An Assessment Of Drinking Water Quality In Parts Of Skudai, Johor Bahru

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ABSTRACT

In a assessment of drinking water quality in Skudai, Johor Bahru, piped water samples in the distribution system from three different standpipe locations in Taman Sri Skudai, Taman Sri Pulai and Universiti Teknologi Malaysia (UTM) campus were collected and tested for selected ions and bacteriological quality. The result show that pipe water supplied from a treatment plant at Gunung Pulai in Pontian was low in mineral content. No *Eschericia Coli* were detected expected at the UTM Campus with concentration of 3 counts/100 mL in one out of 12 sample tested. Total coliforms were found at each site with concentration ranging from 1 to 13 counts/100 mL in 15 out of 6 samples. Except for the coliforms and the fluoride levels exceeding a little over 1.5 mg/L in 8% of the samples, drinking water in the distribution system in the study area can generally be said to have met the World Health Organization (WHO) guidelines during the study period. However, with the detection of coliforms and *E. Coli* at the household standpipes, the possibility of the distribution system in Skudai having pathogen coutamination from time to time cannot be dismissed.

Keywords: drinking water quality

INTRODUCTION

Clean water is the key to health. Like in many developing countries, adequate water treatment remains a major problem in Malaysia despite ultra modern equipment availabe for purification that boasts pollutant removal up to micron levels in drinking water and escalating government funds being spent and put aside for ambitious water projects. Today, to everyone's pride, Kenyir Dam Terengganu remains Malaysia's largest dam, standing majestically in tropical watershed as a symbolo of the government's determination to provide enough and safe water for all. It has been almost two years now since the declaration of "Clean Water and Adequate Sanitation for All by 1990" by the United Nations in November 1980 [1]. Many of us at Universiti Teknologi Malaysia (UTM). Skudai were curious about the quality of water we drink in Skudai. So, the authors it wise and appropriate to run a fwe tests on drinking water at UTM Campus and the neighbouring *tamans* in Skudai. The result could be used a check on general drinking water quality in the area amidst fear of chemical contamination and nations-wide concern over news of faked mineral being sold to the public even at leading supermarkets.

STUDY AREA AND DISTRIBUTION NETWORKS

The study area showm in Figure 1 was selected, encompassing three major residential area in Skudai, Johor Bahru, namely Taman Sri Pulai (TS Pulai), Taman Sri Skudai (TS Skudai) and UTM Campus at Skudai. Development admittedly was somewhat sluggish until the shifting of UTM's main campus from Jalan Gurney in Kuala Lumpur to Skudai in 1985. Today, Skudai is fast thriving as an important focal township for the surrounding area in Central Johore Bahru, serving many *tamans* along Johore Bahru-Senai Highway, Johore Bahru-Pontian Highway and the university community.

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Figure 2 shows the water supply distribution network serving the study area. Treated water is supplied from the Gunung Pulai Treatment Works in the Pontian District, accessible by about 50 kilometers of the Skudai-Pontian trunk road. The treatment plant is managed and maintained by the Singapore Public Utilities Board (PUB).

SCOPE OF STUDY

The water quality assessment was based on the constituents short-listed in Table 1.

Table 1: Water Quality Parameters

Health Parameters:	Copper, Fluoride, Nitrate, Phosphorous and Sulphate
Aesthetic Parameters:	Chloride, Free Chlorine, Total Chlorine, Hardness Ferrous, Silica, Zinc and pH
Bacteriological Parameters:	*E. Coli* and Total Coliform

By no means exhaustive, the list covers, in general, *health*, *aesthetic*, and *bacteriological aspects* of water quality normally stipulated in the water quality Standards for drinking. Consideration of additional parameters would undoubtedly raise higher level of confidence on the overall quality.

The water quality examination was done only on samples collected at the household standpipes located by the water meters. No analysis was conducted on water entering the distribution system.

SAMPLING AND PARAMETERS ANALYSES

Sampling was carried out on two saparate occasions for the ions and coliforms analyses. A total of 25 samples (collocted from February 13 – March 12, 1991) were analyzed for ions, 6 samples (collected from May 6 – May 13, 1992) were analyzed for coliforms, and anothers 12 samples for *E. Coli*. The samples ware taken from household standpipes by the water meters following a simple 5-minutes flushing procedure. UTM samples were collected from a tap situated in the Environmental Engineering Laboratory, Civil Engineering Faculty in Block C-08. The ion analyses were conducted in accordance with Hach's methods of water analysis [2] while the conform membrane filtration-plate count analyses were conducted in accordance with the procedures using MacConkey agar as culture medium [3].

