APPENDICES

ลิขสิทธิ์มหาวิทยาลัยเชียงใหม่
Copyright© by Chiang Mai University
All rights reserved

APPENDIX A

A-1 Calculation of Minivol Portable Air Sampler flow calibration (Airmetrics, 2001)

Sampling site	:	The roof of nine story building, Faculty of Science, Chiang Mai University
Calibration date	:	15 July 2010
Time	:	8.40 am
Ambient temperature	:	305.15 K
Ambient barometric pressure	:	726.9979 mmHg

1) Calculation of actual flow rate (Q_{act})

$$Q_{act} = m_{vol} \times \sqrt{\frac{\Delta H \times T_{act}}{P_{act}}} + b_{vol}$$

Where m_{vol} is a slope of linear regression of sampler calibration (5.7013)

b_{vol} is an intercept of linear regression of sampler calibration (-0.0548)

T_{act} is an ambient temperature (K)

P_{act} is an ambient barometric pressure (mmHg)

ลิขสิทธิ์มหาวิทยาลัยเชียงใหม่
Copyright© by Chiang Mai University
All rights reserved

2) Calculation of standard correction flow rate ($Q_{@std}$)

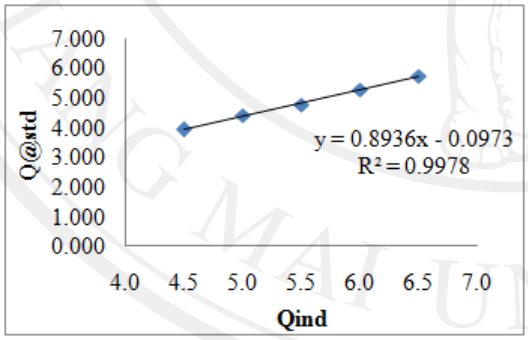
$$Q_{@std} = Q_{act} \times \sqrt{\frac{T_{std} \times P_{act}}{T_{act} \times P_{std}}}$$

Where T_{std} is a standard temperature (298.15 K)

P_{std} is a standard pressure (760 mmHg)

3) Calculation of sampler flow rate from the linear regression (Q_{calc})

Calculate Q_{calc} from linear regression of calibration curve, which constructed by plotting the different Q_{ind} of sampler flow rate versus $Q_{@std}$ obtained from calculation.



Example calculation for Q_{ind} 5.00

Y = 0.8936X - 0.0973

= 0.8936(5.00) - 0.0973

= 4.815 L/min

ลิขสิทธิ์มหาวิทยาลัยเชียงใหม่
Copyright© by Chiang Mai University
All rights reserved

Q_{ind} (L/min)	ΔH (inches of water)	Q_{act} (L/min)	$Q_{@std}$ (L/min)	Q_{calc} (L/min)	Different (%)
4.00	1.24	4.057	3.922	3.912	-0.26
4.50	1.57	4.572	4.420	4.436	0.36
5.00	1.99	5.155	4.983	4.961	-0.45
5.50	2.37	5.630	5.443	5.485	0.77
6.00	2.91	6.245	6.037	6.009	-0.47
6.50	3.40	6.754	6.530	6.533	0.05

A-3 Calculation of PM10 mass concentration (Airmetrics, 2001)

To calculate the PM10 mass concentration for a sample taken with the Minivol Portable Air Sampler, the volume of air that passed through the filter must be calculated.

1) Calculate the volume of air that through the filter during the sampling period at actual ambient conditions, V_{act} (m^3)

$$V_{act} = \frac{60_{min/hrs} \times Q_{act} \times t_{hrs}}{1000_{L/m^3}}$$

Where t_{hrs} is a sampling period (hours)

ลิขสิทธิ์มหาวิทยาลัยเชียงใหม่
Copyright© by Chiang Mai University
All rights reserved

2) Calculate the mass concentration of PM10, divide the net mass gain of the filter by the volume of air that passed through the filter

$$PM_{act} = \frac{M_{PM}}{V_{act}}$$

Where PM_{act} is a PM10mass concentration ($\mu g/m^3$)

M_{PM} is a mass of PM10 collected on the filter (μg)

Example calculation of PM10 mass concentration (Date : 27 February 2010)

1) Calculate the actual flow rate (Q_{act})

$$Q_{act} = 5.7013 \times \sqrt{\frac{1.82 \times 297.15}{727.01}} - 0.0548$$

$$= 4.863 \text{ L/min}$$

2) Calculate the volume of air (V_{act}) in period of 24 hours

$$V_{act} = \frac{60 \times 4.961 \times 24}{1000}$$

$$= 7.1 \text{ m}^3$$

3) Calculate PM10 mass concentration

Pre-exposure weight = 146953 µg and Post-exposure weight = 147063 µg

$$PM_{act} = \frac{147063 - 146953}{7.1}$$

$$= 15.3 \text{ } \mu g/m^3$$

ลิขสิทธิ์มหาวิทยาลัยเชียงใหม่
Copyright© by Chiang Mai University
All rights reserved

