

Wastewater Management and Community Participation in Amphawa District, Samut Songkhram Province, Thailand [†]

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Abstract: This research focused on wastewater management and community participation in Amphawa district, Samut Songkhram province, Thailand. Objectives of the research were (1) To investigate and assess quality of surface water and sewage at the sources before being discharged into main river and canals in Amphawa district, Samut Songkhram province. The study was conducted during October 2016–September 2017. A number of 40 surface water samples and 40 sewage samples were collected. Water quality of the samples were assessed following the Pollution Control Department procedure. The results showed that quality of surface water was likely good with pH, DO and amount of coliform bacteria under the PCD standard. BOD and amount of fecal coliform bacteria were slightly over the threshold and very high amount of NH₃ was found. Sewage contained very low DO, extremely high BOD and slightly high TKN.

Keywords: community participation; wastewater management; Samut Songkhram province

1. Introduction

Amphawa district is a center of agro-tourism of Samut Songkhram province which is composed of plains and canals which could support agricultural development, especially orchards. In addition, three types of aquatic ecosystems i.e., freshwater, brackish water and seawater are highlighted for local tourism promotion in Amphawa district. Mae Klong river is the main river flowing through Amphawa district however also receives water discharged from other sources. According to the surface water standard of Pollution Control Department (PCD), it was classified as class 3 meaning suitable for agriculture and consumption but sterilization and water improvement is needed before consuming. However, regarding the water quality monitoring report in May 2009, quality of water at the police station of Amphawa district monitoring station was found in a critical situation. It was classified as class 5 meaning only suitable for water transportation. Serious increased amount of sewage discharged into canals was presumed as main cause. According to the study on water quality from the water sources for consumption in Samut Songkhram province between 2012 and 2014, it showed that some parameters such as amount of heavy metals, DO and BOD were below the surface water standard [1]. Many heavy metal contaminations were found [2]. In addition to that the study on water quality of majority canals in Amphawa district also indicated that water quality was below standard of class 3 [3]. It was assumed that low quality water found in the river and canals could be caused by direct sewage discharging from the sources such as community, riverside resorts and agricultural activities.

In 2013, very low water quality with many heavy metal contaminations was found [3]. Unfortunately, following the current policy to promote tourism and increase economic growth in the area, there are a number of food shops, resorts and even factories established along the river. Some undertake their business without wastewater treatment system operated. Increased amount of sewage is directly discharged into the river and canals causing water deterioration.

2. Objectives

To investigate and assess quality of surface water and sewage at the sources before being discharged into main river and canals in Amphawa district, Samut Songkhram province.

3. Materials and Methods

3.1. Sampling Sites

Sampling sites were along main river and canals as well as the sources of sewage being discharged into the canals in Amphawa district, Samut Songkhram province.

3.2. Methodology

Water Data Collection

Participatory method was applied. Water samplings were collected between November 2016 and July 2017 by water sampler. A total number of 80 samplings were gathered from surface water in main canals (40 samplings) and sewage from Amphawa market (40 samplings). Water quality of the samplings was measured and analyzed by the standard method.

4. Results

Quality of Surface Water and Sewage

A summary of the results of water quality assessment of surface water is presented in Table 1. Average pH value of surface water samples was 7.5 which was in standard threshold of PCD set as 5.0–9.0 (PCD, 2010). Both minimum pH value (6.6) and maximum pH value (8.0) were also in the threshold. Average DO was 4.1 mg/L where the threshold was ≤ 4.0 mg/L. Minimum DO was 3.1 mg/L and maximum DO was 5.4 mg/L. Average BOD of 2.97 mg/L was slightly over the threshold (≥ 2.0 mg/L) where minimum and maximum BOD were 1.33 and 4.20 mg/L, respectively. Very high amount of NH_3 was found i.e., 3.4 mgTKN/L of NH_3 (with minimum value of 0.6 and maximum value of 6.5) was found which was greatly over the threshold of ≤ 0.5 mgTKN/L. For TS, SS, FOG and P that do not have threshold available, average values were 318 mg/L, 43 mg/L, 23.4 mg/L and 0.24 mgP/L, correspondingly. Regarding micro-biological properties, average amount of TCB was under standard but that of FCB was slightly over the threshold. Average amounts of TCB of 12,751.97 mg/L (with minimum of 796.43 mg/L and maximum of 125,841.78 mg/L) and FCB of 4448.10 mg/L (with minimum of 635.29 mg/L and maximum of 15,121.50 mg/L) were found where the standards were set at $\geq 20,000$ mg/L and ≥ 4000 mg/L, respectively.

Table 1. Summary of the quality of surface water and sewage.

Statistics Value	Water Quality Parameters									
	pH	DO (mg/L)	BOD (mg/L)	NH_3 (mg/TKN/L)	FOG (mg/L)	TS (mg/L)	SS (mg/L)	P (mgP/L)	TCB (mg/L)	FCB (mg/L)
Minimum	6.6	3.1	1.33	0.6	1.4	32	2	0.04	796.43	635.29
Maximum	8.0	5.4	4.20	6.5	90.2	856	151	0.71	125,841.78	15,121.50
Average	7.5	4.1	2.97	3.4	23.4	318	43	0.24	12,751.97	4448.10
Standard	5.0–9.0	≤ 4.0	≥ 2.0	≤ 0.5	-	-	-	-	$\geq 20,000$	≥ 4000

Table 2 summarized the statistical analysis results regarding the quality of sewage. It showed that all pH value was in standard threshold i.e., average pH value of 6.6, minimum pH value of 6.0 and maximum pH value of 7.0. Very low DO and extremely high BOD were found. Average DO was 0.16 mg/L. For TKN, slightly high value over the threshold (≤ 20 mgTKN/L) was found. Regarding SS, FOG and P, average values of 258 mg/L, 14 mg/L, and 11 mgP/L were found, correspondingly.

Table 2. Summary of statistical analysis results regarding the quality of sewage.

Statistics Value	Water Quality Parameters						
	pH	DO (mg/L)	BOD (mg/L)	FOG (mg/L)	TKN (mgTKN/L)	SS (mg/L)	P (mgP/l)
Minimum	6.0	0.15	74	12	27	238	10
Maximum	7.0	0.15	569	16	23	284	12
Average	6.6	0.16	454	13	29	258	11
Standard	5.0–9.0	≤ 4.0	≥ 2.0	-	≤ 0.5	-	-

5. Conclusions

Findings from this research can be conclude as presented in the following sessions.

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Regarding quality of surface water, average pH, DO and amount of TCB of the water samplings were under the PCD standard. Whereas average BOD and amount of FCB were slightly over the threshold. In addition, very high amount of NH_3 was found. For quality of sewage, pH values were under the PCD standard but very low DO and extremely high BOD were found. Moreover, slightly high TKN value over the threshold was found. It could be noticed that, even without threshold available, SS and P of sewage were very much higher than those of surface water.

6. Recommendations

1. Government sections and local community should exchange opinions and knowledge regarding wastewater management plan and action project for a sake of recognition of actual problems occurred and needs required by the community.
2. Local awareness on water conservation to maintain clean water in the canals and rivers flowing through the community should be fostered.
3. Local awareness on domestic wastewater treatment should be provided for the community as well as relevant officers to increase participation.

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