The permissible limits of concentraction of these parameters were compared with WHO guidelines for drinking water quality [4], and the proposed Malaysian guidelines for drinking water quality [5].

RESULT AND DISCUSSION

The result of the analyses for chloride, free chlorine, total chlorine, copper, hardness, ferrous, phosphorus, silica, sulphate, zinc, nitrate, fluoride, and pH are shown in figures 3 through 15 while those for the bacteriological tests are shown in Table 2.

Table 2: Results of Coliform Tests

Parameter	TS Skudai	TS Pulai	UTM Campus
E. Coli	None deteched in 12 samples	None detected in 12 samples	None detected except in 1 sample out of 12 with conc, of 3 counts/100 mL
Total Coliform	2 – 12 counts/100 mL in 5 samples out of 6	1 – 9 counts/100 mL in 5 samples out of 6	1 – 13* counts/100 mL in 5 samples out of 6

Note: *This is the highest count detected (only in 1 sample) during the study period

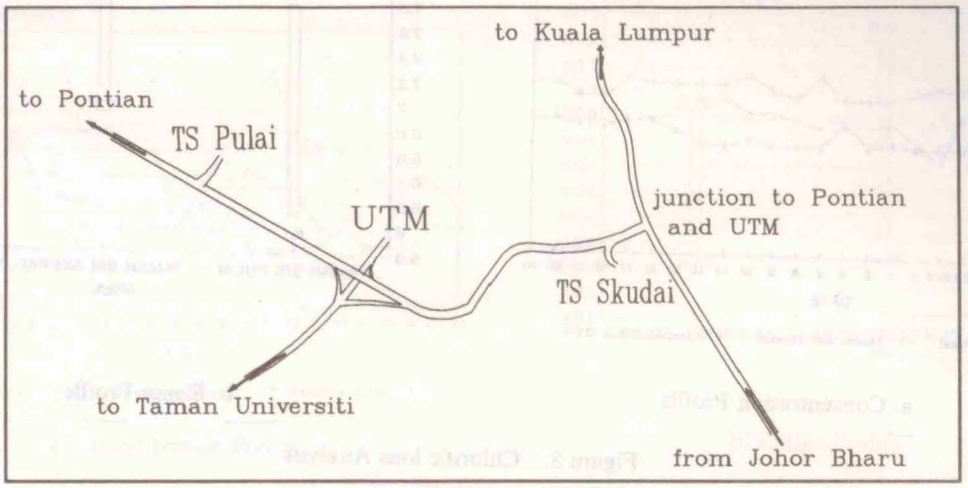


Figure 1. Location of the study area

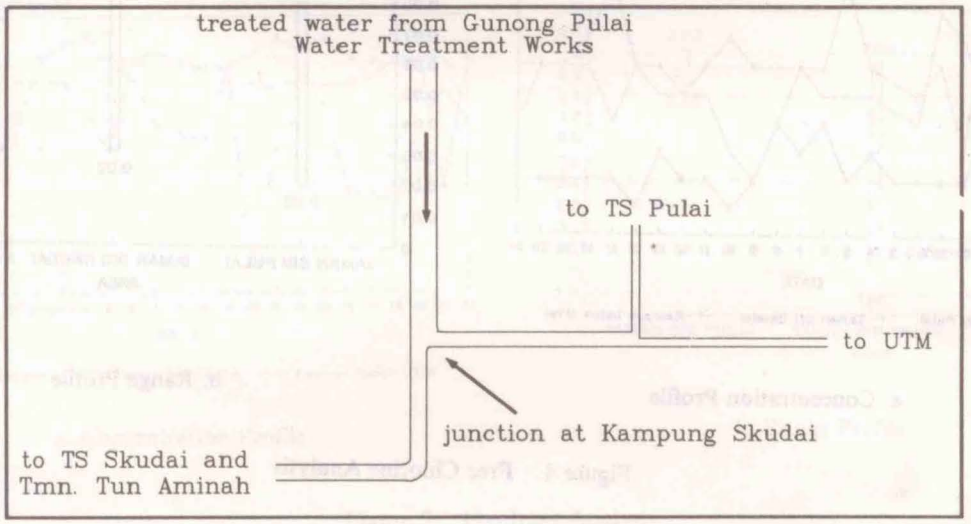
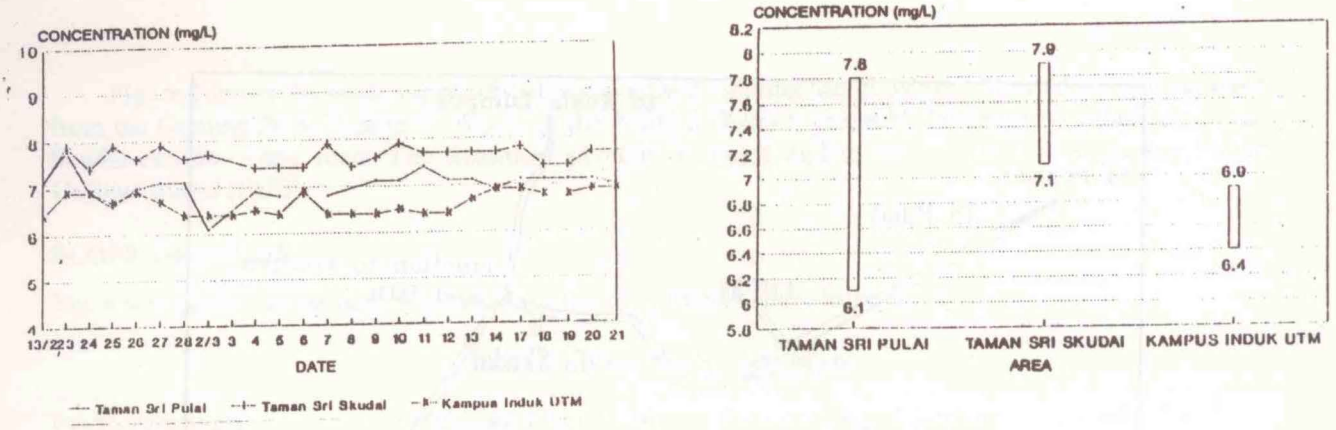


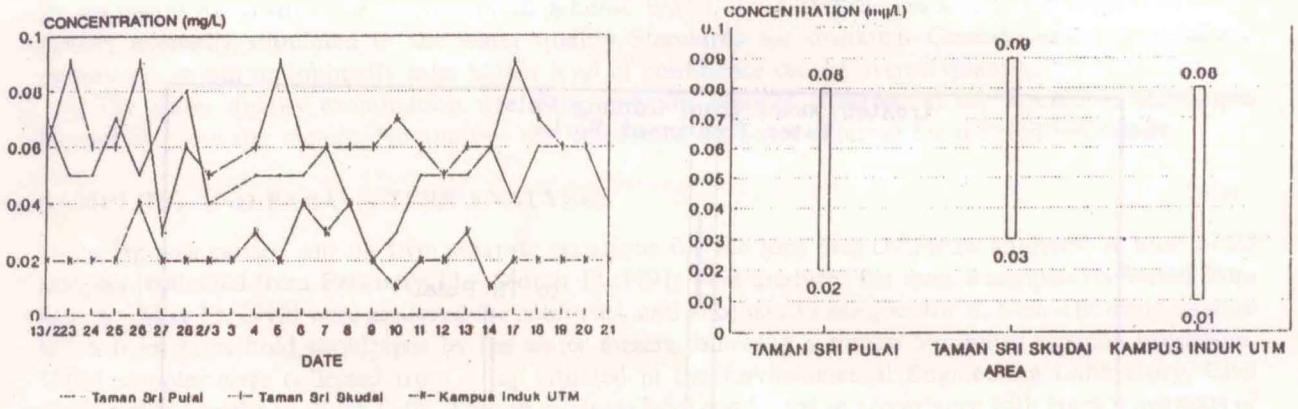
Figure 2. Pipe network of distribution system serving the study area



