

Chapter IV

Result

The study of sulfate aerosol and its acidity in the vicinity of Mae Moh Power Plant, Lampang Province which was conducted during 8-23 January 1996. Ban Tha Si and Ban Sob Pat were selected for sampling sites, and sampling time were divided into two periods which represent daytime (09.00-17.00) and nighttime (17.00-09.00) for studying the diurnal pattern of air pollutants and related meteorological factors. The results of these study have shown in table 4-1 and 4-2.

Table 4-1 Concentrations of various parameters at Ban Tha Si

Date	Period	SO ₄ ²⁻ (neq/m ³)	H ⁺ (neq/m ³)	NH ₃ (ppb)	Fe (µg/m ³)	Mn (µg/m ³)	H ⁺ /SO ₄ ²⁻	SO ₂ (ppb)
01/08/96	night	171.88	56.41	52.73	0.59	0.03	0.33	1.75
01/09/96	day	223.33	62.21	46.10	1.21	0.07	0.28	4.00
	night	718.00	265.66	218.99	0.54	0.03	0.37	1.44
01/10/96	day	414.79	197.38	79.44	1.96	0.08	0.47	60.12
	night	995.00	338.46	197.57	0.42	0.02	0.34	3.13
01/11/96	day	413.13	143.17	71.26	3.20	0.12	0.35	60.00
	night	819.30	335.91	11.93	3.79	0.14	0.41	6.00
01/12/96	day	323.80	67.99	39.88	2.84	0.03	0.21	-
	night	615.21	292.91	33.25	1.01	0.05	0.47	2.31
01/13/96	day	610.42	218.12	71.81	2.84	0.08	0.36	135.37
	night	687.30	316.16	21.93	1.17	0.05	0.46	3.75
01/14/96	day	1135.21	431.67	142.49	3.44	0.10	0.38	13.63
	night	760.00	378.10	205.33	5.12	0.08	0.49	3.31
01/15/96	day	217.90	19.82	42.23	2.29	0.05	0.09	3.40
	night	47.71	5.71	183.91	1.34	0.06	0.12	2.75
01/16/96	day	158.33	17.32	34.58	2.28	0.08	0.11	24.37
	night	431.80	198.76	177.17	0.93	0.04	0.46	2.69
01/17/96	day	139.50	53.70	150.76	4.39	0.14	0.38	6.12
	night	513.70	87.80	216.14	2.34	0.06	0.17	1.87
01/18/96	day	554.79	49.35	93.53	2.28	0.08	0.09	10.00
	night	608.33	69.90	239.60	1.85	0.11	0.11	7.19
01/19/96	day	318.60	57.30	70.69	2.36	0.11	0.18	13.62
	night	433.30	119.60	190.43	1.57	0.08	0.28	7.94
01/20/96	day	127.70	63.10	55.28	3.23	0.10	0.49	7.25
	night	1756.67	201.91	344.05	1.15	0.05	0.11	6.37
01/21/96	day	78.90	36.30	48.76	3.75	0.15	0.46	20.87
	night	377.71	61.90	222.05	0.74	0.02	0.16	7.31
01/22/96	day	129.30	39.10	132.39	3.86	0.16	0.30	12.00
	night	514.70	121.80	206.35	1.59	0.10	0.24	1.93
01/23/96	day	218.40	30.70	179.32	3.12	0.08	0.14	17.5

Table 4-2 Concentrations of various parameters at Ban Sob Pat

Date	Period	SO ₄ ²⁻ (neq/m ³)	H ⁺ (neq/m ³)	NH ₃ (ppb)	Fe (µg/m ³)	Mn (µg/m ³)	H ⁺ /SO ₄ ²⁻	SO ₂ (ppb)
01/08/96	night	477.71	146.54	64.56	3.21	0.13	0.31	2.53
01/09/96	day	61.46	17.41	269.28	3.19	0.17	0.28	2.25
	night	723.00	297.43	201.55	3.32	0.16	0.41	1.63
01/10/96	day	491.25	175.47	69.46	3.01	0.08	0.36	3.63
	night	823.96	333.58	187.98	3.54	0.12	0.40	1.75
01/11/96	day	407.90	168.20	271.12	5.52	0.30	0.41	2.40
	night	388.96	138.92	93.43	1.00	0.03	0.36	1.63
01/12/96	day	330.83	80.61	311.81	1.64	0.06	0.24	4.63
	night	548.82	214.07	19.89	2.09	0.13	0.39	2.00
01/13/96	day	78.33	31.84	27.34	3.51	0.17	0.41	4.63
	night	248.75	117.67	21.93	2.07	0.13	0.47	1.88
01/14/96	day	508.96	202.78	52.84	4.67	0.29	0.40	4.38
	night	36.88	18.61	32.23	3.69	0.15	0.50	2.00
01/15/96	day	378.54	35.01	63.64	3.11	0.10	0.09	2.25
	night	279.58	25.30	165.95	3.42	0.14	0.09	1.75
01/16/96	day	295.80	46.70	41.92	2.98	0.11	0.16	95.25
	night	1747.29	260.78	197.17	1.04	0.05	0.15	2.69
01/17/96	day	68.60	27.50	207.77	5.88	0.38	0.40	3.75
	night	719.30	316.60	191.25	2.89	0.09	0.44	2.06
01/18/96	day	494.40	60.30	81.29	5.06	0.21	0.12	3.75
	night	287.08	36.81	41.00	5.44	0.38	0.13	2.06
01/19/96	day	283.90	50.40	65.79	3.17	0.17	0.18	2.67
	night	208.54	29.42	161.67	3.92	0.29	0.14	1.94
01/20/96	day	182.29	48.10	73.13	3.99	0.16	0.26	2.50
	night	1500.83	177.19	195.64	3.37	0.39	0.12	1.94
01/21/96	day	109.70	41.40	64.77	3.99	0.16	0.38	3.00
	night	1003.75	185.87	109.04	4.26	0.28	0.18	1.94
01/22/96	day	108.96	29.45	193.08	3.50	0.19	0.27	2.58
	night	474.79	131.87	169.12	2.90	0.20	0.28	2.00
01/23/96	day	312.8	21.10	142.49	3.68	0.14	0.07	4.33