APPENDIX B

Table B-1 Concentrations of PM10-bound PAHs from biomass burning in chamber

Biomass Types	PAHs concentrations (µg/ml)															
	NAP	**ACY**	**ACE**	**FLU**	**PHE**	**ANT**	**FLA**	**PYR**	**BaA**	**CHR**	**BbF**	**BkF**	**BaP**	**IND**	**DbA**	**BPER**
L-CD04	0.002	0.003	0.000	0.005	0.029	0.016	0.051	0.044	0.043	0.060	0.070	0.042	0.026	0.031	0.015	0.026
L-CD05	0.002	0.003	0.013	0.044	0.012	0.126	0.076	0.006	0.008	0.008	0.000	0.006	0.005	0.009	0.000	0.005
L-CD06	0.003	0.003	0.000	0.005	0.026	0.015	0.047	0.039	0.035	0.058	0.057	0.033	0.022	0.029	0.014	0.025
L-DK01	0.003	0.003	0.000	0.006	0.053	0.018	0.078	0.063	0.031	0.050	0.032	0.021	0.018	0.017	0.013	0.013
L-DK02	0.002	0.003	0.000	0.006	0.062	0.019	0.003	0.078	0.031	0.051	0.039	0.021	0.017	0.018	0.013	0.016
L-DK03	0.002	0.002	0.000	0.004	0.015	0.014	0.033	0.029	0.035	0.044	0.066	0.039	0.024	0.031	0.016	0.027
L-MR01	0.002	0.003	0.000	0.005	0.047	0.018	0.074	0.065	0.039	0.067	0.049	0.028	0.017	0.020	0.013	0.017
L-MR02	0.002	0.002	0.000	0.004	0.025	0.015	0.037	0.031	0.022	0.034	0.036	0.021	0.015	0.019	0.013	0.019
L-MR03	0.001	0.002	0.000	0.004	0.017	0.014	0.023	0.020	0.017	0.028	0.028	0.018	0.011	0.014	0.014	0.012
M-CD04	0.002	0.002	0.000	0.004	0.015	0.014	0.019	0.017	0.014	0.018	0.017	0.015	0.011	0.016	0.000	0.013
M-CD05	0.002	0.002	0.000	0.004	0.016	0.014	0.019	0.017	0.022	0.027	0.035	0.022	0.018	0.021	0.015	0.016
M-CD05	0.002	0.002	0.000	0.004	0.016	0.014	0.019	0.017	0.024	0.028	0.035	0.022	0.017	0.021	0.015	0.016
M-MC02	0.002	0.002	0.000	0.000	0.011	0.014	0.018	0.016	0.014	0.017	0.015	0.013	0.010	0.014	0.013	0.010
M-MC04	0.003	0.002	0.000	0.000	0.009	0.014	0.014	0.014	0.012	0.015	0.013	0.013	0.010	0.013	0.000	0.010
M-MC05	0.002	0.002	0.000	0.000	0.011	0.014	0.020	0.019	0.014	0.017	0.017	0.015	0.011	0.015	0.000	0.012
M-MR04	0.001	0.002	0.000	0.004	0.012	0.015	0.013	0.011	0.016	0.021	0.024	0.017	0.014	0.016	0.013	0.012
M-MR05	0.001	0.002	0.000	0.000	0.012	0.014	0.018	0.016	0.016	0.021	0.024	0.017	0.015	0.017	0.012	0.013
M-MR06	0.002	0.002	0.000	0.000	0.009	0.013	0.012	0.011	0.016	0.020	0.026	0.018	0.013	0.019	0.013	0.016
RS-CD02	0.003	0.002	0.000	0.000	0.016	0.018	0.025	0.023	0.014	0.017	0.019	0.015	0.014	0.018	0.013	0.013
RS-CD03	0.003	0.002	0.000	0.005	0.018	0.015	0.027	0.025	0.018	0.024	0.037	0.023	0.014	0.023	0.015	0.017
RS-CD06	0.003	0.002	0.000	0.004	0.018	0.019	0.029	0.026	0.019	0.025	0.033	0.021	0.015	0.021	0.000	0.016
RS_DK01	0.003	0.003	0.000	0.005	0.016	0.017	0.051	0.052	0.053	0.059	0.109	0.053	0.044	0.044	0.018	0.033
RS_DK05	0.003	0.003	0.000	0.005	0.017	0.020	0.039	0.040	0.030	0.039	0.080	0.044	0.032	0.038	0.018	0.029
RS_DK06	0.002	0.003	0.000	0.005	0.014	0.015	0.024	0.024	0.026	0.031	0.050	0.029	0.020	0.026	0.014	0.019
RS_MR01	0.002	0.003	0.012	0.005	0.017	0.018	0.052	0.053	0.032	0.038	0.058	0.031	0.026	0.029	0.016	0.023
RS_MR03	0.002	0.003	0.000	0.006	0.045	0.027	0.110	0.105	0.068	0.055	0.062	0.034	0.029	0.025	0.015	0.019
RS_MR05	0.003	0.003	0.189	0.005	0.028	0.017	0.047	0.044	0.053	0.065	0.106	0.053	0.043	0.043	0.018	0.034

ลิขสิทธิ์มหาวิทยาลัยเชียงใหม่
Copyright© by Chiang Mai University
All rights reserved

Table B-1 (Continued)

Biomass Types	PAHs concentrations (μg/gPM10)															
	NAP	**ACY**	**ACE**	**FLU**	**PHE**	**ANT**	**FLA**	**PYR**	**BaA**	**CHR**	**BbF**	**BkF**	**BaP**	**IND**	**DbA**	**BPER**
L-CD04	0.004	0.005	0.000	0.009	0.055	0.029	0.096	0.082	0.080	0.113	0.131	0.078	0.049	0.057	0.028	0.048
L-CD05	0.004	0.005	0.022	0.075	0.021	0.218	0.132	0.011	0.013	0.014	0.000	0.010	0.009	0.015	0.000	0.009
L-CD06	0.006	0.006	0.000	0.010	0.057	0.033	0.106	0.087	0.079	0.131	0.128	0.075	0.049	0.064	0.032	0.056
L-DK01	0.005	0.005	0.000	0.011	0.089	0.030	0.130	0.106	0.053	0.084	0.053	0.035	0.030	0.029	0.022	0.022
L-DK02	0.003	0.004	0.000	0.009	0.088	0.027	0.004	0.111	0.044	0.073	0.056	0.030	0.025	0.026	0.018	0.023
L-DK03	0.003	0.003	0.000	0.006	0.021	0.020	0.046	0.041	0.049	0.062	0.093	0.055	0.033	0.044	0.022	0.037
L-MR01	0.004	0.005	0.000	0.009	0.084	0.031	0.131	0.116	0.070	0.119	0.087	0.050	0.030	0.035	0.023	0.030
L-MR02	0.005	0.007	0.000	0.013	0.073	0.042	0.107	0.090	0.063	0.099	0.103	0.062	0.044	0.056	0.038	0.054
L-MR03	0.003	0.006	0.000	0.012	0.047	0.038	0.063	0.055	0.047	0.076	0.075	0.048	0.030	0.039	0.039	0.031
M-CD04	0.008	0.008	0.000	0.016	0.055	0.052	0.069	0.062	0.052	0.065	0.061	0.054	0.039	0.056	0.000	0.047
M-CD05	0.005	0.006	0.000	0.012	0.043	0.039	0.051	0.048	0.060	0.073	0.095	0.061	0.049	0.057	0.040	0.044
M-CD05	0.007	0.009	0.000	0.017	0.062	0.057	0.074	0.069	0.095	0.111	0.140	0.089	0.067	0.083	0.061	0.065
M-MC02	0.010	0.010	0.000	0.000	0.051	0.064	0.082	0.075	0.063	0.078	0.067	0.058	0.048	0.063	0.059	0.045
M-MC04	0.014	0.010	0.000	0.000	0.042	0.065	0.066	0.064	0.057	0.070	0.060	0.062	0.048	0.060	0.000	0.046
M-MC05	0.011	0.010	0.000	0.000	0.054	0.065	0.094	0.090	0.065	0.081	0.083	0.069	0.053	0.070	0.000	0.056
M-MR04	0.007	0.011	0.000	0.021	0.057	0.071	0.062	0.055	0.077	0.104	0.117	0.084	0.069	0.078	0.065	0.060
M-MR05	0.005	0.008	0.000	0.000	0.040	0.047	0.059	0.052	0.055	0.070	0.081	0.058	0.051	0.057	0.039	0.045
M-MR06	0.010	0.011	0.000	0.000	0.047	0.068	0.059	0.057	0.079	0.102	0.131	0.089	0.067	0.096	0.068	0.080
RS-CD02	0.014	0.010	0.000	0.000	0.069	0.077	0.109	0.102	0.061	0.075	0.083	0.066	0.060	0.078	0.058	0.055
RS-CD03	0.009	0.007	0.000	0.015	0.057	0.047	0.088	0.082	0.059	0.078	0.121	0.074	0.047	0.073	0.047	0.054
RS-CD06	0.013	0.010	0.000	0.017	0.076	0.079	0.120	0.110	0.080	0.103	0.135	0.086	0.064	0.088	0.000	0.064
RS_DK01	0.005	0.006	0.000	0.010	0.035	0.036	0.109	0.113	0.114	0.128	0.236	0.114	0.094	0.095	0.039	0.071
RS_DK05	0.007	0.007	0.000	0.011	0.039	0.046	0.092	0.094	0.070	0.093	0.187	0.103	0.075	0.090	0.043	0.068
RS_DK06	0.007	0.008	0.000	0.014	0.045	0.047	0.073	0.073	0.080	0.097	0.154	0.089	0.062	0.081	0.044	0.059
RS_MR01	0.005	0.006	0.025	0.010	0.036	0.038	0.110	0.112	0.068	0.080	0.124	0.065	0.055	0.062	0.034	0.049
RS_MR03	0.004	0.006	0.000	0.011	0.088	0.053	0.216	0.207	0.134	0.109	0.121	0.066	0.056	0.049	0.030	0.037
RS_MR05	0.006	0.006	0.403	0.011	0.060	0.036	0.101	0.094	0.113	0.139	0.226	0.114	0.092	0.092	0.039	0.072

