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EVALUATION OF SOME WATER QUALITY PARAMETERS WITH SPECIAL REFERENCE TO HEALTH – A CASE STUDY OF MANIKDOH DAM, JUNNAR, MAHARASHTRA

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ABSTRACT

Worldwide, peoples are under tremendous threat due to water pollution. High rates of mortality and morbidity due to water-borne diseases are well known in India. Thus it is necessary that the drinking water quality should be checked at regular interval. The present study deals with the assessment of selected nutrients and metals from Manikdoh dam water during pre-monsoon season in 2016. The parameters analyzed are calcium, phosphate, sulphate, nitrate, iron, manganese, selenium, zinc, chromium and nickel. The result reveals that, there was a significant increase in some nutrients and metal levels when compared to permissible limits for drinking water prescribed by the Indian Standards (IS). Calcium, phosphate, sulphate, iron, manganese, selenium and nickel are observed well above the prescribed limits.

KEYWORDS: Drinking water, water quality, health, pollutants, reservoirs.

INTRODUCTION

Rivers, dams, lakes have an important role because they serve the water for domestic, industrial, agricultural as well as power generation [Subin & Husna 2013]. The community living near the river or dam area use the water for domestic purposes. There is no frequent & up to date monitoring facility for the water quality of most of the rivers & dams. Generating

the information of water quality is good for the environment & also for the good health of the population [Tebutt 1983].

Worldwide, in the recent time, the deterioration of surface water quality due to anthropogenic activities like rapid urbanization & increased agricultural runoff has become a serious problem [Yadav et al. 2014]. From the survey, conducted by WHO, it was found that in Asian Countries around 60% diseases are water borne [Kneis et al. 2009]. In India, water is an essential but scarce resource. For the water quality management program requires adequate knowledge of present status of water quality degradation. To generate such data base, a well designed water quality monitoring is essential [Trivedi et al. 2008].

In India over the past decade, access to drinking water has increased hence, the adverse impact of unsafe water on health continues. It is an urgent need to supply safe drinking water to urban as well as rural population which completely depends on either untreated surface or ground water [WHO/UNICEF 2004, Kumar et al. 2005]. In India, around 21% of communicable diseases are waterborne like diarrhea mainly among children under the age of five [Bradon & Homman 1995, Gadgil 1998].

For healthy aquatic ecosystem & biological diversity good quality of freshwater is an important factor & also necessary for sustainable development [Venkatenaraju et al, 2010, Kumar 1997, Mahananda et al. 2005]. The poor water quality leads to changes in physiology, behavior & histology of aquatic flora and fauna and also human beings [David et al. 2003]. Unfortunately, the available freshwater resources are becoming polluted rapidly and hence becoming a global problem [Mahananda 2005].

For the sustainability of ecosystem health & hygiene, agricultural & domestic use, regular water quality monitoring is very necessary [Pal 2015]. Nutrient contents in any water body play an important role as their increased concentration have an impact on biological community and also water quality. Hence to assess the water quality in relation to health, it has been studied by some researchers [Reddy and Kumar 2001, Nagaraja Gupta and Sadashivaiah 2014].

MATERIALS AND METHODS

Sampling area

For the present investigation water samples were collected during the pre-monsoon season of 2016 from the Manikdoh dam of Junnar Tehsil, Pune district, Maharashtra State as shown in fig. 1. The dam was constructed on Kukadi river of height 51.8 m and length is 930 m. The dam volume is 596 Km^3 while its total capacity is 282070 Km^3. Its co-ordinates are 19.2353041°N and 73.7914508°E.

Sample collection

Water samples were collected in plastic containers previously cleaned by washing in non-ionic detergent, rinsed with tap water and later soaked in 10% HNO_3 for 24 hours and finally rinsed with deionised water prior to usage. During sampling, sample bottles were rinsed with sample water and then filled at a depth of half meter from each of the four designated sampling sites (S_1 to S_4). At each sampling site, water samples were collected in triplicate from three points. The samples were labeled and brought to the laboratory, stored in the refrigerator at 4 ^0C prior to analysis.

Nutrient analysis of samples

Determination of Ca, PO_4^{--}, NO_3^- and SO_4^{--} was carried out by standard methods. Calcium was determined by EDTA – Titrimetric, phosphate by Stannous Chloride, nitrate by Phenol Disulphonic and sulphate by Turbidimetric methods.

