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STUDY OF WATER QUALITY PARAMETERS OF SAVITRI RIVER WATER IN BIRWADI-MAHAD MIDC REGION

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Abstract

The present research work is focused on the determination of physico-chemical parameters, such as temperature, pH, EC, hardness, chlorides, alkalinity, DO, BOD5, COD and phosphate of water samples from different sampling sites. Increase of pollution concentration indicates an increase in the pollution load due to industrial effluents and anthropogenic activities and discharge of wastes into river at Birwadi-Mahad MIDC area. In this research work water samples are collected from three different sites around MIDC area of Savitri River. The results revealed that the higher pH value was analyzed as 7.89, Electrical Conductivity was 920 µS/cm-1, parameters include Total Solids 1750 mg/l, Total Dissolved Solids 1600 mg/l, total suspended solids was 690 mg/l, total hardness was 220 mg/l, chloride was 380 mg/l, dissolved oxygen was 5.98 mg/l, BOD5 was 40 mg/l, COD was 305 mg/l and phosphate was 6 mg/l of the river water sample. Therefore the study revealed that how the Savitri river water is contaminated by direct effluents from industries waste dumping in the river. Therefore water quality management is urgently required to achieve the water quality standards determined by W.H.O.

***Keywords**: Industrial effluent, total dissolved solids, physico-chemical.*

INTRODUCTION

River Savitri is one of the important rivers in the coastal Maharashtra. It originates in the Aurthorsit Point at old Mahabaleshwar. Geographically, the Savitri River extends between 18 0 9'N to 73 0 40'E. The highest altitude is 1212 m above MSL and total catchment area of basin is 2899 km 2 with total length of 99 km. Savitri is seventh order River. Savitri meets to Arabian Sea at Bankot Creek near Devgad village in Shrivardhan tahasil. Water is an important resources in the all living organisms, it is 85% of the earth surface occupies by water used for human development like drinking, irrigation and fishing. The Savitri is one of the largest river of the konkan region. Savitri River is the main source of drinking water, irrigation and industry in Raigad district. Disposal of Sewage, Industrial wastes and other

human activities effects of Savitri river were highly polluted[1]. The quality of potable water depends on water sources like river, well and lake etc. The condition of drinking water may be polluted with pathogen, toxic metal, chemical compounds such as pesticides, herbicides and other industrial waste becomes waterborne outbreaks [2]. The quality of the shallow aquifers in and around the textile, bleaching and dyeing units, which use a wide variety of chemicals and dyes at Birwadi-Mahad MIDC and their environs are highly polluted due to the indiscriminate discharge of untreated effluents in the nearby low lying lands and rivers and found unsuitable for all purposes. The river bank and they are using water from the river and discharging the untreated effluents. The people living in the downstream are using the water for their irrigation, drinking and fishing. As per the survey conducted, about 150 dyeing units and 20 tanneries are in operation in Birwadi area and expected to discharge the trade effluent either directly or indirectly through drain [3]. The present study was aimed at analyzing some important characteristics of wastewater considered herein for the Savitri river. Physic-chemical parameters such as pH, temperature, EC, TS,TDS ,TSS, chloride content, Hardness, alkalinity, DO, BOD5, COD, PO4 etc were carried out.

METHODOLOGY

Sample collection site:

Surface water samples were collected from river Savitri (three polluted sites), 1.5km upstream from Birwadi MIDC Area, actual Birwadi MIDC and 3km downstream from Birwadi MIDC. Among all three locations the actual Birwadi-MIDC site comprises of many small tanning and dyeing units which drains the majority of their effluents into the river without proper effluent treatment. Besides, the water resource was used for domestic and fishing purposes. Water samples from all the sites were collected in sterile glass bottles, brought to the laboratory, processed within 1-3 hrs, and stored at −20°C for further analysis.

Physicochemical analysis

Following physico-chemical properties were studied. Total dissolved solid (TDS) of water and fixed residue was measured by evaporation method. Dissolved oxygen (DO) and biochemical oxygen demand (BOD) of water was measured by sodium thiosulphate titration method. Chemical oxygen demand (COD) was measured by titration of potassium dichromate and sodium thiosulphate [4].

