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APPENDICES

APPENDIX A

CALIBRATION DATA AND CURVE

Table A-1: Calibration data of UV-254

Date : 15/12/2002 Time : 19:51:41

CALIBRATION

Date: 15/12/02 Time: 19:51:37 AM
Instrument: PerkinElmer Lambda 25 Serial No: 101N2020507
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	0.0357	
253.7	0.0 KHP.A02	4.0000 mg/L	0.0649	
253.7	0.0 KHP.A03	8.0000 mg/L	0.1249	
253.7	0.0 KHP.A04	16.000 mg/L	0.2171	
253.7	0.0 KHP.A05	20.000 mg/L	0.2457	

Equation: $y = 1.955467e-02 + 1.180933e-02 * x$

R standard error: 0.010841

Correlation coefficient: 0.994775

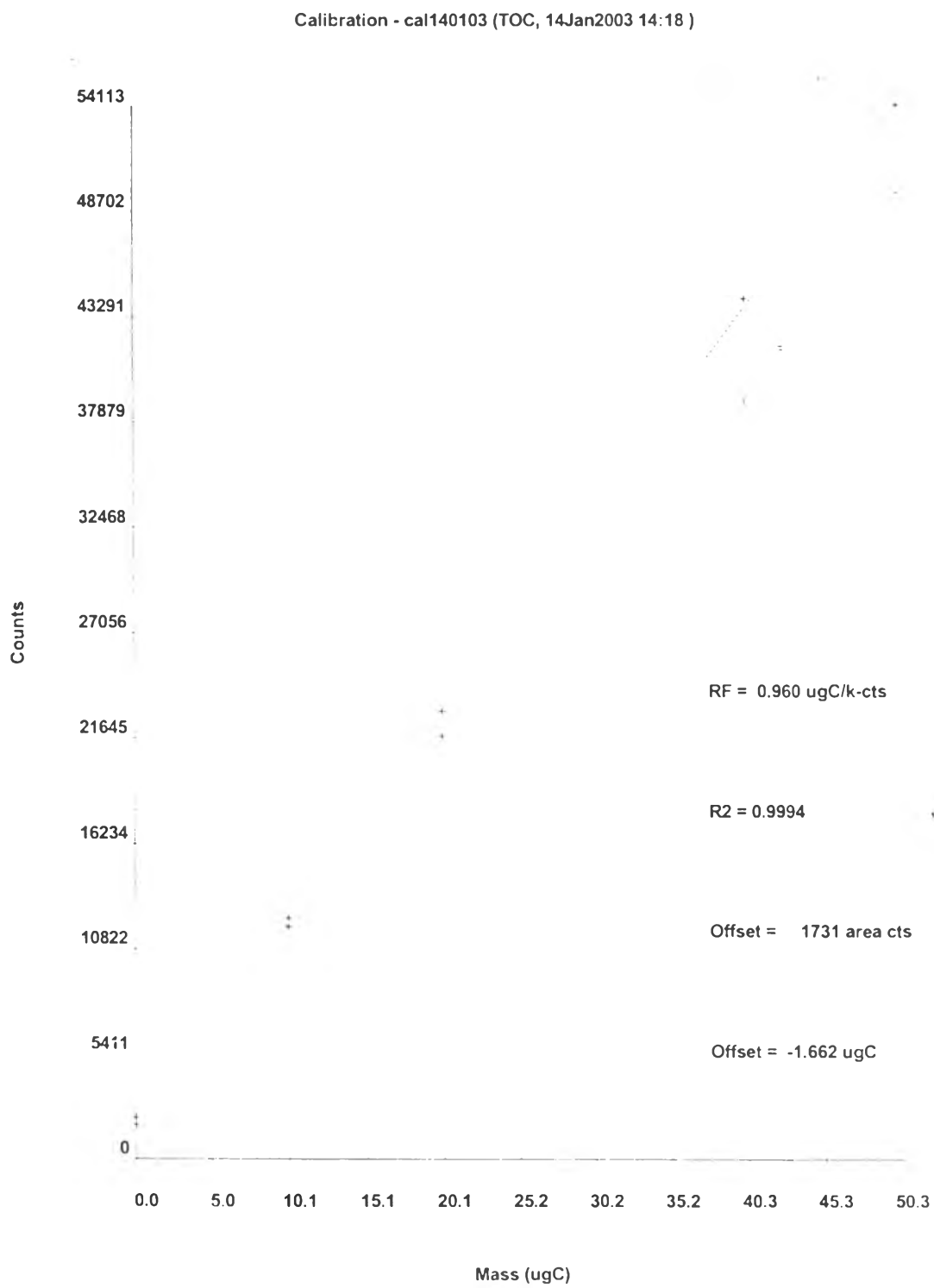


Figure A-1: Calibration curve of TOC

Table A-2: Calibration data of free chlorine residual

Date : 30/1/2003 Time : 10:50:29

CALIBRATION

Date: 30/1/03 Time: 10:50:01 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	0.0324	
515.0	0.0	JIMCHLO.A02 0.2500 mg/L	0.0680	
515.0	0.0	JIMCHLO.A03 0.5000 mg/L	0.1272	
515.0	0.0	JIMCHLO.A04 1.0000 mg/L	0.2401	
515.0	0.0	JIMCHLO.A05 2.0000 mg/L	0.4379	
515.0	0.0	jimchlo.A06 4.0000 mg/L	0.7187	

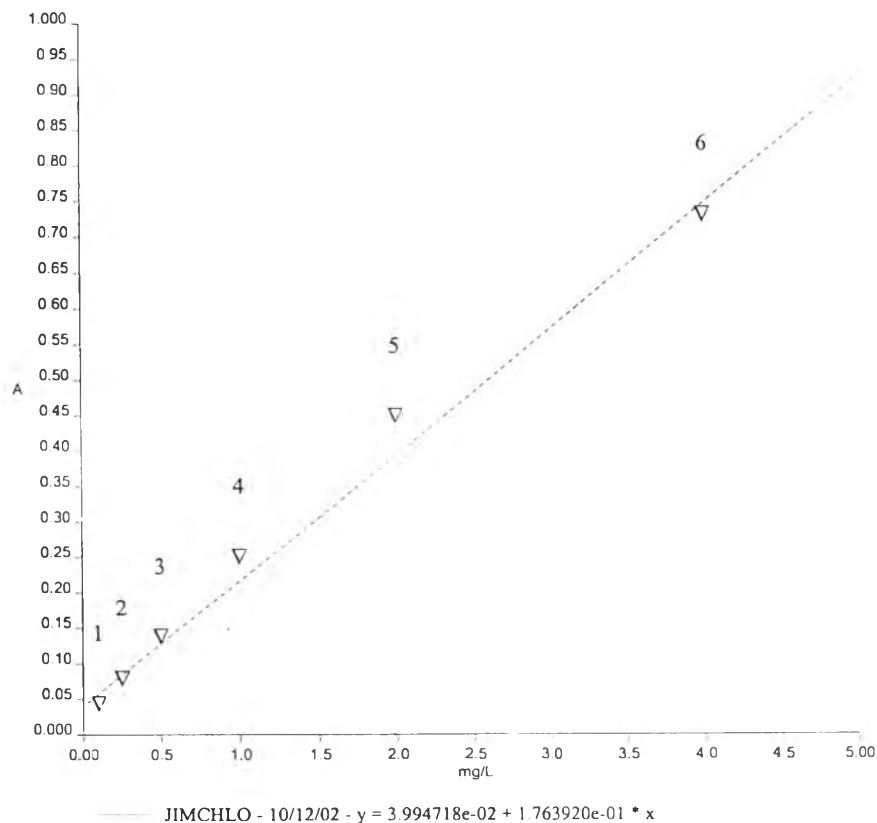
Equation: $y = 3.994718e-02 + 1.763920e-01 * x$

