

Study on Quality Parameters of Raw Natural Water for the Production of Tap Water at Bangka Sub-District, Ratchasan District, Chachoengsao

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Abstract

The study on water quality at Bangka Sub-District, Ratchasan District, Chachoengsao Province, Thailand was the survey research. The study was undertaken to determine the quality of raw natural water before used as raw material to produce tap water. The findings would submit to the Provincial Authority of Waterworks to consider for the production of tap water. We measured the water quality from Ta Lad canal, which had been using to produce the tap water two times each during the rainy season and dry season. The quality of water was analyzed and compared with the class 3 of The Surface Water Standard for Agriculture and Water Quality for Protection of Aquatic Resources. Results showed that the water quality of raw natural water collected on 31 May 2012 was in the range of standard values except the level of Lead was higher than that of the standard one. The water quality of raw natural water collected on 19 September 2012 was also in the range of standard values except the value of the Biochemical Oxygen Demand, which was higher than that of the standard one. These results were probably caused by contaminants leaked into the water. Therefore we should educate and encourage people in the community to become aware of this situation, while the water quality should be monitored regularly and stimulate the cooperation among government authorities, community and stakeholders in helping hands for the preservation of the water quality.

Keywords: Water quality, Tap water, Water resource management.

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Introduction

Water is an indispensable natural resource for the survival and well being of mankind. Water is fundamental for life and health. The human right to water is indispensable for leading a healthy life in human dignity. Therefore, the water quality of water supply should stay clean and clear with pleasant taste and odor. However, the water quality and water supply in the villages of Bangka Sub-District, Ratchasan District, Chachoengsao Province, are not suitable to be used to produce tap water because the quality of tap water that produced from this raw natural water is under the standard criteria for water quality consumption, and water is not enough to support all villagers in a village of Bangka Sub-District even the village has a water supply system, which retrieved from Ta Lad canal. Therefore it is interested to study and analyze the quality parameters of raw natural water in the canal. This research is carried out in the collaboration between the researchers and villagers of Bangka community. The results of this research would be useful for people in the Bangka Sub-District areas and could be used for the basic information for other communities or organizations.

Methodology

This research used a survey research design to collect data both of primary data and secondary data. The secondary data were basic data of Bangka district and data that related to tap water supply system of Bangka Sub-district Administrative Organization. The majority of primary data were obtained from interviewing that related to problems of water quality from the residents of Bangka Sub-District area. The water samples of raw natural water were sampling both from the rainwater during summer and rainy seasons and stored in laboratory for water analysis.

The water sample was analyzed against various parameters by comparing with the surface water quality standard class 3, which was equivalent to medium clean fresh surface water resources. The parameters that need to be considered were described as follows: (1) the water to be used for consumption should pass through an ordinary treatment process before being used. (2) Water that used for agricultural purpose should have the quality met the notification of the National Environmental Board, No. 8, B.E.2537 (1994), which was issued under the Enhancement and Conservation of National Environmental Quality Act B.E.2535 (1992) for the standards of surface water quality. The selected 17 parameters of raw natural water comprised of color and odor, temperature, acidity and alkalinity (pH), dissolved oxygen (DO), biochemical oxygen demand (BOD), total Coliform bacteria, fecal Coliform bacteria, Nitrate (NO_3) in Nitrogen, Copper (Cu), Manganese (Mn), Zinc (Zn), Lead (Pb), Arsenic (As), total Organochlorine pesticides, Dieldrin, Endrin, and Iron (Fe).

The sampling of raw natural water was collected 2 times, where the water sample was taken on May 31, 2012 for summer, and on September 19, 2012 for rainy season. The sites for taking the water sampling were selected along the Ta Lad canal near the water pump station. The water sample was taken before the water was pumped to the water production system

The researchers carried out the experiment for measuring the temperature, pH, and dissolved Oxygen immediately before the water samples were taken at the water sampling point.

