

Assessment of the Quality of Sewage Effluent of Nira River Around Satara and Pune District of Maharashtra - India

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Abstract: Due to industrialization, adverse man made activity and agriculture practices the water of the Nira River around Satara and Pune district (M.S) India is being highly polluted with various contaminants. Water is essential to all kinds of life. Human being cannot survive without it and that is why study of water from different aspects becomes important. It is necessary to know details about different physico-chemical and biological parameters such as Temperature, P^H , Conductance, TDS, Total hardness, chloride, sulphates, phosphates, DO, COD, BOD, acidity, alkalinity used for assessment of the quality of sewage effluent. In the present work water samples were collected from five different sampling stations of Nira River around Satara and Pune district of different seasons and water quality assessment was carried out.

Keywords: Contaminants, Dissolve Oxygen, Biological Oxygen Demand, Chemical Oxygen Demand Sewage Effluent

I. INTRODUCTION

Hydrosphere is one of the most important segments of the environment. Hydrosphere includes all type of water i.e. surface water, ground water, Ocean, Rivers, Lakes etc. Water is essential to all kinds of life.

Water anyone turns on the faucet, Water is expected to flow from it night or day, summer or winter, whether one fills a glass to drink or attempts to water the lawn. It is supposed to be clean, odour free and safe human consumption. Water truly an amazing substance and yet it so mundane that we seldom are really aware its presence, it has a vital role in life process and the importance of its characteristics. The very presence of water on earth is unique phenomenon and it appears to be a rare substance in our overall planetary system. It is water vapors that potentiate life on the earth. The earth and its atmosphere are composed of variety of natural solids and gaseous substances but there are very few natural liquids such as water.

Pollution of natural water by industrial waste is objectionable and damaging by many varied reasons. Primary importance is the possible hazard of public health by a contamination of stream to with disease producing bacteria. Another effect is of heavy metals, acids, radioactive metals and flammable liquid cause a serious problem. Industrial waste also destroys the recreational use of water.

The indiscriminate disposal of water after use in form of wastewater causes water pollution. The water after it is used ones for industrial purpose cannot be reused for same purpose without treatment. Such water which emerges out after use from industries is called as the industrial effluent. Such effluents have no definite composition, as anything, which is not required, is carelessly dumped in to its stream. Such unwanted chemical firms, food and beverage industry, textile and apparel industries, electronics and electrical material industries or thermal power plants contribute disposable material. The quality of such water is characterized by the study of its various physical, chemical and biological properties.

II. MATERIAL AND METHODS

In the study area of Nira River area five sampling sites were selected i.e. named as SS1,SS2,SS3,SS4,SS5 (S=Sample, S=Station).These sampling points are selected on the basis of location of industry, location of common effluent plant(CETP).

Samples were collected using manual sampling method. Samples were collected using day time and hence sampling method was most appropriate. Water sample were taken from 6 inches below the surface of waste water by keeping and opening the mouth of container against the flow of water.

Water samples were taken from 6 inches below the surface of wastewater by keeping and opening the mouth of container against the flow of water.The water samples were collected by holding the glass stopper, sterile bottle near its base in the hand and plugging it and transport to the laboratory in an icebox to avoid unpredictable changes in physical characteristics. Physico – chemical analysis for water were done following the standard methods by APHA (1987) , Trivedi and Goal (1984) , conductance, PH,DO measured at room temperature both by electrically and Iodometrically. EDTA method was used for hardness and Argentometric method was used for chloride content. Samples for BOD were seeded and incubated for 5-days at 25^oC.

Table: Parameters and Methods Employed in the Chemical Examination of Samples

Sr. No.	Parameters	Methods
1	Temperature	Thermometer
2	pH	PH meter
3	EC	Conductivity meter
4	TS	Turbidimeter
7	DO	Winkler's Iodometric method
8	BOD	Incubation method
9	COD	Open reflux method
10	Carbonate	Titrimetric method
11	Chloride	Titrimetric method
12	Sulphate	Turbidimetric method
13	Phosphate	Stanoous chloride method
14	Magnesium	Titrimetric method
15	Calcium	Titrimetric method.

Photographs



III. RESULTS AND DISCUSSION

Pollution is the greatest crime of mankind against himself, with the rapid pace of industrialization. Effluent has posed a serious threat to the vast and varied resources of the country. Water quality of major river system is getting rapidly degraded due to massive discharges of municipal waste and industrial waste of diverse origin.