Residual error: 0.032450

Correlation coefficient: 0.993931

Date: 30/1/03

Time: 10:50:16 PM

**Figure A-2: Calibration curve of free chlorine residual**

Data File C:\HPCHEM\1\DATA\J31145\J0311002.D
blank

Sample Name: Bla

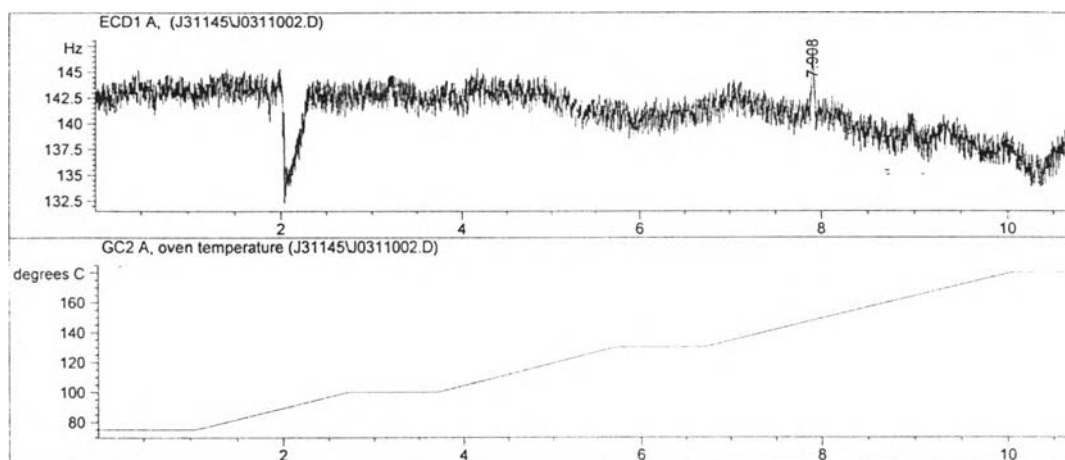
```

=====
Injection Date   : 11/3/02 3:02:15 PM           Seq. Line :    1
Sample Name     : Blank                         Vial      :   201
Acq. Operator   : J3/11/45                     Inj       :    1
                                                    Inj Volume: 1 µl

Acq. Method    : C:\HPCHEM\1\METHODS\TTHMF.M
Last changed   : 11/3/02 3:00:08 PM by J3/11/45
Analysis Method: C:\HPCHEM\1\METHODS\TTHMF.M
Last changed   : 11/3/02 6:21:31 PM by J3/11/45
                (modified after loading)

test standard on uECD
=====

```



=====
External Standard Report
=====

```

Sorted By      :      Signal
Multiplier     :      1.0000
Dilution      :      1.0000
=====

```

=====
Area Percent Report
=====

```

Sorted By      :      Signal
Multiplier     :      1.0000
Dilution      :      1.0000
=====

```

Signal 1: ECD1 A,

Peak #	RetTime [min]	Type	Width [min]	Area [Hz*s]	Height [Hz]	Area %
1	7.908	BP	0.0290	10.63586	5.17231	1.000e2

Totals : 10.63586 5.17231

Results obtained with enhanced integrator!

=====
*** End of Report ***

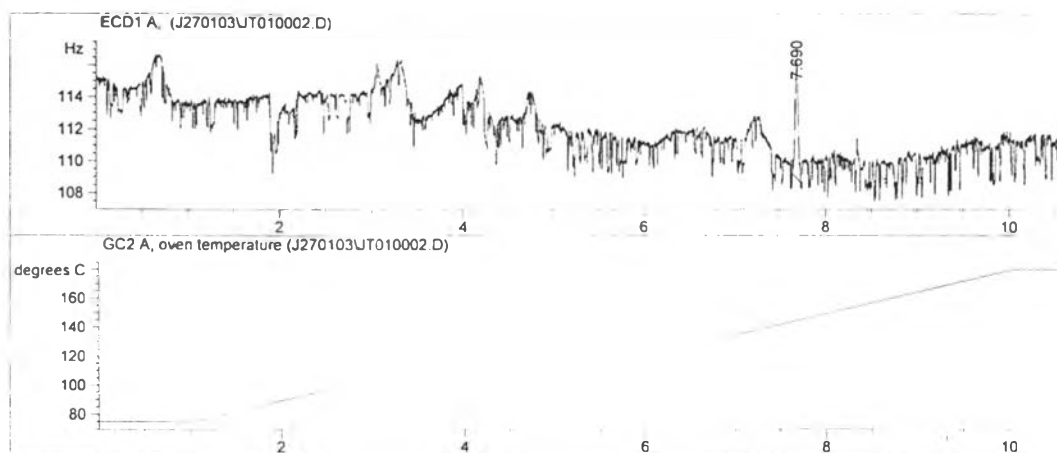
Figure A-3: Chromatogram of blank and oven temperature

Data File C:\HPCHEM\1\DATA\J270103\JT010002.D
 THM0 sampling 27/01/03

Sample Name:

```
=====
Injection Date : 1/30/03 10:53:06 AM      Seq. Line : 2
Sample Name    : RW6                      Vial : 202
Acq. Operator  : jimmy                    Inj : 1
                                           Inj Volume : 1 µl

Acq. Method    : C:\HPCHEM\1\METHODS\TTHMF2.M
Last changed   : 1/14/03 8:35:19 PM by TOOKTA-14-1-03
Analysis Method : C:\HPCHEM\1\METHODS\TTHMF3.M
Last changed   : 3/1/03 6:13:29 PM by JIMMY
test standard  on uECD
=====
```



Internal Standard Report

```
Sorted By      : Signal
Calib. Data Modified : Saturday, March 01, 2003 5:53:25 PM
Multiplier    : 1.0000
Dilution      : 1.0000
```

Sample ISTD Information:

```
ISTD ISTD Amount Name
# [ug/l]
```

```
-----
1 120.00000 Bromofluorobenzene
```

Signal 1: ECD1 A,

RetTime [min]	Type	Area [Hz*s]	Amt/Area ratio	Amount [ug/l]	Grp	Name
3.055		-	-	-		Chloroform
4.182		-	-	-		Bromodichloroform
5.581		-	-	-		Chlorodibromoform
7.271		-	-	-		Bromoform
7.690	BP +I	17.00100	1.00000	120.00000		Bromofluorobenzene

Totals without ISTD(s) : 0.00000

Results obtained with enhanced integrator!

1 Warnings or Errors :

Instrument 1 3/11/03 10:29:17 AM tookta

Page 1 of 2

Figure A-4: TTHM₀ Chromatogram of raw water and oven temperature

Data File C:\HPCHEM\1\DATA\J100203\T7400007.D
THM7 Sampling 10/02/03

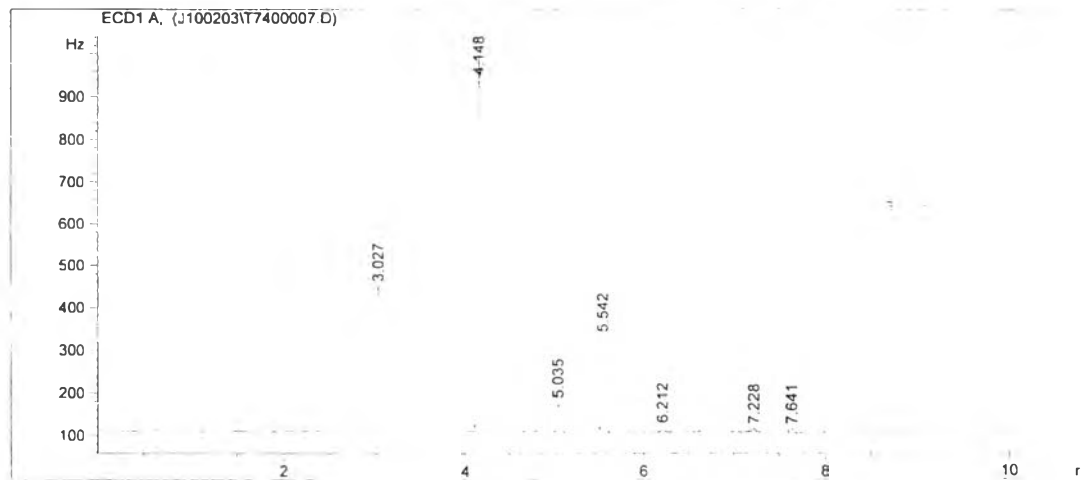
Sample Name:

```

=====
Injection Date   : 3/2/03 12:29:27 AM           Seq. Line :    7
Sample Name     : F5S                          Vial      :   207
Acq. Operator  : JIMmy                        Inj       :    1
                                           Inj Volume: 1 µl

Sequence File   : C:\HPCHEM\1\SEQUENCE\J100203.S
Method          : C:\HPCHEM\1\METHODS\TTHMF3.M
Last changed    : 3/1/03 6:13:29 PM by JIMmy
test standard on uECD
=====

```



Internal Standard Report

```

=====
Sorted By      : Signal
Calib. Data Modified : Saturday, March 01, 2003 5:53:25 PM
Multiplier    : 1.0000
Dilution      : 1.0000
Sample ISTD Information:
ISTD ISTD Amount Name
# [ug/l]
-----
1 120.00000 Bromofluorobenzene
=====

```

Signal 1: ECD1 A,

RetTime [min]	Type	Area [Hz*s]	Amt/Area ratio	Amount [ug/l]	Grp	Name
3.027	BB	938.89240	2.98003e-2	196.04254		Chloroform
4.148	BB	2121.65479	1.01500e-3	104.28372		Bromochloroform
5.542	BP	450.45352	1.27253e-2	40.16346		Chlorodibromoform
7.228	BB	21.47352	1.00049e-1	15.05323		Bromoform
7.641	PB +/-	17.12645	1.00000	120.00000		Bromofluorobenzene

Totals without ISTD(s) : 355.54294

Results obtained with enhanced integrator!

