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RESEARCH ARTICLE

Water quality of ponds in Allahabad city

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SUMMARY : Water is very precious for every living organism on this earth. The present study was done to focus on parameters of the different ponds in Allahabad city which is one of the fresh sources of water. The samples were collected for three months with 15 days interval (Jan. 2012 to March 2012) from four different sites *viz.*, Chaka, Mundera, Dubey and Dadri. Sampling and analysis were carried out according to the guidelines provided. The result obtained from this experiment will help us that the pond at Mundera (P_2) had the highest pollution level than the other ponds. It may be attributed due to increased intensity of turbidity and BOD, less amount of DO, nitrogen comparable to other ponds.

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The World Health Organization (WHO, 2002) estimates 1.7 million deaths and 54.2 million Disability Adjusted Life Years (DALYs) lost worldwide per year due to unsafe water, hygiene and sanitation. In India more than a million child deaths per year results from waterborne diseases like diarrhea (Parikh *et al.*, 1999). According to NWP (2002), drinking water needs of human beings and animals should be the first priority on any available water. The availability of safe and reliable sources of water is an essential pre-requisite for the establishment of a stable community. The hydrobiological cycle stores about 0.6% of water as ground water and accounts for 25% of our fresh water (Mahapatra and Mishra, 2005). Due to several anthropogenic activities ground water is found to be contaminated with heavy metals like arsenic, fluoride. In the north eastern part of India, surface water from ponds and rivers comprised the traditional water supply source.

Water is the most delicate part of the environment which is essential for human and industrial development. In the last few decades the demand of fresh water rises tremendously due to increasing population and rapid industrialization (Yisa and Jimoh, 2010). At the same time the pace of fresh water deterioration by anthropogenic activities is coupled with the ever-growing demands of water resources (Charkhabi and Sakizadeh, 2006). Due to the addition of industrial effluents containing organic pollutant and heavy metals into the river water the quality of water is deteriorating. The natural and anthropogenic metal contamination in aquatic ecosystem leads to the need of characterizing their impact on environment (Mary-Lou and Taillefert, 2008).

The lakes have received much attention in ecological studies in relation to nutrient enrichment and algal blooms. However, the domestic land excavated ponds, though small in size, but large in numbers in certain regions are among the most human influenced systems, as well as most vulnerable. These ponds are important as water sources for drinking and irrigation in rural areas. The water quality of the domestic ponds is influenced by the land use practices in the immediate neighbourhood. According to Akasaka *et al.* (2010) macrophyte diversity and water quality of 55 ponds in western Japan were related to land use and morphometric variables. Soni and

Bhatt (2008) have described the degradation of an urban pond in Gujarath, India due to sewage disposal. The pond has become unfit for use due to proliferating algae, macrophyte and pathogens. Similar studies on changing water quality of ponds in India have been reported by many authors (Bhuiyan and Gupta, 2007, Upadhyay *et al.*, 2010).

The effect of drinking contaminated water results in thousand of death every day, mostly in children below 5 year in developing countries (WHO, 2004) in addition, disease caused through consumption of contaminated water, and poor hygiene practices are leading cause of death among children worldwide after respiratory (WHO, 2003). Thus, lack of safe drinking water supply is associated with high morbidity and mortality from excreta related disease. It is estimated that 80% of all illness in developing countries is related with water (WHO, 2004). Globally 1 billion people rely on unsafe drinking water sources. Waste water must be treated before its discharge into water stream to limit the nutrients value. Recycling of nutrients can be checked through harvest nitrogen and phosphorus should be removed from the source. Algal bloom should be removed upon their death and decompose. Algal food web should be disrupted to stimulate bacterial multiplication. Algal growth can be controlled by limiting the dissolved nutrients most suitable feasible and effective method involve the use of chemicals to precipitate additional phosphorus such precipitants include alum, lime, iron and sodium aluminates.

EXPERIMENTAL METHODOLOGY

The samples were collected from the different ponds located at the different sites of Allahabad city during January to March 2012. Samples were collected from four selected ponds of Allahabad city. The locations are mentioned below:

- Pond (P_1) - Chaka
- Pond (P_2) - Mundera
- Pond (P_3) - Dubey
- Pond (P_4) - Dadri Nagar

Table A : Dates on which the samples were collected

Sampling date	Denoted by
I Sampling = 16 Jan. 2012	D_1
II Sampling = 31 Jan. 2012	D_2
III Sampling = 15 Feb. 2012	D_3
IV Sampling = 01 March 2012	D_4
V Sampling = 16 March 2012	D_5

EXPERIMENTAL FINDINGS AND DISCUSSION

Comprises of experiment which was laid out in different ponds of Allahabad during the period January 2012 – March 2012-05-29.

