

Water Quality monitoring program and activities in Myanmar

1. INTRODUCTION

Today many countries over the world face the crisis of having decreasing water resources, shortage of drinking water, and impact on natural environment. Water is vital to the existence of all living organisms, but this valued resource is increasingly being threatened as human populations grow and demand more water of high quality for domestic purposes and economic activities. Water abstraction for domestic use, agricultural production, mining, industrial production, power generation, and forestry practices can lead to deterioration in water quality. The international community has recognized the important links between ecosystem and human health and well-being, particularly as human populations expand and place ever greater pressures on natural environments.

2. STUDY AREA

Location

Yangon city is situated between Latitude at 16°48' North, 96°09' East . The area of Yangon city ; urban is 231.18 sq mi (598.75 km²), metro is 3,930 sq mi (10,170 km²). The population of Yangon city is about 11, 207, 500 in 2013 estimate.

Topography

Yangon is located in Lower Myanmar at the convergence of the Yangon and Bago Rivers about 30 km(19 mi) away from the [Gulf of Martaban](#) .Its standard time zone is UTC/GMT +6:30 hours.

Name of site	Site Classification	Latitude	Longitude	site Category
Yangon (Kaba-Aye)	Urban	16.5° N	96.11° E	Wet Deposition and Dry Deposition

3. WATER QUALITY MONITORING, MYANMAR

Existing Laws and Policies

Policy for:

- (1) Agricultural Sector
- (2) Irrigation development and efficient utilization of nation's water resources
- (3) Watershed conservation
- (4) National Environment policy
- (5) Environmental health
- (6) Water resources management

Law for;

The first law on water pollution, the penal code was enacted in 1860

Most of existing laws and legislations were enacted before the year 2000

Conservation of Water Resources and River Law was enacted in October 2006 and Environmental Conservation Law was enacted in March 2012

No specific Water Law – Myanmar water professionals are drafting at present

Existing Institutional Structure

Sr	Agency	Ministry	Functions
1	Department of Meteorology and Hydrology (DMH)	Ministry of transport	Water assessment of major rivers, Data collotion & analysing, Monitoring Acid Deposition
2	Irrigation Department (ID)	Ministry of Agriculture and Irrigation	Provision of Irrigation water to Farmland
3	Department of Hydroelectric Power (DHP)	Ministry of Electric Power	Hydropower Generation
4	Factories	Ministry of Industry	Industrial use, water treatment
5	Department of Health	Ministry of Health	Environmental Health, Water Quality Assessment and Control, Monitoring Water Quality
6	City Development committee	Yangon/ Mandalay/ Napyitaw City Development committee	City water supply and sanitation, Water conservation and protection works
7	Department of Development Affairs(DDA)	Ministry of Progress of Border Areas and National Races and Development Affairs	Domestic and rural water supply and sanitation
8	Water Resources Utilization Department (WRUD)	Ministry of Agriculture and Irrigation	Pump Irrigation and Rural water supply
9	DWIR	Ministry of Transport	River training and Navigation
10	Forest Department	Ministry of Environmental conservation and forestry	Reforestation and Conservation of Forest, aforestation and watershed management
11	Myanmar Fishery Enterprise	Ministry of Livestock Breeding and Fisheries	Fishery works, monitoring and controlling water body
12	Department of Human Settlement and Housing Development	Ministry of Construction	Domestic Water Supply
13	Myanmar Engineering Society	Ministry of Construction	Water resources management related activities, especially consultation
14	Technology University	Ministry of Science and Technology	Training and Research
15	Department of Environmental conservation	Ministry of Environmental conservation and Forestry	Environmental conservation and management
16	The township		Organizing the water needs, Conservancy needs

In Department of Meteorology and Hydrology(DMH)

The rapid industrialization in the East Asian countries has helped in achieving economic growth. Along with industrialization, energy consumption such as coal, oil and natural gas has also rapidly increased in East Asia. The combustion of these fossil fuels is the main source of air pollutants such as HNO_3 , H_2SO_4 . The emission of air pollutants will increase, if there is no proper management to control it efficiently. For this reason there is a need for a better understanding in these problems in Myanmar. To protect the country from the acid deposition problem, it is required to monitor the state of acid deposition in the country. So, Myanmar had joined Acid Deposition Monitoring Network in East Asia (EANET) in November 2005. After Myanmar became member country of EANET, Department of Meteorology and Hydrology (DMH) is designated as National Center for EANET.

