International Journal of Science and Research (IJSR)
ISSN (Online): 2319-7064
Index Copernicus Value (2015): 78.96 | Impact Factor (2015): 6.391

Methodology for Analysis of Physico-Chemical Characteristics of Pavana River

Lakhanpal S. Kendre[1], Sagar M. Gawande[2]

[1]PG Student, Anantrao Pawar, College of Engineering & Research , College of Engineering & Research Parwati, Pune-411009 , India

[2]Guide and Professor, Anantrao Pawar, College of Engineering & Research, College of Engineering & Research Parwati, Pune-411009, India

Abstract: ***The study was aimed to know materials and methods for analysis of physicochemical characteristics of Pavana River, Pune from literature survey. Due to the increase in population and industrialization, there shall be a necessity to understand the present status of river. Many government bodied does that work but there should be requirement of analysis of river with new methods. The water sample is collected from river as the depth changes. The physicochemical parameters such as pH, DO, COD, BOD, Electrical Conductivity, Alkalinity, Total Dissolved solid, Hardness, Free Carbon dioxide, total Phosphorous as Phosphate, Total suspended solids, Total solids, Turbidity, Heavy metals etc. has been studied during analysis.***

Keywords: Pavana River, Physico-Chemical, Parameters, Methodology, Characteristics, Methods and Materials

1. Introduction

1.1 General

Water is essential for the survival of all forms of life. Though 80% of earth's surface is covered by water, the fresh water supply has increasingly become a limiting factor because of various reasons. The expansion of industrialization and exploding population are the major once. Acute short fall of heavy rains, poor water shed management, abundant use of water for household and agricultural purposes have led to the overexploitation of the surface water sources especially from the river bodies. Many perpetual rivers become short-lived and even dried up.

Water quality characteristics of aquatic environments arise from a massive amount of physical, chemical and biological interactions. The water bodies such as rivers, lakes and estuaries are continuously subjected to a dynamic state of change with respect to their geological age and geo chemical characteristics. This dynamic balance in the aquatic ecosystem is upset by human activities results in pollution which in turn manifests dramatically as fish kill, bad taste of drinking water, offensive odors and unchecked growth of aquatic weeds etc. Quality of water is now a great concern for environmentalists as well as the common publics in all parts of the world. There are numerous sources of pollutants that could deteriorate the quality of water resources.

The surface water bodies become the dumping source for industrial effluent and domestic wastes. As a result, the naturally existing dynamic equilibrium among the environmental segments get affected leading to the state of polluted rivers. According to World Health Organization's (WHO) decision, water for the consumers should be free from pathogenic organisms and toxic substances. In spite of vast water resources in lakes and rivers and good monsoon, India faces perennial problems of floods and droughts and high pollution of fresh water resources.

1.2 Pavana River

It is a fact that good water quality produces healthier humans than one with poor water quality. Pavana River is life line of Pimpri-Chinchwad city and its water is used for domestic and agriculture purposes. Therefore, effective maintenance of water quality is required through appropriate measurements. Physico-chemical and micro-biological characteristics may describe the quality of water. Therefore,this study was carried out for the actual status of Pavana river from literature survey. In addition, with increasing number of industries and stakeholders of the river, the concern over the quality has also grown up and hence warranted for the present investigation.

The Pavana River originates from the Western Ghats, about 6 km South of Lonavala. Flowing eastwards initially, it becomes southbound and passes through the suburbs of Dehu, Chinchwad, Pimpri and Dapodi before it's confluence with the Mula river near Sangvi. An earthfill gravity dam forms the Pavana reservoir. The dam, constructed in 1972, is 1,329 m (4.360 ft.) long and 42.37 m (139 ft.) high, with a gross storage capacity of 30,500 km^3.

2. Methods and Materials

In order to analyze the effects of pollution, stretch of the river, starting from Pavana Dam toDapodi various station points were selected for sampling. Samples must be taken from locations which are representative of the water from sources, treatment plants, storage facilities, distribution network and household connections. Samples were collected for three seasons i.e. Pre-Monsoon, Monsoon & Post-Monsoon. The samples were of Grab samples & collected in sterilized bottles using standard procedure (APHA 2012). Five samples from each site is collected, two from edge, one from center and two from intermediate of edge and center with measuring depth of each.

2.1 Collection of Samples

Sampling is done with 1 to 2 liter bottle which are clean and free from contaminants. Sample is preserved at 4^0 C or in refrigerator as early as possible to prevent change in characteristics of water.Fill sample containers without prerinsing with sample; prerinsing results in loss of any pre-added preservative and sometimes can bias results high when certain components adhere to the sides of the container. Depending on determinations to be performed, fill the container full or leave space for aeration, mixing, etc. If a bottle already contains preservative, take care not to overfill the bottle, as preservative may be lost or diluted.

