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Limnological Status of Sukhana Dam, Aurangabad (M.S.), India

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Abstract: Water is one of the natural resources for all living organisms in a single-cell or multi-cell climate since it is necessary for its various metabolic activities. Besides, water is needed for various household purposes such as irrigation, navigation, power generation, industry, etc. Natural water has very different chemical compositions. The factors that control the design include physical, chemical and biological processes. The present study deals with assessing the water quality, seasonal variations, and correlation between parameters of Sukhana Dam at Aurangabad (M.S.), India. The Physico-chemical characteristics were studied and analyzed from July 2008 - June 2009. The results revealed the condition of these dam in various seasons regarding various parameters.

Keywords: Limnology, Water quality, Seasonal variations, Sukhana Dam, Physico-chemical characteristics

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Introduction

Limnology is an interdisciplinary science that includes many specific fields and laboratory studies to understand the freshwater environment's structural and functional aspects and problems. Aquatic biodiversity is primarily threatened by human abuse and mismanagement of biological resources and the ecosystems that repair them. Most water bodies are contaminated by household waste, sewers, industrial and agricultural wastewater. It was not planned. The evaluation of water quality generally includes the analysis of physical-chemical and biological parameters and reflects the abiotic and biotic state of the ecosystem (IAAB, 1998; Mulani *et al.*, 2009). Freshwater quality is generally needed to stabilize primary conditions, set quality standards, and monitor the aquatic environment. Changes in the aquatic environment due to anthropogenic contamination are of increasing concern and require monitoring of surface waters and the organisms that live there (Vandysh, 2004).

Numerous anthropogenic activities such as the disposal of wastewater and industrial wastewater, leisure activities, excessive land fertilization, and pesticides have endangered the environmental health of surface and groundwater. Water has become a scarce natural resource and national wealth. Water pollution is now considered in terms of public health and in terms of conservation, aesthetics, and conservation of beauty and natural resources. However, water pollution threatens to reduce the amount available in ponds, lakes, rivers and reservoirs, industrial waters and other human activities. The population explosion, industrialization, urbanization and the promotion of human development have created problems with water pollution. According to several surveys, 70 to 80 % of Indian water sources are polluted, and several enteric diseases affect millions of people every year. The United Nations (UN) reports that most of the world's population does not have reliable drinking water sources. Therefore, the raw water from water is currently being examined for its supply services such as drinks, aquaculture, irrigation and industrial purposes. Considerable work has been done on the Physico-chemical and biological assessment and its functional dynamics in aquatic environments worldwide (Chavuan, 2002).

This study was conducted to assess the monthly values, standard deviation, and correlation of different water parameters of Sukhana Dam in Aurangabad (MS) India, which is essential for human use. Residents use the water for drinking, domestic, agricultural, and recreational purposes.

Materials and Methods

Water samples were taken for physico-chemical analysis at the Sukhana Dam in Aurangabad (M.S.), India, early in the morning between 8:00 and 11:00 AM in the first week of each month from July 2008 - June 2009. Samples were collected in an acid-washed five-liter plastic container at a depth of 5 to 10 cm below the water's surface. Separate samples were collected in 250 ml bottles, and the dissolved oxygen was fixed in the field by adding an alkaline iodide-azide solution immediately after collection. The samples were analyzed directly and returned to the laboratory.

The status of the Dam water quality has been determined seasonally, that is, summer, monsoon, and winter. Physico-chemical properties such as Total Dissolved Solids, Magnesium, Chlorides, Sulphates, Phosphate, Total Hardness, and Total Alkalinity have been seasonally determined in monthly variation in Site A and B using standard methods (Trivedi and Goel, 1987; APHA, 2005).

Results and Discussion

The water parameters were examined and recorded in three seasons: Summer, Monsoon, and Winter. Table 1shows seasonal data and correlation on the physico-chemical parameters.

Total Dissolved Solids (*TDS*):

It is made up of inorganic salts such as calcium, magnesium, potassium, sodium, bicarbonates, chlorides, sulphate and some heavy metal compounds. Furthermore, the small amount of organic substance also contributes to the total amount of solids dissolved in water. The TDS in drinking water comes from natural sources, wastewater, urban runoff, and industrial wastewater. Dissolved solids refer to minerals, salts, metals, cations, or anions dissolved in water. This includes everything in water except the pure water molecule (H_2O) and the suspended solids. Suspended matter does not dissolve or deposit in water. TDS concentrations from natural sources vary from less than 30 mg/l to 6000 mg/l depending on the solubility of minerals in different geological regions. A constant content of these total dissolved solids is essential for the conservation of aquatic life since the density of total solids determines the speed with which water enters and leaves the cells of an organism (osmosis). A sudden or extreme change in TDS can harm aquatic life. For example, an increase in salts could kill freshwater species whose bodies were not designed to live in saltwater.