*** End of Report ***

Figure A-5 TTHM₇ Chromatogram of supernatant and oven temperature

Table A-3: Calibration data of TTHM

Method C:\HPCHEM\1\METHODS\TTHMF3.M

```

=====
                        Calibration Table
=====

```

```

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  Name
#      [ug/l]
-----

```

```

1      120.00000   Bromofluorobenzene

```

Signal 1: ECD1 A,

RetTime [min]	Lvl Sig	Amount [ug/l]	Area	Amt/Area	Ref Grp Name	
3.047	1	1	25.00000	70.26765	3.55783e-1	1 Chloroform
		2	50.00000	194.30623	2.57323e-1	
		3	100.00000	376.51529	2.65593e-1	
		4	150.00000	535.45782	2.80134e-1	
		5	300.00000	1203.70593	2.49230e-1	
		6	500.00000	1824.96387	2.73978e-1	
		7	1000.00000	4791.05078	2.08722e-1	
4.172	1	1	25.00000	420.71561	5.94226e-2	1 Bromodichloroform
		2	50.00000	1021.71686	4.89372e-2	
		3	100.00000	1987.70300	5.03093e-2	
		4	150.00000	2871.34253	5.22404e-2	
		5	300.00000	6490.45410	4.62217e-2	
		6	500.00000	9840.81250	5.08088e-2	
		7	1000.00000	2.30107e4	4.34580e-2	
5.567	1	1	25.00000	437.79565	5.71043e-2	1 Chlorodibromoform
		2	50.00000	991.57202	5.04250e-2	
		3	100.00000	1959.43726	5.10351e-2	
		4	150.00000	2851.71777	5.25999e-2	
		5	300.00000	6082.31250	4.93233e-2	
		6	500.00000	9262.31543	5.39822e-2	
		7	1000.00000	1.99652e4	5.00871e-2	
7.253	1	1	25.00000	218.35396	1.14493e-1	1 Bromoform
		2	50.00000	455.68271	1.09725e-1	

Instrument 1 3/10/03 9:09:14 PM tookta

Page 1 of 3

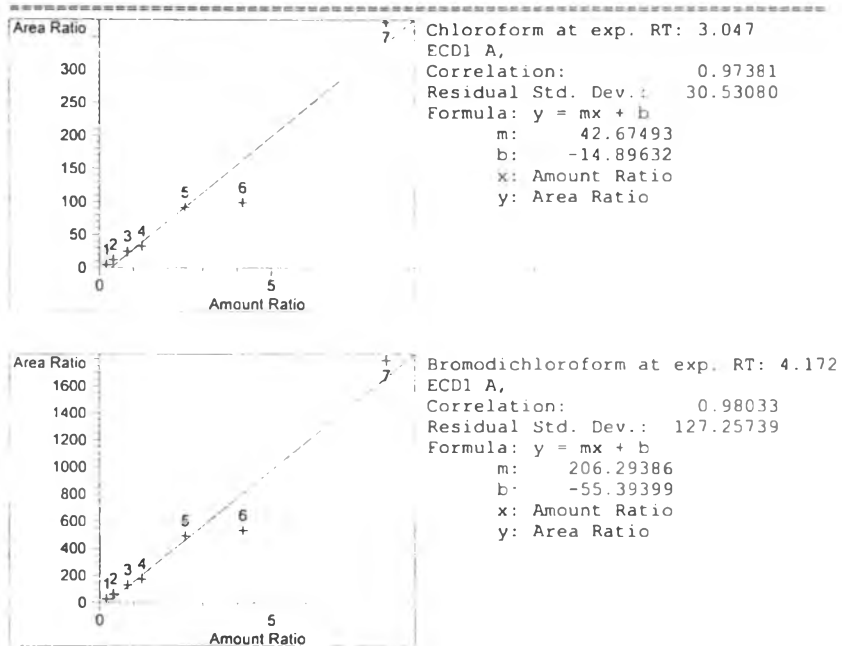
Method C:\HPCHEM\1\METHODS\TTHMF3.M

RetTime [min]	Lvl Sig	Amount [ug/l]	Area	Amt/Area	Ref Grp Name
		3 100.00000	869.94574	1.14950e-1	
		4 150.00000	1246.77893	1.20310e-1	
		5 300.00000	2510.93774	1.19477e-1	
		6 500.00000	3839.49585	1.30225e-1	
		7 1000.00000	7807.56934	1.28081e-1	
7.671	1	1 120.00000	15.80028	7.59480	+I1 Bromofluorobenzene
		2 120.00000	16.23931	7.38948	
		3 120.00000	15.29917	7.84356	
		4 120.00000	16.39823	7.31786	
		5 120.00000	13.17189	9.11031	
		6 120.00000	18.47002	6.49702	
		7 120.00000	12.85622	9.33400	

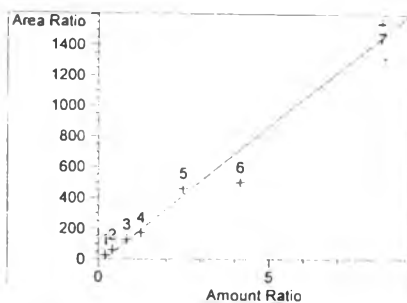
Peak Sum Table

No Entries in table

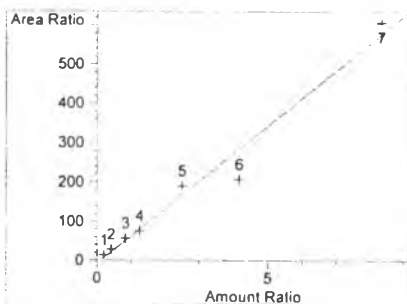
Calibration Curves



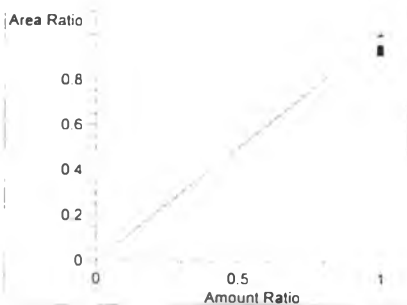
Method C:\HPCHEM\1\METHODS\TTHMF3.M



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

EXPERIMENTAL DATA

Table B-1: Sampling date, pH, Turbidity, Alkalinity, Temperature, UV-254, TOC, DOC, SUVA and TTHM₀ of Treated Industrial Estate Wastewater over the period of study

Sampling Date	pH	Turbidity (NTU)	Alkalinity (mg/L as CaCO ₃)	Temperature (°C)	UV-254 (cm-1)	TOC (mg/L)	DOC (mg/L)	SUVA (L/mg-m)	TTHM ₀ (µg/L)
24/10/45	7.09	12.0	116.4	27.9	0.1801	-	-	-	1.815
08/11/45	7.62	30.9	95.1	23.7	17.39	-	-	-	15.53
26/11/45	6.87	14.7	69.8	25.8	0.3038	-	-	-	11.98
3/12/45	7.30	10.8	104.8	25.0	0.2367	-	-	-	14.69
11/12/45	7.03	19.1	75.7	24.3	0.2000	-	-	-	10.48
17/12/45	7.06	20.2	83.4	25.0	0.1854	-	-	-	14.80
25/12/45	7.23	16.0	97.0	22.5	0.2535	-	-	-	13.49
3/01/46	7.18	25.0	83.9	24.0	0.2688	-	-	-	13.29
11/01/46	6.80	15.6	53.4	23.4	0.1527	5.348	-	-	0
27/01/46	6.80	14.9	88.0	24.6	0.3024	5.180	4.520	6.69	0
04/02/46	7.73	17.2	51.4	22.0	0.1936	6.692	4.994	3.88	0
10/02/46	7.51	16.1	88.0	22.1	0.2147	7.286	5.917	3.63	0