RESULTS AND DISCUSSION

The water samples were analyzed for physicochemical characteristics. The physicochemical parameters were analyzed namely Temperature, pH, EC, TS, TDS, TSS, Total Hardness, DO, COD, BOD5, Chloride and PO4 (Table 1)

Temperature:

Temperature of water may not be as important in pure water because of the wide range of temperature tolerance in aquatic life, but in polluted water, temperature can have profound effects on dissolved oxygen (DO) and biological oxygen demand (BOD).The fluctuation in river water temperature usually depends on the season, geographic location, sampling time and temperature of effluents entering the stream [5]. The water temperature was found to be maximum 30°C at Birwadi MIDC area. The temperature of 3km downstream site was 28.5°C. The lowest water temperatures were observed in 1.5Km Upstream site 25ºC. The variation is mainly related with the temperature of atmospheric and weather condition [6].

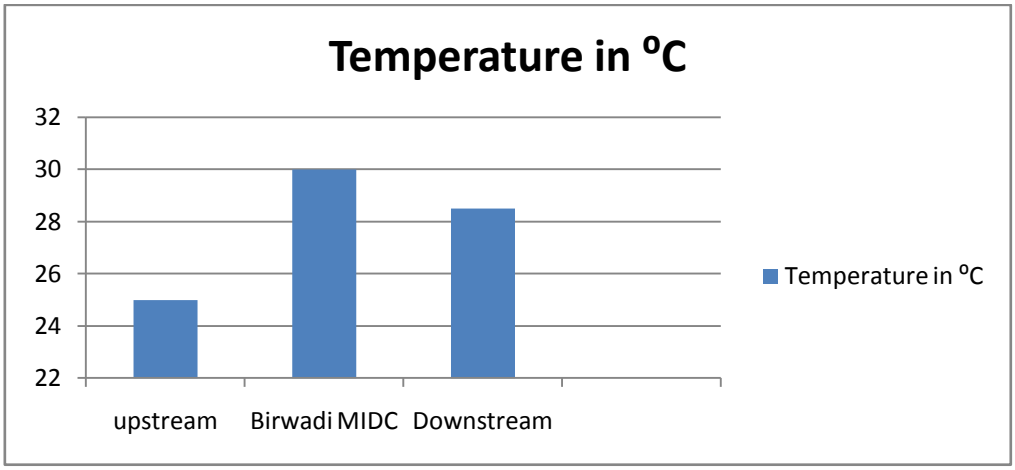

Figure 1 Variation of the temperature of water samples at different locations

pH: The pH values of the samples ranged from 6.95 to 8.80 where the water samples of different location tested in the study were found to be above permissible range of pH value recommended by several health and pollution control organizations e.g. WHO, CPCB, BIS i.e. 6.5-8.5. The pH of river water was showing alkaline character throughout the study period at all three sites. The pH value (Figure 2) ranged between 6.95 to 8.80. At upstream pH value noticed 6.95, at Birwadi MIDC 7.89, and downstream 7.46, respectively.

