ISSN 2348-313X (Print)
International Journal of Life Sciences Research ISSN 2348-3148 (online)
Vol. 6, Issue 2, pp: (28-36), Month: April - June 2018, Available at: www.researchpublish.com

WATER QUALITY ASSESSMENT IN KALINGARAYA CANAL – A DISTRIBUTARY OF RIVER BHAVANI ERODE DISTRICT, TAMILNADU

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Abstract: **Environmental stability and cleanliness are of paramount importance for the existence of life. Slight changes in the environmental conditions of any ecosystem reflect the impact on the living organisms. Various anthropogenic activities are mainly responsible for the deterioration of environmental quality. In developing countries, the rapid industrialization with the resultant urbanization and the unplanned and excessive exploitation of natural resources are the major causes for pollution problem in cities and towns. According to Smith (1977), every human waste product which when ingested into the biosphere, affects the normal functioning of ecosystem and has adverse effects on animals and humans. Water is one of the most important and fundamental natural environmental resources and basic component of the ecosystem. It is the basic need of every living organism. The need of the hour is that the quality as well as the quantity of these vital resources should be maintained. But we are lacking in this effort because billions of gallons of waste water from cities, housing settlements, industries and agricultural fields are thrown into water courses to such an extent that 70% of streams and rive5rs of India contain polluted water (Rastogi and Jayaraj, 1987).**

Keywords: **waste water, natural resources, environmental resources, industries, agricultural fields.**

1. INTRODUCTION

India is a country of river valley civilization as the civilization has grown up on the banks of the river. The industrial development has resulted since industrial development has resulted since independence in the establishment of many industries mostly on the banks of rivers. But unfortunately man uses the river and other lotic habitats as a sink for the industrial wastes as well as domestic and municipal wastes. As a result, the water gets contaminated with harmful chemicals and microorganisms and becomes unsuitable for all legitimate uses including agricultural purposes; the quality of an aquatic ecosystem is mainly dependent on the physical and chemical qualities of water and also on biological diversity of the system.

Erode is more or less an industrial town with many small and large scale industries such as textile, dyeing and tannery industries, bleaching factories and so on. Most of them are situated in places where there are no municipal sewers so that the wastes from these units are to be discharged into the nearby water courses and small stagnant water bodies or stagnated in huge pits at the backyards. The water of the Kalingarayan Canal, distributaries of river Bhavani, is mainly used for agricultural purposes. But this canal is also used for the discharge of industrial effluents and domestic sewage at several points all along its course through a number of small and big drains.

In recent times, the protection and management of water resources is emerging as a major public concern at global level. To communicate the information status of water quality to policy makers, it is of prime important to study the physic-chemical characteristics of water bodies. Therefore, the present work has been carried out to assess the quality of water in Kalingarayan canal through the analyses of physic-chemical parameters at selected stations.

STUDY AREA:

At a stretch of 2 km from B.P.Agraharam to Karaivaikal, the Kalingarayan canal receives effluents from various industries as well as domestic sewage. Different stations have been selected in the canal for the collection of effluents and water samples.

Station I : It is upstream point in the canal, 250 m ahead from a tannery located at B.P.Agraharam

Station II: It is upstream point in the canal, 250 m ahead from a tannery located at B.P.Agraharam mixes with the canal water (250 m downstream to station)

Station III: It is the downstream point (400 m away from station II) where the effluent from a bleaching factory at B.P Agraharam mixes with the canal water.

Station IV: It is the downstream point (300 m away from station III) where the sewage effluent originating from human dwelling at Vaniyamkalthottam mixes with the canal water.

Station V: It is the downstream point (200 m away from station IV) where the effluent originating from dyeing factory at Vaniyamkalthottam mixes with the canal water.

Station VI: It is the downstream point at Karaivaikal(700 m away from station V) which is free from the discharge of any pollutants.

2. MATERIALS AND METHODS

Collection of Samples:

The water samples were collected in plastic cans of 5 liter capacity after rinsing thoroughly with the same samples. In stations where the effluent mixes with the canal water, downstream samples were collected at a distance of 0.5 km of the confluence. Simultaneously, the raw effluents from their sources prior to mixing with the canal water were also collected separately.

DETERMINATION OF PHYSICAO-CHEMICAL CHARACTERISTICS:

Colour:

The colour of the samples was determined by visual comparison method.