a. Concentration Profile

b. Range Profile

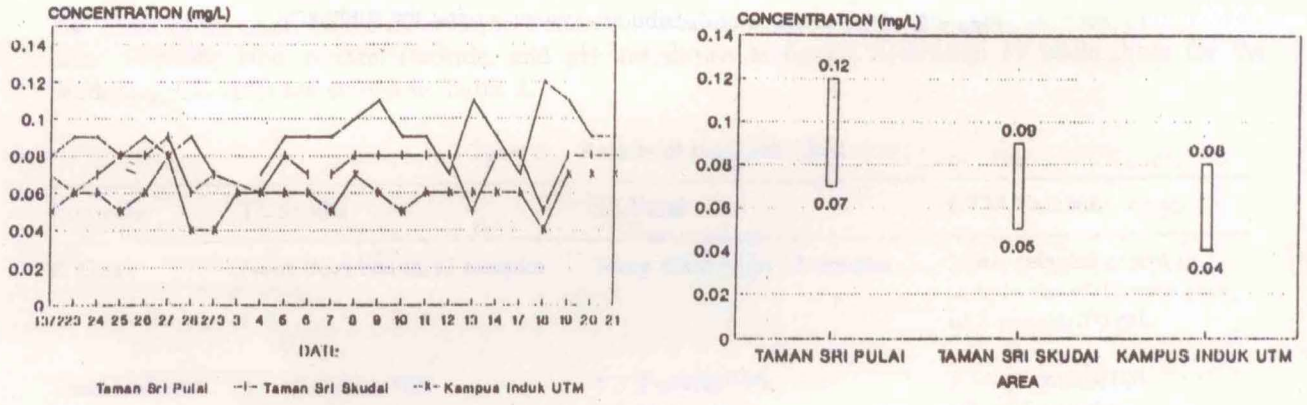
Figure 3. Chloride Ions Analysis



a. Concentration Profile

b. Range Profile

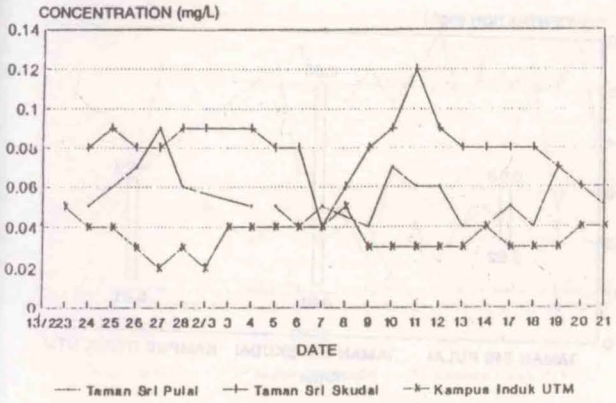
Figure 4. Free Chlorine Analysis



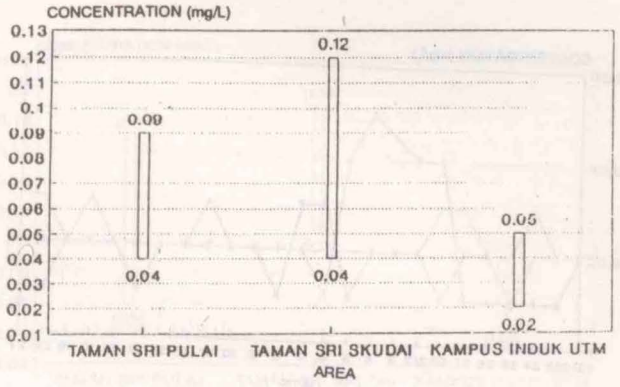
a. Concentration Profile

b. Range Profile

Figure 5. Total Chlorine Analysis

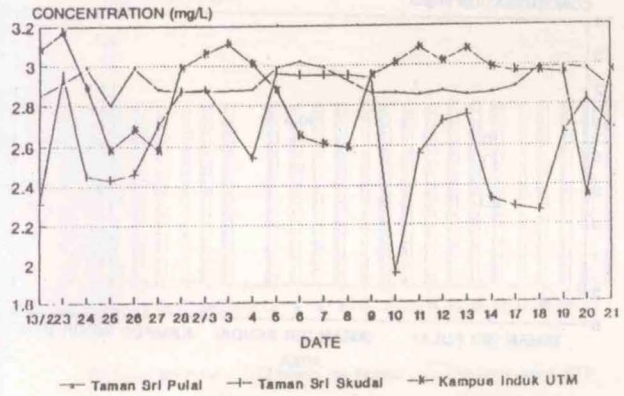


a. Concentration Profile

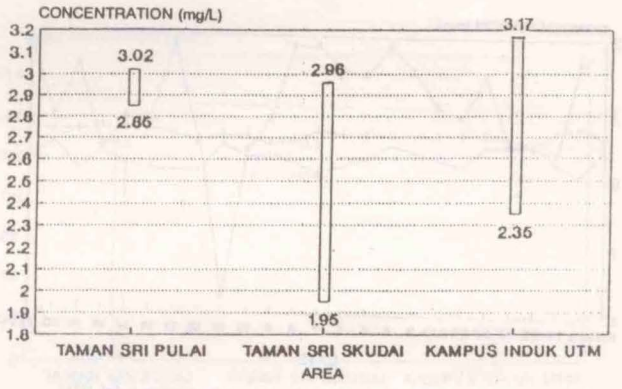


b. Range Profile

Figure 6. Copper Ions Analysis

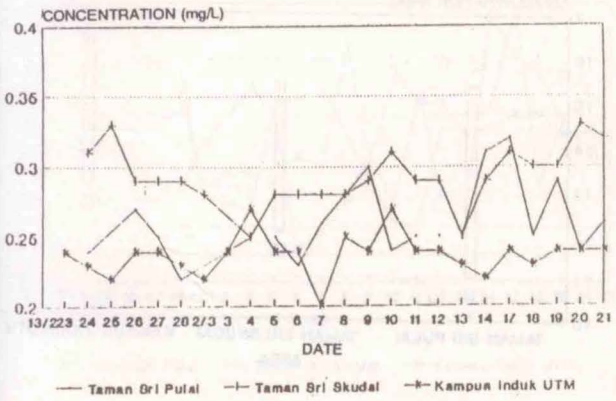


a. Concentration Profile

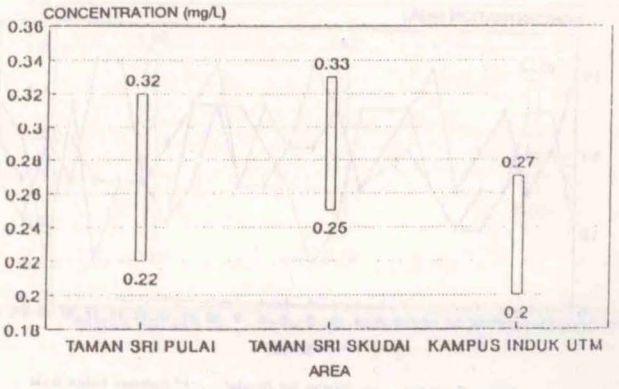


b. Range Profile

Figure 7. Hardness Analysis

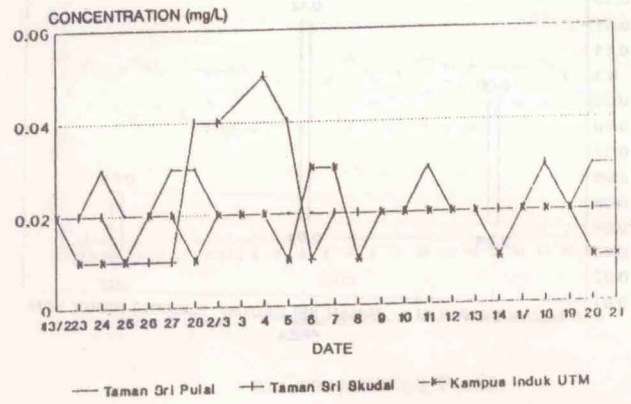


a. Concentration Profile

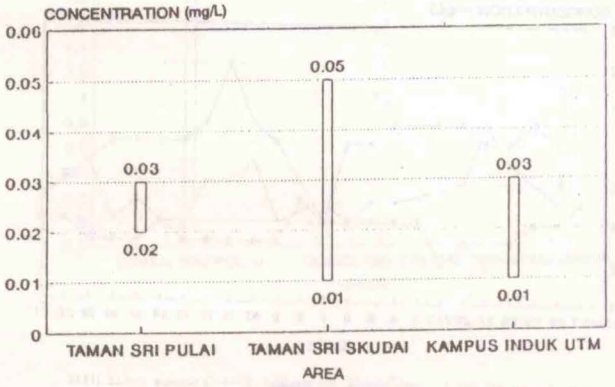


b. Range Profile

Figure 8. Ferrous Ions Analysis

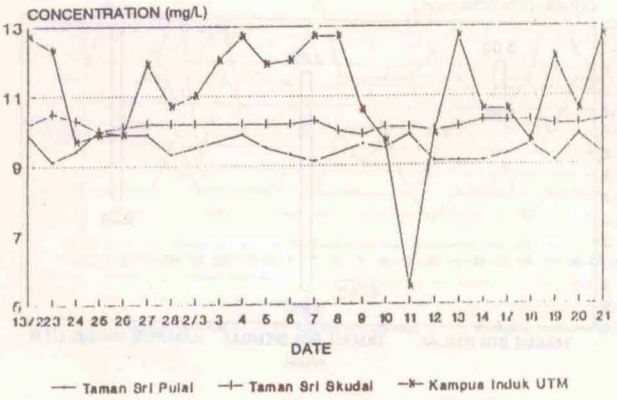


a. Concentration Profile

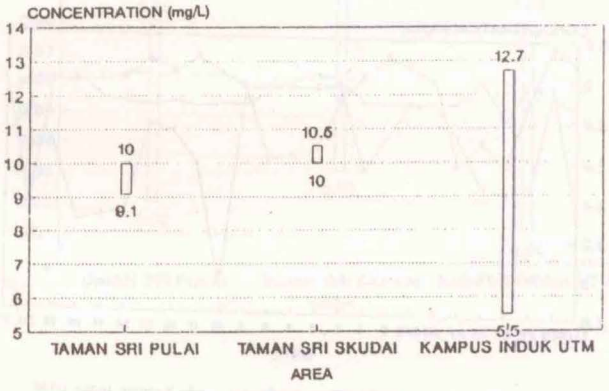


b. Range Profile

Figure 9. Phosphorus Analysis

