

# Assessment of Water Quality of Adyar River

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**ABSTRACT:** This study was conducted to determine the water quality of Adyar River based on the physical and chemical parameters. Water samples were collected from 8 sampling stations along the river during the month of January, 2018. The samples were analyzed for various Physio- chemical parameters such as pH, Turbidity, chloride, sulphate .Total dissolved solids (TDS), Total alkalinity, Total hardness, Magnesium, Calcium and Iron. The results obtained by standard methods were compared with the drinking water quality requirements prescribed by Bureau of Indian Standards (BIS).The physio-chemical parameters reveals that some of the samples exceed the acceptable limit for drinking.The study also reveals that the water quality of Adyar river is highly deteriorated due to anthropogenic activities such as urbanization, construction activities, agricultural activities, discharge of untreated sewage and disposal of solid wastes directly into river.

**KEYWORDS:** Adyar River, Anthropogenic, Deterioration of river, Physio-chemical parameters, Water quality analysis.

## I. INTRODUCTION

Water is the most abundant natural resource on earth. It is a precious component which is essential for survival of all living organisms. It is necessary not only for human beings but also for plants, animals, industries and developmental activities.Rivers are the important source of surface water. They provide magnificent habitat and nourishment for many living organisms. They are also useful for irrigation, navigation, hydroelectric power generation and industrial activities.India is blessed with a network of rivers which play a vital role in the lives of the Indians. Regrettably most of the rivers in the country are polluted due to urbanization, increased human population, industrial effluents, agricultural runoff, and discharge of untreated sewage and throwing of rubbish directly into the rivers.Untreated sewage, industrial effluents, agricultural run-off containing fertilizers and pesticides, when discharged into river, affects the native organisms and therefore disturb the river ecosystem. Consumption of water and fishes caught from contaminated river leads to various health effects. Swimming in the polluted river causes skin rashes.Rubbish floating in the river makes them to look unpleasant. Pollution of water gives rise to offensive smell. Accumulation of solid wastes causes flooding of rivers. It is important to understand the factors responsible for pollution. Periodical assessment of water quality of rivers are necessary to maintain river ecosystem and also sustainable development of the country.The main objective of the study is to assess the water quality of Adyar River. This will help to develop river water quality management policies and prevention of water pollution based on the combined efforts of local government, farmers and students.

## II. METHODS AND PROCEDURE

### 2.1 Study area and Sampling sites

Adyar river (13° 05' N latitude, 80° 15' E longitude) is one of the three rivers that flowing in Chennai district. Two streams, one starting near Manimangalam village and the other starting near Guduvancheri join near Tambaram. It starts to appear as a river with well-defined banks only from the point where the surplus water from Chembarambakkam Lake.

Near Thiruneermalai. It flows through Kanchipuram, Tiruvallur and Chennai district for about 42.5 kilometer before joining the Bay of Bengal in Adyar, Chennai. The River is dry most of the time and has free flow of water only when Chembarambakkam Lake overflows. A lot of slums and industries are located along the banks of the river. It also receives run off and sewage outlets from the Chennai metropolitan city. All the eight sampling stations were fixed as given in the map.