Odour:

The odour was described by direct smelling of the samples on the collection spot itself.

Temperature:

The temperature of the samples was recorded by using the mercury thermometer at the collection site itself.

pH:

The pH of the samples was determined by using universal wide and narrow range pH papers.

- Total suspended solids (TSS)
- Total dissolved solids (TDS)
- Dissolved oxygen (DO)
- Biochemical oxygen (BOD)
- Chemical oxygen demand (COD)
- Salinity
- Alkalinity
- Chlorides

- Sulphides
- Chromium
- Calcium
- Magnesium
- Nitrate
- Phosphate
- Chlorine
- Oil and grease
- Tannin and lignin

Statistical analysis:

The correlation coefficient between various parameters was arrived at. The data were tabulated and graphically represented.

3. RESULTS

The physic – chemical characteristics of various effluents and water samples collected from different stations were analyzed month wise from July 1999 to December 1999 and the data were presented in tables and figures.

Colour:

As shown in table 1, the effluents were found to have their own characteristic colour. The water samples from station II, IV and V were also coloured due to the mixing of effluents at these points. On the other hand, the samples from stations, I, III and VI were colorless during all the sampling months.

Odour:

Various effluents as well as the water samples from station, II, III and IV had unpleasant odour while the samples from stations I, V and VI were found to be odourless(Table 2).

Temperature:

From the table 3 and fig.2, it is clear that temperature for all the effluents and the water samples from different stations varied between 27°C and 30°C except the dyeing factory effluent which had the highest ranges of temperature 39°C - 40°C.

pH:

As presented in table 4 and fig. 3, the pH of the effluents was alkaline, the ranges of values being between 8.0 and 10.8. It was found that the bleaching factory effluent had maximum values and it was followed by the effluents of dyeing and tannery industries. The water samples from different stations had slightly lower pH than the effluents. (the ranges of values were between 7.3 and 9.6).

Table 1: Characteristics of colour in various effluents and water samples collected at different stations during the study period.

Samples / Period	July	Aug	Sep	Oct	Nov	Dec
Tannery effluent	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown
Bleaching factory effluent	Turbid White	Turbid White	Turbid White	Turbid White	Turbid White	Turbid White
Sewage effluent	Light Black	Light Black	Light Black	Light Black	Light Black	Light Black
Dyeing factory effluent	Pale Pink	Pale Pink	Pale Pink	Pale Pink	Pale Pink	Pale Pink
Water sample from station I	Colourless	Colourless	Colourless	Colourless	Colourless	Colourless
Water sample from station II	Pale Brown	Pale Brown	Pale Brown	Pale Brown	Pale Brown	Pale Brown
Water sample from station III	Colourless	Colourless	Colourless	Colourless	Colourless	Colourless
Water sample from station IV	Pale Block	Pale Block	Pale Block	Pale Block	Pale Block	Pale Block
Water sample from station V	Milky Pink	Milky Pink	Milky Pink	Milky Pink	Milky Pink	Milky Pink
Water sample from station VI	Colourless	Colourless	Colourless	Colourless	Colourless	Colourless

Table 2: Characteristics of odour in various effluents and water samples collected at different stations during the study period.

Samples / Period	July	Aug	Sep	Oct	Nov	Dec
Tannery effluent	Highly foul smell	Highly foul smell	Highly foul smell	Highly foul smell	Highly foul smell	Highly foul smell
Bleaching factory effluent	Alkaline odour	Alkaline odour	Alkaline odour	Alkaline odour	Alkaline odour	Alkaline odour
Sewage effluent	Foul smell	Foul smell	Foul smell	Foul smell	Foul smell	Foul smell
Dyeing factory effluent	Pungent smell	Pungent smell	Pungent smell	Pungent smell	Pungent smell	Pungent smell
Water sample from station I	Odourless	Odourless	Odourless	Odourless	Odourless	Odourless
Water sample from station II	Light foul smell	Light foul smell	Light foul smell	Light foul smell	Light foul smell	Light foul smell
Water sample from station III	Alkaline odour	Alkaline odour	Alkaline odour	Alkaline odour	Alkaline odour	Alkaline odour
Water sample from station IV	Foul smell	Foul smell	Foul smell	Foul smell	Foul smell	Foul smell
Water sample from station V	Odourless	Odourless	Odourless	Odourless	Odourless	Odourless
Water sample from station VI	Odourless	Odourless	Odourless	Odourless	Odourless	Odourless