The climate of Allahabad is more or less dry. May and June are the hottest months of the year. Dust storms and hot waves are coming during summer. Rain starts mostly from the third week of June and continues till October, winter starts from mid of October. The most chilling months are December and January. In general, the climatic conditions are beneficial to health.

Table 1 : Sampling analysis : Methods used for analysis of physico-chemical parameters of ponds of Allahabad

Parameter	Method
pH	Digital conductivity (1958)
Bio-chemical oxygen demand (BOD)	Wrinkle's method
Dissolve oxygen (DO)	Wrinkle's method
Turbidity	Turbidity method
Total hardness	Titration method
Electrical conductivity	Digital conductivity meter (1922)
Chloride content	Titration method (1976)
Sulphates	Turbidity meter
Nitrogen	Total kjeldahl nitrogen

pH:

Value in 1 day maximum was 7.83 at Mundera (P_2) and minimum was 7.7 at Chaka (P_1). After 15 days maximum was 7.89 at Mundera (P_2) & minimum was 7.40 at Dadri (P_4). After 30 days maximum was 7.83 at Dadri (P_4) and minimum 7.74 at Dubey (P_3). The pH values were non- significant due to no variations and no difference between sites and interval of time. (Sharma and Dubey, 2011) pH is an important limiting chemical factor for aquatic life. If the water in a pond is too acidic or basic, the H+ or OH- ion activity may disrupt aquatic organisms' biochemical reactions by either harming or killing the stream organisms. The water found in ponds of Allahabad is alkaline in nature.

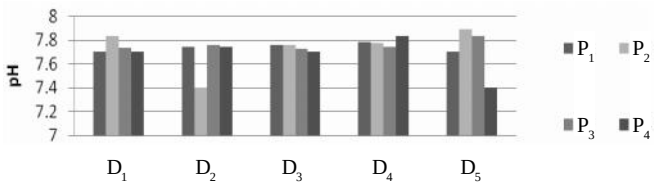

Fig. 1 : Effect of pH on the different pond of Allahabad city

E.C. :

Value in 1 day maximum was .94 at Chaka (P_1) and minimum was .60 at Dubey (P_3). After 15 days maximum was .95 at Chaka (P_1) and minimum was .60 at Mundera (P_2). After 30 days maximum was .72 at Chaka (P_1) and minimum was .44 at Dubey (P_3). (Gupta *et al.*,2009) E.C values were

found to be significant due to sites and different days of interval. The value of E.C is less from standard value of BIS & WHO. Electrical conductivity is a measure of how well water can pass an electrical current. It is an indirect measure of the presence of inorganic dissolved solids such as chloride, nitrate, sulphate, phosphate, sodium, magnesium, calcium, iron and aluminium. The presence of these substances increases the conductivity of a body of water. Organic substances like oil, alcohol, and sugar do not conduct electricity very well, and thus have a low conductivity in water.

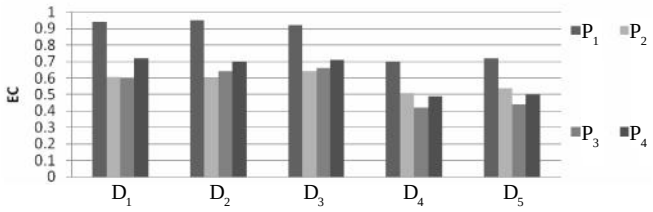

Fig. 2 : Effect of EC on the different pond of Allahabad city

Turbidity :

Turbidity value of ponds in Allahabad city in 1 day maximum was 9.9 at Mundera (P_2) and minimum was 6.9 at Chaka (P_1). After 15 days maximum was 11.8 at Mundera (P_2) and minimum was 8.3 at Chaka (P_1). After 30 days maximum was 11.6 at Dadri (P_4) and minimum was 7.5 at Chaka (P_1). The values of turbidity were not significant due to no variation & no difference between sites and interval of time. (Hameed *et al.*, 2010). The value of turbidity is exceeding from the standard value of BIS and WHO. However, higher levels of turbidity pose several problems for stream systems. Turbidity blocks out the light needed by submerged aquatic vegetation. It also can raise surface water temperatures above normal because suspended particles near the surface facilitate the absorption of heat from sunlight.

