Evaluation of Physicochemical Parameters of Eluru and Bandar Canals of Krishna River in Vijayawada.

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Abstract: In the state of Andhra Pradesh Krishna river water is being used for domestic purposes including drinking water supply for several villages, major panchayats and towns, for irrigation in the delta, for fisheries, industry, religious purposes, etc. Eluru and Bandar canals of Krishna river in Vijayawada has human interference through irrigation, domestic use, discharge of sewage, industrial wastes, immersion of idols etc. by which water quality get changed. Assessment of temperature, pH, total alkalinity, turbidity, chloride, hardness, dissolved oxygen, total dissolved solids, calcium, heavy metals and pesticides were carried out monthly during June, 2015 to June, 2016. Results showed significant alterations in the physicochemical parameters. The analyzed data of water body was interpreted in relation to pollution status.

Keywords: Krishna River, Eluru canal, Bandar canal, physicochemical parameters, heavy metals, pesticides.

Introduction:

The water is an important source of life. It plays an important role in ecological functions in various ecosystems. Life, prosperity and civilization revolve around water in the world. Civilization developed around water bodies that could support agriculture, transportation and drinking. It has been estimated that about 1400 x 10 15M ^{3} of water exist on the earth, of this 97% is in oceans as saline water, 2% in frozen icecaps. The fresh water availability in the lakes, streams, rivers and ground form much more less than 1% of total water resources of the earth. Surface water from rivers and lakes are important sources of public water supplies because of high withdrawal rates they can normally sustain. Most of the ancient cites were observed to have developed on the banks of major rivers. This also amply signifies the role of water in development of civilization in the historic days. One major disadvantage of using surface water is that it is open to pollution of all kinds. Contaminants are contributed to rivers from diverse and intermittent sources, such as industrial and municipal wastes, runoff from urban and agricultural areas and erosion of soil. Water with variable turbidity and a variety of substances that contribute to the taste, odor and color of the water can necessitate extensive treatment.

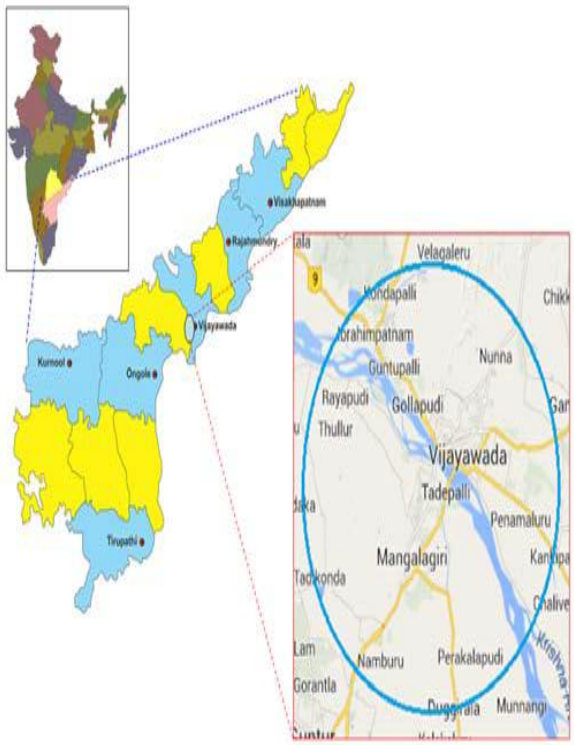
With this view an attempt was made for quality analysis of physicochemical parameters of water in selected areas of Krishna canal in and around Vijayawada. The study gained importance to understand and identify water contamination and reliable management of Krishna canal water quality.

Study Area

Vijayawada is a commercial city located on the bank of river Krishna in Krishna district of A.P, India.

The northern, north western and south western parts of the city are covered by a low range of hills, while the central south western and north western parts are covered by rich and fertile agricultural lands with three major irrigation canals. The Krishna river passing on south and Eluru canal passing on the North-East of the city, Vijayawada is chosen as the study area and these Bandar and Eluru canals are the important sources for recharging ground water.

Fig 1. Location of Studied area



Materials and Methods

One liter of water samples were collected in a clean polyethylene bottles from all sample locations of Krishna canal and Eluru canal. The sample bottles were pre-treated with dilute nitric acid, dried and rinsed with sample water and subjected for analysis. Samples were categorized in five sections, as listed in Table 1. Analysis was carried out and average values are reported.

