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Research Paper

Determination of Physico-Chemical parameters of Surface Water Samples in and around Akot City

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Abstract-*The physico-chemical parameters of water samples collected from various sites in and around Akot city were assess. The physicochemical parameter like, temperature, pH, electrical conductivity (EC), total dissolved solids (TDS), turbidity, dissolved oxygen (DO), total alkalinity (TA), total hardness (TH), calcium (Ca^{++}) magnesium (Mg^{++}), sodium (Na^{+}), potassium (K^{+}), chloride (Cl^{-}), fluoride (F^{-}), nitrate (NO^{-}_{3}) sulphate (SO^{2-}_{4}) and phosphate (PO^{3-}_{4}) was determined. The results were compared with standards prescribed by WHO (1973) and ISI (10500-91). It was found that the water samples collected from various sites in and around akot city was contaminated. All sampling sites showed physicochemical parameters above the water quality standards and the quality of water are very bad and it is unfit for drinking purpose. Whereas the sampling sites S_{11} and S_{12} has somewhat good quality water.*

Keywords: Surface water, physicochemical parameter, in and around, Akot city, River, etc.

Introduction

Natural resources are the important wealth of our country, water is one of them. Water is a wander of the nature. *" No life without water "* is a common saying depending upon the fact that water is the one of the naturally occurring essentional requirement of all life supporting activities[1] Since it is a dynamic system, containing living as well as nonliving, organic, inorganic, soluble as well as insoluble substances. So its quality is likely to change day by day and from source to source. Any change in the natural quality may disturb the equilibrium system and would become unfit for designated uses. The availability of water through surface and groundwater resources has become critical day to day. Only 1% part is available on land for drinking, agriculture, domestic power generation, industrial consummation, transportation and waste disposal. [2]

In India, most of the population is dependent on surface water (damp water) as the only source of drinking water supply. The groundwater is believed to be comparatively much clean and free from pollution than surface water. But prolonged discharge of industrial effluents, domestic sewage and solid waste dump causes the groundwater to become polluted and created health problems [3]. The rapid growth of urban areas has further affected groundwater quality due to overexploitation of resources and improper waste disposal practices. Hence, there is always a need for and concern over the protection and management of surface water and groundwater quality. [4] Heavy metals are priority toxic pollutants that severely limit the beneficial use of water for domestic and industrial application [5]. The lakes have complex and fragile ecosystem, as they do not have self cleaning ability and therefore readily accumulate pollutants [6]. The physicochemical parameters and trace metal contents of water samples from Delhi were assessed [7].

The consequence of urbanization and industrialization leads to spoil the water. For agricultural purposes ground water is explored in rural areas especially in those areas where other sources of

water like dam and river or the canal is available. During last decade, this is observed that the surface water get polluted drastically because of increased human activities[8-10].

Akot city (Distract Akola) which is situated in the heart of the nation in Maharashtra (Vidarbha region) has become an important city because of the natural resources available around it. There are various existing industries and industrial estates. These industries use huge quantity of water for processing and release most of the water in the form of wastewater. The wastewater being generated is discharged into the nearby water resources. Similarly the geochemical and morphological structural changes and for other subsequent uses. Considering the above aspects of surface water contamination, the present study was undertaken to investigate the impact of the surface water quality of some river and other bodies of surface water samples in and around Akot city of Akola district in Vidarbha region. Thus, in this research work an attempt has been made to assess the physical and chemical parameters of surface water like, Temperature (T), pH, electrical conductivity (EC), total dissolved solids (TDS), turbidity, dissolved oxygen (DO), total alkalinity (TA), total hardness (TH), calcium (Ca^{2+}) magnesium (Mg^{2+}), sodium (Na^{+}), potassium (K^{+}), chloride (Cl^{-}), fluoride (F^{-}), nitrate (NO^{-}_3) sulphate (SO^{2-}_4) and phosphate (PO^{3-}_4) was determined. The analyzed data were compared with standard values recommended by WHO. [11]

Method and Materials

The present study was planned and undertaken. Shiv Mandir, Near Gangane School, Sonwaewesh, Bhim Nagar, Shivaji Nagar, Lohari Road, near MIDC, Chandikapur and Panaj in East side, Lolari and Jalgaon Nahate in West side, Popatkhad and Belkhed in North side and Kalwadi and Kutasa in South side of Akot city sites were selected from different localities in and around Akot city for samples collection.

