ANALYSIS OF THE PHYSICO-CHEMICAL PARAMETERS OF DRINKING WATER FROM NATURAL RESERVOIRS ALONG THE BHIWANDI CITY AND ITS ADJOINING AREAS, THANE DISTRICT, MAHARASHTRA (INDIA)

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ABSTRACT

Transmission of many diseases occurs primarily by drinking water. These diseases are produced in the water bodies due to anthropogenic pollutants. The transport of many anthropogenic pollutants in the water is determined by their physico-chemical parameters. The current studies were to analyse the physico-chemical parameters of drinking water from natural reservoirs of the Bhiwandi city and its adjoining areas. The samples of water were collected from three natural resources viz. well, bore well and lake water. Physico-chemical parameters such as water temperature, turbidity, total dissolved solid (TDS), pH, dissolved oxygen (DO), chemical oxygen demand (COD), total hardness, electrical conductivity (EC), chloride (Cl^-), sulphate (SO_4^{2-}), sulphite (SO_3^-), nitrate (NO_3^-) and nitrite (NO_2^-) were analyzed. All parameters were within the permissible limits except lake water. Temperatures were in the range of 26.1 – 32.8^{o}C. All samples show the alkaline pH. Total hardness was in the ordered Lake water > Bore well water > Well water. DO was more in lake followed by well and then bore well water. EC was in the range 138 to 813 µS/cm. All samples show approximate level of NO_3^- and SO_4^{2-}. According to World Health Organization (WHO), all these above results suggested that the quality of water in Bhiwandi city and its adjoining areas is potable for drinking and useful for agriculture practices as well as industrial purposes except lake water.

Key words: Physico-chemical parameters, Water quality, Bhiwandi city.

INTRODUCTION

Water is essential in every stage of life for any living organism. The quality of water is of vital concern for mankind since it is directly linked with human welfare. The water resources now a days as consequences of population explosion coupled with industrialization, urbanization and green revolution. Water related diseases have remained a major concern in

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much of the developing world. The World Health Organization (WHO) estimated in the 2000 assessment that there are four billion cases of diarrhea each year in addition to millions of other cases of illness associated with the lack, of access to clean water[1]. Therefore, analysis of physico-chemical parameters of water is essential for all living organism.

Fig. 1: Location map of Bhiwandi city, Thane District, Maharashtra

Study area

In present investigation, an attempt has been made to analyse the physico-chemical parameters of drinking water available in natural reservoirs along the Bhiwandi city and its adjoining area.

Bhiwandi is located in the district of Thane, around 20 km to the north-east Mumbai city and 15 km to the north-east of Thane city. The exact location of Bhiwandi city is 19°17′38″N 73°03′57″E. The average rainfall is 3224 mm. The average annual day time temperature varies in the range of 30-32°C. The average day time humidity is 62.5 %. This city is known for its textile industry and has the largest number of power looms in the country and hence, need the safe potable drinking water and upgraded environmental status, for power looms workers and other peoples. The population of Bhiwandi city is 7, 11, 329 (2011)[2].

EXPERIMENTAL

Materials and methods

The water samples were collected during the month of May, 2011 from three natural resources viz., well, bore well and lake water. Water samples were collected in two litre cleaned polythene containers and these samples were immediately used for the estimation of various physico-chemical parameters[3].

Temperature of water was measured using mercury thermometer and pH was measured using pH meter Model No. EQ614A at the sampling places. Electrical conductivity value of the all water samples under investigation were measured using conductivity meter model No. CD601. The TDS and SO_4^{2-} of all water samples were measured using gravimetric method. The Winkler method with azide modification was adopted for determination of dissolved oxygen[4]. Chemical oxygen demand (COD) of water was measured by oxidising organic matter of the sample to carbon dioxide, water and ammonia by reflux with a known excess of $K_2Cr_2O_7$ in a 50% H_2SO_4 solution. The excess dichromate was titrated with a standard solution of ferrous ammonium sulphate solution. The dichromate consumed gave the O_2 required for oxidation of the organic matter. SO_3^{2-} was determined titrimetrically using iodate-iodide solution.

Chloride of water samples was determined using titration method with the help of $Na_2S_2O_3$ and starch as an indicator. The total hardness i.e., Mg^{2+} and Ca^{2+} hardness of the

water samples were determined by complexometric titration using EDTA method. Determination of turbidity was done by turbidimetry. The colorimetric method was used for determination of NO_2^- and NO_3^-.

All parameters were analyzed according to the standard methods prescribed in APHA (American Public Health Association) and attempt was also made to compare the results with water quality standards of WHO and USPH (United States Public Health Drinking Water Standards)[5].

