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STUDIES ON WATER QUALITY OF RIVER ERAI NEAR DATALA BRIDGE, CHANDRAPUR, MAHARASHTRA, INDIA

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ABSTRACT:
Rivers are the main inland water resources for domestic, industrial and irrigation purposes and often carry large municipal sewage, industrial wastewater discharge and run off from agricultural land.The present investigation attempts to study the physico-chemical properties of river Erai in Chandrapur. The Chandrapur is known for hot and dry climate located around 155 kms. south of the Nagpur at 19° 57^{1} latitude and 79° 22^{1} longitude at a height of 321.95 meters above MSL. The seasonal variation in physico-chemical parameters like Water Temperature, pH, Alkalinity, Hardness, DO, Free CO_2 etc. were studied for a year i.e. from June -2006 to May -2007. Glimpse of observations on physico-chemical parameters indicate that the river at the sampling site is mildly polluted..

Keywords: - Water quality, Conductivity, Erai river, Datala bridge, Chandrapur.

INTRODUCTION :

The study of different water parameters is very important for understanding the metabolic events in aquatic ecosystem. The physico-chemical parameters not only influence each other but also abundance and distribution of the flora and fauna of the aquatic ecosystem. The area of Chandrapur is known for hot and dry climate with an average rainfall of about 1400 mm; and is a border and backward district in eastern part of Maharashtra. The town is known for the coalmines and industries like Chandrapur Super Thermal Power Station (CSTPS) and Maharashtra Electrosmelt Limited (MEL) and variety of small scale industries around it. Due to the rapid industrialization almost all the aquatic ecosystems have become greatly contaminated with their differential impact on water quality and biodiversity therein. The river Erai originates from Chimur Hills in Chimur Taluka of Chandrapur District by means of two tributaries. One of the tributaries known as Chargaon Nullah originates near village Keslabodi and the another tributary known as Chandai Nullah near village Chakparsodi in Chimur Taluka and join near village Arjuni in Warora Taluka and after travelling about 90 kms joins river Wardha.

In India, number of rivers with respect to physico-chemical characteristics has been extensively studied (Chakraborthy *et al.,*1959, Agarwal *et al.,*1976, Khatavkar *et al.,*1992, Hosetti *et al.,*1994, Gyananath *et al.,*2000, Mane and Pawar 2007). Though many reports are available on the water quality of lotic ecosystems, there are very few reports on this aspect on the river, near Datala Bridge in Chandrapur, therefore this investigation.

MATERIALS AND METHODS:

The water samples were collected in polythene bottle of 2 litre capacity once in a month from selected sampling site for the period of the year i.e. from June -2006 to May -2007. The sampling site selected is near Datala bridge. The parameters analysed as per standard literature (APHA, 1985).

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RESULTS AND DISCUSSION:

The monthly data of water quality analysis is shown in Table 1.

Water Temperature

The measurement of water temperature is very important for calculating the solubility of oxygen and free carbon dioxide. The changes in water temperature affect the chemical reactions going on in natural water system, solubility of gases and nutrient cycle along with other biogenic processes, water mixing and turbulence current as pointed out by Reid (1961), Cole (1983) and Goldman and Horne (1983).

In the present investigation, the minimum water temperature (24.7°C) was recorded in month of December -06 and maximum (34.1°C) in May-07. Dhere and Gaikwad (2006) recorded the range between 18.2°C to 35°C from December to May respectively. Similar observations were also reported by Shivanikar *et al.,* (1999) in the river Godavari where temperature is lowest in December and highest in May.

pH

The acidic or alkaline nature of water is indicated by pH. Verma and Shukla (1970) believed that pH would prove to be an ecological factor in controlling the activities and distribution of aquatic flora and fauna. pH is an aspect affecting species diversity and distribution in an ecosystem (Wetzel, 1975). In river Erai, minimum pH, 7.49 was recorded in December-06 and maximum of 8.17 in August-06. Vyas and Kumar (1968) reported pH values between 8 to 9 in Indian rivers.

