Studies of Physico-Chemical Status of the Sirpur Talab at Indore, India

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Abstract— In India, most of the population is dependent on surface water as the only source of drinking water supply. Water sources available for drinking and other domestic purpose must possess high degree of purity, free from chemical contamination and micro-organism. The fresh water pollution has long been discussed by life scientists. Sirpur Talab, a small Lake located in the outskirts (Dhar Road) of about 6-8 kms away from the city of Indore, India. The Present study was attempted to investigate the Physico-chemical variability of Sirpur talab such as Water Temperature, Transparency, Turbidity, Total Dissolved Solids, pH, Dissolved Oxygen, Total Hardness, Chlorides, Alkalinity, and Sulphate. In the present study water samples were collected in every season between Januarys to December for two different stations of the pond. By observing the result it can be concluded that the parameters which showed the DO (6.9-12.8mg/l), total hardness (53-98mg/L), calcium (28-44 mg/L), magnesium (20-320 mg/L) etc. The results revealed that most of the water samples were out of limited; according to the WHO standards. This work is intended to determine the overall water quality of the Sirpur talab.

Key words: Transparency, Alkalinity Hardness, seasonal variation, Dissolved Oxygen (D.O)

I. INTRODUCTION

Fresh water is one of the most important natural resources crucial for the survival of all living beings. It is even more important for human beings as they depend on it for food production, industrial and waste disposal, as well as cultural requirements [1].

Lakes and ponds are important fresh water habitats throughout many regions of the world; although the amount of water in them constitutes only a minute fraction of the total freshwater resource on earth [5].

India with declining freshwater resources has an acute shortage of potable water of acceptable quality. The socio-economic growth of a region is severely constrained by non-availability of safe drinking water; keeping this in view, Government of India had constituted a Water Technology Mission for drinking water in 1987. The task of planning and management of water resources can be very effectively carried out on a basin wise structure for all infra, intra and interstate as well as international rivers using scientific techniques.

Analysis of water availability and human use suggest that human withdrawal of the total available freshwater resource presently amongst to approximately 50%. The expected population increase coupled with economic development and changing life styles over the next 25 year will substantially increase the demand for fresh water resources like lakes and ponds the availability of freshwater for human consumption will be one of the great issues for human kind in the present century [6]. In spite of the great importance to humans, to access the freshwater of high quality, freshwater systems have been misused for many years. Small lakes and ponds have been drained or filled into extend arable land, regulated to reduce water level fluctuations, used as dumps for an array of anthropogenic wastes ranging from untreated sewage to synthetic substances and many natural populations of commercially important freshwater species have been over exploited [8,4].

The problem of water pollution is now posing a serious problem in India. In many part of India, inland freshwater bodies are the main sources of drinking water for the rural and urban population. Deterioration of these water sources due to contamination with pathogens, parasites, pollutants creates many health problems to the persons consuming this water.

The groundwater is believed to be comparatively much clean and free from pollution than surface water. But prolonged discharge of industrial effluents, domestic sewage and solid waste dump causes the groundwater to become polluted and created health problems [9]. The rapid growth of urban areas has further affected groundwater quality due to overexploitation of resources and improper waste disposal practices. Hence, there is always a need for and concern over the protection and management of surface water and groundwater quality [14]. Heavy metals are priority toxic pollutants that severely limit the beneficial use of water for domestic and industrial application [15]. The lakes have complex and fragile ecosystem, as they do not have self-cleaning ability and therefore readily accumulate pollutants [17]. The physicochemical parameters and trace metal contents of water samples from Delhi were assessed [18]. In India, man-made ponds have been used as an alternate source of drinking water and employed for washing of clothes and bathing purposes by washer men and local people [11]. Rapid growth of urban areas directly or indirectly affected existence of the ponds such as over exploitation of resources and improper waste disposal practice [10]. The physico-chemical parameters have important significance in determining the trophic status of aquatic habitats [16].

Physicochemical factors are very important in estimating the constituents of water and concentration of pollutants or contaminant. The chemical and biological factors are interrelated and interdependent. The physical factors include water movement, light, temperature, turbidity and suspended solids. The chemical factors include pH, carbonates, bicarbonates, oxygen, carbon-dioxide cations and anions and dissolved organic materials. The main object of the physico-chemical analysis of water is to determine the status of different chemical constituents, which are present in the natural and disturbed aquatic ecosystem. The quality of water may be affected in various ways due to pollution. The pollution manifests itself either by altering the existing elements in the water or by generating new substances (e.g. Ammonia nitrates).
The present investigation aims towards analysis of the water quality of the Sirpur talab, with special reference to Dissolved oxygen, Total Hardness, Magnesium Hardness, Sulphate and Chlorides.

II. MATERIALS AND METHODS

In one year's study period 2010-11, the Water Samples from Sirpur talab were collected from two different Sites at fixed date and time. The Water samples were immediately brought in to Laboratory for the Estimation of various Physico-chemical Parameters.

A. Preparation of water samples
The sample were collected from all the stations at 09.00 am to 11.00 AM in both the seasons for physico-chemical examinations, different methods of collection and handling were adopted based on the standard procedures [12]. The samples were collected in plastic canes of five liters capacity without any air bubbles. The instruments were used of accuracy. The temperatures of the samples were measured in the field itself at the time of sample collection.