Monitoring Parameters and Method for wet deposition and Dry Deposition

Monitoring Parameters		Method
Wet Deposition	Dry Deposition	
Electric Conductivity(EC)	-	Conductivity cell Method
pH	-	Glass electrode Method
Cl ⁻ , NO ₃ ⁻ , SO ₄ ²⁻	Cl ⁻ , NO ₃ ⁻ , SO ₄ ²⁻	Ion chromatography (preferably with suppressor)
NH ₄ ⁺ , Na ⁺ , K ⁺ , Ca ²⁺ , Mg ²⁺	NH ₄ ⁺ , Na ⁺ , K ⁺ , Ca ²⁺ , Mg ²⁺	Ion chromatography

3.1. In other departments

Apart from DMH, there are some governmental agencies such as: Yangon/ Mandalay City Development Committee, Department of Health, Department of Atomic Energy, Irrigation Department, Water Resources Utilization Department etc., which monitor water and air qualities. Environmental Conservation Department also installed the PM_{2.5} for air concentration in 2014. Regarding acid deposition monitoring, wet and dry deposition have been monitored. The National Center will seek the possible opportunities to extend the inland aquatic monitoring to follow the examples of other participating countries of EANET.

4. RESULTS AND DISCUSSIONS



Figure 1. Picture of wet & dry deposition monitoring site at Yangon (Kaba-Aye) in Myanmar

For wet deposition, in the year 2010, it was recorded minimum of pH=5.75 (lowest acidic value), EC= 0.36 mS/m and the maximum of pH =6.85, EC= 8.75mS/m. In the year 2011, it was recorded minimum of pH =6.20, EC= 0.30mS/m and the maximum of pH =7.09, EC= 5.28 mS/m. In the year 2012, it was recorded minimum of pH =5.83 (lowest acidic value), EC = 0.31 mS/m and the maximum of pH = 7.10, EC = 4.50 mS/m. In the year 2013, it was recorded minimum of pH =6.06, EC = 0.42 mS/m and the maximum of pH = 6.99, EC = 8.30 mS/m. In the year 2014, it was recorded minimum of pH =6.00 , EC = 0.42 mS/m and the maximum of pH = 6.98, EC = 5.73 mS/m.

For wet deposition, in the year 2010, it was recorded maximum of Anion Cl⁻ = 28.29μmol/l, NO₃⁻ = 96.21 μmol/l, SO₄²⁻=18.46 μmol/l, the Maximum of Cation NH₄⁺ = 70.51μmol/l, Na⁺= 33.41μmol/l, K⁺=20.46μmol/l, Ca²⁺,=40.17μmol/l, Mg²⁺ = 5.55μmol/l. In the year 2011, it was recorded maximum of Anion Cl⁻ = 58.50μmol/l, NO₃⁻ = 106.40 μmol/l, SO₄²⁻=53.30 μmol/l, the Maximum of Cation NH₄⁺ = 98.50μmol/l, Na⁺ = 50.20μmol/l, K⁺ = 10.30μmol/l, Ca²⁺,= 132.40μmol/l, Mg²⁺ = 24.70μmol/l. In the year 2012, it was recorded maximum of Anion Cl⁻ = 95.10 μmol/l, NO₃⁻ = 76.40 μmol/l, SO₄²⁻=43.70 μmol/l, the Maximum of Cation NH₄⁺ = 116.50μmol/l, Na⁺= 95.70μmol/l, K⁺ = 30.10μmol/l, Ca²⁺,= 57.90μmol/l, Mg²⁺ = 21.0μmol/l. In the year 2013, it was recorded maximum of Anion Cl⁻ = 254.90μmol/l, NO₃⁻ = 300.0 μmol/l, SO₄²⁻=73.40 μmol/l, the Maximum of Cation NH₄⁺ = 106.60μmol/l, Na⁺ = 354.40μmol/l, K⁺= 31.70μmol/l, Ca²⁺,=25.10 μmol/l, Mg²⁺ = 824.0μmol/l. In the year 2014, it was recorded maximum of Anion Cl⁻ = 398.62 μmol/l, NO₃⁻ = 43.93 μmol/l, SO₄²⁻=35.93μmol/l, the Maximum of Cation NH₄⁺