Conductivity

Conductivity is a numerical expression of the ability of a water sample to carry an electric current and depends on the total concentration of the ionized substances dissolved in the water and the temperature at which the measurement is made. Increased conductivity of river water indicates contamination of ionic pollutants (Shrivastava, 1993).

In present investigation, minimum conductivity (0.178mmhos/cm) was recorded in July 2006 and maximum of 0.380 mmhos/cm in May-2007. High concentration of municipal wastes and domestic activities and less flow of river during summer is responsible for increase of ionic contents in water with consequent increase in conductivity and more flow of river in rainy season and winter which dilute the pollutants to some extent and lowering the ionic contents of water with consequent decrease in conductivity (Bobdey, 2002). Similar results were reported by Isarailli and Ahemad (1993) in river Yamuna, Bansal Samidha (1989) in river Betwa,

Transparency

One of the most obvious and familiar properties of water is its transparency. Natural waters manifest great differences in the degree, to which the sunlight can illuminate them. The transparency of natural water is an indicator of productivity. Minimum transparency (51.00 cm) was recorded in August 2006 and maximum (108.00 cm) in February 2007 and was due to fine silt held in suspension in rainy season as a result of large inflow of water runoff from catchment area.

Sivakumar and Jagannathan (2002) in river Bhavani, Tamilnadu reported that light penetration in the river was as minimum 45 cm in August and maximum of 65 cm in December.The maximum transparency may be due to the settling of the fine silt.

Total Alkalinity

The alkalinity in water is mainly due to carbonates, bicarbonates and partially hydroxides. Natural bodies of water in tropics usually show a wide range of fluctuations in total alkalinity values depending upon the location, season, plankton population, nature of bottom deposits, waters of hill stream, sandy rocky or clayey areas, flooded rivers during

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monsoon and water infested with submerged weeds usually have low total alkalinity values. On the other hand, stagnant waters in tropical plains during summer seasons are likely to have high alkaline values (Jhingran, 1991).

In the present investigation, maximum alkalinity 298 mg/ltr was recorded in May 2007 and minimum alkalinity 106 mg/ltr in December 2006. Shinde *et al.,* (1997) recorded total alkalinity as 297.5, 391.0 and 433.5 ppm at sampling stations A, B and C respectively. Hosetti *et al.,* (1994) recorded the values of total alkalinity between 66.0 ± 2.8 to 351 ± 89.8 mg/l at different stations of Jayantinala and Punchaganga river. The increase in alkalinity could be attributed to increased quantity of organic matter, sewage and localized detergents (Mitchell and Marshall, 1973).

Total Hardness

Hardness is generally governed by calcium and magnesium salts which largely combines with bicarbonates and carbonates giving temporary hardness, with sulphates, chlorides and other anions of a mineral acid causing permanent hardness. During present investigation, total hardness recorded between 93 to 241 mg/ltr. The minimum values recorded in December 2006 and maximum in August 2006.

Venkateshwaralu *et al.,* (1990) reported the values of calcium and magnesium in the range of 45.1 to 53.3 mg/ltr and 27.1 to 31.3 mg/ltr respectively in the river Moosi, Hyderabad.

Total Dissolved Solids

Total Dissolved Solids depend on various factors such as geological character of water shade; rainfall and amount of surface run off and gives an indication of the degree of dissolved substances. During study, Total Dissolved Solids ranged between 194 to 328 mg/ltr. High TDS value recorded in month of May-2007 and low in winter months. Sinha *et al.,* (1989) reported the low values 212.50 mg/ltr in winter season and high 526.33 mg/ltr in summer season in river Ganga at Kalankar (Pratapgarh). Hosetti *et al.,* (1994) in Jayantinalla and Panchganga river reported the T.D.S. values between 484.0 to 917.3 mg/l at different stations. Dora and Rai (1987) reported average T.D.S. values i.e. 204.2 mg/l to 366.0 mg/l in Subarnarekha river passing through Jamshedpur and Ghatsila.