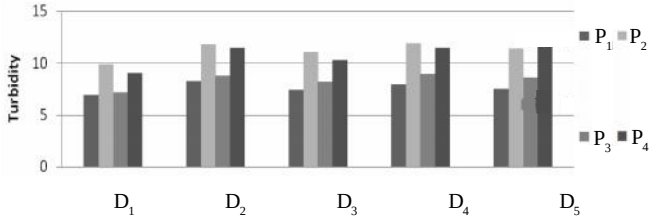

Fig. 3 : Effect of Turbidity on the different pond of Allahabad city

DO :

DO value of ponds of Allahabad in 1 day minimum was 4.5 at Mundera (P_2) and maximum was 9.5 at Dubey (P_3) After 15 days minimum was 4.5 at Chaka (P_1) and maximum was 9.2 at Dadri (P_4). After 30 days minimum was 2.8 at Mundera (P_2) and maximum was 7.0 at Dubey (P_3) . (Agrawal, 1976; Bagde, 1985). The DO values were found to be significant due to sites and different days of interval. The DO values were below the standard value of BIS and WHO. The DO value is less in ponds of Allahabad due to high temperature and over fertilization of water plants by run-off from farm fields containing phosphates and nitrates which may be hard for the aquatic life living in it.

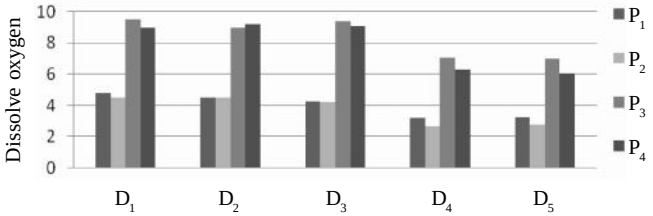

Fig. 4 : Effect of Dissolve oxygen on the different pond of Allahabad city

BOD :

BOD value of ponds of Allahabad in 1 day maximum was 7.8 at Dubay (P_3) and minimum was 2.8 at Mundera (P_2). After 15 days maximum was 7.6 at Dadri (P_4) and minimum was 2.8 at Mundera (P_2). After 30 days maximum was 5.4 at Dubey (P_3) and minimum was 1.2 at Mundera (P_2). (Agarwal, 1976; Bagde *et al.*, 1985). The BOD values were found to be significant due to sites and different days of interval. The BOD value is exceeding from the standard value of BIS and WHO. The BOD value is high in ponds of Allahabad due to high temperature and algal bloom in ponds and water hyacinth covered the whole pond so no sunlight can penetrate in the pond so it is harmful for the aquatic life present in that pond.

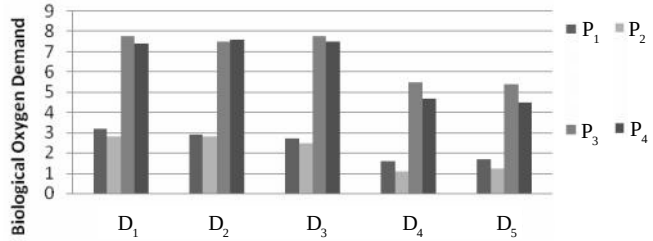

Fig. 5 : Effect of Biological oxygen demand on the different pond of Allahabad city

Total hardness:

Total hardness value of ponds in Allahabad city in 1day maximum was 284 at Dadri (P_4) and minimum was 224 at Chaka (P_1). After 15 days maximum was 282 at Mundera (P_2) and minimum was 228 at Chaka (P_1). After 30 days maximum was 260 at Mundera (P_2) and minimum was 210 at Chaka (P_1). (Ujjania and Multani, 2011) The values of total hardness is significant due to site but not significant due interval of time. The value of total hardness is below the standard value of BIS and WHO. The hardness of a water is governed by the content of calcium and magnesium salts (temporary hardness), largely combined with bicarbonate and carbonate and with sulfates, chlorides, and other anions of mineral acids (permanent hardness). This

concentration of hardness helps to protect fish against harmful effects of pH fluctuation and metal ions. Ponds with low hardness can be treated with lime. The value of total hardness is less in ponds of Allahabad.

