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Physico - Chemical Characteristic of Pravara River

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Abstract: *Tremendous pressure on the limited fresh water resources occurs due to the increase in demand of water for irrigation, natural resources and industrial consumption with the rapid increase in population. Considering the importance of water, the planning and management of the resource has become a serious need. The present attempt was undertaken with the survey of Pravara river, a tributaries of Godavari river of Maharashtra, India, for its water quality and the impact of various human activities.*

The physico-chemical analysis of water samples was done at five sampling sites, by standard methods (A.P.H.A., 1985; Trivedy and Goel, 1986, 1987). The parameters like water temperature, pH, Free Co_2, Dissolved O_2, BOD, TDS, Total Hardness, Chlorides, Phosphate, Sulphate, Nitrate, Calcium and Magnesium were estimated for all 5 study sites of Pravara river. It was noted that pH of water at all sites varied within the same range (6.49 - 7.87), shows slightly alkaline nature of river water. Gradual increase in total alkalinity and hardness towards the down stream is, due to addition of effluents in river basin. The maximum concentration of TDS was recorded during summer, which decreases during rainy season. DO show significant inverse relationship with temperature. Gradual increase in BOD values toward the downstream is due to additional load of organic matter. Wide range of fluctuations, in CO_2 concentration, may relate with water release periodically, from Wilson dam. Increase in nitrate, phosphate and chloride concentration towards down-stream was due to increase in sewage contamination in river basin. Slight decrease in average calcium concentration towards the down stream was found. The minimum nitrate was observed during summer, probably due to heavy growth of phytoplankton.

Keywords: *Water analysis, Pravara river.*

1. INTRODUCTION

Considerable hydrobiological investigations are carried out on the river water if India (Shastri, 1999; Trivedy, 1990; Singh and Kumar, 1993; Zafar, 1966; Shastri and Pendse, 2001; Singh and Gupta, 2004; Singh and Kumar, 1993;). However no such studies are reported from this region. There fore present work was undertaken for investigation of water quality and the impact of various human activities.

Surface water of lakes, streams and rivers are the major sources of fresh water. Along with the major human activities, the river basins are used for discharge of industrial effluents, municipal sewage and dumping of solid waste. Nutrients like Sulphates, Phosphates and Nitrates are added through agricultural waste, which leads to eutrophication (Mitra, 1995). This resulted into complete change in biotic and abiotic components of this aquatic ecosystem. Ultimately most of the rivers are heavily polluted (Bhave and Borse, 2001; Mini et.al, 2003; Jayaraman et.al. 2003; Sinha,et.al, 2004; Hussain and Hussain, 2004; Nandan and More, 2000; Das, 1989).

Present investigation deals with a survey of river Pravara a tributaries of river Godavari in India, originates from Ratangad along the Western Ghats of Maharashtra and runs for 200 km to the east and drains in to the river Godavari. The upper part of the river passes through highly hilly track of Western Ghats termed as upstream. Water flows from this area with high speed. Wilson dam (Bhandardara dam) which built across river Pravara impounds 11 thousands million cubic feet of water, in upstream area. There are two hydro-electric power project, based on water of Wilson dam. Water is mainly used for drinking, irrigation, industrial and domestic purposes. Irrigation on river Pravara started from 1873, have considered as life line of Ahmednagar district. As the river flows through rural and urban area, it receives various domestic, agricultural and industrial effluents; hence water is assessed for its water quality and the impact of various human and cultural activities on physico-chemical and biological characteristics.

2. MATERIALS AND METHODS

Collection and analysis of water samples were done at monthly interval, during the period of two years. Five sampling sites along the course of Pravara river were selected for the study viz. Streams from catchments area (Site-I), Wilson dam (Site- II), Randha fall (Site-III), Akole (Site-IV) and Ozar pick up weir (Site- V). Water samples were collected during morning hours. Physical and chemical parameters of the samples were analyzed. Physical parameters include temperature, pH and total dissolved solids (TDS). Water temperature was recorded with centigrade thermometer in ^{O}C while pH was measured by a digital pH meter. TDS was measured with the help of a Portable Century Water Analyzer Kit. Chemical parameters like free Co_2, dissolved oxygen (DO), biological oxygen demand (BOD), total hardness, chlorides, phosphate, sulphate, nitrate, calcium and magnesium were estimated by following standard methods (A.P.H.A., 1985; Trivedy and Goel, 1986; Trivedi et al., 1987) for all 5 study sites of river Pravara. Metrological data were produced from the Stage Storage Date Center (SDSC) and irrigation department, Nashik.