Table B-2: Residual turbidity, percentage of turbidity removal and residual alkalinity in supernatant at uncontrolled pH and different alum and ferric chloride dosages

Dosage (mg/L)	Alum			Ferric Chloride		
	Residual turbidity (NTU)	Percentage of turbidity removal	Residual alkalinity (mg/L as CaCO ₃)	Residual turbidity (NTU)	Percentage of turbidity removal	Residual alkalinity (mg/L as CaCO ₃)
Blank#	15.6	-	53.33	15.6	-	53.33
10	2.45	84.29	36.29	3.18	79.62	36.29
20	1.81	88.40	34.16	1.18	92.44	25.89
40	1.23	92.12	27.75	0.454	97.09	25.26
60	0.472	96.97	25.26	0.355	97.72	24.48
80	0.477	96.94	23.48	0.460	97.05	10.68

- Raw Water and Sampling Date: 11 January 2003

Table B-3: Residual turbidity, percentage of turbidity removal and residual alkalinity in filtered supernatant at uncontrolled pH and different alum and ferric chloride dosages

Dosage (mg/L)	Alum			Ferric Chloride		
	Residual turbidity (NTU)	Percentage of turbidity removal	Residual alkalinity (mg/L as CaCO ₃)	Residual turbidity (NTU)	Percentage of turbidity removal	Residual alkalinity (mg/L as CaCO ₃)
Blank#	15.6	-	53.33	15.6	-	53.33
10	0.738	95.3	37.48	0.765	95.1	36.29
20	0.675	95.7	36.29	0.697	95.5	29.89
40	0.397	97.5	32.02	0.68	95.6	27.75
60	0.203	98.7	27.69	0.518	96.7	25.62
80	0.155	99.1	21.35	0.43	97.2	8.54

- Raw Water, NT- not tested, and Sampling Date: 11 January 2003

Table B-4: Residual turbidity, percentage of turbidity removal and residual alkalinity in supernatant at pH value of 6.5, 6 and 5.5 with different alum dosages

Alum dosage (mg/L)	pH value of 6.5			pH value of 6			pH value of 5.5		
	Residual turbidity (NTU)	Percentage of turbidity Removal	Residual alkalinity (mg/L as CaCO ₃)	Residual turbidity (NTU)	Percentage of turbidity Removal	Residual alkalinity (mg/L as CaCO ₃)	Residual turbidity (NTU)	Percentage of turbidity Removal	Residual alkalinity (mg/L as CaCO ₃)
Blank#	14.9	-	135.6	17.2	-	110.0	16.1	-	55.0
10	3.31	77.8	125.4	5.53	67.8	83.6	5.76	64.2	35.2
20	2.57	82.8	121.0	4.00	76.7	83.6	4.31	73.2	37.4
40	1.65	88.9	114.4	2.75	84.0	80.0	2.77	82.8	37.4
60	1.37	90.8	107.8	2.29	86.7	77.0	2.26	86.0	39.6
80	1.21	91.9	99.0	1.58	90.8	72.6	1.50	90.7	37.4

- Raw Water

Sampling Date: 27 January 2003 for pH 6.5, Sampling Date: 4 February 2003 for pH 6 and Sampling Date: 10 February 2003 for pH 5.5

Table B-5: Residual turbidity, percentage of turbidity removal and residual alkalinity in filtered supernatant at pH value of 6.5, 6 and 5.5 with different alum dosages

Alum dosage (mg/L)	pH value of 6.5			pH value of 6			pH value of 5.5		
	Residual turbidity (NTU)	Percentage of turbidity Removal	Residual alkalinity (mg/L as CaCO ₃)	Residual turbidity (NTU)	Percentage of turbidity Removal	Residual alkalinity (mg/L as CaCO ₃)	Residual turbidity (NTU)	Percentage of turbidity Removal	Residual alkalinity (mg/L as CaCO ₃)
Blank#	15.6	-	135.6	17.2	-	110.0	16.1	-	55.0
10	0.231	98.4	125.4	0.646	96.2	85.8	0.951	94.1	35.2
20	0.430	97.1	121.0	0.725	95.8	85.8	0.823	94.9	37.4
40	0.326	97.8	116.6	0.578	96.6	81.4	0.704	95.6	37.4
60	0.301	98.0	107.8	0.417	97.6	72.6	0.937	94.2	46.2
80	0.352	97.6	101.2	0.380	97.0	74.8	0.714	95.6	41.8

- Raw Water

Sampling Date: 27 January 2003 for pH 6.5, Sampling Date: 4 February 2003 for pH 6 and Sampling Date: 10 February 2003 for pH 5.5

Table B-6: Residual turbidity, percentage of turbidity removal and residual alkalinity in supernatant at pH values of 6, 5.5 and 5 with different ferric chloride dosages

Ferric chloride dosage (mg/L)	pH value of 6			pH value of 5.5			pH value of 5		
	Residual turbidity (NTU)	Percentage of turbidity Removal	Residual alkalinity (mg/L as CaCO ₃)	Residual turbidity (NTU)	Percentage of turbidity Removal	Residual alkalinity (mg/L as CaCO ₃)	Residual turbidity (NTU)	Percentage of turbidity Removal	Residual alkalinity (mg/L as CaCO ₃)
Blank#	14.9	-	131.49	16.7	-	88	16.1	-	55.0
10	4.87	67.3	112.2	8.36	49.9	44.0	5.96	63.0	11.0
20	4.26	71.4	101.2	7.32	56.6	41.8	4.01	75.1	11.0
40	3.21	78.5	88.0	5.81	65.2	41.8	1.57	90.2	8.8
60	3.00	79.9	66.0	4.75	71.6	41.8	1.34	91.7	8.8
80	2.83	81.0	48.4	2.33	86.0	41.8	1.30	91.9	11.0

- Raw Water

Sampling Date: 27 January 2003 for pH 6.5, Sampling Date: 4 February 2003 for pH 6, and Sampling Date: 10 February 2003 for pH 5.5

Table B-7: Residual turbidity, percentage of turbidity removal and residual alkalinity in filtered supernatant at pH values of 6, 5.5 and 5 with different ferric chloride dosages

Ferric chloride dosage (mg/L)	pH value of 6			pH value of 5.5			pH value of 5		
	Residual turbidity (NTU)	Percentage of turbidity Removal	Residual alkalinity (mg/L as CaCO ₃)	Residual turbidity (NTU)	Percentage of turbidity Removal	Residual alkalinity (mg/L as CaCO ₃)	Residual turbidity (NTU)	Percentage of turbidity Removal	Residual alkalinity (mg/L as CaCO ₃)
Blank#	14.9	-	131.49	16.7	-	88	16.1	-	55.0
10	0.538	96.4	112.2	0.760	95.4	41.8	0.581	96.4	15.4
20	0.418	97.2	101.4	0.768	95.4	41.8	0.270	98.3	13.2
40	0.382	97.4	85.2	0.343	97.9	46.2	0.252	98.7	15.4
60	0.294	98.0	68.2	0.865	94.8	50.6	0.217	98.7	13.2
80	0.216	98.6	50.6	0.653	96.1	41.8	0.300	98.1	13.2

- Raw Water

Sampling Date: 27 January 2003 for pH 6.5, Sampling Date: 4 February 2003 for pH 6 and Sampling Date: 10 February 2003 for pH 5.5

Table B-8: UV-254 and percentage of UV-254 reduction of filtered supernatant (1.2 µm) at uncontrolled pH and different alum and ferric chloride dosages

dosage (mg/L)	Alum		Ferric Chloride	
	UV-254 (cm-1)	Percentage of UV-254 reduction	UV-254 (cm-1)	Percentage of UV-254 reduction
Blank#	0.1527	-	0.1527	-
10	0.1312	14.1	0.1278	16.3
20	0.1306	14.5	0.1173	23.2
40	0.1247	18.3	0.1119	26.7
60	0.0953	37.6	0.0843	44.8
80	0.0848	44.5	0.0760	50.2

- Raw Water, Sampling Date: 11 January 2003

Table B-9: UV-254 and percentage of UV-254 reduction at pH value 6.5, 6 and 5.5 with different alum dosages