Table3: Temperature (°C) in various effluents and water samples collected at different stations during the study period

Samples / Period	July	Aug	Sep	Oct	Nov	Dec
Tannery effluent	30	30	30	29	29	30
Bleaching factory effluent	33	33	33	32	32	33
Sewage effluent	29	29	29	29	28	29
Dyeing factory effluent	40	40	40	39	39	40
Water sample from station I	28	28	28	27	26	28
Water sample from station II	29	29	29	28	28	29
Water sample from station III	31	30	31	29	29	30
Water sample from station IV	28	27	27	28	27	28
Water sample from station V	34	32	30	32	31	32
Water sample from station VI	28	29	28	27	27	28

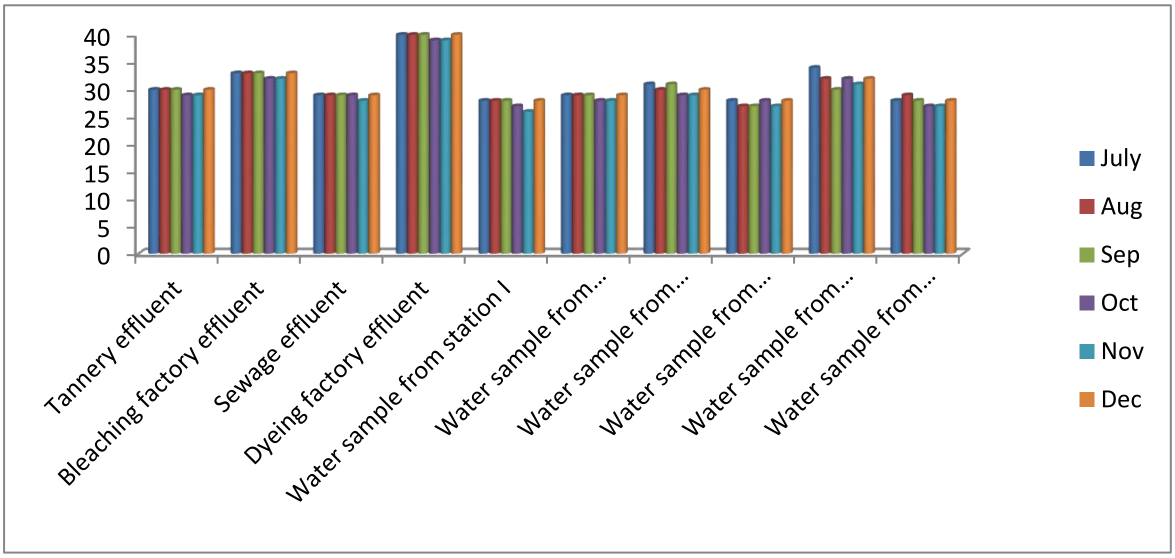

Fig1: Temperature in various effluents and water samples collected at different stations during the study period

Table 4: pH in various effluents and water samples collected at different stations during the study period

Samples / Period	July	Aug	Sep	Oct	Nov	Dec
Tannery effluent	8.2	8.2	8	8.1	8.1	8.2
Bleaching factory effluent	10.5	10.7	10.4	10.5	10.6	10.8
Sewage effluent	7	7.1	6.9	7	6.9	7.1
Dyeing factory effluent	10	10	9.6	9.8	10.1	10.2
Water sample from station I	7.5	7.5	7.4	7.3	7.3	7.7
Water sample from station II	8	7.8	7.4	7.3	7.5	8.2
Water sample from station III	8.4	8.6	8.4	8.2	8	8.4
Water sample from station IV	8.5	8.6	8.4	8.5	8.6	8.7
Water sample from station V	9.1	9.3	9.1	9.3	9.5	9.6
Water sample from station VI	7.4	7.4	7.1	7.2	7.3	7.3

