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Research article

EVALUATION OF SURFACE WATER QUALITY OF KANYAKUMARI DISTRICT THROUGH WATER QUALITY INDEX ASSESSMENT.

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ABSTRACT: Physico-chemical analysis of pond water samples from four different sampling sites of Kanya kumari district were carried out for the period from August 2011 - August 2012. The aim of the present study was to calculate the water quality index(WQI) values to assess the quality of the water. The values of WQI from four different ponds varied from 33.01 - 112.9.

Keywords: Physico-chemical analysis, Pond water samples, Kanyakumari district, Water quality index.

INTRODUCTION

Water pollution is nothing but the deterioration of its quality as a result of various human activities. From WHO survey it was found that nearly 60% of diseases in Asian countries are water borne diseases [1]. Nutrient sources such as pastures, human sewage and even lawn fertilizers can cause explosive growth of algae, loss of rooted plants and many other aquatic species. The degraded water quality creates a condition that, such a water cannot be used for intended beneficial uses including bathing, recreation and as such as a source of raw water supply [2]. Water quality index (WQI) is the best and effective way to get information regarding water quality.

MATERIALS AND METHODS

Study area

In the southernmost tip of India map lies Kanyakumari district. It is surrounded by sea on three sides and by western ghats on the northern side. It lies between 77^{o} 15' and 77^{o} 36' east and 8^{o} 03' and 8^{o} 35' north. This district is divided into four taluks namely Agastheeswaram, Vilavancode, Kalkulam and Thovalai. For the present study, the water samples from four different ponds of Kanyakumari district were collected and analyzed for their water quality.

RESULTS AND DISCUSSION

The water quality parameters were analyzed as per standard methods and the results are as follows:

pH

Usually the pH value of the water changes due to biological activity and industrial contaminations. The values of pH in the present study lies well within the limit.

Electrical Conductivity (EC)

The current carrying capacity of water is measured in terms of conductivity. The conductivity increases as the dissolved salts concentration increases. The values of the present study is within the standard limit.

Total Hardness (TH)

Hardness in water is mainly due to calcium and magnesium salts in it. They enter the water body mainly due to industrial and domestic effluents. The values of the present study lies well within the permissible limit.

Total Dissolved Solids (TDS)

TDS in the water sample does not cause harm to humans but at higher concentration it may cause heart and kidney diseases. TDS values of the present study is within the standard limit prescribed.

Dissolved Oxygen (DO)

DO content in water body is mainly due to direct diffusion from air and also due to the photosynthetic activity of autotrophs [3]. DO is chiefly responsible for the metabolism of all aquatic organisms. The DO values of the present study lies within the desirable limit.

Turbidity

The indicator of water pollution is turbidity, which is due to the existence of many kinds of pathogenic microorganisms. These microorganisms can cause adverse health effects on human beings [4]. Turbidity values of the present study are within the standard limit except S1 and S2 samples.

Alkalinity

The source of alkalinity in water body is mainly due to weathering of rocks. Higher alkalinity causes bitter taste to water. The values of the present study lies well within the permissible limit.

Calcium

The presence of calcium in water is mainly due to the dissolution of rocks. The presence of lesser concentration reduces the corrosion in water pipes. The calcium values of the present study is within the standard limit.

Magnesium

Magnesium hardness in water body is due to the presence of sulphate ions in it. The presence of the sulphate ions at higher concentration causes laxative effect on persons who consumes it [5]. The values of the present study is well within the desirable limit.

Manganese

The source of manganese in water is due to the weathering of manganese bearing minerals and rocks. The high levels of it imparts unpleasant taste to water. The manganese values of the present study lies well within the standard desirable limit.

Potassium

The source of potassium into the water body is mostly from agricultural runoffs. At lower concentration it retards the growth rate and photosynthetical activities of algae's especially blue green algae. Whereas at higher concentration, it may cause nervous and digestive disorders. The values of the present study from four different ponds are higher than the standard limit due to the occurrence of the sample sources near to agricultural fields.

Sodium

In case of using the water for irrigation purpose, then definitely the value of sodium in the water should be considered because it increases the hardness of the soil and reduce its permeability[6]. Sodium values in the present study lies within the permissible limit.

Iron

Iron is considered to be one of the essential element in human body. Its presence in water source may be due to bacteriological degradation of organic matter [7]. The values of iron in the present study lies within the desirable limit except S1 and S2 with slightly greater values than the permissible limit.

Chloride

The presence of chloride is an indicator of organic pollution [8]. The presence of chloride in water body is mainly due to discharge of domestic sewage, industrial effluents and agricultural fertilizers [9]. The values of the present studylies well below the standard desirable limit.

Sulphate

The source of sulphate in water is from leaching of gypsum and other common minerals. At higher concentration, it causes gastro intestinal irritation [10]. Sulphate values in the present study lies well very below the permissible limit.

Phosphate

The phosphate contamination in water is mainly due to the presence of orthophosphate from settling particles. Usually they are obtained from native phosphate minerals but doesn't have considerable effect in water because soils easily retain them. The phosphate values of this investigation are greater than the permissible limit due to the closeness of the study area near the agricultural fields and farms.