B. Physico-chemical analysis
Analysis was carried out for various water quality parameters such as Water Temperature, Transparency and pH were recorded at the time of Sample Collection, by using Thermometer and Pocket Digital pH Meter. Dissolved Oxygen (DO) and alkannity was recorded by using portable water analysis kit. The estimation of total hardness, calcium factors are interrelated and interdependent. The calcium hardness, magnesium hardness, sulphates and chlorides were analyzed in the laboratory after immediately collecting samples. These parameters were measured in using Standard Method as prescribed by APHA (1992, 1998) [2, 3].

III. RESULTS AND DISCUSSION

The physico-chemical parameters of the above mention sites in Sirpur talab can be calculated and it is describe as bellow. The detailed observations for the Monthly fluctuation of Station I and II in all the physico-chemical parameters are recorded in Table and figure I and II.

A. Dissolved oxygen (DO) in mg/l
Dissolved oxygen in natural and waste water depends on the physical, chemical and biological activities in the water body. The annual range of dissolved oxygen varied at station-I and station-II as from 9.7 mg/l to 14 mg/l. The season wise analysis showed that Dissolved Oxygen maximum was recorded in the month of July and the minimum in the month of May.

B. Total hardness (TH) in mg/l
Hardness (mg/l) of water is mainly due to the presence of calcium and magnesium ion, and is an important indicator of toxic effect of poisonous elements. The total hardness at the two sampling stations during 2009-10. Total hardness varied from 47 mg/l to 98 mg/l. Lowest total hardness was recorded in the month of April. Highest was recorded in the month of June.

C. Calcium (Ca²⁺) in mg/l
Calcium is an important micronutrient in an aquatic environment. Hardness of the pond water is of considerable significance in connection with the discharge of the sewage and industrial effluent containing pollution, as indicated by variations in the concentration of the hardness of the water [13]. During the present study, the annual range of calcium was 28 mg/l to 44 mg/l respectively. The range was 28 mg/l to 44 mg/l, which is lowest in month of March. And highest value was observed in month of October.

D. Magnesium (Mg²⁺) in mg/l
Magnesium as co factor for various enzymatic transformations within the cell especially in the transphosphorylation in algal, fungal and bacterial cell [9]. During the present study, the annual range of Magnesium was 00.68 mg/l to 02.73 mg/l. In the present investigation it was found that maximum in winter season in the month of March and minimum in month of March.

E. Sulphate (SO₄²⁻) in mg/l
Sulphate is widely distributed in nature and may be present in natural waters. The main source of sulphur is the rocks present near the water bodies and biochemical action of anaerobic bacteria. During present study, the annual range of Sulphates in the water samples at 0.028 mg/l to 0.032 mg/l, which is lowest in month of November and highest in month of March.

F. Chloride (Cl⁻) in mg/l
Main sources of chloride in river waters are sediments, sewage and trade and industrial effluents, if present. Sewage bring with urine, which is rich in high in concentration. During present study, the annual range of Chloride ranged between 60.5 mg/l to 79.71 mg/l. In the present investigation 60.5mg/L lowest in month of November, and maximum 79.71 mg/L in the month of March. The chloride concentration serves as an indicator of pollution by sewage. People accustomed to higher chloride in water are subjected to laxative effects [16].

![Physico chemical Parameters](image-url)
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Fig. 2: Physico Chemical Parameters of Sirpur Talab (station-II)

Table 1: Physico Chemical Parameters of Sirpur Talab (Station I)

Table 2: Physico Chemical Parameters of Sirpur Talab (station II)

IV. CONCLUSION

This study provides an informative data and helps to understand the contamination of water and the influences the ecology of Pond. The quality of water is deteriorating day by day due to inflow of domestic sewage, municipal waste, agricultural runoff and effluents of organic waste of animal and human origin into the lake. However, analyzing pathogenic microorganisms alone limits the understanding of the poor water physico-chemistry impacts to humans only, thus excluding the role of microorganisms in assessing the ecological health status of freshwater ecosystems. The aim is to understand microbial responses to water physico-chemical changes along the catchment. At the end of the study, it is envisage that new knowledge of possible correlations of water physio-chemistry with and microbial abundance and activity were obtained and relevant recommendations towards the potential development of a microbial index to assess freshwater ecosystems will be made. In the present study it was found that physico-chemical characteristics of a few of the pond water samples crossed the maximum permissible limit, it was noticed that the physic-chemical parameters indicates balance of the Sirpur talab was disturbed. The study concluded that there is an urgent need of regular monitoring of water quality to govern the status and diverting the city sewage away from the lake to preserve the flora and fauna of this ecosystem.

V. RECOMMENDATION

There is a need of awareness among the local people to maintain the talab at least their optimum quality and purity levels. The onset of monsoon helps in diluting the pollutants but awareness and proper management practices such as planting trees around ponds, regularly recharging during summer period, removal of sediments from the bottom of talab, removal of floating debris from the pond surface, diversion of sewage discharge to proper disposal site and proper enforcement of law and policy might be very successful.

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