ลิขสิทธิ์มหาวิทยาลัยเชียงใหม่
Copyright© by Chiang Mai University
All rights reserved

Table B-1 (Continued)

Biomass Types	PAHs concentrations (μg/kg$_{dry}$)															
	NAP	**ACY**	**ACE**	**FLU**	**PHE**	**ANT**	**FLA**	**PYR**	**BaA**	**CHR**	**BbF**	**BkF**	**BaP**	**IND**	**DbA**	**BPER**
L-CD04	0.005	0.006	0.000	0.011	0.071	0.037	0.122	0.106	0.103	0.144	0.168	0.100	0.063	0.074	0.036	0.062
L-CD05	0.005	0.007	0.030	0.103	0.028	0.298	0.180	0.015	0.018	0.019	0.000	0.014	0.012	0.021	0.000	0.012
L-CD06	0.006	0.006	0.000	0.011	0.060	0.034	0.110	0.090	0.082	0.136	0.133	0.078	0.051	0.066	0.033	0.058
L-DK01	0.007	0.007	0.000	0.015	0.128	0.043	0.187	0.152	0.076	0.120	0.077	0.050	0.043	0.042	0.031	0.032
L-DK02	0.005	0.008	0.000	0.016	0.150	0.046	0.007	0.190	0.076	0.124	0.096	0.051	0.042	0.045	0.031	0.039
L-DK03	0.005	0.006	0.000	0.010	0.034	0.033	0.076	0.068	0.081	0.102	0.152	0.091	0.055	0.071	0.037	0.061
L-MR01	0.005	0.006	0.000	0.012	0.118	0.044	0.184	0.162	0.098	0.167	0.121	0.070	0.042	0.050	0.032	0.042
L-MR02	0.004	0.006	0.000	0.011	0.060	0.035	0.089	0.075	0.052	0.082	0.086	0.051	0.036	0.047	0.032	0.045
L-MR03	0.003	0.006	0.000	0.011	0.042	0.034	0.057	0.050	0.043	0.069	0.067	0.043	0.027	0.035	0.035	0.028
M-CD04	0.005	0.006	0.000	0.011	0.037	0.035	0.046	0.042	0.035	0.044	0.041	0.036	0.027	0.038	0.000	0.031
M-CD05	0.004	0.006	0.000	0.011	0.038	0.034	0.045	0.042	0.053	0.065	0.084	0.054	0.043	0.050	0.035	0.039
M-CD05	0.004	0.006	0.000	0.010	0.037	0.034	0.044	0.041	0.057	0.066	0.084	0.053	0.040	0.050	0.037	0.039
M-MC02	0.006	0.005	0.000	0.000	0.028	0.034	0.044	0.040	0.034	0.042	0.036	0.031	0.026	0.034	0.032	0.024
M-MC04	0.007	0.005	0.000	0.000	0.021	0.033	0.034	0.033	0.029	0.036	0.031	0.032	0.025	0.031	0.000	0.024
M-MC05	0.005	0.005	0.000	0.000	0.027	0.033	0.048	0.045	0.033	0.041	0.042	0.035	0.027	0.035	0.000	0.028
M-MR04	0.003	0.005	0.000	0.011	0.028	0.036	0.031	0.028	0.039	0.052	0.059	0.042	0.035	0.039	0.033	0.030
M-MR05	0.003	0.006	0.000	0.000	0.029	0.034	0.043	0.038	0.040	0.051	0.059	0.042	0.037	0.042	0.028	0.033
M-MR06	0.005	0.005	0.000	0.000	0.023	0.033	0.028	0.027	0.038	0.049	0.063	0.043	0.032	0.046	0.033	0.039
RS-CD02	0.004	0.003	0.000	0.000	0.019	0.022	0.031	0.028	0.017	0.021	0.023	0.018	0.017	0.022	0.016	0.015
RS-CD03	0.003	0.003	0.000	0.005	0.021	0.018	0.033	0.031	0.022	0.029	0.045	0.027	0.017	0.027	0.018	0.020
RS-CD06	0.004	0.003	0.000	0.005	0.022	0.023	0.035	0.032	0.024	0.030	0.040	0.025	0.019	0.026	0.000	0.019
RS_DK01	0.003	0.003	0.000	0.006	0.020	0.020	0.063	0.065	0.066	0.073	0.135	0.065	0.054	0.055	0.022	0.041
RS_DK05	0.004	0.003	0.000	0.006	0.020	0.024	0.047	0.048	0.036	0.048	0.096	0.053	0.038	0.046	0.022	0.035
RS_DK06	0.003	0.003	0.000	0.006	0.017	0.018	0.029	0.029	0.031	0.038	0.060	0.035	0.024	0.032	0.017	0.023
RS_MR01	0.003	0.003	0.014	0.006	0.021	0.022	0.064	0.065	0.039	0.046	0.072	0.038	0.032	0.036	0.019	0.028
RS_MR03	0.003	0.004	0.000	0.007	0.055	0.033	0.136	0.130	0.084	0.068	0.076	0.041	0.035	0.030	0.019	0.024
RS_MR05	0.003	0.004	0.230	0.006	0.034	0.020	0.058	0.053	0.065	0.079	0.129	0.065	0.053	0.052	0.022	0.041

