

Study of Physico-Chemical and Bacteriological analysis of Indrayani River Water at Alandi, Pune District (Maharashtra) India

Prof. Ashwini R. Patil¹, Saber H Khureshi², Shubham S. Mahale³, Puja M. Kale⁴

^{1,2,3,4}Savitribai Phule University, D.Y patil College of Engineering, Akurdi, Pune, India

Abstract - The sacred river Indrayani has its origin to the kurvande village near lonavala in Maharashtra. This river happens to be one of the tributaries of great Bhima River, which again happens to be a tributary of Krishna River. Indrayani river faced many difficulties due to increase in industrialization and various other extracurricular activity taking place in and around the holy river and action have been initiated for speedy completion of the same. The aim of the study is Water Quality assessment of Indrayani River.

The study was carried out covering about 11km stretch of Indrayani river close to the Pune city during period from August 2017 to April 2018 at four location namely Moshi, Alandi Upstream to Temple, Alandi Downstream to Temple, Charholi covering Rainy, Winter and Summer season. During this study seasonal in-situ data and water sample were collected and analysed for total 21 parameters.

Key Words: Alandi, Indrayani river, Water Quality Assessment etc.

1. INTRODUCTION

Water is a transparent, tasteless, odourless and nearly colorless chemical substance that is the main constituent of earth's stream, lakes, oceans and fluids of most living organisms. A river is a natural flowing watercourse, usually freshwater, flowing towards an ocean, sea, lake or another river. In India Rivers are one of the main water resources for irrigation, drinking and industrial use. Rivers are the part of hydrological cycle. Water generally collects in a river form precipitation through a drainage basin from surface runoff and other sources such as groundwater recharge and springs.

Due to rapid economic development, urbanization and industrialization the quality of water have become a serious issue. Quality of water is badly affected due to climatic condition, environment, natural and man-made water pollution. To determine the quality of water Quality is performed. Water quality refers to the chemical, physical, biological characteristics of water. In water quality location are selected and various parameters are analysed in the field as well as in laboratory. By performing various tests data are collected in order to specify quality of water at each location

Study Area

The Indrayani River originates in Kurvande village near Lonavala, a hill station in the Sahyadri mountains of Maharashtra. Fed by rain, it flows east from there to meet the Bhima River, through the Hindu pilgrimage centres of Dehu and Alandi. It follows a course mostly north of city of Pune. There is a hydroelectric dam called Valvan dam on the Indrayani at Kamshet. The study was carried out covering about 11km stretch of Indrayani river close to the Pune city during period from August 2017 to April 2018 at four location namely Moshi, Alandi Upstream, Alandi Downstream, Charholi covering Rainy, Winter and Summer season.

2. MATERIALS AND METHODS

The Water was collected from four different station using clean plastic bottles. Temperature Of surface water was measured at the site with Thermometer instrument. DO fixation was done on the site. The collected water was taken to laboratory for analyse of various physico-chemical parameters.