Table 1. List of collected samples

S.No	Effluents type	Sample sites	Canal
1	Sewage	Governerpet (A)	Eluru canal
2	Chemical Manufacturers waste & Auto Nagar effluents	Prasadampadu(B)	Eluru canal
3	Agricultural effluents	Ennguladibba (C)	Bandar canal
4	Power plant waste	Ibrahimpatnam (D)	Krishna river
5	Aquaculture waste (disinfectants, antibiotics, uneaten food)	Poranki (E)	Bandar canal

Results and Discussions

The physicochemical characteristics of Eluru and Bandar canal water in the area of investigation are given in Table-2. Some variations in the physical and chemical parameters have been observed in the study area.

Temperature: Temperature is the most important ecological features also control behavioral characteristics of organisms, solubility of gases and content of salt in water. The result showed the temperature between 25.1^0C to 40.1^0C. The temperature of the water affects the efficiency of treatment units. In cold temperature the viscosity increases which causes increase in pressure drops in operation of filter units. (Arcadio and Gregoria, 2003).

pH: The pH is an important factor of water that indicates the form in which the carbon dioxide is present. A change of pH from 6 to 7 indicates that there is a tenfold decrease in the hydrogen ions concentration. In a similar fashion, a change of pH 7 to 8 indicates a tenfold increase in hydroxyl ions. In the sampling sites A and B of the study area, the pH values of water varied from 5.9 to 4.9 which are reported as acid in nature. The pH values below 5.5 affect the aquatic life. In the sampling sites C, D and E of the study area, the pH values of water varied from 6.11 to 7.6 which are reported as alkaline in nature and within the permissible limits. (WHO,1971, ISI 2012).

Total Alkalinity: Alkalinity is a measure of ability to neutralize acids. Excess alkalinity gives bitter taste to water and reacts with cat ions forming precipitates. Minimum and maximum alkalinity values in the study area ranged from 62.5 to 282mg/l respectively.

Turbidity: The sample site E had lowest turbidity value of 0.612 NTU and a highest of 1.84 NTU for the sample site B. The water found turbid or muddy in color, due to varieties of materials which are being discharged by domestic and industrial use (Hunt et al., 1971) suspended matter, and generally reduces the diversity of the life of the aquatic systems.

Chlorides: High concentrations of chlorides considered to be the indicator of pollution due to high organic wastes of animals or industrial origin. Human body also releases a very high quality of chloride (Sharma and pande, 1988). Higher concentrations of chloride (482mg/l) were observed at sample site B. This may be due to improper disposal of sewage waste and industrial effluents in the study area.

Hardness: Hardness the chemical property of water prevents the formation of lather with soap, caused mainly by metallic cations calcium, magnesium, iron and strontium. It is reported that total hardness at sample site A (298mg/l), sample site B (456mg/l) and sample site D (364mg/l) was higher. It is mainly due to calcium, magnesium and chlorides in domestic sewage. Waters with hardness greater than 300 mg/l may leads to heart and kidney problem.

Dissolved Oxygen: The result of Dissolved Oxygen varied between 4.3mg/l to 9.4mg/l. At sample site B the DO values are slightly low may be due to addition of sewage and industrial effluents.

Total dissolved solids: Water quality is affected by the presence of soluble salts. BIS standards say that the maximum desirable TDS is 500mg/l and the maximum permissible level in absence of a better source of water is 1500mg/l. The TDS concentration in the present study ranged from 515 to 1599mg/l. A slightly higher concentration of TDS recorded at sample site B. Water with high TDS concentrations may cause constipation effects on humans (Kumara swamy, 1991).

Calcium: Calcium occurs in water naturally. In present study calcium levels (163mg/l) exceed the BIS permissible limits (75mg/l) at sample site B. This may be due to the addition of Auto Nagar effluents.

Heavy metals

Lead (Pb): Lead reaches water bodies either through urban runoff or industrial plants. In the present study the minimum and maximum lead concentrations varied between 0.012mg/l to 0.153 mg/l. All the sample sites exceed the relevant prescribed limits.

Copper (Cu): Copper enters the water through mineral dissolution, industrial effluents, as algaecide, agricultural pesticide sprays and insecticide. Values at sample sites B and C (0.25mg/l, 0.1mg/l) exceed the maximum permissible limits.

