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Topic: AQUATIC PLANTS AND TANK WATER QUALITY IN RAIPUR CITY (C.G.), INDIA

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ABSTRACT

Due to increase of global population and indiscriminate planning, the number of tanks has decreased. Most of the surface water bodies are polluted. Regularly dumping all types of waste materials in these water bodies by industry, corporation, private colonies and water flowing from the agricultural lands carrying various types of pesticides and herbicides, polluted these water bodies. In the present study the role of aquatic plants present in these water bodies have been carried out. 12 tanks of Raipur, C.G. have been selected for the study. The contaminants TDS, salinity and conductivity are proportionately related to each other. The maximum TDS, salinity, conductivity are 0.84 ppt, 1.1 ppt and 1.3 ms/cm respectively are found in Mahant Talab and lowest 0.28 ppt, 0.1 ppt and 0.43 ms/cm respectively are found in Telibandha Talab. Maximum pH (8.5) is found in Shitla Talab and minimum (6.9) in Karbala Talab. Maximum DO (8.0 ppm) in Maharajbandh Talab and minimum (7.3 ppm) is found in Hirapur Talab.

Introduction

Most of the tank water is polluted is due to anthropogenic activities, like discharge of sewage, effluents and wastes from domestic, industrial establishments and fertilizers, pesticides are added runoff from agricultural activities (Narayanan, 2009). Odum (1983) has recorded that a dailyproduction of 5-10 g. of O_2 per square meter column of water thorough photosynthesis should be taken as a sign of healthy state of an aquatic ecosystem.

Aquatic plants or wetland plants can purify the water (tank, pond and lake etc.) or minimise the water pollution by removing heavy metals, bacteria, oil and other pollutants. All aquatic plants are helpful for the removal of pollutants, but some are better than others. If the growths of these are not controlled than they increase fast and cover the whole tank. This impacts water flow, blocks sunlight from reaching native aquatic plants and starves the oxygen of water, killing fish and becomes a prime habitat for mosquitoes. Algal growth leads to a great increase in the number of decomposers. As a result the biological oxygen demand (BOD) increases. Low BOD indicates low pollution and vice versa (Goswami, 2013). Loss of oxygen may be counteracted by photosynthesis of green plants, which produce oxygen during daylight. Where the degree of pollution is severe, it becomes impossible to have normal levels of oxygen in water (Sharma and Jha, 2008).

Study Area

The study area Raipur City, Chhattisgarh is included in the survey of India topographical sheet numbers, 64 G/11 and 64 G/12 open series map (new map) numbers F 44 P11 and F 44 P 12, which lies between 21° 12’ 30" N to 21° 17’ 30" N latitude and 81° 35" E to 81° 40" E longitude.

Material and Methods

The water samples have been collected from 12 tanks (two different places from each tank, i.e. A, C1 & C2 Sample near aquatic plant, B, D1 & D2 Sample where aquatic plant is absent) in a 250 ml plastic bottle. Total Dissolved Solids (TDS), Salinity, Conductivity, pH of these samples were determined by the help of EI make Delux Water and Soil Analysis kit model 191. Temperatures have also been measured by a graduated glass thermometer (Strengthened 76 mm Immersion Zeal, N2 Filled Thermometers). Physical parameters of the tank water of Raipur City is given in Table 1.

Table 1 : Physiochemical Parameters of the Tank Water in Raipur City (Nov., 2015).

