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Physico-chemical analysis of drinking water around Mauganj blocks of Rewa district (M.P.) (India)

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Abstract
The present paper deals the physico-chemical properties and heavy metals in drinking water samples collected from different sources in and around Mauganj Blocks District Rewa (M.P.) India. A total number of 75 water samples were collected from different sources like hand pumps (40), wells (20), taps (10), rivers (1) and ponds (4). The gross appearance, taste, odour, temperature, pH, dissolved oxygen, biochemical oxygen demand, alkalinity, conductivity, total dissolved solid and the concentration of lead and cadmium were analyzed. Water samples were transparent, odourless and taste was agreeable except rivers and ponds. The mean value of temperature (26.3±1.05 to 31±0), pH (6.71±0.02 to 7.3±0.03), Dissolved oxygen (2.9±0 to 8.05±0.04), Biochemical oxygen demand (3.2±0 to 6.41±0.76), Alkalinity (46.8±10.2 to 103.2±0.18), Conductivity (122.34±11.09 to 280±0) and Total dissolved solid (141.6±7.06 to 280.6±16.5). Mean levels (ppm) of lead (Pb) was (0.04±0.00 to 0.10±0.04) and cadmium (Cd) was (0.01±0.00 to 0.05±0.0).

Keywords: physicochemical properties, heavy metals, drinking water sources, mauganj blocks

1. Introduction

Water plays an essential role in human life**.** Although statistics, the WHO reports that approximately 36% of urban and 65% of rural Indian were without access to safe drinking water (Akoto and Adiyah, 2007) [1].

Ground water is generally considered as a safe source of fresh drinking water (Haloi and Sarma, 2011) [2]. But rapid population growth, increasing living standards in urban areas and industrialization have resulted in greater demand of quality water on one hand, while on the other hand, pollution of water sources is increasing steadily. Therefore the ground water is getting polluted and among which wells are generally considered as the worst type of ground water sources in the term of physico-chemical contamination due to the lack of concrete plinth and surrounding drainage system (WHO, 1998 and Reza and Singh, 2009) [3, 4]. The incidence of ground water pollution is highest in urban areas where large volumes of waste discharged into relatively small areas (Rao and Mamatha, 2004) [5]. There are various factors, which are responsible for ground water contamination such as use of fertilizer in farming (Altman and Parizek, 1995) [6], seepage from effluent bearing water body (Adekunle, 2009) [7]. Once the groundwater is contaminated, its quality cannot be restored by stopping the pollutants from the source. Therefore it becomes imperative to regularly monitor the quality of groundwater and to device various means to protect it (Ramakrishnaiah, 2009) [8]. The surface water sources, in general, are not acceptable for drinking purpose as these are often loaded by various organic, inorganic and biological constituents (Kumar *et al.* 1996 and Dahiya and Kaur, 1999) [9, 10].

In the recent years, the availability and access to fresh water has become the most critical issue in the world. Freshwater is essential to human health, agriculture, industry and natural ecosystems, but is now running scarce in many regions of the world (WWF,1998) [11]. The desirable properties of water quality should include adequate amount of dissolved oxygen, relatively low organic content, pH value near neutrality, moderate temperature, and free from excessive amount of infectious agents, toxic substances and mineral matter (Oluyemi *et al.* 2010) [12]. Potable water should be free from disease producing microorganisms and chemical substances that are dangerous to health (Lamikaran, 1999 and Shittu *et al.* 2008) [13, 14]. Majority of the rural people do not have access to potable water and therefore, depend on well, stream and river waters for domestic use. Excessive use of limited water resources, disposal of various industrial effluents, human wastes into water may release heavy metals, which harm both human and animals health (Singh and Mosley, 2003) [15]. Continuous exposure to heavy metals to animals and humans cause hepatotoxicity and nephrotoxicity. So, periodical estimation of level of heavy metals in water is necessary.

