SUITABILITY OF ATTANAGALU OYA AS A DRINKING WATER SOURCE

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Abstract

Attanagalu oya basin is situated between the two major river basins Kelani and Maha Oya .It plays a major role in national water supply since it contains major national water supply and drainage board intakes. This study intends to study the quality of water of the Attanagalu Oya and its suitability for drinking purpose. Because of its significance as a drinking water source it is important to maintain the quality of the water. Samples were collected from ten selected sampling locations along the main river including one near the origin of the river, near the sea outfall, NWS&DB intakes from the main river. Other locations were selected so as to have the similar distance between sampling locations Sampling was taken during both high and low flow rate conditions. Analysis was done on physical, chemical and biological parameters.

Results showed that records of COD, BOD, DO, pH, nutrient are low during the high flow rate while the levels of turbidity, metal iron total coliform and faecal coliform are high during the high flow rate.

1. INTRODUCTION

Attanagalu oya basin is situated between the two major river basins Kelani and Maha Oya and has an extent of 779 km^2. This river originates from the second peniplane of Sri Lanka and falls into topographical region of South West. Majority of Attanagalu Oya is located in the Western Province. The four streams Diyaeli Oya, Attanagalu Oya, Uruwal Oya and Kimbulapitiya Oya form the Attanagalu Oya discharges into Negombo lagoon as Dandugam Oya (DANIDA, 1999).

The lower valley of Attanagalu Oya basin which is at an elevation lower than 30 m covers more than 64 % of the basin area. Highest elevation within the basin is at Galapitamada area which is an elevation of 300 m from mean sea level.

The Basin has low country wet zone rainfall pattern. The mean annual rainfall in the area is between 2000 mm -2500 mm and is well distributed from April through to December and is followed by a distinct dry period from January to late March. Other than agriculture there are industrial activities also present in the area. (DANIDA, 1999)

The Attanagalu Oya plays a major role in national water supply since it contains four major national water supply and drainage board intakes. (NWSDB, 2005) The proposed research intends to study the quality of water of the Attanagalu Oya Because of its significance as a drinking water source and the need to maintain the quality of the water.

2. MATERIALS AND METHODOLOGY

2.1 SAMPLING

Samples were collected from ten selected sampling locations along the main river including one near the origin of the river, near the sea outfall, tributary side at the confluences of the main tributaries with the river and, closest possible locations near the NWS&DB intakes from the main river.

Sampling was done during both low and high flow rate of the river at frequent intervals.
Composite sampling is the method adopted for the analysis of pH, turbidity, nutrients, metals and biological parameters. . Equal volumes of water samples will be drawn from the middle and edges of the river and a composite sample will be prepared for a particular sample point. Furthermore samples taken from the middle of the river will be analysed for BOD, DO and COD.
Sampling locations are listed below.

M1-Seeduwa Kotugoda road bridge
M2-Muthuwadiya bridge
M3-Kotugoda National Water Supply and Drinage board intake
M4-Bolanda aniket
M5-Thammita bridge
M6-Gampaha- Udagampola road new bridge
M7-Veediya watta national water Supply and Drainage board intake
M8-Mangalakiriaya national water supply and Dariange board
M9-Attanagalla- Urapola Road Bridge
M10-Kal- eliya – Veyangoda road ½ culvert

2.1 *PARAMETERS USED FOR THE ANALYSIS*

Analysis was done on the following parameters which were selected based on the drinking water quality requirement of the country.

Following table gives the parameters and the method applied for the testing.

Table 1: Parameters and Test methods (APHA, 1998)

Parameter	Test method	Preservation Method	Maximum holding Period
pH	pH meter	Onsite measurements	-
Turbidity	Nephelometric method	Onsite measurements	-
Conductivity	Conductivity meter	Onsite measurements	-
DO	Titrimetry		
BOD	Titrimetry	Cool at 4^0C	6 hours
COD	Reflux method	Cool at 4^0C	7 days
Nitrates (NO_3-N)	Cadmium reduction method	Cool at 4^0C	7 days
Total Phosphate (PO_4-P)	Ammonium molybdate method	Cool at 4^0C	7 days
Metals	Atomic Absorption spectrometric method	H_2SO_4, pH<2	6 months
Total Coliform	Multiple Tube Fermentation	Cool at 4^0C	36 hours
Faecal Coliform	Multiple Tube Fermentation	Cool at 4^0C	36 hours

Values of above parameters were compared with CEA proposed Standards for drinking water category II to check the suitability of water for drinking purposes.

