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IMPACT OF SEWAGE ON WATER QUALITY PROFILE OF SELECTED PONDS OF HUBLI-DHARWAD URBAN ENVIRONMENT, KARNATAKA, INDIA

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ABSTRACT

Water resources are being deteriorated day by day at the very faster rate due to the anthropogenic interferences. Such as sewage, industrial waste and domestic waste disposal into the surface water bodies such as lakes and ponds. The present investigation is an attempt to assess the water quality of the selected ponds and sewage channels of the Hubli-Dharwad urban area. The physico-chemical parameters of water on the selected surface water bodies were carried out to prepare the water quality profile. Surface water samples were analyzed for physico-chemical properties such as pH, EC-TDS, Total alkalinity, Hardness , COD, DO and inorganic elements such as Ca, Mg, Cl, Na & K and water quality index (WQI) was calculated. WQI for the selected water bodies ranges between 104.326 to 1855.54 which reveal that the water is of poor quality and is unsuitable for domestic consumption.

KEYWARDS: **Sewage, Pond, Physico-Chemical Characteristics, Water Quality Index, COD.**

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INTRODUCTION

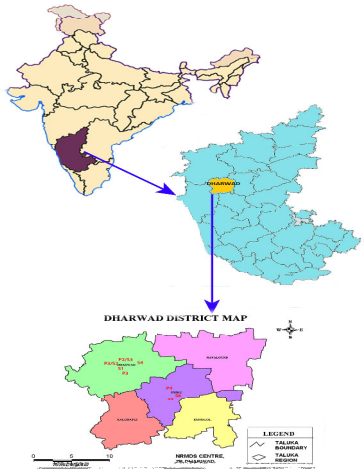
The earth is called as a blue planet as two third of it is occupied by water. About 99.7% of water found on earth is in the oceans while, it is not available for human consumption.Water is one of the most abundant and essential natural resource. Fresh water is an essential for agriculture, industry and human existence; it is a finite resource of earth, without its adequate quantity and quality sustainable development will not be possible[1, 2]. Water resource is deteriorated day-by-day at the very fast rate. So, water quality is a global problem[2]. Therefore, water supply has to be checked regularly. According to World Health Organization (WHO) report in 2006[3], 1.1 billion people lack access to an improved drinking water supply and 1.8 million people die from diarrheal disease each year. Almost 70% of the water in India has become polluted due to the discharge of domestic sewage and industrial effluents into natural water source, such as rivers, streams as well as lakes[4]. The water quality is assessed by determining the physico-chemical parameters like pH, TS, TDS, TSS, Total alkalinity, Free CO2, DO, Total hardness, Ca, Mg, Salinity etc. According to WHO estimate about 80% of water pollution occurs in developing country, like India The improper management of water systems may cause serious problems in the availability and quality of water[5]. Water Quality Index (WQI) is a very useful and efficient method for assessing the water quality. It is also a very useful tool for communicating the information on overall quality of water[7, 8]. Hubli - Dharwad is the twin city situated in the northern part of Karnataka with the population of approximately 9, 43,857[9.] In view of these, the present investigation has been undertaken to assess the water quality of the selected some sewage channels and ponds of the Hubli-Dharwad area to prepare the Water Quality Index and to assess the impact of sewage on the water quality of ponds. The present investigation was carried out during the year Oct-2013.

MATERIALS AND METHODS

STUDY AREA

Hubli-Dharwad urban area was selected for the present investigation Hubli-Dharwad Corporation is the second largest urban area in Karnataka state. The Geographical location of the study area is situated in between longitudes $74^{0}53^{1}$ 98^{11} to $74^{0}58^{1}$ 19^{11} E and latitudes 15^{0} 29^{1} to $15^{0}35^{1}$ N.

SAMPLING STATIONS Ten sampling stations were selected for the present investigation.



SAMPLING OF SEWAGE

Raw sewage samples were collected from the six sewage channel situated at Shrinagar, Madihal, Kelageri, Sadanakeri, Buddarsingi, Bidnal and pond water samples were collected from Kelgeri, Sadankeri, Nuggikeri and Unkal areas of Hubli-Dharwad. Samples were collected in a clean, dry in 10 liters capacity polythene cans. The cans were rinsed with the respective sewage and pond samples for two to three times before sampling. The samples were transported to the laboratory in an ice box with minimum disturbance for the analysis of various Physico-chemical properties The twelve Physico-Chemical parameters of sewage and pond water were analyzed as per the Standard Methods for Examination of Water [10]. The pH of the water sample was measured by a pH meter (Elico, India). The electrical conductivity of the sewage water samples was measured by EC-TDS analyzer (Elico, India). Total dissolved solids were measured by using EC-TDS analyzer (Elico, India) Dissolved oxygen was estimated by the Azide modification method.COD was carried out by using a potassium permanganate method .Alkalinity was measured immediately after collection of samples using phenolphthalein and methyl orange indicators. The estimation of chloride was made by Argentometric method. Free carbon dioxide was estimated by using phenolphthalein as indicator, total alkalinity was estimated by a titrimetric method Calcium was analyzed by EDTA Titrimetric method, The Sodium and potassium content of samples were determined by Atomic Absorption Spectrophotometer (AAS) at the wavelength of 589.6 nm and of 766.5 nm respectively. In the present investigation water Quality Index (WQI) was calculated by using the Weighted Arithmetic Index method[11].