From table 4-1 and 4-2 which showed the concentrations of various parameters that have been measured during January 8-23, 1996. The concentrations of SO₄²⁻ were between 1756.67 - 47.71 and 1747.29 - 36.88 neq/m³ for Ban Tha Si and Ban Sob Pat, respectively. Although the concentrations of H⁺ for both sites were 431.67 - 17.32 and 333.58 - 17.41 neq/m³ while NH₃ were 344.05 - 11.93 and 311.81 - 19.89 ppb, respectively. Table 4-3 has showed mean, minimum and maximum values for daytime and nighttime immediately following. The concentrations of acidic species for each sites also have been showed in figure 4-1. Figure 4-2 also shows the average concentrations of SO₄²⁻ for daytime and nighttime period at both sites.

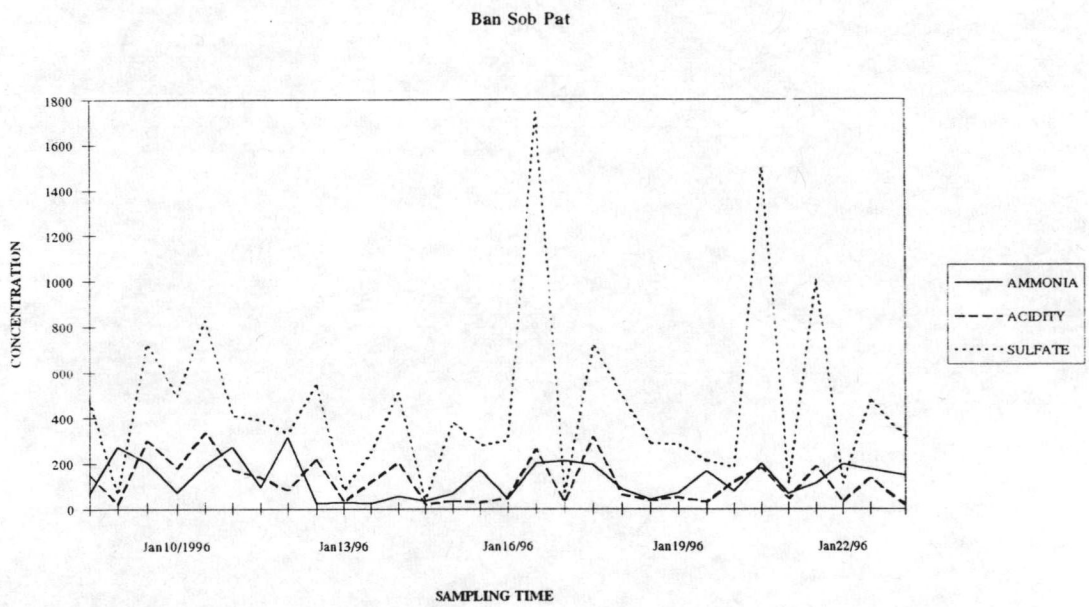
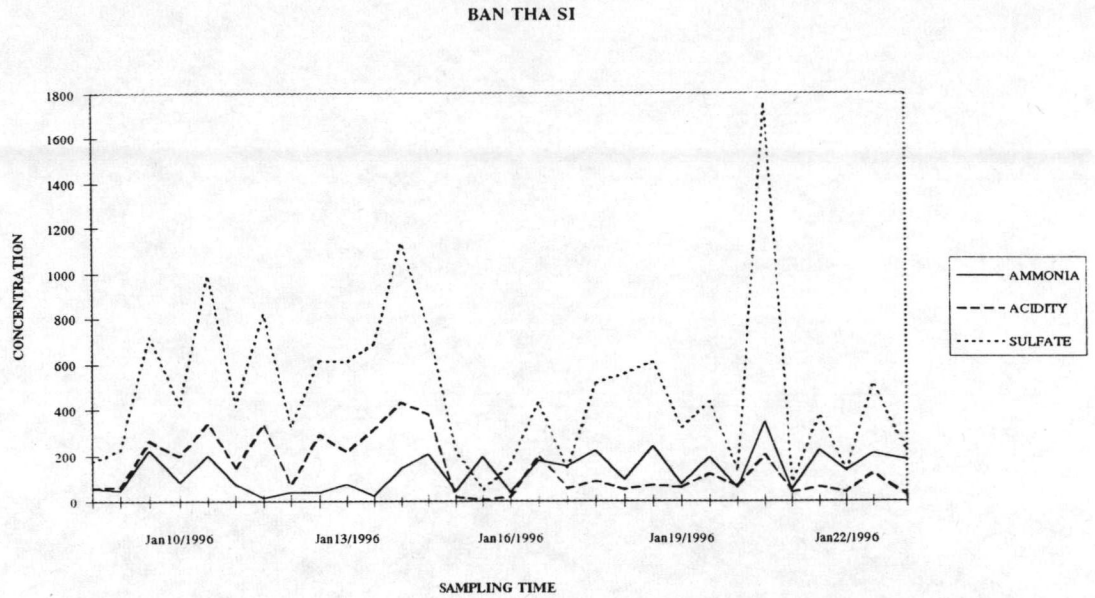