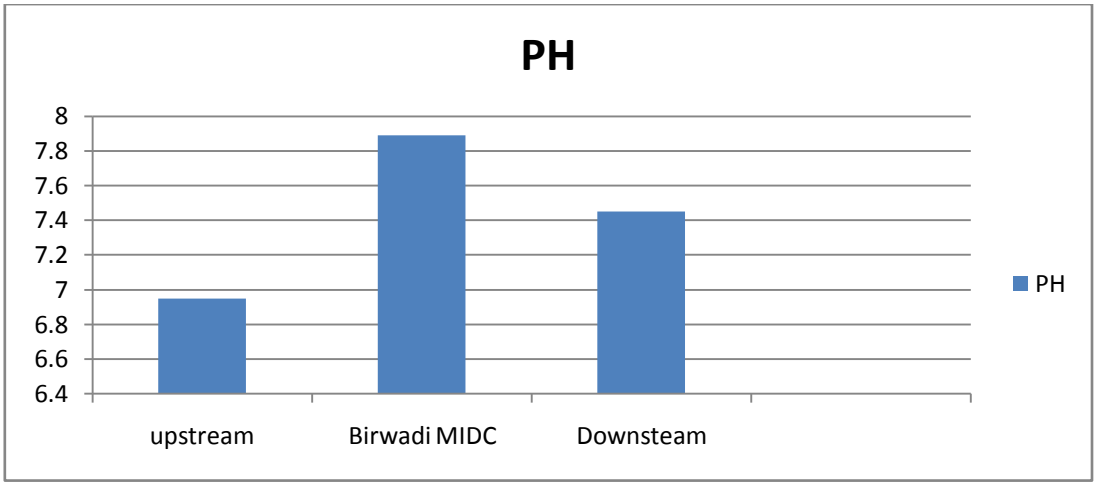

Figure 2 Variation of the pH of water samples at different locations

Electrical conductivity:

Electrical conductivity usually used for indicating the total concentration of ionized constituents of water[6]. Electric conductivity is varying much having low at 1.5km upstream 564µS/cm^{-1}. At Birwadi MIDC range was recorded as 920 µS/cm^{-1}. But slightly vary at downstream 653 µS/cm^{-1}.

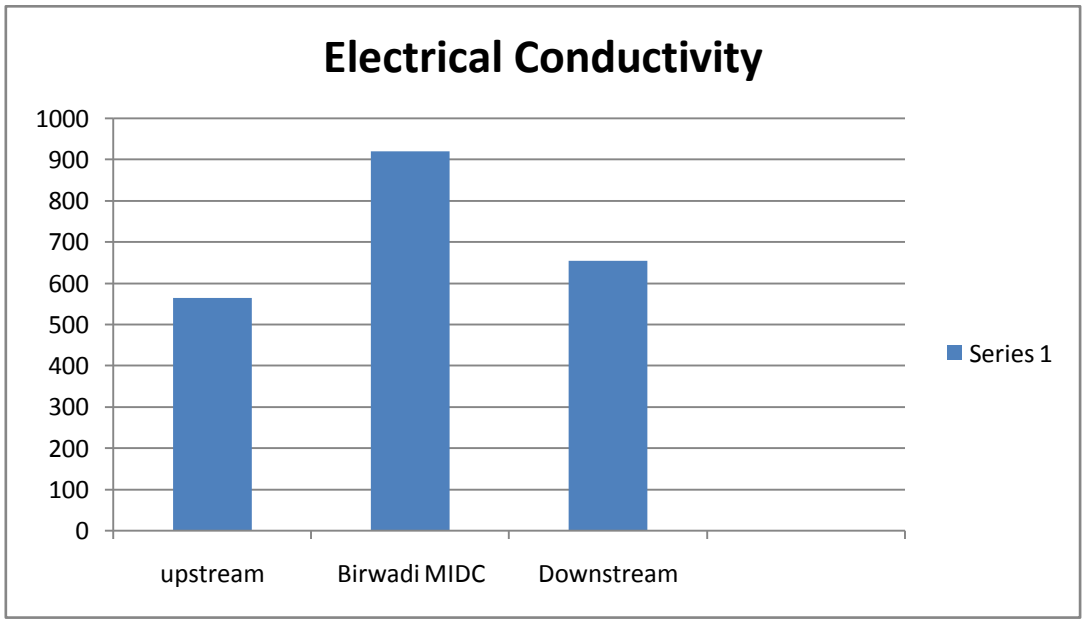

Figure 3 Variation of the Electrical conductance of water samples at different locations

Total Solids: Solid refers to suspended and dissolved matter in water. They are very useful parameters describing the chemical constituents of the water and can be considered as general of edaphically relation that contributes to productivity within the water body[7]. The recorded TS value was more or less similar in all sample points as well as four sites. 1.5km upstream 1560mg/l, Birwadi MIDC 1588 mg/l, downstream 1575 mg/l, respectively.