Preparation of water samples

The sample were collected from all the stations at 09.00 am to 11.00AM in both the seasons for physico-chemical examinations, different methods of collection and handling were adopted based the standard procedures [12]. The samples were collected in plastic canes of five liters capacity without any air bubbles. The instruments were used of accuracy. The temperatures of the samples were measured in the field itself at the time of sample collection. The samples were kept in refrigerator maintained at 08^{o}C. Water samples from ten sampling sites were collected during a post monsoon period of five months (November-2009 to March -2010). The sampling locations in and around Akot city for assessment of physico-chemical parameter status of ground water are given in Table- 1.

due to weathering may also leached out some chemicals / minerals from the geostrata into surface and groundwater and may change the original characteristics of water which could be rather harmful to human health after consumption. The people are using open well water, tube well water, canal water, lack water as well as municipal water for their daily need. The literature survey reveals that no water quality management studies are made in this region so far. Hence it is very essential to maintain the quality of surface water for human consumption, for the aquatic life.

Physico-chemical analysis

Analysis was carried out for various water quality parameters such as Temperature, pH, electrical conductivity (EC), total dissolved solids (TDS), turbidity, dissolved oxygen (DO), total alkalinity (TA), total hardness (TH), calcium (Ca^{++}) magnesium (Mg^{++}), sodium (Na^{+}), potassium (K^{+}), chloride (Cl^{-}), fluoride(F^{-}) nitrate (NO^{-}_3), sulphate (SO^{--}_4) and phosphate (PO^{3-}_4) using standard method[13-15]. All The reagents used for the analysis were AR grade and double distilled water was used for preparation of solutions. Table 1

Results and Discussion

The physico-chemical parameters of the above mention sites in and around Akot city can be calculated and it is describe as bellow.

Temperature (T) in ^{0}C

Temperature is an important biologically significant factor, which plays an important role in the metabolic activities of the organism. The temperature was ranging from 26.0°C to 29.00°C during the study period. Lowest water temperature was observed in the sites S_{11} and S_{12} was 21.0 °C and 22 ^{o}C respectively. A study increase in water temperature in the course of Shiv mandir was noticed i.e. 29.0 °C. An increase in temperature was observed from Bhim Nagar (28.0 °C) to Gangane School (26.5 °C). This might be due to presence of the effluents. Our property of water is that with change in temperature, its density varies and it becomes less with warming up and more with cooling. The sites around the Akot city i.e. S_7 to S_{14} was asses. It was found that the sites S_9 and S_{14} have higher temperature, where as the sites S_{11} and S_{12} has lower temperature.

pH

pH is a term used universally to express the intensity of the acid or alkaline condition of a solution. Most of the water samples are slightly alkaline due to presence of carbonates and bicarbonates. The pH values of water samples varied between 9.5 to 5.4 and were found above the limit prescribed by WHO. The higher range of pH indicates higher productivity of

water.[16] The site S_{12} has lower pH where as S_1 has higher pH

Electrical conductivity (EC) in micro-ohm/cm

Electrical conductivity (EC) is a measure of water capacity to convey electric current. It signifies the amount of total dissolved salts[17]. EC values were in the range of 1590 micro-ohms/cm to 450 micro-ohms/cm. High EC values were observed for six sampling points namely S_1, S_2, S_3, S_4, S_6, and S_7 indicating the presence of high amount of dissolved inorganic substances in ionized form in and around Akot city.

Total dissolved solids (TDS) in mg/l

Total dissolved solids indicate the salinity behavior of groundwater. Water containing more than 500 mg/L of TDS is not considered desirable for drinking water supplies, but in unavoidable cases 1500 mg/L is also allowed[18]. A TDS value varies from 449 mg/L to 1659 mg/L. The sampling points S_1, S_2, S_3, S_4, S_6, S_7, S_9, S_{10} and showed higher TDS values than the prescribed limit given by ISI. On the other hand sites S_{11}, S_{12}, S_{13}, S_{14} and S_5 has lower values of TDS.

Turbidity in NTU

In most water turbidity is due to colloidal and extremely fine dispersions. The turbidity values varied between 13.4 to 4.7 NTU and found above the limits prescribed by ISI (10500-91). The site S_9 has the higher values of turbidity.