Figure 4-1 Acidic species concentration at Ban Tha Si and Ban Sob Pat
 Remark: Diurnal sampling from 01/08/96 (nighttime) to 01/23/96 (daytime)

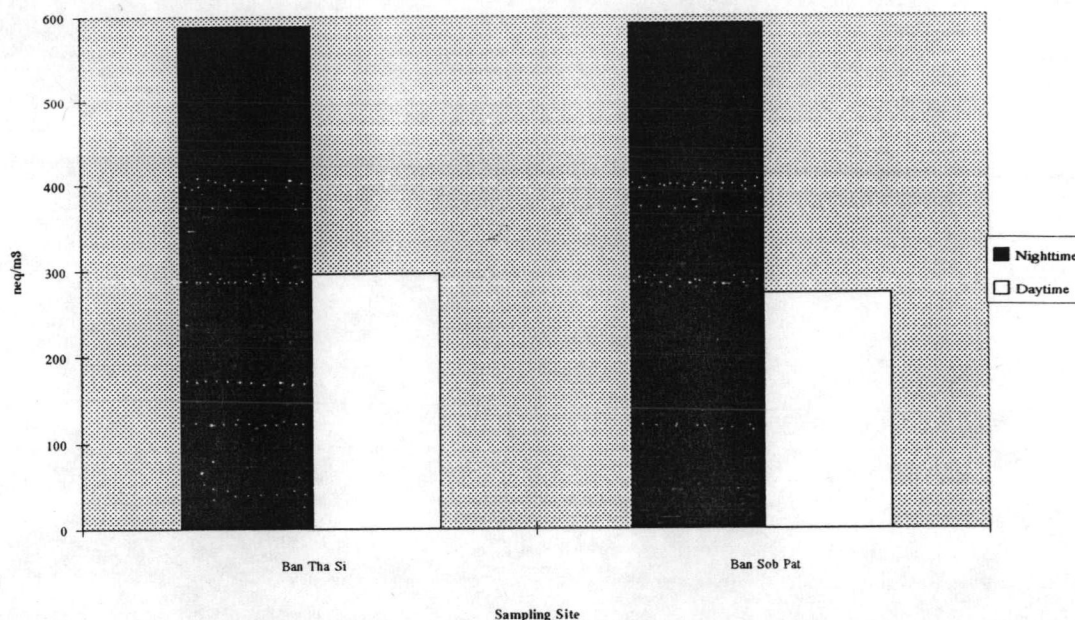


Figure 4-2 Average concentration of sulfate for daytime and nighttime at both sites

Table 4-3 Acidic species and ammonia concentrations at each sites for daytime (0900h - 1700h) and nighttime (1700h - 0900h)

Parameters	site	daytime			nighttime			ratio mean
		min	mean	max	min	mean	max	
sulfate (neq/m ³)	ban sob pat	61.46	272.56±144.9	508.96	36.88	591.16±351.7	1747.29	0.43
	ban tha si	78.90	296.15±154.9	1135.21	47.71	588.17±351.7	1756.67	
ammonia (ppb)	ban sob pat	27.34	122.77±79.1	311.81	19.89	116.46±63.6	201.50	1.05
	ban tha si	34.58	82.54±40.9	150.76	11.93	168.57±72.1	344.05	
acidity (neq/m ³)	ban sob pat	17.41	62.77±48.8	202.78	18.61	159.88±92.4	333.58	0.46
	ban tha si	17.32	78.86±61.6	431.67	5.71	189.78±105.4	378.10	

Remark: Ratio mean is the fraction of average daytime values and average nighttime value.

The concentrations of sulfur dioxide (SO₂) which obtained from continuous measurement by Pulse Fluorescence Analyzer. The values which determined by this method were in 1 h average which have been analysed to the average of 8 h and 16 h for the propose to evaluation and comparison with the average value of acid aerosol which sampling periods were 8 and 16h, respectively. Appendix B showed the diurnal patterns of SO₂ for both sites during 15 sampling day (1 h average). Obtaining by this method, SO₂ concentrations were between 135.37 - 1.44 ppb at Ban Tha Si and 95.25 - 1.63 ppb at Ban Sob Pat. It can be considered that SO₂ values in daytime period (09.00h -17.00) usually have higher concentrations than in nighttime period (17.00 - 09.00) for both sites. The highest concentrations were often found during 10.00-16.00

Iron (Fe) and Manganese (Mn) concentrations in total suspended particulate (TSP) obtained from sampling by high volume air sampler. The values for Fe were 4.39 - 0.42 $\mu\text{g}/\text{m}^3$ and Mn were 0.16 - 0.02 $\mu\text{g}/\text{m}^3$ at Ban Tha Si while the concentrations of Fe and Mn at Ban Sob Pat were 5.52 - 1.0 $\mu\text{g}/\text{m}^3$ and 0.39 - 0.03 $\mu\text{g}/\text{m}^3$, respectively. The concentration of Fe and Mn at 2 sites have been shown in figure 4-3 and figure 4-4.

