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Water Quality Index for Assessment of Water Quality of River Krishna at District Shamli, U. P.

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Abstract: ***Krishna River is an important river in District Shamli. Hence an attempt has been made to study of Water Quality Index and pollution or change in the quality of water. WQI is a useful tool for quick estimation of quality of any water resource. The present investigations were aimed to assessing the water quality index for Krishna River. The present study was carried out from 2020-2021 for Keishna River in District Shamli. Assessment of Water Quality Index (WQI) of River Krishna include Physico-chemical parameters viz. Ph, Biological Oxygen Demand (BOD), Dissolved Oxygen (DO), Total Alkalinity (TA), Total Hardness (TH), Total Dissolved Solids (TDS), Total Suspended Solids (TSS) and Chloride that indicate the extent of pollution. The main causes of detrition in water quality is high anthropogonic activities and direct discharge of industrial effect.***

Keywords: Water quality index, pollution, Krishna River, BOD, COD

1.Introduction

The study of water quality assessment is more complex processes. Life cannot exist without water because it is the major part of all biotic things. In the world, rivers are lifeline of all living organism. Although the rivers are only 0.0001% of the total amount of water in the world at any given time. Rivers are very important for human being and aquatic biodiversity. Now's day, the river is very polluted because of rapid industrialization, urbanization and other development activities. Presently the river are under several threat due to various anthropogenic procedure (Sing *et al*.2007). Natural water is never pure water; it is complex mixture of dissolved inorganic and organic molecule and suspended particle. Water quality is determined by the chemical, physical and biological parameters of water. Water quality index is more effective tool to monitor the surface and ground water pollution and can be used efficiently in the implantation of water quality upgrading program (Alam, 2010). Water Quality Index (WQI) provides the single number that expresses overall quality bases on the different parameter. It summarizes a large amount of water quality data into simple term i. e., excellent, good, bad. That is easily understandable and usable by public. Water Quality Index is a very useful and efficient method for assessing the suitability of water quality. It is also a very useful tool for communicating the information on overall quality of water to the concerned citizen and policy makers. A number of indices have been developed to summarize water quality data in an easily expressible and easily following format. Which first developed by Horton in early 1970, it is basically a mathematical means tool which is used for calculating a single value from multiple test result.

2.Review of Literature

Studies related to water pollution of River like Ramganga (Chandra, R., 2011), Jhelum (Raina, 1984), Kosi (Bhat and Nagi 1985), Alaknada (Tiwari et. Al., 1999), Kaveri (Abida, 2008), Sai River (Kumari, V. et al.2015), Vishav stream (Aabdil et. Al.2013), Ganga (Khanna, D. R. et al 2012), Kosi (Kumar, A. et. Al.2009), Chambal River (Sexsena. D. N. et al.2008), and Kali River (Mishra, A. et al 2015). In the present study about water quality index of Krishana River, District Shamli, Uttar Pradesh there have been various studies taken on the water standard of Krishana River but there were no scientific study found about Water Quality Index (WQI) of Krishna River. So it is necessary we can get more knowledge about this study. Water Quality Index (WQI) of Krishna River checked in three site of this river such as, Thana Bhawan, Banat and Karat. The study area was 30-35 km length of Krishna River in these sites.

About Shamli: The Shamli District of Uttar Pradesh is situated in Ganga-Yamuna Doab of fertile alluvium of Indo-Gangetic basin and it is bounded by Saharanpur District in north, Baghpat in South, and in East Meerut and separate in West by Yamuna river, adjoin state of Haryana.

About the Krishna River: The Krishna river is originating at Saharanpur District; it flows between Hindon and Yamuna River through Muzaffarnagar, Shamli, and Baghpat and finally merge in Hindon River at village Barnava.

3.Material and Methods

The Krishna River is located in District Shamli. The total length was taken 30-35 km. for the study. There are three sites of this river such as 1, Thanabhawan, 2 Banat and 3 Karabaut. All these sites have some small industries, sugar mills, and waste materials derange in this River. This study was performed during 2020-21. As per norms of APAH, using wide mouthed one litter plastic bottle for collection of the sample and preserved it till the use in laboratory. Water sample were analysed for following physio-chemical parameters e. g., Ph, Dissolved oxygen (DO), Total Alkalinity (TA), Total hardness (Thr), Total Dissolved Solids (TDS), Total Suspended Solids (TSS) and chlorides. All sample were analysed for physio-chemical parameter as per procedure prescribed in

standard method and instrument. The entire digital instrument like Ph meter and spectrophotometer were used as per norms. The physio-chemical analysis of water samples were carried out in laboratories of Zoology / Chemistry Department of S. M. College Chandausi. In the Present study the calculated of Water Quality Index (WQI) was based on eight physio-chemical parameters. The Water Quality Index (WQI) calculated using the various standards of quality of water which recommended by WHO, BSI, ICMR.