ลิขสิทธิ์มหาวิทยาลัยเชียงใหม่
Copyright© by Chiang Mai University
All rights reserved

Table B-2 Concentrations of PM10 in ambient air

day/month/year	PM10 ($\mu g/m^3$)	day/month/year	PM10 ($\mu g/m^3$)	day/month/year	PM10 ($\mu g/m^3$)	day/month/year	PM10 ($\mu g/m^3$)	day/month/year	PM10 ($\mu g/m^3$)
6/4/2010	146.5	2/9/2010	7.1	17/10/2010	12.5	29/1/2011	23.2	8/3/2011	67.9
8/4/2010	157.3	5/9/2010	8.6	18/10/2010	11.2	1/2/2011	24.8	9/3/2011	54.4
10/4/2010	124.8	9/9/2010	9.5	19/10/2010	14.2	3/2/2011	26.6	10/3/2011	21.7
12/4/2010	132.8	12/9/2010	5.4	21/10/2010	26.9	5/2/2011	47.5	11/3/2011	46.4
14/4/2010	102.2	16/9/2010	9.3	22/10/2010	4.5	7/2/2011	49.6	12/3/2011	35.9
16/4/2010	95.2	19/9/2010	16.6	23/10/2010	5.1	9/2/2011	44.5	13/3/2011	47.0
19/4/2010	109.5	23/9/2010	22.7	26/10/2010	5.4	13/2/2011	14.5	14/3/2011	18.7
21/4/2010	87.6	26/9/2010	10.7	27/10/2010	15.2	15/2/2011	13.0	15/3/2011	29.4
23/4/2010	73.1	30/9/2010	20.0	28/10/2010	6.3	17/2/2011	14.5	17/3/2011	2.4
25/4/2010	65.6	4/10/2010	22.3	1/11/2010	27.64	19/2/2011	20.8	19/3/2011	26.1
27/4/2010	59.5	5/10/2010	17.4	2/11/2010	17.87	24/2/2011	43.5	21/3/2011	31.3
1/8/2010	30.6	6/10/2010	9.2	3/11/2010	39.64	26/2/2011	82.9	23/3/2011	62.7
5/8/2010	0.7	7/10/2010	6.6	4/11/2010	57.17	28/2/2011	52.6	25/3/2011	37.1
8/8/2010	14.1	8/10/2010	27.4	5/1/2011	15.3	1/3/2011	50.4	27/3/2011	72.0
12/8/2010	3.7	9/10/2010	16.8	8/1/2011	19.0	2/3/2011	51.9		
15/8/2010	1.7	10/10/2010	0.8	11/1/2011	8.2	3/3/2011	42.8		
19/8/2010	3.6	12/10/2010	6.3	14/1/2011	45.4	4/3/2011	25.5		
22/8/2010	9.6	13/10/2010	3.5	19/1/2011	29.9	5/3/2011	27.9		
26/8/2010	7.3	15/10/2010	5.4	22/1/2011	18.7	6/3/2011	39.9		
29/8/2010	13.9	16/10/2010	2.9	26/1/2011	24.3	7/3/2011	75.6		

ลิขสิทธิ์มหาวิทยาลัยเชียงใหม่
Copyright© by Chiang Mai University
All rights reserved

Table B-3 Concentrations of PAHs from PM10 in ambient air in the dry season of 2010

PAHs	Concentration ng/m^3										
	6/4/2010	8/4/2010	10/4/2010	12/4/2010	14/4/2010	16/4/2010	19/4/2010	21/4/2010	23/4/2010	25/4/2010	27/4/2010
NAP	1.00	1.98	1.11	1.23	0.78	0.83	2.18	1.22	1.32	0.52	1.07
ACY	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ACE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
FLU	2.12	2.07	1.89	1.90	1.89	1.94	2.12	1.88	1.75	1.71	1.70
PHE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ANT	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
FLA	5.11	2.78	2.61	2.66	2.50	2.45	2.52	2.39	5.20	2.36	0.00
PYR	2.74	1.21	0.99	1.09	0.00	0.00	0.00	0.00	0.00	0.00	0.00
BaA	4.77	3.93	3.74	3.58	3.69	3.44	0.00	3.37	0.00	0.00	0.00
CHR	5.45	3.01	2.61	2.31	2.15	2.21	2.16	1.74	0.00	1.48	0.00
BbF	1.60	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
BkF	7.23	4.93	5.51	3.83	3.88	3.63	3.98	3.75	0.00	0.00	0.00
BaP	4.25	4.11	4.29	3.72	3.88	0.00	2.96	3.15	0.00	0.00	0.00
IND	4.24	6.33	5.57	5.55	5.13	4.88	5.27	4.88	4.73	4.62	4.33
DbA	0.00	1.63	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
BPER	5.74	4.88	4.17	4.00	3.75	3.45	3.76	3.43	3.32	2.88	2.93
tPAHs	**44.26**	**36.87**	**32.48**	**29.85**	**27.64**	**22.83**	**24.95**	**25.81**	**16.33**	**13.57**	**10.03**
nc PAHs	**16.72**	**12.92**	**10.77**	**10.87**	**8.92**	**8.67**	**10.58**	**8.92**	**11.60**	**7.47**	**5.70**
cPAHs	**27.54**	**23.95**	**21.72**	**18.98**	**18.72**	**14.16**	**14.37**	**16.89**	**4.73**	**6.10**	**4.33**
PM10(µg/m^3)	**146.50**	**157.30**	**124.80**	**132.78**	**102.19**	**95.17**	**109.49**	**87.61**	**73.11**	**65.59**	**59.48**