In the light of above effective management and control of water pollution and becoming increasingly important for sustainable development and human welfare ,because industrial effluent discharged in to water bodies are responsible for number of mortalities and incapacitation in the world. The characterization studies of waste water includes, Temperature, pH, Conductance, TDS, Turbidity, Alkalinity, Acidity, Hardness, Chlorides, DO, COD, BOD, Ca, Mg, Phosphates and Sulphates. The results obtained from the observation made during 2007 to 2008, on the various physico-chemical parameters included in this study shown in following Table 1 to 3.

Table (1): Physico- chemical parameters of **Nira River Water** at different sites during winter Season

Parameters	NIRA RIVER SITES				
	Shirgaon (Nira Kumbh) I	Hirasuli (Khol Dari) II	Nira Deodhar Dam III	Apati IV	Ambawade V
Air Temp. °C	20.00	19.00	20.00	18.00	18.00
Water Temp. °C	21.00	20.00	20.00	17.00	18.00
EC mhos/cm	5600.00	5100.00	5020.00	5832.00	5800.00
Salinity %	3.80	3.800	3.70	3.40	3.20
TS mg/L	4684.00	4920.00	4822.00	4777.00	4822.00
TDS mg/L	467.00	460.10	468.20	470.90	477.00
TSS mg/L	85.00	122.00	38.20	80.00	83.00
pH	8.34	8.44	8.10	8.22	8.21
DO mg/L	5.32	9.70	5.70	8.20	8.30
BOD mg/L	1.1	3.20	1.11	2.39	21.07
COD mg/L	6.70	6.40	7.90	9.19	68.01
CO ₃ ²⁻ mg/L	24.00	14.60	2.40	20.10	14.00
HCO ₃ ⁻ mg/L	172.00	177.20	244.00	169.00	197.00
Cl ⁻ mg/L	1580.50	1582.00	1609.00	1545.00	1495.00
SO ₄ mg/L	322.00	333.40	332.00	332.00	338.00
Ca ²⁺ mg/L	59.10	78.60	69.90	59.12	58.00
Mg ²⁺ mg/L	212.40	194.20	201.00	211.00	196.00
PO ₄ ⁻ μ/L	41.80	42.80	40.10	47.00	54.20
TPμ/L	132.00	94.50	88.80	159.00	192.00

Table (2): Physico- chemical parameters of **Nira River Water** at different sites during summer Season.

Parameters	NIRA RIVER SITES				
	Shirgaon (Nira Kumbh) I	Hirasuli (Khol Dari) II	Nira Deodhar Dam III	Apati IV	Ambawade V
Air Temp. °C	42.00	36.00	38.00	38.00	35.00
Water Temp. °C	40.00	31.00	36.00	31.00	32.00
EC mhos/cm	8000.00	7835.00	7980.00	7988.00	4500.00
Salinity %	3.30	3.20	4.30	4.29	3.30
TS mg/L	5600.00	5592.00	5635.00	5660.00	5522.00
TDS mg/L	5531.00	5498.00	5567.00	5598.00	5453.00
TSS mg/L	89.00	35.00	48.00	62.00	67.90
pH	7.90	7.90	8.60	7.60	8.00
DO mg/L	9.90	10.30	7.20	8.80	9.00
BOD mg/L	4.50	4.70	2.70	4.20	4.20

COD mg/L	10.00	11.20	9.20	8.90	9.40
CO ₃ ⁻ mg/L	19.00	19.20	16.20	16.90	15.00
HCO ₃ ⁻ mg/L	235.00	207.20	202.00	200.50	205.00
Cl ⁻ mg/L	1601.00	1722.00	1713.00	1680.00	1708.00
SO ₄ ⁻ mg/L	318.00	321.00	318.00	315.20	320.60
Ca ²⁺ mg/L	145.00	146.00	141.00	145.20	149.60
Mg ²⁺ mg/L	102.00	105.00	99.70	90.80	85.82
PO ₄ ⁻ μ/L	34.76	25.90	25.80	33.72	32.00
TP μ/L	142	92.00	129.00	95.14	137.00

Table (1): Physico- chemical parameters of Nira River Water at different sites during Autumn Season