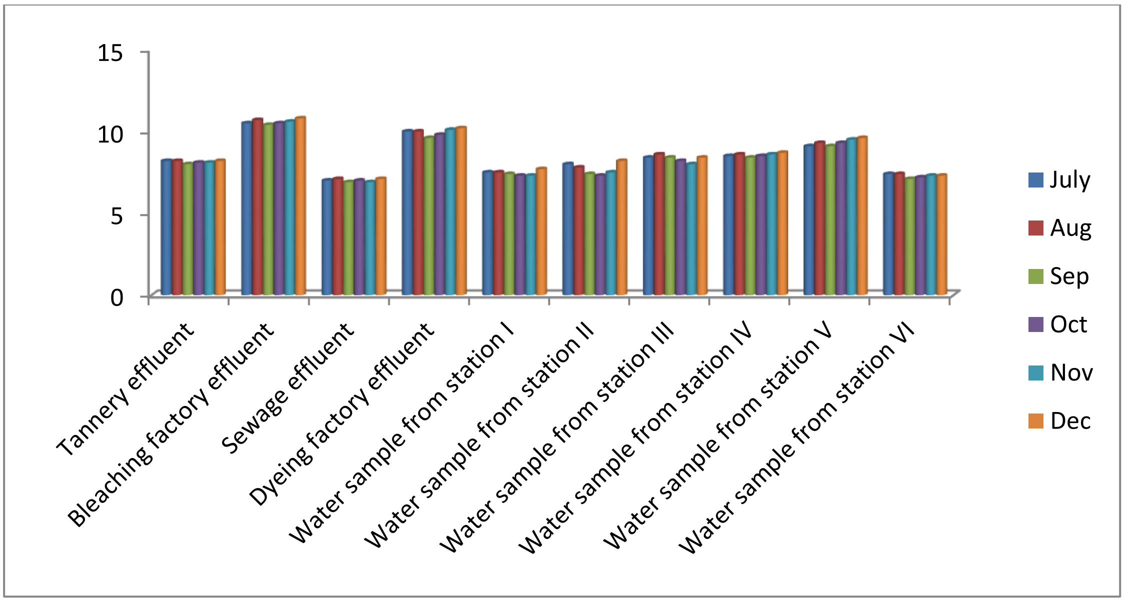

Fig 2: pH in various effluents and water samples collected at different stations during the study period

Table 5: Total suspended solids(mg/l) in various effluents and water samples collected at different stations during the study period

Samples / Period	July	Aug	Sep	Oct	Nov	Dec
Tannery effluent	3216	5271	4821	2296	5164	3247
Bleaching factory effluent	6242	4634	4422	3117	4682	4253
Sewage effluent	8161	9118	7811	6886	7521	8015
Dyeing factory effluent	3421	2882	4118	2437	2827	3418
Water sample from station I	1102	1027	1218	805	984	1211
Water sample from station II	2824	4116	3854	2463	3615	2465
Water sample from station III	4621	4230	4012	3483	4815	3645
Water sample from station IV	8846	8815	7803	5216	7817	8819
Water sample from station V	3927	4211	3206	3105	3813	3214
Water sample from station VI	2145	1963	2937	1831	2039	2640