Dissolved oxygen (DO) in mg/l

Dissolved oxygen is important parameter in water quality assessment and reflects the physical and biological processes prevailing in the water. The DO values indicate the degree of pollution in water bodies. DO values varied from 8.2 to 4.9. The sampling points S_1, S_2, S_3, S_4 and S_8 showed high DO values.

Total Alkalinity (TA) in mg/l

Alkalinity of water is its capacity to neutralize a strong acid and it is normally due to the presence of bicarbonate, carbonate and hydroxide compound of calcium, sodium and potassium. Total alkalinity values for all the investigated samples were found to be greater in samples S_1, S_2, S_3, S_4, S_6, S_7, S_8, S_9, S_{13} and S_{14} than the value prescribed by WHO.

Total hardness (TH) in mg/l

Hardness is the property of water which prevents the lather formation with soap and increases the boiling points of water [19]. Hardness of water mainly depends upon the amount of calcium or magnesium salts or both. The hardness values shown range from 687 mg/L to 312 mg/L. The values for sample from point S_1, S_2, S_3, S_4 and S_8 were higher than the prescribed limit.

Calcium (Ca^{2+}) in mg/l

Calcium is directly related to hardness. Calcium concentration ranged between 147.00 mg/L to 472.00 mg/L and found above permissible limit of ISI, except samples from sampling point S_{11} and S_{12}.

Magnesium (Mg^{2+}) in mg/l

Magnesium are directly related to hardness. Magnesium content in the investigated water samples was ranging from 162.00 mg/L to 26.00 mg/L which were found above WHO limit.

Sodium (Na^+) in mg/l

Sodium concentrations were found in between 274.00 mg/L to 118.00 mg/L. Sampling sites S_{11} and S_{12} showed lower sodium concentration than the prescribed limit by WHO and ISI. The site S_1 has higher value it is found as 274 mg/Lit.

Potassium (K^+) in mg/l

The major source of potassium in natural fresh water is weathering of rocks but the quantities increase in the polluted water due to disposal of waste water [19]. Potassium content in the water samples varied from 15 mg/L to5.1 mg/L. It is found that the contents of potassium in site S_1 is higher i.e. 15.00 mg/l, whereas for sites S_5, S_{11}, S_{12}, S_{13} and S_{14} is zero.

Chloride (Cl^-) in mg/l

The chloride concentration serves as an indicator of pollution by sewage. People accustomed to higher chloride in water are subjected to laxative effects[20]. In the present analysis, chloride concentration was found in the range of 308.00 mg/L to 38.5 mg/L. The values are above the limit except water sample collected from sites S_{11} to S_{14} has higher chloride concentration in samples from sites S_1 may be due to big discharge of domestic sewage near the sampling sites.

Fluoride (F^-) in mg/l

Probable source of high fluoride in Indian waters seems to be that during weathering and circulation of water in rocks and soils, fluorine is leached out and dissolved in ground water. Excess intake of fluoride through drinking water causes fluorosis on human being. In the present analysis, fluoride concentration was found in all samples sites in Akot city. It is found zero for all sites i e from S_2 to S_{14}. The site S_1 has the fluoride and it was found that 0.05 mg/lit.

Nitrate (NO_3^-) in mg/l

Surface water contains nitrate due to leaching of nitrate with the percolating water. Surface water can also be contaminated by sewage and other wastes rich in nitrates. The nitrate content in the study area varied in the range 7.1 mg/L to 0.19 mg/L and found within the prescribed limit except site S_1.

Sulphate (SO_4^{2-}) in mg/l

Sulphate occurs naturally in water as a result of leaching from gypsum and other common minerals[18]. Discharge of industrial wastes and domestic sewage tends to increase its concentration. The sulphate concentration varied between 263 mg/L and 62.8 mg/L. and found above the prescribed limit except site $S_{11,}$ $S_{12,}$ S_{13} and $S_{14.}$

Phosphate (PO_4^{3-}) in mg/l

Phosphate may occur in surface water as a result of domestic sewage, detergents, and agricultural effluents with fertilizers. The phosphate content in the study area was found in all S_1 sites except site $S_{5,}$ $S_{11,}$ $S_{12,}$ S_{13} and $S_{14.}$ The higher values of phosphate is found in sites S_1 and S_2. All the data can be summarized in Table-2.