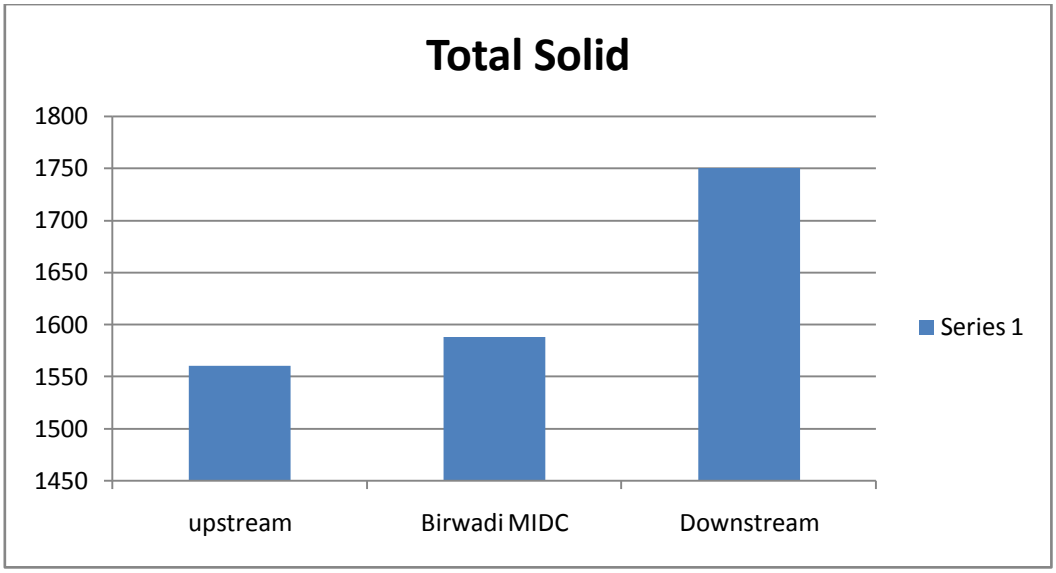

Figure 4 Variation of the total solids of water samples at different locations

Total Dissolved Solids (TDS): Total dissolved solids describes the amount of inorganic salts of calcium, magnesium, sodium etc. and small proportion of organic matter present in the water, where a high value of the same have been reported to be related to acute myocardial infarction as well as ischemic heart diseases in few studies[8]. In this study, TDS values showed a considerable variability ranging from < 100 ppm - >2000 ppm. The maximum value of TDS was at Birwadi MIDC i.e. 1600mg/l, at downstream it was 1450 mg/l and minimum at Upstream i.e. 900 mg/l.

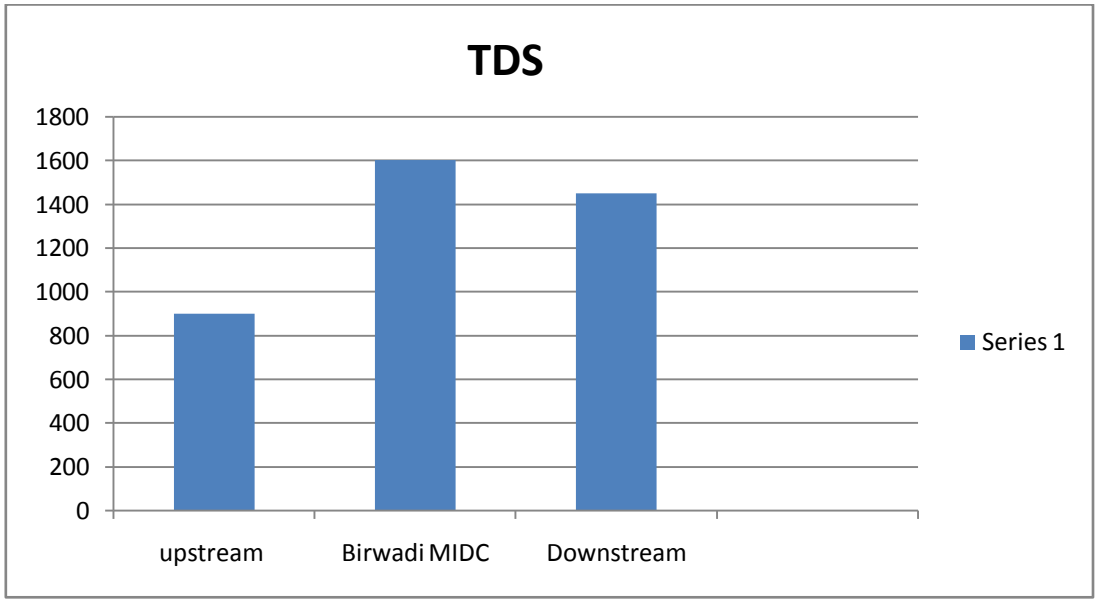

Figure 5 Variation of the total dissolved solids of water samples at different locations