Sl. No.	Tanks	Location of the Sample	Physiochemical Parameters			
			TDS (ppt)	Salinity (ppt)	Conductivity (ms/cm)	pH
1	HirapurTalab	A	0.38	0.3	0.58	7.59
2		B	0.39	0.3	0.59	7.05
3	TatibandhTalab	D1	0.56	0.5	0.84	7.06
4		D2	0.55	0.5	0.82	7.37
5	ShitlaTalab	A	0.41	0.2	0.76	8.40
6		B	0.43	0.2	0.77	8.50
7	DabriTalab	A	0.32	0.5	0.48	7.35
8		B	0.33	0.5	0.49	7.12
9	MahantTalab	C1	0.83	1.1	1.30	7.81
10		C2	0.84	1.1	1.30	8.06
11	Karbala Talab	A	0.31	0.2	0.47	7.23
12		B	0.32	0.2	0.50	6.90
13	KantiTalab	A	0.62	0.6	0.93	7.61
14		B	0.62	0.6	0.93	7.65
15	KankaliTalab	D1	0.53	0.5	0.81	7.02
16		D2	0.53	0.5	0.82	7.08
17	Vivekananda Sarobar	A	0.31	0.2	0.47	7.54
18		B	0.32	0.2	0.49	6.32
19	MaharajbandhTalab	A	0.44	0.4	0.66	7.31
20		B	0.48	0.4	0.73	7.04
21	NayaTalab	A	0.31	0.2	0.47	7.08
22		B	0.31	0.2	0.48	7.04
23	TelibandhaTalab	A	0.28	0.1	0.43	7.18
24		B	0.28	0.1	0.43	7.69

NB: A=Sample near aquatic plant, B= Sample where aquatic plant absent C1 & C2= Sample where fully covered by aquatic plant & D1 & D2= Sample where aquatic plant fully absent.

Observations

Colour

Excessive green and often frothy white scum like colour is indicative of eutrophication or over production of phytoplankton and decomposing of dead plant material. This leads to increased consumption of dissolved oxygen by the decomposer organisms and consequent pollution due to oxygen deficiency. Within a few minutes of fall of dissolved oxygen in water, the fishes die in huge numbers.

The waters of Vivekananda Sarobar and Mahant Talab are found in greenish colour, which is due to Preponderance of microscopic green algae occurring in suspended condition. So, the death of fish is very common in these tanks. But clean water appears colourless in shallow situations but assumes greenish tinge in deep to very deep conditions due to selective absorption of certain wavelength of penetrating light (Ambasht and Ambasht, 2014).

Total Dissolved Solids (TDS)

The Total Dissolved Solids (TDS) are mainly the inorganic substances, like chlorides, carbonates, bicarbonates, nitrates, phosphates and sulphates of calcium, magnesium, sodium, potassium, iron etc. If any one of these becomes in excess, the water is harmful for drinking. Also excessive use of nitrogenous fertilizers to crop fields and garden than the some of these are added to aquatic bodies (tank, lake, river etc.) through runoff, and result in eutrophication of the aquatic ecosystem. The excess Total Dissolved Solids (TDS) content is harmful.

The maximum TDS (0.84 ppt) are found in the Mahant Talab, as most of the portion (near about 99 %) is covered by the aquatic plant like, Kochai, Polygala, Jussiaca repens, Ipomca aquatica, Eichhornia crassipes and Grass spp. etc. (Fig. 7, 8, 9, 11, 12 &13). Govt. has taken some action for cleaning and beautification of Telibandha Talab also there has some aquatic plant (like, Jussiaca repens, Fig. 9). So the minimum TDS (0.28 ppt) are found in the Telibandha Talab. The maximum difference of TDS (0.04 ppt) between sample near aquatic plant (0.44 ppt) and sample where aquatic plants are absent (0.48 ppt) are found in Maharajbandh Talab (Fig. 1). According to Willcox, 1955 the TDS of Samples of the study area are permissible (up to 1.5 ppt is permissible) for domestic uses.

