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Correlation Study on Physico-Chemical Parameters for Assessment of Water Quality of Banegaon Dam District Jalna (M.S.) India.

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Abstract

Present investigation was carried out with the aim to assess of water quality using physico-chemical parameters of Banegaon Dam Dist. Jalna. Banegao Dam is the main source of drinking water and irrigation for nearby villages. Dam is situated 40 km away from Jalna City. For this purpose, water samples were collected from surface and 5 m depth from two stations selected in Banegaon dam. The physico-chemical parameters such as water temperature, dissolved oxygen, conductivity, salinity, p^H, total hardness, calcium, magnesium, nitrate and nitrite were analyzed in the water samples. Many Villages around the dam use water of dam for drinking, washing clothes and domestic animals, agricultural irrigation purposes. Based on the values of obtained physico-chemical parameters it can be concluded that the Banegaon dam water quality was good and show little pollution problems. The results obtained from the present study shall be useful in future management of the Banegaon Dam.

Keywords: Water quality, Physico-Chemical Parameters, Banegaon Dam.

Introduction

Two- thirds of the earth surface is covered by water. Water is very important to life; without water our life cannot move. Availability of quality freshwater is one of the most critical environmental issues of the twenty first century. Various Dams, Lakes and rivers are an important water resource for domestic and agriculture in both rural and urban parts of India. The chemical composition of this water is very important criteria that determine the quality of water. Water quality is very

important and often degraded due to agricultural, industrial and human activities. Even though the natural environmental processes provide by means of removing pollutants from water, there are definite limits. It is up to the people to provide security to protect and maintain quality of water. Drinking water with good quality is very important to improve the life of people and to prevent diseases.

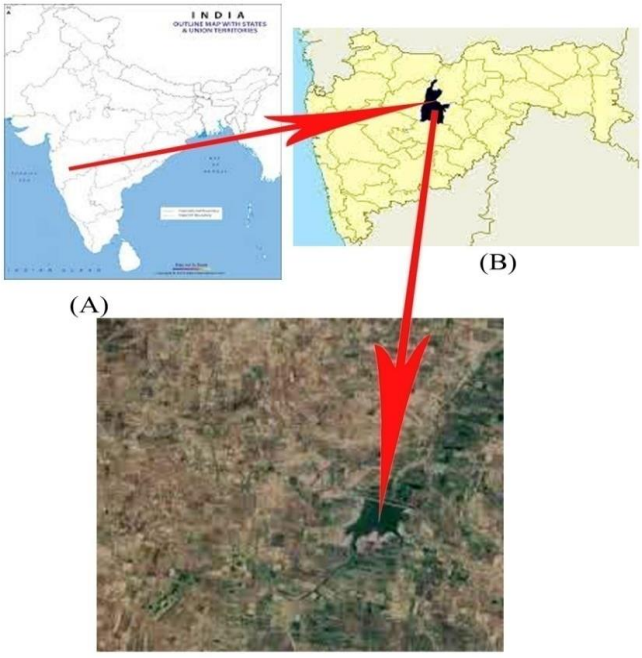
A survey made by NEERI showed that 70% of India's fresh water is polluted by industrial effluents. Aquatic pollution has resulted in the disintegration of flora and fauna. According to Philip Weinberg and Jadhav [1,2] types of water pollution is due to inorganic pollutant: enrichment with phosphate, sulphate, nitrate, trace element like Hg, Cd, Pb, As, Se, Zn etc. The improper management techniques have to lead to the contamination of ground water in urban areas [3]. Divya *et al.* [4] reported that to safeguard the long termed sustainability of ground water resources, the quality of water needs to be continually monitored. Shrivastava *et al.* [5] reported that the physico-chemical characteristics of river water changed due to addition of sugar factory effluents into the river water and become unfit for human consumption during crushing season. The present study deals with the assessment of water and on the basis of selected parameters, water quality index is determined of surface water of Banegaon Dam.

