



Self-refinement of Erai River in district Chandrapur, Maharashtra, India

S K Gudadhe^{1*}, V S Manik²

¹ Assistant Professor, Department of Environmental Science, Dr. Khatri Mahavidyalaya, Tukum, Chandrapur, Maharashtra, India

² Assistant Professor, Department of Environmental Science, Gramgeeta Mahavidyalaya, Chimur, Chandrapur, Maharashtra, India

Abstract

Evaluation of a river self-purification capability gives required information for a sustainable management of the river receiving pollutants. The aim of this paper is to investigate the self-power of river to purify water after some distance from the pollutants added in it. The Erai River is the famous river in Chandrapur district because of CSTPS. The water supply department of Chandrapur treated the Erai water and distribute to peoples of city, the river water is directly used by nearest agriculture field due to that some impurities and pollutants is directly or indirectly added in water. Some of vital physico-chemical parameters i.e. temperature, pH, electrical conductivity, total solids, hardness, dissolved oxygen and alkalinity was analyzed in this study. The observations and results shows that the addition of oxygen by naturally in water is maintain the purity and quality of Erai river water.

Keywords: self-refinement, sustainable management, purity, dissolved oxygen and Erai River

Introduction

Water is one of the most basic needs for all living entities and the river is one of the vital of its sources. Human beings using water from river and has a crucial role for their survival and it is mostly used for purpose of drinking, irrigation, fishery, household, and many other activities. Due to these activities, the rivers are susceptible of being polluted. In addition, the rapid evolution of industries can cause the decreased value of the water. Essentially, a river has its capacity of cleaning any pollutants which naturally combined into the river. Water bodies in flowing state normally have the capacities to clean itself from the pollution of outer sources release into the river ^[1, 2]. This inherent capacity of a river to disentangle any pollutants will only be occurred as the contamination ratio is lower than the determined limit because self-purification will only take place in a certain condition.

Self-purification of water is a very long and slow process which involves physical, chemical and biological processes that which are occurs simultaneously and it allows a river to recover to its natural state over a certain period of time and distance ^[3, 4].

The river has having the capacity to filter out the organic substances, plant nutrients or other contaminants from biological activities. The self-purification capability is based on biological activity in the water body. Hence, self-purification is associated with organic substance oxidation of aerobic organisms ^[5]. Self-purification process is affected by living entity in the river. A study to investigating self-purification capacity of a river is needed to understand its capability of decontamination of anypollutants in the water.

Self-purification of natural river water systems is a systematic process that involves physical, chemical, and biological processes employed concurrently. The water is purified in the sense that the concentration of waste material has been reduced mostly by means of biodegradation processes. Therefore, this process is very closely tied with the content of dissolved oxygen and indeed with all the sources and sinks of oxygen in a river. So dissolved oxygen (DO) and biochemical oxygen demand (BOD) are critical water quality parameters ^[6].

Running water is capable of cleansing itself with distances through a procedure known as self-purification. This ability of rivers is to purify itself from sewage or other wastes naturally which is developed by some processes which worked as rivers moves downstream. This mechanism of dilution of polluted water with invasion of surface water and ground water or through some complex hydrologic, biological and chemical processes like sedimentation (behind obstruction), co-agulation, volatilization, precipitation of colloids and its successive settlement at the bottom of the channel, or lastly due to biological uptake of pollutants. On the other hand, certain streams are capable of adding-up extra materials as they flows downstream from riparian inputs ^[7, 8, 2]. River is a natural or artificial water reservoir and path which consists of water flow network from upstream to downstream and it is restricted by border line (riverbed) on the right and left side as river border protection ^[9]. Naturally, the river can recover the pollutant burden within parameters. The self-recovery abilities of every stream is not the similar and its depend upon the characteristics of individual river, including velocity of flow, water discharge volume and initial waste content in the stream water. The habits of riverside communities also

resulted in increased polluted loads to the river waters ^[10, 11]. If the pollutant load is higher than the water assimilation capacity, indicated by the high pollutant concentration compared to the standard quality threshold, then it will have a negative impact on the decreasing quality of river water.

Erai river is as side stream of river Wardha and it is an important river in Chandrapur district of Maharashtra State. This river originated near Kasarbodi village of Chimur taluka and meets Wardha river near Hadasti village. This river is 78 km long and situated within Chandrapur district. The dam has built on this river is Erai Dam and this dam providing water to Chandrapur city and Chandrapur Super Thermal Power Station. The tributary of Erai River is Zarpur river and it meets near Mana village. ^[12]. The choice of river Erai is because it is a stream segments drawing an urban environment and later flowing into a dam and from where the water is pumped for various uses.

Material and Method

The study was carried out with the help of observations and physico-chemical parameters of water analyzed in laboratory. Six water samples were collected from various sampling locations of Erai river basin (Table 1). Location A, E and F is human activity free area and location B, C and D is concern with CSTPS, human activity and agricultural field. Samples were collected in polythene bottles and analyzed for various water quality parameters as per standard procedures given in APHA, Standard Methods, 1992 ^[13]. The observed values were compared with standard values recommended by World Health Organization (WHO) ^[14].