Iron (Fe): Iron exists naturally in rivers, lakes, and underground water. It may also be released to water from natural deposits, industrial wastes, refining of iron ores, and corrosion of iron containing metals. All the sample sites exceed the relevant prescribed limits (0.3mg/l).

Zinc (Zn): All the sample sites showed the measurable concentration of Zn. But the metal concentration is not exceeded the limits. Zn has lots of use like galvanization of steel, preparation of negative plates in electric batteries, vulcanization of rubber, wood preservatives.

Table -2.Physical and chemical parameters in study area.

S.No	Parameter	Sample Site					Limits as per IS10500-2012
		A	B	C	D	E	
1	Temperature	32.2	40.1	29.6	38.2	25.1	< 50 degrees C
2	pH	5.98	4.9	7.4	6.11	7.61	6.5-8.5
3	Total Alkanity	62.5	76.9	269	80.9	282	200 mg/l
4	Turbidity	0.693	1.84	0.69	0.93	0.392	1NTU
5	Chloride	193	482	368	62.9	268	250 mg/l
6	Hardness	298.5	456	181.9	364	169.09	200 mg/l
7	Dissolved oxygen	5.67	4.3	8.63	8.46	9.41	>5 mg/l
8	TDS	495	1599	892	597	515	500 - 1500 mg/l
9	Calcium	73.8	163	75.6	25.63	43.2	75 mg/l
10	Lead	0.103	0.153	0.0145	0.093	0.012	0.01 mg/l
11	Copper	0.088	0.25	0.13	0.008	0.024	0.05 mg/l
12	Iron	1.846	2.079	1.778	1.328	1.347	0.3 mg/l
13	Zinc	3.125	2.783	1.219	2.396	1.116	5 mg/l
14	Mercury	0.0019	0.008	0.0023	0.0065	0.0021	0.001 mg/l
15	Alachlor	0.019	0.021	0.098	0.065	0.075	20 µg/l
16	Aldrin	0.023	0.028	0.031	0.021	0.029	0.03 µg/l
17	Alpha HCH	0.02	0.052	0.053	0.028	0.049	0.01 µg/l
18	Atrazine	0.97	1.672	1.8	0.63	1.799	2 µg/l
19	DDT	0.801	0.802	0.945	0.532	0.615	1 µg/l
20	Endosulfan	0.261	0.396	0.299	0.02	0.31	0.4 µg/l
21	Melathion	0.0962	0.041	0.04	0.026	0.065	190 µg/l
22	Monocrotophos	0.623	0.741	0.983	0.626	0.233	1 µg/l

Mercury (Hg): Mercury occurs naturally due to its presence in rocks and soils, where it is slowly released through erosion and weathering into surface waters. Almost, all sample sites slightly exceed the maximum permissible limits (0.001mg/l).

Pesticides: Agriculture is considered as the greatest contributor to pesticides in surface and groundwater. Even though groundwater and surface water are used as a drinking water resource, there is limited information available on pesticide contamination, and a lack of reliable and comparable data. Monitoring of pesticides is a challenging task because of the high number of registered pesticides, cost of analyses, and the need for sampling to be performed during periods of application and use, and under various weather conditions. Extensive data sets of high quality are consequently often missing. The data used for this indicator were limited, both in time and space, and the need for harmonization is apparent. This indicator is still a subject for development.

In the present study the concentration of selected pesticide values are within the permissible limits of WHO standards. But their concentrations nearer to the standards are alarming the chance of leaching and bioaccumulation.

Conclusion

Significant alterations in the physicochemical parameters at sample site B exceeding the maximum limits according to WHO and IS10500:2012 clearly shows the contamination of Eluru canal. From the results it is evident that, at present the metal ion concentration is not at the levels which could be harmful for humans. But the study clearly points out that the concentrations of toxic metals are present in slight excess in some locations. It indicates precautionary measures should be taken immediately. The pesticide analysis clearly concludes that most of the parameters are very nearer to the WHO limits and EQS. As we are drawing the Eluru canal and Bandar canal water for drinking in panchayatas, packaged drinking water and fishery units there may be a chance for bio-accumulation. Hence a membrane filtration treatment is necessary.

Recommendations

1. Environmental awareness among the public on the pollution aspects is to be created**.**
2. Sewage treatment plans should made compulsory in all village Panchayats and Mandals.
3. NGO's, academicians and local communities should be involved in extension of the programme.
4. R.O plants should establish for packaged drinking water.
5.

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