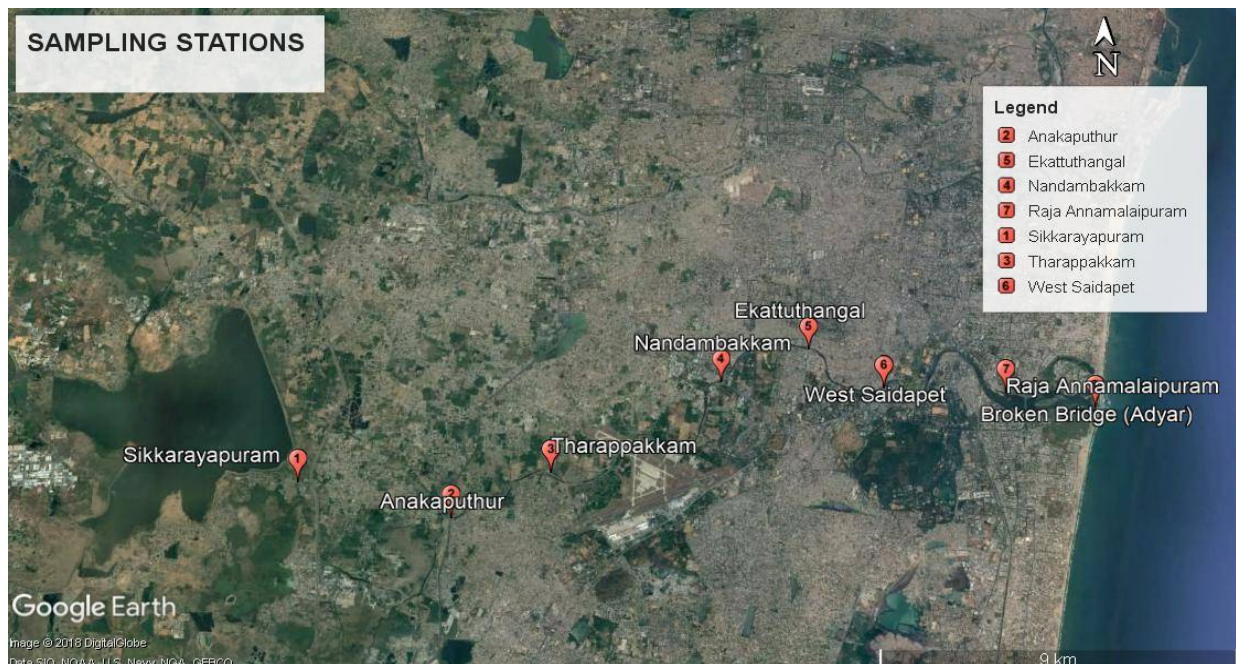


Fig. 1. Sampling stations

The table provided below shows the latitude and longitude of the sampling stations.

TABLE I  
SAMPLING STATIONS

Sampling station	Latitude	Longitude
1.Sikkarayapuram	12.994641	80.084339
2.Anakaputhur	12.985899	80.121162
3.Tharappakkam	12.996700	80.144803
4.Nandambakkam	13.018762	80.185887
5.Ekattuthangal	13.026820	80.207325
6. West Saidapet	13.017086	80.225191
7.Raja Annamalipuram	13.016067	80.254627
8.Broken Bridge(Adyar)	13.012087	80.275951

## 2.2 Sampling and Laboratory methods

All the eight samples were collected in the plastic bottles of one litre capacity which is thoroughly rinsed with distilled water. The samples were analyzed for various physico-chemical parameters such as pH, Turbidity, Chloride, Sulphate, Total dissolved solids (TDS), Total alkalinity, Total hardness, Magnesium, Calcium, Iron and Silica.

The following table shows the methods used for analysing various physico-chemical parameters.

TABLE II  
Methods used for estimation of various physicochemical Parameters

Parameters	Methods
pH	Digital pH meter (Systronics 335)
Turbidity	Turbidity meter
Chloride	Argentometric method
Sulphate	Turbidity method
Total dissolved solids	Gravimetric method
Total alkalinity	Indicator method
Total hardness	EDTA method
Magnesium	EDTA method
calcium	EDTA method
iron	Phenanthroline method

## III. RESULT AND DISCUSSION

### 3.1 pH (*potential of hydrogen*)

pH is a scale of acidity from 0 to 14. It tells whether a substance is acidic or alkaline in nature. A value of 7 on the pH scale indicates that the solution is neutral. pH value less than 7 is considered as acids while greater than 7 is considered as alkalis. The desirable pH value ranges from 6.5 to 8.5. The pH in all the sampling stations varies between 7.22 and 7.88 which shows the river water is slightly alkaline.

### 3.2 Turbidity

Turbidity is the haziness or cloudiness of water. It may be caused by the presence of clay, slit, organic or inorganic matter and micro-organisms. The acceptable limit of turbidity is 1 NTU. All the 8 sampling stations exceed the limit.

