An investigation on the Water Quality of Water Sources in Phak Mai Subdistrict, Huai Thap Than District, Sisaket Province

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Abstract

This research aims to study the water quality of water sources in Phak Mai Subdistrict, Huai Thap Than District, Sisaket Province. The study focuses on water quality analysis, assessing the impact of physical and chemical factors, and developing water management and conservation plans. Additionally, it aims to raise community awareness about the importance of shared water resources to ensure proper and sustainable water usage.

Water samples were collected from three study points: Point 1 – Ban Hai Yai-Hai Noi village water supply well, Point 2 – Ban Phak Mai Yai village water supply well, and Point 3 – Ban Phrai Pha Nao village water supply well. Sampling was conducted once a month for four months, from November 2024 to February 2025. The parameters used to assess water quality included water temperature, water transparency, electrical conductivity (EC), dissolved oxygen (DO), pH level, nitrate concentration, and phosphate concentration. Research Findings: Based on the test results, all three water sources were classified as Type 2 water according to the National Environmental Board Notification No. 8, B.E. 2537 (1994). This classification indicates that the water quality is suitable for domestic use, agricultural activities, and conservation of aquatic life, and it meets the standards for potable water production.

Keywords: **Water Quality, Parameters, Water Assessment**

1. Introduction

Water is a vital natural resource essential for human survival. It is extensively utilized for various purposes, including domestic consumption, agriculture, livestock farming, industry, transportation, and aquaculture (Ministry of Natural Resources and Environment, 2018). However, once water is used for these purposes, a portion of it inevitably becomes wastewater and is discharged back into natural water sources (Marut Suksomchit & Traithep Wichayakowitthen, 2016). This process contributes to the degradation of water quality.

According to Thailand's Pollution Situation Report from 1996 to 2021, the quality of surface water across the country has deteriorated significantly. Reports indicate that 5-44% of surface water bodies fall into the "poor quality" category, while 25-55% are classified as "fair quality" (Pollution Control Department, 2012, 2017, 2021). With rapid urban expansion, the demand for clean water for domestic use and consumption continues to rise. Tap water plays

a crucial role in fulfilling this demand, as it is sourced from natural water bodies, such as surface water and groundwater, and undergoes purification processes to ensure cleanliness and safety. High-quality tap water must be free from pollutants and pathogens to prevent health risks to consumers (Naiyana Niyomwan, 2005).

Previous studies on water quality for tap water production have yielded varying results. While some sources meet the standards for safe domestic use and consumption, others fail to meet the required criteria (Tipawan Prasertsin, 2016). Ensuring safe and clean tap water not only depends on an efficient purification process but also requires the initial water source to be of sufficient quality for treatment. The National Environmental Board's Notification No. 8, B.E. 2537 (1994) provides the standard for surface water quality, which serves as a key reference for evaluating water suitability.

Given these concerns, this research focuses on assessing the water quality of three community water supply wells: Ban Hai Yai-Hai Noi village water supply well Ban Phak Mai Yai village water supply well Ban Phrai Pha Nao village water supply well. These villages rely on the Huai Wa Stream, which supplies water for the community's daily activities, including domestic use, agriculture, transportation, and wastewater discharge. Such diverse usage increases the risk of water contamination.

This study aims to evaluate the water quality, analyze the impact of physical and chemical factors, and develop water management and conservation strategies. Additionally, it seeks to raise community awareness about the importance of shared water resources and propose effective solutions for maintaining water quality to ensure its suitability for tap water production.

2. Research Question

What is the water quality of the water sources in Phak Mai Subdistrict, Huai Thap Than District, Sisaket Province at each study site?

3. Objective

To assess the water quality of the water sources in Phak Mai Subdistrict, Huai Thap Than District, Sisaket Province at each study site.

4. Hypothesis

The water quality of the water sources in Phak Mai Subdistrict, Huai Thap Than District, Sisaket Province at each study site meets the established standards.

5. Variables in the Study

Independent Variable: Sampling locations, including

Dependent Variable: Water quality at each study site.

Controlled Variables: Sampling methods at each study site, Sampling timeframes, Type of sampling equipment used and Instruments used for water quality measurement

6. Research Findings

The test results indicate that all three studied water sources are suitable for domestic use and consumption. Based on the National Environmental Board Notification No. 8, B.E. 2537 (1994), the water is classified as Type 2, meaning it meets the standards for agricultural use and aquatic life conservation. Additionally, the water quality is appropriate for tap water production according to the established guidelines.

