



HYDROGEOCHEMISTRY AND FLUORIDE CONTAMINATION AT MAE THA FAULT, DOI SAKET AND SAN KAMPHAENG DISTRICT, CHIANG MAI PROVINCE.



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ABSTRACT

Fluoride contamination in groundwater is a significant public health concern, particularly in areas with complex geological structures such as the Mae Tha Fault zone in Doi Saket and San Kamphaeng districts, Chiang Mai province. In these areas, the groundwater often contains higher fluoride content than normal level, due to the dissolution of fluoride-bearing minerals in subsurface rock formations. If fluoride levels exceed the World Health Organization (WHO) guideline of 1.5 mg/L, it may lead to adverse health effects such as dental fluorosis, skeletal fluorosis, and impaired cognitive development in children. This study aims to examine the fluoride content in groundwater along the Mae Tha fault zone and to assess the health impacts from the fluoride levels found in the groundwater. Twenty of water samples were collected and physical properties of the water were recorded in the field, including temperature, pH, and electrical conductivity. The samples were then analyzed for their chemical properties in the laboratory, including turbidity, carbonate and bicarbonate levels, total dissolved solids, fluoride concentration, and cation analysis. The study found that fluoride contamination levels exceeding the standard in two wells in southeastern Doi Saket, and two wells in the middle of San Kamphaeng district as well. The health risk assessment of these groundwater sources indicated potential health risks, particularly for children aged under 6 years and adults aged over 70 years. This study will help us to understand the geological factors influencing fluoride contamination in groundwater and to assess the health impacts on the local population effectively.

INTRODUCTION

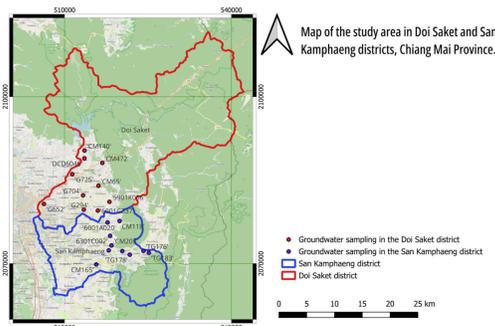


Figure.1 Map of the study area in Doi Saket and San Kamphaeng districts with groundwater sampling locations.

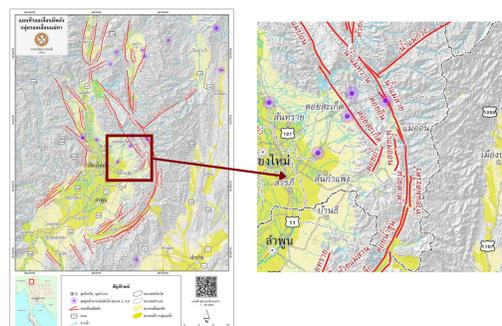


Figure.2 Active fault map of the Mae Tha Fault Zone (กรมทรัพยากรธรณี, 2566)

- The study area is Doi Saket and San Kamphaeng districts, Chiang Mai province.
- Fluoride is a mineral found in groundwater, which has higher concentrations than surface water. The World Health Organization recommends a maximum fluoride level of 1.5 mg/L in drinking water to prevent tooth decay.
- Groundwater near fault zones is more prone to contamination, as the movement of rock layers causes water to flow through fluoride-rich minerals, raising its concentration.

OBJECTIVE

- To investigate the fluoride concentration in groundwater along the Mae Tha Fault in Doi Saket and San Kamphaeng districts.
- To assess the health impacts of fluoride levels found in the groundwater of the study area.

RESULTS

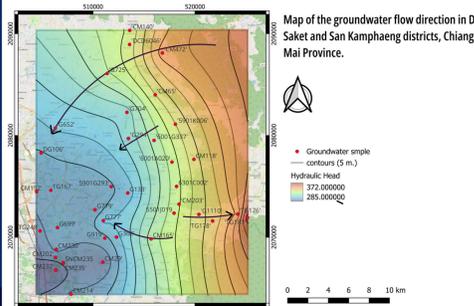


Figure 3. Map of the groundwater flow direction in Doi Saket and San Kamphaeng districts, Chiang Mai province.