### 3.3 Chloride

Chloride in surface and groundwater from both natural and anthropogenic sources, such as run-off, the use of inorganic fertilizers, landfill leachates, septic tank effluents, animal feeds, industrial effluents, irrigation drainage, and seawater intrusion in coastal areas [13]. The desirable limit of chloride is 250 mg/l. The stations 4,5,6,7 exceed the

acceptable limit whereas the stations 1, 2, 3 within the limit. The station 8 has more chloride content due to intrusion of sea water.

### 3.4 Sulphate

Sulfates are discharged into water from mines and smelters, paper mills, textile mills and tanneries. Atmospheric sulfur dioxide, formed by the combustion of fossil fuels and in metallurgical roasting processes, may contribute to the sulfate content of surface waters. Sulfur trioxide, produced by the oxidation of sulfur dioxide, combines with water vapour to form dilute sulfuric acid, which falls as acid rain [14]. The desirable limit of Sulphate is 200 mg/l. The stations 1,2,3,4 fall under the desirable limit whereas the stations 5, 6, 7 exceed the limit.

TABLE III  
Physio-chemical parameters of sampled waters

Parameters	Units	S-1	S-2	S-3	S-4	S-5	S-6	S-7	S-8	Limits
pH	-	7.22	7.88	7.53	7.62	7.68	7.75	7.32	7.47	6.5 to 8.5
Turbidity	NTU	3.21	5.67	6.84	7.81	5.61	7.32	4.89	5.27	1
Chloride	mg/l	58	68	156	270	308	237	294	2299	250
Sulphate	mg/l	35	85	63	140	274	415	127	319	200
Total dissolved solids	mg/l	324	290	621	1114	442	718	4951	6236	500
Total alkalinity	mg/l	155	119	169	334	406	186	247	389	200
Total hardness	mg/l	148	107	181	432	581	771	482	960	200
Magnesium	mg/l	16	24	34	41	38	57	112	163	30
Calcium	mg/l	34	58	65	106	129	92	74	115	75
Iron	mg/l	0.038	0.048	0.071	0.054	0.031	0.046	0.027	0.042	0.3

### 3.5 Total Dissolved Solids

Total dissolved solids (TDS) is the term used to describe the presence of solids (inorganic salts and small amounts of organic matter) dissolved in water. Desirable limit of TDS is 500 mg/l. The station 8 has more number of total dissolved solids when compared to the other stations.

### 3.6 Total Alkalinity

The measurement of all alkaline substances dissolved in the water is termed as total alkalinity. The alkaline substances dissolved in water are primarily carbonates, bicarbonates and hydroxides. By neutralizing acids, these substances buffer pH in water. The water for domestic use having alkalinity less than 200 mg/l is safe. Total alkalinity of water in terms of CaCO<sub>3</sub> varies from 119 mg/l to 406 mg/l.

### 3.7 Total Hardness

Water hardness is the traditional measure of the capacity of water to react with soap, hard water requiring considerably more soap to produce a lather. Hard water often produces a noticeable deposit of precipitate in containers, including bathtub ring. It is not caused by a single substance but by a variety of dissolved metallic ions, predominantly calcium and magnesium cations, although other cations such as aluminium, barium, iron, manganese and zinc also contribute. Hardness is most commonly expressed as milligrams of calcium carbonate equivalent per litre. Water containing calcium carbonate at concentrations below 60 mg/l is generally considered as soft; 60–120 mg/l, moderately hard; 120–180 mg/l, hard; and more than 180 mg/l, very hard [12]. The desirable limit of total hardness is 200 mg/l. The stations 1, 2, 3 fall under the desirable limit whereas the stations 5, 6, 7 exceed the limit.

### 3.8 Magnesium

The desirable limit of magnesium content for drinking water is specified as 30 mg/l. The lowest magnesium content 16 mg/l is observed at station-1 while maximum 163 mg/l at station-8.

### 3.9 Calcium

The desirable limit of magnesium content for drinking water is specified as 30 mg/l. The lowest magnesium content 16 mg/l is observed at station-1 while maximum 163 mg/l at station-8.

