2	0.72	0.56	2.1009
3	88.6	0.69	0.50	0.0031
5	85.1	0.65	0.44	0.0907

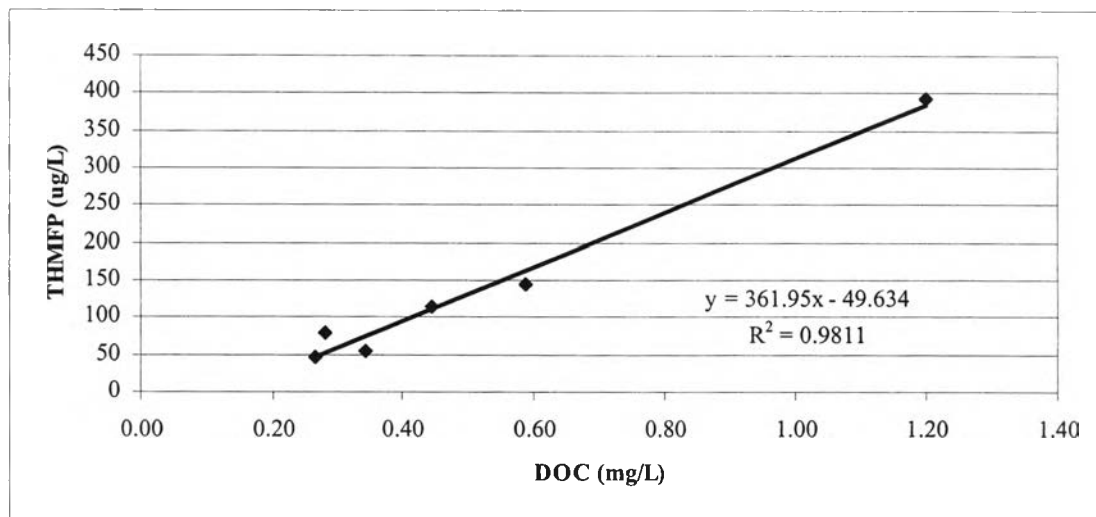


Figure C-1 Correlation between THMFP and DOC conducted of pH 6 at Aung-Kaew

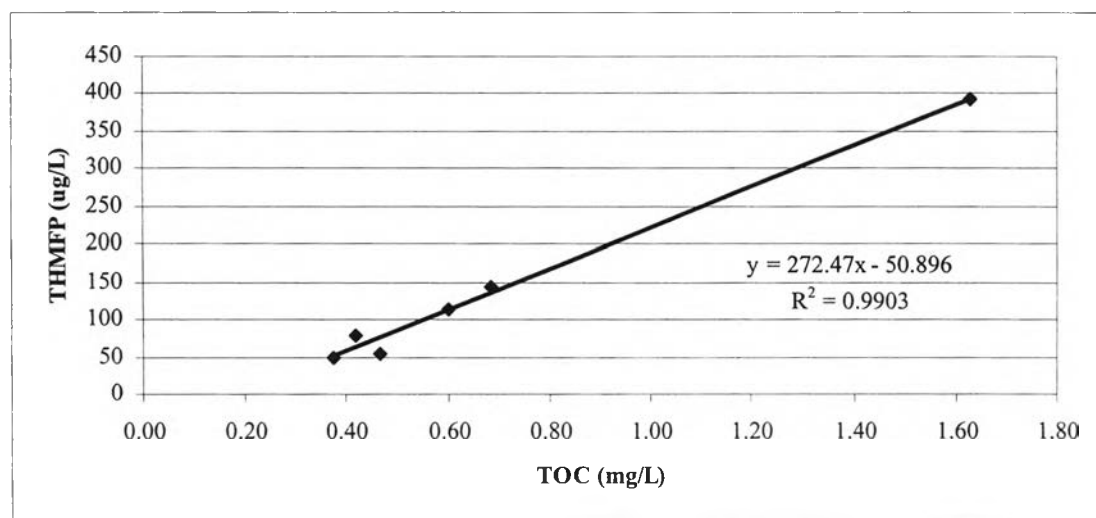


Figure C-2 Correlation between THMFP and TOC conducted of pH 6 at Aung-Kaew

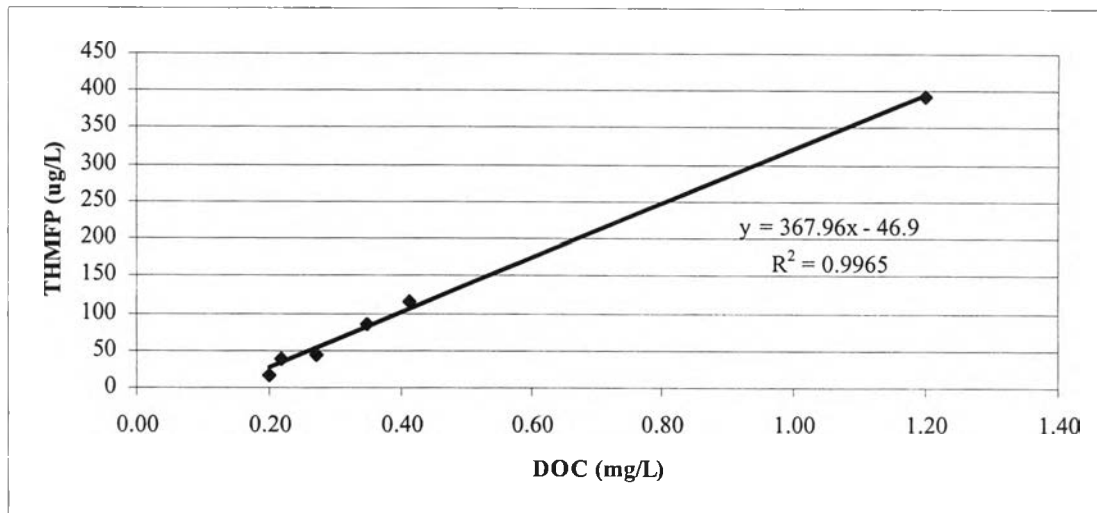


Figure C-3 Correlation between THMFP and DOC conducted of pH 7 at Aung-Kaew

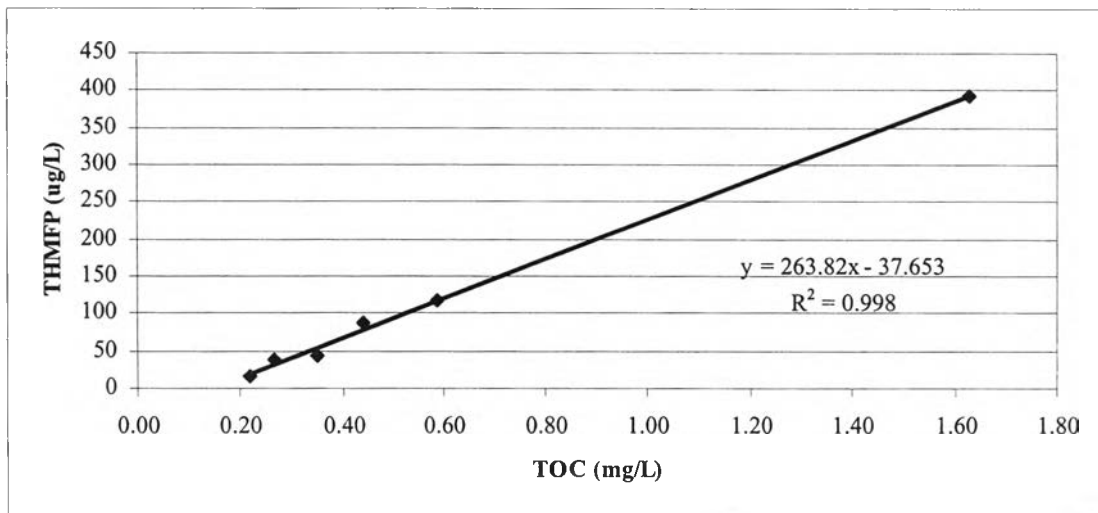


Figure C-4 Correlation between THMFP and TOC conducted of pH 7 at Aung-Kaew

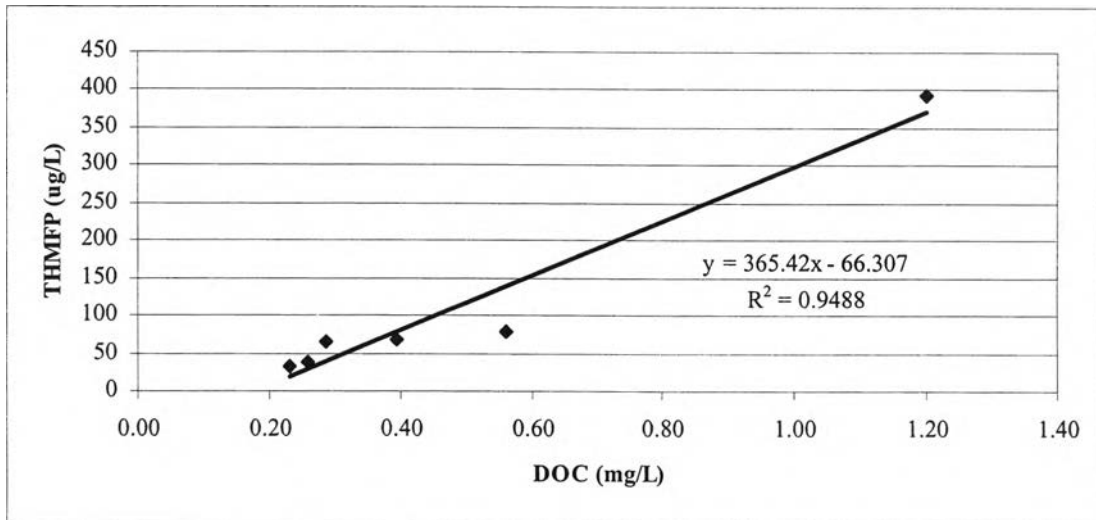


Figure C-5 Correlation between THMFP and DOC conducted of pH 8 at Aung-Kaew

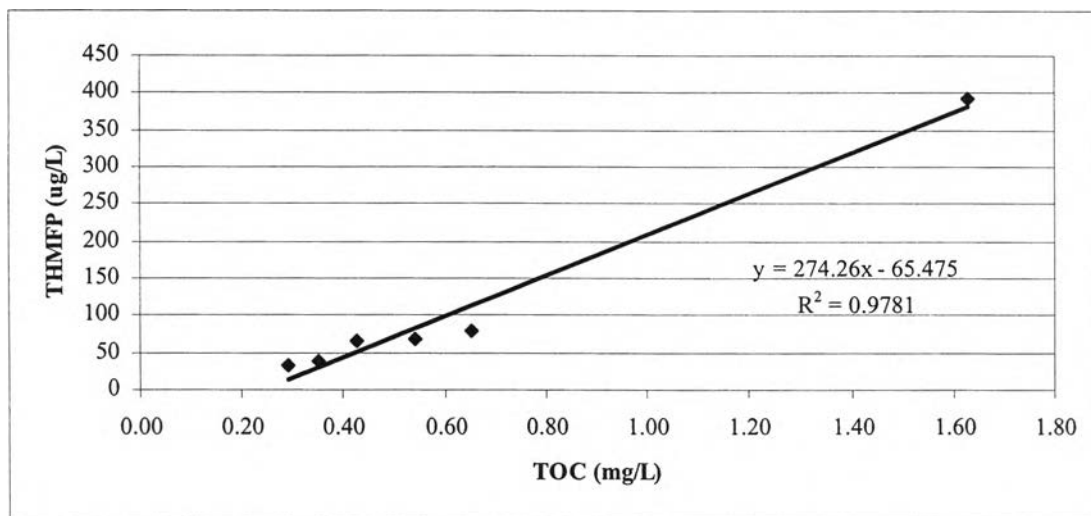


Figure C-6 Correlation between THMFP and TOC conducted of pH 8 at Aung-Kaew

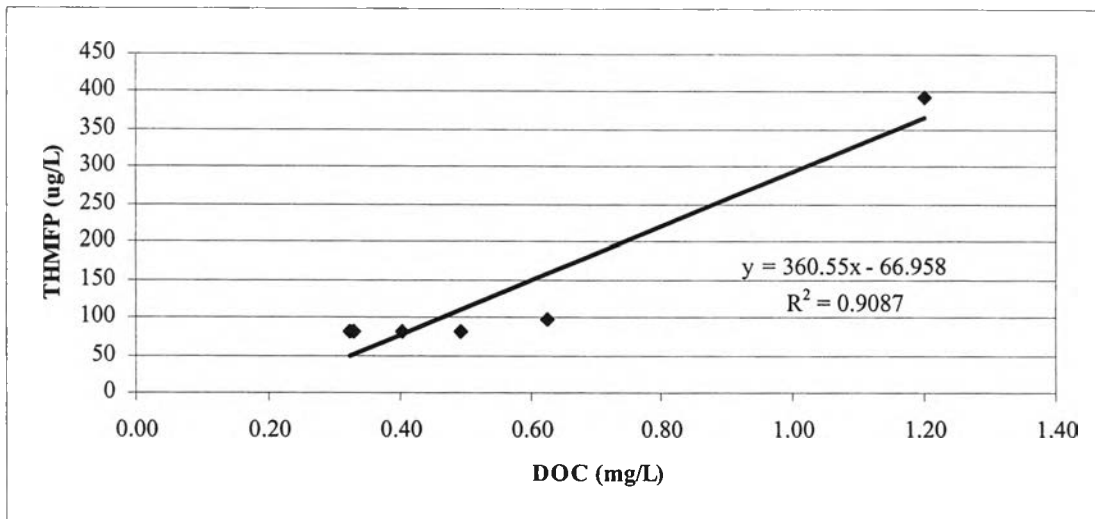


Figure C-7 Correlation between THMFP and DOC conducted of pH 9 at Aung-Kaew

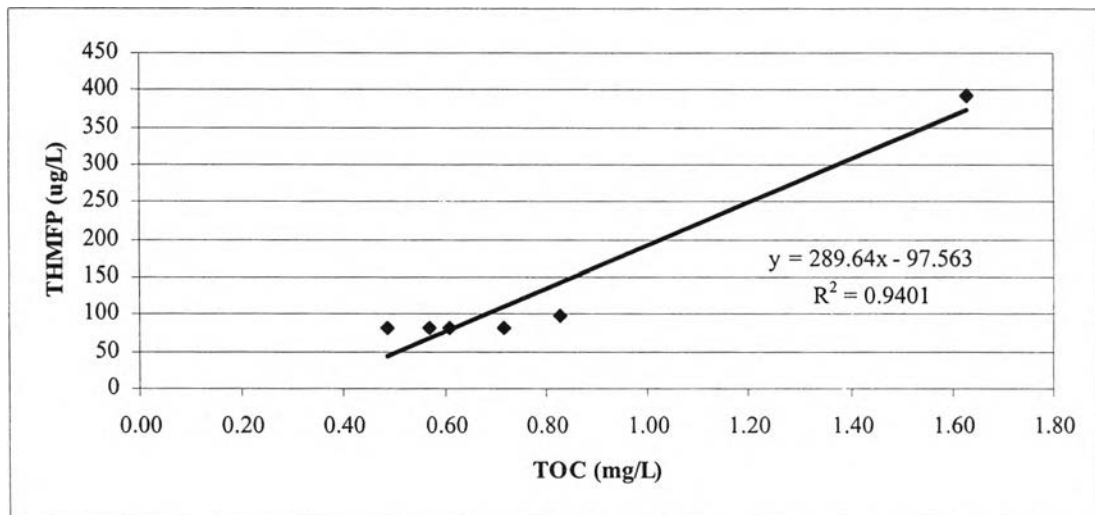