ลิขสิทธิ์มหาวิทยาลัยเชียงใหม่
Copyright© by Chiang Mai University
All rights reserved

Table B-4 Concentrations of PAHs from PM10 in ambient air in the wet season of 2010

PAHs	Concentration ng/m^3											
	1/8/2010	**5/8/2010**	**8/8/2010**	**12/8/2010**	**15/8/2010**	**19/8/2010**	**22/8/2010**	**26/8/2010**	**29/8/2010**	**2/9/2010**	**5/9/2010**	**9/9/2010**
NAP	0.58	0.75	0.71	0.49	0.00	0.51	0.14	0.36	0.57	0.05	0.54	0.68
ACY	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ACE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
FLU	0.27	0.26	0.26	0.26	0.25	0.27	0.26	0.26	0.26	0.00	0.24	0.29
PHE	0.00	0.25	0.28	0.00	0.22	0.24	0.21	0.20	0.00	0.00	0.00	0.00
ANT	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
FLA	0.23	0.21	1.70	0.20	0.00	0.20	0.20	0.19	0.00	0.49	0.50	0.00
PYR	0.48	0.49	0.99	0.45	0.00	0.47	0.45	0.45	0.00	0.55	0.71	0.00
BaA	0.65	0.66	0.69	0.00	0.00	0.00	0.00	0.00	0.00	0.91	0.00	0.00
CHR	0.21	0.23	0.00	0.23	0.00	0.22	0.00	0.00	0.00	0.38	0.00	0.00
BbF	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.65	0.00	0.00
BkF	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.34	0.00	0.00
BaP	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
IND	0.00	0.49	0.35	0.37	0.00	0.00	0.00	0.00	0.00	0.54	0.00	0.00
DbA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
BPER	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.57	0.00	0.00
tPAHs	**2.41**	**3.34**	**4.98**	**2.01**	**0.47**	**1.90**	**1.26**	**1.47**	**0.83**	**5.47**	**1.99**	**0.97**
nc PAHs	**1.56**	**1.96**	**3.93**	**1.41**	**0.47**	**1.68**	**1.26**	**1.47**	**0.83**	**1.66**	**1.99**	**0.97**
cPAHs	**0.86**	**1.38**	**1.05**	**0.60**	**0.00**	**0.22**	**0.00**	**0.00**	**0.00**	**3.81**	**0.00**	**0.00**
PM10(µg/m^3)	**30.62**	**0.73**	**14.13**	**3.74**	**1.73**	**3.55**	**9.57**	**7.34**	**13.94**	**7.11**	**8.61**	**9.52**

ลิขสิทธิ์มหาวิทยาลัยเชียงใหม่
Copyright© by Chiang Mai University
All rights reserved

Table B-4 Concentrations of PAHs from PM10 in ambient air in the wet season of 2010 (continued)

PAHs	Concentration ng/m^3										
	12/9/2010	**16/9/2010**	**19/9/2010**	**23/9/2010**	**26/9/2010**	**30/9/2010**	**4/10/2010**	**5/10/2010**	**6/10/2010**	**7/10/2010**	**8/10/2010**
NAP	0.07	0.47	0.00	0.00	0.21	0.17	0.25	0.30	0.30	0.37	0.44
ACY	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.00	0.05	0.05	0.05
ACE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.07	0.05
FLU	0.27	0.26	0.25	0.26	0.26	0.00	0.18	0.20	0.17	0.16	0.18
PHE	0.00	0.00	0.00	0.00	0.00	0.33	0.34	0.37	0.36	0.33	0.48
ANT	0.00	0.00	0.00	0.00	0.00	0.40	0.33	0.40	0.38	0.57	0.39
FLA	0.00	0.00	0.00	0.00	0.00	0.00	0.22	0.21	0.17	0.16	0.17
PYR	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
BaA	0.00	0.00	0.00	0.00	0.00	0.00	0.58	0.58	0.50	0.49	0.50
CHR	0.00	0.00	0.00	0.00	0.00	0.00	0.60	0.59	0.56	0.55	0.54
BbF	0.00	0.00	0.00	0.00	0.00	0.00	1.13	1.39	1.05	0.92	0.72
BkF	0.00	0.00	0.00	0.00	0.00	0.00	0.87	1.46	0.81	0.78	0.73
BaP	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.42	0.42	0.00	0.00
IND	0.00	0.00	0.00	0.00	0.00	0.00	1.19	1.23	1.03	0.73	1.00
DbA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
BPER	0.00	0.00	0.00	0.00	0.00	0.00	1.14	1.10	1.15	0.75	0.99
tPAHs	**0.35**	**0.74**	**0.25**	**0.26**	**0.46**	**0.90**	**6.87**	**8.28**	**6.96**	**5.94**	**6.26**
nc PAHs	**0.35**	**0.74**	**0.25**	**0.26**	**0.46**	**0.90**	**2.50**	**2.60**	**2.59**	**2.47**	**2.76**
cPAHs	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**4.37**	**5.68**	**4.38**	**3.48**	**3.50**
PM10(µg/m^3)	**5.42**	**9.34**	**16.59**	**22.69**	**10.66**	**20.00**	**22.28**	**17.40**	**9.25**	**6.61**	**27.44**

ลิขสิทธิ์มหาวิทยาลัยเชียงใหม่
Copyright© by Chiang Mai University
All rights reserved

Table B-4 Concentrations of PAHs from PM10 in ambient air in the wet season of 2010 (continued)