Parameters	NIRA RIVER SITES				
	Shirgaon (Nira Kumbh) I	Hirasuli (Khol Dari) II	Nira Deodhar Dam III	Apati IV	Ambawade V
Air Temp. 0C	24.00	23.00	22.00	23.00	24.00
Water Temp.0C	20.00	20.00	19.00	20.00	20.00
EC mhos/cm	5409.00	5518.00	5400.00	5200.00	5600.00
Salinity %	3.30	3.90	4.50	3.10	3.10
TS mg/L	5022.00	5082.00	5062.00	5105.00	5065.00
TDS mg/L	4930.00	4987.00	4865.00	4895.00	7900.00
TSS mg/L	90.10	95.00	195.00	211.00	267.00
p ^H	8.20	7.20	7.10	8.40	7.10
DO mg/L	7.80	8.10	6.50	6.00	7.15
BOD mg/L	2.10	3.00	2.00	2.00	2.00
COD mg/L	5.40	3.70	4.00	5.00	4.50
CO ₃ ⁻ mg/L	ND	ND	ND	ND	ND
HCO ₃ ⁻ mg/L	322.00	355.40	371.00	338.20	352.40
Cl ⁻ mg/L	1804.00	1771.40	1770.00	1751.50	1843.40
SO ₄ ⁻ mg/L	486.20	545.00	510.00	537.00	509.55
Ca ²⁺ mg/L	210.24	202.40	200.40	200.00	200.00
Mg ²⁺ mg/L	112.62	106.30	91.72	95.60	132.20
PO ₄ ⁻ μ/L	25.60	34.75	53.13	30.72	48.30
TP μ/L	72.60	95.60	94.30	81.70	100.00

- **Temperature:** The minimum value of temperature among all the sampling points was recorded 18°C to 20°C, during winter season, while maximum value was found 34°C to 42°C, during summer season.
- **p^H:** Desirable PH for lotic water is 7 to 12, deviation of this range may indicate the entry of acidic and basic medium.
- **Conductance:** Conductance of water sample range from 4050 mhos/cm² to 8990 mhos/cm².
- Where minimum conductance was observed during summer season at SS-V.
- **TDS:** More than 5000mg/L of total dissolve solids are not suitable for drinking purpose.
- TDS of water samples ranged to 873.5 mg/L, all season up till, all the samples from sampling station I to V were within the desirable limit of 500 mg/L in winter season.
- **Turbidity:** Turbidity was observed minimum for all station in all seasons.
- **Total Alkalinity:** The value of alkalinity provides an idea of natural salt present in water. The minimum value of alkalinity among the sampling points was recorded 40 mg/L for sampling station I to V.
- **Acidity:** Acidity was observed minimum for sampling station I to V all season i.e.0.6 mg/L.

- **Total Hardness:** It is water quality parameter used to describe the effect of dissolve minerals (mostly Ca and Mg), determining suitability of water for domestic, industrial and drinking purpose. Total Hardness ranged from 62 mg/L to 510 mg/L.
- **Chlorides:** Excessive chloride gives the water an objectionable salty taste and gives laxative effect on human beings. Chloride value ranged from 149.5 mg/L to 198.20 mg/L. All samples showed chloride values within permissible limit 1000 mg/L.
- **DO, COD and BOD:** Dissolve Oxygen (DO), is one of the most important factors of existence of an aquatic organism in water body. The minimum value of DO observed among all the samples was 5.70 mg/L and 5.32 mg/L for sampling station I and III in winter season.

Chemical Oxygen Demand (COD), is the amount of oxygen required to carry out oxidation of organic waste by using strong oxidizing agents, whereas Biological Oxygen Demand (BOD), is the amount of oxygen required to microorganism to degraded organic waste anaerobically. COD and BOD of samples were ranging from 32.0 mg/L to 205.0 mg/L and 100.0 mg/L to 113.0 mg/L respectively.

- **Ca and Mg:** Ca and Mg ranged from 59.10 mg/L to 215.40 mg/L. The values of all samples stations recorded during all seasons were observed above the desirable limit of 75.0 mg/L.
- **Sulphate and Phosphate:** Sulphate has been recognized under secondary drinking water standard as it affects taste, associative with respiratory disease and laxative effects. Sulphate content of water samples ranged from 162.10 mg/L to 546.0 mg/L, above the desirable limit 200.0 mg/L. Phosphate content in all sample stations was observed almost minimum in autumn season.