Total Suspended Solids (TSS): Total suspended solid content of water depends on the amount of suspended particle, soil and salt which is directly related to turbidity of water. The present study shows that the average value of TSS varies from 167.78 to 278.33 mg/l**.** The

present investigation, TSS value of 1.5km upstream 450mg/l, Birwadi MIDC (690mg/l) and downstream (556mg/l). The maximum value was at Birwadi and upstream at north.

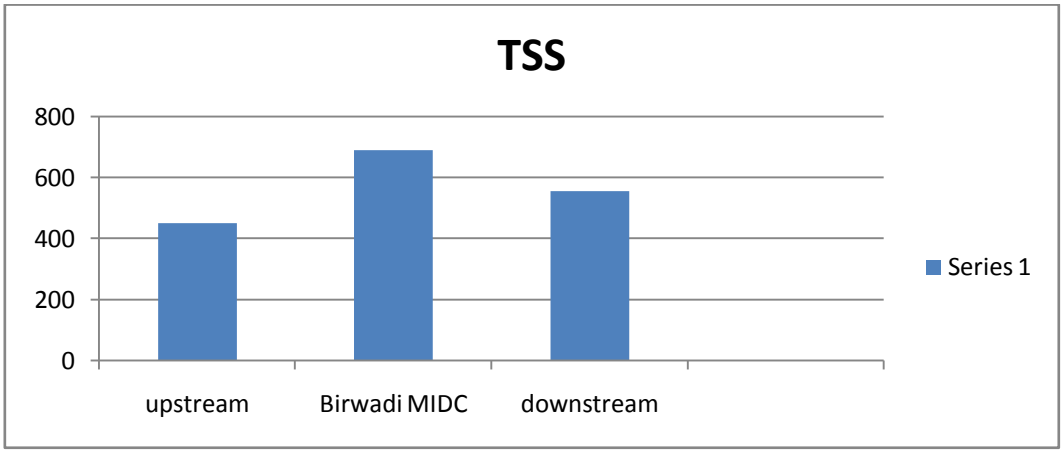

Figure 6 Variation of the total suspended solids of water samples at different locations

Hardness: Hardness of water is an important consideration in determining the suitability of water for domestic and industrial uses. Hardness is caused by multivalent metallic cations and with certain anions present in the water to form scale. The principal hardness-causing cations are the divalent calcium, magnesium, strontium, ferrous iron and mangnous ions. Total hardness was recorded at upstream site (220mg/l), Birwadi MIDC site (150mg/l), downstream site (160mg/l). Hardness was below the permissible limit in all samples and might have caused increased concentration of salts by excessive evaporation.

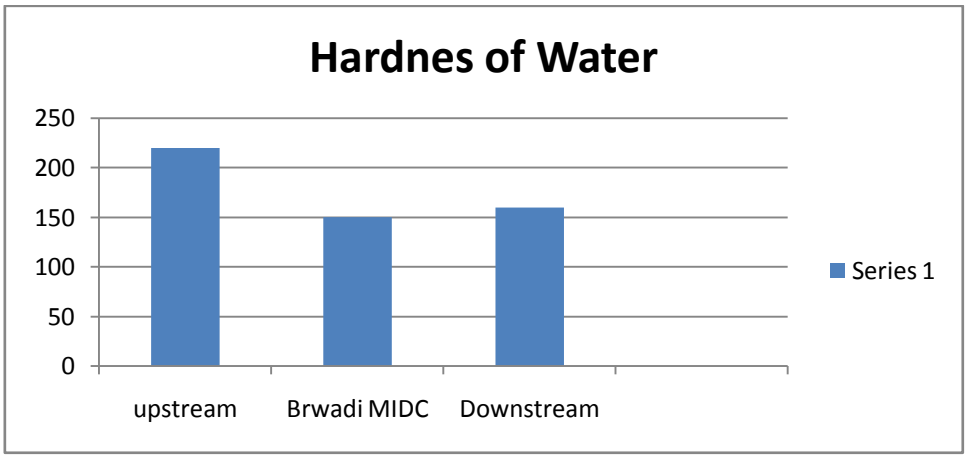

Figure 7 Variation of the Hardness of water samples at different locations

Chlorides:

It occurs naturally in all types of waters. High concentration of chlorides is considered to be the indicators of pollution due to organic wastes of animal or industrial origin. Chlorides are troublesome in irrigation water and also harmful to aquatic life [9]. The chloride content showed very narrow changes in sampling points between four sites. The recorded values of upstream site 260 mg/l, Birwadi MIDC 380 mg/l, and downstream 359 mg/l. Higher

concentration of chloride is hazardous to human consumption and creates health problems. Desirable limit of chloride by ISI (1991) for drinking purpose is 250 mg/l.

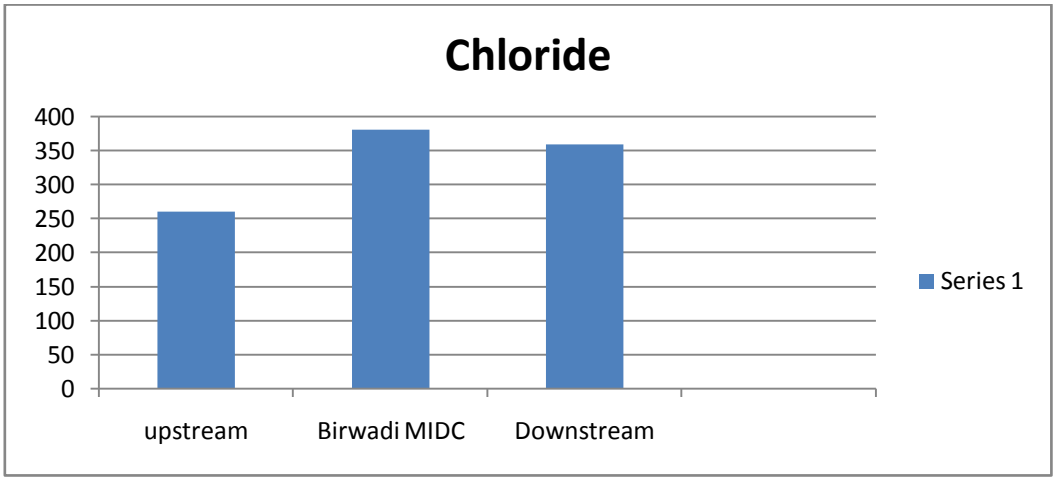

Figure 8 Variation of the Chloride of water samples at different locations

Dissolved oxygen (DO): The dissolved oxygen content is one of the most important factors in stream health. Its deficiency directly affects the ecosystem of a river due to bioaccumulation and biomagnifications. The oxygen content in water samples depends on a number of physical, chemical, biological and microbiological processes. DO values also show lateral, spatial and seasonal changes depending on industrial, human and thermal activity. In the present study, the value of DO ranged from 5.04 mg/l to 5.98 mg/l. at upstream 5.98 mg/l, Birwadi MIDC 5.05mg/l and downstream 5.48mg/l.