Alum dosage (mg/L)	pH value of 6.5		pH value of 6		pH value of 5.5	
	UV-254 (cm-1)	Percentage of UV-254 reduction	UV-254 (cm-1)	Percentage of UV-254 reduction	UV-254 (cm-1)	Percentage of UV-254 reduction
Blank#	0.02881	-	0.1876	-	0.02144	-
10	0.0889	69.1	0.0866	53.8	0.0921	56.9
20	0.0876	69.6	0.0724	61.4	0.0755	64.7
40	0.0784	72.8	0.0750	60.0	0.0721	66.3
60	0.0793	72.5	0.0682	63.6	0.0662	69.0
80	0.0713	75.3	0.0662	64.7	0.0716	66.5

- Raw Water

Sampling Date: 27 January 2003 for pH 6.5

Sampling Date: 4 February 2003 for pH 6

Sampling Date: 10 February 2003 for pH 5.5

Table B-10: UV-254 and percentage of UV- 254 at pH value 6, 5.5 and 5 and different ferric chloride dosages

Alum dosage (mg/L)	pH value of 6.5		pH value of 6		pH value of 5.5	
	UV-254 (cm-1)	Percentage of UV-254 reduction	UV-254 (cm-1)	Percentage of UV-254 reduction	UV-254 (cm-1)	Percentage of UV-254 reduction
Blank#	0.2881	-	0.1876	-	0.2137	-
10	0.1037	64.0	0.0559	70.0	0.0797	62.7
20	0.0751	73.9	0.0567	69.8	0.0552	74.2
40	0.0603	79.0	0.0379	79.8	0.0505	76.4
60	0.0570	80.2	0.0340	81.9	0.0507	76.3
80	0.0582	78.0	0.0328	82.5	0.0517	75.8

- Raw Water

Sampling Date: 27 January 2003 for pH 6.5

Sampling Date: 4 February 2003 for pH 6

Sampling Date: 10 February 2003 for pH 5.5

Table B-11: TOC and percent removal of TOC at uncontrolled pH and different alum and ferric dosages

Dosage (mg/L)	TOC (mg/L)		Percentage of TOC removal	
	Alum	Ferric chloride	Alum	Ferric chloride
Blank#	5.307	5.307	NT	NT
10	5.014	4.739	5.5	10.7
20	4.781	4.275	9.9	19.4
40	4.454	3.671	14.4	30.8
60	4.25	3.636	19.3	31.4
80	4.115	3.139	22.5	40.9

- Raw Water,

Sampling Date: 11 January 2003

Table B-12: TOC, DOC, SUVA, percent reduction of TOC, DOC and SUVA at pH value of 6.5 with different alum dosages

Alum dosage (mg/L)	TOC (mg/L)	DOC mg/L	SUVA (L/mg-m)	Percentage of TOC reduction	Percentage of DOC reduction	Percentage of SUVA reduction
Blank#	5.174	4.620	6.37	-	-	-
10	4.624	4.502	1.97	10.6	0.4	69.1
20	4.476	4.448	1.97	13.5	1.6	69.1
40	4.313	4.240	1.85	16.6	6.2	71.0
60	4.248	4.179	1.90	17.9	7.5	70.2
80	4.246	4.181	1.73	17.9	8.6	72.8

- Raw Water

Sampling Date: 27 January 2003

Table B-13: TOC, DOC, SUVA, percent reduction of TOC, DOC and SUVA at pH value of 6 with different alum dosages

Alum dosage (mg/L)	TOC (mg/L)	DOC mg/L	SUVA (L/mg-m)	Percentage of TOC reduction	Percentage of DOC reduction	Percentage of SUVA reduction
Blank#	5.437	4.994	3.76	-	-	-
10	4.758	3.909	2.22	12.5	21.7	41.0
20	4.447	3.506	2.07	18.2	29.8	44.9
40	4.144	3.683	2.04	23.8	26.3	45.7
60	3.968	3.51	1.94	27.0	29.7	48.4
80	3.902	3.847	1.72	28.2	23.0	54.3

- Raw Water,

Sampling Date: 04 February 2003

Table B-14: TOC, DOC, SUVA, percent reduction of TOC, DOC and SUVA at pH value and 5.5 with different alum dosages

Alum dosage (mg/L)	TOC (mg/L)	DOC mg/L	SUVA (L/mg-m)	Percentage of TOC reduction	Percentage of DOC reduction	Percentage of SUVA reduction
Blank#	6.032	5.917	3.61	-	-	-
10	5.156	5.205	1.77	14.5	12.0	51.0
20	4.982	5.029	1.50	17.4	15.0	58.4
40	4.659	4.285	1.68	22.8	27.6	53.5
60	4.328	3.972	1.67	28.3	32.9	53.7
80	4.033	3.269	2.19	33.1	44.8	39.3

- Raw Water,
 Sampling Date: 10 February 2003

Table B-15: TOC, DOC, SUVA, percent reduction of TOC, DOC and SUVA at controlled pH value of 6 with different ferric dosages

Ferric chloride dosage (mg/L)	TOC (mg/L)	DOC mg/L	SUVA (L/mg-m)	Percentage of TOC reduction	Percentage of DOC reduction	Percentage of SUVA reduction
Blank#	5.174	4.620	6.37	-	-	-
10	4.177	4.165	2.49	19.3	7.9	64.3
20	4.085	3.811	1.97	21.0	15.7	71.7
40	3.673	3.587	1.68	29.0	20.6	75.9
60	3.422	3.482	1.64	33.9	23.0	76.5
80	3.217	3.171	1.84	37.8	29.8	73.6

- Raw Water,
 Sampling Date: 27 January 2003

Table B-16: TOC, DOC, SUVA, percent reduction of TOC, DOC and SUVA at controlled pH value of 5.5 with different ferric dosages

Ferric chloride dosage (mg/L)	TOC (mg/L)	DOC mg/L	SUVA (L/mg-m)	Percentage of TOC reduction	Percentage of DOC reduction	Percentage of SUVA reduction
Blank#	5.437	4.994	3.76	-	-	-
10	5.101	4.058	1.38	6.2	18.7	63.3
20	4.512	3.968	1.43	17.0	20.6	62.0
40	3.897	3.532	1.07	28.3	29.3	71.5
60	3.474	3.111	1.09	36.1	37.7	71.0
80	3.203	2.665	1.23	41.1	46.6	67.3

- Raw Water,
 Sampling Date: 04 February 2003

Table B-17: TOC, DOC, SUVA, percent reduction of TOC, DOC and SUVA at controlled pH value of 5 with different ferric dosages

Ferric chloride dosage (mg/L)	TOC (mg/L)	DOC mg/L	SUVA (L/mg-m)	Percentage of TOC reduction	Percentage of DOC reduction	Percentage of SUVA reduction
Blank#	6.302	5.917	3.61	-	-	-
10	4.806	3.786	2.11	23.7	36.0	41.6
20	4.210	3.594	1.54	33.2	39.3	57.3
40	3.398	3.480	1.45	46.1	41.2	59.8
60	3.100	2.973	1.71	50.8	49.8	52.6
80	3.029	2.868	1.80	51.9	51.5	50.1

- Raw Water,
 Sampling Date: 10 February 2003

Table B-18: TOC in Supernatant and filtered Supernatant, UV-254, DOC and SUVA of filtered Supernatant, free chlorine residual after 7 days reaction, THMFP, pH during coagulation and sampling dates of raw and reclaimed water at different alum dosages.