Conclusion

Deviations were observed by surface water samples in and around Akot city. The water samples from sites S_1 to S_4 and S_6 and S_{10} showed very poor water quality as compared to other water samples, It was probably due to the domestic discharge in Rive. The water samples from sites S_1 to S_{14} are polluted and unfit for drinking purpose. The sampling point S_1 showed high TDS, total alkalinity and sodium content indicating the need of some treatment for minimization of the parameters. The sampling sites S_{11} and S_{12} showed some physicochemical parameters within the water quality standards and the quality of water is good. The parameters namely F^- and PO_4^{3-} is found as zero for all sites except $S_{1.}$ The sampling site S_1 has highly contaminated and highly polluted.

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Table 1: Sampling locations in and around Akot city

S. No.	Sample locations	Source	Sample number	Distance from Akot city	Side from Akot City
1	Shiv Mandir,	River	S_1	00 km	In Akot
2	Near Gangane School,	River	S_2	00 km	In Akot
3	Sonwaewesh,	River	S_3	00 km	In Akot
4	Bhim Nagar,	River	S_4	00 km	In Akot
5	Shivaji Nagar	Canal	S_5	00 km	In Akot
6	Lohari Road Near MIDC,	River	S_6	00 km	In Akot
7	Chandikapur	River	S_7	09 km	East side
8	Panaj	River	S_8	10 km	East side
9	Lolari	River	S_9	06 km	West side
10	Jalgaon Nahate	River	S_{10}	07 km	West side
11	Popatkhad,	Lake	S_{11}	09 km	North side
12	Belkhed	Lake	S_{12}	11 km	North side
13	Kalwadi	Field water pond	S_{13}	06 km	South side
14	Kutasa	Field water pond	S_{14}	07 km	South side

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o **Table -2 : Average results of the physicochemical parameters of different sites in Akot city**

S. No.	Parameter	WHO	ISI	Sampling points in Akot City													
				S_1	S_2	S_3	S_4	S_5	S_6	S_7	S_8	S_9	S_{10}	S_{11}	S_{12}	S_{13}	S_{14}
1	Temperature	--	--	29	26.5	26	28	25	27	26	25.3	26	25.2	21	22	25	26
2	pH	7-8.5	6.5-8.5	9.5	9.2	9.1	8.9	7.8	8.9	9.2	7.4	7.2	7.1	6.2	5.4	7.9	8.1
3	EC	1400	--	1590	1585	1478	1473	1255	1472	1249	1496	1378	921	450	327	758	687
4	TDS	1000	500	1659	1481	1463	1421	973	1235	1493	1321	1173	1011	449	493	551	957
5	Turbidity	5.0	10	12	12	12	12	4.2	11.6	11.6	10.1	13.4	12.8	0.00	0.00	4.7	4.12
6	DO	--	5.0	7.2	6.8	6.3	4.8	5.00	6.4	4.3	6.7	6.5	5.4	0.00	0.00	2.42	3.40
7	TA	120	200	370	349	338	178	118	178	178	124	210	195	115	117	137	135
8	TH	500	300	687	675	675	675	441	336	476	513	389	334	314	312	335	380
9	Ca^{2+}	100	75	147	147	135	134	85	112	118	99.5	123	127	72	72	74	77
10	Mg^{2+}	150	30	162	162	153	148	32	145	160	160	147	50	29	26	57	41
11	Na^{+}	200	200	274	271	262	262	180	268	265	273	257	199	118	199	204	204
12	K^{+}	--	--	15	14	12	8.00	0.00	13	10	7.4	7.6	501	0.00	0.00	0.00	0.00
13	Cl^{-}	250	250	308	308	308	307	258	301	290	257	230	235	48.9	38.5	78.7	72.6
14	F^{-}	1.5	--	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
15	NO_3^{-}	5	45	7.1	1.29	1.18	1.10	0.802.8	2.8	3.2	4.7	1.82	0.97	0.00	0.000.19	0.19	0.10
16	SO_4^{2-}	250	200	263	263	244	224	62.3	221	239	236	225	257	80.9	62.8	174	187
17	PO_4^{3-}	--	--	10.2	10.2	8.5	8.3	0.00	6.4	4.9	8.7	7.6	8.3	0.00	0.00	0.00	0.00