2.2 Preservation technique

Grab samples: Grab samples are single samples collected at a specific spot at a site over a short period of time (typically seconds or minutes). Thus, they represent a ‘‘snapshot’’ in both space and time of a sampling area. Discrete grab samples are taken at a selected location, depth, and time. Depth-integrated grab samples are collected over a predetermined part or the entire depth of a water column, at a selected location and time in a given body of water.

To minimize the potential for volatilization or biodegradation between sampling and analysis, keep samples as cool as possible without freezing. Preferably pack samples in crushed or cubed ice or commercial ice substitutes before shipment. Avoid using dry ice because it will freeze samples and may cause glass containers to break. Dry ice also may effect a pH change in samples. Keep composite samples cool with ice or a refrigeration system set at 4°C during compositing. Analyze samples as quickly as possible on arrival at the laboratory. If immediate analysis is not possible, preferably store at 4°C.

2.3 pH

The PH is the activity of Hydrogen ions in the water and expressed by negative logarithm to the base 10 of the H+ ion activity in moles/L. pH is measure with help of portable pH meter on site of sample collection. The pH meter is the first calibrated by using buffer solution having pH 4.7 and 9.2.

$$pH = - \log H^+ \text{ ; or } H^+ = (10)^{-pH}$$

2.4 Temperature

Temperature is measure with help of Digital thermometer on site of sample collection. It is very important parameter because of this parameter the changes occurin the water.

2.5 Dissolve Oxygen (DO)

The determination of dissolved oxygen present in River is very important, because aquatic life of river is depend upon DO and minimum 4 ppm DO is required to survival of aquatic life. To measure on site of sample collection with the help of Digital Dissolve Oxygen Meter. Because of on-site measurement of DO gives the accurate result and if DO is measure after some time period then because of temperature changes and atmospheric changes DO get changed. Or by other method such as Dissolved oxygen content of the water samples was measured by using Winkler’s method (modified azide method).

The sample was collected in 300 ml bottle and DO was fixed on site by using 2 ml each of Manganoussulphate and Alkaline-iodide-azide. The precipitate formed was dissolved in laboratory by using sulphuric acid and titrated with sodium thiosulphate using starch as an indicator. The end point of titration was blue to straw pale colour.

$$DO\left(\frac{mg}{l}\right) = \frac{(\text{ml of titrant x N x 1000 x 8})}{\left[V2\left(\frac{V1-V2}{V1}\right)\right]}$$

Where,
V1=volume of BOD bottle,
V2=volume of content titrated and
V= volume of MnSO4 and Alkaline-iodide-azide

2.6 Biochemical Oxygen Demand (BOD)

Biochemicalcal Oxygen Demand (BOD) is a measure of the oxygen used by microorganisms to decompose this waste. If there is a large quantity of organic waste in the water supply, there will also be a lot of bacteria present working to decompose this waste.

The dilution method was followed to determine the BOD after three days at 27^0C. For the same dilution water was prepared with the addition of nutrients namely phosphate buffer, magnesium Sulphate, calcium chloride and ferric chloride. The diluted sample was transferred to BOD bottles of 300 ml capacity. After determining initial dissolved oxygen (DO), final DO was estimated from the bottles kept for incubation period for three days.

2.7 Chemical Oxygen Demand (COD)

Chemical oxygen demand is related to biochemical oxygen demand (BOD), another standard test for assaying the oxygen demanding strength of waste waters. However, biochemical oxygen demand only measures the amount of oxygen consumed by microbial oxidation and is most relevant to waters rich in organic matter.

$$COD\left(\frac{mg}{l}\right) = \frac{(b-a)\text{ x ml of ferrous ammonium sulphate x 1000 x 8}}{\text{ml of sample}}$$

Where,
a = ml of titrant with sample
b = ml of titrant with blank

2.8 Total Suspended Solids (TSS)

Total suspended solids are those solids which are retained by the filter of 1 micro meter pores, and they are, therefore, also called as non-filterable solids. Their quantity can be determined by passing a known volume of water sample

ISSN (Online): 2319-7064
Index Copernicus Value (2015): 78.96 | Impact Factor (2015): 6.391

through a glass fiber filter apparatus and weighing the dry residue left.

$$T.S.S.\left(\frac{mg}{l}\right) = \frac{\text{Mass of the residue}}{\text{Volume of sample filtered}}$$

2.9 Total Dissolve Solids (TDS)

Total dissolve solid are those which are present in water after filtering water through 1 micro meter pores. The procedure is carrired out by heating i the sample at 103^0 C in the oven till drying of evaporated dish.