Dosage (mg/L)	UV-254 (cm-1)	TOC (mg/L)	DOC mg/L	SUVA (L/mg-m)	Free chlorine residual after 7 day reaction (mg/L)	THMFP (µg/L)	pH after 7 days reaction	pH during coagulation.	Sampling Date
0	0.2147 (R)	7.286	5.917	3.63	3.0041	480.6805	7.07	5.0	10/02/2003
10	0.0896(F)	4.806	3.786	2.40	3.1597	444.4252	7.13	5.0	10/02/2003
20	0.0802(F)	4.210	3.594	2.20	3.7827	334.8781	7.15	5.0	10/02/2003
80	0.0575(F)	3.029	2.868	2.00	4.8265	355.5429	7.16	6.0	10/02/2003
0	0.2147 (R)	7.286	5.917	3.63	3.0041	480.6805	7.07	5.5	10/02/2003
10	0.1370(A)	5.156	5.205	2.63	3.5927	409.3070	7.15	5.5	10/02/2003
20	0.926(A)	4.982	5.029	1.84	4.0257	392.1986	7.15	5.5	10/02/2003
40	0.0836(A)	4.659	4.285	1.95	4.5030	395.8520	7.12	5.5	10/02/2003
60	0.0757(A)	4.328	3.972	1.91	4.4942	377.8530	7.13	5.5	10/02/2003
80	0.0741(A)	4.033	3.269	2.27	4.7546	359.3946	7.12	5.5	10/02/2003

(R)-Raw water

(F)-Coagulation by ferric chloride

(A)- Coagulation by alum

APPENDIX C

**Profiles of UV-254, DOC and SUVA with various dosages of alum
and ferric chloride at different controlled pH**

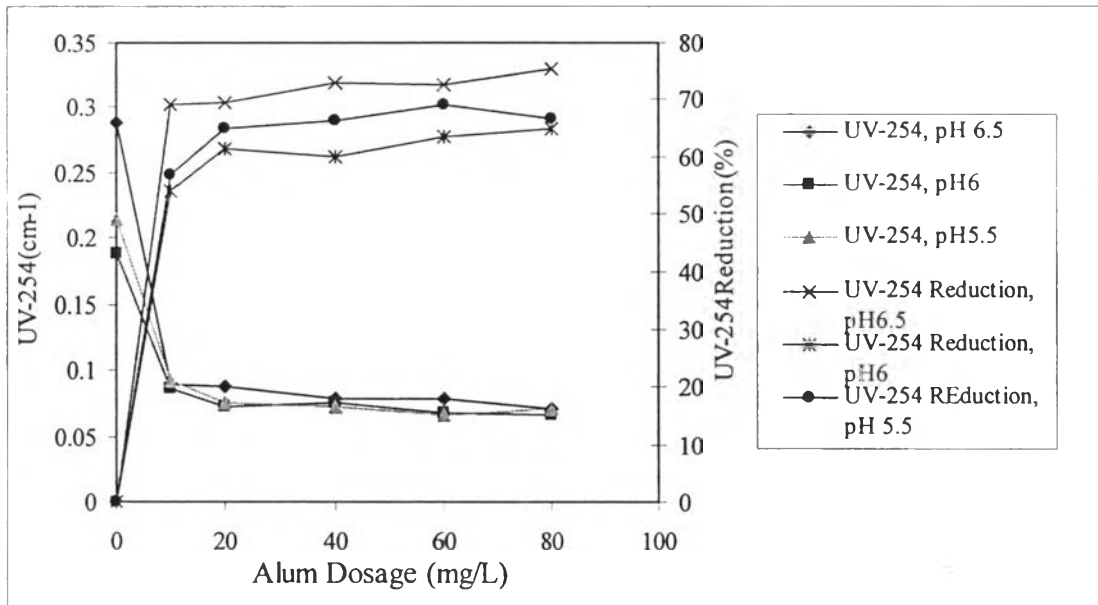


Figure C-1: UV-254 and percentage of UV-254 reduction as a function of alum dosage at different controlled pH

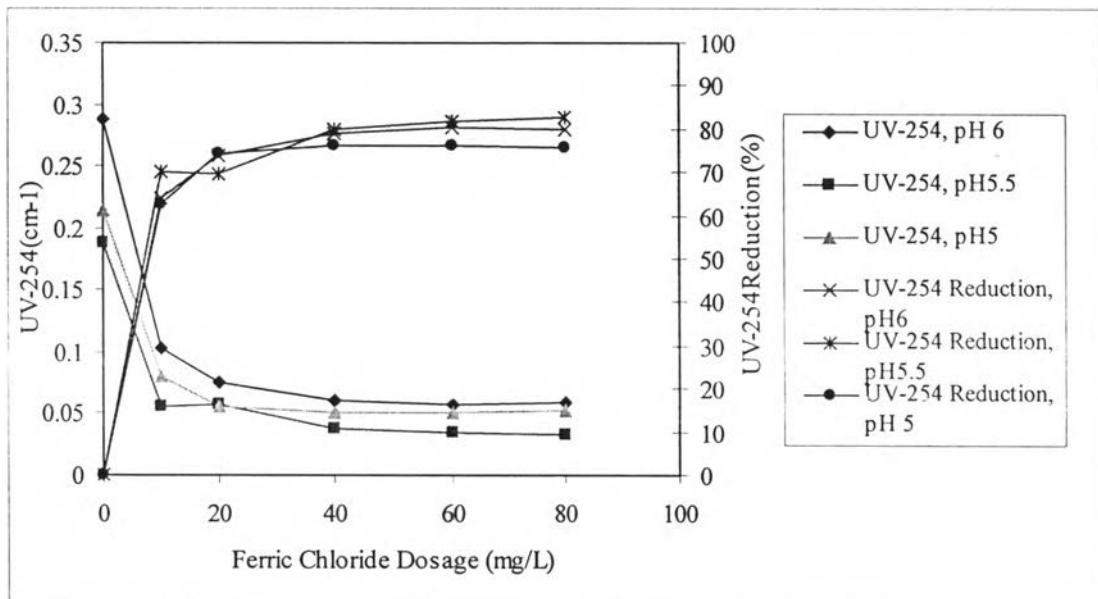


Figure C-2: UV-254 and percentage of UV-254 reduction as a function of ferric chloride dosage at different controlled pH

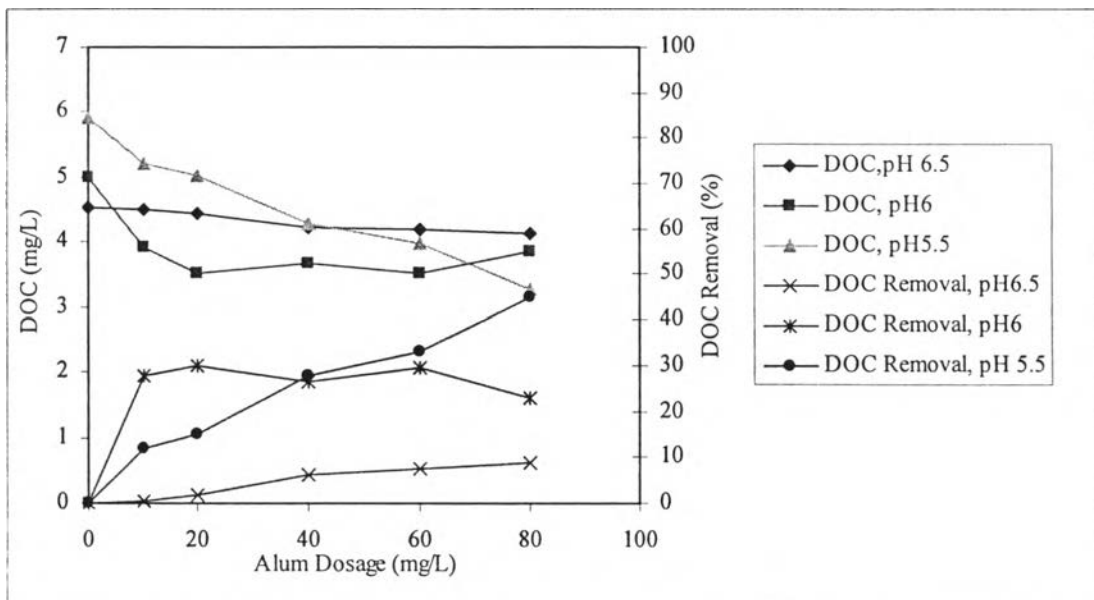


Figure C-3: DOC and percentage of DOC removal as a function of alum dosage at different controlled pH