Methodology

Two different sites were selected for the collection of water samples. The samples were collected in sterilized polythene bottles of one litter capacity. Monitoring was performed during June 2018 to May 2019. For unstable parameters such as temperature, electrical conductivity (EC), pH, and dissolved oxygen (DO) were measured at the sampling sites. Samples were brought to the laboratory for analysis of other physico- chemical parameters like total hardness, total alkalinity, sodium, calcium, magnesium, chlorides, nitrate and biochemical oxygen demand (BOD). The parameters were compared according to the standard methods by APHA [6].

Study Area

Banegaon Dam is located 20^0 06′ 50.9"| N and 75^0 50′ 12.5"|E Latitude and longitude respectively at Banegaon, Tehsil Bhokardan Dist. Jalna 35 Km away from Jalna City. This Dam is main source for nearby villages for drinking, agricultural irrigation and fish farming.



Map Showing Study Area (A) Map of India
(B) Map of Maharashtra and jalna District
(C) Map of Banegaon Medium Project

Results and Discussions

Temperature

Temperature varied from 17 to 36°C for the period spreading from June to November 2016. The peak temperature occurred in July and August while the lowest temperature was recorded in December. During the intermediate period a steady decline in temperature was evident, this corresponds to the atmospheric thermal variations. The water of the dam at sampling site 1 was contaminated with sewage effluents of the surrounding villages and sampling site 2 was domestic sewage which was rich in organic matter which is biologically active and thus increases the temperature of water. Higher temperature was recorded at site 1in July and August. Here water is contaminated with highly reactive chemical discharge by factories nearby dam which generate heat and thus rise in temperature.

Electrical conductivity:

Water capability to transmit electric current is known as electrical conductivity and serves as tool to assess the purity of water [7]. This ability depends on the presence of ions, their total concentrations, mobility, valence, relative concentrations, and temperature of measurement [8]. The electrical conductivity ranged from 2.17 to 3.49Ω/cm. The highest electrical conductivity was reported during winter 3.49Ω/cm due to addition of domestic sewage into the dam and lowest in monsoon 2.17Ω/cm because of water dilution by rainy water.

pH:

pH is most important factor in water quality. The fluctuations in surface water pH indicate the buffering capacity of total alkalinity. During this study, pH values were ranged from 7.34 to 8.15 that indicate slightly alkaline nature of water body which was within the standard limit, i.e.6.5-8.5 [9].

Dissolved Oxygen:

DO is one of the most important parameter. Its correlation with water body gives direct and indirect information e.g. bacterial activities, photosynthesis, availability of nutrients, stratification etc. [10]. In the progress of summer, dissolved oxygen decreased due to increase in temperature and also due to increased microbial activities [11, 12]. The high DO in summer is due to increase in temperature and duration of bright sunlight has influence on the percentage of soluble gases (O_2 and CO_2). During summer the long days and intense sunlight seem to accelerate photosynthesis by phytoplankton, utilizing CO_2 and giving off oxygen. This possibly accounts for the greater qualities of oxygen recorded during summer [13]. DO in sample is measured titrimetrically by Winklers method after 5 days incubation at 290K. The difference in initial and final DO gives the amount of oxygen consumed by the bacteria during this period. This procedure needs special BOD bottles which seal the inside environment from atmospheric oxygen.

Alkalinity:

Total alkalinity was higher in summer and lower in winter at both the sites. In summer higher temperature increases the decomposition of organic matter, liberating CO_2 in water. In a CO_2 rich aquatic medium, there is dissociation of bicarbonates into carbonates and CO_2 is inhibited. Presence of high bicarbonate contents increases the total alkalinity of water. During winter, due to slow decomposition rate of organic matter, carbon dioxide production is less. Furthermore, due to clear days, photosynthetic activities of plants increase, increasing the utilization of CO_2. All these factors collectively depletes water of its CO_2 content. To replenish the aquatic medium, bicarbonates present in it tend to dissociates to provide CO_2 to the medium. In the process alkalinity which is mainly because of bicarbonates declines. Similar observations were made by Munwar *et al.* [14] Seenayya [15], Hennan and Young [16]. Alkalinity was high at both the sampling sites. This is because of decomposition of organic matter present in the sewage.