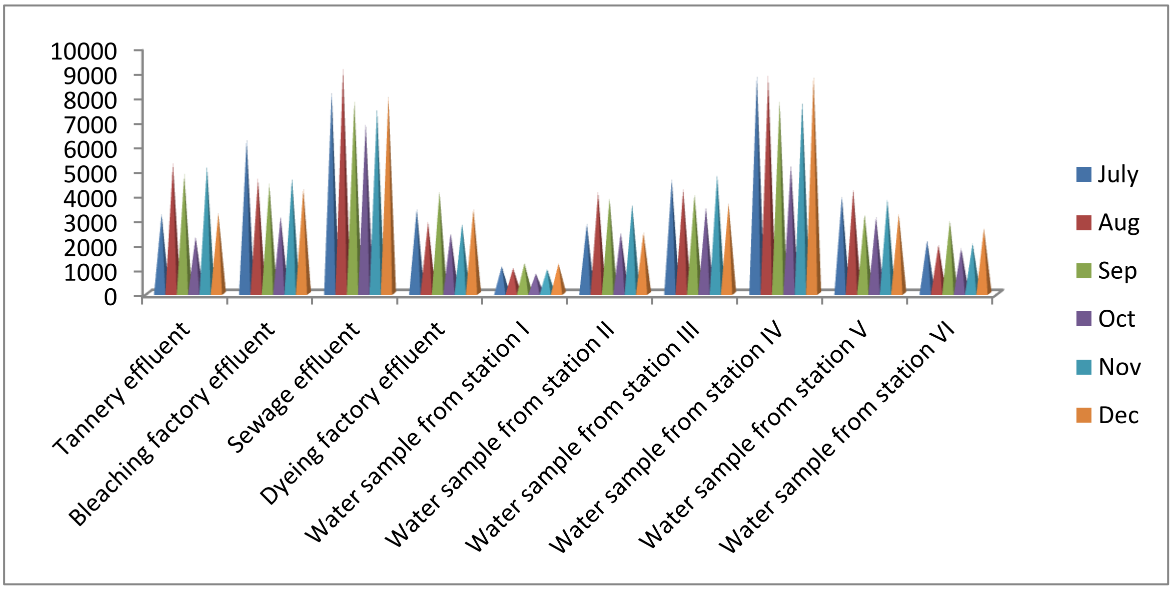

Fig 3: Total suspended solids(mg/l) in various effluents and water samples collected at different stations during the study period

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Table 6: Total dissolvedsolids(mg/l) in various effluents and water samples collected at different stations during the study period

Samples / Period	July	Aug	Sep	Oct	Nov	Dec
Tannery effluent	8125	6245	6033	5175	6116	7076
Bleaching factory effluent	6229	6246	5862	4987	4292	4546
Sewage effluent	6413	7217	6703	5212	6518	5423
Dyeing factory effluent	12427	10368	9982	8452	10527	10986
Water sample from station I	1558	1826	1453	1321	1281	1436
Water sample from station II	6716	5679	5974	5346	6816	6226
Water sample from station III	7319	7628	5742	4916	5989	6316
Water sample from station IV	5862	4631	5218	4213	4821	5416
Water sample from station V	8462	7914	7813	7693	8127	7629
Water sample from station VI	1827	1547	1618	1463	1752	1681

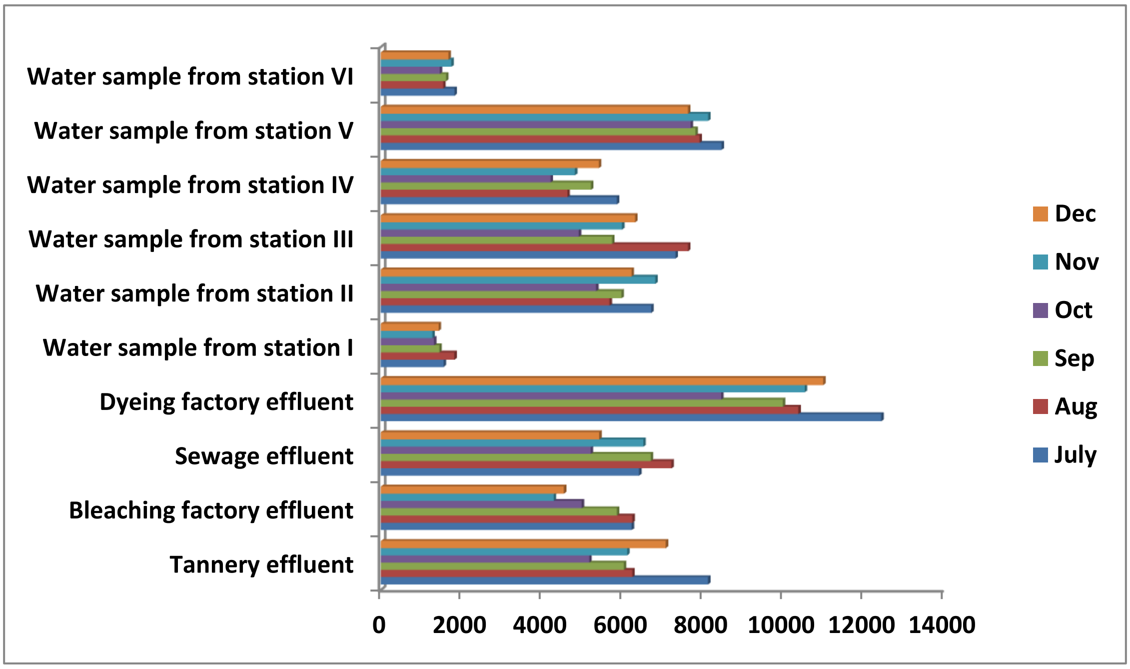

Fig4: Total dissolved solids (mg/l) in various effluents and water samples collected at different stations during the study period