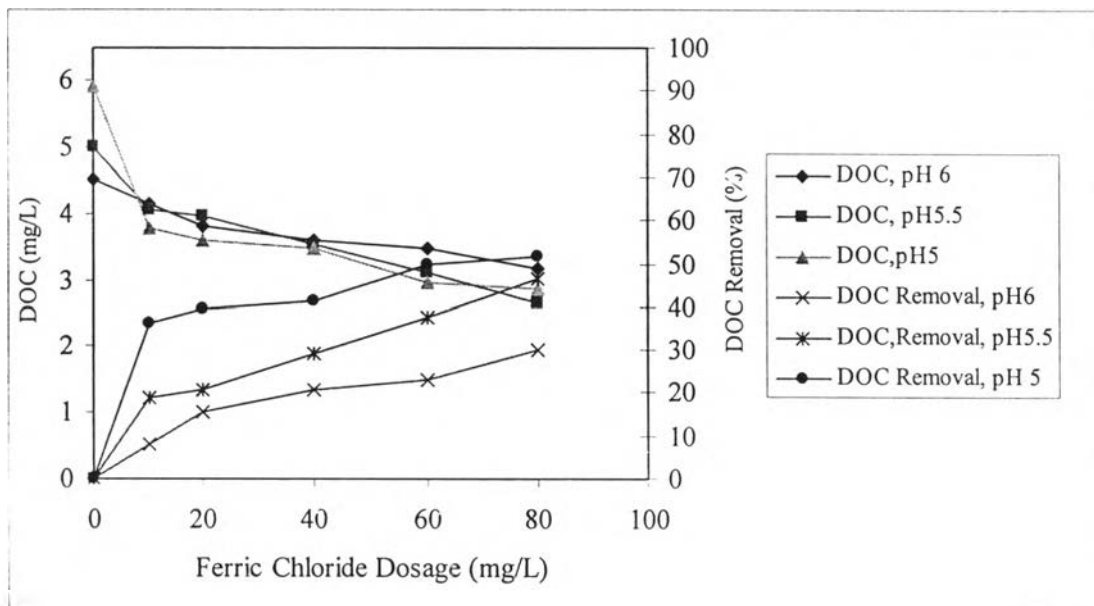


Figure C-4: DOC and percentage of DOC removal as a function of ferric chloride dosage at different controlled pH

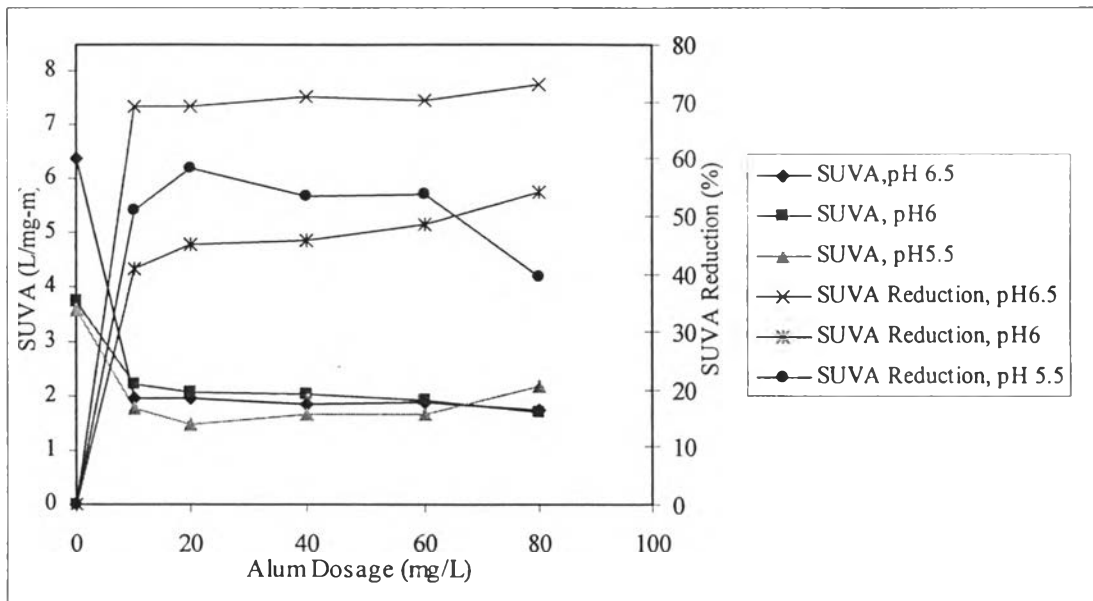


Figure C-5: SUVA and percentage of SUVA reduction as a function of alum dosage at different controlled pH

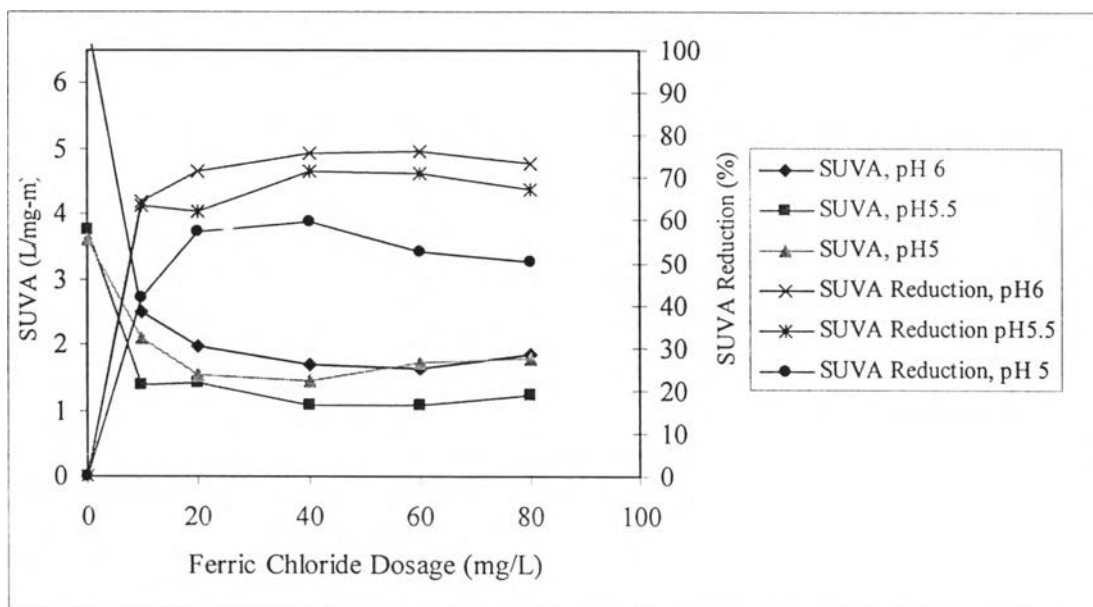


Figure C-6: SUVA and percentage of SUVA reduction as a function of ferric chloride dosage at different controlled pH

APPENDIX D

STATISTICS ANALYSIS

Figure D-1: Correlation and regression between THMFP (dependent variable) and UV-254 (independent variable)

Correlations

Correlations

		THMFP	UV254
THMFP	Pearson Correlation	1.000	.899**
	Sig. (2-tailed)		.000
	N	10	10
UV254	Pearson Correlation	.899**	1.000
	Sig. (2-tailed)	.000	
	N	10	10

** Correlation is significant at the 0.01 level (2-tailed).

Regression

Variables Entered/Removed^a

Model	Variables Entered	Variables Removed	Method
1	UV254 ^a		Enter

^a. All requested variables entered.

^b. Dependent Variable: THMFP

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.899 ^a	.808	.784	22.923829

^a. Predictors: (Constant), UV254

ANOVA^a

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	17695.138	1	17695.138	33.673	.000 ^a
	Residual	4204.015	8	525.502		
	Total	21899.154	9			

^a. Predictors: (Constant), UV254

^b. Dependent Variable: THMFP

Coefficients^a

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	321.212	16.500		19.468	.000
	UV254	768.839	132.494	.899	5.803	.000

^a. Dependent Variable: THMFP

Figure D-2: Correlation and regression between THMFP (dependent variable) and TOC (independent variable)

Correlations

Correlations

		THMFP	TOC
THMFP	Pearson Correlation	1.000	.931**
	Sig. (2-tailed)		.000
	N	10	10
TOC	Pearson Correlation	.931**	1.000
	Sig. (2-tailed)	.000	
	N	10	10

** Correlation is significant at the 0.01 level (2-tailed).

Regression

Variables Entered/Removed^b

Model	Variables Entered	Variables Removed	Method
1	TOC ^a		Enter

^a. All requested variables entered.

^b. Dependent Variable: THMFP

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.931 ^a	.866	.850	19.133134

^a. Predictors: (Constant), TOC

ANOVA^b

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	18970.539	1	18970.539	51.821	.000 ^a
	Residual	2928.615	8	366.077		
	Total	21899.154	9			

^a. Predictors: (Constant), TOC

^b. Dependent Variable: THMFP

Coefficients^a

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	238.552	24.199		9.858	.000
	TOC	33.886	4.707	.931	7.199	.000

^a. Dependent Variable: THMFP

Figure D-3: Correlation and regression between THMFP (dependent variable) and DOC (independent variable)

Correlations

Correlations

		THMFP	DOC
THMFP	Pearson Correlation	1.000	.815**
	Sig. (2-tailed)		.004
	N	10	10
DOC	Pearson Correlation	.815**	1.000
	Sig. (2-tailed)	.004	
	N	10	10

** . Correlation is significant at the 0.01 level (2-tailed).

Regression

Variables Entered/Removed^a

Model	Variables Entered	Variables Removed	Method
1	DOC ^a		Enter

^a . All requested variables entered.