Values for total dissolved solids ranged from 102 to 202 mg/l. Total dissolved total solids were a maximum of 181.87 ± 16.53 mg/l during the monsoon and at least 122.37 ± 13.77 mg/l in winter (Table 1). In the Sukhana dam, total solids were positively correlated with magnesium and negatively correlated with chloride (Table 2).

The concentration of dissolved solids is generally obtained from the weight or dry residue that remains after evaporation of the volatile rate of the water sample. The obtained value shows different types of minerals dissolved in water. Verma *et al*. (1978) noted that excessive amounts of dissolved solids resulted in high osmotic pressure, which in turn caused an imbalance in osmatic regulation and suffocation in wastewater. Similar observation was shown by Shinde *et al*. (2010, 2011).

Magnesium:

Magnesium is widespread in minerals. It is also highly chemically active; therefore, it cannot be found in its actual state in nature. Except for magnesium hydroxide at high pH, its salts are very soluble. Magnesium ions are essential for water pollution. They can contribute to the hardness of the water. The amount of magnesium and calcium in the water can also be a distribution factor for molluscs, fish and other organisms in specific internal passages. Magnesium is the eighth most common element in the earth's crust and the natural element of water. It is vital for the smooth functioning of living things and occurs in minerals such as dolomite and magnetite. The human body contains approximately 25 g of magnesium (60% in bones and 40% in muscles and tissues).

The magnesium values ranged between 0.79 and 3.23 mg/l. The mean magnesium values were a maximum of 2.71 ± 0.34 mg/l in winter and a minimum of 1.66 ± 0.86 mg/l in summer (Table 1). Magnesium was positively correlated with the total dissolved solids in the Sukhana dam (Table 2).

Beriberi *et al*. (1999) reported that magnesium showed a significant positive correlation with pH, electrical conductivity, calcium, TA and sulphate. Rao *et al*. (1999) also reported similar observation.

Chlorides:

Chlorides are generally found in natural waters. The presence of chlorides in raw water can be attributed to the dissolution of salt deposits, sewage discharge from the chemical industry, oil extraction, discharge of sewage, irrigation drainage, contamination by leachate infiltration, and sea water in coastal areas. Any of these sources can lead to local contamination of surface and groundwater. The salty taste produced by chloride depends on the chemical composition of the water. A concentration of 250 mg/l can be detected in some waters that contain sodium ions. On the other hand, the typical salt water test with 1000 mg/l chloride may be absent if calcium and magnesium ions predominate.

Chloride values ranged from 41.3 to 69.8 mg/l. The mean values of chloride in the summer were 56.58 ± 8.26 mg/l (maximum) and 43.95 ± 3.55 mg/l (minimum) during the monsoon (Table 1). Chlorides were positively correlated with magnesium and negatively correlated with the total dissolved solids in the Sukhana dam (Table 2).

Venkateshwarlu (1969), Rajagopalan *et al*. (1970) and Rai (1974) reported a sharp increase in chloride concentration at the river sewage contamination station. Seasonal variation in chloride levels was high in summer and low during monsoons. The latter could be due to the dilution of the water.

Sulphate:

The most stable forms of sulfur in water at 250 ° C and one atmospheric pressure are free sulfur, H_2SO_4, HS-H_2S and S_2- (Garels and Christ, 1965). The involvement of Sulphate species in geological and biological processes and the use of Sulphate fertilizers contribute to water pollution. In urban areas, the industrial emission of SO_2 gas and its contact with atmospheric moisture to form sulfuric acid is a significant source of contamination by sulphates in surface water. The discharge of industrial waste and wastewater into the water also increases their concentration. Chemically, sulphate plays an essential role in the formation of Ca and Mg salts to give the water a permanent hardness. The biological contamination of sulphates in the form of sodium salt affects the normal functioning of the intestine. (Trivedi and Goel, 1986).

The sulphate levels ranged from 1.3 to 9.1 mg/l. The mean sulphate values in the monsoon were a maximum of 7.25 ± 1.78 mg/l, and in summer, at least 2.75 ± 1.79 mg/l (Table 1). In the Sukhana Dam, sulphates were not positively correlated but negatively correlated (Table 2).

Water, which contains magnesium sulphates in about 1000 mg/l, acts as a laxative in adult people. Lower concentrations can affect children (Welch, 1980).

Phosphate:

The presence of phosphates in the analysis of water and wastewater is of great importance. Low concentration phosphates are used in water to remove iron and manganese in micro quality and coagulation, especially in acidic conditions. The presence of large amounts of phosphate in freshwater indicates contamination by sewage and industrial waste. It promotes the growth of disruptive microorganisms. Although phosphate presents problems in surface waters, its presence is necessary for the biological degradation of wastewater. The primary sources of phosphorous in the river are: (i) the decomposition of the bodies of organisms in the soil and (ii) the wastewater that enters the river. The high level of soluble phosphorous in summer is due to the increase in the decomposition of the corpses by the microbial populations. Welch (1980) and Wetzel (1983) concluded that phosphorous waste is the most critical factor in eutrophication and algae growth.