Figure C-8 Correlation between THMFP and TOC conducted of pH 9 at Aung-Kaew

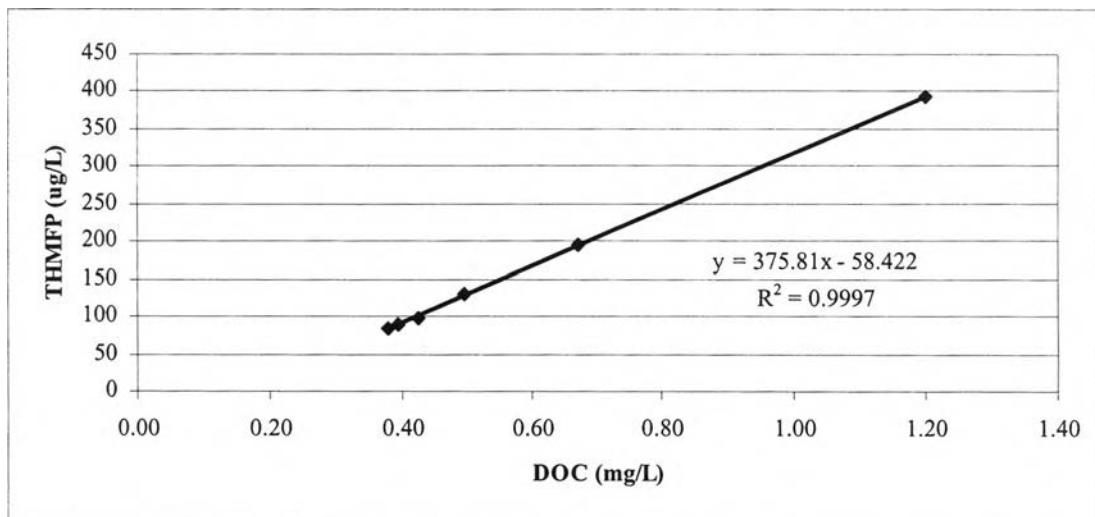


Figure C-9 Correlation between THMFP and DOC conducted of pH 10 at Aung-Kaew

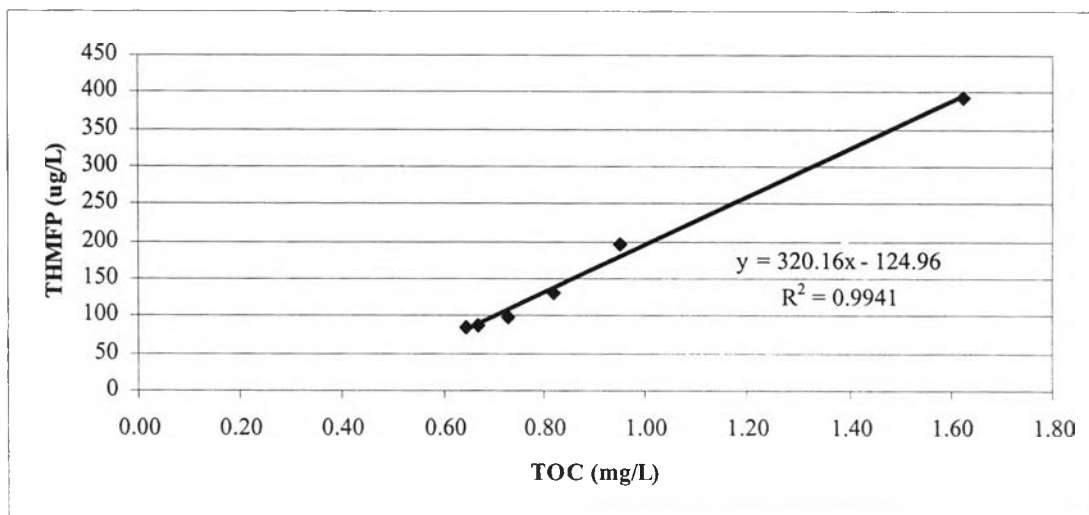


Figure C-10 Correlation between THMFP and TOC conducted of pH 10 at Aung-Kaew

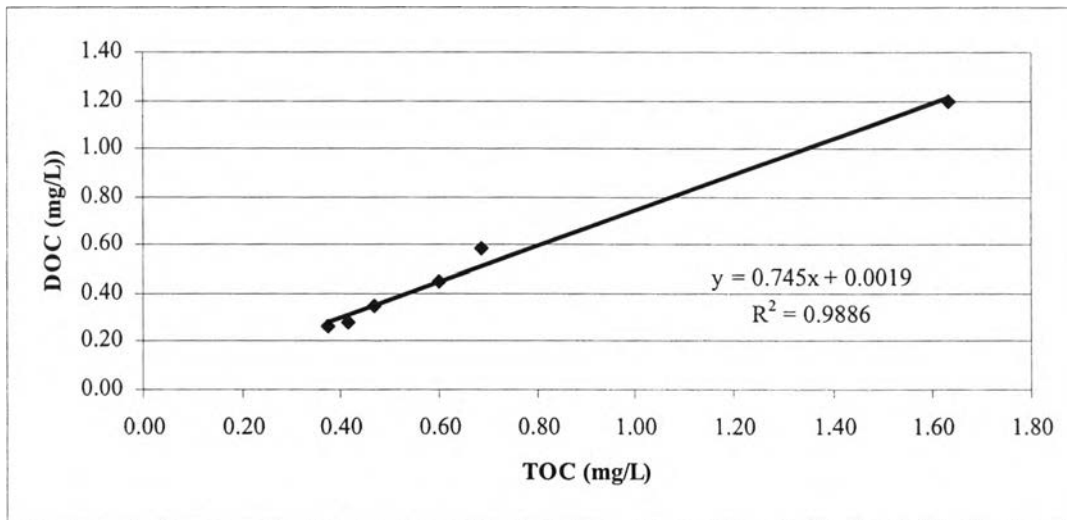


Figure C-11 Correlation between DOC and TOC conducted of pH 6 at Aung-Kaew

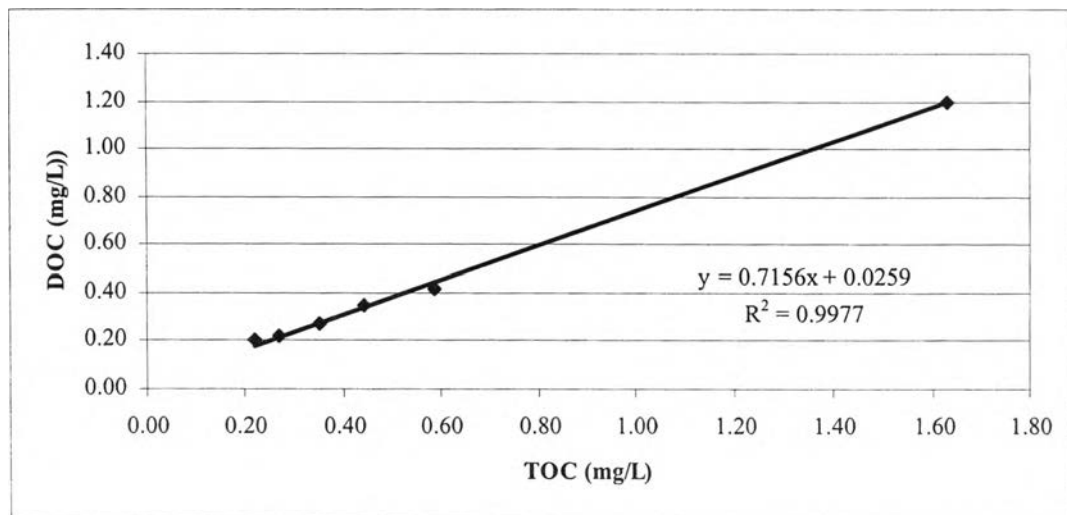


Figure C-12 Correlation between DOC and TOC conducted of pH 7 at Aung-Kaew

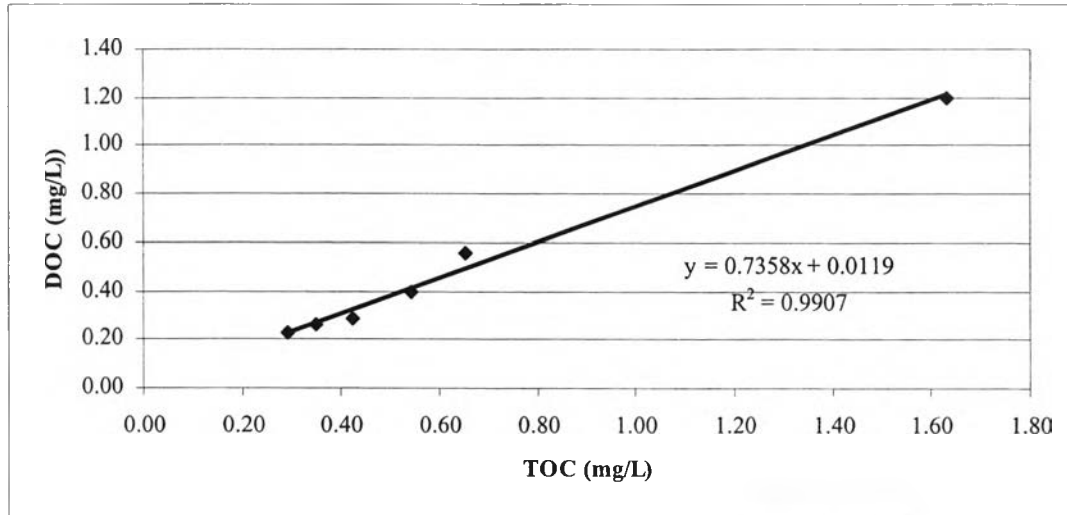


Figure C-13 Correlation between DOC and TOC conducted of pH 8 at Aung-Kaew

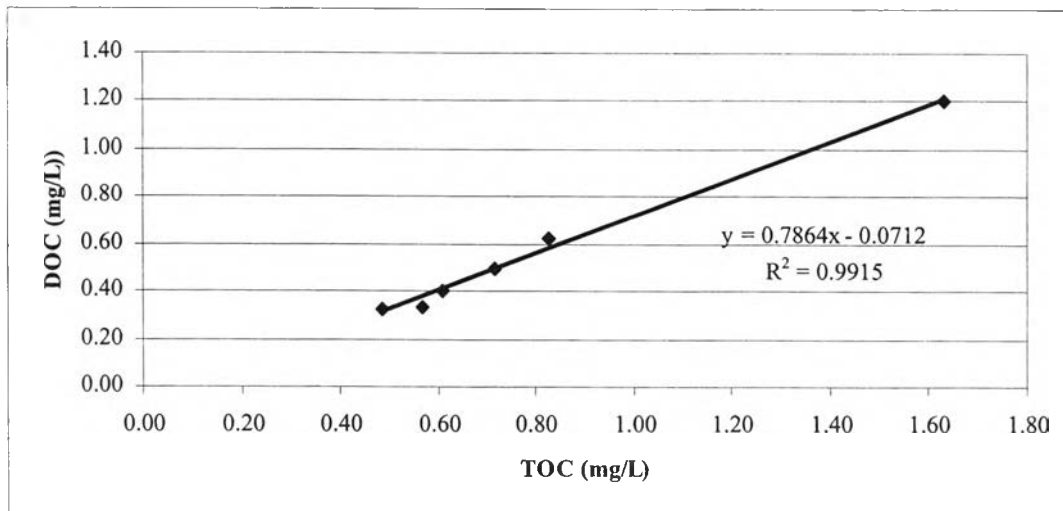


Figure C-14 Correlation between DOC and TOC conducted of pH 9 at Aung-Kaew

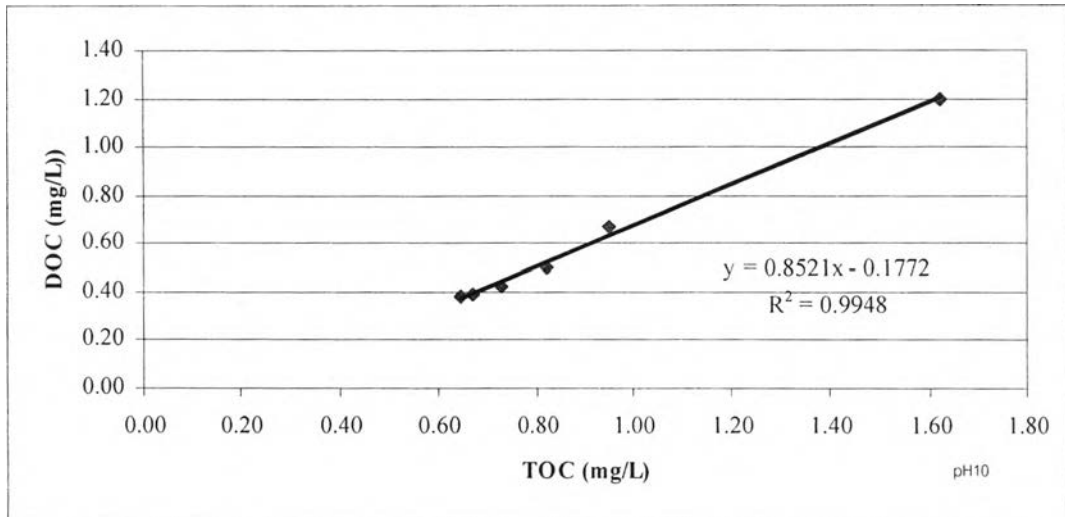


Figure C-15 Correlation between DOC and TOC conducted of pH 10 at Aung-Kaew

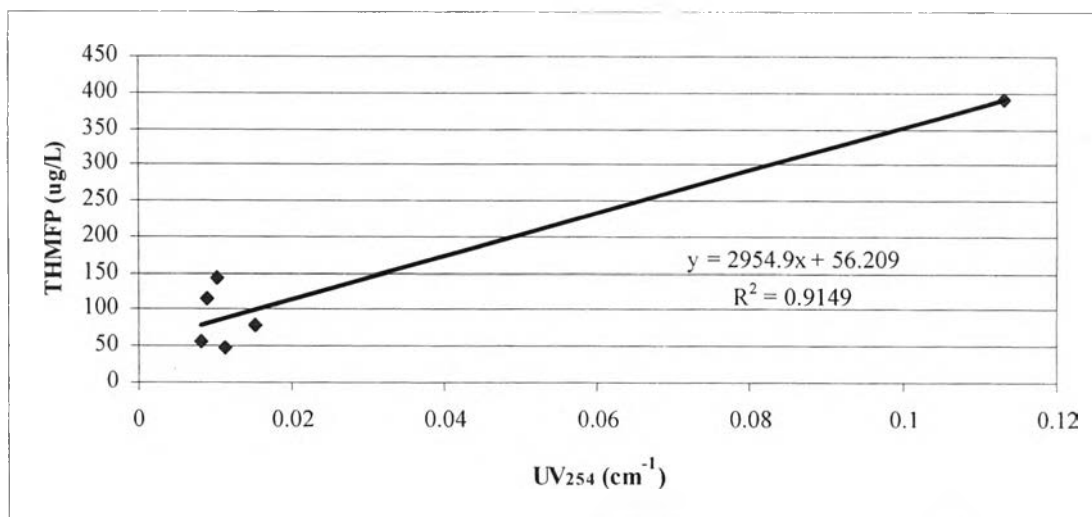


Figure C-16 Correlation between THMFP and UV-254 conducted of pH 6 at Aung-Kaew