^b . Dependent Variable: THMFP

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.815 ^a	.664	.622	30.331070

^a . Predictors: (Constant), DOC

ANOVA^a

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	14539.363	1	14539.363	15.804	.004 ^a
	Residual	7359.791	8	919.974		
	Total	21899.154	9			

^a . Predictors: (Constant), DOC

^b . Dependent Variable: THMFP

Coefficients^a

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	244.024	42.157		5.788	.000
	DOC	17.224	9.364	.815	3.975	.004

^a . Dependent Variable: THMFP

Figure D-4: Correlation and regression between THMFP (dependent variable) and SUVA (independent variable)

Correlations

Correlations

		THMFP	SUVA
THMFP	Pearson Correlation	1.000	.868**
	Sig. (2-tailed)		.001
	N	10	10
SUVA	Pearson Correlation	.868**	1.000
	Sig. (2-tailed)	.001	
	N	10	10

** . Correlation is significant at the 0.01 level (2-tailed).

Regression

Variables Entered/Removed^a

Model	Variables Entered	Variables Removed	Method
1	SUVA ^a		Enter

^a. All requested variables entered.

^b. Dependent Variable: THMFP

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.868 ^a	.754	.723	25.948915

^a. Predictors: (Constant), SUVA

ANOVA^a

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	16512.384	1	16512.384	24.523	.001 ^a
	Residual	5386.770	8	673.346		
	Total	21899.154	9			

^a. Predictors: (Constant), SUVA

^b. Dependent Variable: THMFP

Coefficients^a

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	250.664	32.662		7.674	.000
	SUVA	64.006	12.925	.868	4.952	.001

^a. Dependent Variable: THMFP

Figure D-5: Correlation and regression between TOC (dependent variable) and UV-254 (independent variable)

Correlations

Correlations

		UV254	TOC
UV254	Pearson Correlation	1.000	.966**
	Sig. (2-tailed)		.000
	N	10	10
TOC	Pearson Correlation	.966**	1.000
	Sig. (2-tailed)	.000	
	N	10	10

** . Correlation is significant at the 0.01 level (2-tailed).

Regression

Variables Entered/Removed^a

Model	Variables Entered	Variables Removed	Method
1	UV254 ^a		Enter

a. All requested variables entered.

b. Dependent Variable: TOC

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.966 ^a	.932	.924	.373372

a. Predictors: (Constant), UV254

ANOVA^b

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	15.405	1	15.405	110.507	.000 ^a
	Residual	1.115	8	.139		
	Total	16.521	9			

a. Predictors: (Constant), UV254

b. Dependent Variable: TOC

Coefficients^a

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	2.440	.269		9.078	.000
	UV254	22.685	2.158	.966	10.512	.000

a. Dependent Variable: TOC

Figure D-6: Correlation and regression between DOC (dependent variable) and UV-254 (independent variable)

Correlations

Correlations

		UV254	DOC
UV254	Pearson Correlation	1.000	.897**
	Sig. (2-tailed)		.000
	N	10	10
DOC	Pearson Correlation	.897**	1.000
	Sig. (2-tailed)	.000	
	N	10	10

** . Correlation is significant at the 0.01 level (2-tailed).

Regression

Variables Entered/Removed^a

Model	Variables Entered	Variables Removed	Method
1	UV254 ^a		Enter

a. All requested variables entered.

b. Dependent Variable: DOC

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.897 ^a	.804	.779	.507094

a. Predictors: (Constant), UV254

ANOVA^b

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	8.436	1	8.436	32.806	.000 ^a
	Residual	2.057	8	.257		
	Total	10.493	9			

a. Predictors: (Constant), UV254

b. Dependent Variable: DOC

Coefficients^a

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	2.506	.365		6.867	.000
	UV254	16.787	2.931	.897	5.728	.000

a. Dependent Variable: DOC

Figure D-7: Correlation and regression between SUVA (dependent variable) and UV-254 (independent variable)

Correlations

Correlations

		UV254	SUVA
UV254	Pearson Correlation	1.000	.955**
	Sig. (2-tailed)		.000
	N	10	10
SUVA	Pearson Correlation	.955**	1.000
	Sig. (2-tailed)	.000	
	N	10	10

** Correlation is significant at the 0.01 level (2-tailed).

Regression

Variables Entered/Removed^a

Model	Variables Entered	Variables Removed	Method
1	UV254 ^a		Enter

^a. All requested variables entered.

^b. Dependent Variable: SUVA

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.955 ^a	.912	.901	210456

^a. Predictors: (Constant), UV254

ANOVA^a

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	3.676	1	3.676	83.002	.000 ^b
	Residual	.354	8	.4429E-02		
	Total	4.031	9			

^a. Predictors: (Constant), UV254

^b. Dependent Variable: SUVA

Coefficients^a

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	1.206	.151		7.963	.000
	UV254	11.082	1.216	.955	9.111	.000

^a. Dependent Variable: SUVA

Figure D-8: Correlation and regression between TOC (dependent variable) and DOC (independent variable)

Correlations

Correlations

		TOC	DOC
TOC	Pearson Correlation	1.000	.930**
	Sig. (2-tailed)		.000
	N	10	10
DOC	Pearson Correlation	.930**	1.000
	Sig. (2-tailed)	.000	
	N	10	10

** Correlation is significant at the 0.01 level (2-tailed).

Regression

Variables Entered/Removed^b

Model	Variables Entered	Variables Removed	Method
1	TOC ^a		Enter

^a All requested variables entered.

^b Dependent Variable: DOC

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.930 ^a	.865	.848	421457

^a Predictors: (Constant), TOC

ANOVA^b

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	9.072	1	9.072	51.074	.000 ^a
	Residual	1.421	8	.178		
	Total	10.493	9			

^a Predictors: (Constant), TOC

^b Dependent Variable: DOC

Coefficients^a

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.690	.533		1.305	.228
	TOC	.741	.104	.930	7.147	.000

^a Dependent Variable: DOC

Figure D-9: Correlation and regression between SUVA (dependent variable) and TOC (independent variable)

Correlations

Correlations

		TOC	SUVA
TOC	Pearson Correlation	1.000	.887**
	Sig. (2-tailed)		.001
	N	10	10
SUVA	Pearson Correlation	.887**	1.000
	Sig. (2-tailed)	.001	
	N	10	10

** . Correlation is significant at the 0.01 level (2-tailed).

Regression

Variables Entered/Removed^a

Model	Variables Entered	Variables Removed	Method
1	TOC ^a		Enter

^a. All requested variables entered.

^b. Dependent Variable: SUVA

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.887 ^a	.786	.759	.328336

^a. Predictors: (Constant), TOC

ANOVA^b

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	3.168	1	3.168	29.388	.001 ^a
	Residual	.862	8	.108		
	Total	4.031	9			

^a. Predictors: (Constant), TOC

^b. Dependent Variable: SUVA

Coefficients^a

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.266	.415		.641	.539
	TOC	.438	.081	.887	5.421	.001

^a. Dependent Variable: SUVA

Figure D-10: Correlation and regression between SUVA (dependent variable) and DOC (independent variable)

Correlations

Correlations

		SUVA	DOC
SUVA	Pearson Correlation	1.000	.731*
	Sig. (2-tailed)		.016
	N	10	10
DOC	Pearson Correlation	.731*	1.000
	Sig. (2-tailed)	.016	
	N	10	10

*. Correlation is significant at the 0.05 level (2-tailed).

Regression

Variables Entered/Removed^a

Model	Variables Entered	Variables Removed	Method
1	DOC ^a		Enter

^a. All requested variables entered.

^b. Dependent Variable: SUVA

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.731 ^a	.534	.476	484293

^a. Predictors: (Constant), DOC

ANOVA^b

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	2.154	1	2.154	9.185	.016 ^a
	Residual	1.876	8	.235		
	Total	4.031	9			

^a. Predictors: (Constant), DOC

^b. Dependent Variable: SUVA

Coefficients^a

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.459	.673		.683	.514
	DOC	.453	.150	.731	3.031	.016

^a. Dependent Variable: SUVA

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