### 3.10 Iron

Iron is the second most abundant metal in the earth's crust. It is most commonly found in the form of its oxides, as the iron ions readily combine with oxygen and sulphur containing compounds. The desirable limit of iron in drinking water is 0.3 mg/l. Iron in samples varies from 0.027 mg/l to 0.071 mg/l, which is the safe limit

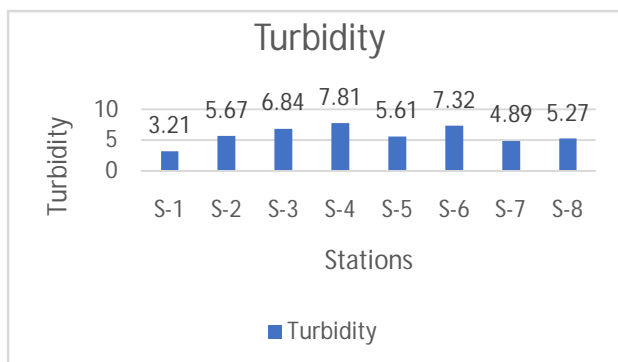


Fig. 2. Variation in pH with respect to sampling stations

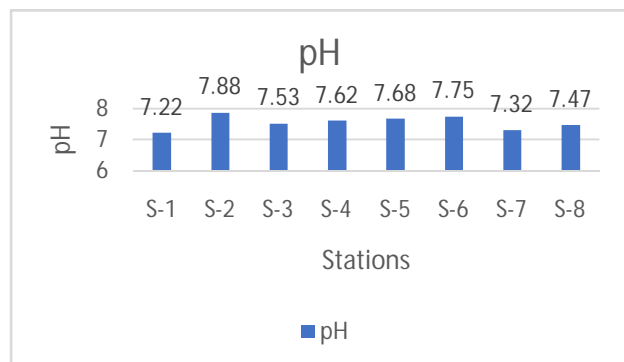


Fig. 3. Variation in turbidity with respect to sampling stations

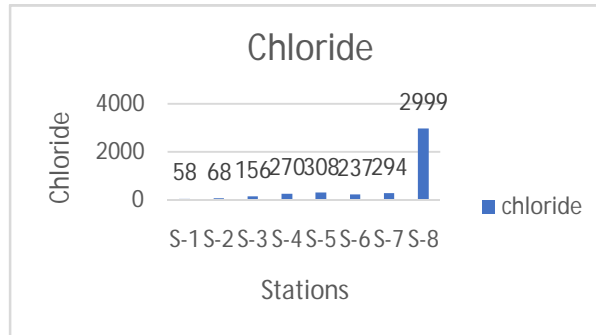


Fig. 4. Variation in chloride content with respect to sampling stations

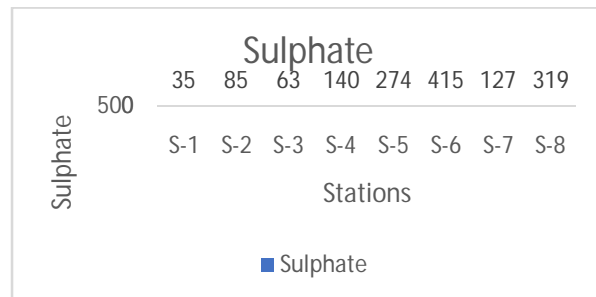


Fig. 5. Variation in Sulphate content with respect to sampling stations.

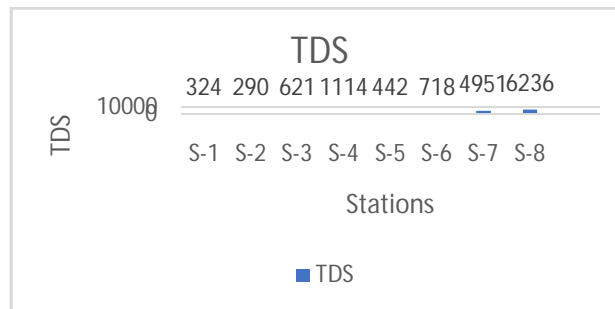


Fig. 6. Variation in TDS with respect to sampling stations.