PAHs	Concentration ng/m^3									
	9/10/2010	**10/10/2010**	**12/10/2010**	**13/10/2010**	**15/10/2010**	**16/10/2010**	**17/10/2010**	**18/10/2010**	**19/10/2010**	**21/10/2010**
NAP	0.38	0.06	0.41	0.27	0.32	0.24	0.36	0.34	0.20	0.13
ACY	0.04	0.00	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ACE	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
FLU	0.17	0.14	0.16	0.14	0.11	0.10	0.10	0.11	0.09	0.09
PHE	0.41	0.30	0.34	0.32	0.28	0.29	0.31	0.26	0.28	0.28
ANT	0.29	0.26	0.29	0.27	0.30	0.37	0.26	0.18	0.00	0.29
FLA	0.18	0.14	0.14	0.15	0.08	0.09	0.96	0.08	0.07	0.08
PYR	0.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
BaA	0.63	0.46	0.47	0.46	0.45	0.41	0.37	0.00	0.00	0.00
CHR	0.58	0.52	0.53	0.54	0.52	0.51	0.46	0.00	0.00	0.00
BbF	0.77	0.63	0.71	0.75	0.60	0.34	0.34	0.56	0.58	0.00
BkF	0.72	0.62	0.77	0.65	0.62	0.36	0.36	0.00	0.00	0.00
BaP	0.00	0.00	0.00	0.00	0.00	0.42	0.42	0.00	0.00	0.00
IND	1.04	0.56	1.19	0.69	1.06	0.22	0.22	0.00	0.53	0.00
DbA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
BPER	0.72	0.53	0.75	0.66	0.98	0.23	0.23	0.00	0.42	0.62
tPAHs	**6.05**	**4.22**	**5.78**	**4.90**	**5.31**	**3.60**	**4.39**	**1.53**	**2.16**	**1.49**
nc PAHs	**2.32**	**1.43**	**2.12**	**1.81**	**2.06**	**1.33**	**2.22**	**0.96**	**1.05**	**1.49**
cPAHs	**3.73**	**2.79**	**3.66**	**3.09**	**3.25**	**2.27**	**2.17**	**0.56**	**1.11**	**0.00**
PM10(µg/m^3)	**16.80**	**0.82**	**6.29**	**3.51**	**5.38**	**2.87**	**12.53**	**11.16**	**14.17**	**26.86**

ลิขสิทธิ์มหาวิทยาลัยเชียงใหม่
Copyright© by Chiang Mai University
All rights reserved

Table B-4 Concentrations of PAHs from PM10 in ambient air in the wet season of 2010 (continued)

PAHs	Concentration ng/m^3								
	22/10/2010	**23/10/2010**	**26/10/2010**	**27/10/2010**	**28/10/2010**	**1/11/2010**	**2/11/2010**	**3/11/2010**	**4/11/2010**
NAP	0.18	0.20	0.20	0.16	0.20	1.03	1.34	0.80	0.72
ACY	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ACE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
FLU	0.11	0.10	0.10	0.09	0.10	0.20	0.11	0.00	0.12
PHE	0.00	0.29	0.00	0.30	0.00	0.00	0.25	0.24	0.26
ANT	0.00	0.25	0.00	0.31	0.00	0.00	0.67	0.36	0.60
FLA	0.20	0.00	0.13	0.11	0.12	0.00	0.32	0.39	0.55
PYR	0.00	0.00	0.00	0.00	0.00	0.00	0.39	0.35	0.48
BaA	0.58	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CHR	0.00	0.00	0.00	0.52	0.50	0.08	0.18	0.21	0.29
BbF	0.00	0.00	0.00	0.70	0.00	0.00	0.00	0.30	0.50
BkF	0.00	0.00	0.00	0.61	0.00	0.00	0.00	0.00	0.00
BaP	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
IND	0.81	1.27	0.92	0.62	0.72	0.00	0.00	0.66	0.98
DbA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
BPER	0.81	0.79	0.70	0.64	0.64	0.00	0.00	0.00	0.66
tPAHs	**2.68**	**2.90**	**2.06**	**4.07**	**2.28**	**1.31**	**3.27**	**3.32**	**5.17**
nc PAHs	**1.30**	**1.64**	**1.14**	**1.62**	**1.06**	**1.24**	**3.08**	**2.14**	**3.39**
cPAHs	**1.38**	**1.27**	**0.92**	**2.45**	**1.22**	**0.08**	**0.18**	**1.18**	**1.78**
PM10(µg/m^3)	**4.47**	**5.15**	**5.42**	**15.22**	**6.35**	**27.64**	**17.87**	**39.64**	**57.17**

ลิขสิทธิ์มหาวิทยาลัยเชียงใหม่
Copyright© by Chiang Mai University
All rights reserved

Table B-5 Concentrations of PAHs from PM10 in ambient air in the dry season of 2011

PAHs	Concentration ng/m^3										
	5/1/2011	**8/1/2011**	**11/1/2011**	**14/1/2011**	**19/1/2011**	**22/1/2011**	**26/1/2011**	**29/1/2011**	**1/2/2011**	**3/2/2011**	**5/2/2011**
NAP	0.42	0.93	1.07	0.76	1.14	0.72	0.60	0.57	0.45	0.35	0.09
ACY	0.00	0.00	0.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ACE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
FLU	0.00	0.18	0.18	0.16	0.13	0.12	0.09	0.13	0.08	0.10	0.10
PHE	0.18	0.49	0.81	0.37	0.28	0.22	0.14	0.25	0.07	0.30	0.18
ANT	0.42	1.00	0.69	0.42	0.32	0.38	0.20	0.25	0.09	0.21	0.13
FLA	0.33	0.78	1.10	0.69	0.36	0.29	0.25	0.40	0.23	0.40	0.35
PYR	0.41	0.84	1.09	0.75	0.46	0.37	0.32	0.22	0.31	0.42	0.39
BaA	0.00	0.12	0.07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CHR	0.17	0.24	0.29	0.23	0.20	0.18	0.13	0.25	0.00	0.18	0.19
BbF	0.00	0.44	0.49	0.29	0.37	0.00	0.00	0.00	0.00	0.00	0.00
BkF	0.00	0.49	0.50	0.58	0.00	0.00	0.00	0.00	0.00	0.31	0.00
BaP	0.00	0.00	0.54	0.32	0.00	0.36	0.00	0.28	0.00	0.00	0.32
IND	0.61	0.46	0.71	0.65	0.44	0.59	0.38	0.43	0.35	0.38	0.59
DbA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
BPER	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
tPAHs	**2.54**	**5.97**	**7.59**	**5.24**	**3.69**	**3.22**	**2.11**	**2.78**	**1.57**	**2.65**	**2.34**
nc PAHs	**1.76**	**4.23**	**5.00**	**3.16**	**2.67**	**2.09**	**1.60**	**1.82**	**1.21**	**1.77**	**1.24**
cPAHs	**0.78**	**1.75**	**2.59**	**2.08**	**1.01**	**1.13**	**0.51**	**0.96**	**0.35**	**0.87**	**1.10**
PM10(µg/m^3)	**15.31**	**18.99**	**8.21**	**45.40**	**29.91**	**18.67**	**24.31**	**23.24**	**24.78**	**26.55**	**47.46**

ลิขสิทธิ์มหาวิทยาลัยเชียงใหม่
Copyright© by Chiang Mai University
All rights reserved

Table B-5 Concentrations of PAHs from PM10 in ambient air in the dry season of 2011 (continued)

