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Water quality assessment of river Urmodi, Satara district (MS), India.

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ABSTRACT

Deterioration of water quality and their impact over the aquatic biota foundone of the severe threats in front of the scientific community.However, the most reliable way to interact with this global concern is periodical investigations of valued aquatic resources by means of their physico-chemical properties along with the distribution of the biota at the region. Urmodi riverfrom Satara district considered as one of the sacred river from the Maharashtra state, India. It originates at Kas Lake, which is amongst the famous destination. Hence, in order to realize the status of the water qualitypresent investigation was performed. Physicochemical parameters were assessed from the different sampling stationsof the river in order to assess level of contamination at the study region. Physicochemical properties showed significant variation and denoted the better water quality of the river with continuously increasing pollution status of the river.

Key words: Urmodi river, Water quality, Aquatic pollution.

INTRODUCTION

Amongst globally distributed freshwater resources, Asiatic continent alone contributes 36 percent. South Asian countries together contribute over 2800 km^3 of the freshwater resources (Gleick, 1998). However, due to unequal distribution of water resources, some areas face the serious problem of water scarcity (Pasquiniand Depetris, 2007). Numerical data on the average quantity of freshwater bodies noted that, the amount of potable water available for wellbeing of humanity is only 1 percent (WHO, 2004a and Adhakari *et al*., 2013). Rivers found immensely important in this concern due to its higher water retaining capacity and widely distributed flow of water (Peel and Mcmahon, 2004). It plays vital role in concretion of biotic community along the marginal area and so forms main basis of topography of the area (Redmond and Koch, 1991). It contributes in the hydrological cycle. and confirms the regular availability of water. Large flow of river for

thousands of miles across the land area provides valued freshwater, which get utilized for drinking, irrigation, agricultural, domestic and industrial activities (Savoskul and Smakhtin, 2013). These rivers perform the major role in integrating and organizing the landscape of Indian continent and hence regarded as Cradle of India civilization (Kar, 2008). The total length of these riverine systems is 2900 km which flourishes huge floral and faunal diversity. The ample amount of freshwater resulted in to water associated activities such as farming, fishery etc. which forms the basis of Indian economy (CWC,1997, Sakthivadivel, 2007).

India has the second largest population of the world, which requires tremendous amount of water per day (Hegde, 2011 and Hagg *et al*., 2013). But due to the limited and unevenly distributed aquatic resources, we face water crises and these conditions become worst day by day. Along with restricted resources and thickest population which contributes large scale water contaminating activities, resulted in to the deterioration of these natural water resources (Central Pollution Control Board, 2005). Due to continuously deteriorated aquatic systems, millions of Indians, they did not have access to get clean drinking water (Chitale, 1992). By upcoming each and every day, water pollution has becoming the dreadful concern to counteract with, which requires through investigation, curative methodologies and precautionary measures. Hence, deterioration of water quality becomeschallenging taskbefore the scientific community. By considering present status of river, work has been carried out for pollution study from selected monitoring stations of the river Urmodi.

METHODOLIGY

Selection of Monitoring stations:

Urmodi river originated at Kas near Satara, MS, India. It flows along the length of 85 km. It was major source of drinking water for the Satara city and nearby areas. During flow, it continues in broad fashion and meets river Tarli near Umbraj. The numbers of industries situated near the river along with domestic and agricultural sewage are the major source of pollution of the river. So, in order to assess the water quality five sampling sites from Urmodi river were selected. The location of the sampling sites along with latitude and longitude were mentioned in the Table.No.1 and their exact geographical position were shown in the Fig. No. 1.

Sampling:

From all monitoring stations, monthly water sampling wascarried out at early hours of the day i.e. before 10.00 a.m. during the assessment period.

Physicochemical Analysis:

Water samples from each of sites were collected monthly by applying standard methods, in the period of February 2012 to January 2015. Sampling was carried using one litter acid leached polythene bottle. Physical parameters such as Temperature and pH of the water were measured in-situe at every monitoring sites using thermometer and calibrated pH meter (Hanna, pocket pH meter). Total Solids (TS) and Total Dissolved Solids (TDS) were determined by Hach'sgravetric method. Other chemical parameters as- Dissolved Oxygen (DO), (Wrinkler'sidometric method), Total Hardness (TH), (EDTA method), Total Alkalinity (TA), (Simple titration method), Free Carbon Dioxide (CO2), (Simple titration method), Inorganic Phosphate (IP), (Molybdophosphoric Blue Colour method), Nitrate, (Brucine method) and Total Chloride (TC), (Simple titration method) were studied as standardized by APHA (2005).

Statistical Analysis:

All the values were calculated, analyzed and tabulated. Data was summarized by applying standard deviations and presented graphically. Comparison was made by considering pollution status at different sites.

Table. 1- Geographical distribution of the selected Monitoring stations.

Monitoring sites from river Urmodi- Satara district				
Code	Name	Longitude	Latitude	Elevation from Sea level
U_1	Kas	17º 05' N	74º 19' E	3681 ft.
U_2	Bhondwade	17º 05' N	74º 19' E	2138 ft.
U_3	Jakatwadi	17º 05' N	74º 19' E	2099 ft.
U_4	Shendre	17º 05' N	74º 19' E	2083 ft.
U_5	Nagthane	17º 05' N	74º 19' E	2035 ft.

Fig. 1: Location of the sampling sites along with satellite views.

RESULTS

Average values of physicochemical variables (± S.D) with WHO standards were showed in the Table 2.

pH:

During the entire period of investigation, pH showed average alkaline nature and ranges between 7.8 to 8.9. The highest pick was noted at monitoring stations U_1 i.e. Kas, while lowest values were noted at monitoring site U_4 i.e. Shendre. However, the observed values were below the WHO standards giving the positive remark of palatability of the water. The higher values at monitoring stations U_1 may be because of temperature variation, decomposition of organic matter and dilution of water through surface runoff from nearby streams.