The technique that used to preserve the water sample for analysis of individual parameter was done as follows: (1) water sample to be used for the determination of heavy metals as preserved by adding the concentrated nitric acid at pH below 2. (2) The water sample to be used for the determination of the content of nitrate – nitrogen was preserved by adding concentrated sulfuric acid of 2 ml per 1 liter of water sample. (3) The water sample to be used for the determination of the content of phosphate was preserved by adding the concentrated hydrochloric acid 1 ml per 1 liter of the water sample. (4) The water sample to be used for the determination of the content of sulfate by keeping the water samples in the brown bottle. (5) The water sample to be used for the determination of Coliform bacteria and fecal Coliform bacteria by storing the water samples under 4 to 8 ° C conditions in the refrigerator.

All water samples were labeled according to the name and type of sample, place and environments, date, time, and names of the sample collectors, and also recorded all of the details in the logbook. All samples were sent to the Central Laboratory (Thailand) Co., Ltd., Chachoengsao branch for the analysis.

The collection of the secondary data that included information regarding the area base, populations, and socio-economics were done through the survey of the tap water production system in Bangka Sub-District area and discussion with the committees and the Chief Executive of the Sub-District Administrative Organization on March 23, 2012. The consultation was carried out in collaboration between staff of the Faculty of Science and Technology, Rajabhat Rajanagarindra University, and authorities of local organizations.

Results

It was shown that the amount of raw natural water in Ta Lad canal was abundant all the year, where the water was clear with low in numbers of suspended solids. All residents in the village were able to use water for consumption all the year. The amount of water in rainy season was higher than the amount of water that was available in the summer. This observation was probably due to the fact that water in Ta Lad canal was originated from Klong Si Yad diversion dam, the water current was flowed continuously with brown color water and much more turbidity of the water body, where most of residents used water from the canal for the agricultural purposes. Information obtained from interviewing suggested that the pressure of the water pump house located at the bridge across Ta Lad canal in front of Bangka temple was too low, where the water was allowed to sit in a clarifier of Bangka Sub-District Administrative Organization, and was subsequently pumped into the village tap water production system. The water was filtered through the sand and fine sieve with adsorbents, where the filtrate was disinfected with chlorine. The filtered water was then pumped in to the storage room to silt settle. The final water product was then released into the tap water system in the village using high pressure water pump and distributed to all subscribed recipients in the village.

Results of interviewing that obtained from residents demonstrated a positive satisfaction concerning the quality of tap water in Bangka Sub-District Administrative Organization, where most of the residents were satisfied for the quality of tap water. But there were some complaints about the sour taste and rust odor occurred sometimes. It was found that there was more sediment in tap water during rainy

season; this might due to the efficiency of filter system was reduced during heavy rain in the rainy season.

Results of water analysis related to the quality of raw water samples that collected at Ta Lad canal are summarized in Table 1. The samples that collected during the summer month showed that most of the parameters of the water quality fell in the water quality standards class 3 criteria, i.e., color, odor, temperature, pH, dissolved oxygen, BOD, total Coliform bacteria, fecal Coliform bacteria, nitrate as nitrogen, copper, manganese, zinc, arsenic, Total organochlorine pesticides, dieldrin, endrin and iron; whereas the lead was higher than the standard criteria. The content of iron was rather high, even though the water quality standards class 3 did not require as an important parameter.

Table 1. Results of the analysis of the water quality parameters of raw natural water at Ta Lad canal.

No.	Parameters	Unit	Water quality standards class 3	Samples collected during Summer	Samples collected during Rainy season
1.	Colour and Odour	-	Natural	Normal both Colour and Odour	Normal both Colour and Odour
2.	Temperature	^o C	Natural	29.7	29.5
3.	Acidity and alkalinity (pH)	-	5.0 - 9.0	7.4	7.2
4.	Dissolved oxygen	mg/l	> 4.0	5.71	8.0
5.	Biochemical Oxygen Demand (BOD)	mg/l	2.0	1.25	3.33*
6.	Total Coliform Bacteria	MPN/100 ml	20,000	1,600	9,200
7.	Fecal Coliform Bacteria	MPN/100 ml	4,000	540	3,500
8.	Nitrate (NO ₃) in Nitrogen	mg/l	5.0	0.25	0.29
9.	Copper (Cu)	mg/l	0.1	0.011	0.006
10.	Manganese (Mn)	mg/l	1.0	0.142	0.287
11.	Zinc (Zn)	mg/l	1.0	0.097	0.014
12.	Lead (Pb)	mg/l	0.05	0.310*	0.008
13.	Arsenic (As)	mg/l	0.01	0.003	0.004
14.	Total Organochlorine Pesticides	mg/l	0.05	Not Detected	Not Detected
15.	Dieldrin	µg/l	Not Detected	Not Detected	Not Detected
16.	Endrin	µg/l	Not Detected	Not Detected	Not Detected
17.	Iron (Fe)	µg/l	-	4.610	7.488