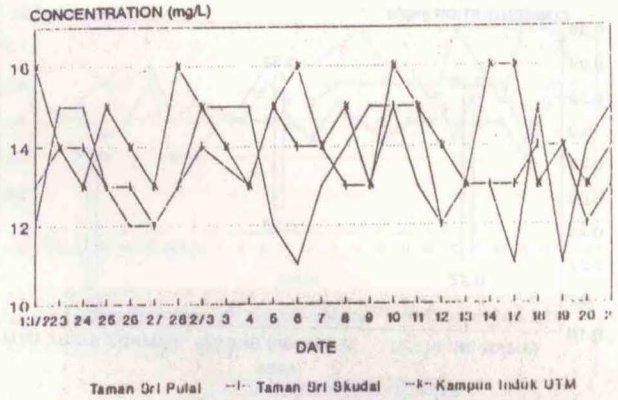


a. Concentration Profile

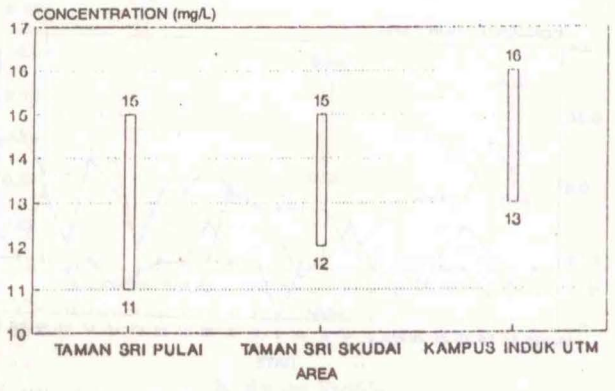


b. Range Profile

Figure 10. Silica Analysis

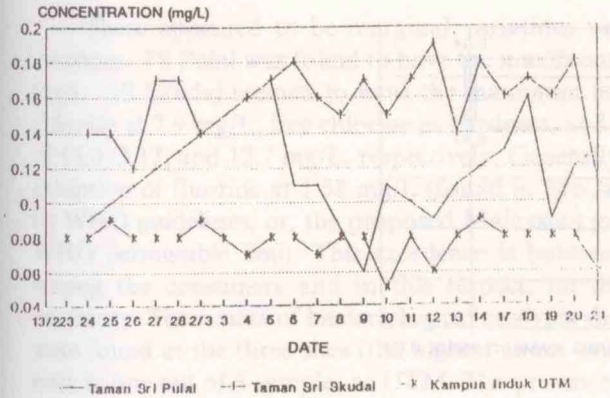


a. Concentration Profile

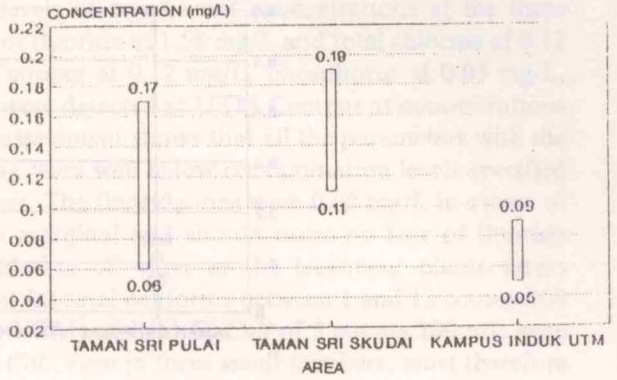


b. Range Profile

Figure 11. Sulphate Ions Analysis

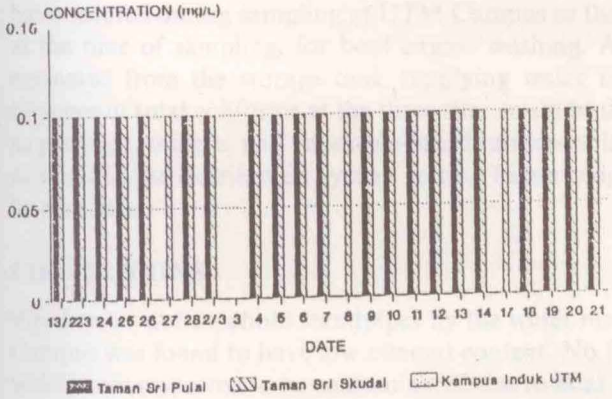


a. Concentration Profile

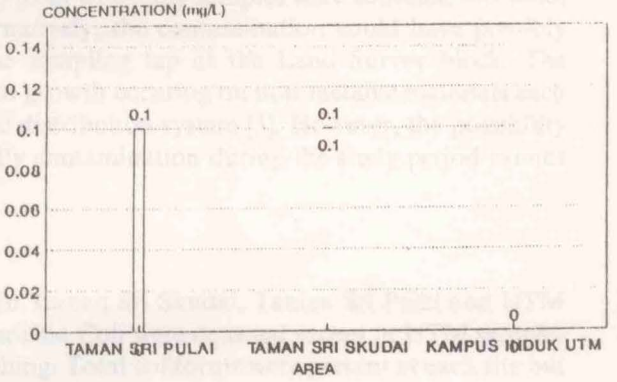


b. Range Profile

Figure 12. Zinc Ions Analysis

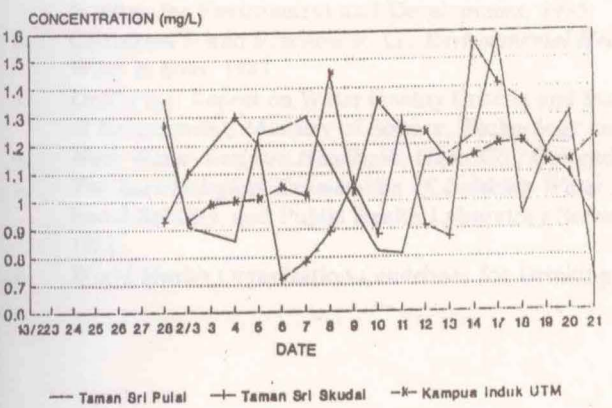


a. Concentration Profile

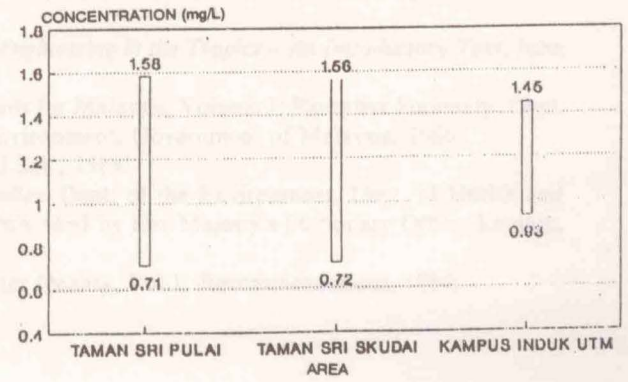


b. Range Profile

Figure 13. Nitrate Ions Analysis



a. Concentration Profile



b. Range Profile

Figure 14. Fluoride Ions Analysis

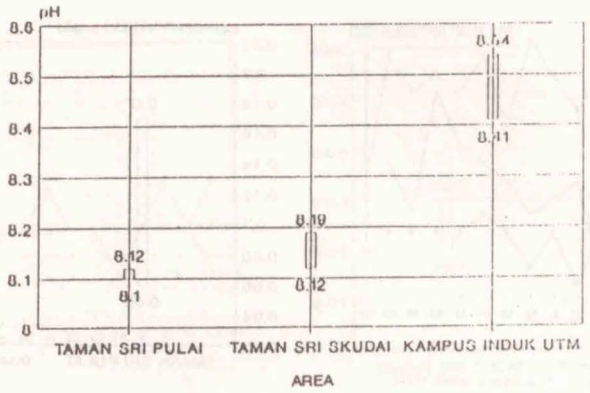


Figure 15. pH Range

There appeared to be marginal variations on the levels of constituent concentrations at the three locations. TS Pulai was found to have the maximum level of fluorida at 1.58 mg/L and total chlorine of 0.12 mg/L. TS