

Analysis of Water Quality using Physico-Chemical Parameters of Four Water Reservoirs in Karjat Tahsil of Ahmednagar District (M.H), India.

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ABSTRACT

There are many artificial and natural water sources in India that are used for a variety of uses, primarily agricultural and drinking. In the present study seasonal physico-chemical fluctuations were recorded and analyzed of four different water reservoirs such as Sina dam, Gurav Pimpri, Durgaon and Bahirobawadi for the period of one year i.e. February 2023 to January 2024. Various physicochemical parameters like pH, air, water temperature, conductivity, humidity, Transparency, total solid, dissolved oxygen, Total alkalinity, Total hardness, BOD, COD, Calcium, carbonate, Bicarbonate were studied. It was observed that Bahirobawadi and Durgaon lakes are highly polluted in summer season due to various anthropogenic activities taking place in and around the water bodies.

Keywords: Water quality, Water pollution, Seasonal variation.

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INTRODUCTION

Life on Earth depends on water, which is a vital element of the ecosystem. Water is crucial for the survival of all organisms [17]. Freshwater bodies are essential wetlands that are found in and near residential areas because they are artificially produced, semi-natural ecosystems that are designed to allow for water stagnation [22]. Water quality is a vital component of life. Because of improper handling and disposal of human and animal waste, industrial and domestic wastewater, and over use of limited water resources, contaminants like bacteria, viruses, heavy metals, nitrates, and salt have polluted water supplies [11]. Hence, it is essential to periodically assess the quality of drinking water, as the human population is susceptible to many water-borne diseases as a result of using contaminated water. The chemistry of water reveals a great deal about the ecosystem's metabolism and explains the general hydro biological interaction, it is challenging to completely understand the biological phenomenon [2]. In contrast to flowing water bodies, stagnant water bodies have a more complex and delicate ecology because they are unable to purify themselves, which allows pollutants to quickly build up in larger concentrations. The aquatic systems and ultimately the physico-chemical qualities of water are harmed by an increase in human activity in and around water bodies [14]. The physico-chemical parameters are ideal and dependent on the structure and composition of the reservoir. Several investigations have been conducted to investigate the relationship between diverse physico-chemical characteristics and pollution, exploitation, and seasonal fluctuations in various aquatic environments, such as lakes, rivers, and reservoirs [18]. The Karjat is an important Tahsil of Ahmednagar district of Maharashtra. It is located within 18°19'86" N to 18°49'86" N and 74°43'20" E to 75°13'20" E. The area of Karjat tahsil is 1503.61Sq.kms. The mean of annual rainfall is 540mm and these are the drought-prone areas and largely dependent on surface water source because highly erratic and less rainfall showing the highly dependence on groundwater for irrigation [1]. The population of this area is dependent on river, little ponds and lake water for agriculture as well as for their everyday needs, including drinking water, washing clothes, and water for domestic animals.

STUDY AREA

For the present study four different water reservoirs were selected, namely Sina dam, Durgaon, Gurav pimpri, and Bahirobawadi. All four of the water bodies are artificially created to accommodate the needs of

villagers. Out of these four, the Bahirobawadi lake comparatively smaller and is formed due to construction during 1953s. The temple of "Bahiravnath" is near to the lake. The plastic bags and flowers, along with other temple garbage, were dumped directly into the lake. The Sina Dam was constructed in 1984s on the Sina River near Nimgaon Gangarda village in Karjat under the Sina medium irrigation project. Gurav pimpri lake constructed in 1955s for irrigation and domestic purpose and the Durgaon lake in constructed during 1981 and the source of water is Kukadi canal and rainfall.

MATERIAL AND METHODS

Collection of Samples: The samples of water were collected seasonally from these four different water reservoirs during February 2023 to January 2024. The samples were collected in plastic container in the morning hours and brought to the laboratory for further analysis.

Analysis of physico-chemical properties: For the analysis, standard methods were used. The parameters like temperature, humidity, transparency and pH were done at the investigation sites. The DO sample was collected from the sites, fixed in the BOD bottle, and brought to the laboratory for analysis. This analysis was conducted using Winkler's method; the other analyses were conducted using standard methods proposed by Trivedy and Goel, [20] and APHA [1].

