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ORIGINAL ARTICLE

Evaluation Of Water Quality Index For Drinking From Ashvi Dam Water Sangamner, Ahmednagar, Maharashtra

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Abstract:

The present work was evaluates water quality index [WQI] for drinking from Ashvi dam water, Sangamner, Maharashtra. It was assessed by using parameters such as pH, total dissolve solids, total hardness, dissolved oxygen, biological oxygen demand, total phosphate, nitrates, turbidity and fecal colliforms. The WQI score of dam water was 56.68, 53.16 and 56.52 values in rainy, winter and summer. This indicates that the reservoir water is medium for drinking. The contributions of parameters to WQI in percent were also evaluated.

KEY WORDS:

Water Quality Index (WQI), Q-value, weighting factor, Ashvi dam.

INTRODUCTION

Water is one of the vital sources for all kind of life on earth. Human history has been shaped by the water that provides us water, transport and means of water disposal, though the water becomes polluted. River or dam water is the sources of water use all over the world. In the last few decades, there has been a tremendous demand for fresh water due to population, industrialization and urbanization. Nowadays water bodies are contaminated by one or the other ways. Simultaneously raise the problem of water pollution. According to WHO 80% of human diseases are caused by water or water related or water born and reported 600 million cases of diarrhea with 4.6 lakh death toll. Hence there is need to evaluate water quality index for drinking. There is no literature available on WQI for drinking from Ashvi dam water, hence present study was assigned.

WQI is one of the most effective tools to communicate information on quality of water. It is mathematical equation used for to facilitate quantification, simplification and communication of complex environmental data. One of the first attempts in formulating the WQI was made [1] and used this method to evaluate a WQI for National Sanitation Foundation [2]. On the basis of these, it is easy to formulate public policy and to implement water quality improved programmer.

The study also reviewed how to evaluate, addressed and discussed further role of WQI. The pioneer of this field [1] and followers were modified and used WQI [2-6]. Those have discussed the steps and the theory behind construction of WQI. Several Indian workers attempted WQI [7-10] and were the

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bases on the other workers [11-14].

The study had covered only WQI related parameters from Ashvi dam water, Sangamner Ahmednagar district, Maharashtra. It is man made [1971] on river Pravara a tributary of river Godavari at Ashvi located between19035' N latitude and 74027' E. The capacity of dam is 2 TMC and provided water to the several bank villages.

MATERIALS AND METHODS

Collection of samples: Water samples were collected from Ashvi dam during 2009. The samples were collected at early in the morning [9.00 am] for three seasons on monthly basis. Two liters of sample was found to be sufficient to carry out all the physical, chemical and biological tests. For the analysis, methods of collection and handling were followed using appropriate classical and instrumental methods [15].

Analysis of samples:

The pH of water samples was noted on the spot with the help of digital pen pH meter. The analysis of filtered water samples was carried out for the parameters, such as Total Dissolved Solids [TDS], Total Hardness [TH], Dissolved oxygen [DO], Biological Oxygen Demand [BOD], Total phosphate [PO4], nitrates [NO3], turbidity and fecal colliforms were performed [15]. All the nine parameters of bimonthly analysis were averaged and presented in table 1. The statistical analyses were performed using WindowsTM /Excel /2007.

WQI calculation:

Water quality index was evaluated by using nine parameters. The mean value was referred to the standard weighting curve chart available in the text [16] and corresponding water quality [Q] value was noted from net search [17]. To obtain the contribution of each parameter towards WQI, the Q-value was multiplied by their respective weighed factor [W]. The nine resulting values were then added to arrive at over all WQI. As-

$$WQI = \sum_{i=1}^{n} wi\ qi$$

Where wi is weight factor and qi is result of the parameters.

WQI=0.19DO+0.12pH+0.136BOD+0.11PO4+0.11NO3+0.09TBD+0.182TDS+0.45FC+0.091TH WQI Ranges: The WQI range was grouped in to five categories such as very bad [0-25], bad [25-50], medium [50-70], good [70-90] and excellent [90-100].

RESULTS AND DISCUSSION

The physico-chemical parameters of dam water are given in table 1. The observed pH value showed that water sample were alkaline ranging from 7.0 to 7.1. These values were within the permissible limit prescribed by ICMR. The contribution of pH to WQI was 18.84, 20.32 and 18.68 % in rainy, winter and summer respectively.