3. RESULTS AND DISCUSSION

Results obtain during the analysis of the physico-chemical parameters have been given in table 1 and 2.

During the monsoon the colour of Pravara river water was muddy. After that, it becomes clear. This was the period when algal growths, especially benthic algae, become visible giving a greenish appearance to water. In overall observations, colour of Pravara river water, varies clear at up stream to brownish green at down stream.

Transparency varies as per the season. Water becomes clear, attending maximum transparency in the winter season. Decrease in transparency after winter, indicates increase in population of organism (Munawar, 1970). Average transparency in Pravara river water ranged, 15 to 100 cms, from Ozar pick up weir (Site-V) to Wilson dam (Site-II).

Minimum temperature 14.2 ^{O}C in January at site-II and maximum, 35.3 ^{O}C in April, at site-V (Table no.1) was recorded. Overall observations shows, gradual increase in temperature recorded from site -I to site-V (i. e. from upstream to the down stream), because of effluents inflow (Bhave and Borse, 2001).

Monthly fluctuation of pH was noted at all five sites of river Pravara (Table no. 1). Average values ranged between 7.11 and 7.35 (Table no.2). It was noted that pH of water at all sites varied within the same range (6.49 - 7.87). In general, pH values shows, slightly alkaline nature of river water at all the station. It is within the limit of drinking purpose. Mini *et* al. (2003) showed similar results.

The total alkalinity values were ranged from 83.33 mg/L to 147.29 mg/L. Peak values are found during winter and low value during summer and monsoon. This may be due to decrease rate of decomposition (Trivedy, 1990). Gradual increase in alkalinity and hardness (Table No. 2) was found from upstream (Site-I) to the down stream (Site-V). This may be due to the high temperature, low water level and addition of effluents in river basin (Mitra, 1995; Manna and Das, 2004).

The maximum concentration of TDS (312 mg/L) was recorded during summer, which decreases (36 mg/L) during rainy season due to dilution of rainwater. Same situation was noted by Jayaraman *et* al. (2003). Increase in TDS, increases hardness of water (Shastri *et* al., 2004).

Present study showed maximum values of DO (9.33 mg/L) during September, October and minimum (4.41 mg/L) during January to March. Increase in DO is obviously related to decrease in temperature (Trivedy, 1990; Bhave and Borse, 2001).

Gradual increase in BOD values toward the downstream is due to additional load of organic matter. High values during summer months may be due to high temperature and higher organic load associated with reduced river flow (Singh and Rai, 2003).

The range of CO_2 values was quite wide. This may be related with the growth of phytoplankton supported by results drawn by Das, 1989 and Munnawar, 1974. Minimum value 0.00 (nil) was recorded in January at sites-II and site- IV, while maximum value 45.80 mg/L recorded in April at site-II.

Chlorides were found present throughout the period. Its range was comparatively wide. Maximum value 42.95 mg/L was obtained in October, while minimum value 2.28 mg/L was obtained in March.

Increase in chloride concentration towards down-stream may be due to increase in sewage contamination in Pravara river basin. This was agreeable with the observations of Zafer (1966) and Venkateswarlu (1969a).

There is no significant difference in the average value of Calcium at all five sites (Table no.2). Values of Magnesium showed fluctuations along different station. This is due to sewage contamination. Higher values were recorded in January at site -III and –IV and September at site -V. Gradual increase in average values of Phosphate from upstream to downstream (Table no. 2) was found. Nitrate concentration mainly depends on the biological activity of nitrifying bacteria (Manna and Das, 2004). Maximum value 2.67 mg/L was noted. Overall observations of nitrate at all five sites show quite low concentration of nitrate (Nandan and More, 2000).

The analysis of physico-chemical parameters has indicated the wider human activity and influx of domestic waste in river, which causes the eutrophication. Therefore the values obtain are quite similar to the values represented by Munawar (1970), Trivedy (1990), Singh and Rai (2003), Nandan and More (2000) for eutrophication of rivers in India. The phosphorous and nitrogen are supposed to be the most important nutrient controlling growth of aquatic organism (Hussain and Hussain, 2004; Mitra, 1995). Due to this, the river Pravara had showed enormous growth of phytoplankton throughout the study period.