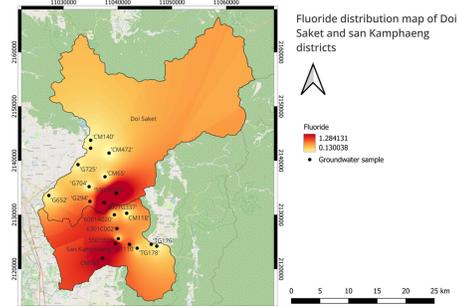


Figure 4. Map of the fluoride distribution in Doi Saket and San Kamphaeng districts, Chiang Mai province.

HEALTH RISK ASSESSMENT (HRA)

Stage of life	Children	Humans	
Ingestion Rate (IR)	0.78	2.5	L/day
Exposure Duration (ED)	6	70	years
Exposure Frequency (EF)	365	365	day/year
Average Body Weight (ABW)	15	65	kg
Average Exposure Time (AET)	2190	25550	day
Reference Dose (RfD)	0.078	0.058	mg/kg/day
The World Health Organization (WHO)	1.5	1.5	mg/L

Table 1. Various variables used to calculate Average Daily Dose (ADD) and Hazard Quotient (HQ) in children and humans. (Duvva et al., 2022)

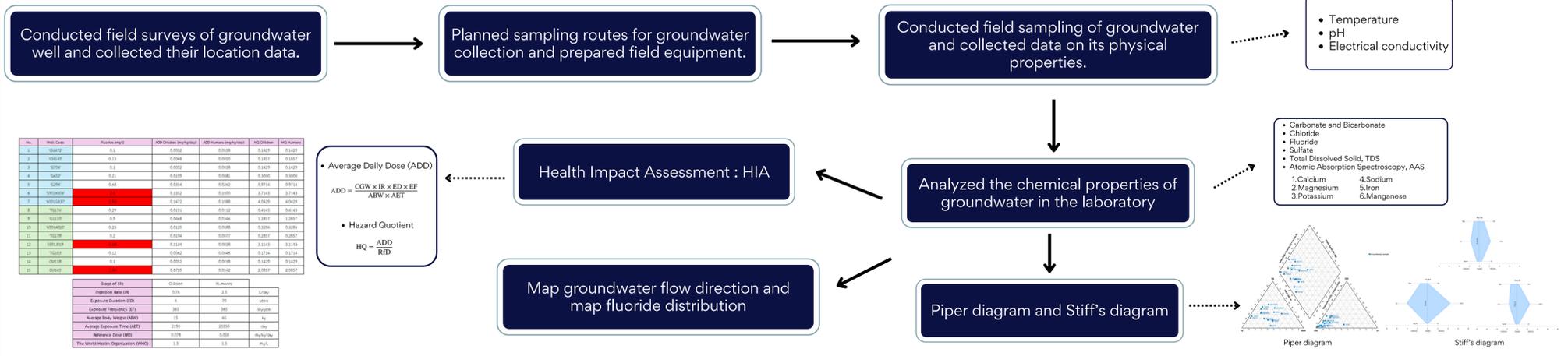
No.	Well Code	ADD Children (mg/kg/day)	ADD Humans (mg/kg/day)	CGW Fluoride (mg/l)	HQ Children	HQ Humans
1	'5901K006'	0.1352	0.1000	2.6	1.7333	1.7333
2	'6001G337'	0.1472	0.1088	2.83	1.8867	1.8867
3	5501J019	0.1134	0.0838	2.18	1.4533	1.4533
4	CM165'	0.0759	0.0562	1.46	0.9733	0.9733

Table 2. Average Daily Dose (ADD) in children and humans, Chronic Guideline Value (CGW) for fluoride in water, and Hazard Quotient (HQ).

If HQ ≥ 1, there may be potential health effects

A total of 20 groundwater samples were collected, but only 15 samples could be used for Health Risk Assessment (HRA) calculations because Course Based Evaluation (CBE) exceeded 10%.

METHODOLOGY



CONCLUSIONS

- Fluoride levels are distributed across various areas. In the southeastern part of Doi Saket District, fluoride contamination in two groundwater wells exceeds the standard limit. Similarly, in the central and southern parts of San Kamphaeng District, another two wells have been found with excessive fluoride levels.
- A health risk assessment of groundwater sources in both districts indicates potential health risks, particularly for children aged 6 years and elderly individuals aged 70 years.

REFERENCE

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