3. RESULTS AND DISCUSSION

Figure 1 shows the turbidity variation along the river.

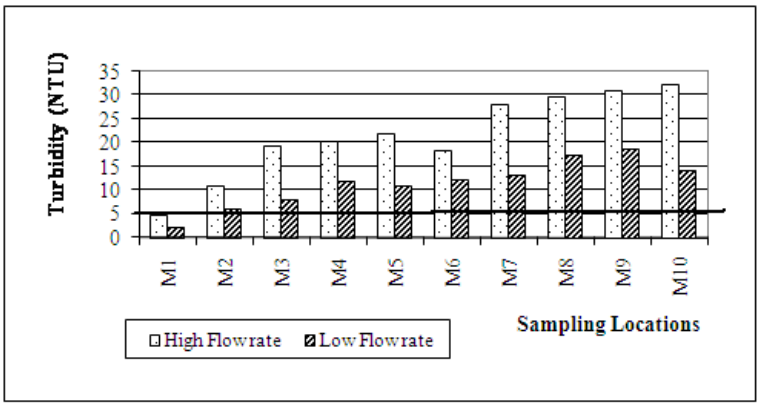

Figure 1: Mean Turbidity variation along the river

According to the above results, samples at the origin of the river have a turbidity value within the standard (5 NTU) during the high flow rate of the river. However all the other samples have values above the standard during high flow rate. In low flow rates, turbidity of M1 is within the standards. Turbidity of the sections downstream of the river shows high values of turbidity specially at sampling point M10 which is at the sea out fall in both conditions.

Average pH obtained during high flow rate times is always less than the respective values obtained during low flow rates. However pH levels of all sampling locations are within the standard value for drinking water with simple treatment (6.0-8.5)

According to the ambient water quality standards for drinking water with simple treatment, minimum DO level should be 6 mg/l. DO of the sampling location of M4 and M4 show a lower value from the standard in both flow rate conditions. Even though the other samples show a value of DO higher than samples obtained during the high flow rate the samples obtained at M6 and M9 shows lower levels than the standard value.

Conductivity of tributary confluences in the upper portion is higher than the conductivity of the main river. The values of all samples both during high and low flow rate conditions are below the standard level (750 mg/l). A conspicuous peak is observed in the sample taken near the sea out fall in low flow rate conditions with a value of 545 mg/l.

There is no value obtained for phosphate during both periods exceeding the standard level (0.7 mg/l). One conspicuous peak is observed in low flow rate condition in the sample from M10

There is no violation for nitrate from the standard (5 mg/l) in both periods. Three higher values than the rest are observed in low flow rate condition in the samples M2, M3 and the sample collected near the Veediyawatta National water Supply and Drainage Board intake sample taken from M5 shows the highest value during the low flow rate.

Figure 2 shows the BOD variation along the river.

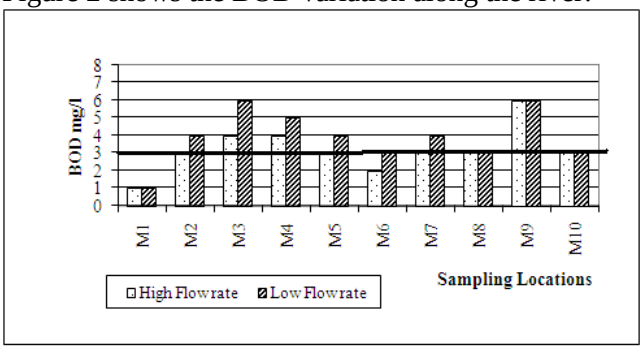

Figure 2: Mean BOD variation along river

According to the Central Environmental Authority of Sri Lanka ambient water quality standards, for drinking water, BOD for drinking water with simple treatment is 3 mg/l. BOD of sampling locations at M3, M4 and M9 exceed the standard value both in low and high flow rates

Figure 3 shows the COD variation along the river.