Table1. *Range in physico-chemical characteristic at five sites of river Pravara during two years study.*

Parameters	Site-I(P1)	Site- II(P2)	Site-III(P3)	Site-IV(P4)	Site-V(P5)
Water temp.(^{0}C)	**14.4 - 18.8**	**14.2 - 25.5**	**15 - 30.2**	**15.1 - 33.2**	**15.1 - 35.3**
pH	**6.49 - 7.65**	**6.60 - 7.68**	**6.82 - 7.84**	**6.75 - 7.87**	**6.71 - 7.83**
Alkalinity	**45 - 205**	**35 - 215**	**35 - 225**	**45 - 235**	**40 - 265**
Total Hardness	**10 - 86**	**14 - 150**	**18 - 165**	**20 - 152**	**20 - 154**
TDS	**40 - 201**	**30 - 306**	**38 - 302**	**45 - 310**	**56 - 312**
DO	**4.11 - 9.25**	**3.61 - 9.18**	**3.45 - 9.33**	**3.41 - 9.12**	**3.85 - 9.13**
BOD	**1 - 5.75**	**1.60 - 48**	**1.40 -35.33**	**1 - 42.15**	**1 - 50.12**
Free CO_2	**4.25 - 32.10**	**0 - 45.80**	**1.15 - 44.40**	**0 - 44.42**	**1.43 - 44.46**
Chlorides	**8.30 - 38.48**	**2.44 - 38.33**	**2.28 - 38-64**	**2.43 -39.32**	**2.68 - 42.95**
Calcium	**18.30 - 60.01**	**18.90 - 80.40**	**20.37 - 63.11**	**18.11- 80**	**18.76 - 60**
Magnesium	**4.01-14.07**	**3.82 - 16.61**	**4.11- 17-20**	**3.78 - 17.21**	**3.72 -17.52**
Phosphate	**0.01-1.36**	**0.01 - 3.31**	**0.0 - 3.57**	**0.0 - 5.01**	**0.0 - 5.12**
Nitrate	**0.0 - 2.01**	**0.0 - 2.04**	**0.0 - 2.05**	**0.0 - 2.67**	**0.0 - 2.12**

Values except temperature and pH are in mg/L.

Table2. *Mean values of Physico-chemical parameters at five sites of river Pravara during two years study.*

Parameters	Site-I	Site- II	Site - III	Site - IV	Site - V
Water temperature(^{0}C)	**17.03**	**18.99**	**20.31**	**21.40**	**22.70**
PH	**7.11**	**7.19**	**7.31**	**7.32**	**7.35**
Total alkalinity	**94.28**	**83.33**	**93.94**	**102.95**	**147.29**
Total hardness	**37.14**	**66.79**	**80.20**	**84.58**	**86.33**
TDS	**103.5**	**136.66**	**154.66**	**152.33**	**163.45**
DO	**6.45**	**5.75**	**5.69**	**5.48**	**5.84**
BOD	**3.75**	**10.04**	**9.63**	**10.59**	**11.58**
Free CO2	**18.00**	**17.95**	**18.72**	**19.74**	**21.04**
Chlorides	**18.02**	**13.91**	**14.00**	**14.47**	**15.46**
Calcium	**36.33**	**37.69**	**36.82**	**38.16**	**38.58**
Magnesium	**7.85**	**8.60**	**8.32**	**8.40**	**9.58**
Phosphate	**0.33**	**1.25**	**1.40**	**1.94**	**1.96**
Nitrate	**0.60**	**0.49**	**0.47**	**0.50**	**0.45**

Values except temperature and pH are in mg/L.

4. CONCLUSION

- PH values shows, slightly alkaline nature of river water. It is within the limit of drinking purpose.
- Gradual increase in alkalinity and hardness was found from upstream to down stream.
- The maximum concentration of TDS was recorded during summer.
- Gradual increase in BOD towards the down stream was observed.

- Increase in chloride concentration towards down stream may be due to increase in sewage contamination.
- Calcium, Magnesium, Phosphate and Nitrate shows fluctuation along different station due to addition of sewage contamination
- The wider human activity and the domestic waste cause the eutrophication.

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