RESULTS AND DISCUSSION

The air temperature from the selected sites ranges from 27°C to 36°C. Maximum (36°C) temperature was recorded in summer season and minimum (27°C) was recorded in winter season. Water temperature ranges from 20°C to 26°C. Maximum (26°C) temperature was recorded in summer season and minimum (20°C) was recorded in winter season. Jayabhaye *et al.* [5], Salve and Hiware [15] stated that low water levels, high temperatures, and clear weather all contributed to high water temperatures during the summer season. The chemical, biological, and physical properties of a body of water are significantly influenced by the temperature of the water. Humidity also varies seasonally. The maximum humidity i.e. 76% was recorded at Sina dam during monsoon season, while minimum i.e. 20% at Durgaon during summer season. Transparency of water fluctuates from 19 cm to 40.5 cm. The maximum (40.5 cm) was recorded in winter season. Minimum (19 cm) was recorded in summer season. Khan and Chowdhury [7] recorded more transparency in the winter and summer because there was less precipitation, runoff, and floodwater, and suspended particles gradually settled. Kadam *et al.* [6] also reported similar observation from the Masoli reservoir located in the Parbhani region of Maharashtra. The turbidity also shows seasonal variation. The maximum turbidity was observed in Durgaon (48 NTU) during summer season, it may be brought about by human action, a drop in water level, and the presence of suspended particles and minimum (22 NTU) in Gurav pimpri during winter season. The range of pH of water sample is 6.38 to 8.4 in the lakes. Maximum pH was recorded at Bahirobawadi during summer season and minimum in monsoon season at Gurav Pimpri. The electrical conductivity shows seasonal variation. The maximum value (1.19) recorded at Sina dam during the summer and minimum (0.40) at Durgaon during monsoon. Electrical conductivity is an appropriate method to express the overall concentration of soluble salts for the purposes of diagnosis and categorization. It is mostly dependent on the dissolved solids content in water. According to Kumar *et al.* (2005), the conductivity range for the Jagath tank in Gulbarga is 900–1640 $\mu\text{mhos/cm}$. The Total dissolved solids fluctuate from 225 to 602 mg/l. The maximum value was recorded at Durgaon during summer and minimum in winter season at Gurav Pimpri. Total alkalinity ranges from 122 to 205.7 mg/l. Maximum value (205.7 mg/l) was recorded at Bahirobawadi during summer season and minimum value (122 mg/l) was recorded at Sina dam during winter season. Hujare [4] also shows similar results indicating maximum concentration in summer and minimum during winter due to high photosynthetic rate. The hardness of water was recorded maximum (312 mg/l) at Durgaon during summer season and minimum value (60.7 mg/l) was recorded at Gurav pimpri during winter season. The summer months have higher total hardness than the monsoon and winter [4, 5]. Decreased water volume and increased water evaporation rate during the summer are the reasons for high summer higher values. The current investigation obtained similar results. The dissolved oxygen of water maximum value (7.2 mg/l) was recorded at Sina dam during summer season and minimum value (3.05 mg/l) was recorded at Gurav pimpri during winter season. In summer season high DO is brought on by rising temperatures and longer periods of intense sunshine, which also affect the percentage of soluble gases (O_2 and CO_2). Summer seems to accelerate photosynthetic processes by phytoplankton, which uses CO_2 and releases oxygen, because to its long days and strong sunshine. The higher O_2 quality values observed throughout the summer may be explained by this. Masood and Krishnamurthy (1990) observed that the quality is slightly lower during the winter. Biological oxygen demand (BOD) is the quantity of oxygen needed by microbes to break down organic materials. Consequently, it indicates the concentration of organic pollutants in the water. Maximum BOD was

recorded at Bahirobawadi during summer season. High BOD value indicates the presence of a large number of microorganisms, which shows a high level of pollution [9] and minimum at Sina dam during winter season. Maximum COD was recorded during summer season and minimum during winter season at Gurav pimpri. Pollution in aquatic systems is measured by COD. Due to the breakdown of microcubes, high COD might result in oxygen depletion [16]. The values of chlorides range from 16 mg/l to 282 mg/l. The maximum value (282 mg/l) was recorded at Bahirobawadi during summer season and minimum value (16 mg/lit) at Sina dam during winter season. In the present study maximum value of chloride reaches in summer. Swarnalatha and Rao (1998) observed similar results. A high concentration of chlorides in the water body is an indicator of industrial or organic waste contamination [14]. The values of nitrate ranges from 2.19 mg/l to 5.02 mg/l. The maximum value (5.02mg/l) was recorded at Bahirobawadi during winter season and minimum value (2.19 mg/l) at Gurav Pimpri during summer season. The increasing biological activity in water bodies can cause a rapid change in the concentration of nitrates, making it extremely changeable both seasonally and geographically [21]. Maximum sodium value (97mg/l) was recorded at Durgaon during summer season and minimum (7mg/l) was recorded at Sina dam during winter. Maximum potassium value (80mg/l) was recorded at Durgaon in rainy season and minimum (2mg/l) was recorded at Sina dam and Gurav Pimpri during summer and rainy season. Na and K concentration in Durgaon indicate the increased level of pollution.