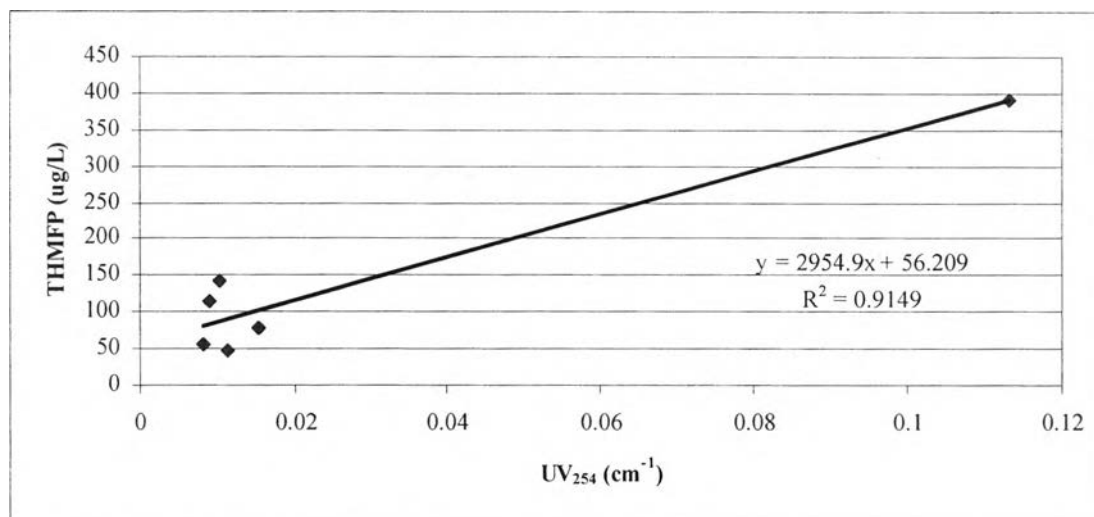


Figure C-17 Correlation between THMFP and UV-254 conducted of pH 7 at Aung-Kaew

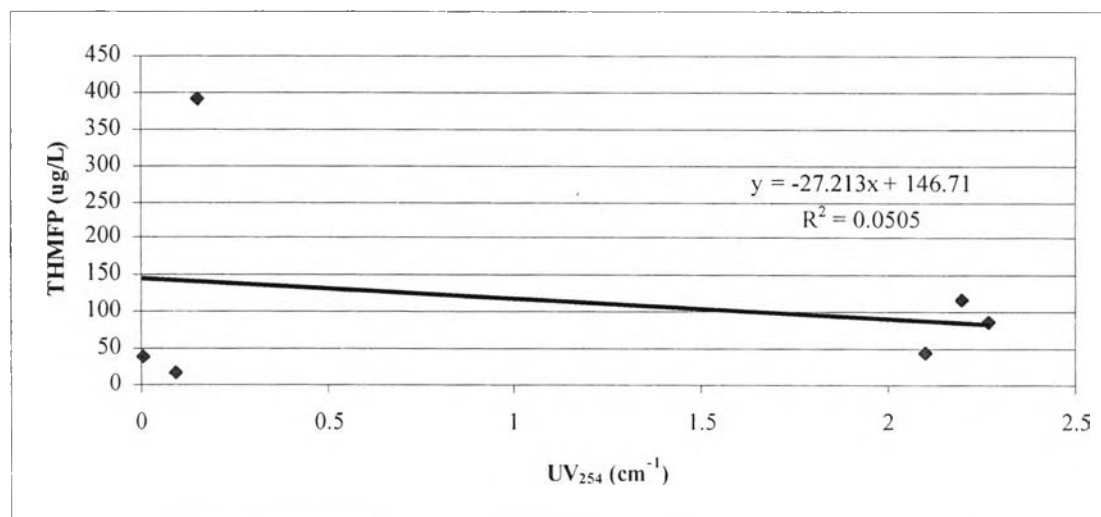


Figure C-18 Correlation between THMFP and UV-254 conducted of pH 8 at Aung-Kaew

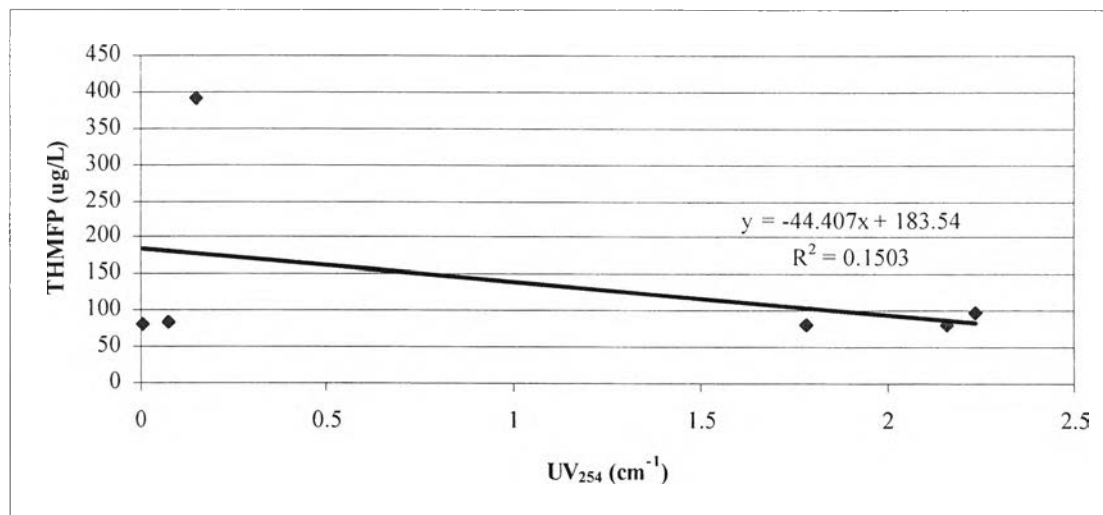


Figure C-19 Correlation between THMFP and UV-254 conducted of pH 9 at Aung-Kaew

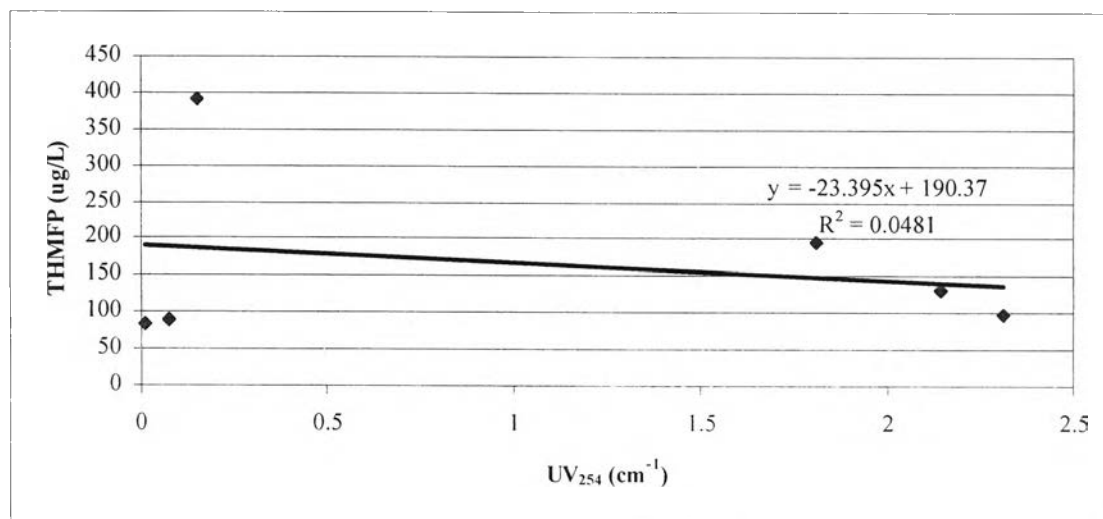


Figure C-20 Correlation between THMFP and UV-254 conducted of pH 10 at Aung-Kaew

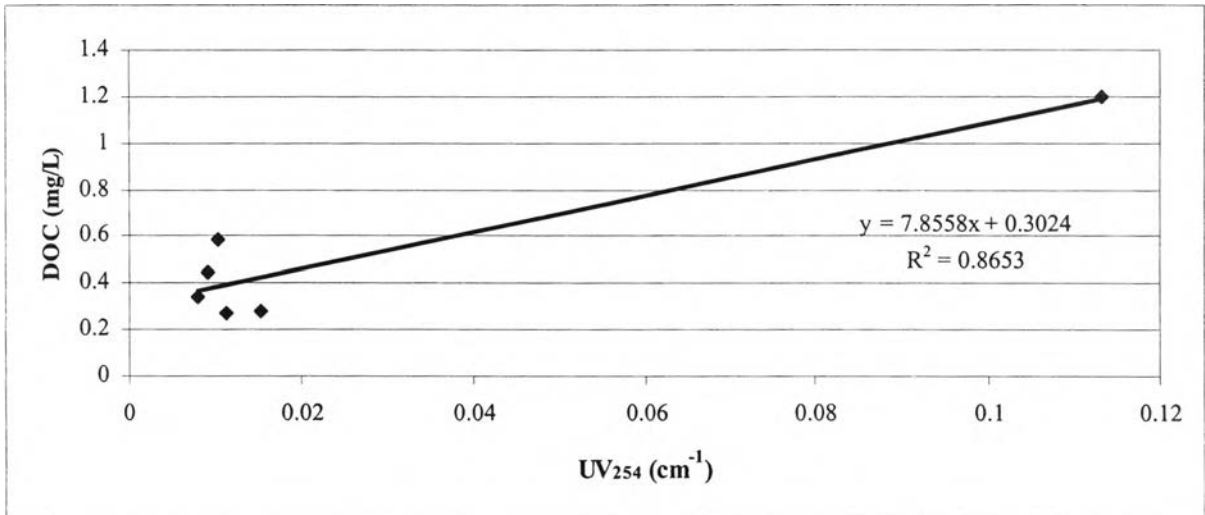


Figure C-21 Correlation between DOC and UV-254 conducted of pH 6 at Aung-Kaew

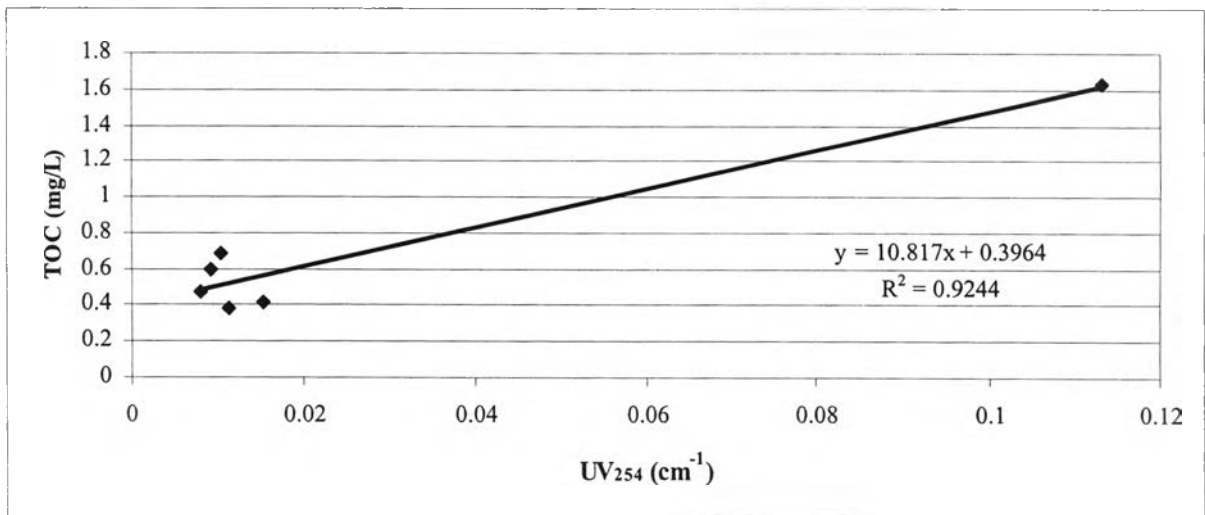


Figure C-22 Correlation between TOC and UV-254 conducted of pH 6 at Aung-Kaew

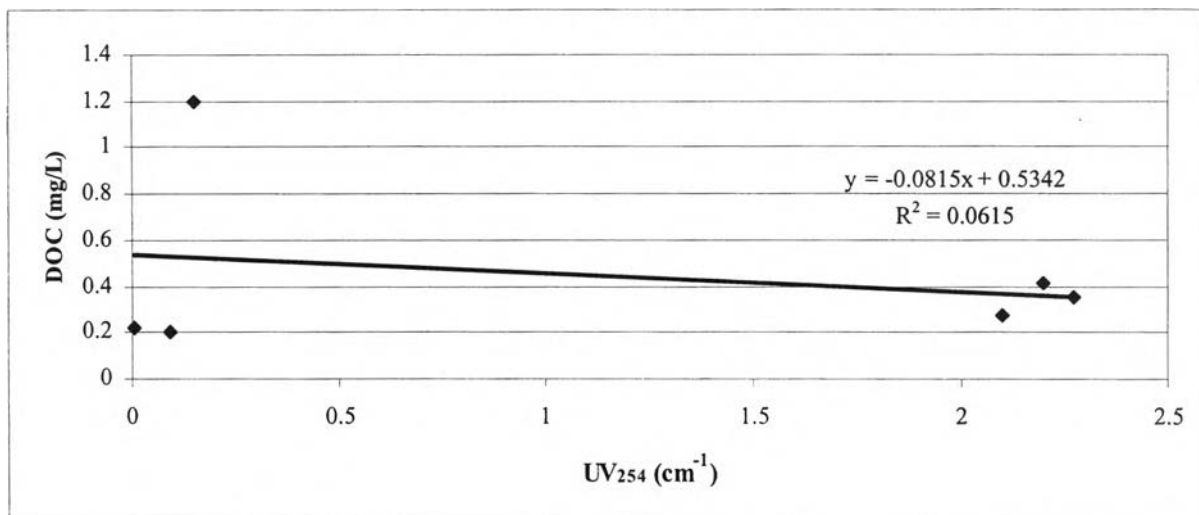


Figure C-23 Correlation between DOC and UV-254 conducted of pH 7 at Aung-Kaew

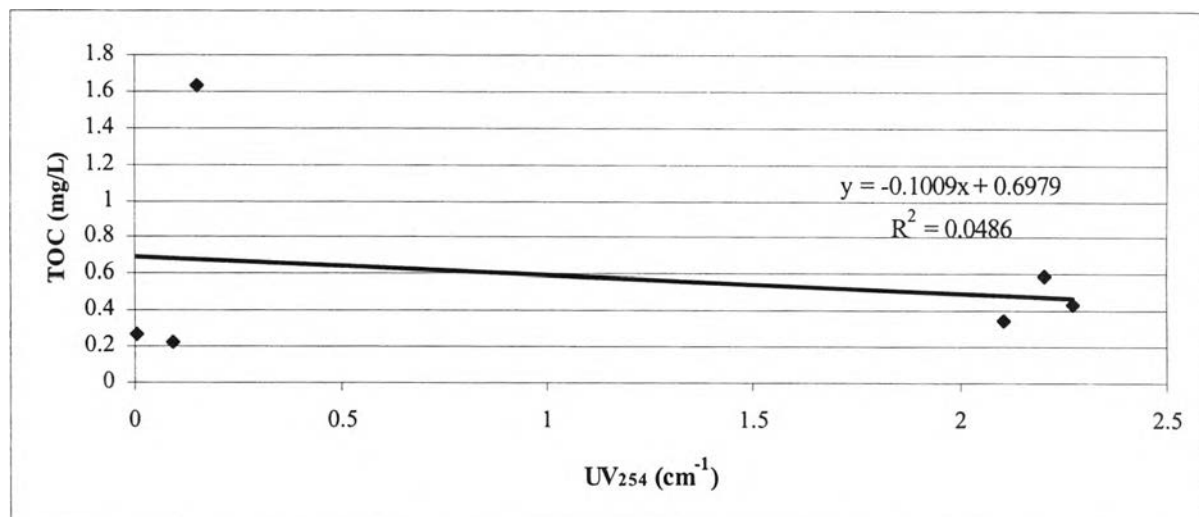


Figure C-24 Correlation between TOC and UV-254 conducted of pH 7 at Aung-Kaew