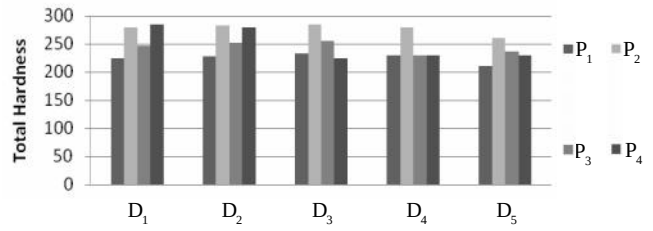

Fig. 6 : Effect of Total hardness on the different pond of Allahabad city

Chloride :

Chloride value of ponds of Allahabad in 1 day maximum was 16.8 at Dadri (P_4) and minimum was 12.0 at Dubey (P_3). After 15 days maximum was 16.4 at Chaka (P_1) and minimum was 12.1at Dubey (P_3). After 30 days maximum was 16.5 at Dadri (P_4) and minimum was 11.2 at Dubaey (P_3) (Nayal *et al.*, 2008). The value of chloride is significant due to site but not significant due to dates. The value of chloride is below the standard value of BIS andWHO. Free chloride is toxic to fish and aquatic organisms, even in very small amounts.

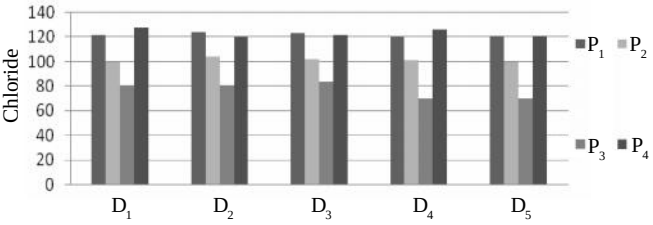

Fig. 7 : Effect of Chloride on the different pond of Allahabad city

Sulphate :

Sulphate value of ponds of Allahabad in 1 day maximum was 22.5 at Dubey (P_3) and minimum was 16.6 at Mundera (P_2). After 15 days maximum was 24.7 at Dubey (P_3) and minimum was 18.1 at Mundera (P_2). After 30 days maximum was 32.0 at Dubey (P_3) and minimum was 22.5 at Mundera (P_2) (Garg *et al.*, 2010).The sulphate values were found to be significant due to sites and different days of interval. The value of sulphate is below the standard value of BIS and WHO. Sulphate has a short term effectiveness is often misused and overused. Sulphate remains in the pond and does not biodegrade. Sulphate can be toxic to fish and other organisms.

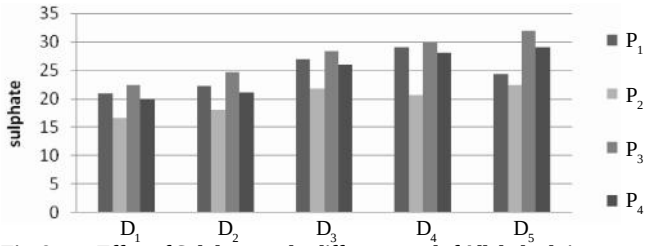

Fig. 8 : Effect of Sulphate on the different pond of Allahabad city

Nitrogen :

Nitrogen value of ponds of Allahabad in 1 day maximum was 2.8 at Dadri (P_4) and minimum was 2.5 at Chaka (P_1). After 15 days maximum was 2.8 at Mundera (P_2) and minimum was 2.6 at Dubey (P_3) and minimum was 2.0 at Chaka (P_1). After 30 days maximum was at Mundera (P_2) and minimum was 2.0 at Chaka (P_1). The nitrogen values were found to be significant due to sites and different days of interval. (Mukhopadhyay *et al.*, 2004). The value of nitrogen is below the standard value of BIS and WHO. Nitrate is non-toxic to fish in small quantities and is used by plants and other organisms in the pond for food.

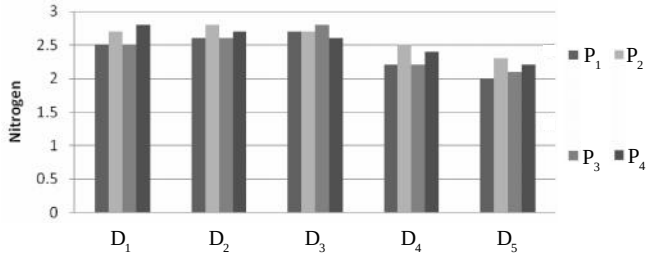

Fig. 9 : Effect of Nitrogen on the different pond of Allahabad city

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