Elemental analysis of samples

Determination of Cr, Fe, Mn, Ni, Se and Zn was carried out by Spectrophotometric methods. Chromium was determined by diphenyl carbazide, iron by thiocyanate, manganese by persulphate, nickel by dimethyl glyoxime, selenium by diamino benzidine and zinc by dithizone methods.

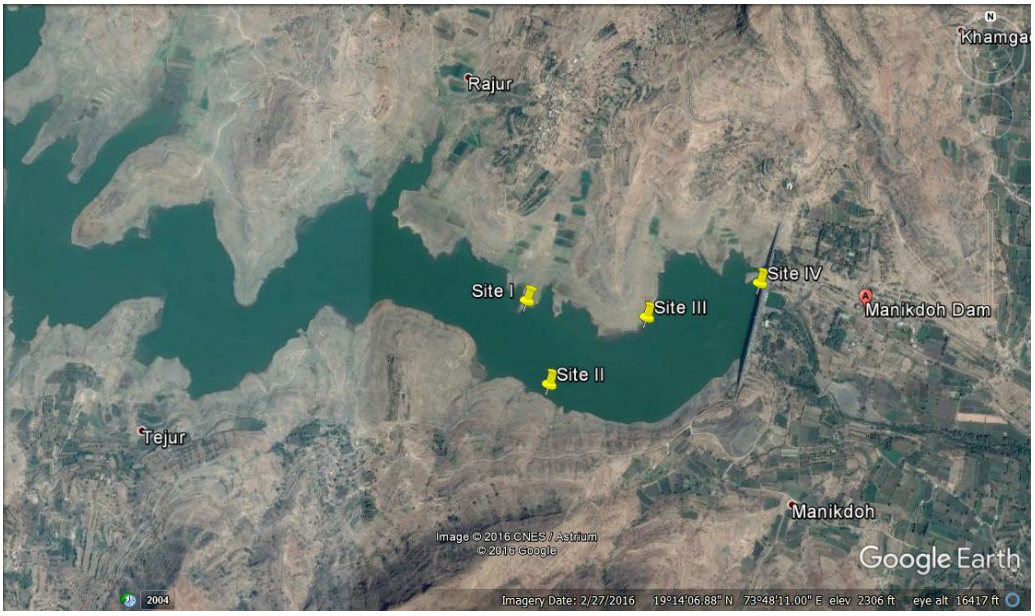

Figure 1: Map of study area (Manikdoh dam) with four sampling sites.

RESULTS AND DISCUSSION

Occurance of nutrients and metals in surface water has drawn worldwide attention due to their impacts on humans. Hence keeping this view in mind the study of Calcium, Chromium, Iron, Manganese, Nickel, Selenium and Zinc has been carried from the water of Manikdoh dam. The analysis of the metals was carried out during pre-monsoon season of 2016. The results of nutrient and metal contents were as shown in table 1 and fig. 2 respectively.

Calcium: Calcium content of water samples at different sites fluctuated in the range of 50.33 mg/L to 84.00 mg/L. Desirable and maximum permissible limit of calcium in drinking water is 75 mg/L and 200 mg/L respectively [BIS 1992].

Phosphate: The concentration of phosphate in water samples during the present study varied from 0.063 mg/L to 0.74 mg/L. The highest phosphate value was observed at site II (0.74 mg/L). Sometimes phosphate content in surface water is high which is due to the release of phosphates from phosphorous detergents discharged along with sewage waste. The high phosphate content in water causes vomiting, diarrhea and bone loss [Papadopoulou – Mourkidou et al, 2004]. The phosphate content in the surface water is also due to the closeness of water body to the agricultural fields and farms [Amaliya and Sugirtha 2013].

Nitrate: Nitrate content of water samples during the present study varied from 0.20 mg/L to 0.23 mg/L. The study clearly indicates that, nitrate content of all the water samples are well within the desirable limit [BIS 1992].

Sulphate: Sulphate content of water samples varied from 220.33 mg/L to 323.66 mg/L during the study period, exceeding maximum limit. The highest sulphate content was obtained from site III (323.66 mg/L). An excess of sulphate in freshwater body is taken as an index of pollution [Bolawa & Gbenle 2012].