Mauganj is a town and a nagar panchayat in Rewa district in the Indian state of Madhya Pradesh. Bagheli is the regional language of Mauganj. The area is famous for waterfalls.

Mauganj was the capital of Mau, which was a principality before the capture of Rewa. The Rajas of Mau were of the Sengar (a Rajput clan). It is notable for the monuments built by the Sengar, who ruled in the area before Indian sovereignty. Major Population in Mauganj are Brahman, Kshatriya, Vaishya and other minority group.

2. Materials and Methods

Mauganj is located at 24.68°N and 81.88°E. It has an average elevation of 313 metres (1,026 feet). Mauganj is 65 km from Rewa, and villages Panni, Dhera, Barahata, Pakara Pande, Khatkhri, Padar, Nandanpur.

Some sites of religious significance around Mauganj are:

- Mahadev Temple in Devatalab (17 km from Mauganj).
- Asht Bhuji temple
- Hanuman Mandir, Ram janki mandir and Alopan Mandir

Sample Collection
A total of 75 samples were taken from different sources like hand-pumps (40), wells (20), taps (10), ponds (4) and rivers (1) were collected in and around Mauganj blocks.
Water samples were randomly collected from different sources at varying interval in thoroughly washed and sterilized bottle. Physico-chemical analysis was done within 48 hours and the samples were stored at room temperature.

Physico-Chemical Analysis
Gross appearance, odour and taste: The water samples were observed with naked eyes for gross appearance and examined for offensive odour through the subjective organoleptic assessment.
Temperature: The temperature was recorded in Celsius (°C) with the help of mercury thermometer.
pH: pH of the water was determined with the help of pH meter (Model Digital pH meter 335).
Dissolved oxygen (DO): Dissolved oxygen of water was determined as per method (Winkler, 1988) [16] and expressed in terms of ppm.
Biochemical oxygen demand (BOD): BOD was determined as per the method (APHA, 1971) [17] and was expressed in terms of ppm. The method involves, measuring difference of oxygen concentration of the sample before and after incubation of 5 days at 20° C.
Alkalinity: Alkalinity was determined as per the method (APHA, 1975) [18] and expressed in terms of ppm.
Conductivity: The conductivity of water was determined with the help of Conductivity meter (Model Inolab Cond 720) and expressed in terms of μS/cm.
Total dissolved solids (TDS): The total dissolved solids of water was determined by Conductivity meter (Model Inolab Cond 720) and expressed in mg/l.
Heavy metal estimation: The estimation of Lead (pb) and Cadmium (Cd) of the water samples was done as per method (Tandon, 1999) [19] by SL-176, Double beam atomic absorption spectrophotometer, ELICO.

Statistical Analysis
The simple linear correlation analysis has been carried out to find out correlation between two tested parameters.