Temperature:

The average range of temperature varied between 19 ºC to 23 ºC during the entire study period. The maximum temperature was noted at monitoring stations U_5, while least value noted at monitoring site U_1.The observed values were well below the WHO standards denoting the suitability of the water form study region.

Total Solids:

The results obtained for average TS rangedbetween 54 to 232 mg/lit. In comparison maximum TS concentration found at monitoring stations U_5, while least was noted at monitoring site U_1.The values obtained were within the standards of WHO's presenting less turbidity of water and implies the low level of contamination at respective monitoring stations.

Total Dissolved Solids:

Average TDS concentration found between 21 to 168 mg/lit. TDS concentration also exhibit similar trend of fluctuation as that of TS. The results confirmed that, TDS concentrationwere well within the permissible limits of WHO.

Dissolved Oxygen:

During entire assessment period, concentration of DO was found within the range of 1.42 to 2.71 mg/lit. The richest concentration observed at site U_1while the least was noted at site U_5. However, determinedDO concentration was noted well below the WHO standard which assures the excess nutrients concentration and higher organic activities at the region.

Table No. 2: Average values assessed form the monitoring stations during the investigation period.

	Assessment period2012-2015					
Parameters	WHO standards	**U_1**	**U_2**	**U_3**	**U_4**	**U_5**
pH	6.5-8.5	8.9	8.2	8.2	7.9	8.2
Temp. º C	< 40	19.91	21.75	21	21.25	22.16
TS mg/ lit.	500	54.66±21.931 02134	129.66± 29.66275085	159± 32.2772084	219± 26.26439	232± 26.58776205
TDS mg/ lit.	2000	21± 17.15172931	68.66± 29.5337506	89.66± 34.84859025	158.33± 18.32699615	167± 24.18865249
DO mg/ lit.	5-7	2.71± 0.590236214	2.29± 0.56546776	2.21± 0.460460902	2.02± 0.464356022	1.42± 0.356892098
CO_2mg/ lit.	22	3.99± 1.477097892	4.90± 1.505042031	4.24± 1.356801051	5.49± 1.566698904	7.15± 2.165222887
TH mg/ lit.	300	0.66± 1.556997888	14.83± 3.352972449	25.16± 8.066015501	36.5± 5.334280219	45.5± 7.292586522
TA mg/ lit.	200	22.5± 6.908492797	32.5± 6.908492797	45.83± 12.76239742	48.56± 15.69776388	68.33± 22.19063411
TC mg/ lit.	200	9.34± 1.958115204	13.13± 3.929698886	13.49± 1.866245624	12.66± 3.44961087	16.92± 2.869430838
IP mg/ lit.	45	0.21± 0.062279916	0.31± 0.125142343	0.34± 0.123582876	0.38± 0.101384357	1.14± 2.240346294
Nitrates mg/ lit.	45	1.15± 0.358024885	1.85± 0.30895719	1.95± 0.414509568	2.15± 0.334392257	2.99± 0.864512474

Free Carbon Dioxide:
The average range of CO_2 estimated was 3 mg/lit. to 8 mg/lit. during the investigation period. It represents exactly reverse trend than that of DO. Concentration of CO_2 found well within the miscible limits of the WHO, which gives positive indication for the suitability of water.

Total Hardness:
During the assessment, mean hardness value ranges between 0.6 to 45 mg/lit. In station wise comparison, it represents exactly similar trend as that of CO_2 and found well within the WHO standards, which confirmed suitability of water for variety of usages.

Total Alkalinity:
Average concentration of TA observed ranged between 22 to 68 mg/lit. during experimentation. Total alkalinity was found with similar trends like that of CO_2 and TH. The concentration obtained for TA was noted well below the WHO standards, which remarked the favorability of river basin.

Total Chloride:
Average TC concentration ranged between 09 to 17 mg/lit. It found with higher concentration at site U_5 and noted with least concentration at U_1. The values were below the permissible limits of WHO standards, denoting the less deposition through agricultural inputs in aquatic system.

Inorganic Phosphate:
The results for average Ip was noted within the range of 0.2 to 1.15 mg Ip/lit. Ip concentration also observed with similar pattern of distribution as that of TC. However, values were below the WHO standards, denoting favorable water quality and palatability of the study regions.

Nitrates:
During the assessment period average nitrate, concentrations ranged between 1.15 to 3 mg/lit. and represents similar trend of fluctuation at sites like the other parameters. However, average nitrate content obtained was below the WHO standards, representing less contamination aquatic system.

DISCUSSION

Water quality assessment was noted as baseline of water quality management and thus periodical monitoring of water quality of the river, by applying physicochemical variables became necessary to regulate better water quality of the river (Rani *et al*., 2011). Assessment of physicochemical parameters of river Urmodi was noted as fascinating phenomenon caused due to imbalanced process of mineralization and its consumption as priorly mentioned by Morris, (2000) and Adeyemo, (2008) for number of rivers. During the entire flow of the river Urmodi the monitoring station U_1 i.e. Kas and U_2 i.e. Bhondawade were noted as comparatively least affected zones, whereas monitoring stations U_3 and U_4 i.e. Jakatwadi and Shendre were observed as continuously contaminating zones of the river. However, monitoring stationU_5 i.e. Nagthane was noted as polluted station as physicochemical parameters at the site fluctuates continuously andshowed dumping of the contaminants at the region.

CONCLUSION

Assessed physicochemical parameters of river Urmodirepresents favorable water quality from the assessed monitoring stations, which is fruitful for domestic uses. However, periodic monitoring is necessary for keep check on the level of contamination.

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