Table 1: Nutrient contents of Manikdoh dam during Pre – monsoon season of 2016 from site I to IV.

Sr. No.	Parameters	Concentration (mg/L)			
		Site I	Site II	Site III	Site IV
1	Calcium	72.33 ± 2.516	65.33 ± 2.516	84 ± 3.605	50.33 ± 2.516
2	Phosphate	0.73 ± 0.140	0.74 ± 0.062	0.17 ± 0.025	0.063 ± 0.015
3	Nitrate	0.23 ± 0.035	0.20 ± 0.060	0.23 ± 0.040	0.20 ± 0.040
4	Sulphate	220.33 ± 2.516	321 ± 3.605	323.66 ± 5.507	251.66 ± 3.511

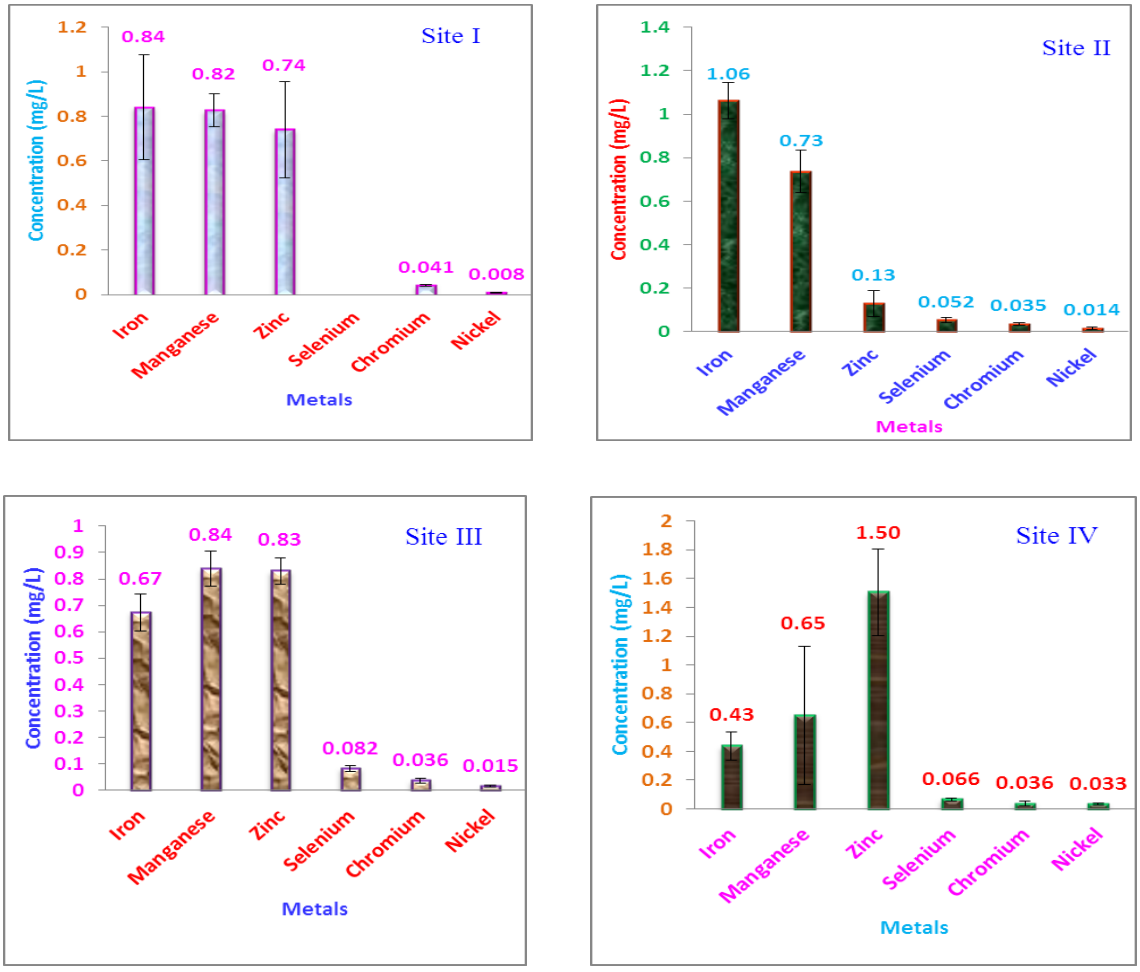

Figure 1: Metal contents of Manikdoh dam during Pre-monsoon season of 2016 from site I to IV.