TDS values ranged from 440.3 to 525.0 mg/L [avg. 450.2 mg/L]. This indicates that the water was tolerable concentration of soluble salts. These values were within permissible and slight rating scale. The contribution of TDS to WQI was 13.16, 6.85 and 6.44 % in rainy, winter and summer respectively. The TDS interference the transition of light and settle out of suspension covering a streamed or dam bottom. It has adversely affected on organism respiration.

The TH of water sample ranged from 170 to 187 mg/L which was exceeds the maximum permissible limits according to WHO, ICMR & BIS but slight in rating scale. It is mainly caused from cations and of Ca++, Mg++ Sr++ and Fe++. As per Durfer and Beker's classification water sample was hard in nature, which may cause scale deposition followed by subsequent scum formation. The contribution of TH to WQI was 12.84, 13.69 and 12.88 % in rainy, winter and summer.

The colliforms present in the dam water have possible damages from diseases causing organisms, while live in the water environment where fecal colliforms which was ranging from 11 to 21 MPN/100 ml.

Fecal colliforms was taken as indicator parameter in WQI and had been assigned 0.16. The contribution of fecal coli to WQI was 5.01, 5.42 and 4.87 % in rainy, winter and summer respectively.

Since the WQI is a good indicators of pollution, the WQI value of dam water were calculated for a period of one year [Table 3]. According to WQI legend the WQI values are above 50. The WQI score of dam water was 56.68, 53.16 and 56.52 values in rainy, winter and summer. This indicates that the reservoir water was medium in all seasons. It might be a pollution load from surrounding and catchments.

Dam WQI was calculated by using the nine parameters. The mean value of each parameter was calculated and reflected to the standard weighting chart available in the text and the corresponding water quality value [17]. Using Q-values and their respective weight factors the over all WQI was calculated. National Sanitation Foundation [NSF] of America had noticed the contributing percentages of the parameters towards the calculating of WQI. The WQI formula proposed herein was designed to suit the prevailing conditions of dam water.

There was no restriction for the inclusion or exclusion of any variables and selection [1]. Several worked used different water quality variables for their WQI calculation. Hence, here was no specification for the minimum or maximum numbers of parameters. The nine parameters included in the calculations were chosen on the basis of the data available and get the WQI value as quickly as possible [5] and expressed similar view.

In the study DO was ranged from 3.03 to 3.28 mg/L. The contribution of DO to WQI was 1.21, 1.28 and 1.34 % in rainy, winter and summer. Since the solubility of oxygen was closely related to all season. DO was one of the important parameter in assessing water quality and it reflects the physical and biological processes prevailing in water.

Similarly to measured BOD value we had weight for five days, because the sample has to be incubated for five days. It was ranged from 9.75 to 31.0 mg/L. The contribution of BOD to WQI was 6.25, 7.42 and 17.09 % in rainy, winter and summer respectively. The BOD had direct effect on DO value of water. The measured value of DO reflect the pollution. The weighting of BOD was proportionally added to other parameters of which the DO got more percentage as it due. BOD was measured using initial and final however, DO value has a linear relationship with BOD. Hence, BOD value was more redistributed to their parameters [12].

Both phosphate and nitrates are essential nutrients for plants and animals which made up aquatic food chain/web. They were ranged from 0.48 to 0.75 mg/L and 0.95 to 2.58 mg/L in PO4 and NO3 respectively. The contribution of PO4 and NO3 to WQI was 11.66, 12.83, 9.34 and 18.82, 19.86 and 18.86 % in rainy, winter and summer respectively. The increase in phosphorus and nitrogen will set up a chain of aquatic plant growth, algae bloom, low DO and death of fishes, invertebrates and other aquatic animals. Phosphorus and nitrogen were added in river or dam water due to surface runoff during rainy season. The both had the same effect on water quality. NO3 concentration in dam water depends upon geochemical conditions and nitrogenous fertilizers. PO4 might readily take in phytoplankton because of essential plant nutrients. PO4 in dam water was due to agricultural waste, fertilizers, man generated waste and land runoff.

