

# A Study on Physico-chemical Analysis of Omakulam Pond Water, Chidambaram, Cuddalore District (India)

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## **Abstract**

Water samples were collected from Omakulam pond, Chidambaram, Cuddalore District (India). These water samples were analyzed for their physico-chemical characteristics. Laboratory tests were performed for the analysis of sample for alkalinity, total dissolved solids, sulphate, phosphate, nitrate, temperature, pH, BOD, COD, magnesium, turbidity, chloride and calcium. Physico-chemical analysis of pond water sample was observed within the permissible limit as prescribed by WHO and Indian standards but alkalinity and total dissolved solids are higher than that of permitted limit in pond water. The sulphate, phosphate and nitrate are lower than that of permitted limit in pond water. The temperature, pH, BOD, COD, magnesium, turbidity chloride and calcium are within the permitted limit in pond water.

**Keywords:** Pond water, Physico-chemical, Alkalinity, Phosphate, Sulphate, Turbidity

## **1. INTRODUCTION**

Water is a vital element for the survival of life on our planet. It covers about three fourth of the earth's surface<sup>1</sup>. Surface water is a general term describing any water body which is found flowing or standing on the surface such as streams, rivers, ponds, lakes and reservoirs<sup>2</sup>. India is a country of rivers. Like network number of river systems spreaded all over the country<sup>3</sup>. Life, prosperity and civilization revolve around water in the Indian sub-continent<sup>4</sup>. Unfortunately, pollution of the environment is one of the most horrible ecological crises to which we are subjected today. The three basic amenities for living organisms are air, water, and soil or land. Some times in the past, these amenities were pure, virgin, undisturbed, uncontaminated and basically most

hospitable for living organisms, but the situation is just the reverse today because progress in science and technology is also leading to pollution of environment and serious ecological imbalance which in the long run, may prove disastrous for mankind. The root cause of the environmental pollution has been the man's misbehavior with the nature under the false ego that he is the master of nature. These undesirable situations are created by man himself and other living biota on the earth<sup>5</sup>.

Water pollution is the phenomenon that is characterized by the deterioration of the quality of land water (rivers, lakes, marshes and ground water) or seawater as a result of various human activities<sup>6</sup>. Use of polluted water itself takes about 25000 peoples all over the world every day<sup>7</sup>. Water is the basic need of life. Fresh water immediately available to man for drinking and other purposes is only 0.002% of the total water. Since the demand for water is mostly for fresh water, and everyone have to depend mainly on this tiny fraction of the total water present on this planet. Further the uneven distribution of water on the surface of the earth makes it a scarce resource at several places. A number of diseases are caused by the consumption of poor water quality. It has been reported in the "community health study" that 50% of all reported cases of illness, and 40% of deaths in Pakistan are due to drinking of poor water quality<sup>8</sup>. The main aim of the present study was to assess the states of the physico-chemical water quality conditions and valuable measures for conservation and sustainability of the Omakulam pond, Chidambaram, Cuddalore district.

## **II. MATERIALS AND METHODS**

The water sample was collected from Omakulam pond, Chidambaram, Cuddalore district, Tamil Nadu, India.

### **Collection of Sampling**

Sample was collected in 250 ml glass bottles. Before sampling, the bottles were rinsed three times with sample water before being filled with the water sample. The actual samplings were done midstream by dipping each sample bottle at approximately 25-30 cm below the water surface, projecting the mouth of the container against the flow direction. The samples were placed in cooler boxes and transported to laboratory for analyzing the physico-chemical parameters.



Fig.1 Omakulam Pond

**Physico-Chemical Parameters**

The methods used for the analysis of various physico-chemical parameters were analysed in laboratory by following the methodology of APHA (1967, 1980), APHA-AWWA-WPCF (1976) and NEERI. The water temperature was recorded at the sampling area by using digital thermometer. Surface water temperature was recorded by dipping thermometer directly into water in a container, taking care not to expose it to the direct solar radiation. pH was recorded at the sampling site using digital pH meter maintained at the room temperature. Transparency, Turbidity and conductivity were measured by using Secchi disc, Jackson turbidity unit and conductivity meter. Total alkalinity, Total hardness, Calcium, Magnesium, Chloride, Free CO<sub>2</sub>, DO and BOD were analysed by titration method. Phosphate and Nitrate were analysed by using UV-VIS spectro photometer, sodium and potassium by Flame Photometer.

