

# Analysis of The Water Quality of a Dam in Thiruvananthapuram District, Kerala

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## Abstract

The present attempt is the analysis of the water quality of the dam (Aruvikkara reservoir). The following parameters viz temperature, pH, dissolved oxygen, biological oxygen demand, calcium, magnesium, hardness, nitrate, alkalinity, electrical conductivity and sodium of the Aruvikkara reservoir were analysed. Five different locations of the reservoir were identified. The study conducted during the month of February 2013 to January 2014. The study revealed that water quality index of four stations lies in the range of 26-50 which was good. The water quality index of the station 3 (Mundela) lies in the range of 51-75 which was poor.

**Keywords:** Aruvikkara reservoir, physico chemical parameters water quality index

## Introduction

The quality of water resource is usually described according to its physical, chemical and biological characteristics for confirming the good quality of water resources large number of physico-chemical and biological parameters are to be studied in details and must be found in normal range. Rivers, lakes and man-made reservoirs and ponds are used for water supply to domestic, industrial, agricultural and fish culture purposes hence assessment of water resource quality of any region is an important aspect for developmental activities of the region. Aruvikkara dam is one of the main sources of water for distribution in the Trivandrum city. Aruvikkara reservoir coordinate's 8.5677800°N 77.018890°E in Thiruvananthapuram district. It is located on the banks of the Karamana river 15 km from Thiruvananthapuram city.

## Materials and Methods

The Water Samples were collected from five different stations (Kaliankuzhi, Vembanni, Mundela, Mullilavinmoodu & Temple side) between 8am to 12pm in sterilised Polythene bottles regularly for every month. The collected samples were immediately brought in to Laboratory for the Estimation of various Physico-chemical parameters. pH was recorded at the time of sampling by Digital pH Meter. Other parameters were estimated in the Laboratory by us-

ing Indian Standard Procedures (Trivedy and Goel (1986), Grasshoff (1983), APHA (1992).

## Results and Discussion

**Water Temperature:** Temperature of water depends upon water depth besides solar radiation, climate and topography. It is the most important factor as it has profound direct or indirect influence on physico chemical, biological, metabolic and physiological behavior of aquatic ecosystem (Welch, 1982). The maximum seasonal average of temperature was 31°C at the station 5 during the pre monsoon and the minimum was 25.5°C at the station 1 during the post monsoon.

### Water pH

Water pH is one of the very significant chemical characteristic of all waters, which explains certain significant biotic and abiotic ecological characteristics of aquatic systems in general. Seasonal average values of pH ranged between 6.6 at station 3 in the pre monsoon and 7.3 at station 3 in the post monsoon. The pH was within the limits of standard values (WHO, 1985- 7 to 8.5).

### Alkalinity

Alkalinity of water is its capacity to neutralize acid and is characterized by the presence of hydroxyl ions capable of combining with hydrogen ions in solution. The maximum seasonal average of alkalinity was 20.79mg/L at the station 3 in the pre monsoon and the minimum alkalinity was 11.34mg/L at the station 5 in the post monsoon. The permissible value of Alkalinity ranges a maximum of 600mg/L.

### Hardness

Hardness to water is imparted by alkaline earth metal cat-

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**Figure 1. WHO standards and unit weights of water quality parameters**

Parameters	Recommended Unit Standard (Si)	Unit weight (Wi)
pH	7.0-8.5 (avg. 7.0)	0.005
Dissolved Oxygen, mg/L	>5.00	0.2
Biochemical Oxygen Demand, mg/L	<5.00	0.2
Calcium, mg/L	75	0.0133
Magnesium, mg/L	50	0.02
Hardness, mg/L		0.0033
Nitrate, mg/L	45	0.022
Alkalinity, mg/L	120	0.0155
Electrical Conductivity, $\mu$ S/cm	300	0.003
Sodium , mg/L	200	0.005

ions mainly calcium and magnesium present in it. The maximum total hardness was 24mg/L at the station 1 during the pre monsoon and the minimum total hardness was 7mg/L at station 4 in the monsoon. The hardness of water observed at all stations was within the limits - 100mg/L and 250mg/L respectively. Sawyer (1960) classified water on the basis of hardness into three categories i.e., soft (0-75mg/L), moderately hard (75-150mg/L) and hard (151-300mg/L). According to this classification, Aruvikkara reservoir falls in the category of soft water body with hardness ranging from 7mg/L to 24mg/L.