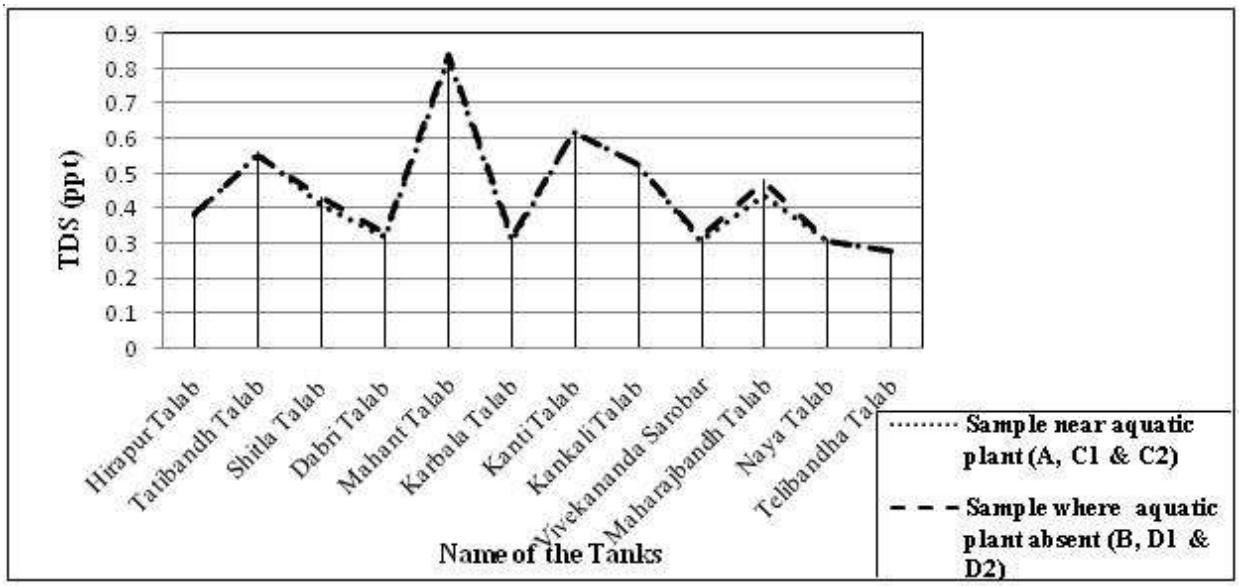

Fig. 1. TDS (ppt) of the Tank Water in Raipur City

Salinity

Salinity is proportionally related to TDS. In Mahant Talab the TDS is found in maximum quantity, and the salinity is high (1.1 ppt). In the other hand the TDS is minimum and salinity is low (0.1 ppt) in Telibaandha Talab. The salinity difference has not found in between two different locations (i.e. A, C1 & C2 sample near aquatic plants, B, D1 & D2 sample where aquatic plants are not found) (Fig. 2) of a particular tank.