IV. SUMMARY

Maharashtra is the third largest state in India both in area (307.6090sq.km.) and population. There are total 35 districts and 7 Industrial Regions. The state of Maharashtra has major Rivers such as the Krishna, Bhima, Godavari, Tapi-Purna and Wardha-Wainganga river. Water pollution is the outcome of the interaction of environmental parameters by themselves due to human interference. During last 80 years, the problems of environment have increased and some problems have posed a great threat and have become persistent. Therefore, the increasing need to study and understand an aquatic environment and potability of water has become important and essential part for managing the environment, so that it can be preserved and protected. Human being cannot survive without it and that is why study of water from different aspect become important.

1. Lotic water and Ground water has been used for drinking for a long time and its purity has made it well source that is known source of potable water.
2. All problems of safe drinking water supply in rural as well as urban areas is a global issue and the anthropogenic activities are main factors responsible for the same.
3. The water quality has degraded due to the transport of various organic and inorganic pollutants to the ground water.
4. In view of these facts, the main objectives of the present investigation was to assess the socioeconomic important of lotic water by collecting the base line data on physio-chemical characteristics of lotic water in available literature on the subject.
5. During the study physico-chemical analysis of water was carried out in order to assessment of Lotic water quality of Satara district ten sampling stations were selected and referred as SS1,SS2,SS3,SS4,SS45 respectively.
6. These stations were under the influence of polluted Nira river basin around Satara and Pune district and situated completely between the different industries and Agricultural purposes.
7. The physical parameters such as Temperature, P^H, Conductance, TDS, Total hardness, chloride, sulphates, phosphates, DO,COD,BOD, acidity, alkalinity etc. were analyzed.
8. Temperature, P^H, DO etc. were measured at the station during sampling and other parameters were measured within 24 hours in the laboratory.
9. All results compare with WHO and ISI standards.

10. To summarize, the base line results of present investigations, it is clearly indicate that Lotic water of these area is not highly contaminated but there is an indication of increase in pollution may be due to discharge of industrial effluents in to the river.
11. Therefore constant monitoring of water is required to prevent the health hazards in the all sampling station (1 to 5).

V. CONCLUSION

Based on present status Nira water pollution in the five different stations around Satara and Pune districts, In the present study we tried to carry out samples stations of Nira River a case study of lotic water analysis. Samples are collected from different stations. We have studied few important characteristics properties of lotic water. From the result it is observed that most of the characteristics properties of lotic water are beyond the tolerance limit of Indian standards. In order to protect that environment and aquatic life, it is necessary to treat such lotic water and then discharge in to the common stream. However, it is necessary to collect such data for longer period so that it is possible to predict the result more precisely, which will give some important results about the quality of lotic water. Then accordingly, we can control or minimize the contamination in lotic water in Nira River.

1. The available work shows scattered report having each with different approach. Based on present status of Nira River pollution in Maharashtra, there is need to take up a systematic long term monitoring program to assess the pollution of rivers in order to have uniform monitoring using defined protocols.
2. Significant levels of Nira River pollution are reported from around Pune and Satara districts.
3. Nira River is close to industrial areas showed chemical pollution.
4. Such a data will help to plan restoration of river ecosystem in the state using appropriate mechanism.
5. There is a need to regulate Urban and Industrial development particularly in the catchment areas of water bodies to ensure the quality of water and to protect human health.
6. There is a need to revise developmental zones along the water bodies, which are lifelines for water supply.
7. Major thrust areas for research in restoration ecology could be identified for funding to the institutes universities from the states.
8. Education and awareness is equally important aspect in environmental protection. A special chapter on water pollution based on present state of water bodies could also be incorporated at college, school and primary level.

VI. SUGGESTIONS

1. Safe water supply and hygienic waste disposal should receive priority in to the area.
2. The domestic, industrial and gram panchayat and different Tehsil waste should be utilized in proper manner rather than the direct discharge in to the lotic water bodies.
3. Special emphasis should be given to the different water parameters and WHO action level of these parameters for characterization of water regarding its use in drinking purpose for safe drinking water supply to the population.
4. Health education is also necessary in this areas because it plays significant role in success of water programming.
5. Rehabilitation of residential area of the MIDC around, Satara and Pune district is essential the best solution for the health hazard in view of the water and air pollution.

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