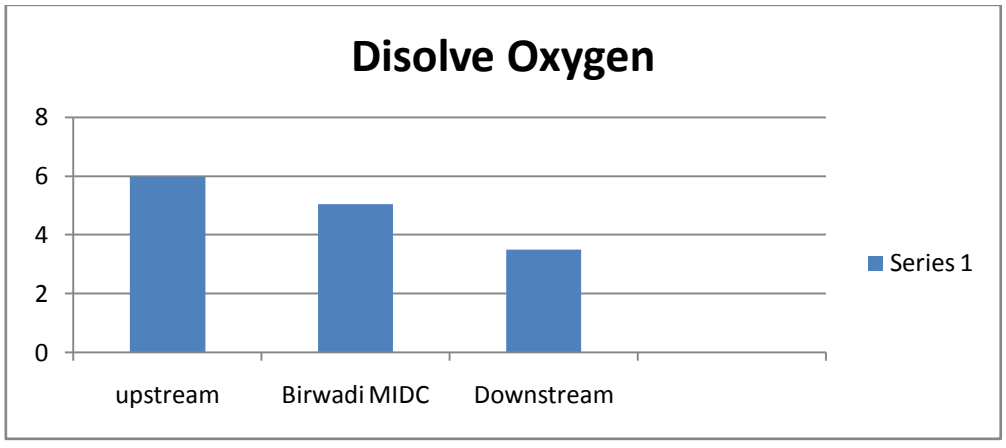

Figure 9 Variation of the DO of water samples at different locations

Biological Oxygen Demand (BOD): is a measure of the oxygen in the water that is required by the aerobic organisms. The biodegradation of organic materials exerts oxygen tension in the water and increases the biochemical oxygen demand. BOD5 is the amount of oxygen required by the living organisms engaged in the utilization and ultimate destruction or

stabilization of organic water [10]. The value for BOD was found as 40mg/l at upstream, 15mg/l at Birwadi MIDC and 22mg/l at downstream.

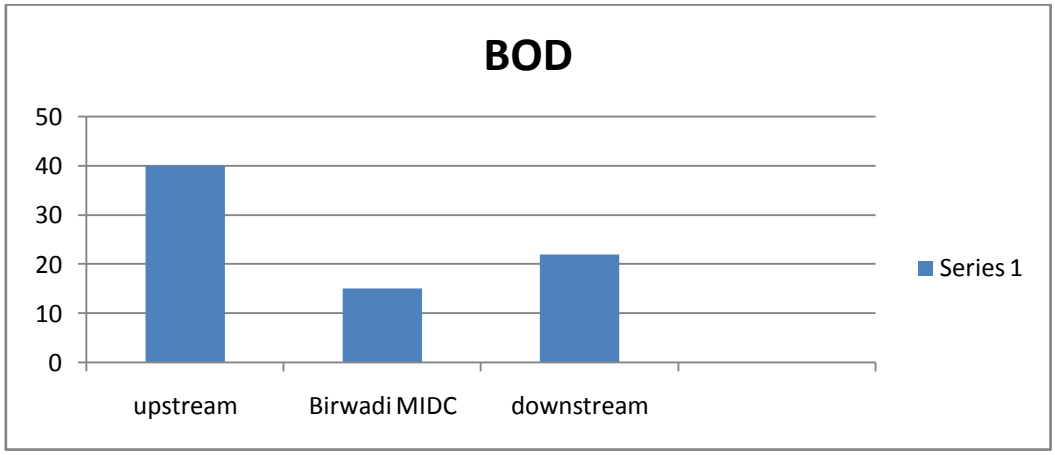

Figure 10 Variation of the BOD5 of water samples at different locations

Chemical Oxygen Demand (COD): is a measure of the oxidation of reduced chemicals in water. It is commonly used to indirectly measure the amount of organic compounds in water. The measure of COD determines the quantities of organic matter found in water. This makes COD useful as an indicator of organic pollution in surface water [11]. The chemical oxygen demand (COD) marked difference among varies site. The highest COD range observed at BIrwadi MIDC 304mg/l followed by, upstream 155 mg/l and downstream 136 mg/l,