**III. STATISTICAL MEASUREMENT**

Statistical analysis like Standard deviation and Karl Pearson's correlation co-efficient was carried out with the help of the statistical software SPSS to find the relation between the hydrological attributes and their impact on biological variables.

**IV. RESULTS AND DISCUSSION**

The present study was carried out to investigate the physicochemical characters of pond water. The observations made on pond water sample were compared with WHO and ICMR drinking water standard<sup>9</sup>.

Table 1. Shows the pH, Turbidity, TDS and Water Temperature of Omakulam Pond Water Sample

| Parameters                    | Water sample            | WHO                     | ICMR                    |
|-------------------------------|-------------------------|-------------------------|-------------------------|
| Odour                         | No characteristic odour | No characteristic odour | No characteristic odour |
| pH                            | 8.10                    | 6.5-8.5                 | 7-8.5                   |
| Turbidity                     | 4.8                     | 5                       | 5                       |
| Total dissolved solids (mg/l) | 260.5                   | 500                     | 500                     |
| Temperature (°C)              | 28.5                    | 28-35                   | 28-37                   |

*Values were expressed as mean  $\pm$  SD for triplicate.*

Table 1 represent the pH, turbidity, TDS and temperature of pond water sample. Water sample of pH, turbidity, TDS and temperature are within the limit when compared to standard.

Table 2. Shows the BOD, COD and Total Alkalinity of Pond Water

| Parameters              | Water sample | WHO | ICMR |
|-------------------------|--------------|-----|------|
| BOD (mg/l)              | 3.87         | 10  | 12   |
| COD (mg/l)              | 5.15         | 10  | 12   |
| Total Alkalinity (mg/l) | 298.7        | 75  | 100  |

*Values were expressed as mean  $\pm$  SD for triplicate.*

Table 2 represents the concentration of BOD, COD and total alkalinity of pond water. BOD and COD level was decreased when compared to standard. The total alkalinity level was higher than that of standard.

Table 3. Shows the Magnesium and Calcium of Pond Water

| Parameters        | Water sample | WHO    | ICMR   |
|-------------------|--------------|--------|--------|
| Calcium (mg/dl)   | 99           | 75-200 | 75-200 |
| Magnesium (mg/dl) | 22           | 150    | 148    |

*Values were expressed as mean  $\pm$  SD for triplicate*

Table 3 represents the concentration of magnesium and calcium of pond water. Magnesium and calcium were lowest range when compared to standard.

Table 4. Shows the Chloride, Sulphate, Nitrate and Phosphate of Pond Water

| Parameters       | Water sample | WHO      | ICMR     |
|------------------|--------------|----------|----------|
| Chlorides (mg/l) | 308          | 200-1000 | 250-1000 |
| Sulphates (mg/l) | 21           | 200      | 200      |
| Nitrates (mg/l)  | 29           | 45       | 20-100   |
| Phosphate        | 1.7          | 5        | 4        |

*Values were expressed as mean  $\pm$  SD for triplicate*

Table 4 represents the concentration of sulphates, nitrates and chlorides of pond water. Nitrate, sulphate and phosphate were lowest range when compared to standard while chloride within the standard limit.

Water resources are of critical importance to both natural ecosystem and human development. It is essential for agriculture, industry and human existence. The healthy aquatic ecosystem is depended on the physico-chemical and biological characteristics<sup>10</sup>. The quality of water in any ecosystem provides significant information about the available resources for supporting life in that ecosystem. Good quality of water resources depends on a large number of physico-chemical parameters. To asses that monitoring of these parameters is essential to identify the source of any pollution. These characteristics can identify and suggest appropriate conservation and management strategies. Many researches are being carried out till present<sup>11</sup>.