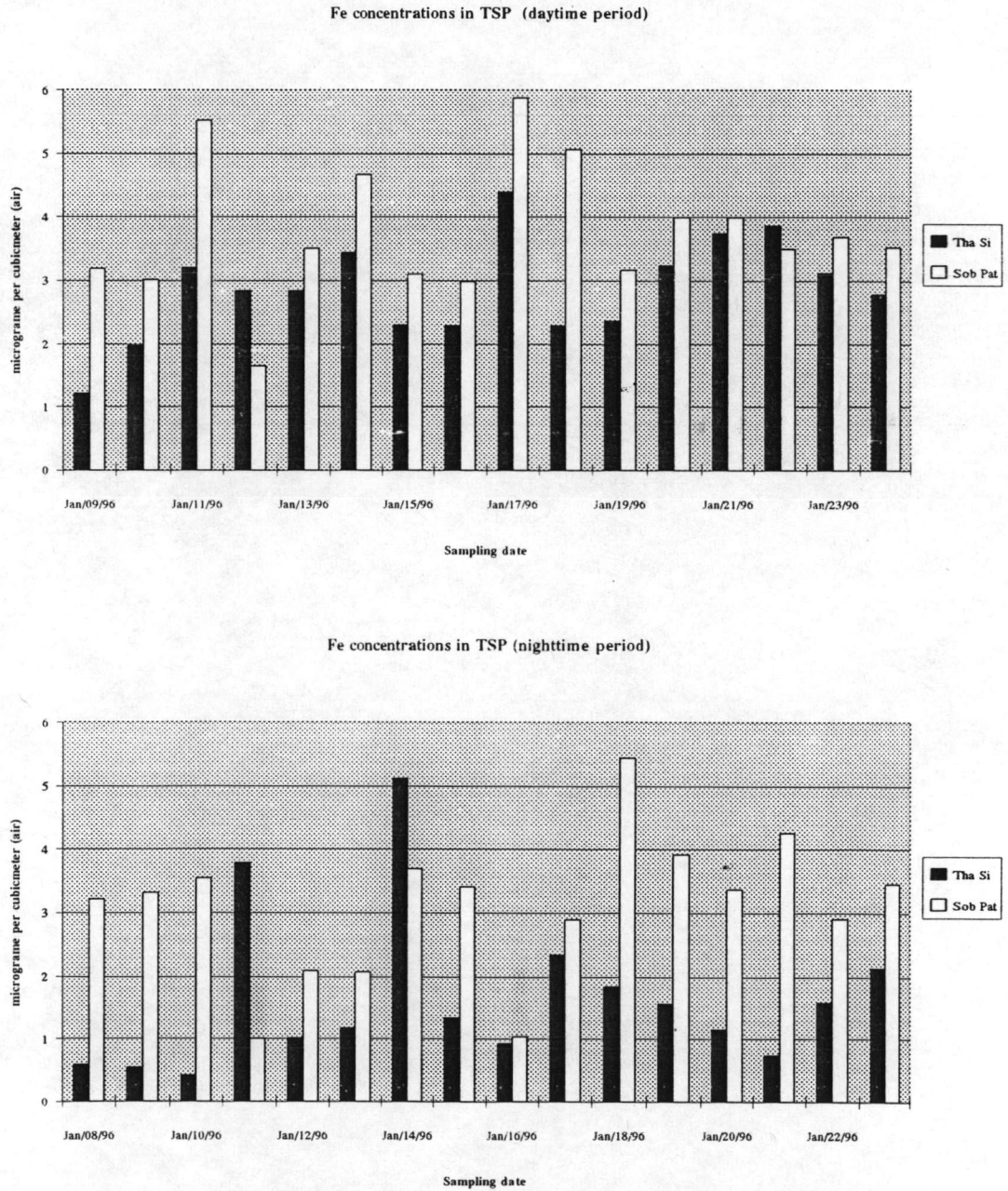


Figure 4-3 Fe concentrations for daytime and nighttime period at 2 sites

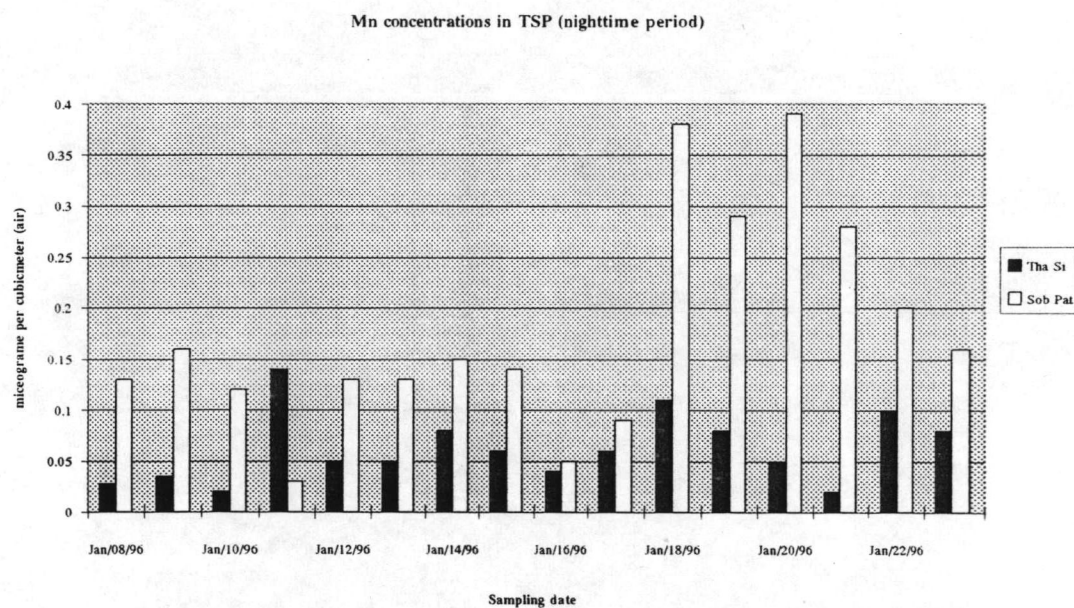
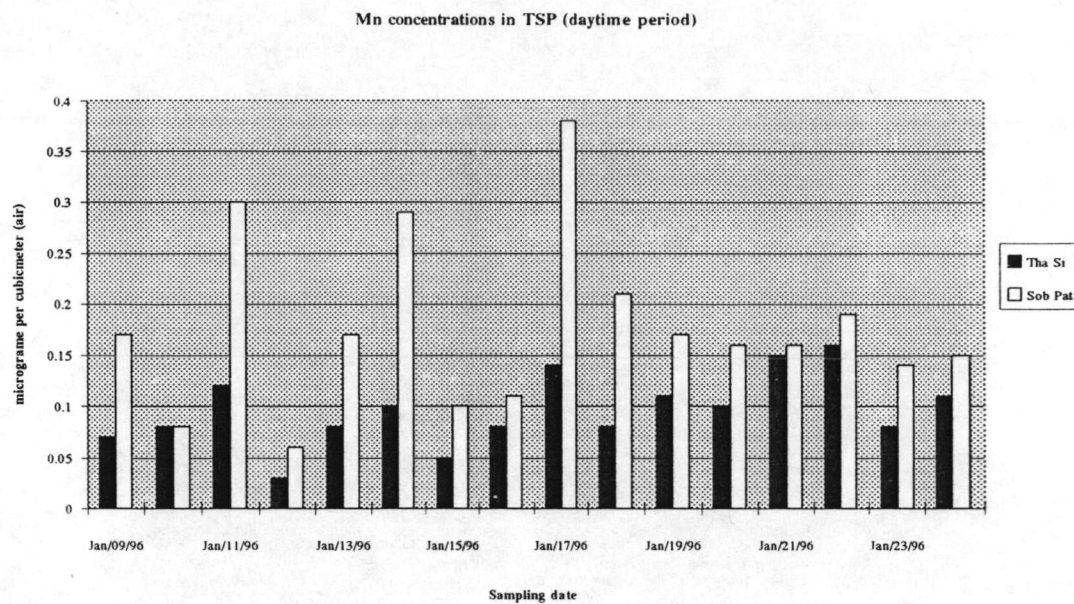


Figure 4-4 Mn concentrations for daytime and nighttime period at 2 sites

The acidic and total sulfate aerosol concentrations for Ban Tha Si and Ban Sob Pat have been showed in figure 4-5 which indicated the same pattern of H^+ and SO_4^{2-} variations for both sites. By mean that when SO_4^{2-} was increase, there was the increasing of H^+ , too.

