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Original Research Article

Status of water quality and strategies for conservation of Pushkarni reservoir, Ambad

D. D. Bhutekar[1], S. B. Aher[2*], M. G. Babare[3]

[1]MSS's Arts, Science and Commerce College, Ambad, Jalna-431204, Maharashtra, INDIA.
[2]Indian Institute of Soil Science, Bhopal- 462038, Madhya Pradesh, INDIA.
[3]Arts, Science and Commerce College, Naldurg, Osmanabad-413 602, Maharashtra, INDIA.
Email: satishbaher@yahoo.com

Abstract

Pushkarni reservoir was constructed by Devi Ahilyabai Holkar to fulfill the drinking water demand for Ambad town, Dist- Jalna, Maharashtra (India). The physico-chemical and ecological parameters of water of Pushkarni reservoir was studied to assess the status of water quality. The water samples were collected monthly during 2015-16 from two different sampling points and analyzed for pH, EC, DO, BOD, COD, phosphates, nitrates etc. Present investigation reflects that, the urban development in the town led adverse changes in the physico-chemical and ecological characteristics of Pushkarni water. The urban runoff,washing,bathing and dumping of solid waste,Ganesh idol immersion, and other activity deteriorated the water quality of Pushkarni and it is getting enriched with plant nutrients and other pollutants, becoming more and more infested with macrophytes, getting slowly shallower and shallower and shrinking gradually. In conclusion, the water is polluted and unfit for drinking, bathing purpose without any treatment. The eutrophic condition affected the aesthetic value of Pushkarni. The best suggested strategies for conservation of Pushkarni reservoir on the basis of conducted study are prevention of pollution, lake cleaning by de-silting, de-weeding, bioremediation, public awareness and public participation.

Key Words: Lake Conservation, Water pollution, Water quality, Physico-chemical analysis, Pushkarni.

[*]**Address for Correspondence:**
Dr. S. B. Aher, Indian Institute of Soil Science, Bhopal- 462038, Madhya Pradesh, INDIA.
Email: satishbaher@yahoo.com

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INTRODUCTION

Water is essential for life on the earth, without water neither plant survives nor animals survive nor do industries thrive (Agrawal and Narain, 1997). The availability of good quality water is a necessary feature for preventing diseases and improving quality of life. Lakes and surface water reservoirs are the planet's most important freshwater resources and provide numerous benefits (Bhutekar *et al*., 2014). They also play an equally important role in controlling flood but human development including urbanization, construction, industrialization and increase in irresponsible use of water resources has deteriorated river and lake water qualities. The natural and manmade factors responsible for surface water pollution. The quality of water resources usually depends on its physical, chemical, biological characteristics (Begum, *et al*., 2006). Storage of water in cisterns was known by the first time the first cities were built. The oldest cisterns were discovered in Palestine and Greece. These cisterns were used to collect rainwater from roofs, from paved squares and sometimes also from water-bearing subsoil strata. The early Hindu texts, written around 800-600BC, revel a certain knowledge of hydrological relationship. The Vedic hymns, particularly those in the Rig Veda, contain many notes on irrigated agriculture, river courses, dykes, water reservoirs, wells and water lifting structures (Agrawal and Narain, 1997). Pushkarni reservoir was constructed by Devi Ahilyabai Holkar to fulfill the demand of drinking water for Ambad town. Rectangular in design having steps on four sides, these are excellent architectural design, and need to be protected-both as town heritage unique natural water

source. Considering the importance of the Pushkarni reservoir, monitoring and control of water quality is essential to conserve the ecosystem and improve management policies. The present investigation was carried out to determine the present ecological status of the Pushkarni reservoir and to suggest the conservation strategies based upon the observations.

