International Archive of Applied Sciences and Technology
Int. Arch. App. Sci. Technol; Vol 9 [3] September 2018 : 21-25
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www.soeagra.com/iaast.html

IAAST
ONLINE ISSN 2277- 1565
PRINT ISSN 0976 - 4828

CODEN: IAASCA **ORIGINAL ARTICLE**

DOI: .10.15515/iaast.0976-4828.9.3.2125

Evaluation of the Range of Heavy Metal concentration and other chemical compositions in the sample of Jagbudi River & Vashishti River at Lote Parshuram MIDC, Ratnagiri District, Maharashtra, India

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ABSTRACT
In the present paper we have analysed the water samples collected from River Jagbudi and Vashishti flowing from MIDC area of Lote Parshuram (Taluka Chiplun, District Ratnagiri, M.S.) region to check the range of pollution level. Water samples in triplicate from different location were collected from each river and then they mixed to form the composite samples and these composite samples were analysed for different parameters such as pH, Electric Conductance (EC), Alkalinity, Total Hard ness (TH), Total Dissolved Solid (TDS), Biochemical Oxygen Demand (BOD), Chloride (Cl), Turbidity, Sulfate (SO_4), Ammonia (NH_3), Nitrate, Phosphate and Heavy Metals etc . The samples were collected during Summer season. The Analytical study shows that the presence of heavy metals range are above normal range when compared with standards. The same river water is used for drinking purpose by near by villages and used for agriculture purpose.
Keywords: BOD, Heavy metals, TDS, TOC, Ammonia, Fluoride, Chloride .

Received 12.04.2018 Revised 02.05.2018 Accepted 13.07.2018

CITATION OF THIS ARTICLE
K Chitalkar, M Lanjewar, R Lanjewar.Evaluation of the Range of Heavy Metal concentration and other chemical compositions in the sample of Jagbudi River & Vashishti River at Lote Parshuram MIDC, Ratnagiri District, Maharashtra, India. Int. Arch. App. Sci. Technol; Vol 9 [3] September 2018 : 21-25

INTRODUCTION

Water is an essential constituent of all animals, plants, and human beings. It is used for various purposes like agriculture, industries, fisheries and recreational uses. In India most of the industries are situated along the river banks for easy availability of water and also disposal of the waste In India being a developing Country huge investment is expected in manufacturing Chemicals, Pesticides, Textile & every imaginable products which increase in waste output and spread of toxic hot spots across the Country. The growing eco-system degradation due to rapid industrialization in India is particularly more damaging to the vast population of poor in the Country who depends on the eco-system services. The time has come to move towards eco-system specific discharged standards to maintain the health and productivity of natural resources on which the majority of Indians are dependent. Presently the water quality is largly under treat due to domestic, sewage wastes and industrial release in the surface and ground water reservoirs. Heavy metals and their salts are consider as very important group of environment pollutant which in even small quantities may become toxic and dangerous to animals and Human being[1-3].

Vashishti & Jagbudi are major river flowing through Chiplun area of Ratnagiri District of Maharashtra, India. It is major source of water for domestic consumption, agriculture and industrial purposes in this region. Ratnagiri district is geographically divided into sea coast, hilly area and central belt. The industrial development is made mainly in the vicinity of rivers. There are different types of industries like

Dyes and dyes intermediate, Paint, Pesticides, Petrochemicals, Chemicals, Pharmaceuticals, Agrochemical, Catalyst, detergent etc. Almost all industries are fall under Red Category and their effluents are disposed in the river after treatment in ETP & CETP [4].

Possible Sources of the pollution:

i] Discharge of Domestic Waste water is major pollution source.
ii] Discharge of Domestic waste from MIDC area.
iii] Discharge of industrial effluent directly or indirectly from the industries,
iv] Washing of Tankers, cloths, vehicles, in the river at many places.

In the present paper the main objective is to study the Water quality and Chemical composition of Jagbudi and Vashishti River and to investigate the cause of pollution. Also to study the environmental impact of possible effluent pollution by analysing chemical composition and heavy metal contents.

MATERIALS AND METHODS

Water samples were collected during summer season to study the Physico – Chemical Parameters and concentration of heavy metals. Samples were collected in triplicate from different sampling sites of Vashishti & Jagbudi Rivers including MIDC area.

The samples were collected in polythene container of 2 L capacity. Before sampling the containers were rinsed with the sample water. The collection, transportation and preservation were done properly by taking atmost care.. The various water quality parameters such as, pH, Electric Conductance (EC), Alkalinity, Total Hardness (TH), Total Dissolved Solid (TDS), Biochemical Oxygen Demand (BOD), Chloride (Cl), Turbidity, Sulfate (SO_4), Ammonia (NH_3), Nitrate, Phosphate etc were analyzed in laboratory according to standard procedure recommend by APHA, AWWA, WPCF [5].