Dissolved Oxygen (D.O.)

Dissolved oxygen plays an important role in precipitation and dissolution of organic substances in water (NEERI, 1998). The main source of dissolved oxygen is the diffusion from the atmosphere and the photosynthetic activities. Welch (1952) pointed out that under natural condition; the running water contains typically high concentration of dissolved oxygen tending towards saturation.

In present investigation, maximum DO (8.00 mg/ltr) recorded in January 2007 and minimum (4.19 mg/ltr) in June 2006. Saraf and Shenoy (1986) also recorded the range between 4.5 to 8.9 mg/ltr of DO. Haniffa *et al.,* (1993) reported range of D. O. level 4.62 mg/l to 5.38 mg/l in the perennial river Tambaraparani. Singh *et al.,* (1989) recorded the values of D. O. between 7.1 mg/l to 8.6 mg/l at the Sangam in river Ganga and Yamuna.

Free Carbon Dioxide (Free CO_2)

Carbon dioxide is a normal component of all natural waters. The free carbon dioxide of any aquatic body is one of the best indexes to understand the quality of water. In the present investigation, minimum value (2.88 mg/ltr) of free CO_2 was recorded in November 2006 and maximum (6.15 mg/ltr) in April 2007.

Shinde *et al.,* (1997) recorded the values of free CO_2 as 3.7 mg/l, 11.2 mg/l and 14.9 mg/l at station A, B and C respectively during the study of river Godavari at Nasik. Haniffa *et al.,* (1993) recorded the range of free carbon dioxide between 2.16 to 6.52 mg/l in the perennial river Tambaraparani. The high values of CO_2 can be attributed to the higher rate of decomposition of

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organic matter by microorganisms with consequent increased release of free CO_2, decrease in utilization in photosynthetic activity and high respiratory activity of benthos and microbes.

Chloride

Chloride is universally present in soil. The concentration of chlorides in natural water generally bears a strong correlation with sodium content and a specific conductance. In present study, minimum chloride value (19.3 mg/ltr) recorded in January 2007 and maximum (61.3 mg/ltr) in July 2006.

The study was conducted on Tungabhadra river at Kurnool town (A. P.) by Ramana Murthy *et al.,* (1994) who, observed chloride concentration in between 80 mg/ltr to 369 mg/ltr. The chloride content normally increases as the mineral content increases. Omkumar (1995) studied on Song river in eastern Doon vally forests and recorded chloride values from 8 to 13 mg/ltr, 11 to 16 mg/ltr and 4.5 to 13.5 mg/ltr respectively at different stations.

Biochemical Oxygen Demand (B.O.D.)

The B.O.D. is a direct measure of O_2 requirement and indirect measure of biodegradable organic matter. The B.O.D. is the parameter which enables the determination of relative oxygen requirement especially of polluted water and effluents.

During study, the BOD values ranged between 3.60 to 10.10 mg/ltr. Sharma and Pande (1999) reported the high content of B.O.D. 35.0 mg/ltr to 45.0 mg/ltr between stations 5 to 7 due to the discharge of wastes from factory drains into the river.

Chemical Oxygen Demand (C.O.D.)

Chemical oxygen demand represents chemically oxidisable load of organic matter in water and indicates the extent of chemical pollution mainly from industrial effluents. In the present investigation, minimum C.O.D.(23.8 mg/ltr) was recorded in June 2006 and maximum (49.2 mg/ltr) during March 2007. Saraf and Shenoy (1986) recorded 50 mg/ltr to 89 mg/ltr of C.O.D. in Wardha River at Kalmana Dist. Chandrapur. Atthappan *et al.,* (1992) recorded the range of C.O.D. 35.0 ppm to 743.4 ppm at different stations of river Vaigai at Madurai.

Sulphate

Natural water contains higher levels of sulphates contributed from weathering of the rocks. In addition to this, domestic sewage and industrial waste also contribute sulphates to an aquatic ecosystem and hence high level of sulphate is an indication of pollution from organic matter.In the present investigation, the maximum sulphate (46.43 mg/ltr) was recorded in month of April 2007 and minimum (19.13 mg/ltr) in January 2007.