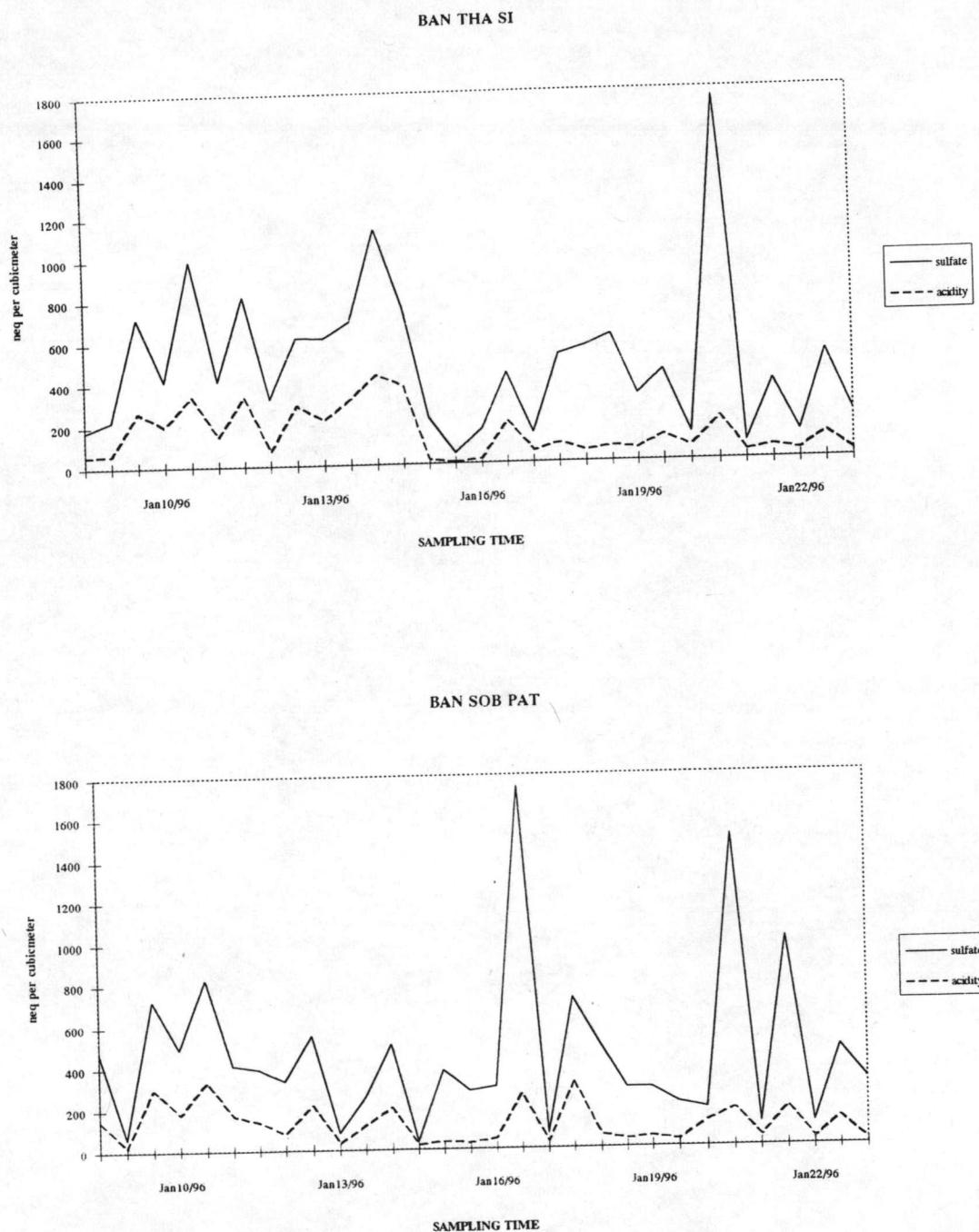


Figure 4-5 Acidic and total sulfate aerosol concentration at both sites

In addition to these parameters, there were other related factors which have been used for the study. These parameters were ozone concentrations, solar radiation, net radiation, wind speed and wind direction which also measured during the same time with sampling time of acid aerosol. The results were as below:

1. Ozone

Measuring of ozone were simultaneous values for 1h average at Ban Sob Pat by using Chemiluminescence Technique. Results from the measurement was shown in appendix C which indicated that ozone concentrations were about 56.25-0 ppb. From these diurnal patterns of ozone, the ozone concentrations often rise up at 0900h and had highest peak during 16.00-17.00. These indicate that there is the significantly difference between nighttime and daytime ozone concentrations.

2. Solar radiation and Net radiation

The one hour average value for both solar and net radiation have been analyzed by considering the diurnal pattern during 15 days sampling time as shown in appendix C. These indicate that solar radiation were zero during 18.00 -07.00 although there is the highest values during 12.00-14.00 which had the same pattern with net radiation in consistently to both heat gain and heat loss from surface soil and higher than zero during 07.00-18.00. While, the maximum heat loss values from net radiation was -64 w/m^2 and 631 w/m^2 for heat gain.