Metal analysis was done by Atomic Absorption Spectrophotometer (GBC,- SensAA, Australia) at parts per million (ppm). The calibration curves were prepared separately for all the metals by running different concentrations of standard solutions The Heavy Metals having notable reading in the AAS where further analysed using Hydride Generator at parts per billion (ppb) level.

RESULTS AND DISCUSSION

In Table – 1, are listed the Physiochemical parameters, Heavy metal concentration along with microbial activities. The details of each parameter is discussed as below

1.pH

The pH value of water is the indication of its quality. pH values usually changes due to contamination from industrial waste, carbonate and bicarbonate.[6] The pH values for the samples are within the range of 6.5 – 8.5 standard limit.

2.Electrical Conductivity

It indicates mineral, geological effect and organic pollution. It increases as dissolved salt concentration increases. The conductivity values at the River sites are found lower than the desirable limit of 300 - 1500.

3.Total Hardness

The Total Hardness value of water is due to the calcium and magnesium salts. The total Hardness values for samples are 30 – 40 mg/l which are found within the range of permissible limit.

4.Total Dissolved Solids

Dissolved solids influence other qualities of drinking water such as taste, hardness, corrosion and scaling. Total Dissolved Solids values does not cause harm to human but higher concentration may cause heart and kidney disease.[6] Total dissolved solids values for all sampling sites are found 35 – 84 mg/l which is within the range of permissible limit.

5.Metal Content

Trace elements were present in relatively low concentration of less than few mg/l. The trace elements which are potentially toxic metals like Cr, Cd, Ni, Zn, Cu, Pb, As, Mn, Ba and Fe which are having the potential to create health hazards among humans, plants and other aquatic life were analysed. The values of trace elements like Lead, Nickel, Cadmium were found above the permissible limit.

6.Turbidity

The Turbidity in water is the reduction of transparency due to the presence of particulate matter It is an indicator of pollution. The turbidity values are in the range of 0.4 to 0.6 NTU, which are below the permissible limit.

7.Alkalinity

The source of alkalinity in water body is mainly due to weathering of rocks. Total alkalinity indicates the concentration of carbonates and bicarbonates in water..The values of the present study is found 8 – 13 mg/l well below permissible limit

8. Fluoride

The Fluoride content in samples was analysed by colorimetric method by using standard fluoride solution of variable concentration and preparing standard graph. The values by analysis are found well within limit of 1.0 mg/l. of standard permissible limit.

9.Chloride

The presence of chloride is an indicator of organic pollution which is mainly due to discharge of sewage, industrial effluents and agricultural fertilisers. The values for all samples are found below the 250 mg/l acceptable standard limit given in IS:10500:2012. [7]

10.Sulfate

The sulphate in water is due to leaching of gypsum and other minerals. The values of the present study lie well below the standard limit of 200 mg/l..

11.Ammonia

Ammonia accounted for the major proportion of total soluble inorganic nitrogen. The values of ammonia for all samples are found within the permissible limit.

12. Total Organic Carbon

The TOC found in the River samples are 0.014 mg/l & 0.074 mg/l in Vashishti River and Jagbudi River respectively.

13. Sodium

Sodium is an important constituent for determining the quality of irrigation water. The sodium content of the samples was determined by a flame photometer (ELICO – CL22D]. Sodium content in the water samples varies between 19 and 18 mg/l**.** [8-9]

14.Potassium

Potassium is nearly as abundant as sodium in igneous rocks, its concentration in water is comparatively very less as compared to sodium (nearly one-tenth or one-hundred that of sodium). This is due to the fact that the potassium minerals are resistant to decomposition by weathering. The potassium concentration in the water was determined with the help of Flame photometer (ELICO – CL22D]. Analysis of water samples in the study area indicates that potassium value varies between 8 and 11 mg/l. [9]

15.Calcium

The presence of calcium in water is mainly due to the dissolution of rocks. The values for calcium are below 75 mg/l which is well below permissible limit.

16.Magnesium

The Magnesium hardness is due to the presence of sulphate ions in it. The values are below 30.0 mg/l which is the desirable limit.

17.Biochemical Oxygen Demand

The amount of oxygen in water is from biochemically oxidisable carbonaceous matter. The BOD values of present study are greater than 3 mg/l, in Jagbudi river which indicates that the quality of water is bad and hence it is not permissible for drinking purposes.

