

Studies of Physicochemical Parameters of Water from Two Ponds of Dhanbad City, Jharkhand, India

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ABSTRACT- Dhanbad is one of the densely populated city of Jharkhand. Mining industries and other small industry attract many people every day. Surface and ground water sources are the main source of water in the city. People from lower economic background in Dhanbad city depends majorly on two ponds mainly Bekarbandh pond and Polytechnic Pond for their day-to-day work like bathing, cleaning of utensils, washing of clothes etc. They are also using this water for drinking purposes. In the present study the physicochemical parameters of the above mentioned two ponds have been studied. It has been found that in both the ponds, the parameters of the water exceed the IS/BIS 10500:1991 standards and hence considered unsuitable for drinking.

Keywords: Surface Water, Pond Water Pollution, Physico-Chemical Parameters, Drinking Water.

Introduction- Freshwater sources are important for industry, agriculture, and human existence. Human health is directly linked with the quality of water. Good quality of drinking water is one of the basic requirements of human physiology. Existence of mankind depends vastly on the availability of good water for drinking (Lamikarna A.1999). Water quality includes the physical, chemical, and biological characteristics of water (Diersing N,2009). Due to increase in population and economic development, the demand of freshwater has been increased rapidly since the last century (Postel S., 1992). Moreover, discharge of effluents from the industries, domestic sewage and disposal of solid wastes causes the freshwater to become polluted, which in turn create health problems. (Raja et.al, 1999). Due to this, the number of cases of water borne diseases are increasing day-by-day (Mishra A, Bhatt V, 2008). Untreated freshwater contains many salts and ions etc. which if used for drinking may lead to severe water borne diseases (A. Mishra, et.al. 2010). According to an estimation of the world Health organization (WHO), about 4 billion cases of diarrhea occurs in the world annually, which lead to about 2.2 million deaths.

Coal mining adversely affects surface water and ground water. The surface mining activities has affected the hydrology of the nearby area in many ways. Various mining activities like presence of active and abandoned coal mines, dumps of mining wastes, coal washeries, thermal power plants, cooking coal plants and steel plants result into significant water pollution (Kumari B. et.al, 2014). Due to these mining activities, water is becoming unsuitable for drinking and irrigation and also altering the biological communities. Discharges from the mining areas are enriched with high TSS, TDS, sulphates, and sometimes very low pH value.

Like other developing cities of India, Dhanbad is also facing a major problem of increasing population. Even though the city is getting water from Jamadoba and Maithon dam yet a major population of the city depends on ground water as their source of water (Kumari B. et.al, 2014). There were few ponds inside the Dhanbad city

which were widely used for domestic purposes. The water from these ponds is used by many people for their drinking and other household purposes. However, human activities like dumping organic wastes and the process of cultural eutrophication, increases the level of pollution of these ponds. The present work basically focuses on calculating the water quality Index of these ponds and obtaining the pollution load in the pond water.

Materials and Methods, Study area- Bekarbandh pond is situated on the side of national highway 32, known as polytechnic road or mandir road of Dhanbad Jharkhand, India). The pond is situated near district jail and circuit house garden. The pond is surrounded by Manoramnagar colonies. The pond is famous for fishing, recreational cultural, and devotional activities. Nearby people use the water for domestic purposes too.

Polytechnic pond is also one of the major ponds of Dhanbad city, Jharkhand, India. It is situated near the government polytechnic college, Dhanbad. People of nearby villages uses the pond water for domestic purposes as well as washing of clothes and bathing of animals.

Sampling - Sampling was done three times in the year from August 2012, June 2013 for monsoon, post monsoon and pre monsoon times. Grab sample techniques is used for collection of samples from the sites and carried to the laboratory for further study.

Methods- The following physicochemical parameter were analyzed as per guidelines provided by IS/BIS (10500:1991) summarized in table 1.

Table 1: Physicochemical parameters and their methodologies

Sl. no	Physicochemical parameters	Methodologies
1	pH	Electronic method
2	Chloride	Argentometric Titration method
3	Conductivity	Electronic method
4	Total Dissolved Solids	Evaporation Dish method
5	Total Hardness	Titration by EDTA
6	Total Alkalinity	Titration by dil HCL
7	Dissolved Oxygen	Winkler's method
8	Biological oxygen demand	5-Day BOD method

Results & Discussions

Table 2 : IS/BIS standards 10500/1991 for drinking water

Sl no	Parameters	Requirement (Desirable limit)
1	pH	6.5-8.5
2	DO (mg/l)	5
3	TSS (mg/l)	500
4	Total Hardness (mg/l)	300
5	Turbidity	05
6	Chloride (ppm)	250
7	Alkalinity (mg/l)	200
8	TDS (mg/l)	300

Table 2 : The Results of two ponds are summarized.