$$TDS\left(\frac{mg}{l}\right) = \frac{[(Wf - Wi)\ x\ 1000\ x\ 1000]}{\text{Volume of sample}}$$

Where,
Wi- Initial weight of evaporated dish
Wf- Final weight of evaporated dish

2.10 Total Solids (TS)

Total solids are those which are present in water without filtering water. The procedure is carried out taking direct samples in crucible dish and heating in oven till drying crucible dish at 103^0 C.

$$TDS\left(\frac{mg}{l}\right) = \frac{[(Wf - Wi)\ x\ 1000\ x\ 1000]}{\text{Volume of sample}}$$

Where,

Wi- Initial weight of crucible dish
Wf- Final weight of crucible dish

2.11 Total Alkalinity (TA)

Total alkalinity is the total concentration of bases in water expressed as parts per million (ppm) or milligrams per liter (mg/l) of calcium carbonate ($CaCO_3$). These bases are usually Bicarbonates (HCO_3) and carbonates (CO_3), and they act as a buffer system that prevents drastic changes in pH. Alkalinity is usually given in the unit mEq/L (mill equivalent per liter). Commercially, as in the pool industry, alkalinity might also be givenin the unit ppm or parts per million.

$$T.A.\left(\frac{mg}{l}\right) = \frac{\text{ml of HCL used with phenophthalein and Methyl orange x normality of HCL x 1000 x 50}}{\text{ml of sample}}$$

2.12 Turbidity

Determine turbidity as soon as possible after the sample is taken. Gently agitate all samples before examination to ensure a representative measurement. Sample preservation is not practical, begin analysis promptly. Refrigerate or cool to 4°C, to minimize microbiological decomposition of solids, if storage is required. For best results, measure turbidity immediately without altering the original sample conditions such as temperature or pH. Turbidity is measure with the help of Digital turbidity meter. This calibrated with the help of standard NTU.

The parameters and methods generally employed in the chemical examination of water samples as per APHA 2012 is shown in table-I while BIS drinking water standards is shown in table-II.

Table 1: Parameters and methods generally employed in the chemical examination of water samples

Sr. No.	*Parameters of water analysis*	*Methods*	*As Per APHA 2012*
1	Temperature	Thermometric	2550
2	pH	Potentiometric	4500-H^+
3	D.O.	Azide modification/ Titrimetric	4500-O
4	B.O.D.	Azide modification/ Titrimetric	5210
5	C.O.D.	Dichromate reflux/ Titrimetric	5220
6	T.S.	Argentiometric/ Gravimetric	2540-B
7	TDS	Argentiometric/ Gravimetric	2540-C
8	TSS	Argentiometric/ Gravimetric	2540-D
9	Turbidity (NTU)	Nephelometric	2130
10	Alkalinity	Titrimetric	2320

Table 5: Different analytical water quality parameters with their analytical technique and guideline values as per who and Indian standard

S.No	*Parameter*	*Technique used*	*WHO standard*	*Indian Standard*	*EPA guidelines*
1	Temperature	Thermometer	-	-	-
2	Colour	Visual/ colour kit	-	5 Hazen units	-
3	Odour	Physical sense	Acceptable	Acceptable	
4	Elecrtical Conductivity	Conductivity meter/ water analysis kit	-	-	2500 us/cm
5	pH	pH meter	6.5-9.5	6.5-9.5	6.5-9.5
6	Dissolved Oxygen	Redox titration	-	-	-
7	Total Hardness	Complexometric titration	200 ppm	300 ppm	< 200 ppm
8	Alkalinity	Acid-Base titration	-	200 ppm	-
9	Acidity	Acid-Base titration	-	-	-
10	Ammonia	UV Visible Spectrophotometer	0.3 ppm	0..5 ppm	0.5 ppm
11	Bicarbonate	Titration	-	-	-
12	BOD	Incubation folloed by titration	6	30	5
13	Carbonate	Titration	-	-	-
14	COD	COD digester	10	-	40
15	Chloride	Argentometric titration	250 ppm	250 ppm	250 ppm
16	Magnesium	Complexometric titration	150 ppm	30 ppm	

17	Nitrate	UV Visible Spectrophotometer	45 ppm	45 ppm	50 mg/l
18	Nitrite	UV Visible Spectrophotometer	3 ppm	45 ppm	05 mg/l
19	Potassium	Flame photometer	-	-	-
20	Sodium	Flame photometer	200 ppm	180 ppm	200 ppm
21	Sulphate	Turbiditymeter	250 ppm	200 ppm	250 ppm
	TDS	Argentiometric/ Gravimetric	500 ppm	500 ppm	500 ppm

3. Acknowledgment

I am very thankful to the guide for providing me valuable information which is very useful for this paper.My thanks and appreciations also go to my project guide in developing the paper and people who have willingly helped me out with their abilities.