3. Result and Discussion
The results and discussion of physico-chemical properties of water samples was given below-
Gross appearance, odour and taste: Water samples from most of the sources were transparent, odourless and taste was agreeable except water from rivers and ponds which were highly turbid and foul smelling, which appears aesthetically objectionable for human and animal use.
Temperature: Water samples were collected and analyzed between March to July. The mean temperature ranged from 26.3±1.05 to 31±0°C (Table-1), almost similar findings were observed by Mishra and Bhatt (2008) [20], who examined water samples collected from Anand district of Gujarat and reported that the temperature of water samples ranged between 28 to 31°C. In the similar study conducted in Bichi Local Government Area of Kano State of Nigeria by Bernard and Ayeni (2012) [21] and reported the mean temperature ranged from 24.5 to 26.2°C. The low temperature may be due to winter season.
pH: The mean values ranged from 6.71±0.02 to 7.3±0.03 (Table-1). These findings were supported by the results of (Shittu *et al.* 2008) [14], who reported pH of water samples ranging from 6.8 to 7.3. The pH of water ranged from 6.8 to 8.3 in a similar study conducted by Pandey and Tiwari (2009) [22] in the selected area of Ghazipur city, India.
Dissolved oxygen: The mean values ranged from 2.9±0 to 8.05±0.04 ppm (Table-1). In a similar study conducted by (Simpi *et al.* 2011) [23] who reported the DO fluctuated from 7.25 to 16 ppm. This variation in dissolved oxygen might be due to temperature, photosynthesis, respiration, aeration, organic waste and sediment concentration (Budget and Verma 1985) [24].
Biochemical oxygen demand: The mean varying from 3.2±0 to 6.41±0.76 ppm (Table-1). According to study conducted by Usharani *et al.* (2010) [25] who found biochemical oxygen demand ranging from 0.16 to 11.6 mg/l. Water with BOD < 4 ppm are considered to be clean water, while those with > 10ppm are considered to be polluted and unsafe (Kurup *et al.* 2011) [26].
Alkalinity: The mean values ranged from 46.8±10.2 to 103.2±0.18 ppm (Table-1). Similar findings were observed by Belorkar (2010) [27] who recorded alkalinity upto 290 mg/l in the river water. These findings are not in line with the observation of (Odeyemi *et al.* 2010 and Pandey and Tiwari 2009) [28, 22] who recorded lower alkalinity of water samples ranging from 20-110 mg/l and 110 to 149 mg/l respectively.
Conductivity: Conductivity of water samples varied the mean values range from 122.34±11.09 to 280±0 μS/cm (Table-1). It was noticed that 2 samples were above the prescribed level of 1400 μS/cm by WHO (1973) [29]. The results were in partial accordance with those of Devi and Premkumar 2012) [30] who found the electrical conductivity of water was varying from 334-1640 μS/cm and 423-1197 μS/cm, respectively.
Total dissolved solids: The mean values ranged from 141.6±7.06 to 280.6±16.5 mg/l (Table-1). These findings are not in line with (Pandey and Tiwari 2009) [22] who reported the TDS values ranged from 145 to 245 mg/l. Higher presence of high levels of TDS in water may be objectionable to consumers owing to the resulting taste and to excessive scaling in water pipes, heaters, boilers, and household appliances. Some dissolved organic matter may contribute to increased level of TDS which also indicates that water is polluted (Rao *et al.* 2012) [31].
While, water with extremely low concentrations of TDS may also be unacceptable to consumers because of its flat and insipid taste.
Heavy metal estimation: In the present study, the concentrations of lead and cadmium were found more than the prescribed permissible limits of WHO (2003) [32]. The increase in the lead level may indicate presence of old pipes and industrial pollution (Gebrekidan and Samuel, 2011) [33], effect of combustion of petrol (Hardman *et al.* 1999) [34] and gasoline (Banat *et al.* 1998) [35]. The increased levels may cause damage to brain, kidney if taken in high concentration (Hanaa *et al.* (2000) [36]. The increase in level of cadmium indicates the pollution of water bodies by industrial activities (Nassef *et al.* 2006) [37], excessive uses of steel plating, nickel cadmium batteries. Exposure to cadmium causes kidney damage (Rajappa *et al.* 2010) [38]. The accumulation of these heavy metals might be due to anthropogenic activities and important in public health point of view.

Table 1: Physico-chemical properties of drinking water samples (Mean ± SEM)

S. No.	Source	No. of sampled examined	Temp. °C	pH	DO (ppm)	BOD (ppm)	Alkalinity (ppm)	Conductivity (µS/cm.)	TDS (mg/L)
1.	Hand pump	40	26.3 ±1.05	6.71 ±0.02	8.05 ±0.04	5.23 ±0.03	103.2 ±0.18	254.51 ±11.36	174.5 ±6.04
2.	Well	20	28.4 ±1.07	6.93 ±0.01	5.0 8±0.06	6.41 ±0.76	46.8 ±10.2	210.53 ±110.1	141.6 ±7.06
3.	Tap	10	30.6 ±0.06	7.21 ±0.02	7.06 ±0.07	5.67 ±0.08	82.5 ±5.03	196.22 ±25.36	212.2 ±10.2
4.	Ponds	4	30.2 ±0.28	7.3 ±0.03	3.2 ±0.14	3.33 ±0.22	76.32 ±3.05	122.34 ±11.09	280.6 ±16.5
5.	River	1	31±0	6.8±0	2.9±0	3.2±0	76±0	280±0	244±0