Sl. no	Parameters	Bekarbandh pond			Polytechnic Pond		
		Monsoon (August 2012)	Post Monsoon (December 2012)	Pre-Monsoon (April 2013)	Monsoon (August 2012)	Post Monsoon (December 2012)	Pre-Monsoon (April 2013)
	pH	7.9	7.5	7.4	7.2	7	6.8
	Chloride (ppm)	1942.98	2345	2210	2428.73	1472	1162
	Conductivity (μ s)	442	398	413	460	373	430
	Total Dissolved Solids (mg/l)	714	720	735	658	672	695
	Total Hardness (mg/l)	190	245	250	220	196	210
	Total Alkalinity (mg/l)	210	295	302	330	265	250
	Dissolved Oxygen	5.8	5.2	4.8	5.4	5	4.6
	Biological oxygen demand	3.5	3.5	3.7	1	2.4	2.7

pH- pH of water samples is affected due to the reaction of carbon dioxide as well as by the presence of various organic and inorganic solutes. Any change in the physio-chemical parameters results in an alteration in water pH. (Wetzel R.G. et.al.,1975). pH is considered as one of the most vital attributes of any aquatic ecosystem. This is basically due to the fact that all biochemical activities depend on the water that is present in the surrounding. The pH of the pond water is slightly alkaline, this may due to the sewage discharge by the surroundings.

Conductivity- Electrical conductivity is a measure of the ability of the water to transmit electric current and is a useful tool to predict the purity of the water. The conductivity falls in the region of 375-450 μ s. The conductivity is comparably higher in bekarbandh pond than that of polytechnic pond. This may be due to the higher concentration of various cations like sodium, magnesium and calcium and anions like chloride, phosphate and nitrate that had been coming from the sewage or other domestic wastes (Chouhan R.et.al., 2012).

Total Hardness- Hardness is a very important parameter that helps in minimizing the toxicity of various poisonous elements. The hardness of water increases as the calcium and magnesium ions in water increases. (Bhatt L.R,1995). The hardness of bekarbandh pond is found to be in the range of 190-250 mg/l and that of the polytechnic pond in the range 190- 220mg/l. The hardness is higher in Bekarbandh pond than that of polytechnic pond, although it is in the desirable range.

Total Dissolved Solids-The total dissolved solids in both the ponds are higher. It is in the range 714-720mg/l in bekarbandh pond and in the range 658-710mg/l in polytechnic pond. The maximum permissible limit for potable water according to WHO is 500mg/l. A higher value of TDS in drinking water leads to many diseases. Many of them are not water borne, rather occur due to presence of excess salts. (Sabata B.C,1995)

Dissolved Oxygen-Dissolved oxygen is one of the key factors which determines the biological process going on in water samples. In present study, the maximum concentration of dissolved oxygen is in the monsoon season, which favours solubility of oxygen in lakes. In the pre monsoon and post monsoon season due to low rainfall the parameters get lowered.

Biological Oxygen Demand-BOD determines the pollution load in water. Higher the value of BOD, higher is the pollution. The BOD value is in the range of 3.5 to3.7 mg/l for bekarbandh lake and 1-2.4 for polytechnic lake. The BOD values are within the limit of WHO guidelines.

Total Alkalinity -Total alkalinity is the amount of basic salts in water samples. These are due to discharge of sewage, domestic waste water, washing of clothes and etc. The permissible limit for water sample is IS/ BIS 10500 is 200mg/l. But the alkalinity range in both the ponds are above 200mg/l. The range is higher during post monsoon season when there is less rain.

Chloride - The source of chloride in water sample are the salts that comes from municipal wastes. The permissible limit according to IS/BIS 10500 is 250 ppm. But both the ponds have an enormous increase in range of chloride content. This may due to sewage discharge, animal and human bathing or other domestic activities.

Conclusion- The different physico-chemical parameters of two different ponds of Dhanbad city were studied for three seasons i.e. monsoon, pre monsoon and post monsoon. After getting the results, the parameters are compared with the desirable limit certified by the Indian Standards for drinking water (IS/BIS 10500:1991). By comparing the results, we found that the pH of the water samples is slightly acidic in nature. The total hardness is much lower than the permissible limit. The parameters like dissolved oxygen (DO), Total dissolved solids, chloride content and biological oxygen demand (BOD) are much higher than the permissible and desirable limit. During the monsoon season although the parameters shift towards the desirable limit but the pollution load increases during the post monsoon and monsoon season.

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