MATERIAL AND METHODS

Pushkarni reservoir is located at 18° 07' N, 75° 37' E, and 530 m above MSL, in Ambad town, District Jalna of Maharashtra state, India. Water samples from two different sampling points of Pushkarni reservoir were collected between 8:00 A.M. to 10:00 A.M. using plastic containers for analysis of Physico-chemical and biological analysis. Samples were taken once every month from June 2015 to May 2016. Temperature and pH was recorded at site and dissolved oxygen was fixed at the sampling sites while turbidity, electrical conductivity, total dissolved solids, total alkalinity, total hardness, chloride, nitrates, phosphates, chemical oxygen demand and biological oxygen demand were analyzed in laboratory as per the standard methods of APHA outlined by Trivedi and Goyal (1986).

RESULTS AND DISCUSSION

The seasonal variation in the water quality parameters are presented in Table 1. Temperature can exert great control over aquatic communities. If the overall water body temperature of a system is altered, an aquatic community shift can be expected. The maximum temperature range found in summer 23.5^{o}C and minimum 19.2^{o}C in winter. The seasonal variation in water temperature was due to fluctuation in water level, air temperature and stability of atmosphere (Sharma *et al*., 2000). pH is an indicator of the existence of biological life as most of them thrive in a quite narrow, the observed pH is maximum in rainy and minimum in winter 8.7-7.5, the high pH value due to runoff agricultutre, washing and bathing activity (Umavathi *et al*., 2007). Conductivity indicates the presence of ions within the water, usually due to in majority, saline water and in part, leaching. Conductivity ranged in between 229.8 µ mohs/cm in rainy and 336.8µ mohs/cm in summer. Turbidity may be due to organic and/or inorganic constituents. Organic particulates may harbor microorganisms. Thus, turbid conditions may increase the possibility for waterborne disease. Nonetheless, inorganic constituents have no notable health effects, the observed turbidity is 20.8 NTU in summer and 106.4 NTU rainy season. During rainy season silt, clay and other suspended particles contribute to the turbidity values, while during winter and summer seasons settlement of silt, clay results low turbidity (Dagaonkar and Saksena, 1992; Garg *et al*. 2006). The total hardness average ranged from 174.1 to 274.8 mg/l in different seasons (Table. 1). The highest total hardness 315.4 mg/l was observed in summer season with lowest in 102.3 mg/l in rainy season. The variation in total hardness was due to mass reduction by evaporation in summer and dilution by precipitation in rainy season respectively. Researchers already reported high total hardness during summer than rainy season and winter season (Hujare, 2008). The Chlorides was recorded in the range from 290.3 mg/l to 364.9 mg/l in rainy and summer season. The growth of macrophytes and phytoplankton is stimulated principally by nutrients such as nitrates. Many bodies of freshwater are currently experiencing influxes of nitrate and phosphate from outside sources. The Nitrate level observed in range of 0.9 mg/l in summer and maximum 2.8 mg/l in rainy season. Phosphate found maximum in rainy season 5.8 mg/l and minimum in summer 3.2mg/l, the concentration beyond 0.5 mg/l of nitrate-nitrogen is indicative of eutrophication (Sawyer, 1996).

Table 1: Seasonal variation in water physic-chemical parameters of water of Pushkarni reservior

Parameters	Site	Rainy			Winter			Summer		
		Min	Max	Mean	Min	Max	Mean	Min	Max	Mean
Temp (°C)	A	21.5	22.8	22.4	19.2	21.5	19.8	21.5	23.5	22.7
	B	20.3	22.6	21.5	19.5	21.2	20.1	21.1	23.5	22.5
pH	A	7.9	8.7	8.3	7.8	8.3	8.1	7.9	8.3	8.1
	B	8.1	8.7	8.3	7.5	8.4	7.8	7.6	8.1	8.0
EC (µmohs/cm)	A	231.4	244.1	237.2	249.3	291.8	277.2	279.4	333.4	306.8
	B	229.8	247.7	238.1	248.8	290.8	273.4	278.9	336.8	307.3
Turbidity (NTU)	A	41.7	106.4	87.4	31.4	44.3	38.8	20.8	27.8	24.4
	B	41.9	104.9	86.0	31.9	44.8	37.8	21.2	28.1	24.3
Total Hardness	A	102.8	227.9	176.1	169.2	217.4	188.6	198.7	313.8	274.8
	B	102.3	221.5	174.1	166.3	219.2	186.6	191.4	315.4	273.7
Total Alkalinity	A	289.2	351.2	322.9	358.2	501.5	438.4	398.1	509.3	456.1
	B	281.4	348.7	318.8	356.8	499.8	438.5	387.9	507.4	451.4