Table 7: Dissolved oxygen content (mg/l) in various effluents and water samples collected at different stations during the study period

Samples / Period	July	Aug	Sep	Oct	Nov	Dec
Tannery effluent	-	-	-	-	-	-
Bleaching factory effluent	-	-	-	-	-	-
Sewage effluent	-	-	-	-	-	-
Dyeing factory effluent	-	-	-	-	-	-
Water sample from station I	5.2	5.25	6.62	7.23	7	6.46
Water sample from station II	3.12	4.16	4.25	6.39	5.27	6.15
Water sample from station III	2.36	3.31	3.63	4.38	4.02	3.62
Water sample from station IV	3.92	3.06	3.18	4.1	3.32	3.04
Water sample from station V	2.52	2.6	4.7	5.9	4.8	4.6
Water sample from station VI	4.7	4.7	5.85	6.72	5.96	6.12

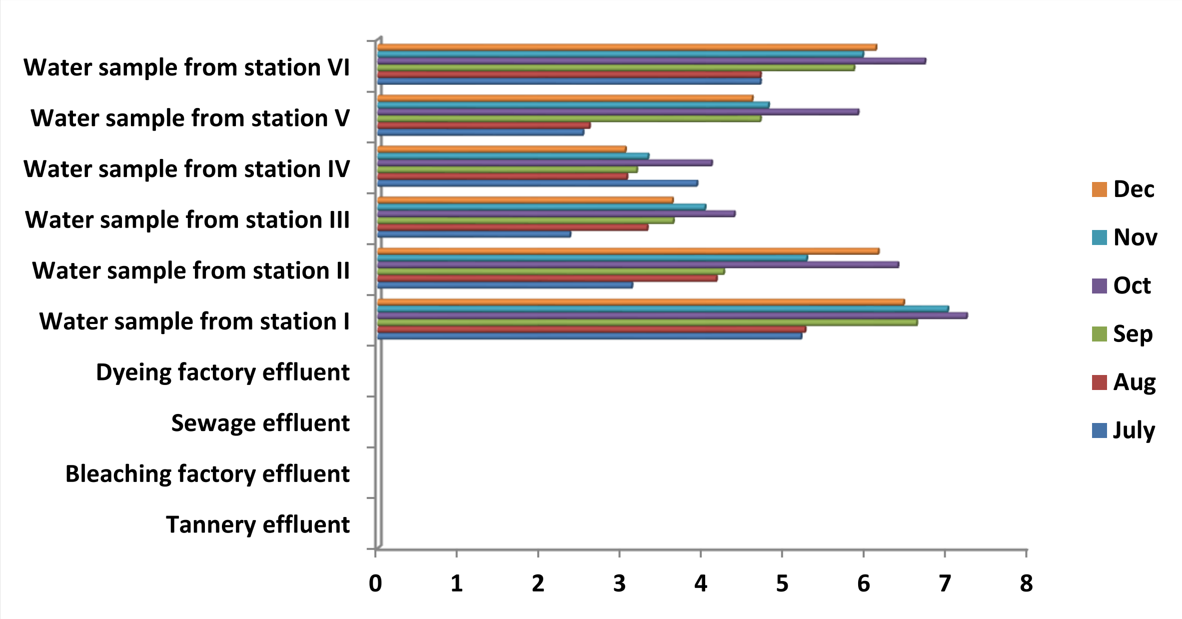

Fig 5: Dissolved oxygen content (mg/l) in various effluents and water samples collected at different stations during the study period

Total suspended solids (TSS):

While all the effluents had a higher concentration of total suspended solids, the sewge effluent was at the top in having very high values (6886 – 9118 mg/1). Consequently, all the water samples were also found to have higher values (5216 to 8846mg/1). It is also evident that the concentration of TSS was lesser during the month of October when compared to other sampling months (table 5 and fig 4).

Total dissolved solids (TDS):

Table and fig. 5 depict that the concentration of dissolved solids was also found to be higher in the effluents, of which the dyeing factory effluent had the maximum value (upto 12427 mg/1), followed by the effluents of tannery and bleaching industries and sewage water. Among the water samples analyzed, the higher values were estimated for the station II, III, IV and V whereas the water samples from I and VI had lesser quantity of TDS which ranged between 1281 and 1827 mg/1.