Table 1: Physio-Chemical Parameters

S. N.	Parameter	Recommended Agency	Standard Mg/L
1	Ph	ICMR/BIS	6.5 to 8.5
2.	Total hardness (THa)	ICMR/BIS	300
3.	Dissolved oxygen (DO)	ICMR/BIS	5
4.	Biological Oxygen Demand (BOD)	ICMR	5
5.	Total Dissolved Solids (TDS)	BIS	500
6.	Total Suspended Solids (TSS)	WHO	500
7.	Chlorides (CL)	ICMR/BIS	250
8.	Alkalinity (ALk)	BIS	200

Water Quality Index (WQI) determination:

Water quality Index (WQI) was calculated by using the weighted arithmetic index method as described by (Cued, 2001). Recently (Khwarazm, 2012) modified this method in which different water quality components are multiplied by a weight factor and are then aggregated using simple arithmetic mean. For assessing the quality of water in this study, first the quality rating scale (Qi), for each parameter was calculated by using the following equation:

Qi= { [Vactual-Videal] / Vstandard-Videal]} *100

Where,

Qi = Quality ratting of I the parameter for a total of n water quality parameter.

V actual = Actual value of the water quality parameter obtained from analysis.
V ideal = Ideal value of that water quality parameter be can from the standard table.
V standard = Recommended standard of the water quality parameter.

Then the relative (unit) weight (Wi) is calculated by a value inversely proportional to the recommended standard (Si) for the cores ponding parameter using the following expression.

Wi = I/Si

Where,

Wi = Relative (unit) weight for nth parameter
Si = Standard permissible value for nth parameter.
I = Proportionality constant.

The relative (unit) and Weight (Wi) to various Water quality parameter are inversely proportional to the recommended standard for the corresponding parameter. Finally, the overall WQI was calculated by aggregating the quality rating with unit weight linearly by using the following equation.
WQI =∑QiWi/∑Wi

Where,

Qi = Quality rating.
Wi = Relative (unit) weight.

In this study, the WQI level is categories of the usage by human being

Table 2: Categorization of water quality based on WQI level

Parameter	Ph	Total hardness /Mg	BOD/Mg	Alkalinity/ Mg	DO /Mg	Total Dissolve Solids /Mg	Total Suspended Solids /Mg	Chlorides/ Mg
S 1	7.22	220	28	243	6.0	395	16	40
S 2	7.10	208	24	232	5.5	365	14	37
S 3	7.32	211	26	240	5.8	380	15	39

Where;
S 1= Thana Bhawan,
S 2= Banat
S 3= Kabraut

Table 3: Calculation of water quality index of sampling station [S 1]

S. N.	Parameters	Observed Value (Va)	Standard Value (Vs)	Wi	Quality Rating (Qi)	WiQi
1	Ph	7.22	8.5	0.1176	14.66	1.72
2	Total Hardness	22.0	300	0.0033	73.33	0.24
3	BOD	28	5	0.2	560	112
4	Alkalinity	243	200	0.005	121.5	0.6075
5	DO	6.0	5	0.2	89.58	17.916
6	Total dissolved Solids	395	500	0.002	79.0	0.158
7	Total Suspended Solids	16	500	0.002	3.2	0.006
8	Chlorides	40	250	0.004	16.0	0.064
				∑Wi=0.5339		∑WiQi=132.7115

Water Quality Index = ∑WiQi/∑Wi
= 248.569956

Table 4: Calculating of water quality index of sampling station [S 2]

S. N.	Parameter	Observed value (Va)	Standard Value (Vs)	Wi	Quality Rating (Qi)	WiQi1
1	PH	7.10	8.5	0. .1176	66.66	7.84
2	Total Hardness	208	300	0.0033	69.33	0.24
3	BOD	24	5.0	0.2	480	96
4	Alkalinity	232	200	0.005	116	0.58
5	DO	5.5	5.0	0.2	94.79	18.95
6	Total Dissolved Solids	365	500	0.002	79	0.158
7	Total Suspended Solids	14	500	0.002	2.8	0.0056
8	Chlorides	15	250	0.004	6.0	0.024
				∑Wi=0.5339		∑WiQi=123.7976

