

Approach to Assessment of Heavy Metals Contamination in Drinking Water, Mandalay Region, Myanmar

Aye Min Maw¹, Khin Phyu Phyu¹, Myo Nanda Aung¹, Khaing Khaing Mar¹, Saw Ohnmar Khin¹, Kyawt Kyawt Khaing¹, Aung Thura¹, Aung Thu¹, Phyo Wai Zin¹, Khin Maung Thin², Kyaw Zin Thant¹

¹Department of Medical Research, Myanmar

²Mandalay City Development Committee

Introduction

- Water is essential to sustain life and people use their drinking water sources from surface water or ground water.
- Contaminants such as bacteria, viruses and heavy metals have found their way into water supplies due to inadequate treatment and improper disposal of waste and industrial discharges.
- The present study aimed to assess the water quality parameters including the level of heavy metals in drinking water from tube wells in 6 selected townships of Mandalay region.

Objectives

- 1) To describe level of heavy metal contamination (As, Ca, Cu, Fe, Hg, Mg, Mn, Pb, Zn) in water samples from tube wells in selected townships of Mandalay region
- 2) To detect physicochemical parameters (pH, electrical conductivity, total dissolved solids, chloride, cyanide, nitrite, total hardness, turbidity) of water samples from tube wells in selected townships of Mandalay region

Methodology

Study design

- Cross-sectional analytical study

Study area

- 6 selected townships (Aung-Myay-Tharzan, Chan-Aye-Tharzan, Chan-Mya-Tharzi, Mahar-Aung-Myay, Pyigy-Tagon and Amarapura) in Mandalay region

Study population

- 20 water samples from different tube wells of each township (Total 120 samples)

Study period

- September, 2016 to August, 2017

Sample collection and preservation

- Sampling points of 120 water samples from different tube wells by Water & Sanitation Department of Mandalay City Development Committee
- The one litre pre-washed polyethylene bottles used for sample collection
- Acidified to 1% with nitric acid for sample preservation

Analysis of water samples

- Arsenic (As), Calcium (Ca), Copper (Cu), Iron (Fe), Mercury (Hg), Magnesium (Mg), Manganese (Mn), Lead (Pb) and Zinc (Zn) were analyzed using Atomic Absorption Spectrophotometer (AAS) (Shimadzu, Japan)
- Chloride, cyanide, nitrite, total hardness, and turbidity by Lovibond Water Testing (Photometer SpectroDirect)
- pH, electrical conductivity (EC) and total dissolved solids (TDS) of water samples by Pocket Pro™ Tester.