Dissolved oxygen (DO):

The DO of the effluents and the water samples from various sampling stations were shown in table 7 fig. 6. It is noteworthy that all the effluents were characterized by having no oxygen content. Among various stations, the DO was highest at station (5020- 7.23 mg/l) and station (5.85 - 6.72 mg/l). Generally higher values had been recorded for all the water samples during October and the lower values in July.

4. DISCUSSION

Since our independence, India has achieved considerable progress in industrialization and today it is among the first ten industrialized nation of the world. However, there is always some amount of environmental degradation because many toxic chemicals are released into different compartments of the environment either by industries or by agriculture and public operations or through the automobile exhaust.

A successful pollution abatement depends not only on treatment and but also on efficient monitoring of the general environment. The monitoring of water pollution implies regular assessment of one or more parameters which may include physic – chemical and biological monitoring. The physico–chemical monitoring includes a continuous recording of a large number of parameters as indicators of water quality.

The present study has been carried out by selecting specific location of the local canal which gets pollute by effluents from tannery and bleaching factory as well as sewage wastes within a short stretch of 2 kms. The water samples of the present study from stationII, IV and V show colour variations because the industries like tannery, bleaching factory and dye making discharge coloured and toxic effluents which are discharged into the canal water. Most of the colours bearing waste waters are found to contain high COD and BOD values affecting the water quality so that it cannot be used for drinking purposes.

It is exemplified that the dissolved oxygen is also shown to affect the solubility and availability of many nutrients in water courses (Wetzel, 1993). Rajagopalan(1990) has also recorded that the organic constituents besides inorganic chemicals may change the oxygen balance in streams. In the present study, the higher values of dissolved oxygen content in the water samples of station I indicate that this station is free from organic pollution. In almost all the mixing points, a lower concentration of oxygen has been recorded in the water samples during all the sampling months except October and November. This indicates a high organic load in the flowing water of the canal resulting in oxygen depletion. Badge and Verma (1985) have shown that the decomposition of organic matter could be an important factor for the decreased oxygen level which is more vigorous in warm waters.

All natural waters contain various amounts of different salts which are responsible for the salinity of water. The desirable limit of chloride content prescribed by BIS (1991) is 250mg/l and the permissible limit is 1000 mg/l. but all the effluents and the water samples except at station IV contain chloride concentrations exceeding the above limits. In the present study, both effluents and the water samples are found to contain excess concentrations of sulphide. Sulphur is the most damaging constituent because it is positively correlated with BOD and negatively correlated with dissolved oxygen.

Thus the perusal of results clearly indicates that the quality of the Kalingarayan canal at the study area is greatly affected due to the discharge of the toxic effluents and sewage water. In such places where the pollutants are being introduces, more than one toxic chemicals may be present. Therefore, the wastes have to be made to reduce the pollution load in the canal through long term management plans. The identification of core areas and regulation of discharges of pollutants into the canal water are utmost important for the sustainable habitat conservation. For this, factual information about the water quality status and the related effects are to be carried out further along the entire course of the canal for an effective control of water quality.

5. SUMMARY

1. Studies were carried out ot find the effect of various pollutants at Kalingarayan canal on the water quality stretch of 2 km from B.P Agraharam to Karivaikl.
2. Six stations were idemtified in the canal (station I, the upstream point, free from the discharge of pollutants; station II, the admixing point of the tannery effluent and the canal water; station III, the admixing point of bleaching factory effluent and the cnalwate; station IV, the admixing point of sewage and the canal water; station, the admixing point of dyeing factory effluent and the canal water and station VI, the downstream point which is free from the discharge of the pollutants.)
3. The water samples were collected from each station for period of six months from July 1999 to December 1999. Simultaneously, the raw effluents for their sources prior to mixing with the canal water were also collected.
4. To assess, the water quality of the canal water, physic – chemical characteristics of the effluents and water samples from various stations were analysed.
5. The analyses clearly indicated that the quality of the water in the Kalingarayan canal at the study area was greatly affected due to the discharge of pollutants.
6. The data obtained were discussed with relevant literature.

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