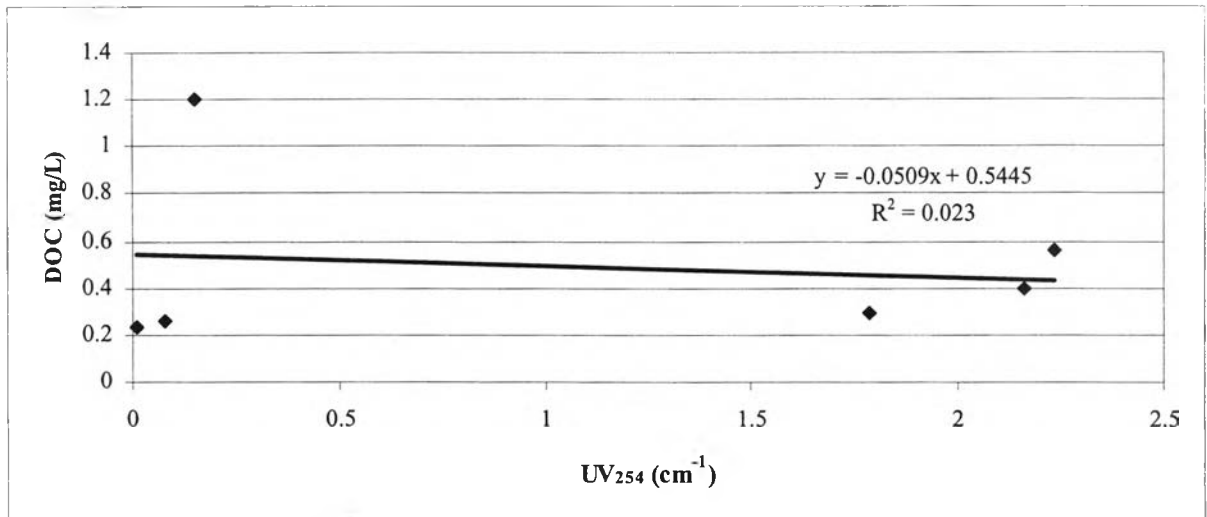


Figure C-25 Correlation between DOC and UV-254 conducted of pH 8 at Aung-Kaew

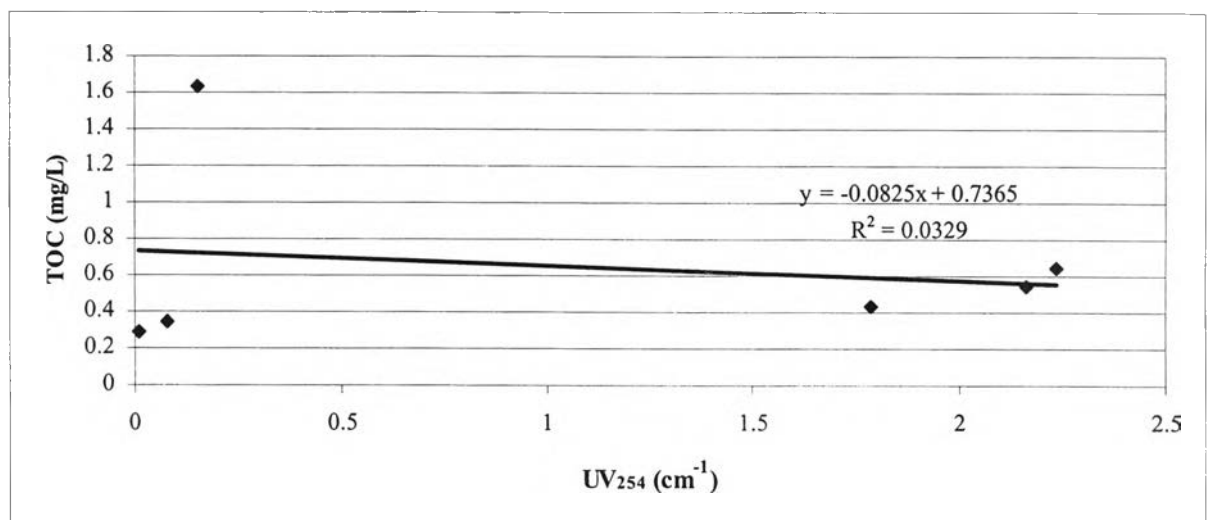


Figure C-26 Correlation between TOC and UV-254 conducted of pH 8 at Aung-Kaew

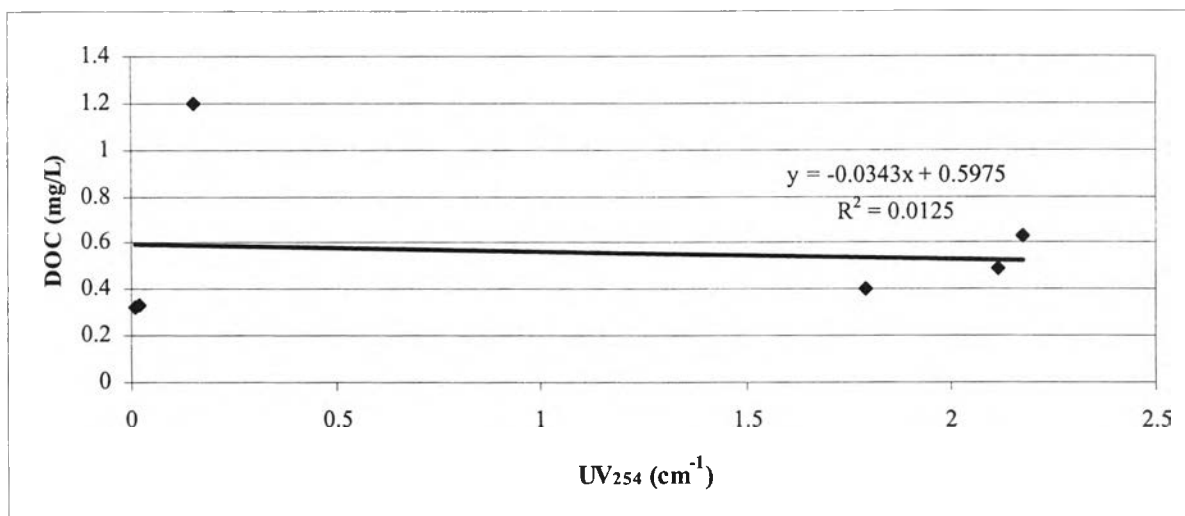


Figure C-27 Correlation between DOC and UV-254 conducted of pH 9 at Aung-Kaew

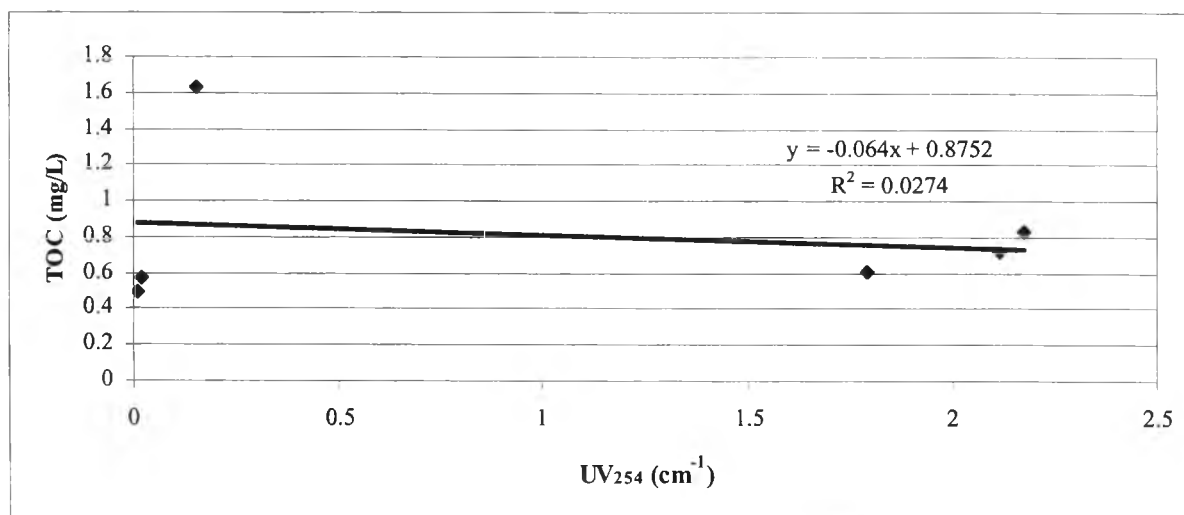


Figure C-28 Correlation between TOC and UV-254 conducted of pH 9 at Aung-Kaew

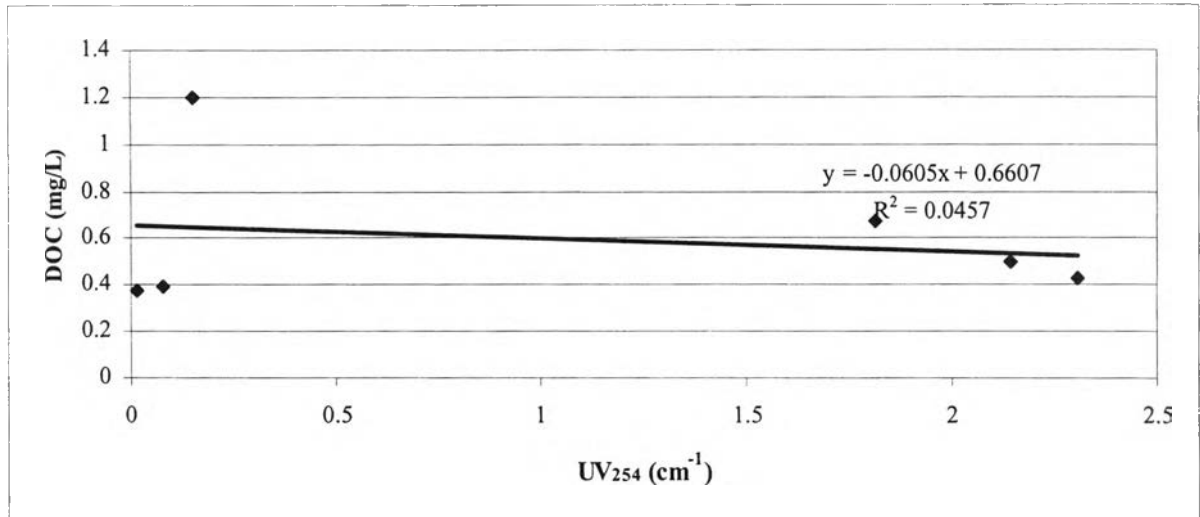


Figure C-29 Correlation between DOC and UV-254 conducted of pH 10 at Aung-Kaew

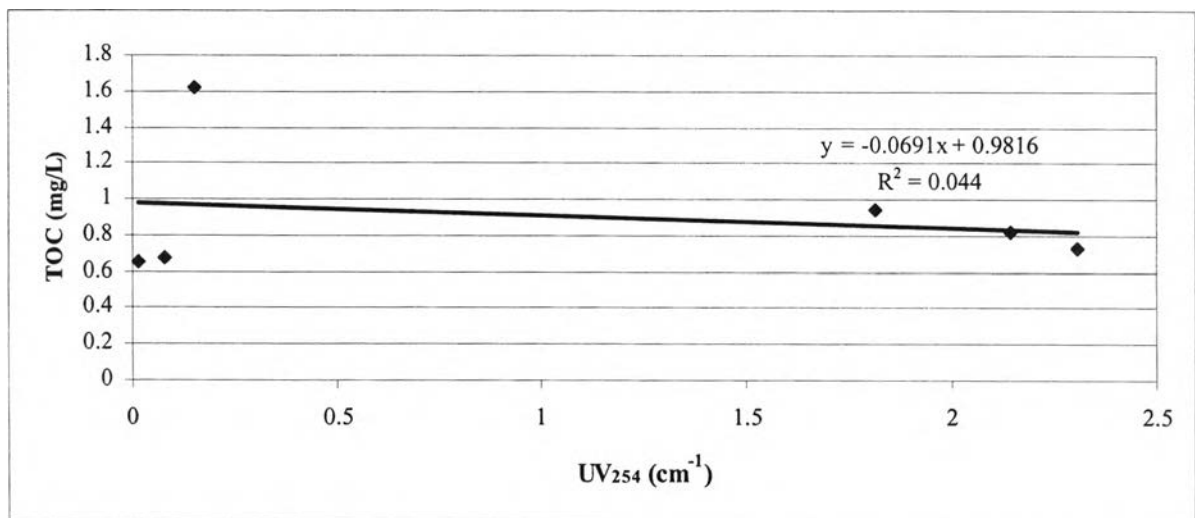


Figure C-30 Correlation between TOC and UV-254 conducted of pH 10 at Aung-Kaew

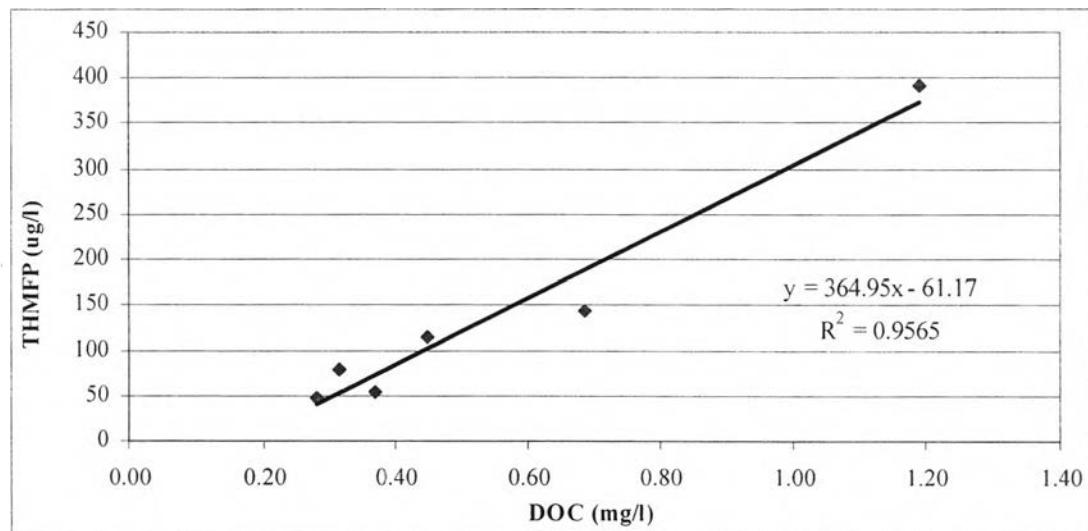


Figure C-31 Correlation between THMFP and DOC conducted of pH 6 at Mae-Hia

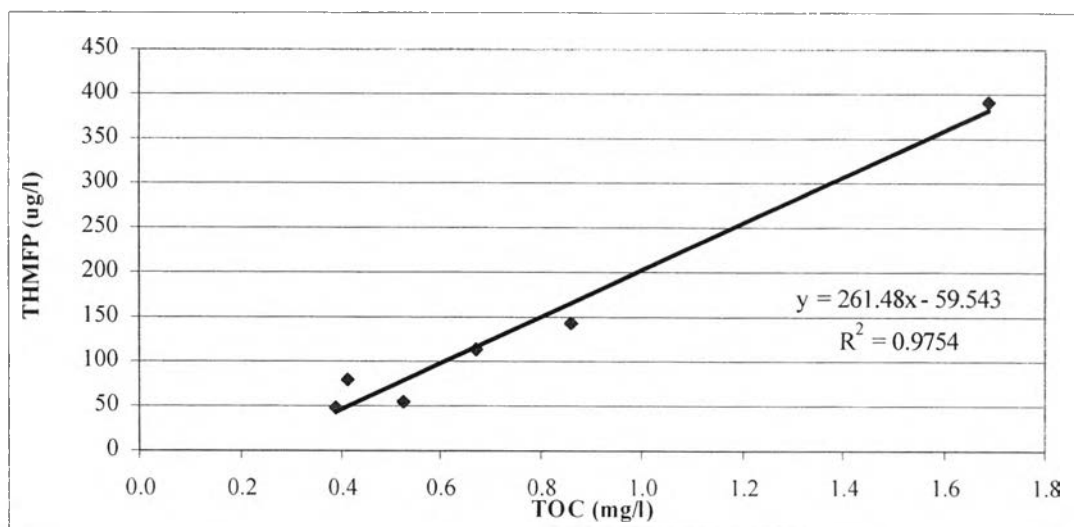


Figure C-32 Correlation between THMFP and TOC conducted of pH 6 at Mae-Hia