#### **Nitrate**

The nitrogen in water occurs as bound forms like nitrate, nitrite, ammonia and organic nitrogen viz. urea, amino acids etc. The seasonal data on nitrate varied between 1.79mg/L at the station 3 in the pre monsoon and 0.43mg/L at the station 2 in all the post monsoon season. The amount of nitrate found in the water was less than the accepted drinking water standards.

#### **Dissolved Oxygen (DO)**

Dissolved oxygen provides valuable information about the biological and biochemical reactions going on in waters. The DO concentration varied between 7.5mg/L at station 5 during monsoon and 6.1mg/L at the station 1 during the pre monsoon. The values of dissolved oxygen ranged between 7.7mg/L to 12.5mg/L in Mhaswad reservoir at Maharashtra (Lubal *et al.* 2012). These DO values were above the standard values prescribed by various authorities.

**Figure 2. Water Quality Index and water quality status (Tiwary and Mishra, 1986)**

Water Quality Index Level	Water quality status
0-25	Excellent
26-50	Good
51-75	Poor
76-100	Very Poor
>100	Unsuitable

#### **Biological Oxygen Demand (BOD)**

Biological Oxygen Demand is the amount of oxygen utilized by microorganisms in consuming the organic matter in waters. Seasonal values of BOD ranged between 3.5mg/L at the station 1 during the pre-monsoon and 1.7mg/L at the station 1 in the monsoon. The results are in agreement with the results in Ramsagar reservoir which was in the range of 0.93mg/L to 4.68mg/L with low values in monsoon and high values during pre-monsoon (Garg *et al.*, 2009). The average values of BOD during all seasons were generally not greater than the international standards - 6mg/L prescribed by WHO.

**Table 3. Tiwary and Mishra Water Quality Index for the Aruvikkara reservoir**

Stations	Water Quality Index (WQI)		
	Monsoon	Post monsoon	Pre monsoon
Station 1	29.6	40.4	42.2
Station 2	32.6	38.1	42.5
Station 3	30.7	39.9	52.1
Station 4	37.2	40.3	43.7
Station 5	35.9	34.7	38.7

### Water Quality Index (WQI)

Water quality index may be defined as a rating reflecting the composition influence of a number of water quality parameters. It provides a convenient means of summarizing complex water quality data.

The index generally produces a number between 0 and 100. Higher the index better the quality, lower the value higher the pollution.

WQI is calculated from the formula given below:

$$WQI = \left[ \sum q_i W_i \right] \div \sum W_i$$

$$\text{Where, } q_i = 100(V_i/S_i) \\ W_i = K/S_i$$

$q_i$  = quality rating for the  $i^{\text{th}}$  water quality parameter ( $i = 1, 2, 3, \dots, N$ )

$V_i$  = measured value of the  $i^{\text{th}}$  parameter at a given sampling station,

$S_i$  = the standard of permissible value for the  $i^{\text{th}}$  parameter

The standard permissible values for various pollutants in drinking water, recommended by WHO, are given in the Table 1.

It is well known that, the more harmful a given pollutant is, the smaller is its permissible value for the standard ( $V_s$ ) recommended for drinking water. So, the weights for various water quality parameters are assumed to be inversely proportional to the recommended standards for the corresponding parameters, namely  $W_i = K/S_i$  (where  $W_i$  is the unit weight for the parameter  $P_i$  ( $i = 1, 2, 3, \dots$ )) and  $K$  is a constant for proportionality. Table 2 shows the water quality index values suggested by Tiwary and Mishra, (1986) and respective values of monsoon, post monsoon and pre-monsoon illustrated in Table 3.

The water quality in the Aruvikkara reservoir was good as indicated by high dissolved oxygen and low biological oxygen demand. All Parameters were within the permis-

sible limits prescribed by various agencies (WHO, ISI, BIS). The study revealed that water quality index of all the stations except the station 3 lies in the range of 26-50 which was good. The water quality index of the station 3 lies in the range of 51-75 which was poor. The study of physical and chemical characteristics of water present in the reservoir provides an insight into the quality of water. The increasing concentration of various nutrients released from the neighboring agriculture fields as well as the domestic water can cause adverse effects on human health and environment. The results from the present study clearly indicated that the water in the reservoir is non-polluted and can be used for domestic and irrigation purposes.

### Conclusion

Water quality index was used as a tool to analyse the water quality of the Aruvikkara dam. The study revealed that most of the stations selected for study were within the admissible range as suggested by WHO. Therefore we concluded that the dam was not much polluted and the water present in the dam can be used for domestic and irrigation purposes.

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