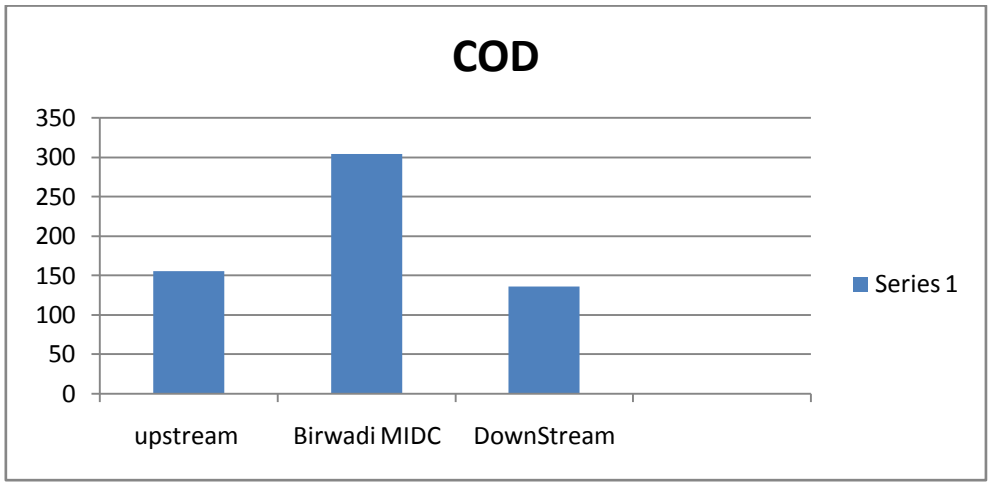

Figure 11 Variation of the COD of water samples at different locations

Phosphate: Phosphate is rarely found in high concentrations in waters as it is actively taken up by plants. High concentrations of phosphates can indicate the presence of pollution and are largely responsible for eutrophic conditions [12.] The anthropogenic additions of phosphorus to the river have a considerable effect on the quality of the water. Such phosphate is derived mainly from domestic sewage and the runoff from agricultural areas. The

phosphate content found maximum in Birwadi MIDC 6 mg/l followed by, upstream 5.42mg/l and downstream 5.45mg/l.

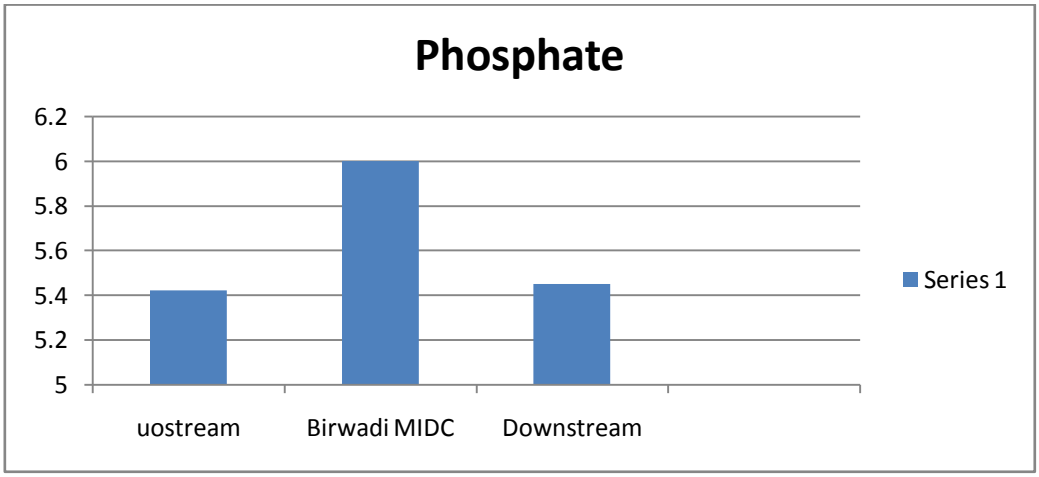

Figure 12 Variation of the PO4 of water samples at different locations

Table 1 Physico-chemical parameters of four sampling site

Sr.No.	Parameter	1.5km Upstream	Brwadi MIDC	3km Downstream	WHO Standard (1993)
1	Temperature in °C	25	30	28.5	
2	PH	6.95	7.89	7.45	6.5 to 8.5
3	EC (µS/cm-1)	564	920	653	
4	TS (mg/l)	1560	1588	1750	
5	TDS (mg/l)	900	1600	1400	1000
6	TSS (mg/l)	450	690	556	
7	TH (mg/l)	220	150	160	500
8	Chloride (mg/l)	260	380	359	250
9	DO (mg/l)	5.98	5.05	5.48	
10	COD (mg/l)	155	304	136	250
11	BOD5 (mg/l)	40	15	22	
12	PO4 (mg/l)	5.42	6	5.45	0.1

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