Total Hardness:

The total hardness of water is not a specific constituent but is a variable and complex mixture of cations and anions. Principally the water hardness is changed by ions such as calcium and magnesium. The total hardness from the water samples at Banegaon dam ranged between 315 to 350mg/L. The highest amount of total hardness in the water was recorded during monsoon was 350mg/L due to presence of high content of calcium and magnesium in addition to sulphate and nitrate in the sewage waste added during monsoon [17]. The lowest amount of total hardness was recorded during winter season due to low concentration of calcium and magnesium [18].

Sodium:

Sodium is measured with the help of flame photometer. The instrument is standardized with the known concentration of potassium solution, in the range of 1mg to 5mg/L. The sample having higher concentrations is suitably diluted with distilled water and the dilution factor is applied to the observed values.

Magnesium:

It is measured by complexometric titration with standard solution of EDTA using Eriochrome black T as indicator under the buffer conditions of pH 10. The buffer solution is made from Ammonium Chloride and Ammonium Hydroxide. The solution resists the pH variations during titration.

Calcium:

Calcium is the most abundant substances of natural water. In aquatic environment calcium serves as one of the

micronutrients for most of the organisms [19]. Calcium concentration ranged between 55.80mg/L to 70.30mg/L in pond water and 18.70mg/L to 40.60 mg/L in the laboratory water.

Nitrates:

Comparatively higher concentration of nitrates was found during winter than in summer. Munwar [14] also observed a similar trend who suggested that in summer, denitrifying bacteria break up nitrates into nitrites and ammonia. In winter, however the activities of these bacteria convert free ammonia into nitrites and the matter is further oxidized to nitrates. Both the sites show nitrates in good amount because of sewage discharge.

Chlorides:

The Chloride concentration or salinity serves as an indicator of pollution by sewage. People accustomed to higher chlorides in water are subjected to laxative effects [20]. In the present analysis, chloride concentration was found in the range of 245.10 mg/L to 290.5 mg/L in dam water. In laboratory water the minimum quantity was recorded as 112. 6 mg/L in the month of March and the maximum salinity was observed as 130.5 mg/L in the laboratory tap water in the month of July. The pattern has also been recorded by Lendhe *et al.* [21]. This again implies that all the water studied was all of satisfactory quality in their chloride contents and that chloride does not contribute to problems of taste in some of the waters.

Biochemical Oxygen Demand:

BOD is dissolved oxygen required by micro-organisms for aerobic decomposition of organic matter present in water. Jain and Dhanija [20] have considered BOD as an important parameter in aquatic ecosystem to establish the status of pollution. The observations of present study showed that highest value of BOD 3.20mgl^{-1} during the June and lowest1.50 mgl^{-1} in January. Seasonally, the BOD was highest during summer. High BOD during late summer or early rainy season may be due to the presence of several microbes in water bodies which accelerates their metabolic activities with the increase in concentration of organic matter in the form of municipal and domestic waste pouring into the dam with run off. The BOD of unpolluted water is less than 1.00mgl^{-1} moderately polluted water 2.00- 9.00mgl^{-1} while heavily polluted water have BOD more than 10 mgl^{-1}. The BOD in the present study fluctuates between 1.50 and 3.10 mgl^{-1} indicating dam status as moderately polluted.

Conclusion

From the above study, it can be concluded that almost all the parameters are within the prescribed limit of WHO and BIS standards. The assessment of water quality is an important factor to assess of pollution levels. The environmental factors and seasons are responsible for the variations in the physico-chemical factors of the Banegaon Dam. Finally it is concluded that the ecological as well as biological environment of Banegaon Dam is free from large pollution and water is quite suitable for drinking purpose, and also for agricultural and fish culture activities.

Conflicts of interest: The authors stated that no conflicts of interest.

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