Table 2: Mean Concentration (ppm) of Lead and Cadium in water samples (Mean ± SEM)

S.No.	Sources	Lead (Pb) ppm Mean ±SE	Cadmium (Cd) ppm Mean ± SE
1.	Wells (20)	0.06±0.02	0.02±0.01
2.	Hand pump (40)	0.07±0.03	0.01±0.01
3.	Taps (10)	0.10±0.04	0.01±0.00
4.	Ponds (4)	0.05±0.02	0.02±0.01
5.	River (1)	0.04±0.01	0.05±0.02

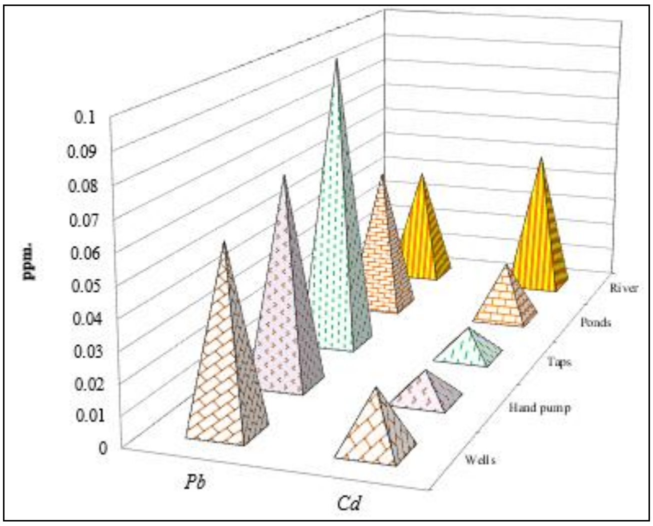

Fig 1: Graphics analysis of Mean Concentration (ppm) of Lead and Cadium in water samples

4. Conclusion

The gross appearance, odour and taste were agreeable except pond and river water which revealed high turbidity and foul smelling odour. Parameters like temp, pH, DO, BOD, alkalinity, Conductivity and total dissolved solid was within the permissible limits of WHO. The lead and cadmium levels were slightly more than the permissible limits of WHO in all water samples, which could be important in public point of view. The physico-chemical characteristics in the study suggested that river and pond water is not suitable for drinking purpose. Regular estimation of the above mentioned parameters would be helpful to improve water quality.