Various physical and chemical parameters i.e. temperature, pH, electrical conductivity (EC), total solids, hardness, dissolved oxygen and alkalinity were analyzed for to identifying the quality of river water and find out the how water can self-purified water after some downward distance.

Results and Discussion

Temperature: The temperature of location B is slightly rise as compare to other locations. This is not getting any effect to characteristics of river and not harmful to aquatic life. (Table 2)

pH: It is a measure of hydrogen ions concentration present within the solution and from that we identify the solution is acidic or basic. From the data obtained the pH of location B, C and D shows slightly alkaline condition in nature due to discharge of CSTPS wastewater, gray water and washing of cattle's and vehicles directly in Erai River basin. The permissible limit for pH is 5.5 implies pH values at all the disposal point's remains within the limit. (Table 2)

EC: Electrical Conductivity is amount of waters ability to carry electric current ^[15]. If conductivity increases, it shows the presence of dissolved ions. Conductivity can serve as an indicator of water quality problems ^[16]. Electrical conductivity is a vital parameter in determining suitability of water for particular purpose and classified according to electrical conductivity ^[15]. The range of electrical conductivity at all locations found in the range of 860 μ S/cm to 980 μ S/cm (Table No. 2).

Total Solids: The total solids of location B, C and D is increased as compare to other locations due to anthropogenic activities occurred in this areas but that is within permissible limit. (Table 2)

Turbidity: It is an expression of light scattering and absorbing properties of the water sample caused by the existence of clay, silt, suspended matter, colloidal particles, plankton and other microorganisms ^[17]. The range of turbidity at all locations found in the range of 12 NU to 16 NTU (Table No. 2). Permissible limits of turbidity ranges between 1 NTU to 5 NTU as per IS 10500-2012. Due to slightly high concentration of solids in ground, the turbidity values is increase and shown above permissible limit.

Hardness: The total hardness of the Erai river found in the range of 452 mg/l to 485 mg/l (Table No. 2). As per IS10500-2012 the range of total hardness is 200 mg/l to 600 mg/l.

Dissolved Oxygen: The oxygen contained in water is called Dissolved Oxygen (DO) and is usually used as a sign of pollution degree in water bodies ^[18]. Table 2 shows the dissolved oxygen (DO) levels measurements results in the sample of location A showed the value of 7.0 mg/l (before infiltration to CSTPS, Human activity) and decreased to the location B, C and D, up to 3.6 mg/l to 5.0 mg/l. DO of Location E and F increase i.e. 6.5 to 6.9 mg/l caused by the diffuse mixture of pollutant and impurities that cause the dissolved oxygen concentration to decrease.

Alkalinity: Alkalinity is the buffering ability of water and is an important parameter of water quality. The alkalinity of location A is 74 mg/l (before infiltration to CSTPS, Human activity) and then increased in location B and C 109 mg/l and 122 mg/l due to discharge pollutants and impurities load in river. The alkalinity of location D, E and F is decrease i.e. 92 mg/l to 72 mg/l.

Table 1: Sampling Location of Erai River

Location	Area	Latitude and Longitude
A	Near Payli-Bhatadi Bridge	20° 02' 59.53" N 79° 17' 29.66" E
B	Near Ambhora Railway Crossing Bridge	20° 00' 09.99" N 79° 16' 10.39" E
C	Chandrapur- Nagpur Highway Bridge	19° 59' 28.15" N 79° 15' 46.42" E
D	Ram Nagar-Datala Road Bridge	19° 57' 50.85" N 79° 16' 34.23" E
E	Near Binba Gate Bridge	19° 06' 32.62" N 79° 16' 55.43" E
F	Near Pathanpura Gate	19° 55' 55.73" N 79° 17' 26.68" E



Fig 1: Sampling Locations and Erai River Path

Table 2: Physico-chemical Characteristics of Erai River

Sr. No.	Parameters	Unit	Locations					
			A	B	C	D	E	F
1	Temperature	°C	23	29	25	26	27	25
2	pH	--	7.5	8.6	8.4	8.1	7.4	7.3
3	E.C.	μS/cm	980	870	952	973	860	878
4	Total Solids	mg/l	870	1214	1125	1207	1009	854
5	Turbidity	NTU	12	16	13	15	14	12
6	Hardness	mg/l	481	485	467	456	474	452
7	Dissolved Oxygen	mg/l	7.0	3.6	4.5	5.0	6.5	6.9
8	Alkalinity	mg/l	74	109	122	92	88	72

Conclusion

On account of above investigation, it may state that all parameter which were analyzed was below the prescribed limits of IS 10500-2012 and overall Erai River is not highly polluted but, when this river runs near to CSTPS, residential, agricultural, human actuated and rural areas, the characteristics of river somewhat changed. Self-purification process is apparent in the river after flowing certain distance. After passing the city area river shows the characteristics like before the city area. Distribution of river water impurities in the study area showed a changeable pattern. The degree of waste contamination tends to increase in location B, C and D sample points; for DO as a supporting factor, the self-purification process tends to decrease up to location F i.e. last sample point. This is the self-refinement of Erai River. Then this, pollution free Erai River is meet with Wardha River.

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