The turbidity was caused due to the presence of suspended matter, clay silts, colloidal organic particles, planktons and other microscopic organisms. It is an expression of certain light scattering and absorbing propertied of water. It was ranged from 10 to 33 NIU. It has effect and microbiological quality of drinking and irrigation water. It may cause jaundice and polio in man. The contribution of turbidity to WQI is 12.06, 12.19 and 10.67 % in rainy, winter and summer.

CONCLUSION

It is concluded that the dam water was medium for drinking. A WQI value assessed clearly indicates the extents of pollution. A dam which was envisaged to store water for irrigation and drinking has turned out to be a storehouse of contaminants. The pollution control board and authorities concerned regarding this issue should not permit the untreated industrial waste into river water. The sediments of the dam water must be removed to minimize its ill effect

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Table 1.Seasonal mean and statistical parameters of Ashvi water.

Water Parameters	Seasonal Mean			Statistical Parameters					
	R	S	W	Mean	Mn	Mx	SE	SD	CV%
pH	7.03	7.1	7.0	7.1	6.7	7.2	1.05	1.17	2.59
TDS	440.3	525.0	518.0	450.2	308	704	33.03	18.9	28.7
DO	3.03	3.23	3.28	3.14	200	272	30.25	11.6	22.8
TH	187.0	172.0	170.0	175.2	154	192.0	12.07	1014	18.12
BOD	31.0	21.0	9.75	142.2	118	270	4.66	10.2	5.05
PO_4	0.58	0.48	0.75	87.6	44.2	190.2	17.2	34.9	33.3
NO_3	2.58	0.98	0.95	63.7	18.2	92.2	6.71	20.1	37.5
Turbidity	0.09	12.0	33.0	11.9	07.2	41.4	1.21	0.91	11.8
Fecal coli.	21.0	11.0	19	2.10	0.7	3.5	1.1	1.41	9.41

R=Rainy, S=summer, W=winter, Mn=Minimum, Mx =Maximum,
SD =Standard deviation, SE =Sum of Error and CV =Covariance.
All figures are mg/l except pH, turbidity and fecal colliforms .

Table 2. Water quality parameters used in the study.

Sr No.	Parameters	units	Standards (WHO)	Weight (W_t)	Unit weight (W_i)
1	pH	Std. unit	7.0-8.5	4	0.12
2	TDS	mg/L	500-1500	4	0.182
3	TH	mg/L	100-500	2	0.091
4	DO	mg/L	3.0	2	0.19
5	BOD	mg/L	<120	3	0.136
6	PO_4	mg/L	75-200	2	0.11
7	NO_3	mg/L	30-150	2	0.11
8	Turbidity	NIU	20*	1	0.90
9	Fecal coli.	MPN/ 100ml	10*	1	0.045

* = ISI standards.

Table 3. Seasonal WQI of Ashvi dam water.

Sr No	Parameters	Weighted factor (W)	Rainy			Winter			Summer		
			Value of sample	Q- value (Q)	Subtotal WxQ	Value of sample	Q-value (Q)	Subtotal WxQ	Value of sample	Q- value (Q)	Subtotal WxQ
1	pH	0.12	7.03	89.0	10.68	7.1	90.0	10.8	7.0	88.0	10.56
2	TDS	0.182	440.3	41.0	7.46	525.0	20.0	3.64	518.0	20.0	3.64
3	TH	0.091	187.0	80	7.28	172.0	80.0	7.28	170.0	80.0	7.28
4	DO	0.19	3.03	4.0	0.76	3.23	4.0	0.76	3.28	4.0	0.76
5	BOD	0.136	12.5	26.0	3.54	11.5	29.0	3.94	9.75	71.0	9.66
6	PO_4	0.11	0.58	56.0	6.61	0.48	62.0	6.82	0.75	48.0	5.28
7	NO_3	0.11	2.58	97.0	10.87	0.98	96.0	10.56	0..83	96.0	10.56
8	Turbidity	0.09	10.0	76.0	6.84	12.0	72.0	6.48	33.0	67.0	6.03
9	Fecal coli.	0.045	21.0	63.0	2.84	18.0	64.0	2.88	24.0	61.0	2.75
Over all WQI calculated					**56.68**			**53.16**			**56.52**