Water Quality Index =∑WiQi /∑Wi
= 123.7976/0.5339
=231.87

Table 5: Calculation of water quality index of sampling station [S 3]

S. N.	Parameter	Observed Value (Va)	Standard Value (Vs)	Wi	Quality Rating (Qi)	WiQi
1	Ph	7.32	8.5	0.1176	23.33	2.74
2	Total Hardness	211	300	0.0033	70.33	0.232
3	BOD	26	5.0	0.2	520	104
4	Alkalinity	240	200	0.005	120	0.6
5	DO	5.8	5.0	0.2	109.09	21.818
6	Total Dissolved Solids	380	500	0.002	76	0.152
7	Total Suspended Solids	15	500	0.002	3.0	0.006
8	Chlorides	39	250	0.004	15.6	0.624
				∑Wi =0.5339		∑WiQi =130.54

Water Quality Index = ∑WiQi/ Wi
= 130.54/0.5339
= 244.502715

The suitability of WQI for human consumption is as follows:

0-25 = Excellent
26-50 =Good
51-75 =Bad
76-100 =very bad and above it unfit for human and other living being.

4.Results and Discussions

Results to above Water Quality Index (WQI) value at different station shows that the pollution load is increased in Krishna river region because of effluent discharge from small scale industries such as sugar mills, paper mills and municipality waste etc. On the bases of these studies we can say that the river is more polluted due to high anthropogenic activity and direct discharge of municipality wastes. Different type physio chemical parameter were selected for water quality index calculation. Such as Ph, Total Dissolved Solids (TDS), Total Hardness (THa), Biological Oxygen Demand (BOD), Alkalinity (Alk), Dissolved Oxygen (DO), Total Suspended Solids (TSS) and Chloride (CL).

Ph: The presence of hydrogen ion concentration was measured into term Ph. range. In this study Ph Value, off surface, water ranged is 7.10 to 7.32 indicate that the nature of water is slightly basic in nature.

Total Hardness (THa): Insoluble calcium and magnesium salt are contributing in hardness of water (Shrivastava and Patil, 2002). The hardness range is 208 to 220. This range is not suitable for water use in domestic use.

Biological Oxygen Demand (BOD): BOD is important parameter of surface water quality; it can be defined as the amount of oxygen required by microorganism in stabilizing the biogradeble organic matter under aerobic condition (Gangwar et. al, 2012). In this study the BOD of surface water ranges were from 26 mg to 28 mg/l. This shows that the River is much polluted.

Alkalinity: Alkalinity are influenced with bicarbonate and another ion. Alkalinity is directly related to the abundance of phytoplankton which is dissociated bicarbonate into carbonate and carbon dioxide (Shrivastava and Patil, 2002). In this study alkalinity range was 232 to 243 mg/l if alkalinity value in drinking water is higher than 200mg/l, then the taste of water become unpalatable for drinking.

Dissolve oxygen (DO): Dissolve oxygen is a factor which determines whether the biological change is brought about by aerobic /anaerobic organism (Gangwar. et al.2012) In our investigation ranges of DO were 5.5 to 6.8 mg/l. Oxygen is generally reduced in the water due to respiration of biota, decomposition of organic matter, rise to in temperature, oxygen demand by wastes and inorganic reductant such as hydrogen sulphide, ammonia, nitrate ferrous iron etc (Sexena, et al.2008).

Total Dissolve Solids (TDS): The total dissolved solid are expressed by the weight of residue left when water sample has been evaporated to dryness. The range of TDS varied from 365 to 395/ mg.

Total Suspended Solids (TSS): Total suspended solids are different type material that decays plant and animal matter, industrial waste and slit. Range of TSS are 14to 16 / mg in this river. Suspended soiled concentration is harem full for aquatic life.

Chloride (CL): It is indicator for sewage contamination (Zhou 2002 and Singh. et al.2012). Range of chloride in river is 37 to 40 /mg.

5.Conclusion

In the present study investigation analysis of different type parameters using in Water Quality Index (WQI). It was concluded on the water quality of Krishna River, Shamli which is unfit for human being and domestic uses. Water Quality Index (WQI) also uses for investigation for health of river. So, results of this study are that River Krishna is in very poor condition. The reason of this poor condition of the Krishna River is that the uses of domestic and individual waste and other human activities. So, results of this study shows that awareness should be done to human beings, Govt. and NGO that they do work as war level, for river health and monitory help is also necessary at very regular time.

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