7. Scope of the Study

7.1 Content Scope

Physical water quality parameters: Water transparency, water temperature
Chemical water quality parameters: pH level, dissolved oxygen (DO), nitrate concentration, electrical conductivity (EC), and phosphate concentration Geographical Scope and Water samples were collected from three study sites: Ban Hai Yai-Hai Noi village water supply well, Ban Phak Mai Yai village water supply well and Ban Phrai Pha Nao village water supply well

7.2 Time Frame

Water samples were collected once a month on the 2nd of each month for four months, as follows: 1st collection: November 2, 2024, 2nd collection: December 2, 2024
3rd collection: January 2, 2025 and 4th collection: February 2, 2025

8. Materials and Methods

8.1 Study Site Selection

Three study sites were identified in Phak Mai Subdistrict, where water from the Huai Wa Stream is used for tap water production. The selected locations include:
Study Site 1: Ban Hai Yai-Hai Noi village water supply well
Study Site 2: Ban Phak Mai Yai village water supply well
Study Site 3: Ban Phrai Pha Nao village water supply well

9. Materials, Equipment, and Chemicals

1. Secchi Disk Set (or Water Transparency Measuring Set)
2. Sensor Thermometer
3. Alcohol Bulb Thermometer
4. Dissolved Oxygen (DO) Test Kit
5. Electrical Conductivity (EC) Meter
6. Total Dissolved Solids (TDS) Meter
7. pH meter
8. LabQuest Sensor for measuring temperature, pH, and relative humidity of the air.
9. Nitrate Test Kit for Water
10. Phosphate Test Kit

10. Research Methodology

Study Site Selection: Three study sites were identified:

Site 1: Ban Hai Yai-Hai Noi village water supply well
Site 2: Ban Phak Mai Yai village water supply well
Site 3: Ban Phrai Pha Nao village water supply well

Field Survey

Conducted an on-site survey to assess the selected study locations.
Water Sample Collection and Analysis. Collected water samples from all three sites for quality analysis following the GLOBE Program methodology.

The analysis included two main aspects:

Physical characteristics: Water temperature, water transparency

Chemical characteristics: pH level, dissolved oxygen (DO), electrical conductivity (EC), nitrate concentration (NO_3^-), and phosphate concentration (PO_4^{3-}) Results were

compared against the surface water quality standards to evaluate the impact of physical and chemical factors.

Findings were used to develop water management strategies and water resource conservation plans.

Data Submission

Uploaded the collected data into the GLOBE Program system via Data Entry for further analysis and global comparison.

11. Research Results

Water samples were collected and analyzed from the three study sites once a month on the 2nd of each month for a period of four months, from November 2, 2024, to February 2, 2025. The collected data were then compared with the surface water quality standards, yielding the following results:

Table 1: Water Temperature at the Three Study Locations in Phak Mai Subdistrict, Huai Thap Than District, Si Sa Ket Province

Locations	Water Temperature Measurement (°C) at Study Locations				
	Round 1	Round 2	Round 3	Round 4	Average
1	32	34	31	28	31.25
2	32	31	30	28	30.25
3	30	32	30	26	29.50
Average	**31.33**	**32.33**	**30.33**	**27.33**	**30.33**

From Table 1, it was found that the water temperature at all three locations varied According to the weather conditions each month and did not differ significantly between locations. The temperature showed an increasing trend in the second collection and then decreased in the third and fourth collections. The highest recorded temperature was 32.33°C, while the lowest was 27.33°C, with an average temperature ranging between 29.50°C and 31.25°C.

Table 2: Water Transparency Measurements at the Three Study Locations in Phak Mai Subdistrict, Huai Thap Than District, Si Sa Ket Province

Locations	Water Transparency (cm) at Study Locations				
	Round 1	Round 2	Round 3	Round 4	Average
1	70	68	67	65	67.50
2	80	87	88	90	86.25
3	78	75	73	72	74.50
Average	**76.00**	**76.67**	**76.00**	**75.67**	**76.08**

From Table 2, it was found that the water transparency varied across the three locations. Water from Point 1 had the highest transparency, with an average ranging between 65 – 70 cm, as it is the closest to the Huai Wa stream.Water from Point 2 had the lowest transparency, with an average ranging between 80 – 90 cm, due to the presence of surrounding trees and its proximity to agricultural areas more than the other locations.