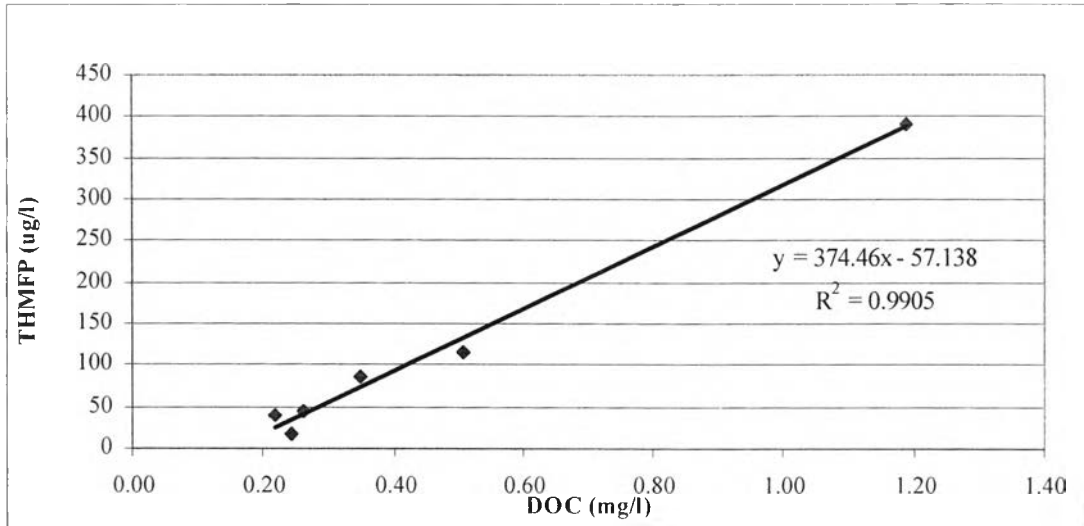


Figure C-33 Correlation between THMFP and DOC conducted of pH 7 at Mae-Hia

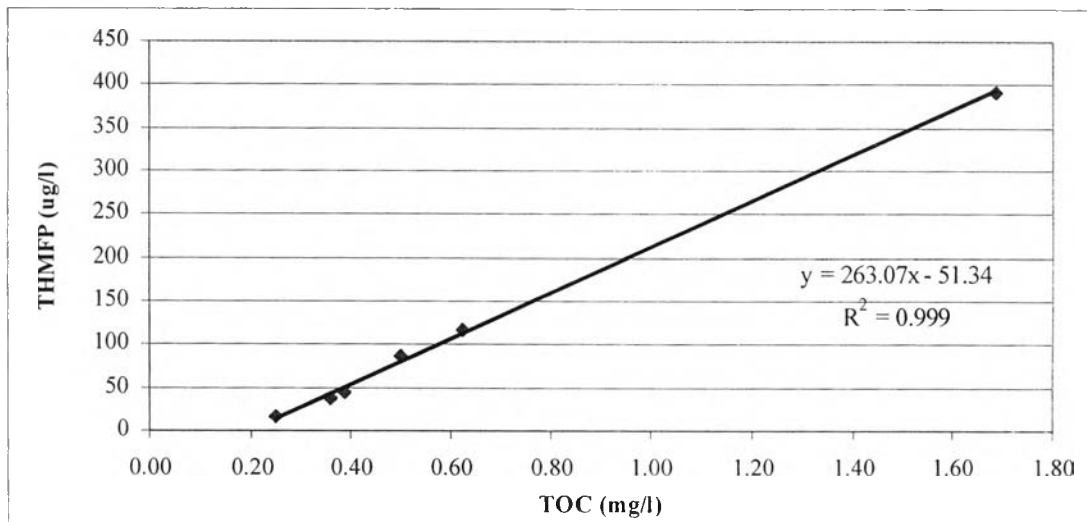


Figure C-34 Correlation between THMFP and TOC conducted of pH 7 at Mae-Hia

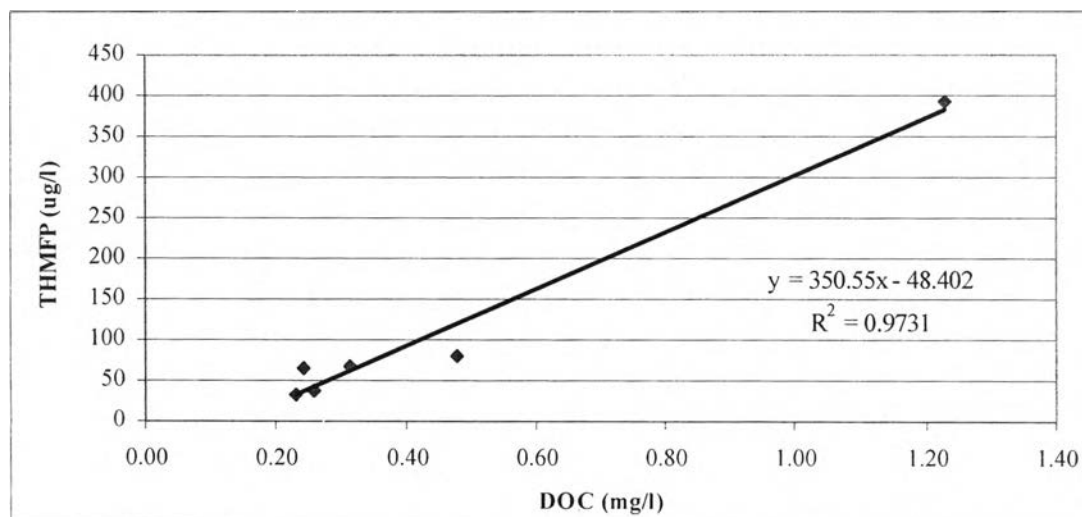


Figure C-35 Correlation between THMFP and DOC conducted of pH 8 at Mae-Hia

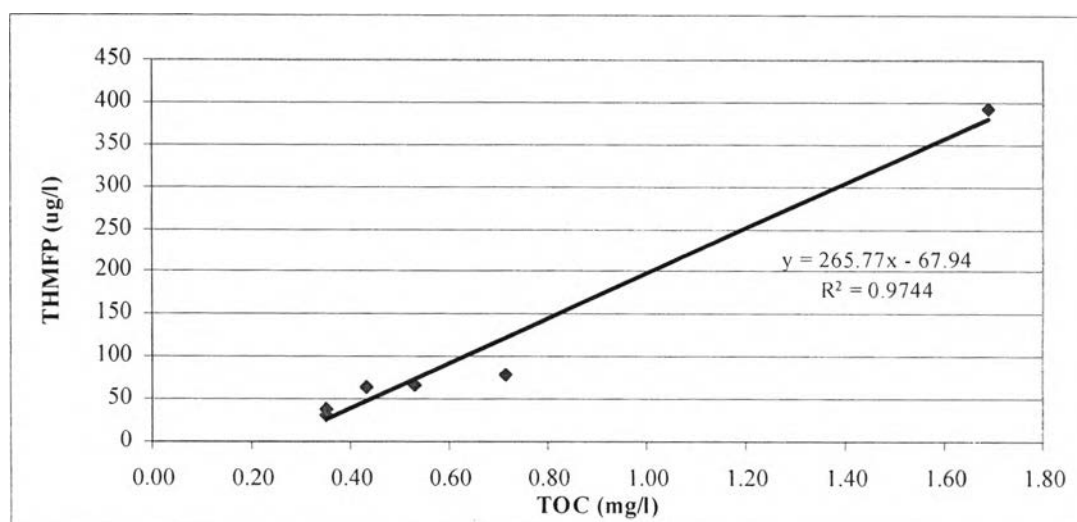


Figure C-36 Correlation between THMFP and TOC conducted of pH 8 at Mae-Hia

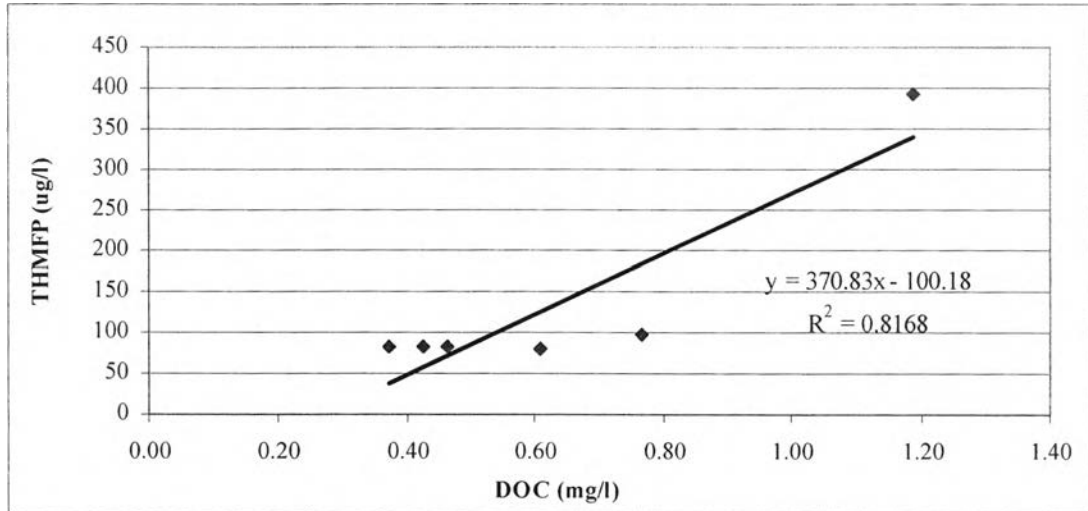


Figure C-37 Correlation between THMFP and DOC conducted of pH 9 at Mae-Hia

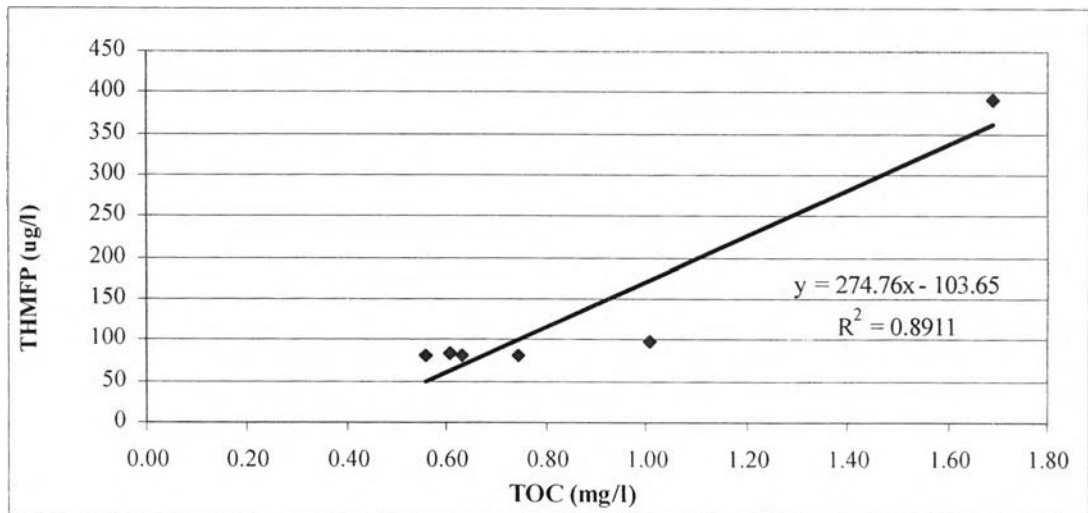


Figure C-38 Correlation between THMFP and TOC conducted of pH 9 at Mae-Hia

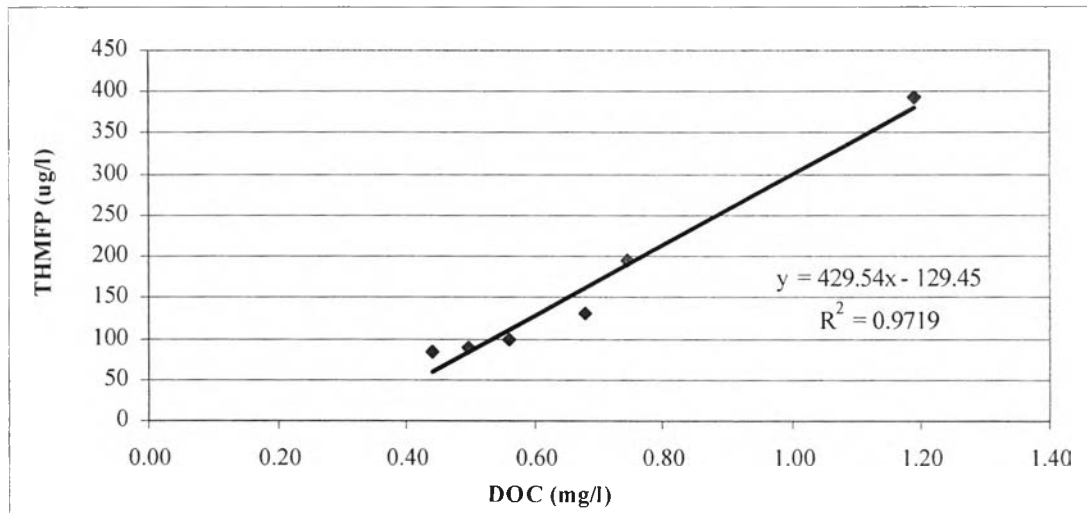


Figure C-39 Correlation between THMFP and DOC conducted of pH 10 at Mae-Hia

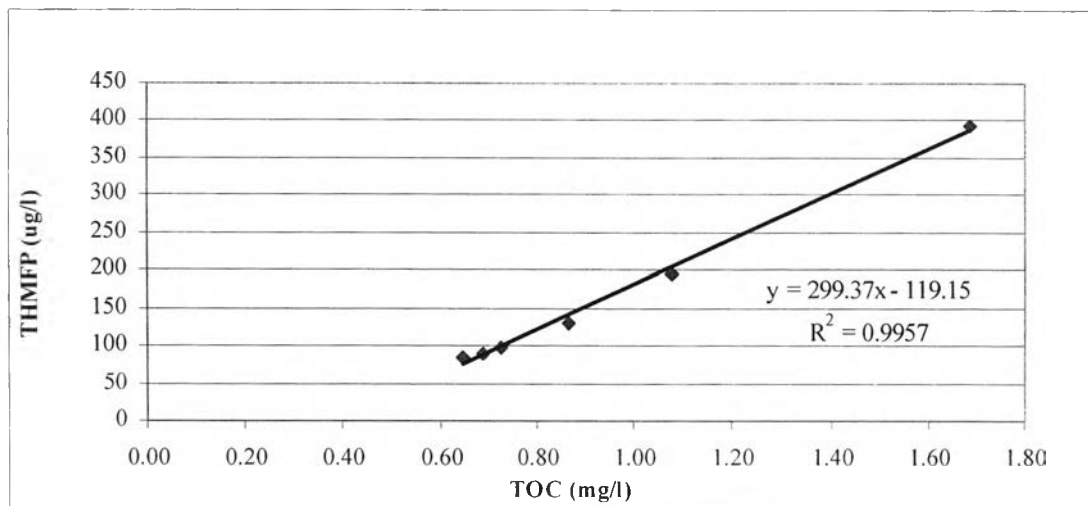


Figure C-40 Correlation between THMFP and TOC conducted of pH 10 at Mae-Hia