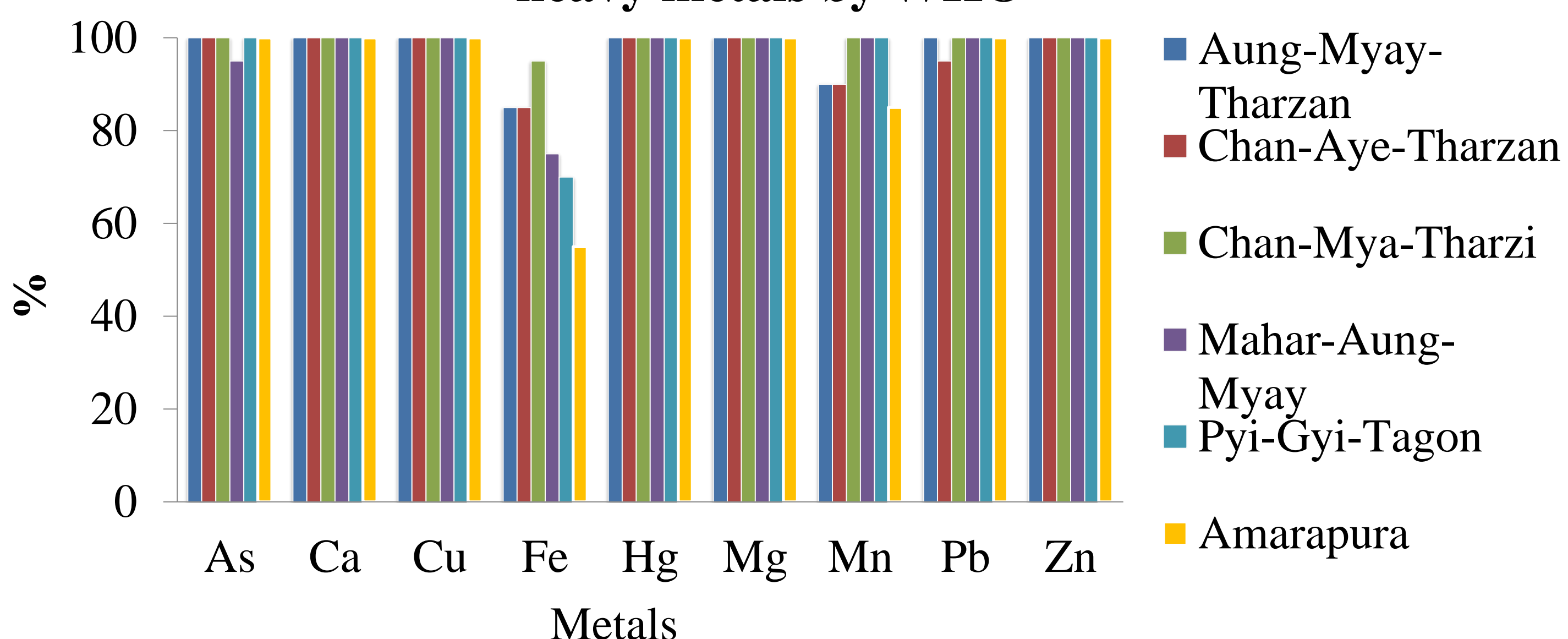


Statistical analysis

- Data were analyzed by using Microsoft Excel Version 2007

Results and Discussion

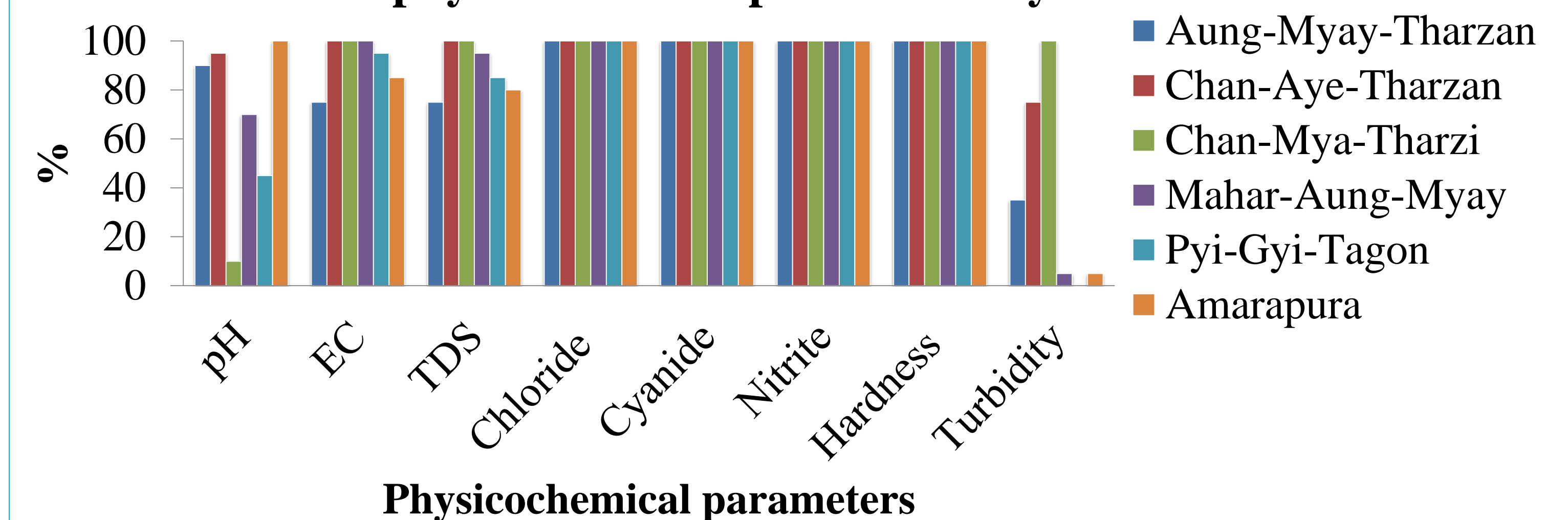
Percentage of water samples complied with MPL of heavy metals by WHO



Water samples within maximum permissible limit (MPL) by WHO

- **As (0.01 mg/L):** 95% in Mahar-Aung-Myay and 100% in other townships
 - ❖ Poisonous metal (arsenicosis, neurological effects, etc.)
 - ❖ The only one way of prevention is the avoidance of drinking water with unsafe level of arsenic.
- **Fe (1 mg/L):** 85% in Aung-Myay-Tharzan and Chan-Aye-Tharzan, 95% in Chan-Mya-Tharzi, 75% in Mahar-Aung-Myay, 70% in Pyi-Gyi-Tagon and 55% in Amarapura
 - ❖ Naturally found in groundwater
- **Mn (0.4 mg/L):** 90% in Aung-Myay-Tharzan and Chan-Aye-Tharzan, 85% in Amarapura and 100% in other townships
 - ❖ Manganese together with iron in water may lead to the accumulation of microbial growth in the water distribution system.
- **Pb (0.01 mg/L):** 95% in Chan-Aye-Tharzan and 100% in other townships
 - ❖ Natural sources of lead in groundwater
 - ❖ Lead water pipes used in some old household plumbing systems
- **Ca (200 mg/L), Cu (2 mg/L), Hg (0.001 mg/L), Mg (150 mg/L) & Zn (3 mg/L):** 100% within MPL in all townships

Percentage of water samples complied with MPL of physicochemical parameters by WHO



Water samples within maximum permissible limit (MPL) by WHO

- **pH (8.5):** < 100% in all townships except Amarapura
 - ❖ One of the most important water quality parameters for household water treatment for acidity or alkalinity of the water
- **EC(1400 µS/cm):** < 100% in Aung-Myay-Tharzan, Pyi-Gyi-Tagon and Amarapura but 100% in others
 - ❖ Unpalatable at levels >1400 µS/cm
- **TDS (1000 mg/L):** < 100% in Aung-Myay-Tharzan, Mahar-Aung-Myay, Pyi-Gyi-Tagon and Amarapura but 100% in others
 - ❖ Unpalatable >1000 mg/L
- **Turbidity (5 NTU):** < 100% in all townships
 - ❖ The precipitation of non-soluble reduced iron and other oxides or inert clay or chalk particles
- **Chloride (250 mg/L), cyanide (0.07 mg/L), nitrite (3 mg/L) and hardness(500 mg/L):** 100% of samples within MPL in all townships

Conclusion

- Most of the tube wells for drinking water sources in Mandalay region were in accordance with the maximum permissible limit of water quality parameters for drinking water set by WHO.

Acknowledgement

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