Table 3: Electrical Conductivity (EC) of Water at the Three Study Locations in Phak Mai Subdistrict, Huai Thap Than District, Si Sa Ket Province

Locations	Water Electrical Conductivity (EC) (µS/cm) at Study Locations				
	Round 1	Round 2	Round 3	Round 4	Average
1	185	190	195	200	192.50
2	99	100	102	105	101.50
3	80	85	87	96	87.00
Average	121.33	125.00	128.00	133.67	127.00

From Table 3, it was found that the electrical conductivity (EC) of water in all supply wells showed a similar trend, with a noticeable increase over time. In early November, which marks the end of the rainy season, occasional rainfall still occurred, causing rainwater to dilute the water sources. As a result, the concentration of dissolved substances was lower compared to the period from December to February. The location with the highest average electrical conductivity (EC) was Point 1 (Hai Yai - Hai Noi water supply well), with an average of 192.50 µS/cm, while the lowest was Point 3 (Phrai Phanao water supply well), with an average of 87.00 µS/cm.

Table 4: pH Measurement of Water at the Three Study Locations

Locations	pH Measurement of Water at Study Locations				
	Round 1	Round 2	Round 3	Round 4	Average
1	7.50	7.60	7.80	7.90	7.70
2	9.10	9.30	9.30	9.40	9.28
3	7.30	7.50	7.70	7.90	7.60
Average	7.97	8.13	8.27	8.40	8.19

From Table 4, it was found that the pH levels of water at each location were neutral to slightly alkaline. In most cases, the pH value was greater than 7.60, indicating the acidity and alkalinity levels of the water at each site. Point 2 had the highest alkalinity, with an average pH of 9.28.

Table 5: Dissolved Oxygen (DO) Levels at the Three Study Locations in Phak Mai Subdistrict, Huai Thap Than District, Si Sa Ket Province

Locations	Dissolved Oxygen (DO) (mg/L) at Study Locations				
	Round 1	Round 2	Round 3	Round 4	Average
1	10.20	10.30	10.40	10.50	10.35
2	9.80	8.80	8.50	7.50	8.65
3	9.50	8.80	8.60	8.50	8.85
Average	9.83	9.30	9.17	8.83	9.28

From Table 5, it was found that the dissolved oxygen (DO) levels at each study location had an average range of 8.68 – 10.35 mg/L.

Based on the analysis, the DO levels did not exceed the water quality standards set by the National Environmental Board Notification No. 8 (1994). Therefore, it can be concluded that the water at all study locations is suitable for sustaining aquatic life.

Table 6: Nitrate Concentration in Water at the Three Study Locations in Phak Mai Subdistrict, Huai Thap Than District, Si Sa Ket Province

Locations	Nitrate Concentration in Water (mg/L) at Study Locations				
	Round 1	Round 2	Round 3	Round 4	Average
1	0.15	0.2	0.2	0.2	0.19
2	0.35	0.35	0.4	0.4	0.38
3	0.25	0.28	0.3	0.3	0.28
Average	0.25	0.28	0.30	0.30	0.28

From Table 6, it was found that the nitrate concentration in water at all study locations did not exceed 1 mg/L. The highest nitrate concentration was observed at Point 2 (Phak Mai Yai water supply well), with an average of 0.38 mg/L. The lowest nitrate concentration was recorded at Point 1 (Hai Yai - Hai Noi water supply well), with an average of 0.18 mg/L.

Table 7: Dissolved Phosphate Concentration (mg/L) at the Three Study Locations in Phak Mai Subdistrict, Huai Thap Than District, Si Sa Ket Province

Locations	Dissolved Phosphate Concentration (mg/L) at Study Locations				
	Round 1	Round 2	Round 3	Round 4	Average
1	0.1	0.09	0.06	0.05	0.08
2	0.6	0.58	0.28	0.25	0.43
3	0.45	0.4	0.27	0.25	0.34
Average	0.38	0.36	0.20	0.18	0.28

From Table 7, it was found that the dissolved phosphate concentration was highest during November to December and began to decrease from January to February.
The highest phosphate concentration was observed at Point 2 (Phak Mai Yai water supply well), with an average of 0.43 mg/L. The lowest phosphate concentration was recorded at Point 1 (Hai Yai - Hai Noi water supply well), with an average of 0.08 mg/L.

Table 8: Summary of Water Quality Measurements at the Three Study Locations Measurements were conducted once a month on the 2nd of each month for four months, from November 2, 2024, to February 2, 2025.