#### **Temperature**

In the present study temperature range was kept from 28.5°C for sample. This temperature was ranged within the permissible limit of WHO.

#### **pH**

pH is a scale of intensity of acidity or alkalinity and pH measures the concentration of hydrogen ions in water, the variations in temperature effects on pH. P<sup>H</sup> was ranged within the permissible limit of WHO. However higher values of pH hasten the scale formation in water heater and reduce the germicidal potential of Chlorine.

**Alkalinity**

The total alkalinity of water samples was ranges from 75 to 100mg/l. The total alkalinity 298.7 mg/dl for pond water. The water sample has within the permissible limit as compared to standard. Alkalinity in itself is not harmful to human being; still the water samples with less than 100 mg/l are desirable for domestic use<sup>12</sup>. The high alkalinity imparts an unpleasant taste.

**Turbidity**

The turbidity profile of the pond water is 4.8 NTU. The turbidity values obtained from the sampling points was higher than WHO standard of 5 NTU. None of the receiving water body met the FEPA guideline of 0 to 1 NTU for turbidities in water for domestic use. These values are grossly exceeded in the water samples and it disqualifies the receiving water body for direct domestic use. Also, the excessive turbidity in water can cause problem with water purification processes such as flocculation and filtration, which may increase treatment cost. High turbid waters are often associated with the possibility of microbiological contamination, as high turbidity makes it difficult to disinfect water properly<sup>13</sup>.

**Calcium**

The calcium is 99mg/dl for pond water. The tolerance range for calcium hardness is 75 to 200 mg/l. Calcium is needed for the body in small quantities, though water provides only a part of total requirements.

**Chemical oxygen demand (COD) and Biochemical oxygen demand (BOD)**

The Chemical oxygen demand is a measure of pollution in aquatic ecosystems. It estimates carbonaceous factor of organic matter. In the present study Chemical oxygen demand value obtained in the range of 5.15mg/l.

The Biochemical oxygen demand is the amount of oxygen required by the living organisms. It is a very important indicator of the pollution status of a water body. The Biochemical oxygen demand value shown range from 3.87 mg/l. The Biochemical oxygen demand values for all water samples were found lower than the prescribed limit WHO (10mg/l) and ICMR (12mg/l). Both Biochemical oxygen demand and Chemical oxygen demand may be due to discharge of domestic sewage and industrial waste water to water bodies.

**Sulphate**

Sulphate range 21mg/dl for sample. The tolerance range for sulphate is 200 to 400 mg/l. The high concentration of sulphate may induce diarrhoea.

**Chloride**

Chloride found low during the study ranged from 308mg/dl for sample. Similar results were reported by Swarnalatha and Nasing Rao and Umavathi *et al.*,<sup>14</sup> showed that low concentration of chloride is associated with decreased level of pollution. Chloride values ranged from 200 to 1000

mg/l. High chloride content can cause high blood pressure in people. Chloride in excess (1000 mg/l) imparts a salty taste to water and people who are not accustomed to high chloride may be subjected to laxative effect<sup>15</sup>.

#### **Nitrate**

During the study Nitrate 29mg/dl for sample. All the samples are within the permeable limit. High concentration of nitrate in drinking water is toxic<sup>16</sup>.

#### **V. CONCLUSION**

The following conclusion obtained from the study. Physico-chemical analysis pond water sample was observed within the range as prescribed by WHO and Indian standards but alkalinity and total dissolved solid are higher than that of permitted limit in pond water. The sulphate, phosphate and nitrate are lower than that of permitted limit in pond water. The temperature, pH, BOD, COD, magnesium, turbidity chloride and calcium are within the permitted limit in pond water. From the present study, the physico-chemical condition of Omakulam pond is polluted and it is important to monitor it regularly. Management efforts should be made for the conservation of pond otherwise it will rapidly turn into the state that would not be fit for the domestic use, growth and survival of aquatic life present in it.

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