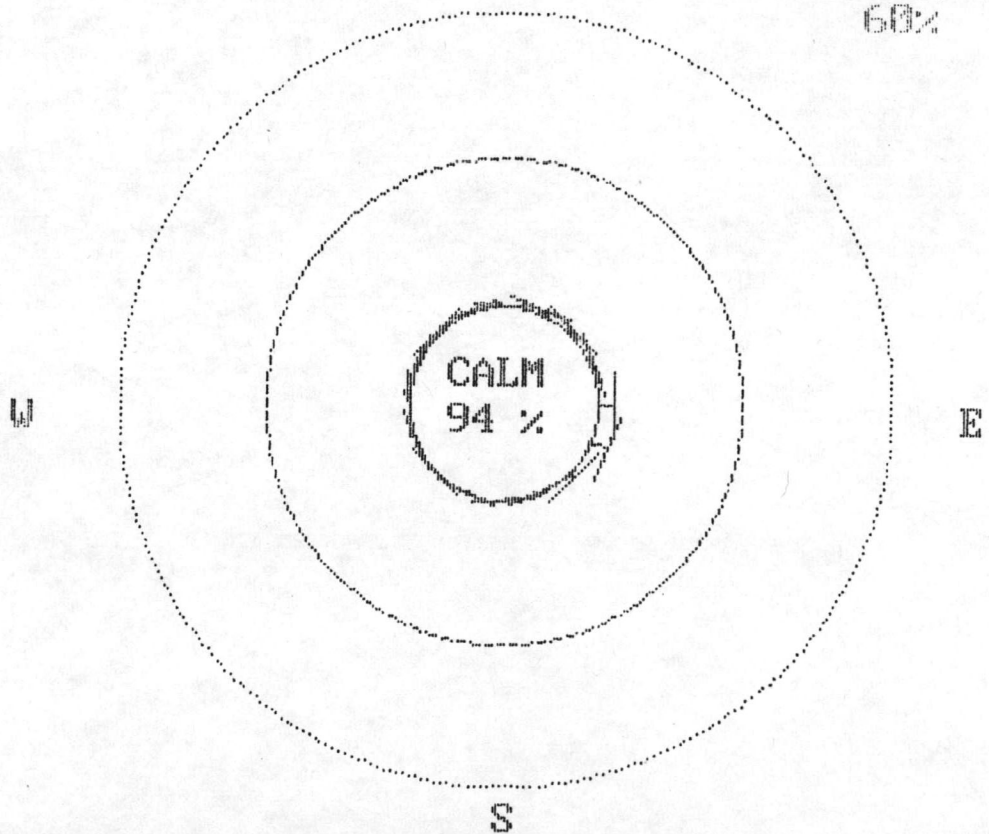
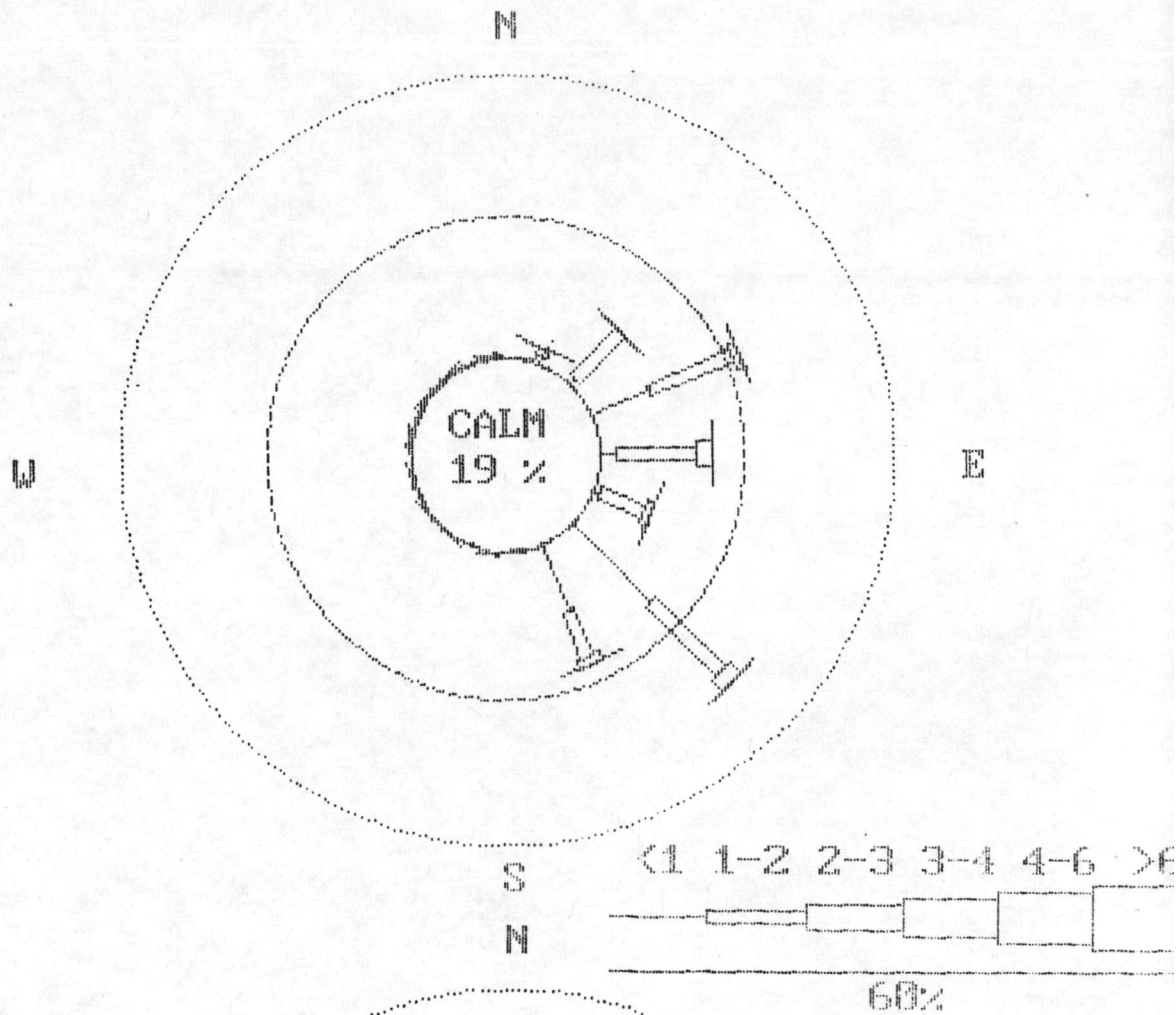
3. Wind speed and Wind direction

Wind speed and wind direction were the data which obtained from the meteorological main station of EGAT. The 1h average values at 10 and 100 m above ground have been studied to represent lower and upper wind, respectively. The data were analyzed for wind rose at both levels during January 8-23, 1996 as shown in figure 4-6 and figure 4-7. From figure 4-6, it indicated that during daytime period, almost of lower wind (10 m above ground) were from southeast (SE) and eastern (E) directions, especially SE direction while in nighttime period, there have no dominant wind directions. Both day and nighttime also had many calm conditions (wind speed $< 0.1 \text{ m/s}$). Percent of calm during daytime was 19% and nighttime was 94%.

At 100 m above ground (upper wind), daytime wind always had the directions from south (S) and southwestern (SW), although percent of calm was 29%. In addition to the nighttime period, percent of calm was 84% which cannot identify the actual directions as showed in figure 4-7. Appendix D also indicates the frequency of occurrence of wind direction grouped in various wind speed intervals for both daytime and nighttime and both upper and lower wind levels.

MAE MOH (LOWER WIND)

08-23/01/96 (DAYTIME)



MAE MOH (LOWER WIND)

08-23/01/96 (NIGHTTIME)

Figure 4-6 Daytime and Nighttime Wind Rose at 10 m above Ground (Lower Wind)