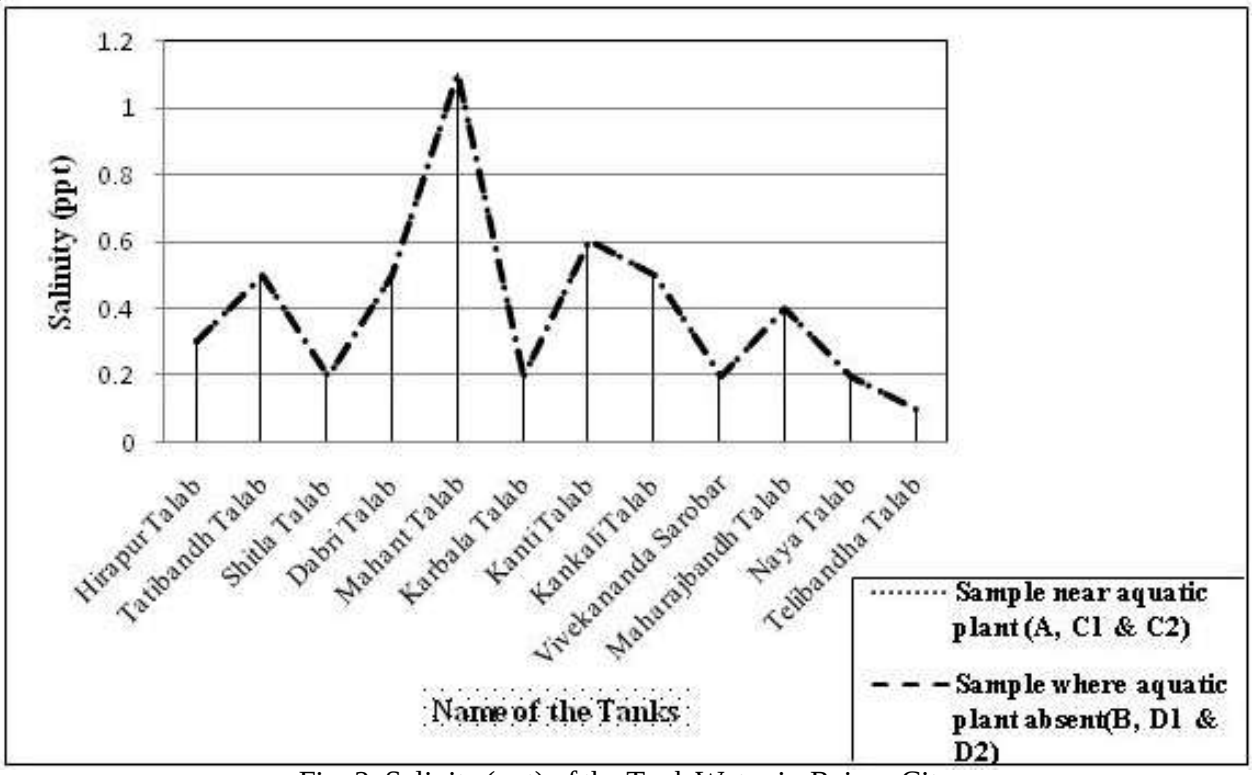

Fig. 2. Salinity (ppt) of the Tank Water in Raipur City

Conductivity

Conductivity of an inorganic substance is good so they are better conductance while organic compounds are poor currents conductors as they do not dissociate.

Thus conductivity gives us information of ionic concentration or dissolved inorganic substances.

Conductivity is proportionally related to TDS . So, the maximum conductivity (1.3 ms/cm) is found in the same tank (Mahant talab). The minimum conductivity (0.43 ms/cm) is found in the Telibandha Talab. The maximum difference (0.7 ms/cm) of conductivity in between sample near aquatic plant (0.66 ms/cm) and sample where aquatic plant absent (0.73 ms/cm) are found in Maharajbandh Talab as shown in Fig. 3.

pH

Sculthorpe (1967) has observed that pH, CO_2 and ammonia are critical factors in the survival of aquatic plants and fishes than the oxygen supply. As the photosynthesis progresses there is an increase in O_2 and decreases in CO_2 levels in water and these are accompanied with some rise in pH. The minimum pH (6.32) is found in Vivekananda Sarobar.

The difference of pH (1.22) between a sample near aquatic plant (7.54) and a sample where aquatic plant is absent (6.32) is found in Vivekananda Sarobar (Fig. 4).