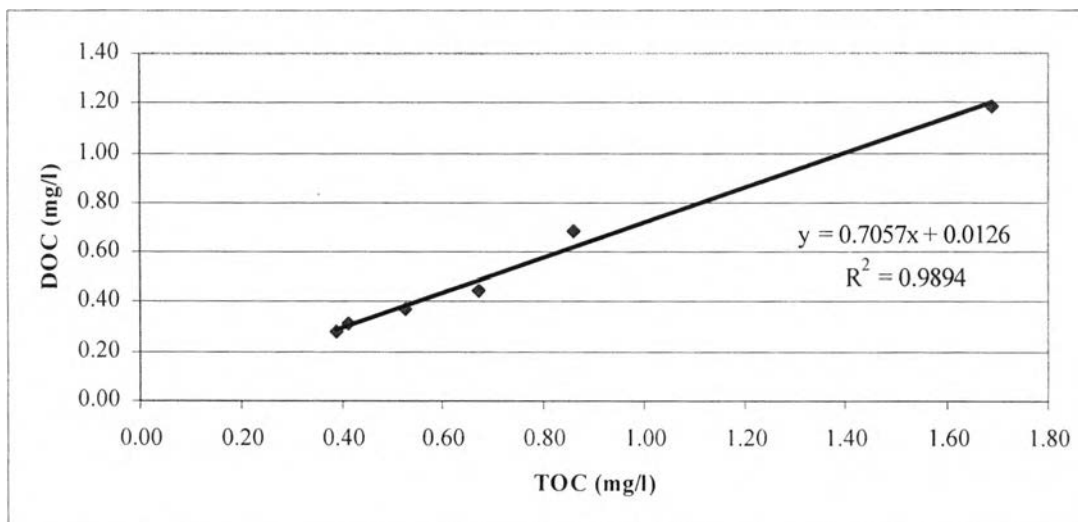


Figure C-41 Correlation between DOC and TOC conducted of pH 6 at Mae-Hia

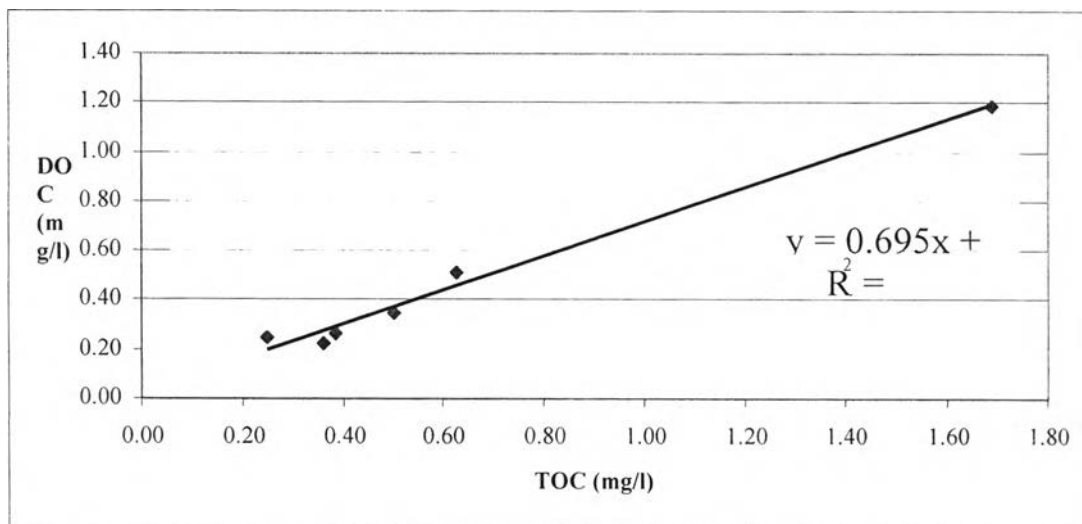


Figure C-42 Correlation between DOC and TOC conducted of pH 7 at Mae-Hia

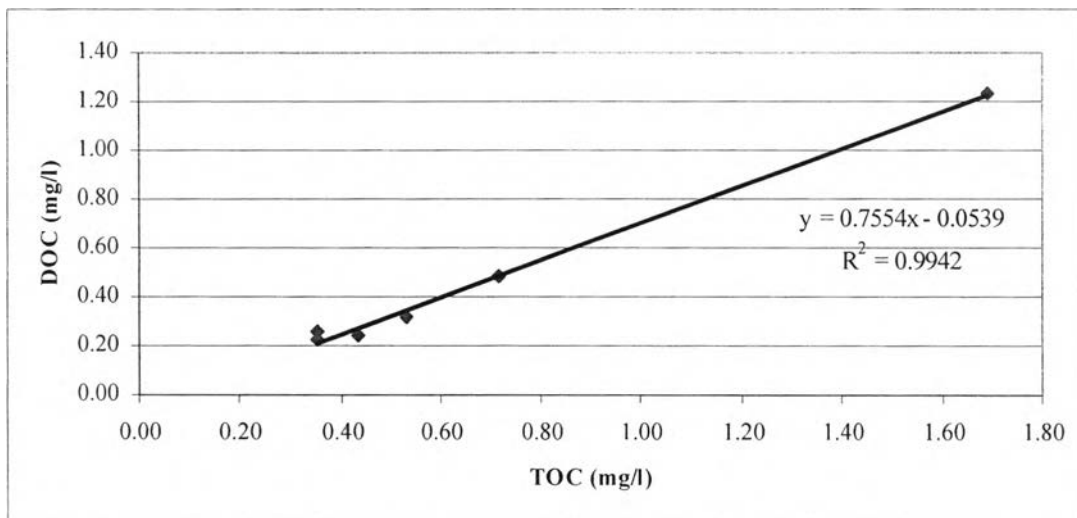


Figure C-43 Correlation between DOC and TOC conducted of pH 8 at Mae-Hia

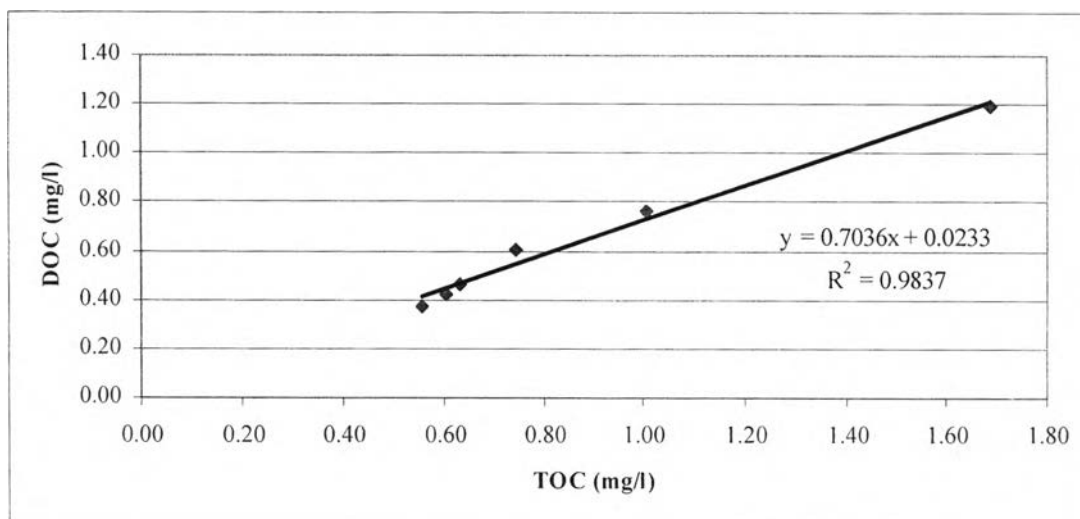


Figure C-44 Correlation between DOC and TOC conducted of pH 9 at Mae-Hia

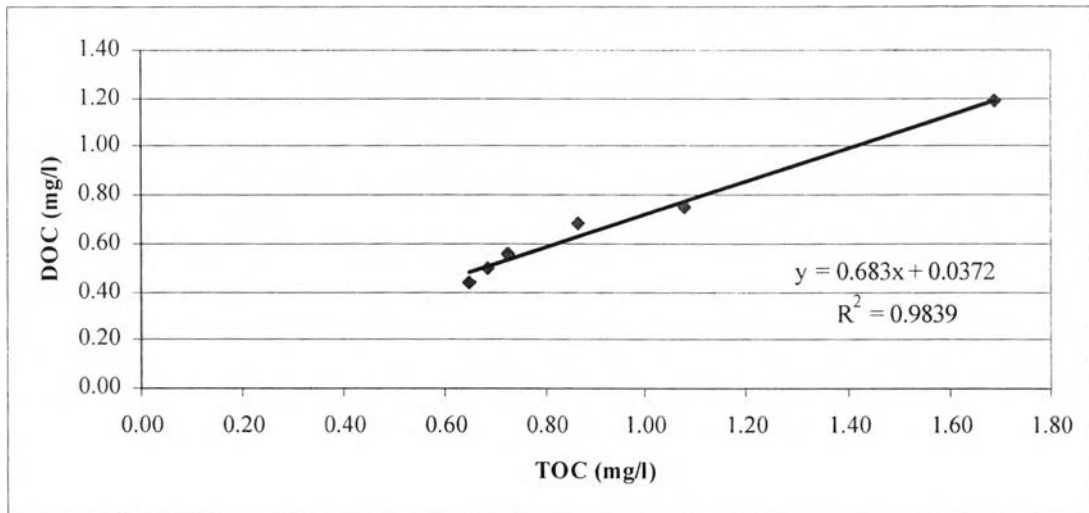


Figure C-45 Correlation between DOC and TOC conducted of pH 10 at Mae-Hia

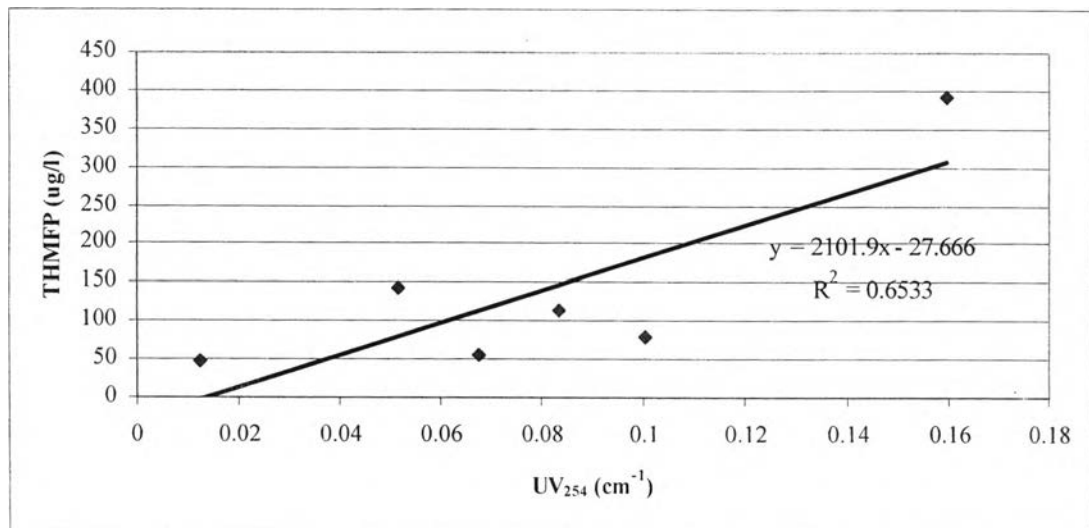


Figure C-46 Correlation between THMFP and UV-254 conducted of pH 6 at Mae-Hia

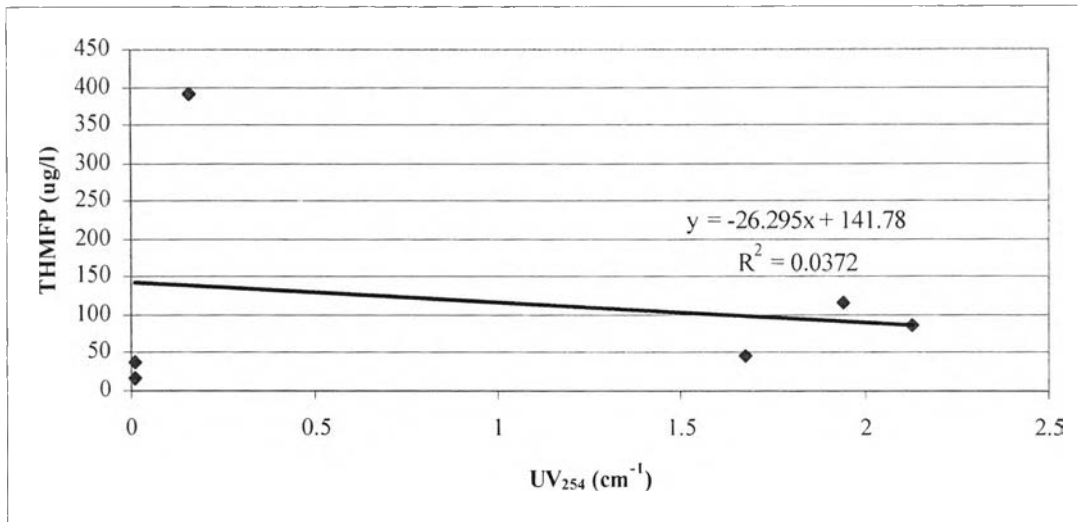


Figure C-47 Correlation between THMFP and UV-254 conducted of pH 7 at Mae-Hia

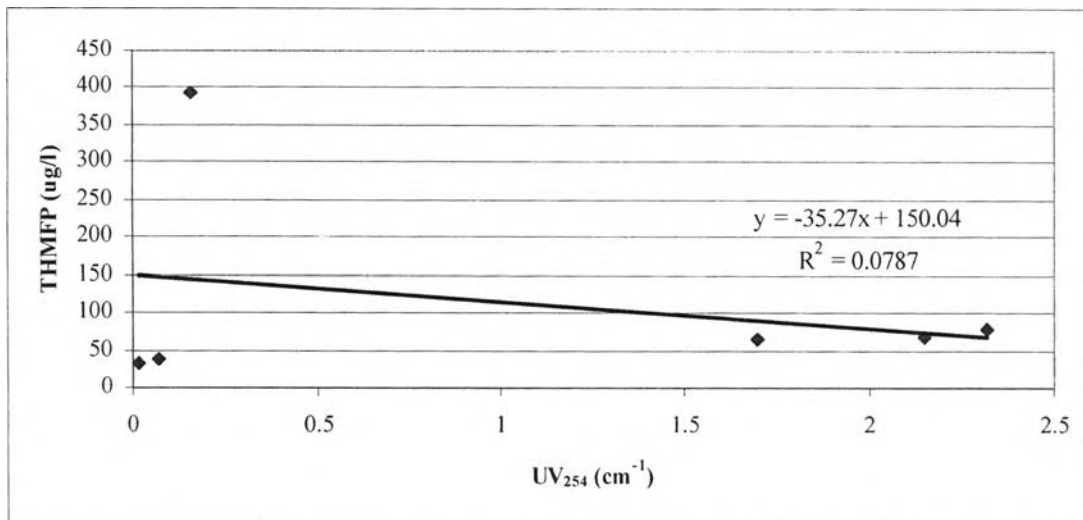


Figure C-48 Correlation between THMFP and UV-254 conducted of pH 8 at Mae-Hia

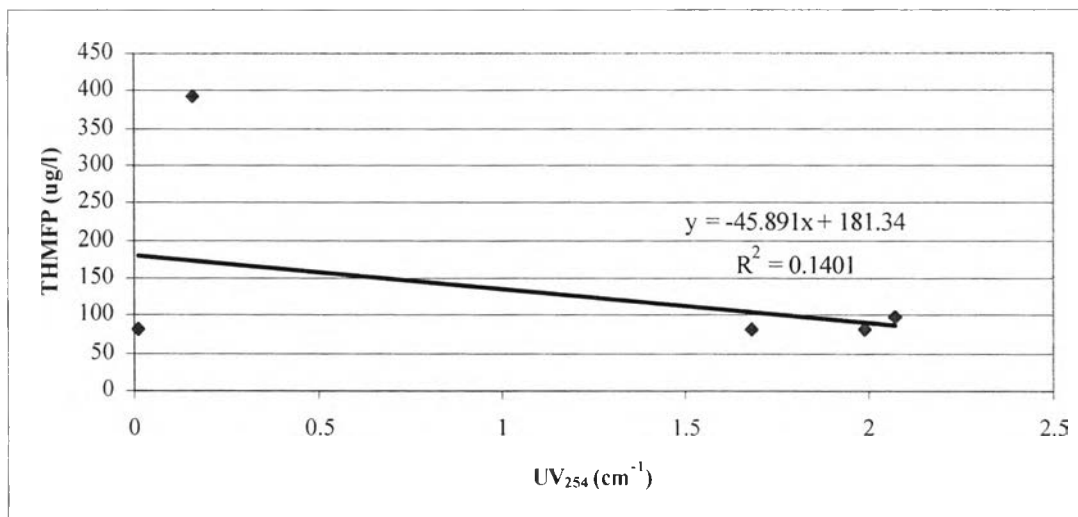