3 Result and Discussion

Following are the result of three seasons

	Sampling Season	Rainy Season				Winter Season				Summer Season			
	Date	28/8/2017				9/1/2018				3/4/2018			
	Sampling Stations	1	2	3	4	1	2	3	4	1	2	3	4
Field Observation	Time(am)	9:05	9:50	10:40	11:19	8:27	8:53	9:11	10:03	8:15	8:40	9:05	9:55
	Air temp(°C)	23	25	26	26	14	13	15	15	25.2	25.8	27.5	30
	Water temp(°C)	24	24	24	24	18	18	19	19	25.6	21.5	21.5	24.1
Physical parameters	Ph	7.82	7.50	7.79	7.82	7.05	7.25	7.33	7.16	6.75	6.45	6.59	6.79
	EC (µS/cm)	197	187	195.4	219	722	672	712.72	1123	352	551	565	624
	Turbidity (NTU)	37	30	44	30	29.2	20.1	30.3	26.8	17.2	13.7	15.7	15.3
Physico-chemical parameters	DO(mg/lit)	6.74	7.32	10.5	6.605	0	0.40	1.224	0.51	0.8	0	1.6	2.4
	BOD(mg/l)	7.21	5.84	7.23	7.23	15.3	17.3	18.36	17.33	25.7	34.3	38.62	21.476
	COD(mg/l)	16	12	17.6	14.4	27.3	26	27.33	28.66	40	44	52	28
Cations	Na ⁺ (mg/lit)	3.5	2.8	3	3.4	14.8	35.5	34.6	17.3	6.2	12.4	18.4	11.8
	K ⁺ (mg/lit)	2.1	1.8	1.9	2.2	4.9	3.8	4.2	8.6	2.8	4.2	4.4	6.6
	Ca ²⁺ (mg/lit)	22.8	15.6	28.627	20.107	72.1	64.9	72.180	122.7	73.5	87.8	192.4	104.02
	Mg ²⁺ (mg/lit)	3.09	7.02	0.413	5.989	29.5	16.4	14.215	40.45	19.6	22.4	21.00	35.002
Anions	CO ₃ ⁻ (mg/lit)	-	-	-	-	-	-	-	-	-	-	-	-
	HCO ₃ ⁻ (mg/lit)	73.6	73.6	81.606	80.670	333	380	328.79	576.6	190	269	276.2	301.20
	Cl ⁻ (mg/lit)	8.66	9.30	9.558	10.968	36.1	36.0	33.518	56.22	84.7	91.2	101.3	141.94
	SO ₄ ⁻ (mg/lit)	1.74	1.60	1.909	2.018	18.7	18.3	18.532	23.92	0.89	1.71	1.726	1.807
Nutrients	NO ₃ ⁻ (mg/lit)	6.14	5.01	6.9012	7.9704	0.50	0.58	0.5418	1.026	0.93	1.06	1.199	1.600
	PO ₄ ⁻ (mg/lit)	2.42	1.79	2.018	2.508	1.19	1.27	1.3209	1.601	0.36	0.62	0.792	0.9741
Other	Total Iron(mg/lit)	0.96	1.04	1.07	1.61	3.53	3.27	3.42	5.48	0.29	0.27	0.281	0.273
	Silica(mg/lit)	3.09	3.69	3	3.68	1.34	5.33	1.37	3.75	0.87	0.97	1.01	0.9088
	TS(mg/lit)	130	120	130	150	500	480	490	770	230	360	370	410

1. Temperature

Temperature is one important physical parameter which directly influence some chemical reactions in aquatic ecosystem. Low temperature favored the dissolution of dissolve oxygen. Warm water is more susceptible to eutrophication a build-up of nutrients and possible algal blooms, because photosynthesis and bacterial decomposition both work faster at higher temperature. Warm water also accelerates corrosion in pipelines and cooling system.

Temperature fluctuations can also affect the behaviour choices of aquatic organisms. Plants are also affected by water temperature. Algal photosynthesis will increase with temperature. During the study, we have observe that the surface temperature of Indrayani river varies between 18 to 25.6.

2. pH

pH value changes according to the characteristics of effluent enter into the river water. Some type of rock and soil such as limestone can neutralize acid more effectively than other type of rock and soil such as granite. When large number of plants growing in river they release carbon dioxide when they die and decompose. When carbon dioxide mix with water weak carbonic acid is form and pH decreases. Due to chemical and industrial pollution pH value may increase or decrease according to their chemical composition. pH value for all the station was in the range of 6.45 to 7.82. All water samples were found to have within the limit of BIS/WHO i.e. 6.5 to 8.5.

3. Electrical conductivity

Electrical conductivity is depends on various salt concentration, anions , cations, inorganic chemicals and total dissolved solids. Agricultural runoff or a sewage leak will increase conductivity due to additional chloride, phosphate and nitrate ions. An oil spill or addition of other organic compound would be decrease conductivity. Electrical conductivity value for all the station was in the range of 195.4 to 1123.36.

4. Turbidity

Due to suspended solids, sediments, silts, sand, chemical precipitation turbidity increases. The increase of turbidity of water results into interference of penetration of light. This will cause damage to the aquatic life and deteriorate surface water. High values of turbidity minimise the filter runs, which cause pathogenic organisms too dangerous to

human. Turbity of Indrayani River decreases from rainy season to summer season. In Rainy season due to runoff of rain water turbidity of water increases. Turbidity value for all the station was in the range of 13.7 to 44.

5. Dissolved Oxygen

DO depends on temperature, pressure, salinity. Due to turbulence in river DO value increases. Due to wind and wave action (aeration) DO value increases. Due to sewage discharged in river DO value decreases. DO value is inversely proportional to the temperature. As temperature increases DO value decreases and vice versa. Dissolved Oxygen (DO) in water is the most fundamental parameters of lakes and reservoirs. It is the most essential component for survival and growth of all desirable forms of aquatic life. The sources of oxygen, from the atmosphere and from photosynthetic inputs, are counter balanced by consumption metabolism of living organisms. DO value for all the station was in the range of 0 to 10.5. All water samples were found to be not in the permissible limit.

6. Biochemical Oxygen Demand

BOD represents the amount of oxygen that microbes need to stabilize biologically oxidizable matter. BOD test actually measures the oxygen equivalence of biochemically decomposable or degradable materials. In BOD test, the organic materials supply the biological food and the water supplies the dissolved oxygen. In itself, BOD is not a pollutant and exercises no direct harm.