Remark: * = higher than standard criteria

The secondary data were collected from the study area using surveying method and group discussion with committees and the Chief Executive of the Sub-District Administrative Organization. The activities of group discussion between researchers and the executive officers of the organization are shown in Figure 1.



Figure 1. Showing activities during group discussion between researchers and executives of Bangka Sub-District Administrative Organization.

The examples of activities during attempts to collect the secondary data at the study area are summarized in Figures 2 and 3. All information that related to the tap water production system, tap water's demand of community, tap water production rate, amount of raw natural water that was used from Ta Lad canal, water quality during each season, quality of village tap water, and tap water issues from past to present were collected.



Figure 2. Pictures showing environment status at and around Ta Lad canal that used for the production of tap water for the communities.



Figure 3. Pictures showing activities related to the collection of water samples at the study area for an analysis in the laboratory.

Discussion

It is shown that almost all parameters of the water quality that collected during summer months are fallen in the ranges of the water quality standards class 3 criteria except the lead which is higher than that of the standard one. This observation may be due to the contamination from materials used in daily activities of man, i.e., paints, fuel oil, batteries, ink, colors, and other materials that contain lead components.

Results obtained from the analysis of the water quality of water samples collected during rainy season show that almost all parameters of the water quality that collected during summer months are also fallen in the ranges of the water quality standards class 3 criteria except BOD value, which is higher than that of the standard criteria. The high value of BOD means that the water is contaminated with more organic substances. The microorganisms in the water are usually required high amounts of oxygen to decompose the organic matter in the water. Therefore, BOD value is higher than that of the standard one. The contaminants maybe derived from the communities or other sources that flow into the canal. However, the level of lead content in water is lower than that of the standard one.

The level of Fe in the water is rather high, but is not higher than that of the quality standards. This observation is probably related to the contamination of iron from organic mater in wastewater that releases into the canal.

The study of the quality of raw natural water in Ta Lad canal during the summer months and during rainy season showed that there were some parameters had values higher than those of the standard ones, i.e., lead during the summer months and values of BOD in the rainy season. Therefore, it is recommended that guideline to prevent and solve the problems that make the quality of raw water to become lower than the standard ones should be established, and the guideline of how to maintain the quality of raw water in the range of the standard ones should be published.

Conclusion

The study on the quality of raw natural water was carried out at the Bangka canal where the water in the canal was used for the production of tap water for the consumption of residents in Bangka Sub-District, Ratchasan District, Chachoengsao Province, Thailand. All information concerning both the preliminary and secondary data was collected from the study area. All parameters required to determine the quality of raw water that needed for the consideration for the production of tap water were studied, while the secondary data concerning information that related to the tap water production system, tap water's demand of community, tap water production rate, amount of raw natural water that was used from Ta Lad canal, water quality during each season, quality of village tap water, and tap water issues from past to present were obtained through interviewing and group discussion with local residents and authorities and executives of Bangka Sub-District Administrative Organization. The quality of raw water in Ta Lad canal both during summer months and rainy season were appropriate to be used for the production of tap water

Recommendations for the activities to maintain the production of tap water

The study on all parameters of raw natural water in Ta Lad canal should be carried out all year round in order to monitor the quality of raw natural water using in the production of tap water. The sites for water sampling should be expanded further above the water current of Ta Lad canal in order to monitor all parameters of the quality of raw natural water for more distant above the site that water was used. All environmental conditions above and along the site of collection of water should be maintained as clean and green environment all year round.

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