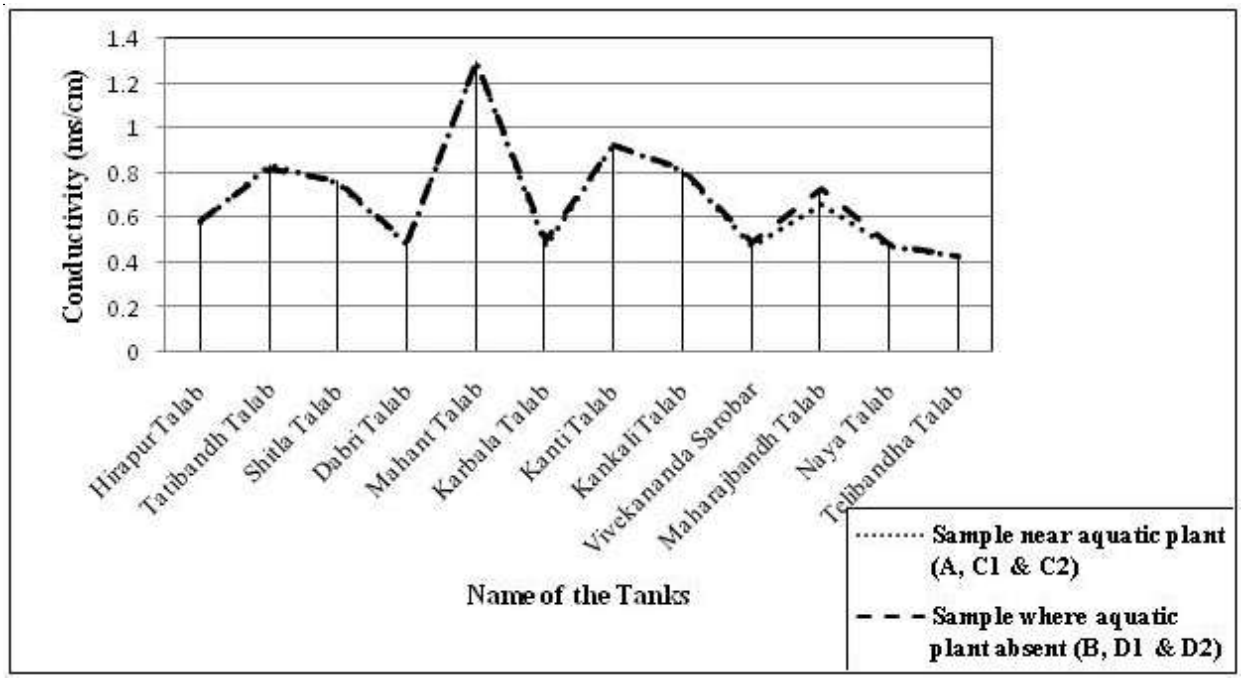

Fig. 3. Conductivity (ms/cm) of the Tank Water in Raipur City.

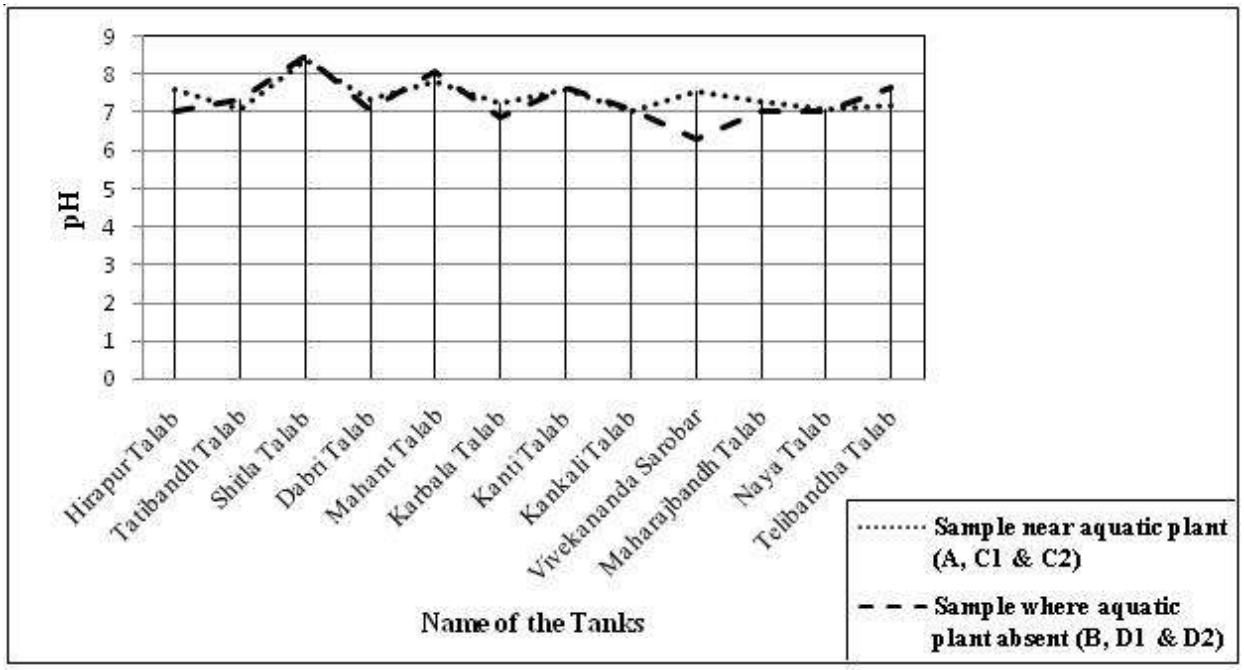

Fig. 4. pH of the Tank Water in Raipur City

Temperature

The phenomenon of thermal pollution in water bodies is also known as calefaction (Ambasht & Ambasht, 2014). The study shows that the surface temperature of the tank water varies from 24°C to 28°C (Variation, 4°C) in the study hours, 10.30 AM to 11.30 AM. The surface temperature of the

sample near aquatic plant in 7 tanks (58.33 %) is found lower than the sample where aquatic plant is absent in these tanks. The other 5 tanks (41.67 %) have same temperature in two different locations in each tank. The maximum variation (3°C) of surface temperatures in two different locations of each tank is found in the Vivekananda Sarober and Maharajbandh Talab (Table 2).