Chlorides	A	298.6	368.2	336.0	211.7	384.2	265.1	331.4	364.2	350.9
	B	290.3	360.2	335.4	210.4	378.9	262.4	323.9	362.4	346.5
Phosphate	A	3.5	5.8	4.6	3.8	4.9	4.2	3.8	4.7	4.2
	B	3.7	5.7	4.7	3.3	4.3	3.9	3.2	4.2	3.7
Nitrate	A	1.9	2.8	2.3	1.3	1.9	1.5	1.0	1.5	1.2
	B	1.7	2.3	2.0	1.1	1.8	1.3	0.9	1.3	1.2
DO	A	6.2	6.3	5.0	8.3	9.2	8.9	5.1	5.1	5.7
	B	6.3	6.8	5.0	8.5	9.3	8.8	5.3	6.0	5.8
BOD	A	18.8	26.9	25.7	19.1	22.9	21.1	17.2	18.9	17.9
	B	19.1	26.2	24.8	19.4	24.2	22.1	18.0	19.1	18.5
COD	A	113.1	123.1	118.6	124.2	138.4	131.2	155.9	162.8	152.8
	B	110.2	123.6	118.8	127.1	138.8	131.3	159.1	167.1	150.2

(All values are in mg/lit except temp., pH, EC and turbidity)

DO is essential for aquatic life. A low DO (less than 2mg/l) would indicate poor water quality and thus would have difficulty in sustaining much sensitive aquatic life. In the present study the DO values found from 5.1 mg/l to 9.3 mg/l. in summer and winter. The lower value of dissolved oxygen in summer was due to elevated temperature and higher rate of decomposition of organic matter. BOD is a measure of organic pollution to both waste and surface water. High BOD is an indication of poor water quality. During the study BOD recorded from 18.8 mg/l to 26.9 mg/l which indicates the degree of water pollution. The higher BOD values attributed due to the organic load from discharge of municipal sewage (Singh and Patil, 1991). COD is an indicator of organics in the water, usually used in conjunction with BOD. High organic inputs trigger deoxygenation. If excess organics are introduced to the system, there is potential for complete depletion of dissolved oxygen. Without oxygen, the entire aquatic community is threatened. The only organisms present will be air-breathing insects and anaerobic bacteria, COD values observed in the range from 110.2 to 167.1 mg/l in rainy and summer season respectively. The higher values of COD indicate pollution due to oxidisable organic matter (Rasool *et al*., 2003).

Strategies for conservation: The results revealed that, the Pushkarni reservoir is moderately polluted due to the urban runoff, washing, bathing and dumping of solid waste, Ganesh idol immersion and monsoon runoff. The conservation of the Pushkarni reservoir is essential as far as the water demand of the Ambad is concerned. The suggested strategies on the basis of obtained results are prevention of pollution by diverting surface runoff the municipal sewage entering the lake, lake cleaning by removing the aquatic vegetation, and public awareness and participation in conservation of excellent architectural town heritage.

CONCLUSION

The study revealed that the water of Pushkarni reservoir is moderately polluted and unfit for drinking purpose without any treatment. The aesthetic value of Pushkarni gets deteriorated due to eutrophication in the water body. The best suggested strategies among conservation of the Pushkarni reservoir on the basis of study includes prevention of water pollution, cleaning by removal of macrophytes, de-silting, bioremediation, public awareness and public participation.

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