Phosphate levels ranged between 0.2 and 0.7 mg/l. Average phosphate levels were maximum of 0.47 ± 0.19 mg/l in summer and at least 0.3 ± 0.10 mg/l during monsoons (Table 1).

According to Wetzel (1983), each phosphorous molecule promotes incorporating 7 nitrogen molecules and 40 carbon dioxide molecules in water algae. In the Ganges River near Kanpur, Saxena *et al*. (1966) recorded maximum phosphates of 32 mg/l and found this within limits.

Total Hardness:

The total hardness of water is its ability to precipitate soap and can vary from 0 to 100 mg/l (Wetzel, 1975). Water hardness was initially considered as a measure of the precipitation capacity of water. Soap mainly precipitates with calcium and magnesium ions; other polyvalent cations can pour soap. The presence of hardness is an essential parameter in the detection of water pollution. The primary hardness is caused bycalcium and magnesium. However, iron, strontium, barium and manganese also contribute to the hardness. Hardness and alkalinity are closely related. Like alkalinity, hardness is vital to reduce the toxic effects of toxic elements. It has also been suggested that hardness, if lower than alkalinity, is due to carbonates.

The total hardness values ranged from 92 to 142 mg/l. The mean total hardness values were a maximum of 133.37 ± 6.43 mg/l in summer and at least 102.12 ± 7.47 mg/l in winter (Table 1).

The hardness of the water is not a contamination parameter but rather indicates the quality of the water mainly in the form of Ca^{++} and Mg^{++}, expressed as $CaCO_3$. The increase in hardness can be attributed to decreased water volume and the increased evaporation rate at high temperatures (Kaur and Sharma, 2001). Rajurkar *et al*. (2003) classified waters with hardness values in the range of 60 to 180 ppm as moderately difficult to difficult.

Total Alkalinity:

Alkalinity is the ability of some substances in water to bind to a quantity of strong acid that

Table 1: Seasonal variations in physico-chemical parameters of Sukhana dam July 2008 - June 2009.

PARAMETERS	TOTAL DISSOLVED SOLIDS (mg/l)	MAGNESIUM (mg/l)	CHLORIDES (mg/l)	SULPHATES (mg/l)	PHOSPHATE (mg/l)	TOTAL HARDNESS (mg/l)	TOTAL ALKALINITY (mg/l)
MONSOON	181.87±16.53	1.76±0.40	43.95±3.55	7.25±1.78	0.3±0.10	121.25±8.11	110.37±9.73
WINTER	122.37±13.77	2.71±0.34	52.17±8.33	6.3±1.88	0.35±0.17	102.12±7.47	113.75±3.05
SUMMER	177.25±18.44	1.66±0.86	56.58±8.26	2.75±1.79	0.47±0.19	133.37±6.43	116.75±3.84
RANGE	102-202	0.79-3.23	41.3-69.8	1.3-9.1	0.2-0.7	92-142	98-123

Table 2: Correlation coefficient of the physico-chemical variables of Sukhana dam during July 2008 -June 2009

	Cl	Mg	PO_4	SO_4	T A	TDS	T H
Cl	1	**0.839****	-0.41	0.013	-0.416	**-0.711****	-0.412
Mg		1	-0.408	0.374	-0.581	**0.694***	-0.484
PO_4			1	-0.091	0.002	0.311	0.227
SO_4				1	-0.341	-0.137	-0.349
TA					1	0.093	0.480
TDS						1	0.670
TH							1

** Correlation is significant at the 0.01 level; * Correlation is significant at the 0.05 level

corresponds to their total concentration. These substances include all the cations associated with weak bases, bicarbonates, carbonates, organic acids and hydroxyl ions. The volume of strong acid required to neutralize the above, measures the alkalinity level of the water. Weak acids and strong bases due to free hydroxyl ions and salt hydrolysis form alkalinity in natural waters. Natural water samples also show significant alkalinity because it is a capacity function that differs from the intensity function (Hem, 1970). The weak acid can no longer be dissociated, and if the titration is done with a strong acid, the balance shifts to the right and all the salt hydrolyzes. The number of acid used in the titration to combine all the hydroxyl ions is called total alkalinity (Trivedi and Goel, 1986).

Total alkalinity values ranged from 98 to 123 mg/l. The mean total alkalinity was 116.75 ± 3.84 mg/l in summer and 110.37 ± 9.73 mg/l during the monsoon (Table 1).