RESULTS AND DISCUSSION

The various physico-chemical analysis results are reported in Table 1 and represented graphically in Fig. 2 and Fig. 3.

pH: During the tenure of the investigation, pH varied from 7.1 (Tilak chowk Bore well) to 7.9 (Kawad Lake); thus, it is within permissible range 6.5-9.8 prescribed by USPH 6.0-8.5[6].

Temperature: The lowest temperature of well water of Ambika Nagar was observed as 26.1°C while highest temperature at upper layer of Shelar lake was observed as 32.8°C. The upper layer temperature of lake water was observed high than the middle layer of lake water.

Turbidity: Turbidity is used to measure intensity of pollution. The values of turbidity of water samples collected from various sources varied in the range from 5-18 NTU (Nephelometry Turbidity Unit). Increase in turbidity is mainly due to presence of colloidal matter or very finely divided suspended matter, which settles only with great difficulty, sewage and industrial wastes[7].

Electrical conductivity: The electrical conductivity values of the samples were found in the range 138-813 µS/cm, the lowest at Gokul Nagar Bore well to high at middle layer of Shelar lake. The EC is strongly dependant on temperature and therefore, EC of water samples measured at various temperatures have to be corrected for 25°C.

Total hardness: In the present investigation, the lake of middle of Kawad layer water was moderately high (592 mg/L). Concentration of calcium where as in bore well water of Gokul Nagar it was less (110 mg/L). Middle layer of Shelar lake show the highest (518 mg/L) value of magnesium while well water of Karivali Gaon shown lowest (46 mg/L) value of magnesium.

Table 1: Physico-chemical analysis of natural reservoirs at Bhiwandi city and its adjoining areas

Sampling places	pH	Temp. (°C)	Turbidity (NTU)	EC (µS/cm)	Ca^{2+}	Mg^{2+}	NO_3^-	NO_2^-	SO_4^{2-}	SO_3^{2-}	D.O.	C.O.D.	Cl^-	T.D.S.
(a) Well water														
Ambica Nager	7.4	26.1	6	252	246	112	0.18	0.21	16.03	2.80	5.53	3.66	55.5	262
Kasar Ali	7.3	28.6	5	170	190	68	0.15	0.19	18.00	3.72	5.98	4.01	52.1	255
Chavindra Gaon	7.6	28.3	7	198	146	98	0.16	0.11	15.66	2.87	5.60	3.12	62.8	391
Karivali Gaon	7.5	30.1	5	200	170	46	0.14	0.13	21.18	3.18	5.10	3.18	61.0	411
(b) Bore well water														
Tilk chowk	7.1	30.5	8	256	289	135	0.19	0.23	15.24	2.86	3.87	4.33	38.1	404
Gokul Nager	7.7	26.2	5	138	110	91	0.21	0.28	15.66	2.96	3.01	3.82	42.8	315
P.R.High school	7.4	29.4	7	212	205	102	0.11	0.16	18.77	3.04	3.61	4.62	31.1	407
Bhrahman Ali	7.6	28.5	6	472	200	106	0.26	0.30	16.67	2.14	3.88	3.99	31.0	395
(c) Lake water														
Shelar Lake														
Upper layer	7.6	32.8	16	718	410	402	16	4.2	260	5.40	6.10	20.12	480.4	546
Middle layer	7.5	31.4	18	813	530	518	13	5.7	286	6.17	6.12	18.20	482.3	665
Kawad Lake														
Upper layer	7.9	32.2	15	692	479	398	25	6.2	362	4.28	6.33	26.05	507.8	525
Middle layer	7.2	31.9	14	803	592	453	18	8.3	368	4.22	6.41	24.14	506.2	636