References

[1] Research Journal of Animal, Veterinary and Fishery Sciences Vol. 1(1), 11-16, February (2013) *Res. J. Animal, Veterinary & Fishery Sci.* The Seasonal Fluctuation of Physico-Chemical parameters of River Mula- Mutha at Pune, India and their Impact on Fish Biodiversity ChandanshiveNavnathEknath Zoology Department, Fergusson College, Pune, MS, INDIA

[2] International Journal of Innovative Research in Science, Engineering and Technology (An ISO 3297: 2007 Certified Organization) Vol. 2, Issue 9, September 2013 Copyright to IJIRSET www.ijirset.com 4349 physico-chemical characteristics of river water of ganga in middle ganga plains Dr. LeenaSingh& Prof. (Dr.) S.K Choudhary Assistant Professor, Department of Chemistry, Galgotias College of Engineering. & Technology, Greater Noida, U.P, India Department of Botany T.M. Bhagalpur University, Bhagalpur, Bihar, India.

[3] Physico-chemical assessment of water quality of river chambal in kota city area of rajasthan state (india) Nitin Gupta, S.M.Nafees, M.K.Jain and S. Kalpana Environmental Chemistry Laboratory, P.G. Department of Chemistry, Govt. College, Kota, Rajasthan.

[4] Qualitative analysis of surface water of panchganga river (ms), indiaSanindharShreedharGaikwad and NitinAnandraoKamble Department of Zoology, Shivaji University, Kolhapur- 416 004, (MS) India.

[5] PHYSICOCHEMICAL ANALYSIS OF MULA MUTHA RIVER PUNE Pali Sahu1, SonaliKarad, SagarChavan and SourabhKhandelwalAsst.Prof. Environmental Engineering, Civil Department, VIIT, Pune, India U.G. Student, Civil Department, VIIT, Pune, India.

[6] Dr. RoohollahBehzad Department of Environmental Science. University of Pune Dr. Ravindra G. Jaynhaye Professor of the Department of Geography. University of Pune Dr. Praveen G. Saptarshi Retired Professor of the Department of Environmental. University of Pune Assessment of Water Quality in Manas Lake (Pune-India) With Reference to the Human Impact.

[7] Hydrobiological Study of Algae of an Urban Freshwater River JAFARI, N G; GUNALE, V RDepartment of Environmental Sciences, University of Pune, India.Department of Botany, University of Pune, India.

[8] Water quality and sediment analysis at selected locations of Pavana river of Pune district, Maharashtra Mane A. V., Pardeshi R. G., Gore V. R., Walave R. L., Manjrekar S. S. and Sutar G. N. Department of Environmental Sciences, Fergusson College, Pune Fergusson College, PuneDepartment of Chemistry, Fergusson College, Pune. (Journal of Chemical and Pharmaceutical Research, 2013, 5(8):91-102 Research Article ISSN : 0975-7384 CODEN(USA) : JCPRC5)

[9] Comparative ComparativeComparativeComparativeComparative Review of Physico chemical Assessment of Pavana River RiverNidhi Jain,2R.K. Shrivastava Department of Science and Humanity, Genba-SopanraoMoze Institute of Technology, Pune University, India P.G.Department of Environmental Science, Government Model Science College, Center of Excellence (NAAC Accredited ('A' Grade, Jabalpur (M.P.), India. (*IOSR Journal of Environmental Science, Toxicology and Food Technology (IOSR-JESTFT) e-ISSN: 2319-2402,p-ISSN: 2319-2399.Volume 8, Issue 6 Ver. III (Jun. 2014), PP 25-30).*

[10] D.G.Kanase, S.D.Jadhav, R.W.Jawale, M.S.Kadam, A study on some physicochemical characteristics of flowing water of Major River in Pune city.

[11] Patil. P.N, Sawant. D.V, Deshmukh. R.N " Physico-chemical parameters for testing of water – A review" International Journal of Environmental Sciences Volume 3, No 3, 2012

[12] InderdeepKaur and DeenDayalVerma, "Physicochemical and Microbiological Study of River Water of Ganga and Yamuna in Allahabad" Asian Journal of Science and Technology ISSN: 0976-3376 Vol. 5, Issue 11, pp.669-673, November, 2014

[13] Manohar G. Gavit, Mohd. Shahnawaz, Manish K. Sangale, Halimabi A. Kureshi and Avinash Bade, (2013), International Journal of Current Research 5(02), Page 232-235.

[14] APHA 2012 EDITIO