RESULTS & DISCUSSION

The physico-chemical parameters of the sewage and ponds of Hubli-Dharwad urban area was analyzed to prepare the water quality profile are presented in the (table 1). It is known fact that the pH plays a major role in the most of the chemical and biological reactions. The pH of drinking water should be in the range of 6.5-8.5. But in sewage water of Hubli-Dharwad which is unsuitable for human consumption, urban area under investigation ranges between 7.3 to 7.8 which indicates the alkaline water. The pH of pond waters of Hubli-Dharwad urban area ponds ranges between 7.3 to 9.4 which indicate the alkaline nature of water. Unakal lake water has the pH of 7.3 indicating slightly alkaline. While the Nuggikere pond has the pH 9.4 which is more alkaline and exceeds the Indian standard limit of about 6.5-8.5. High pH value induces the formation of trihalomethanes, which are toxic[12]. pH affects the dissolved oxygen level in the water, photosynthesis of aquatic plants, metabolic rates of aquatic organisms and the sensitivity of organisms, towards parasites and disease[13]. This was positively correlated with Ganga and Ghanghara river water were the alkalinity ranges from 7.3 to 7.9[14]. The pH value of Marana River was also in the alkaline range[15]. The electric conductivity (EC) is due to the dissolved salts in the water sample is a direct function of its total dissolved solids. Hence it is an index parameter to represent the total concentration of dissolved salts in water. The permissible limit of total dissolved solids in the drinking water is 500 mg/L. In the absence of potable water source, the permissible limit may be up to 2000 mg/L. It is found that the TDS value of the water of all the ponds exceeds the potable limit.the sewage water sample collected from above places were within the permissible limit of ISI (1000mg/l). This was positively correlated with the river water samples of the Ranchi District, were the total dissolved solids ranges from 50 to 450 mg/l[16-18]. The EC of sewage which ranges from 690 µs/cm to 1390 µs/cm and total dissolved solids found to be similar distribution patterns as EC, the TDS values ranges between 430 to 830 mg/L while EC for pond ranges between 860 µs/cm to 1184 µs/cm, the TDS values ranged from the 540 mg/L to 74 mg/L. The total alkalinity of water and sewage under investigation varied from 295 to 410 mg/L. Sadankeri channel has the least alkalinity of 295 mg/L followed by Bidnal, Madihal, Kelegeri and Budrsingi having the total alkalinity of 395, 340,405 & 410 mg/L respectively. Among the ponds under investigation studied Nuggikeri