PAHs	Concentration ng/m^3									
	7/2/2011	**9/2/2011**	**13/2/2011**	**15/2/2011**	**17/2/2011**	**19/2/2011**	**24/2/2011**	**26/2/2011**	**28/2/2011**	**1/3/2011**
NAP	0.00	0.68	0.38	0.46	0.09	0.92	0.75	0.86	1.25	1.02
ACY	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ACE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
FLU	0.09	0.11	0.16	0.11	0.07	0.06	0.08	0.12	0.18	0.09
PHE	0.09	0.17	0.37	0.14	0.44	0.12	0.43	0.17	0.49	0.19
ANT	0.19	0.30	0.38	0.74	0.36	0.24	0.35	0.31	0.40	0.41
FLA	0.29	0.35	0.67	1.02	0.00	0.00	0.00	0.37	0.68	0.00
PYR	0.30	0.48	0.60	0.92	0.00	0.00	0.00	0.49	0.53	0.00
BaA	0.00	0.00	0.00	0.08	0.13	0.00	0.08	0.00	0.00	0.00
CHR	0.15	0.22	0.21	0.29	0.45	0.19	0.38	0.24	0.00	0.00
BbF	0.00	0.32	0.00	0.42	0.52	0.51	0.52	0.37	0.00	0.62
BkF	0.00	0.56	0.00	0.59	0.58	0.43	0.00	0.00	0.00	0.00
BaP	0.00	0.41	0.49	0.44	0.57	0.26	0.60	0.55	0.00	0.00
IND	0.56	0.77	0.59	0.83	0.91	0.40	0.72	0.73	0.64	0.72
DbA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
BPER	0.00	0.83	0.00	1.40	1.26	0.68	0.00	0.60	0.00	0.00
tPAHs	**1.67**	**5.19**	**3.85**	**7.41**	**5.37**	**3.81**	**3.91**	**4.83**	**4.18**	**3.06**
nc PAHs	**0.96**	**2.92**	**2.55**	**4.78**	**2.22**	**2.02**	**1.61**	**2.93**	**3.54**	**1.71**
cPAHs	**0.71**	**2.27**	**1.30**	**2.63**	**3.15**	**1.79**	**2.29**	**1.90**	**0.64**	**1.34**
PM10(µg/m^3)	**49.60**	**44.47**	**14.47**	**12.97**	**14.51**	**20.77**	**43.49**	**82.92**	**52.64**	**50.44**

ลิขสิทธิ์มหาวิทยาลัยเชียงใหม่
Copyright© by Chiang Mai University
All rights reserved

Table B-5 Concentrations of PAHs from PM10 in ambient air in the dry season of 2011 (continued)

PAHs	Concentration ng/m^3									
	2/3/2011	**3/3/2011**	**4/3/2011**	**5/3/2011**	**6/3/2011**	**7/3/2011**	**8/3/2011**	**9/3/2011**	**10/3/2011**	**11/3/2011**
NAP	1.10	0.76	0.47	0.14	0.60	0.31	1.94	1.34	1.29	1.50
ACY	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ACE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
FLU	0.15	0.10	0.09	0.08	0.09	0.10	0.00	0.00	0.00	0.00
PHE	0.23	0.17	0.16	0.00	0.21	0.83	0.64	0.35	0.00	0.58
ANT	0.47	0.29	0.44	0.00	0.42	0.00	0.45	0.51	0.61	0.24
FLA	0.73	1.03	0.46	0.00	0.00	0.00	0.68	0.19	3.16	0.24
PYR	0.62	0.96	0.43	0.00	0.00	0.00	0.42	0.04	3.73	0.03
BaA	0.15	0.16	0.00	0.00	0.00	0.00	0.23	0.24	0.22	0.36
CHR	0.24	0.26	0.17	0.22	0.00	0.61	0.34	0.42	0.35	0.34
BbF	0.49	0.58	0.00	0.00	0.54	0.54	0.92	0.49	0.63	0.00
BkF	0.00	0.00	0.00	0.51	0.00	0.82	0.00	0.00	0.00	0.00
BaP	0.00	0.26	0.00	0.00	0.00	0.61	0.00	0.00	0.00	0.00
IND	0.71	0.66	0.43	0.42	0.63	0.83	0.86	0.55	0.96	0.64
DbA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
BPER	0.00	0.00	0.00	0.00	0.00	0.59	0.77	0.56	0.66	0.70
tPAHs	**4.88**	**5.23**	**2.64**	**1.36**	**2.49**	**5.24**	**7.26**	**4.68**	**11.61**	**4.62**
nc PAHs	**3.31**	**3.31**	**2.04**	**0.22**	**1.32**	**1.82**	**4.91**	**2.98**	**9.45**	**3.29**
cPAHs	**1.58**	**1.93**	**0.59**	**1.14**	**1.17**	**3.42**	**2.35**	**1.70**	**2.16**	**1.33**
PM10(µg/m^3)	**51.89**	**42.84**	**25.48**	**27.91**	**39.91**	**75.55**	**67.85**	**54.36**	**21.75**	**46.38**

ลิขสิทธิ์มหาวิทยาลัยเชียงใหม่
Copyright© by Chiang Mai University
All rights reserved

Table B-5 Concentrations of PAHs from PM10 in ambient air in the dry season of 2011 (continued)

PAHs	Concentration ng/m^3									
	12/3/2011	**13/3/2011**	**14/3/2011**	**15/3/2011**	**17/3/2011**	**19/3/2011**	**21/3/2011**	**23/3/2011**	**25/3/2011**	**27/3/2011**
NAP	2.30	0.85	1.43	1.26	1.33	1.40	1.90	1.81	1.84	1.05
ACY	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ACE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
FLU	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PHE	0.61	0.39	0.74	0.00	0.41	0.10	0.36	0.62	0.57	0.58
ANT	0.74	0.54	0.64	0.00	0.91	0.24	0.51	0.55	0.90	1.16
FLA	0.64	0.48	1.32	0.50	0.26	0.16	0.44	0.03	0.22	0.10
PYR	1.43	0.39	0.70	1.19	1.20	0.55	0.29	0.00	0.09	0.04
BaA	0.35	0.37	0.31	0.00	0.00	0.30	0.43	0.24	0.24	0.25
CHR	0.41	0.37	0.25	0.30	0.00	0.27	0.42	0.21	0.25	0.21
BbF	0.49	0.00	0.00	0.00	0.00	0.00	1.02	0.42	0.48	0.32
BkF	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.01	0.00	0.00
BaP	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
IND	0.53	0.62	0.47	0.46	0.41	0.37	0.67	0.61	0.77	0.52
DbA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
BPER	0.51	0.79	0.65	0.44	0.45	0.49	0.49	0.54	0.66	0.56
tPAHs	**8.02**	**4.80**	**6.51**	**4.13**	**4.98**	**3.90**	**6.53**	**5.04**	**6.02**	**4.78**
nc PAHs	**6.22**	**3.44**	**5.47**	**3.38**	**4.57**	**2.95**	**3.99**	**3.54**	**4.29**	**3.49**
cPAHs	**1.79**	**1.36**	**1.03**	**0.76**	**0.41**	**0.95**	**2.54**	**1.49**	**1.73**	**1.30**
PM10(µg/m^3)	**35.89**	**46.99**	**18.73**	**29.35**	**2.38**	**26.09**	**31.31**	**62.72**	**37.15**	**72.00**