BOD value for all the station was in the range of 5.84 to 38.62. All water samples were found to have within the limit of BIS/WHO i.e.30 except from two station during summer.

7. Chemical Oxygen Demand

Chemical Oxygen Demand is the amount of oxygen needed to oxidize the organic matter present in water. COD is also measure of the organic pollutant in water. In this method all organic matter in the sample are oxidized, some of which may not be susceptible to bacterial decomposition by COD test one gets idea about toxic pollution. COD value for all the station was in the range of 12 to 52. All water samples were found not to have within the limit of BIS/WHO i.e. 250.

8. Sodium

Sodium is an indicator of water quality index for Sodium Adsorption Ratio (SAR) calculation. The SAR is a comparison of the concentration of sodium salt that effect

dispersion to a combination of the calcium and magnesium salt. A significant source of sodium is from laundry detergent. Sodium concentration determined by direct aspiration atomic absorption spectroscopy. Sodium value for all the station was in the range of 2.8 to 35.5.

9. Potassium

Potassium is non water soluble, but potassium compound may be water soluble. Elementary potassium is extracted from potassium chloride, but does not serve many purposes because of its extensive reactive power. Potassium salts and mixtures of magnesium and calcium compound are also applied regularly. Regeneration releases waste water that is hazardous when discharge on surface water that is river. Potassium value for all the station was in the range of 1.8 to 8.6.

10. Calcium

Calcium is naturally present in water. It may be dissolved from rocks such as limestone, marble, calcite, dolomite, gypsum, fluorite and apatite. Calcium is a determinant of water hardness, because it can be found in water as Ca^{2+} ions. Calcium also functions as a pH stabilizer, because of its buffering qualities. Calcium also gives water a better test. Calcium value for all the station was in the range of 20.107 to 192.468.

11. Nitrate

All living things require nitrogen for the building of proteins and a variety of other essential compounds. Nitrogen is central to all ecosystems because of its role in the synthesis and maintenance of protein, which is, along with carbohydrates and fats, major constituents of living substances. It is one of the major constituent of cellular protoplasm of organisms along with phosphorus, carbon and hydrogen Nitrate is one of the major constituent of cellular protoplasm of organisms and plays vital role in synthesis and maintain protein along with carbohydrates and fats. Nitrate value for all the station was in the range of 0.504 to 7.97.

12. Phosphate

Phosphate is a common constituent of agriculture fertilizers manure and organic waste in sewage and industrial effluent. It is an essential element for plant life, but when there is too much of it in water, it can speed up eutrophication (reduction in dissolved oxygen in water bodies) soil erosion is major contributor of phosphate to streams. Phosphate concentration in Indrayani River varies

from 0.36 to 2.508. Concentration is less in summer and more in rainy season. Phosphate value for all the station was in the range of 0.36 to 2.508.

13. Total Dissolved solids

TDS dissolved solids refers to any minerals, salts, metals, cations or anions dissolve in water. TDS comprise inorganic salt and some small amounts of organic matter that are dissolved in water. Minerals come from human activity like agriculture and industrial runoff. TDS concentration on all the four station ranges in between 120 to 770(mg/l). Maximum is in winter season and lowest in rainy season. As per WHO standard all these values are in acceptable limits.

14. Thermotolerant (Fecal) coliform

Total Coliform bacteria test is a primary indicator of portability, suitability for consumption of drinking water. It measures the concentration of total coliform bacteria associated with the possibility of presence of disease causing organism. Values of thermotolerant coliform varies from 6 to 16. It is maximum in summer season and minimum in rainy season.

4. CONCLUSIONS

We have analysed various physico-chemical and biological parameters and their variation in rainy, winter and summer season respectively. It was revealed that water of the river is not suitable for drinking purpose. Some of the parameters were having maximum value this may be due to less water available in river for dilution.

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AUTHER PROFILE



Ashwini R Patil is from Pune, Maharashtra. She completed her ME in Construction Management, currently she is Assistant Professor in D. Y. Patil College of Engineering, Akurdi, Pune.



Saber H. Khureshi is from Latur, Maharashtra. Currently he Pursuing Final Year (Civil) From D.Y. Patil College of Engineering, Akurdi, Pune



Shubham Shivaji Mahale is from Malegaon, Maharashtra .Currently he Pursuing Final Year (Civil) From D.Y. Patil College of Engineering, Akurdi, Pune



Puja M. Kale is from Jalgaon, Maharashtra. Currently she Pursuing Final Year (Civil) From D.Y. Patil College of Engineering, Akurdi, Pune