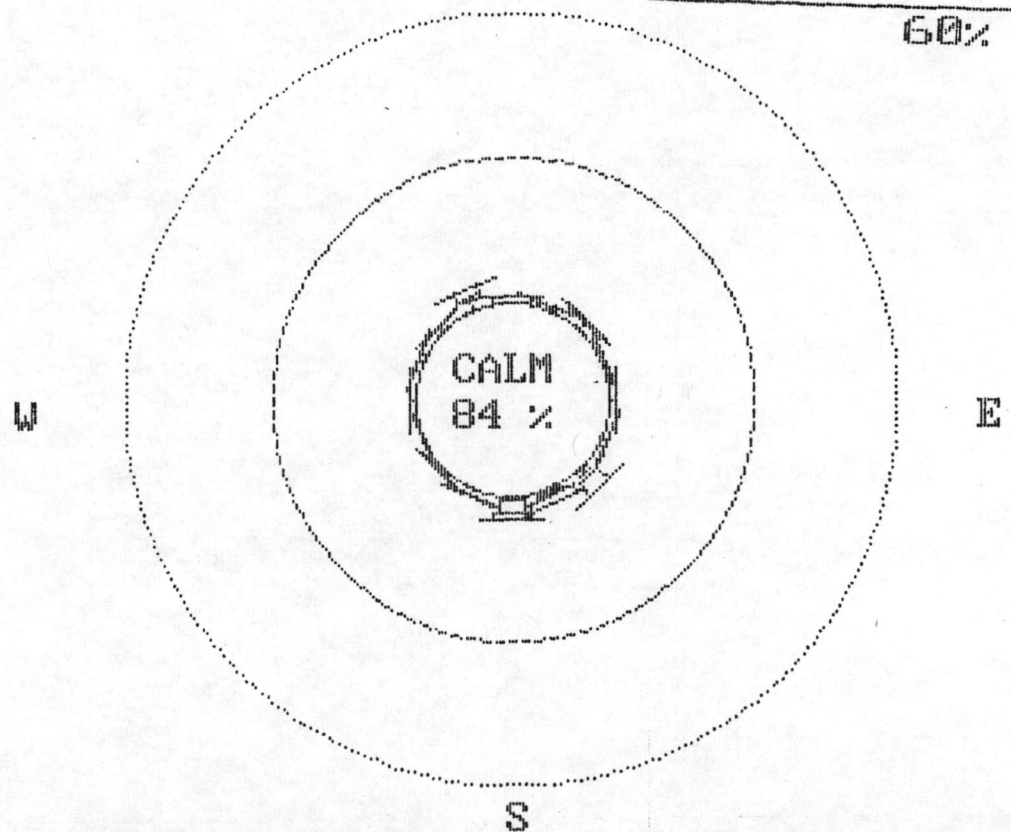
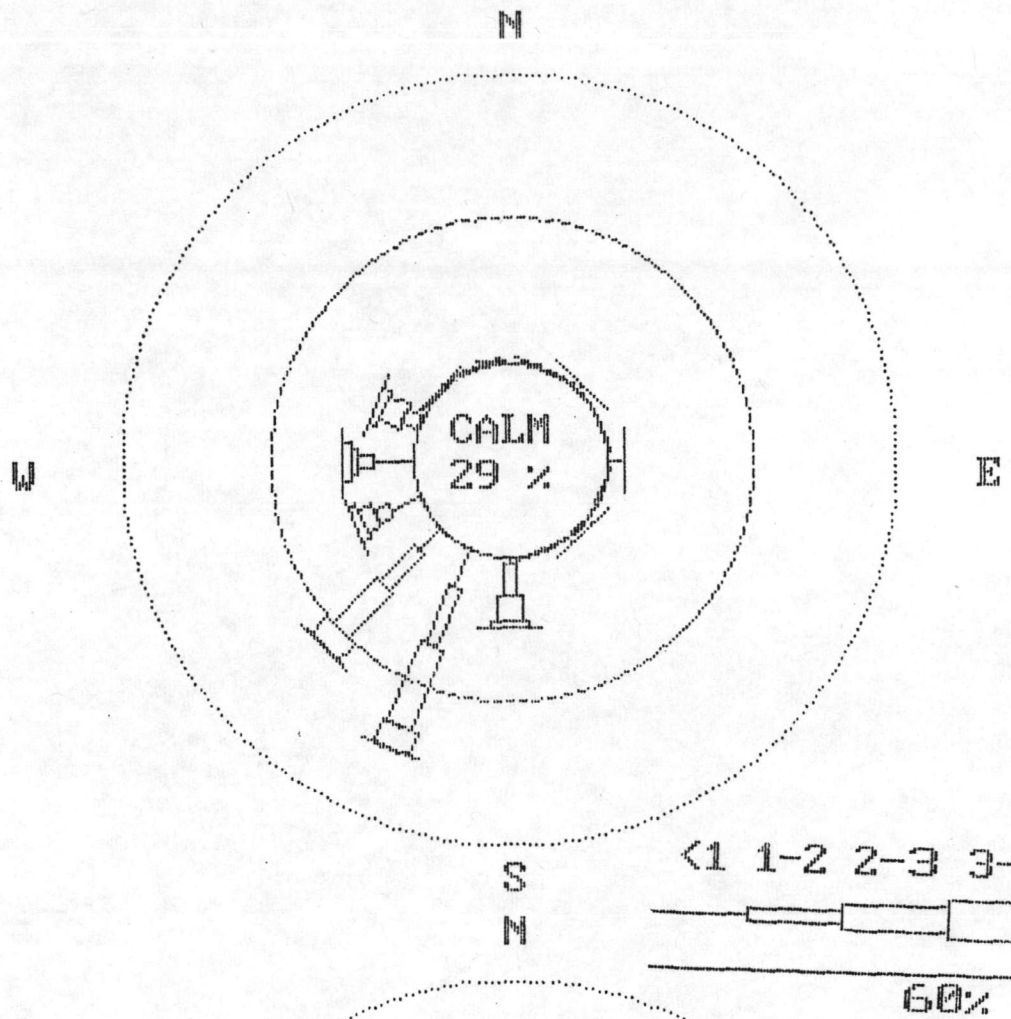


Figure 4-7 Daytime and Nighttime Wind Rose at 100 m above Ground (Upper Wind)