Figure C-49 Correlation between THMFP and UV-254 conducted of pH 9 at Mae-Hia

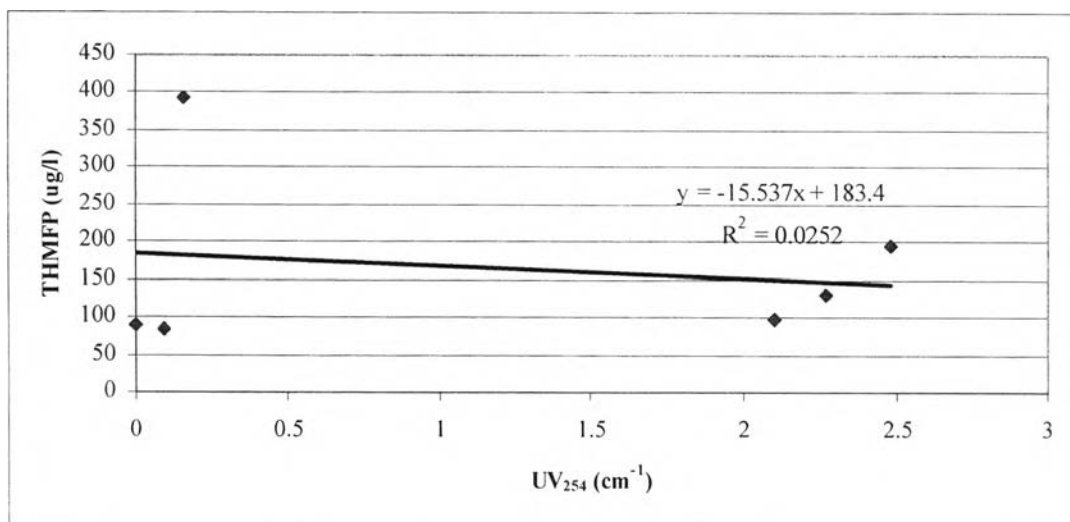


Figure C-50 Correlation between THMFP and UV-254 conducted of pH 10 at Mae-Hia

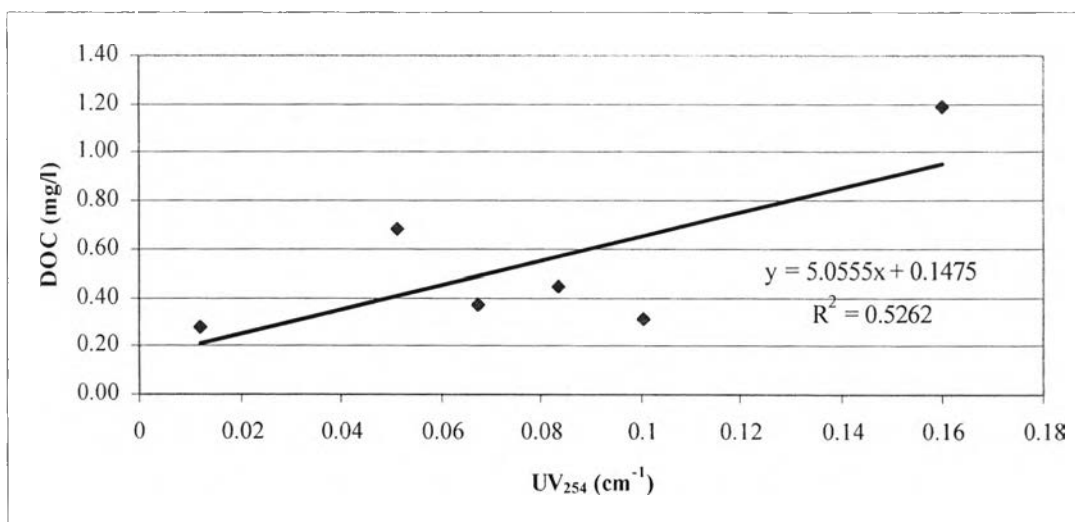


Figure C-51 Correlation between DOC and UV-254 conducted of pH 6 at Mae-Hia

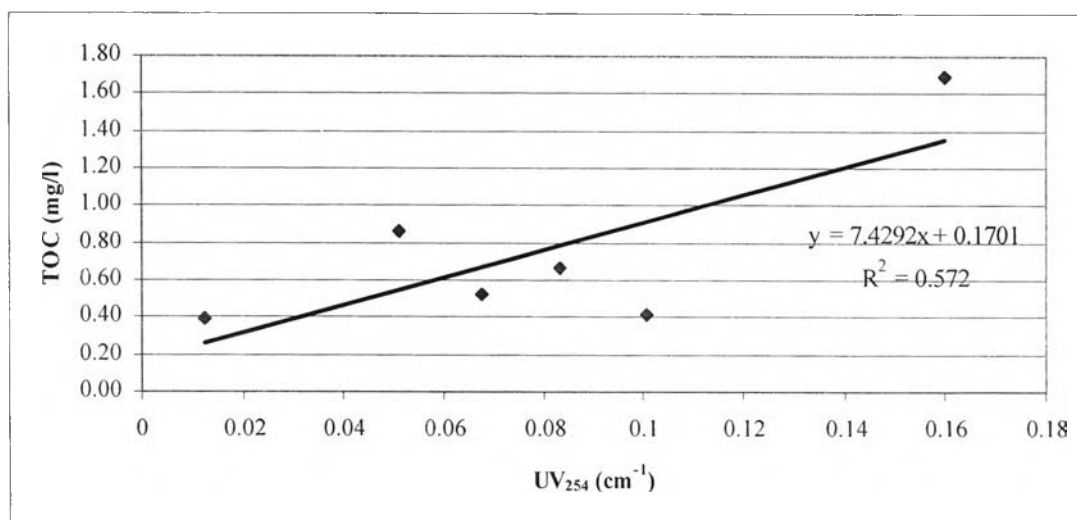


Figure C-52 Correlation between TOC and UV-254 conducted of pH 6 at Mae-Hia

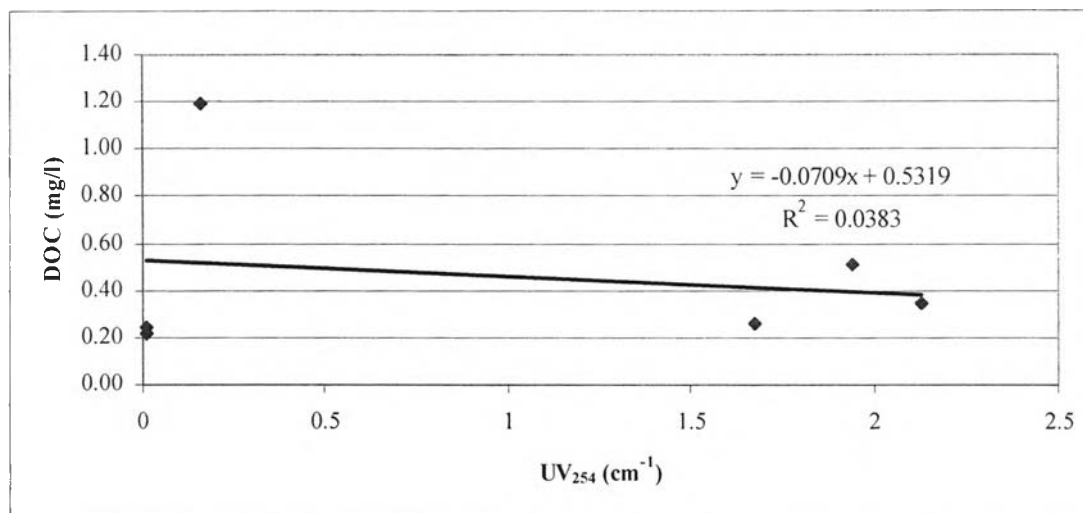


Figure C-53 Correlation between DOC and UV-254 conducted of pH 7 at Mae-Hia

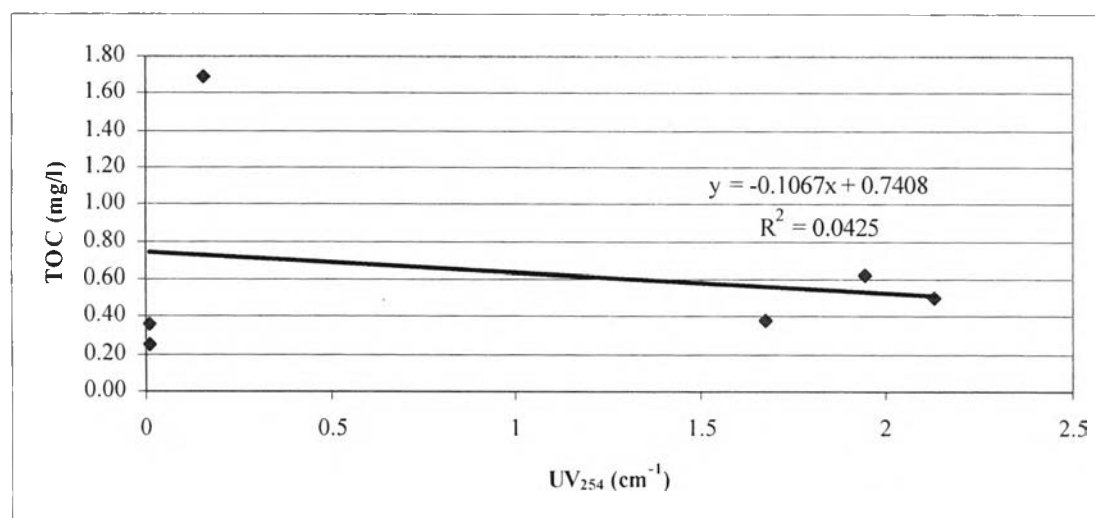


Figure C-54 Correlation between TOC and UV-254 conducted of pH 7 at Mae-Hia

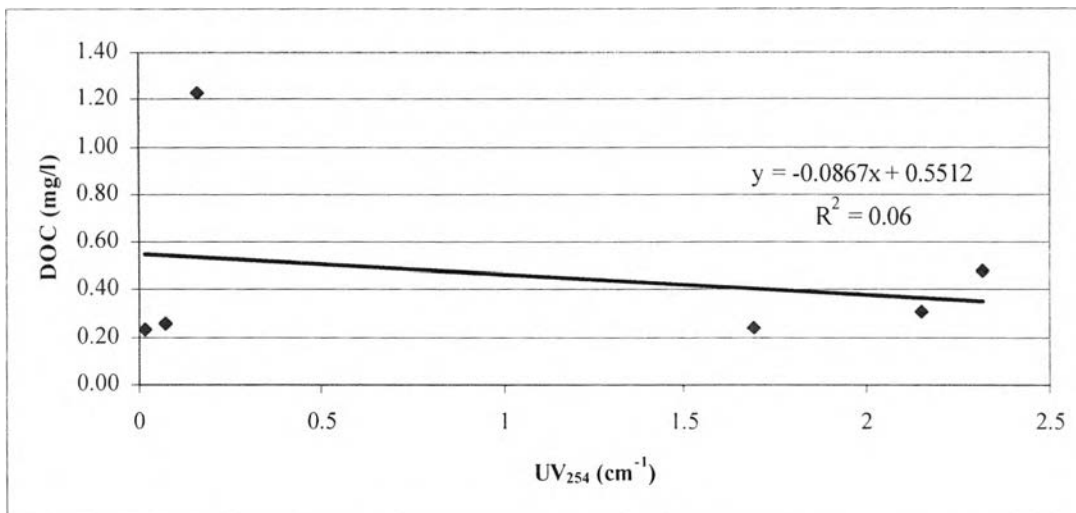


Figure C-55 Correlation between DOC and UV-254 conducted of pH 6 at Mae-Hia

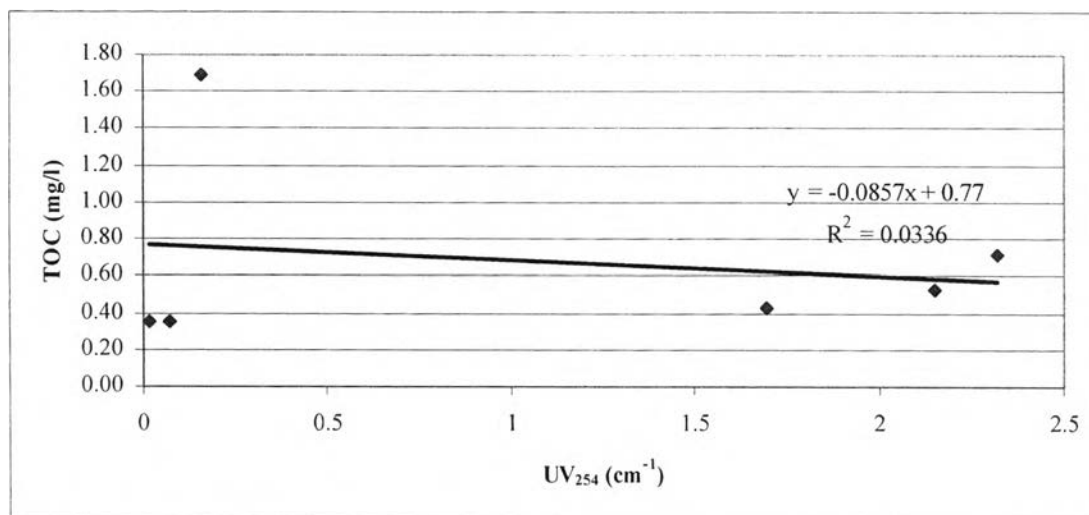


Figure C-56 Correlation between TOC and UV-254 conducted of pH 9 at Mae-Hia

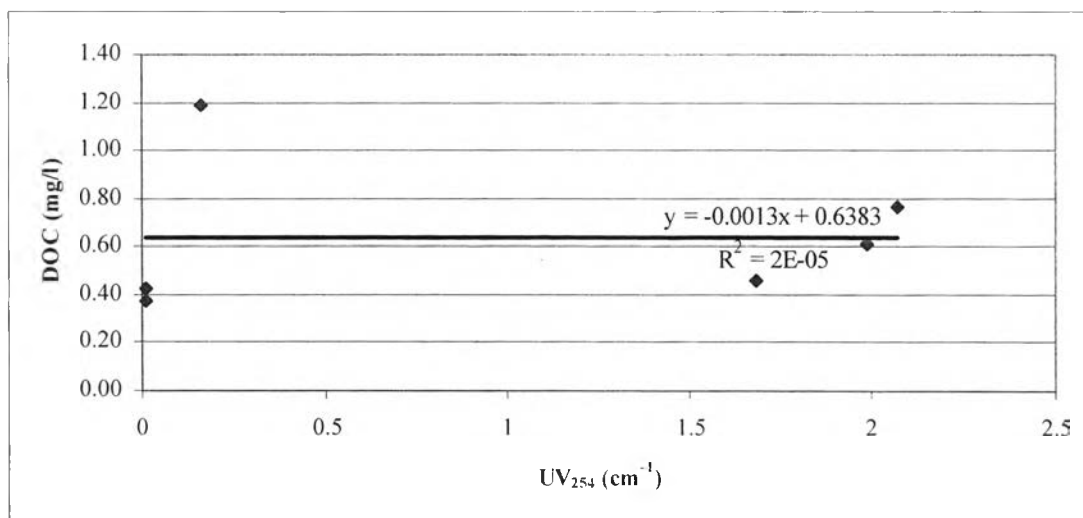