pond has the least total alkalinity of 90 mg/L followed by the Sadankeri, Unakal and Kelegeri having 155, 180 and 180 mg/L repectively. Kelegeri and Unkal pond showed the similar total alkalinity of 180 mg/L. These results are positively correlated with the borewell water of Chirala town at Prakasam district, which was in the range of 110 to 850mg/l[19]. The hardness of sewage water in the present investigation ranges 232 mg/L to 490 mg/L. Sadankeri channel has the lowest hardness of 232 mg/L followed by Shrinagar, Bidnal, Budrsingi, Madihal and Kelegeri having the hardness of 260, 290, 300 & 490 mg/L respectively. Kelegeri channel has 25mg/L the highest hardness of 490 mg/L. Among the ponds studied in the present investigation. Nuggikeri had the highest hardness of 220 mg/L followed by Unakal, Kelegeri and Sadankeri having 200, 154 and 150 mg/L. This result was positively correlated Surface and Ground Water of Abhanpur Block in Raipur District, Pramisha[20] hardness of water mainly depends upon the amount of Calcium or Magnesium salts or both. Calcium and magnesium are directly related to the hardness, the Calcium concentration of sewage channels and ranges between 6 to 87.3 mg/L. Kelegeri sewage channel had the highest Calcium concentration of 87.3 mg/L followed by Madihal, Budrsingi, Bidnal, Sadankeri and Srinagar having the Calcium concentration of 80,60,60 & 48 mg/L respectively. Among the ponds under the present investigation Sadankeri pond had the highest Calcium concentration of 43 mg/L followed by Unakal, Nuggikeri and Kelegeri having 40, 32, 31 mg/L respectively. The Magnesium concentration in Kelegeri sewage channel is 402.7mg/L being the highest followed by Budrsingi, Madinal , Bidnal and Sadankeri having 220, 222, 200 and 171.1 mg/L respectively. Nuggikeri pond had the highest Magnesium concentration of 188 mg/L followed by Unakal, Kelegeri and Sadankeri having 160, 123, and 107 mg/L. Sadankeri pond water has the least Magnesium concentration. Sodium ranges from 51.5 to 110 mg/L showing the Sodium concentration lower than the prescribed limit by WHO and ISI. Nuggikeri pond has the highest concentration of 124 mg/L Sodium followed by Unakal, Kelegeri and Sadankeri having 110, 85 and 51.5 mg/L respectively. Sodium of sewage channels ranges from 38 to 120 mg/L. Kelegeri pond being the lowest and Madihal being the highest in Sodium concentration followed by Budrsingi, Bidnal and Sadankeri has the concentrations 92, 90 & 38.5 mg/L respectively, these concentrations also fall within the permissible limit of WHO & ISI. The Potassium concentration of pond water samples ranges from 1.2 mg/L to 45 mg/L for the sewage channels and 1.2 mg/L to 10 mg/L for the ponds. The higher Potassium concentration of 45 mg/L was found in the sewages sample collected from the Madihal followed by 7.3, 7, 1.8, 1.3 and 1.2 mg/L for Bidnal, Budrsingi, Kelegeri, Sadankeri and Shrinagar channels. Among the ponds of study area higher concentration of 10 mg/L of Potassium was found in the water sampled from Nuggikeri pond followed by 5, 1.5, 1.2 mg/L in water samples from Unakal, Kelegeri and Sadankeri respectively. These results are consistent with the findings of researcher [21]. The chloride concentration serves as an indicator of pollution by sewage; people accustomed to higher chloride in water are subjected to laxative effects. In the present investigation the Chloride concentration estimated for the water samples collected from the sewage channels ranges from 125 mg/L to 165 mg/L and for water samples from the ponds ranges from 170mg/L to 290 mg/L. Maximum permissible limit of chloride is 1000 mg/L and desirable limit of chloride is 250 mg/l as per Indian standards. Chloride concentration in the sewage channels and ponds are within the limit except the Nuggikeri and Unakal Ponds which found to have calcium concentration of 290 mg/L which exceeds the limit presented by WHO & ISI the higher concentration may be due to the disposal of domestic waste. Dissolved oxygen is one of the most important parameter and its concentration in water indicates the status of water such as bacterial, photosynthetic activity, availability of nutrients Etc. The average value of DO levels (6.5mg/l) indicates the average quality of river water[22, 23.] Dissolved oxygen ranges between of 0.1 mg/L to 0.2 mg/L higher degree of organic pollution. Chemical oxygen demand of water samples ranges between 74.5 mg/L to 1168 mg/L and for pond water sample 27.4 mg/L to 54.85 mg/L

which exceeds in the limit and WHO as international standards for surface water The higher level of Chemical oxygen demand is due to organic matter and anthropogenic activity[24]. Water quality index (WQI) of status sampling stalious under investigation found to be in the range 104.326 to 1855.54 which represent the poor, very poor and water unsuitable for domestic use.

Table 1
Physico-chemical characteristics of the Sewage water and ponds water of Hubli-Dharwad urban area.

Sl No.	Parameters	Shrinagar sewage	Kelegeri pond	Kelegeri sewage	Sadankeri pond	Sadankeri sewage	Madihal sewage	Nuggikeri pond	Unakal pond	Buddrsingi sewage	Bidnal sewage
1	pH	7.4	8.5	7.5	8.3	7.8	7.3	9.4	7.3	7.4	7.3
2	Conductivity	690	860	1260	940	1030	1390	1160	1184	1380	1296
3	Total Dissolved Solids mg/L	430	540	790	590	640	870	720	740	860	720
4	Total Hardness mg/L as CaCO3	254	154	490	150	232	300	220	200	290	260
5	Calcium mg/L as Ca	48	31	87.3	43	60.9	80	32	40	68	60
6	Dissolved Oxygen mg/L	0.01	0.07	0.05	0.1	0.08	0.8	0.09	0.09	0.2	0.1
7	Chloride mg/L as Cl	95.6	189	139	170	125	165	290	230	160	140
8	Total Alkalinity mg/L as CaCO3	220	180	405	155	295	395	90	180	410	340
9	Sodium mg/L as Na	58	85	18.5	51.5	38.8	120	124	110	92	90
10	Potassium mg/L as K	1.2	1.5	1.8	1.2	1.3	45	10	5	7	7.3
11	Carbon Dioxide mg/L as Co2	0.66	08	3.5	1.3	2.2	4	6	4	8.8	4.5
12	COD mg/L	74.5	31.4	113.7	54.85	105.8	298	35.5	27.5	1168	1068
13	WQI Value	176.208	119.286	242.537	155.224	226.057	587.246	151.6	104.326	1855.543	1702.488
14	Water Quality indicators	Poor water	Poor water	Very poor water	Poor water	Very poor water	Not Potable	Poor water	Poor water	Not Potable	Not potable

CONCLUSION

The present investigation of some ponds and sewage channels of Hubli-Dharwad urban area revealed that the Water Quality Index (WQI) is very poor and unsuitable for the domestic use. The concentration of Calcium, Magnesium, Sodium, Potassium, Chloride, Dissolved Oxygen and Chemical Oxygen Demand (COD) exceeded the standard limit presented by WHO and indicates the water pollution from the Domestic waste water.

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