Arvindkumar and Singh (2002) recorded the values of sulphate as 8.80 to 16.00 mg/l, 16.00 to 38.20 mg/l, 11.20 to 18.80 mg/l and 8.60 to 15.20 mg/l at a different station in the river Mayurakshi. Unni (1990) reported the level of sulphate between 10.00 to 32.00 mg/l in Narmada river.

Phosphate

Phosphate found mostly in the form of inorganic PO4, is applied as a fertilizer and ultimately ends up into water bodies with runoff from rural environment. Detergents are another important source of phosphorus in urban environment. In present study, phosphate ranged from 0.198 mg/ltr in December 2006 to 1.054 mg/ltr in April 2007. Somashekhar (1988) reported the range of phosphate from 0.07 ppm. to 2.30 ppm. At unpolluted and polluted sites respectively in river Kapila. Reginna and Nabi (2003) recorded the lowest value 0.01 mg/ ltr in the month of September and May and highest value 0.9 mg/ltr in the month of June.

Nitrates

The domestic sewage and agricultural runoff are the chief sources of nitrogenous organic matter. The metabolic wastes of aquatic community and

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dead organisms add to the nitrogenous organic matter. In the present investigation, the nitrates ranged between 0.25 mg/ltr to 1.02 mg/ltr, Saraf and Shenoy (1986) recorded organic nitrogen in the range of 0.7 to 0.8 mg/ltr from river Wardha at Rajura Bridge near Ballarshah.

CONCLUSION:

The present study summarizes the monthly fluctuations in various physico-chemical parameters in the Eari River. The studies on water quality in general showed increased level of nutrients indicating deteriorating condition of river at study point. The deterioration can be attributed to pollution by growing effluent load. Periodic monitoring and preventative measures are required to save the aquatic system from further contamination.

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Table 1 Monthly Variation in Physicochemical Parameters of River Erai During Year 2006-2007

Mon/ Para	Temp	pH	Cond	Trans	Alk	Hard	TDS	DO	CO_2	Chl.	BOD	COD	Sul	Phos	Nit
Jun-06	32.9	7.89	0.321	75.0	187	198	295	4.19	5.26	25.8	9.40	23.8	35.00	0.979	0.61
Jul-06	30.8	8.10	0.178	67.5	175	241	234	4.77	4.93	61.3	8.70	27.7	38.11	0.881	1.02
Aug-06	29.1	8.17	0.284	51.0	161	154	223	5.34	4.21	56.7	10.10	35.1	45.27	0.530	0.98
Sep-06	29.2	7.74	0.259	53.5	134	103	212	5.78	3.29	34.2	7.00	34.5	41.14	0.461	0.91
Oct-06	27.7	7.78	0.288	65.5	121	112	241	6.64	3.18	42.4	6.70	40.3	35.09	0.262	0.58
Nov-06	27.1	7.82	0.293	80.0	129	97	229	7.01	2.88	26.7	4.60	42.4	26.67	0.319	0.41
Dec-06	24.7	7.49	0.299	82.0	106	93	201	7.49	3.10	21.2	4.10	46.8	22.41	0.198	0.25
Jan-07	25.6	7.55	0.291	101.5	147	123	208	8.00	3.58	19.3	3.60	41.3	19.13	0.217	0.26
Feb-07	26.4	7.83	0.292	108.0	173	129	194	7.61	4.99	28.6	6.20	48.6	33.54	0.402	0.34
Mar-07	30.8	7.91	0.311	102.5	195	157	275	5.83	5.33	28.2	5.90	49.2	42.85	0.725	0.52
Apr-07	32.8	7.85	0.326	88.0	224	142	311	4.60	6.15	33.3	6.70	31.9	46.43	1.054	0.57
May-07	34.1	7.97	0.380	81.5	298	202	328	4.48	5.96	41.6	7.10	28.2	38.19	1.012	0.82

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