18. Nitrate

The Nitrate is analysed spectrophotometrically by using UV – visible spectrophotometer [EUIP-TRONICS – EQ-826]. [10] The Nitrate concentration present in Jagbudi river is 0.026 mg/l. & in Vashishti it is below 0.001 mg/l. The values are below 45.0 mg/l the desirable limit.

19. Phosphate

The Phosphate value measured spectrophotometrically by UV – Visible spectrophotometer [EUIP-TRONICS – EQ-826] in Vashisthi River and Jagbudi River are found as 0.028 & 0.047 mg/l. respectively.

20. Microbial Activity

The Source of Microbial contamination are numerous and include the land disposal of sewage effluent, sludge and solid waste, septic tank effluent, urban runoff, and agricultural, mining and industrial effluent. [11-12] The microbial content of E. Coli and total Coliform Bacteria count are found in both the samples.

Table – 1: Analysis Reports of Vashishti & Jagbudi River (Physio-Chemical parameters, Metal concentration and Microbial Activity)

Parameters	Units	Vashishti River	Jagbudi River	Method Referred
Colour (Pt. Scale)	Colour Unit	< 1.0	< 1.0	APHA 2120 B
Odour	---	Odourless	Odourless	IS 3025 Part V 1983
Turbidity	NTU	0.4	0.6	APHA 2130 B
pH	---	7.65	7.80	APHA 4500 H^+
Total Hardness as $CaC0_3$	mg/ltr	30	40	APHA 2340 C
Total Suspended Solids at 105^0C	mg/ltr	10	10	APHA 2540 D
Total Dissolved Solids at 180^0C	mg/ltr	84	35	APHA 2540 C
Conductivity	µS/cm	112	63	APHA 2510 B
Calcium as Ca	mg/ltr	6.41	11.22	APHA 3500 Ca B
Magnesium as Mg	mg/ltr	3.41	2.92	APHA 3500 Mg B
Ammonia	mg/ltr	0.02	0.03	APHA 4500 NH_3 B & C
Copper	mg/ltr	0.019	0.019	APHA 3111 B
Iron	mg/ltr	0.790	0.029	APHA 3111 B
Aluminium	mg/ltr	< 0.001	< 0.001	APHA 3111 B
Sodium	mg/ltr	19	18	APHA 3500 Na
Potassium	mg/ltr	8	11	APHA 3500 K
Fluoride	mg/ltr	0.084	0.024	APHA 4500 F^{--}
Chlorides	mg/ltr	19.97	21	APHA 4500 Cl—B
Sulphate	mg/ltr	2.25	2.75	APHA 4500 SO_4^{2-} E
Cadmium	mg/ltr	0.003	0.004	APHA 3111 B
Nitrate	mg/ltr	< 0.001	0.026	APHA 4500 NO_3 B
Phosphate	mg/ltr	0.028	0.047	APHA 4500 D
Alkalinity	mg/ltr	8.78	13.17	APHA 2320 B
COD	mg/ltr	8	24	APHA 5220 B
BOD 3 days 27ºC	mg/ltr	2	10	IS 3025 (Part 44) : 1993
Total Organic Carbon	mg/ltr	0.014	0.074	APHA 5310 B
Barium as Ba	mg/ltr	< 0.001	< 0.001	APHA 3111 D
Lead	mg/ltr	0.370	0.730	APHA 3111 B & C
Nickel	mg/ltr	0.418	0.981	APHA 3111 B
Chromium	mg/ltr	< 0.001	< 0.001	APHA 3111 B
Arsenic	mg/ltr	< 0.001	< 0.001	APHA 3111 B
Zinc	mg/ltr	0.016	0.019	APHA 3111 B
Manganese	mg/ltr	0.010	0.024	APHA 3111 B
E. Coli	/ 100 ml	35	51	APHA 9221 E
Total Coliform Bacteria	/ 100 ml	> 1600	> 1600	APHA 9221 C

CONCLUSION

The finding of present study of different physico-chemical and microbial parameters of water samples collected from Vashishti River and Jagbudi River from Lote Parshuram industrial area, quality of water is not suitable for human being for drinking purposes without proper treatment for purification. The heavy metal contents in two different rivers shows the variations. Heavy metals, if present beyond permissible limits in water are toxic to human beings, aquatic flora and fauna. In the present study, we found that Pb, Ni, & Cd are higher concentrations as compare to their permissible limits of WHO. Regular monitoring of the water quality is thus required to assess the heavy metal content in water so that remedial measures can be adopted to save the river water from heavy metal pollution.

CONFLICT OF INTEREST

The authors declare that there is no conflict of interest regarding the publication of this paper

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