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Assessment of water quality in relation to physico-chemical parameters and heavy metal concentrations of Pentakli Dam (M. S.), India

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Abstract

The objective of the present study is to determine physico-chemical parameters and heavy metal concentrations in surface water of Pentakli dam. The physico-chemical parameters, temperature, pH, dissolved oxygen, total alkalinity, total hardness, chlorides, salinity and electrical conductivity and heavy metal concentrations Zn, Pb, Cu, Cd and As were determined seasonally from water samples collected from Pen Takli dam. Temperature, pH and total alkalinity was observed highest during summer than monsoon and winter season. The dissolved oxygen was found highest during winter than summer and monsoon season. The total hardness, chloride, salinity and electrical conductivity were observed highest during summer than monsoon and winter season. The heavy metal concentrations were highest during summer season than winter and monsoon season.

Keywords: Surface water, Pentakli dam, heavy metals, physico-chemical parameters

1. Introduction

Water is one of the abundantly available resources of nature, which has more exploited than any other resources by living organisms for the sustenance of life. Freshwater is used for industrial, household, agricultural, drinking, recreational and environmental activities. Any change in the aquatic ecosystem influence on the abiotic and biotic factors. Most of the fresh water bodies become polluted due to indiscriminate disposal of sewage, agricultural runoff, and human activities, domestic and industrial waste add in freshwater and which become unhealthy for agricultural and drinking purposes. The knowledge of these all factors is necessary for maintenance of an aquatic ecosystem. Therefore, it is necessary to check quality of drinking water at regular time interval because large number of population suffers from variety of water borne diseases due to polluted drinking water (Shinde, 2011) ^[18].

Chemical fertilizers, herbicides, pesticides, industrial and domestic waste have entered into water bodies and degrade the quality of water. Studies from several decades have showed that presence of metals in surface water is significantly higher than safe permissible limits. The problem increases due to their non-biodegradability, bio magnifications and bioaccumulation (Pitter, 1999; Lodhi *et al.*, 2006) ^[17, 13]. There are two main anthropogenic sources that pollute the water are deterioration of commercial waste product and fly ash produce due to burning of coal, which add Cu, Cr, Pb and galvanized metals (Al-Hiyaly *et al.*, 1988) ^[2].

Freshwater is an important natural resource, the increasing demands of freshwater for drinking, aquaculture, agriculture and industrial purposes. Hence analysing physico-chemical parameters and heavy metal concentrations is the first step to the monitoring of water quality of aquatic ecosystem. Management of aquatic ecosystem is important for conservation of habitat hence present study will be carried out to analyse physico-chemical parameters and heavy metal concentrations of Pentakli dam.

2. Materials and Methods

The water samples for physicochemical and heavy metal analysis were collected seasonally (summer, monsoon and winter seasons) from Pentakli Dam in Buldana district of Maharashtra state, India. The samples were collected in acid washed plastic bottles from of 5-10 cms depth. Temperature measurement was carried out directly on field by thermometer,

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pH was measured on pH meter. Separate samples were collected to measure dissolved oxygen (DO) in 250 ml bottles and dissolved oxygen was fixed by adding alkali reagent in the field. The samples were analyzed immediately after return to the laboratory. Physico-chemical parameters like alkalinity, O₂, total hardness, chloride, salinity, electric conductivity were determined seasonally during summer, monsoon and winter seasons (APHA, 1998) [3].

For the analysis of heavy metals (Zn, Pb, Cu, Cd and As) water samples were collected in plastic containers, which were thoroughly cleaned with nitric acid and rinsed with distilled water. Water sample is mixed with HNO₃ and preserved at 4^o C in a refrigerator until analysis. Analysis of heavy metals like zinc, lead, copper, cadmium and arsenic was carried out by using Atomic Absorption Spectrophotometer (AAS).

3. Results and Discussion

The physico-chemical parameters, temperature, pH, dissolved oxygen, total alkalinity, total hardness, chlorides, salinity and electrical conductivity was determined seasonally from water samples collected from Pen Takli dam (table 1). The heavy metal concentrations Zn, Pb, Cu, Cd and As were determined seasonally from water samples collected from Pen Takli dam (table 1). Temperature, pH and total alkalinity was observed highest during summer and lowest during winter season. The dissolved oxygen was found highest during winter and lowest during summer season. The total hardness, chloride, salinity and electrical conductivity were observed highest during summer and lowest during monsoon season.

Table 1: Seasonal variations in physico-chemical parameters and heavy metal concentrations of water form Pentakli Dam

	Summer	Monsoon	Winter	Highest Permitted value for drinking water
Temperature (°C)	27.05±1.28	24.81±1.09	21.02±0.94	
pH	7.95±0.58	7.61±0.41	7.12±0.52	6.5-8.5
Dissolved Oxygen (mg/l)	6.89±0.41	7.41±0.50	9.82±0.68	-
Total alkalinity (mg/l)	132.14±2.47	88.37±1.72	81.54±1.60	600
Total hardness (mg/l)	145.29±3.08	96.43±2.29	119.55±2.72	600
Salinity (mg/l)	108.71±3.50	68.84±1.68	102.70±2.75	-
Chlorides (mg/l)	59.15±1.97	38.07±1.48	54.32±1.88	1000
Electrical Conductivity (µmho/cm)	347.85±4.35	226.61±4.10	240.18±2.98	-
Zn	0.1032±0.0005	0.0704±0.0004	0.0873±0.0003	15
Pb	0.0295±0.0002	0.0256±0.0003	0.0271±0.0005	0.05
Cu	0.0205±0.0004	0.0158±0.0002	0.0164±0.0003	1.5
Cd	0.0087±0.0002	0.0062±0.0001	0.0074±0.0003	0.01
As	0.0083±0.0003	0.0055±0.0002	0.0071±0.0004	0.01

Mean±S.D.

High pH level of water during summer season could be due to enhanced photosynthetic absorption of dissolved inorganic carbon by planktons (Goldman, 1972; Farrell *et al.*, 1979) [8, 7]. Higher levels of alkalinity were reported during summer season by Singh and Saha (1987) [19]. Higher dissolved oxygen was observed during winter season and lower during summer season the results corresponding to the results obtained from the study of Deshmukh (2013) [6]. Calcium and magnesium salts play an important role in formation of hardness of water and observed highest during summer and winter season (Munawar, 1970; Chandrashekhar and Jafer, 1998) [14, 4]. Higher chloride concentration in summer season could be due to increased temperature, evaporation of water and sewage mixing (Jana, 1973; Govindan and Sundaresan, 1979) [11, 9]. During monsoon season salinity of surface water decrease due to release of freshwater from river (La Fond, 1954) [12]. Electrical conductivity was lower during monsoon than summer season this could be due to dilutions of reservoir during monsoon season (Deshmukh, 2013; Chapman and Krammer, 1991; Akin-Oriola, 2003) [16, 5, 1].

The heavy metal concentrations Zn, Pb, Cu, Cd and As in surface water of Pentakli dam were highest during summer season and lowest during monsoon season. This could be due to decrease in water level during summer season and increase in water level during monsoon season (Paka and Rao 1997; Patil *et al.*, 2004; Deshmukh, 2013) [15, 16, 6].

4. Conclusion

The study indicates that physico-chemical parameters and heavy metal concentrations analysed to assess the water

quality of Pentakli dam were below the permissible limits set by regulating agency (Indian Standard 1991, 10500) [10]. Therefore this study clearly indicates that water of Pentakli dam is suitable for drinking, agricultural and industrial purposes.

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