Iron: The concentration of iron ranges from 0.43 mg/L to 1.06 mg/L. The maximum concentration of iron was noted at site II. The presence of iron in water may be due to

microbial degradation of organic material [Applin et al. 1989]. Iron is an essential element for human being. At the same time iron toxicity may lead to vomiting, cardiovascular collapse and its deficiency causes failure of blood clotting [Akan et al. 2012].

Manganese: Manganese concentration in water samples from four sampling sites was studied and the results revealed that, the manganese concentration ranges from 0.65 mg/L to 0.84 mg/L. The maximum concentration was found to be 0.84 mg/L at site III. Similarly, Giri et al. 2010 had worked out an evaluation of metal contamination in surface water of Jharkhand. They recorded a maximum concentration of manganese was recorded as 0.32 mg/L and minimum concentration as 0.02 mg/L. In freshwater, the higher concentration of manganese imparts unpleasant taste to the water.

Zinc: In the present investigation, concentration of zinc was found to be higher 1.50 mg/L at site IV while its lowest concentration was noted as 0.13 mg/L at site II. The hydro-geochemistry of river water from Nigeria revealed that, during dry season the maximum zinc concentration was recorded as 1.08 mg/L and minimum as 0.48 mg/L [Ameh and Akpah 2011].

Selenium: The level of selenium in the water samples was highest at site III (0.082 mg/L) while it was below detection limit at site I. Similarly, Li et al. 2008, studied the dissolved trace elements and heavy metals from Danjiangkou reservoir of China. During this study, the mean selenium concentration of 15. 36 µg/L was recorded within the range of 0.00 µg/L to 50.2 µg/L.

Chromium: The concentration of chromium in the water samples of Manikdoh dam is ranging from 0.035 mg/L to 0.041 mg/L, during the present study. According to Virha et al. 2011, they found the mean concentration of chromium between 0.047 mg/L and 0.087 mg/L in water of upper lake of Bhopal during 2006 – 2007. Similarly Kar et al, 2008, assessed the heavy metal pollution in surface water from river Ganga. During this investigation, they noted the chromium concentration ranging from 0.010 mg/L to 0.018 mg/L. The highest value of chromium was observed during summer season.

Nickel: The nickel content in the water samples ranges between 0.008 mg/L to 0.033 mg/L. Its maximum concentration was found at site IV. The nickel concentration in the Manikdoh water samples is within the permissible limit set by WHO i.e. 0.01 mg/lit (WHO 2004).

There are several sources of nickel in surface water mainly includes anthropogenic activities such as extensive use of chemical fertilizers and pesticides for agricultural purposes [Rajmohan and Elango 2005].

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REFERENCES

1. Akan, J. C., et al. Assessment of pollutant in water and sediment samples in lake Chad, Baga North Eastern, Nigeria, *J. of Environmental Prot.*, 2012; 3: 1428 – 1441.
2. Amaliya, N.K. and Sugirtha, P. K. Evaluation of surface water quality of Kanyakumari District through water quality Index Assessment, Intl. *J of Plant, Animal and Environmental Science*s, 2014; 4(1): 73 – 77.
3. Ameh, E. G. and Akpah, F. A. Heavy metal pollution indexing and multivariate statistical evaluation of hydrogeochemistry of Pov in Itakpe iron – ore mining area, Kogi state, Nigeria, *Advances in Appl. Sci. Res.*, 2011; 2(1): 33 - 46.
4. Applin, K. R. and Zhoo, N. The kinetics of Fe (II) oxidation and well screen encrustation, *Ground Water*, 1989; 27(2): 168 – 174.
5. BIS, Indian Standard specification for drinking water, IS 10500, Bureau of Indian Standards, New Delhi, 1992.
6. Bolawa, O. E. and Gbenle, G. O. Analysis of industrial impact on physicochemical parameters and heavy metal soncentrations in water of river Majidun, Molatori and Ibeshe around Ikorodu in Lagos, Nigeria, *J. of Environmental Science & Water Resources*, 2012; 1(2): 34 – 38.
7. Bradon, C. and Homman, K. The cost of inaction: valuing the economy-wide cost of environmental degradation in India, *Asia Environment Division, World Bank 7, October memo*, 1995.
8. Gadgil, A. Drinking water in developing countries, *Ann. Rev. Energy Environ.*, 1998; 23: 253 – 286.
9. Giri et al. An evaluation of metal contamination in surface and ground water around a proposed uranium mining site, Jharkhand, India, *Mine Water Environment*, 2010; 29: 225 – 234.