Figure C-57 Correlation between DOC and UV-254 conducted of pH 9 at Mae-Hia

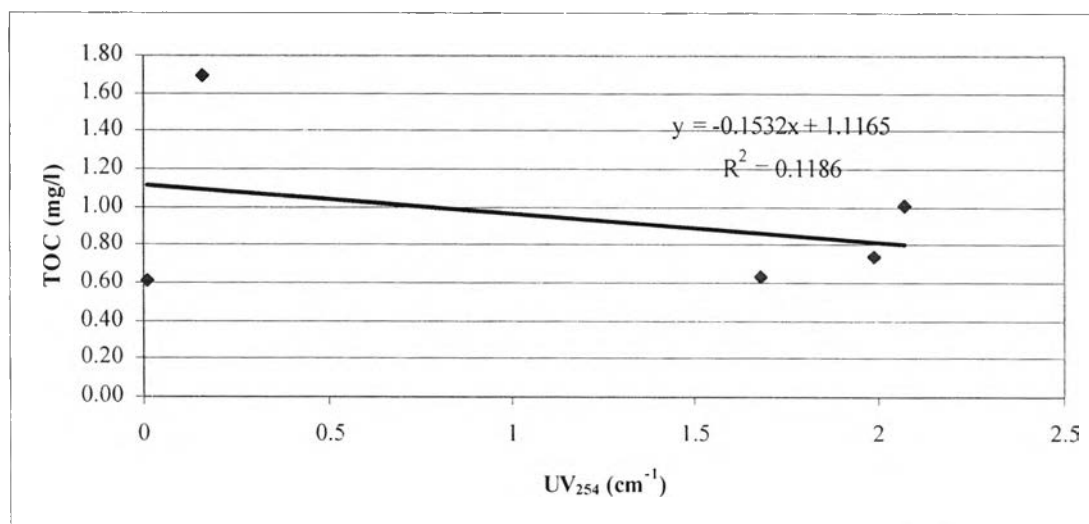


Figure C-58 Correlation between TOC and UV-254 conducted of pH 9 at Mae-Hia

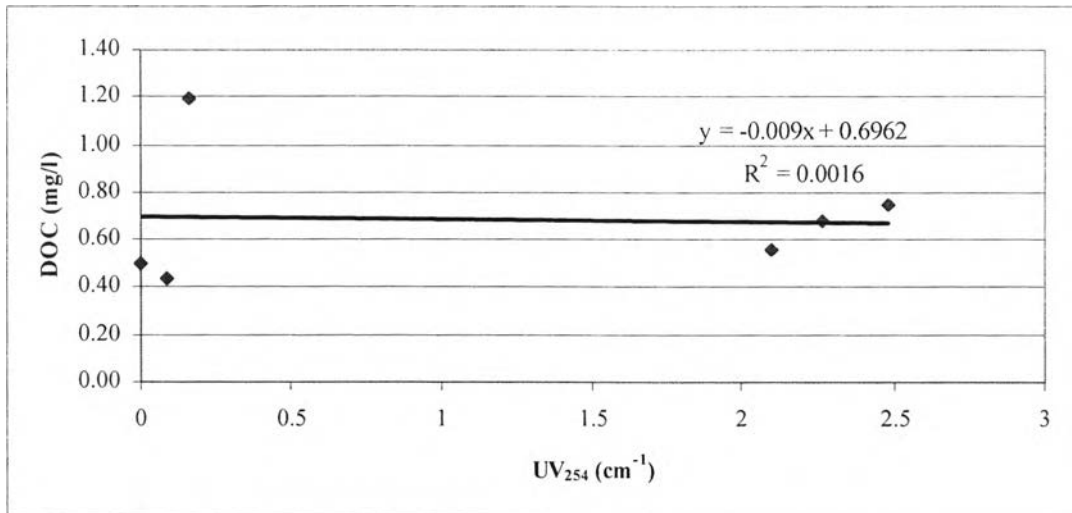


Figure C-59 Correlation between DOC and UV-254 conducted of pH 10 at Mae-Hia

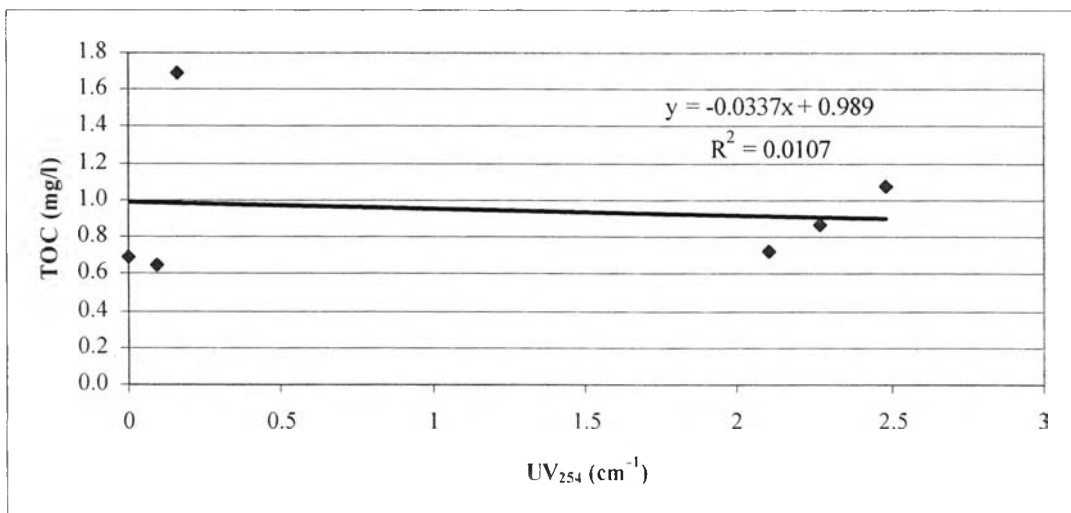


Figure C-60 Correlation between TOC and UV-254 conducted of pH 10 at Mae-Hia

BIOGRAPHY



Miss Orathai Permsuk was born on July 14, 1974 in Ubonratchathani Province, Thailand. She graduated from Benjamamaharaj School in Ubonratchathani Province. She received her Bachelor's Degree in General Science from Chulalongkorn University in 1996. She pursued her Master Degree study in the International Postgraduate Programs in Environmental Management, Inter-Department of Environmental Management, Chulalongkorn University, Bangkok, Thailand in May 2001. She finished her Master Degree of Science in Environmental Management in May 2003.