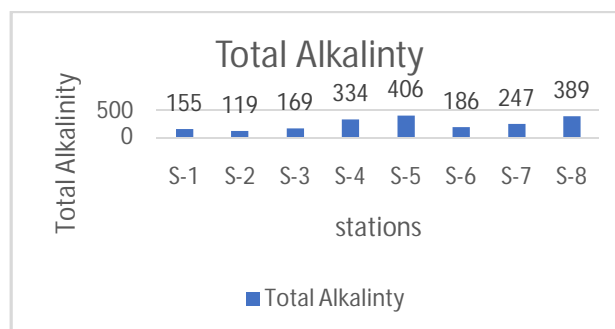


Fig. 7. Variation in Total alkalinity with respect to sampling stations.



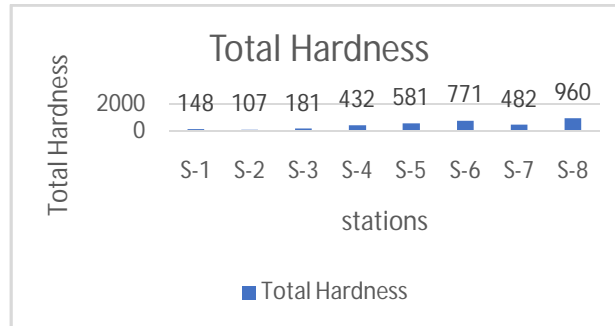


Fig. 8. Variation in Total Hardness with respect to sampling stations.

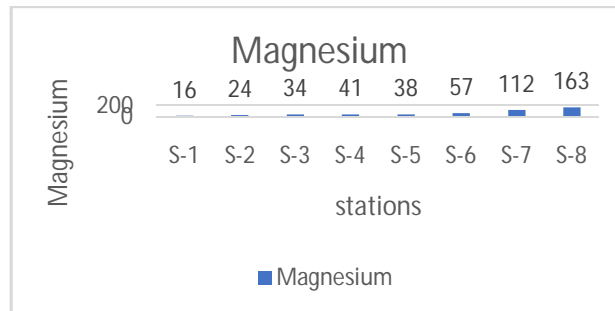


Fig. 9. Variation in Magnesium with respect to sampling stations.

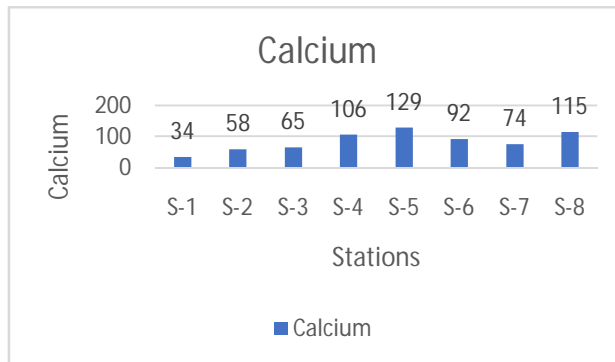


Fig. 10. Variation in Calcium with respect to sampling stations.

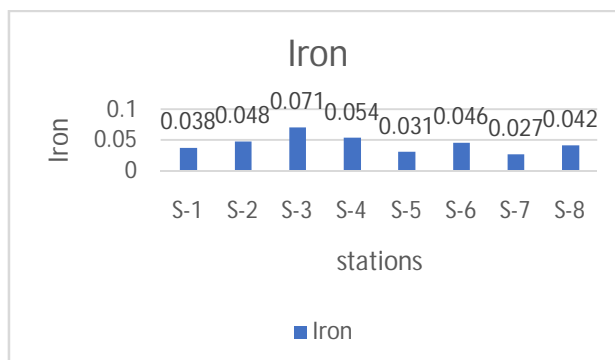


Fig. 11. Variation in Iron with respect to sampling stations

#### IV. CONCLUSION

River pollution is a serious social problem, which affects public health and environment. For sustainable development, assessment and monitoring of water quality of rivers is important. The present study reveals that the urban part of the Adyar River is highly polluted when compared to the rural area. Effective pollution control measures have to be taken to save the river from further pollution. People living on the river bank has to be educated about river pollution and its effect on human and environment. Strict order has to be issued to industries to follow standard effluent limits. Sewage has to be treated in sewage treatment plants before directing to the river. Proper maintenance is required to protect the river from further deterioration.

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