Skudai seemed to have the maximum level of copper at 0.12 mg/L, phosphorus at 0.05 mg/L, chloride at 7.9 mg/L, free chlorine at hardness, and silica were detected at UTM Campus at concentrations of 16.0, 3.17, and 12.7 mg/L, respectively. Generally, the assessment shows that all the parameters with the exception of fluoride at 1.58 mg/L (found in two samples), were well below contamination levels specified by WHO guidelines, or, the proposed Malaysian guidelines. The fluoride ions were 0.08 mg/L in excess of WHO permissible limit. This excedence is however only marginal and should cause no fear of fluorisis among the consumers and in this respect, no defluoridation of water at the treatment plants seems necessary. The results of bacteriological analyses show that (a) total coliforms between 1 and 13 counts/100 were found at the three sites (the highest count being for UTM) and (b) *E. Coli* of 3 counts/100 mL were only in one out of 6 samples at UTM. The presence of *E. Coli*, even in these small numbers, must therefore be regarded as indicating the possible presence of intestinal pathogens [6]. WHO standards [4] suggest that (a) the water at the tap, i.e. from pipe supply in the distribution system, should contain no coliforms in 95% of samples examined throughout the year when sufficient number of samples are taken and it should never contain more than 3 coliforms in 100mL of sample in occasional samples but not in two consecutive samples, (b) the water in the distribution system should contain no *E. Coli.*

The results of the study obtained generally indicate the overall drinking water quality in the distribution system in Skudai. Variations in the ions level were expected. The *E. Coli* contamination could have occured during sampling at UTM Campus as the tap from which the samples were collected was used, at the time of sampling, for boat engine washing. Alternatively, the contamination could have possibly emanated from the storage tank supplying water to the sampling tap at the Land Survey block. The presence of total coliforms at the three sites could be due to growth occuring on non-metallic materials such as packing, washers, and vegetable-based lubricants in the distribution system [3]. However, the possibility of water in the distribution system getting bacteriologically contamination during the study period cannot be dismissed.

CONCLUSIONS

Piped water at household standpipes by the water meter in Taman Sri Skudai, Taman Sri Pulai and UTM Campus was found to have low mineral content. No Esherichia Coli were detected except in UTM samples which were suspected to be contaminated due to boat washing. Total coliforms were present at each site but whether they emanated from the main distribution systems, or, the household connection pipe from the main to the water meter, was not determined. However, the possibility of the distribution system having pathogen contamination from time to time cannot be dismissed.

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