=304.82 $\mu\text{mol/l}$, Na^+ = 47.24 $\mu\text{mol/l}$, K^+ =527.70 $\mu\text{mol/l}$, Ca^{2+} ,=197.48 $\mu\text{mol/l}$, Mg^{2+} = 38.26 $\mu\text{mol/l}$

For dry deposition, in the year 2012, it was recorded maximum of Anion $\text{Cl}^- = 41. \text{nmole/m}^3$, $\text{NO}_3^- = 56.0 \text{nmole/m}^3$, $\text{SO}_4^{2-} = 118.68 \text{ nmole/m}^3$, the Maximum of Cation $\text{NH}_4^+ = 75.17 \text{ nmole/m}^3$, $\text{Na}^+ = 79.64 \text{ nmole/m}^3$, $\text{K}^+ = 65.30 \text{ nmole/m}^3$, $\text{Ca}^{2+} = 80.4 \text{ nmole/m}^3$, $\text{Mg}^{2+} = 13.06 \text{ nmole/m}^3$. In the year 2013, it was recorded maximum of Anion $\text{Cl}^- = 44.29 \text{ nmole/m}^3$, $\text{NO}_3^- = 23.00 \text{ nmole/m}^3$, $\text{SO}_4^{2-} = 90.17 \text{ nmole/m}^3$, the Maximum of Cation $\text{NH}_4^+ = 90.42 \text{ nmole/m}^3$, $\text{Na}^+ = 54.76 \text{ nmole/m}^3$, $\text{K}^+ = 23.02 \text{ nmole/m}^3$, $\text{Ca}^{2+} = 24.69 \text{ nmole/m}^3$, $\text{Mg}^{2+} = 6.94 \text{ nmole/m}^3$. In the year 2014, it was recorded maximum of Anion $\text{Cl}^- = 68.62 \text{ nmole/m}^3$, $\text{NO}_3^- = 10.35 \text{ nmole/m}^3$, $\text{SO}_4^{2-} = 210.75 \text{ nmole/m}^3$, the Maximum of Cation $\text{NH}_4^+ = 167.68 \text{ nmole/m}^3$, $\text{Na}^+ = 59.46 \text{ nmole/m}^3$, $\text{K}^+ = 123.64 \text{ nmole/m}^3$, $\text{Ca}^{2+} = 171.83 \text{ nmole/m}^3$, $\text{Mg}^{2+} = 33.10 \text{ nmole/m}^3$.

By the analysis of water quality monitoring in Myanmar, among the observed data (rain water sample) from Yangon (Kaba-Aye) urban site, minimum pH value for 2010 and 2012 were 5.75 and 5.83 respectively; most of the measured pH values throughout the year were between 6 and 7, which is within the desirable range for drinking water from **national drinking water quality standard (6.5 -8.5)** and **Maximum permissible range of WHO standard (6.5 -9.2)**. Regarding the value of EC, the maximum of 8.75 mS/m was recorded on 27 May 2010 but it is under the acceptable level. It was the early monsoon season in 2010, and there could be some contaminants in that rain water sample. Meteorological data such as wind direction, wind speed, temperature, humidity and sunshine hours are also observed together with precipitation at the site. From the data recorded in 2010 to 2014, the overall analysis describes the average concentrations of pH and EC receptivity, which are still within the acceptable levels. Most of the analysis ions values throughout the year were under maximum permissible value which are also still within the acceptable level.

5. CONCLUSIONS

Hence, it can be generally concluded that acid deposition is not significant in Myanmar. Based on monitoring results of Acid deposition from 2010 to 2014, the status of Yangon rain is not acidic and its negative impacts have not yet been identified in Myanmar.

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APPENDIX A. METEOROLOGICAL DATA

Monthly means Meteorological Data at Yangon (Kaba-Aye) in 2010 -2014

A.1. PH, EC, IONS ANALYSIS DATA

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