Table 1: Physico-chemical variation of four water reservoir From February 2023 to January 2024.

Parameter	Sina dam			Gurav pimpri			Durgaon			Bahirobawadi		
	Summer	Monsoon	Winter	Summer	Monsoon	Winter	Summer	Monsoon	Winter	Summer	Monsoon	Winter
Water temp. (°C)	23.3	22	20	22.7	23	22.4	26.8	22.2	22.7	21.4	20.32	20.2
Humidity (%)	30	76	71	31	70	69	20	75	72	28	68	67
pH	7.2	7.2	6.5	8.2	6.3	7	7.5	7.5	7	8.4	7.6	7.4
Turbidity (NTU)	27	26	27	34	38	22	48	37	36	35	28	41
Transparency(cm)	26.5	28.88	40.5	27	26.32	31.34	19	20.33	30.64	20	22.76	30.54
EC	1.19	0.45	0.88	0.83	0.76	0.65	0.5	0.4	0.72	0.68	0.56	1.04
Alkalinity (mg/l)	149.4	125.7	122	198.08	179.73	148.7	143	199.78	188.78	205.7	161.6	175.6
TDS (mg/l)	590	403	381	410	360	225	602	508	390	330	412	435
Hardness(mg/l)	215	185.7	102	117	105	60.7	312	228	98.5	261	125	110.2
BOD (mg/l)	7	5.12	5	8	6.7	6.02	6.5	8.01	7.01	10.2	7.2	5.5
DO (mg/l)	7.2	6.26	6.5	4.05	4.2	3.05	4.4	4.78	6.2	4.02	5.11	5.7
COD (mg/l)	43.6	40	39.5	78.32	56.9	38.9	64.04	67	45.78	38.89	46.2	40

Table 2: Chemical Parameter of four water reservoirs. (mg/l)

Parameter	Sina dam			Gurav pimpri			Durgaon			Bahirobawadi		
	Summer	Monsoon	Winter	Summer	Monsoon	Winter	Summer	Monsoon	Winter	Summer	Monsoon	Winter
Chloride	34	64	16	190	128	30	62	26	130	282	62	124
Nitrate	4.11	3.57	4.43	2.19	2.89	3.12	3.69	4.4	4.34	3.11	4.78	5.02
Sodium	65	12	7	82	9	32	97	43	11	86	25	43
K	2	3	10	6.3	2	6	3.2	80	76	4.5	4	6.5
Calcium	31.8	43.3	68	32	29	75	48.8	75	110	50.2	30.25	20
Mg	56	20	26	38	12	32	32	15	14	41	36	34
HCO ³⁻	165	126	375	241	255	402	146	165	120	357	203	321
Sulphate	76.2	10	30.45	94	53.2	21	117	48.06	102.5	126	20.4	54.03
CO ³⁻	75	86	76	61	125	143	120	78	110	95	112	97
Iron	0.013	0.002	0.023	0.011	0.095	0.013	0.012	0.011	0.025	0.011	0.031	0.022
Mn	0.0083	0.0012	0.005	0.0045	0.033	0.01	0.029	0.0029	0.008	0.0042	0.021	0.012
Zinc	0.004	0.011	0.02	0.008	0.027	0.018	0.009	0.0009	0.021	0.006	0.024	0.07
Copper	0.041	0.009	0.011	0.036	0.003	0.019	0.019	0.002	0.01	0.061	0.008	0.021

CONCLUSION

From the present piece of work, it can be concluded that the lake water might be used for irrigation and domestic use. However, if they are not maintained via appropriate management, they will become less useful in the future. Activity by humans has put the Bahirobawadi and Durgaon water reservoirs in danger. If the water is to be used for agricultural and domestic use, there has to be constant monitoring and treatment.

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