Preliminary Physico-Chemical Study of Water at Outlet of MIDC, Warora, (India)

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Abstract:

A preliminary study for evaluation of water quality of the Wardhariver at the site where industrial effluents from Warora Development Centre, Warora (M. S.) are released was carried out. Seasonal variation in physio-chemical characters such as pH, conductivity, ionic concentrations, turbidity, hardness, and total dissolved solids (TDS) were recorded. Most of the physico-chemical parameters studied were found within standard permissible limits except alkalinity. Assessed water quality shows no danger signs for water consumption for domestic as well as drinking purpose.

Keywords: Water Quality, Physico-chemical characters, Wardhariver, Effluent, Warora Development Center.

Introduction:

Freshwater ecosystems are deteriorating day by day due to unplanned effluent release from industries and urban areas. Considerable number of reports is available which traces deterioration of water quality in a number of freshwater ecosystems (Chattopadhayay*et al.,* 1984; Nandan and Patel, 1985; Venkateshwarlu, 1986; Kulshreshtha*et al.,* 1989; Reddy and Venketashwar, 1987). Analysis of physico-chemical parameters of water is essential to assess the quality of water for the best usage like irrigation, drinking, bathing, fishing, industrial processing and so on. Water quality of Wardhariver has been assessed by various workers at different sites (Khati*et al.*, Tambekar *et al.*), however, till date no work has been reported in and around WaroraTahsil of Chandrapur District, Maharashtra (India). Warora Development Center confined several industries of which Wardha Power Ltd., and GMR Ltd., both thermal power plants are chief. An effluent from these industries is released into the DaiwalNala which meets Wardhariver near the village, Ekona. A cause of concern for present investigation is that the study site is the source of drinking water for Warora city and nearby villages. Present paper is dealing with the physico-chemical characteristics of water samples collected from afore said site.

Materials and Methods:

Surface water samples in two replicates from the point source where DaiwalNala meets Wardhariver were collected monthly during January 2014-December 2014. Standard methods were employed during the collection, preservation and analysis of the water samples (Trivedy and Goel, 1986 and APHA *et al.,* 1985).

Results and Discussion:

Results for physico-chemical characters of Wardhariver at the downstream point source of industrial effluents are summarized in the Table No. 01.

pH of the collected water sample was found within standard limit during three months of rainy season while for rest of the year it was higher. Highest pH 8.63 was recorded in the month June. Higher value of pH may be due to uptake of CO_2 by photosynthesizing organisms. The lower pH value observed during the month of July to October may be due to influence of fresh water influx, low temperature and organic matter decomposition. Reduced rate of photosynthetic activities reduces the assimilation of carbondioxide and bicarbonates which are ultimately responsible for increase in pH from January to June (Kamle*et al.,* 2009). The recorded high value of pH (8.63) in the month of June may be due to intense solar radiation, increased penetration of water into the soil and high biological activity during summer.

Electrical conductivity was recorded to be ranging from 230-630 µS/cm and is very well within prescribed standard limit. The capacity of substance or water to conduct electricity is its conductivity. It is directly proportional to the concentration and mobility of ions which are obtained by the breakdown of the compound. Hence we can say that it is the best indicator of water pollution as conductivity is the indirect measure of presence of total dissolved solid or nutrients. The maximum conductivity of water for the study site was recorded to be 630 µs/cm in the month of May.

The total dissolved solids (TDS) in water were increased from the month January (304.85 ppm) up to June (419.25 ppm) and then declined during rainy season. TDS content in collected water sample was more during April to June, which may be due to anthropogenic activity, animal and agriculture waste and also caused by increased evaporation and less rainfall (Soundarapandianet, al., 2009). A high content of TDS elevates density of water, influences osmoregulation, reduce gas solubility and utility of water for drinking (Manivaskam, 2003).

The hardness of water is mainly contributed by Calcium and Magnesium compounds. On the basis of hardness, water can be classified into three categories viz., soft water (0.009 – 75 ppm), moderately hard water (76 – 150 ppm), and hard water (151 – 300 ppm). Total hardness (130-188 ppm) as well as specific hardness due to Calcium (58-92 ppm) and Magnesium (72-112 ppm) of collected water sample showed sparse variation and found much less than the suggested standard limits and can be kept under moderately hard category.

Alkalinity of the collected water sample was however, higher than the standard limit throughout the year. Maximum alkalinity, 236 ppm was recorded in the month of June *i. e.* at the end of summer season and before onset of rainy season while minimum record of 130 ppm was in the month of July i.e. peak of rainy season which is mainly contributed by carbonates (CO_3^{2-}), bicarbonates (HCO^{3-}) and hydroxides (OH^-).

Measured chloride contents vary between 28 ppm in April to 36 ppm in November and found far less within standard limits. The presence of chloride in river water is mainly due to domestic sewage and its concentration is an indicator of organic pollution (NEERI, 1979; Kumara, 2002).

Every water supply contains at least some silica (SiO_2). Silica occurs naturally at levels ranging from a few ppm to more than 200 ppm. At the study site, Silica content in the water was recorded very well within standard limit and ranges from 8.4 ppm in July to 16.3 ppm in May.

Turbidity of the collected water sample was found to be greatly varying from 4.9 NTU to 22.2 NTU with seasonal variation. Turbidity was higher during the months, September (15.4 NTU). Turbidity is caused by the substances which do not exist in the form of true solution and is directly related with scattering of light. The higher turbidity during monsoon represent high rate of light scattering affecting photosynthesis (Chauhan*et al.,* 2006).

Table. 1- Seasonal variations in physico-chemical parameters of collected water samples from study site.

Sr. No.	Parameters	Standard Range	Jan.	Feb.	March	April	May	June	July	Aug	Sept.	Oct.	Nov.	Dec.
1	pH	7.8-8.2	8.35	8.31	8.4	8.44	8.49	8.63	8.17		8.21	8.13	8.26	8.42
2	Conductivity	<3200µS/cm	469	471	510	501	630	645	230	Readings not available	468	443	394	483
3	TDS	<2500 ppm	304.85	306.15	331.5	325.7	409.5	419	149.5		304.2	287.95	258	313.95
4	T-Hardness	<780 ppm	168	168	168	168	188	160	130		168	164	156	180
5	Ca-Hardness	<550 ppm	80	88	84	86	76	64	58		84	88	84	92
6	Mg-Hardness	<230 ppm	88	80	84	82	112	96	72		84	76	74	88
7	Alkalinity	<120 ppm	200	208	224	204	196	236	130		138	152	130	224
8	Chloride	<180 ppm	30	32	32	28	28	32	32		32	32	36	34
9	Silica	100 ppm	10.1	11.2	11.7	11.2	16.3	14.6	8.4		14.2	11.9	12.6	13
10	Turbidity	<10 NTU	10.4	7.5	6.7	5.8	5.2	8.9	4.9		15.4	22.2	11.2	7.8

ppm- Parts per million, µS/cm- micro Siemens per centimeter (Siemens means mhos),
NTU- Nephelometric turbidity unit.

Conclusion:

Preliminary physico-chemical study of water samples collected from study site shows that the water quality is upto mark for domestic as well as drinking purpose provided, effluents from mentioned industries are strictly pre-treated prior to release into the river.

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