Fluoride

One among the essential element for human body. Human body gets this element mainly due to water consumption [11]. Fluoride values of this present study is too low than the desirable limit.

Ammonia

Ammonia will exist in its gaseous form which becomes harmful for fishes and other aquatic species at higher values of pH, whereas it is toxicity is reduced at lower pH value due to its conversion into ammonium ions. The values of the present study are greater than the desirable limit even though the pH values are well within the limit.

Nitrate

The self-purification property of water sources are assessed from the values of nitrate present, because the source of nitrate is mainly due to the decaying of plant and animal materials [12]. Nitrate values lie well below the permissible limit in this study indicating the purity of water sources.

Nitrite

During winter season, the productivity of phytoplankton increases and it utilizes this nitrite as its nutrient. So the concentration of nitrite was found to be too low in the water. The nitrite values of this study are well below the desirable limit.

Biological Oxygen Demand (BOD)

The amount of BOD in the water is from biochemically oxidisable carbonaceous matter [13]. If the BOD values are greater than 3 mg/L then the water quality will be considered bad. The BOD values of the present study are greater than 3 mg/L, which indicates that the quality of water is bad and it needs proper management.

Water Quality Index (WQI) Assessment:

The composite influence of different analyzed water quality parameters are taken into consideration here for calculating the water quality index. Water quality index was done mainly to find the suitability of water source for human consumption.

The WQI is calculated by following the steps used by Brown et.al,1972.

i. **Calculation of Q_n:**

Q_n Values are calculated using the equation

$$Q_n = 100 \frac{(V_n - V_i)}{(V_s - V_i)}$$

V_s → Standard Value

V_n → Observed Value

V_i → Ideal Value

The value of $V_i = 0$ for almost all parameters except pH & dissolved oxygen.

For pH, $V_i = 7$

For DO, $V_i = 14.6$

ii. **Calculation of W_n :**

W_n is calculated using the equation

$$W_n = \frac{K}{S_n}$$

K → Proportionality constant

S_n → Standard permissible value for n^{th} parameter

iii. Calculation of K:

The value of K is obtained using the following equation

$$K = \frac{1}{\sum_{i=1}^{n}\left(\frac{1}{(S_1+S_2+S_3+\cdots+S_n)}\right)}$$

$S_n \rightarrow$ Standard values

iv. Calculation of WQI:

The WQI values are obtained from the equation given below:

$$WQI = \sum_{i-1}^{n} Q_n W_n / \sum_{i-1}^{n} W_n$$

Water quality status:

< 50 = Excellent ; 50-100 = Good water ; 100-200 = Poor water; 200-300 = Very poor water ; >300 = Water unsuitable for drinking.

The water quality index values for four different pond waters were calculated by following the above steps and the results were found to be S1 = 33.52; S2 = 44.10; S3 = 33.01; S4 = 112.90.

Table 1: Physico-chemical analysis for four different pond water samples

PARAMETERS	S1	S2	S3	S4	STANDARD LIMITS
pH	7.4	7.1	7.1	7.8	6.5-8.5
Electrical Conductivity	522	309.9	162	251.7	300-1500
Total Hardness	103.6	84.5	36.5	71.1	300-600
Total Dissolved Solids	348.5	206.1	142.2	167.5	500-2000
Dissolved Oxygen	4.1	4.2	4.4	3.3	4-7
Turbidity	11.7	13.1	8	7.8	5-10
Alkalinity	40.6	46.7	27.7	69.4	200-600
Calcium	26.9	22.9	9.2	18.3	75-200
Magnesium	8.3	6.7	3.2	6.2	30-100
Manganese	0.04	0.1	0.08	0.1	0.1-0.3
Potassium	5.9	4.3	2.4	2.8	1.4
Sodium	60	27.9	22.9	23.3	200
Iron	1.1	1.1	0.7	0.9	0.3-1.0
Chloride	131.1	65.1	46	32.3	250-1000
Sulphate	12.3	10.9	6.8	7.5	200-400
Phosphate	0.8	1.2	0.8	2.9	< 0.05
Fluoride	0.2	0.2	0.2	0.2	1-1.5
Ammonia	0.6	0.7	0.5	0.5	< 0.2
Nitrate	5.2	2.2	2	2.6	45
Nitrite	0.1	0.2	0.1	0.1	0.5
Biological Oxygen Demand	8.6	11.3	9.8	10.3	2
ΣW_n	2.33	2.33	2.33	2.33	----
$\Sigma Q_n W_n$	78.15	102.81	76.96	263.14	----
WQI	33.52	44.10	33.01	112.90	----

All the values are expressed in mg/L except pH, EC (µS/cm) and Turbidity (NTU).

CONCLUSION

From the Physico-chemical analysis of 21 above said water quality parameters, it was found that except turbidity, iron, potassium, phosphate and BOD all other parameters agree within the permissible limit. Regarding the water quality assessment values it ranges from 33.01–112.9 with S1, S2 & S3 having WQI values lower than50 which means under excellent water quality status. But the WQI value of S4 is found to be 112.9 that is greater than 100 and it lies under the status of poor water quality. So from this present investigation it was found that all the water bodies need careful periodic monitoring and best water quality management practices to be strictly followed to restore their conditions into a good one specially in case of S4.

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