In summer, the general high alkalinity is due to the concentration of alkaline components in the water due to water drainage, which increases during the rainy season due to slight erosion of the rocks despite a small dilution with rainwater. Similar observations have also been made by Shinde *et al*. (2010 and 2011). A high level of total alkalinity in summer is due to the concentration of alkaline components in the water due to evaporation of the water, which increases slightly during the rainy season due to the more natural alteration of the rocks despite the dilution with rainwater (Goel *et al*., 1980).

Conclusion

The present study shows the quality of water in Sukhana Dam at Aurangabad (M.S) India. The summer, monsoon, and winter seasons show different seasonal fluctuations of the other physical-chemical parameters. During the present investigation, the observed parameters are lower than the permitted limit values specified by the

ISI, which indicates that the dam's water is suitable for consumption. This study examines the physico-chemical and biological factors to assess water quality, and it is clear that all parameters are also important. Physico-chemical analysis revealed that the dam water sample is ecologically balanced. These parameters were selected for their simple, fast, and continuous measurement in water quality monitoring stations.

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References

APHA. (2005) Standard methods for the examination of water and waste waters, 21st edn., Washington, DC. U.S.A.

Barberi A, Veronesi M, Simona M, Malusardi S And Straskrabova V. (1999) Limnological survey of eight high mountain lakes located in Lago Maggiore watershed (Switzerkabd). J Limnol. 58(2):179-192.

Chavuan JP. (2002) The effect of effluent on the physicochemical characteristic of soil and water in Aurangabad. Ph.D. Thesis, Dr. B. A. M. University, Aurangabad.

Garels RM and Christ CL. (1965) Solutions, minerals and equilibrium. Harper and Row, New York, pp: 456.

Goel PK, Gopal B and Trivedy RK. (1980) Impact of sewage on fresh water ecosystem. I. general features of water bodies and sewage. J Ecol Environ Sci. 6: 83-96.

Hem JD. (1970) Study of interpretation of the chemical characteristics of natural water. U.S. Geol. Survey of Water Supply paper 1473, pp. 1-363.

IAAB. (1998) Methodology for water analysis. Indian Association of Aquatic Biologists (IAAB), Hyderabad.

Kaur H and Sharma ID. (2001) Hydrobiological studies on river Basantar, Samba, Jammu (Jammu and Kashmir). J Aquat Biol. 16(1): 41-44.

Mulani SK, Mule MB and Patil SU. (2009) Studies on water quality and zooplankton community of the Panchganga River in Kolhapur city. J Environ Biol. 30: 455-459.

Rai H. (1974) Limnological studies on river Yamuna at Delhi, India. Part-I: Relation between chemistry and state of pollution in river Yamuna. Arch Hydrobiologia 73: 369-393.

Rajurkar NS, Nongbri B and Patwardhan AM. (2003) Physiochemical and biological investigation of river Umshyrip at Shillong, Meghalaya. Indian J Environ Health 45(1): 83-92.

Rao D, Ravindar RR, Bhoi AV, Biswas AK, Ganguly AK and Sanyal PB. (1999) Physico-chemical quality of drinking water in Rohtas district of Bihar. Environ Monit Assess. 61: 387-398.

Saxena KL, Chakrabarty RN, Khan AK, Chattopandhya SN and Chandra H. (1966) Pollutions studies of river Ganga near Kanpur. Indian J Environ Health 8(4): 270-285.

Shinde SE, Pathan TS, Raut KS, More PR and Sonawane DL (2010) Seasonal variations in physico-chemical characteristics of Harsool-Savangi Dam, district Aurangabad, India. Ecoscan 4(1): 37-44.

Shinde SE, Pathan TS, Raut KS and Sonawane DL. (2011) Studies on the physico-chemical parameters and correlation coefficient of Harsool-savangi Dam, District Aurangabad, India. Middle-East J Sci Res. 8 (3): 544-554.

Trivedi RK and Goel PK. (1987) Chemical and biological methods for water pollution studies. Environment Publications, Karad, India.

Vandysh OI. (2004) Zooplankton as an indicator of the state of lake ecosystems polluted with mining wastewater in the Kola Peninsula. Russian J Ecol. 35(2): 110-116.

Venkateswarlu V. (1969) Ecology of algae in the River Moosi, Hyderabad with special reference to water pollution (I): Physico-chemical complexes. Hydrobiolgia (33): 117-143.

Verma SR, Tyagi AR and Dalela RC. (1978) Physico-chemical and biological characteristics of Karadabad drain in UP. Indian J Environ Health 20(1) : 1-13.

Welch EB. (1980) Ecological effects of wastewater. Press syndicate of the University of Cambridge, pp. 337.

Wetzel RG. (1975) Limnology W.B. Sauders, Philadelphia Pensilvania, pp. 743.

Wetzel RG. (1983) Limnology. 2nd Edn, (ed.) Wetzel L.G., Michigan State University, CRS College Publishing Philadelphia, New York, Chicago, pp. 784.