Table 2 : Temperature and DO of the Tank Water (with respect to Distilled water) in Raipur City

Sl. No.	Tanks	Location of the Sample	Temperature (°C)	DO (ppm) in Distilled Water	DO (ppm) in Water Sample
1	HirapurTalab	A	27	7.9	7.5
2		B	28	7.8	7.3
3	TatibandhTalab	D1	28	7.8	7.6
4		D2	28	7.8	7.4
5	ShitlaTalab	A	27	7.9	7.7
6		B	28	7.8	7.6
7	DabriTalab	A	26	8.1	7.5
8		B	28	7.8	7.5
9	MahantTalab	C1	25	8.2	7.5
10		C2	25	8.2	7.4
11	Karbala Talab	A	24	8.3	7.9
12		B	24	8.3	7.8
13	KantiTalab	A	25	8.2	7.9
14		B	26	8.1	7.8
15	KankaliTalab	D1	28	7.8	7.5
16		D2	28	7.8	7.6
17	Vivekananda Sarobar	A	24	8.3	7.9
18		B	27	7.9	7.6
19	MaharajbandhTalab	A	24	8.3	8
20		B	27	7.9	7.8
21	NayaTalab	A	27	7.9	7.7
22		B	28	7.8	7.6
23	TelibandhaTalab	A	28	7.8	7.6
24		B	28	7.8	7.5

NB: A=Sample near aquatic plant, B= Sample where aquatic plant absent C1 & C2= Sample where fully covered by aquatic plant & D1 & D2= Sample where aquatic plant fully absent.

Dissolved Oxygen (DO)

During active photosynthesis by phytoplankton and macrophytes, the release of oxygen may be so much as to cause over saturation or super saturation to 200 percent. Rising temperature reduces the 100 percent saturation level and therefore, the water may become supersaturated with the rise in temperature also. Super saturation is for short periods only as this leads to a slow loss of DO into air

through slow babbling. Depletion of dissolved oxygen in water supplies can encourage microbial reduction of nitrate to nitrite and sulphate to sulphide, giving rise to bad odour. It can also cause an increase in the concentration of ferrous iron in solution.

Due to the addition of industrial dust by wind, the minimum Dissolved Oxygen (DO, 7.3 ppm) is found in the Hirapur Talab B (but, the sample of Hirapur Talab A is near aquatic plant, Lotus Fig. 6). Maharajbandh Talab has kochai, polygala, jussiaca repens, pistia stratiotes, ipomca aquatica, eichhormia crassipes and grass spp. (Fig. 7, 8, 9, 10, 11, 12 & 13) plants and has maximum DO (8.0 ppm). Interestingly DO in water sample (maximum difference 7 to 8 ppm) is found in the Mahant Talab, because 99 % of this tank is covered by aquatic plant. The minimum difference (1 to 3 ppm) is found in the Maharajbandh Talab (Fig. 5).