Parameter	1	2	3	Average	Water Quality Standards
Temperature (°C)	31.2	30.25	29.50	30.33	Meets Standard
Water Transparency (cm)	67.50	86.25	74.50	76.08	Meets Standard
Water Electrical Conductivity (EC) (µS/cm)	192.50	101.50	87.00	127	Meets Standard
pH Value	7.70	9.28	7.60	8.19	Meets Standard
Dissolved Oxygen (DO) (mg/L)	10.35	8.65	8.85	9.28	Meets Standard
Nitrate Concentration (mg/L)	0.19	0.38	0.28	0.28	Meets Standard
Phosphate Concentration (mg/L)	0.08	0.43	0.34	0.28	Meets Standard

12. Conclusion and Discussion

The study on water quality in three locations within Phak Mai Subdistrict, Huai Thap Than District, Si Sa Ket Province was conducted over four months. Water samples were collected once a month on the 2nd of each month, with the first collection on November 2, 2024, the second on December 2, 2024, the third on January 2, 2025, and the fourth on February 2, 2025. The study examined seven water quality parameters, including: Water temperature Water transparency, Electrical conductivity (EC), Dissolved oxygen (DO) pH (acidity and alkalinity), Nitrate concentration, Phosphate concentration

The results are as follows:

1. Water quality measurement at Point 1 (Hai Yai - Hai Noi village water supply well) showed the following average values: Water temperature: 31.25°C, Water transparency: 67.50 cm Electrical conductivity (EC): 192.50 µS/cm, pH value: 7.70, Dissolved oxygen (DO): 10.25 mg/L Nitrate concentration: 0.18 mg/L, Phosphate concentration: 0.08 mg/L

2. Water quality measurement at Point 2 (Phak Mai Yai village water supply well) showed the following average values: Water temperature: 30.25°C Water transparency: 86.25 cm Electrical conductivity (EC): 101.25 µS/cm pH value: 9.28 Dissolved oxygen (DO): 8.65 mg/L Nitrate concentration: 0.28 mg/L Phosphate concentration: 0.42 mg/L

3. Water quality measurement at Point 3 (Phrai Phanao village water supply well) showed the following average values: Water temperature: 30.33°C Water transparency: 76.08 cm Electrical conductivity (EC): 127 µS/cm pH value: 8.19 Dissolved oxygen (DO): 9.28 mg/L Nitrate concentration: 0.28 mg/L Phosphate concentration: 0.28 mg/L

4. Based on the experiment, the water quality measurements from all three locations classify the water as Type 2 according to the Notification of the National Environmental Board No. 8, B.E. 2537 (1994) on Surface Water Quality Standards. This indicates that the water quality is suitable for agricultural use, consumption, and conservation of aquatic life. Additionally, it meets the standards required for municipal water supply production.

5. Based on the experiment, the water quality at Point 1 (Hai Yai - Hai Noi village water supply well) was better than at Points 3 and 2, as it had the highest dissolved oxygen (DO) levels. The next highest DO levels were observed at Point 3, followed by Point 2, which had the lowest.

13. Suggestions

1. Caution should be taken during site surveys and data collection, especially when collecting water samples. Safety considerations should be prioritized.

2. Water samples brought to the laboratory should be tested immediately to prevent data inaccuracies.

3. Additional data should be collected throughout the year to assess water quality across all seasons.

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References

Pollution Control Department. (2010). Standards for controlling wastewater discharge from municipal wastewater treatment systems. [Online]. Available from: http://www.pcd.go.th/info_serv/water04.html. (Accessed on December 12, 2022).

Kasem Chankaeo. (1998). Environmental Technology. Interdisciplinary Graduate Program in Environmental Science, Kasetsart University.

Kantaree Sriphongpan. (2004). Water Pollution. 3rd Edition. Nakhon Pathom: Silpakorn University Press.

Chanitta Charoenlap. (2012). Efficiency of floating plant systems in wastewater treatment from dyeing processes. Aquatic Plants. Retrieved on January 15, 2022, from: https://dspace.rmutk.ac.th/handle/123456789/1418.

Panya Maneejak. (2011). Preparation of activated carbon from Indian almond (Terminalia catappa) seeds. (Research). Pathum Thani: Department of Chemistry, Faculty of Science, Rangsit University.

Maitree Duangsawat & Jaruwan Somsiri. (1985). Evaluation of pH from the National Inland Fisheries Institute. Retrieved on January 7, 2022, from: http://www.inlandfisheries.go.th/research/files/full/F223097.pdf.

Srisuwan Kasemsak & Colleagues. (2012). Environmental quality control standards by the Department of Environmental Quality Promotion. Retrieved on January 25, 2022, from: http://www.ssruir.ssru.ac.th/bitstream/ssruir/859/1/rid_031_2555.pdf.