10. Kar, D., et al. Assessment of heavy metal pollution in surface water, *Int. J. Environ. Sci. Tech.,* 2008; 5(1): 119 – 124.
11. Kneis, D., Foster, S. and Bronstert, A. Simulation of water quality in a flood detention area using models of different spatial disceretization, *Ecological Modelling,* 2009; 220: 1631 – 1642.
12. Kumar N. A review on freshwater environment, *Ecology, Environment & Conservation,* 1997; 3: 3 – 4.
13. Kumar R., Singh R. D. and Sharma K. D. Water resources in India, *Curr. Sci.,* 2005; 89: 794 – 811.
14. Li, S., ET al. Dissolved trace elements and heavy metals in the Danjiandkou reservoir, China, *Environ. Geol.,* 2008; 55: 977 – 983.
15. Mahananda, H.B., Mahananda M.R. and Mohanty B.P. Studies on the physico-chemical and biological parameters of a freshwater pond ecosystem as an indicator of water pollution, *Ecology Environment and Conservation,* 2005; 11(3 – 4): 537 – 541.
16. Nagaraja Gupta, M.S. and Sadashivaiah C. Assessment of water quality in Peenya industrial area, Bangalore, *International Journal of Research in Engineering and Technology*, 2014; 3(6): 52 – 60.
17. Pal, M., et al. Water Quality Index as a Reliable Indicator of Water Pollution Level-A Case Study of Rudrasagar Lake, Tripura, *Int. J. of Innovative Res. In Sci. Engg. And Tech.,* 2015; 4(8): 7801 – 7806.
18. Papadopoulou – Mourkidou, E.G., et al. The potential of pesticides to contaminate the groundwater resources of the Axios river basin in Macedonia, Northern Greece. Part I. Monitoring study in the north part of the basin, *Sci. Total Environ.,* 2004; 321: 127 – 146.
19. Rajmohan, N. and Elango, L. Distribution of Iron, Manganese, Zinc and Atrazine in ground water in parts of Polar and Cheyyar river basins, South India, *Environmental Monitoring and Assessment,* 2005; 107: 115 – 131.
20. Reddy, M.V. and Kumar, A.V. Effects of Ganesh-idol immersion on some water quality parameters of Hussansagar Lake, *Current Science,* 2001; 81: 1412 – 1413.
21. Subin, M.P. and Husno, A.H. An assessment on the impact of waste discharge on water quality of Priyar river lets in certain selected sites in the Northern part of Ernakulum district in Kerala, India, *Intl. Res. J of Environmental Sciences,* 2013; 2(6): 76 – 84.
22. Tebutt, T. H. Y. Principles of quality control, Pergamon, England, 1983; 235.

23. Trivedi R.C., Bhardwaj, R.M. and Agrawal, S. Biological monitoring of water quality in India – needs and constraints, *Proceeding of Taal: The 12th World Lake Conferenc, 2007;* 1 – 6.
24. Venkateshraju, K., et al. Physicochemical and bacteriological investigation on the river Cauvery of Kollegal stretch in Karnataka, *J. Sci. Engg. & Tech.*, 2010; 6(1): 50 – 59.
25. Virha, R., et al. Seasonal variation in physicochemical parameters and heavy metals in water of Upper lake of Bhopal, *Bull. Environ. Contam. Toxicol*, 2001; 86: 168 – 174.
26. WHO, "World Health Organization Standard for Drinking Water Quality." Vol. 1, Recommendation, France, 2004; 181.
27. WHO/UNICEF. Meeting the MDG drinking water and sanitation target: A mid-term assessment of progress, WHO, Geneva, 2004.
28. Yadav, N. S., Kumar A. and Sharma M. P. Ecological health assessment of Chambal river using water quality parameters, *J. Integ. Technol.*, 2014; 2: 52 – 56.