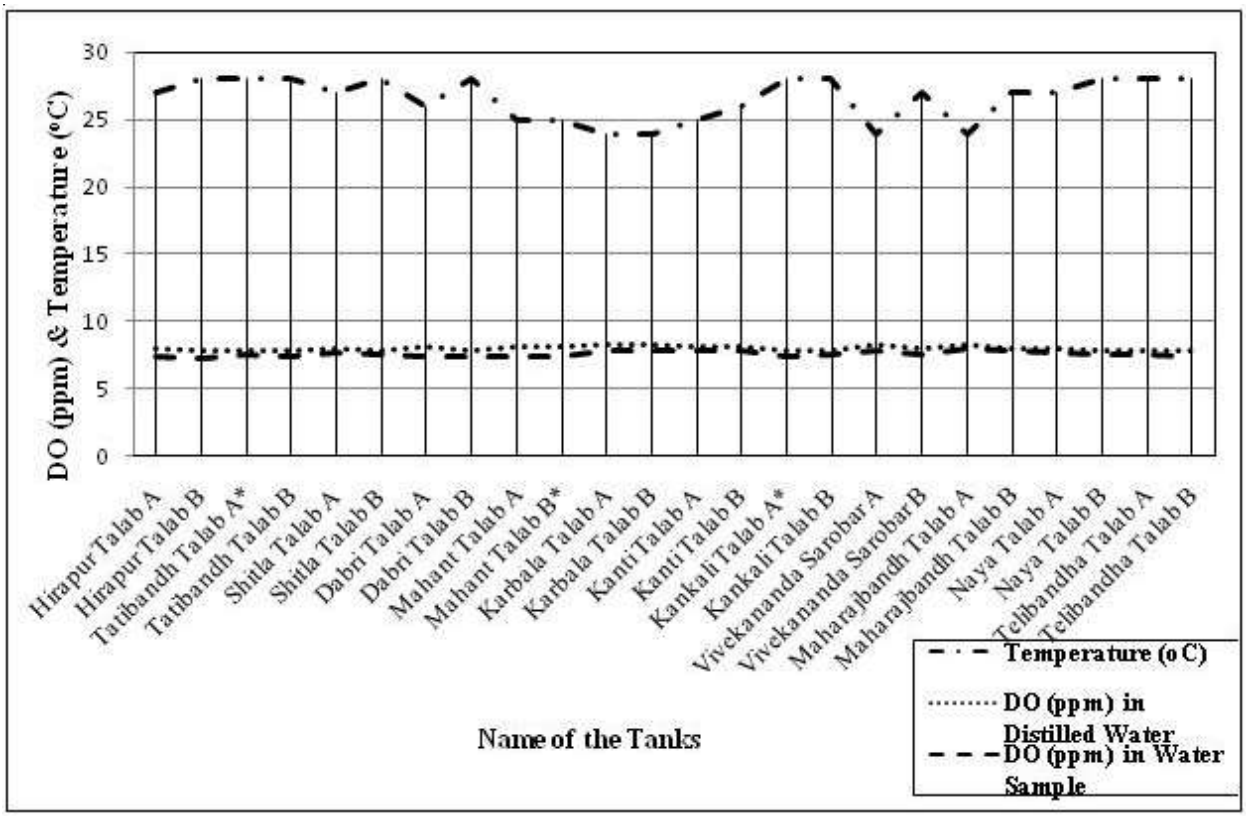

Fig. 5. Relationship between DO (ppm) & Temperature (°C) of the Tank Water in Raipur City.

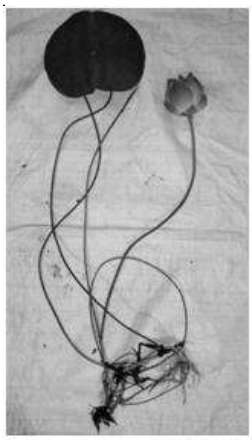

Fig. 6. Lotus

Fig.7. Kochai

Fig. 8. Polygala

Fig.9. Jussiaca repens

Fig.10. Pistia Stratiotes

Fig.11. Ipomca aquatica

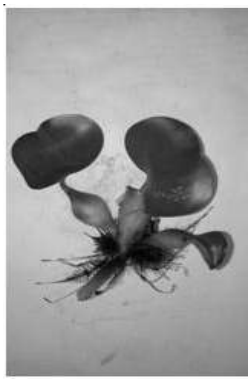

Fig.12. Eichhornia crassipes

Fig.13. Grass spp.

Conclusion

The study revealed that the water samples of near aquatic plant, the TDS, salinity, conductivity and temperature are found slightly lower and dissolved oxygen is higher than the sample where aquatic plant is absent and also the tank which is fully covered by aquatic plant. Due to aquatic plant cover the Telibandha Talab has low TDS, salinity and conductivity and good governs by DO. The other hand Mahant Talab has high TDS, salinity and conductivity and Biological Oxygen Demand (BOD) is common in this tank, because the tank is fully covered by aquatic plants. So, specific variety of aquatic plants may be very useful for purifying the polluted water to certain level. The main problem with the aquatic plant is it grows very fast so it is not controlled regularly it will cover the whole surface area of the water body.

Acknowledgement

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