All values are in mg/L except pH, Temperatures (°C) and Electrical conductivity (µS/cm)
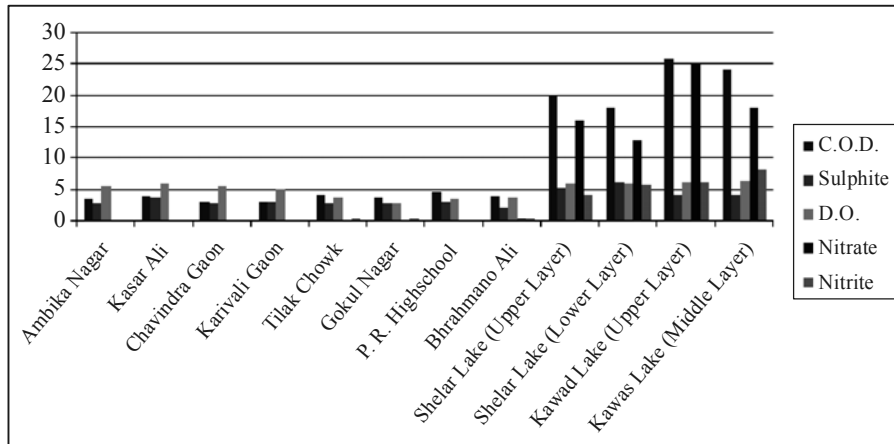
Fig. 2: Comparative graphical representation of analytical results of ground water at Bhivandi city and its adjoining areas
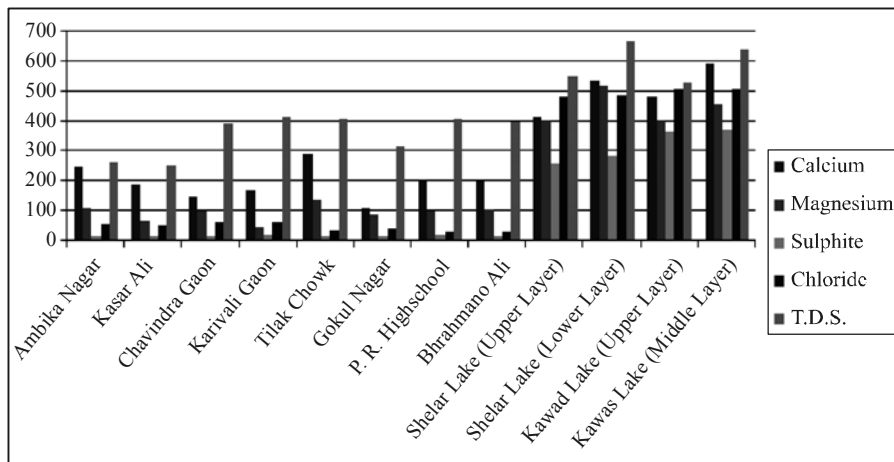

Fig. 3: Comparative graphical representation of analytical results of ground water at Bhivandi city and its adjoining areas

Nitrate: Nitrate enters the human body through drinking water causing a number of health disorders such as methemoglobinemia, hypertension etc. All samples of nitrates show permissible limit (< 10 mg/L) expect all lake water samples, which were found in the range (13-25 mg/L) [8].

Nitrites: Nitrites show highest 8.3 mg/L value in Kawad lake middle layer of water and lowest 0.11 mg/L value in well water of Chavindra Gaon.

Sulphate: High sulphate concentration in water may contribute to the corrosion of

the metals. Sulphate in well and bore well water of the samples were found to be 15.24-21.18 mg/L lower than desirable level i.e., 250 mg/L. except all lake water samples i.e., 260-368 mg/L.

Sulphite: Sulphite in bore well water shows lower value (2.14mg/L) while higher range in all lake water samples was found to be 2.14-6.17 mg/L.

Dissolved oxygen: Dissolved oxygen of water is the most fundamental parameter of reservoir and lakes. The DO in well and bore well water samples is within limit (4-6 mg/L) but lake water samples show in the range 6.10-6.41 mg/L, which is higher in level.

Chemical oxygen demand: COD of all samples under study varies from 3.12 mg/L to 26.05 mg/L. The analysis of chemical oxygen demand shows highest (26.05 mg/L) value in upper layer of Kawad lake water while it shows lowest (3.12 mg/L) value in Chavindra Gaon well water samples.

Chloride: The chloride content in the samples were in between 31.0 mg/L to 507.8 mg/L. Water upper layer of Kawad lake shows moderately high concentration of chloride i.e., 507.8 mg/L and lower concentration in bore well water sample of Brahman Ali i.e., 31.0 mg/L.

Total dissolved solids: The concentration of total dissolved solids in the present study was observed in the range of 255 to 665 mg/L. Only all lake water samples show higher total dissolved solids as compared to desirable levels (permissible limit) 500 mg/L.

CONCLUSION

The pH, temperature, turbidity, electrical conductivity, total hardness, nitrate, nitrite, sulphate, sulphite, dissolved oxygen, chemical oxygen demand, chloride and total dissolved solids were studied. From the present study, most of the parameters are within the permissible range of WHO and USPH except Lake water. Results suggest that the quality of water in Bhiwandi city and its adjoining areas is potable for drinking and useful for agriculture practices as well as industrial purposes except lake water.

ACKNOWLEDGEMENT

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