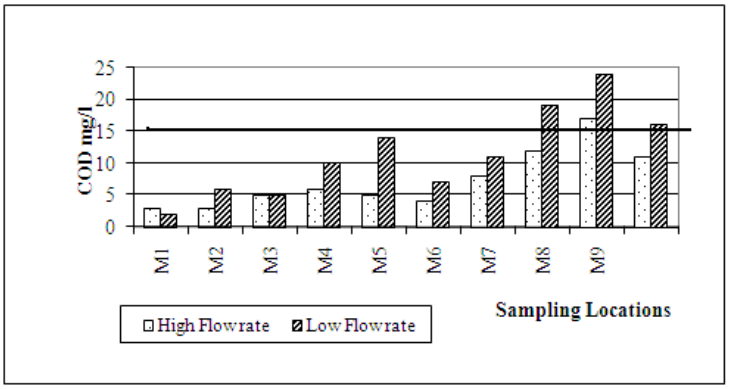

Figure 3: Mean COD variation along the river

Expected values of low flow rate are higher than the respective COD values at high flow rate. Furthermore Values obtained at high flow are closer to the standard value (15 mg/l) than the value of low flow rate. COD values show a gradual increase with the distance down stream with a maximum value observed at M9 in both flow rate conditions, showing a value of 24 mg/l value for COD in low flow condition and 16 mg/l in high flow condition which violates the standard.

There is no record of Cd in the upper part of the river. There is a peak value observed at the sample point M9. Cd concentration of this sample is higher than the standard during the low flow condition. Furthermore, it is close to the standard during high flow rate.

There are records of Cu in the upper reaches of the river in minute amounts. There is a peak value observed at the sample point M9. Cu concentration of this location is 9 µg/l and 7 µg/l in high and low flow rates respectively. Thus it does not violate permissible level.

Figure 4 shows the Total coliform variation along the river

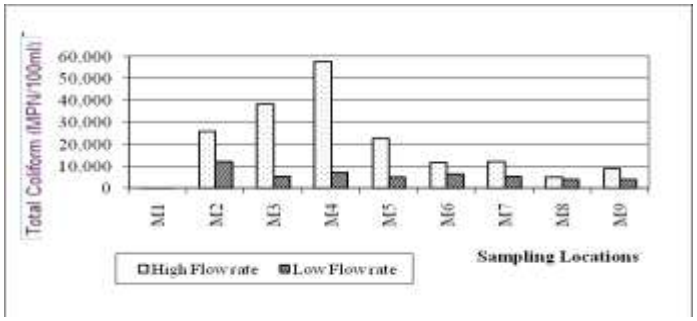

Figure 4: Mean Total Coliform variation along the river

According to the Standards, for drinking water with simple and conventional treatment standard value for Total coliform is 5000. During high flow rate conditions there is a conspicuous increase of total coliform count in the sample taken at M4. From that point onwards gradually decreases toward the sea out fall

During high flow rate conditions there is a steep rise in faecal coliform count up to the samples at M4 and then the values gradually decrease toward the sea out fall. Highest average which is 19,067 which was recorded during high flow rate is at the point of first tributary confluence of the main river. Desirable level for faecal coliform (250) is recorded only in the sample at the origin of the river. All the other samples show values higher than the maximum permissible level (600).

4. CONCLUSION

COD, BOD, DO, pH, nutrient and inorganic ion concentration are low during the high flow rate due to the dilution effect. Even with dilution, values of turbidity, total coliform and faecal coliform are high during the high flow rate due to the erosion and septic tank over flows.

According to the results of sampling locations near the NWS&DB intakes, water from Kotugoda, Mangalathiriya and Veediyawatta intakes which offer conventional treatment show COD and BOD values within standard levels.

Most of the other intakes which offer only simple treatment violate the given standard for "drinking water with simple treatment". Hence, it can be emphasised that simple treatment is not adequate for drinking purposes. Coliform counts at all intakes are significantly high when compared to the required standards.

5. RECOMMENDATION

According to the results obtained from this study the following recommendations are made for consideration.
There should be a proper sewage collection and treatment system at least for the townships

Simple treatment is not adequate since the concentrations of some contaminant parameters are far above the limit which is recommended for only simple treatment. Hence, it is required to establish "conventional treatment systems" for intakes where conventional treatment is not already provided.

Consumers are advised to use only boiled water for drinking purposes due to the high indication of fecal contamination at all times of the year.

Although the quality of water at Veediyawatta and Manglathiriya intakes where the main water intake of the latter stretch of the river is presently within the current standards for drinking water with conventional treatment, situation may rapidly change due to the upstream discharges. There is a possible danger of contamination with heavy metals especially Cd and of an increase in COD.

It is required to have continuous monitoring to assess the water quality since changes in discharges due to non-point sources of pollutants emitted with the expansion of housing and commercial activities and associated increase in population along the river.

Public awareness should be enhanced at divisional levels mainly among water users of the river for the possible risks that are associated with water consumption

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