ลิขสิทธิ์มหาวิทยาลัยเชียงใหม่
Copyright© by Chiang Mai University
All rights reserved

CURRICULUM VITAE

Name	Mr. Wan Wiriya
Date of birth	September 20, 1981
Education	B.S. (Biochemistry and Biochemtechnology), Chiang Mai University, 2004 M.S. (Environmental Science), Chiang Mai University, 2004
Scholarship	Ph.D scholarship from the Office of the Higher Education Commission (OHEC), Thailand, under the Strategic Scholarships for Frontier Research Network

Oral presentations

Wiriya, W., and Chantara, S. Potential sources of PM_{10}-bound polycyclic aromatic hydrocarbons in Chiang Mai, Thailand. Commission on Higher Education Congress IIII: University hydrocarbons in Chiang Mai, Thailand. The second International Conference on Air Pollution and Control (CAPACII), Turkey, 18-23 September 2011.

Wiriya W., and Chantara S., 2011, Potential sources of PM_{10}-bound polycyclic aromatic hydrocarbons in Chiang Mai, Thailand. Commission on Higher Education Congress IV:University Staff Development Consortium CHE-USDC Congress IV, 14-16 September 2011, The Zign Hotel, Pattaya, Chonburi.

Wiriya, W., and Chantara, S. Possible sources of atmospheric dry deposition in Chiang Mai Province; year 2006 – 2007.13th International Conference on Integrated Diffuse Pollution Management (IWA DIPCON 2009), Seoul, Korea, 12-15 October 2009.

ลิขสิทธิ์มหาวิทยาลัยเชียงใหม่
Copyright© by Chiang Mai University
All rights reserved

Oral presentations

Wiriya, W., and Chantara, S. Chemical Composition and Component Analysis of Atmospheric Wet Deposition in Chiang Mai. 12th International Conference on Integrated Diffuse Pollution Management (IWA DIPCON 2008), Khon Kaen, Thailand, 25-27 August 2008.

Wiriya, W. and Chantara, S. Chemical Composition and Factor Analysis of Atmospheric Wet Deposition in Chiang Mai, Thailand. Third Regional Symposium on Environment and Natural Resources, KL., Malaysia, 5-6 August 2008.

Graduated Seminars

Wiriya W., 2010. Emission of polycyclic aromatic hydrocarbons from biomass burning in Chiang Mai. Graduated Seminar I, 17th February 2010, ScB 1-720, Science Complex I Faculty of Science, Chiang Mai University. (Best Oral Presentation)

Wiriya W., 2011. Characterization of atmospheric PM_{10}-bound PAHs at Chiang Mai. Graduated Seminar II, 1st July 2011, SCB 1-720, Science Complex I Faculty of Science, Chiang Mai University. (Best Oral Presentation)

Poster presentations

Wiriya, W., and Chantara, S. Validation of Extraction Method and Characterisation of PM_{10} Bound PAHs from Rice Straw burning Emission. Commission on Higher Education Congress III: University Staff Development Consortium CHE-USDC Congress III, Thailand, 9-11 September 2010.

Wiriya, W., and Chantara, S. Chemical Composition and Factor Analysis of Atmospheric Wet Deposition in Chiang Mai, Thailand. Center on Environmental Health, Toxicology and Management of Chemical Meeting 2008, Thailand, 28 June 2008.

Publications

Wiriya, W., Sillapapiromsuk, S., Prapamontol, T., Prasitwattanaseree, S., Chantara, S., 2013. Emission profiles of PM10 and polycyclic aromatic hydrocarbons from biomass burning in the chamber for the assessment of air pollutant emissions from open burning. *Atmospheric Environment*, ATMENV-D-12-01115 (submitted)

Wiriya, W., Prapamontol, T., Chantara, S., 2012. PM10-bound polycyclic aromatic hydrocarbons in Chiang Mai (Thailand): seasonal variations, source identification, health risk assessment and their relationship to air-mass movement. *Atmospheric Research*, ATMOSRES-D-12-00375 (submitted after revised)

ลิขสิทธิ์มหาวิทยาลัยเชียงใหม่
Copyright© by Chiang Mai University
All rights reserved

Publications

Chantara, S., Sillapapiromsuk, S.,Wiriya, W., 2012. Atmospheric pollutants in Chiang Mai (Thailand) over a five-year period (2005-2009), their possible sources and relation to air mass movement. *Atmospheric Environment* 60, 88-98.

Pakpahan, E.N., Isa, M.H., Kutty, S.R.M., Chantara, S., Wiriya, W., 2011. Polycyclic aromatic hydrocarbon removal from petroleum sludge cake using thermal treatment with additives. *International Journal of Applied Science and Technology* 1(5). 201-207. ISSN ISSN 2221-0997 (Print), 2221-1004 (Online)

Wiriya, W., Sillapapiromsuk,S., and Chantara, S. 2011. Seasonal Variation of Atmospheric Dry Deposition (2006 to 2007) in Chiang Mai, Thailand. *EANET Science Bulletin*, 1.125-132.

Pakpahan, E.N., Isa, M.H., Kutty, S.R.M., Chantara, S., Wiriya, W., Faye, I., 2010. Comparison of polycyclic aromatic hydrocarbons emission from thermal treatment of petroleum sludge cake in the presence of different additives. *Journal of Scientific and Industrial Research* 71(6), 430-436.

Wiriya, W., and Chantara, S. 2009. Chemical Composition and Component Analysis of Atmospheric Wet Deposition in Chiang Mai. *KKU Research Journal*. 13(9), 1017-1024.

ลิขสิทธิ์มหาวิทยาลัยเชียงใหม่
Copyright© by Chiang Mai University
All rights reserved