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6. References

1. Akoto O, Adiyiah J. Chemical analysis of drinking water from some communities in the Brong Ahafo region, International Journal of Environmental Science and Technology. 2007; 4(2):211-214.
2. Haloi N, Sarma HP. Ground Water Quality Assessment of some parts of Brahmaputra Flood plain in Barpeta district, Assam with special focus on Fluoride, Nitrate, Sulphate and Iron analysis, Int. J. Chem. Tech. 2011; 3(3):1302-1308.
3. WHO. Guidelines for drinking water quality, 3rd edn. World Health Organisation, Geneva, 1998.
4. Reza R, Singh G. Physico-chemical Analysis of Ground Water in Angul-Talcher Region of Orissa, India, Marsland Press, J. Am. Sci. 2009; 5(5):53-58.
5. Rao SM, Mamatha P. Water quality in sustainable water management. Cur. sci. 2004; 87(7):942-947.
6. Altman SJ, Parizek RR. Dilution of nonpoint source nitrate in ground water. J. Environ. Qual. 1995; 24:707-717.
7. Adekunle AS. Effects of Industrial Effluent on Quality of Well Water Within Asa Dam Industrial Estate, Ilorin, Nigeria., Nat. Sci. 2009; 7(1):34-39.
8. Ramakrishnaiah CR. Assessment of Water Quality Index for the Groundwater in Tumkur Taluk, Karnataka State, India. E-J. Chem. 2009; 6(2):523-530.
9. Kumar A, Bagavathiraj B, Kumarji B. Physico-chemical and microbiological aspects of Courtallam water. Poll. Res. 1996; 15(2):159-161.
10. Dahiya S, Kaur A. Assessment of physico-chemical characteristics of underground water in rural areas of tasham subdivisions, Bhiwani district, Haryana. Enviro. J. Poll. 1999; 6(4):281-288.
11. WWF. Living planet report: over consumption in driving the rapid decline of the world's environments. World Wide Fund for Nature, Gland, Switzerland, 1998.
12. Oluyemi EA, Adekunlel AS, Adenuga AA, Makinde WO. Physico-chemical properties and heavy metal content of water sources in Ife North Local Government Area of Osun State, Nigeria. Afr. J. Environ. Sci. Technol. 2010; 4(10):691-697.
13. Lamikaran A. Essential Microbiology for students and Practitioners of Pharmacy, Medicine and Microbiology, 2nd Edn., Amkra books, 1999, 406.
14. Shittu OB, Olaitan JO, Amusa TS. Physico-chemical and Bacteriological Analyses of Water Used for Drinking and Swimming Purposes in Abeokuta, Nigeria. Afr. J. Biomed. Res. 2008; 11:285-290.
15. Singh S, Mosley LM. Trace metal levels in drinking water on Viti Levu, Fiji Islands. S. Pac. J. Nat. Sci. 2003; 21:31-34.
16. Winkler LW. The determination of dissolved oxygen in water. Berline Deutsch Chan Gesellsch. 1888; 21:2843.
17. APHA. Standard method for the examination of water and wastewater. Washington D.C, 1971, 874.
18. APHA. Standard methods for the examination of water and waste water. 19thEdn., American Public Health Association, 1975.

19. Tandon HLS. Methods of analysis of soil, plants, waters and fertilizers. Fertilizer development and consultation organization. New Delhi, 1999, 1-144.
20. Mishra A, Bhatt V. Physico-chemical and microbiological analysis of underground water in V.V. Nagar and nearby places of Anand district, Gujarat, India. E-J. Chem. 2008; 5(3):487-492.
21. Bernard E, Ayeni N. Physico-chemical analysis of groundwater samples of Bichi local government area of Kano state of Nigeria. ARPN J. Sci. Technol. 2012; 2:2225-7212.
22. Pandey SK, Tiwari S. Physico-chemical analysis of ground water of selected area of Ghazipur city-A case study. Nat. Sci. 2009; 7(1):17-20.
23. Simpi B, Hiremath SM, Murthy KNS, Chandrashekarappa KN, Patel A, Puttiah ET. Analysis of Water Quality Using Physico-Chemical Parameters Hosahalli Tank in Shimoga District, Karnataka, India. Global J. Sci. Front. Res. 2011; 11(3):31-34.
24. Budget US, Verma AK. Limnological studies on J.N.U. Lake, New Delhi, India. Bull. Bot. Soc. Sugar. 1985; 32:16-23.
25. Usharani K, Umarani K, Ayyasamy PM, Shanthi K, Lakshmanaperumalsamy P. Physico-chemical and bacteriological characteristics of Noyyal river and ground water quality of Perur, India. J. Appl. Sci. Environ. Manage. 2010; 14(2):29-35.
26. Kurup R, Persaud R, Caesar J, Raja V. Microbiological and physiochemical analysis of drinking water in Georgetown, Guyana. Nat. Sci. 2011; 8(8):261-265.
27. Belorkar SA. Assessment of the deterioration in physio-chemical and microbiological quality of Shivnath River Water in Durg District, India. E-J. Chem. 2010; 7(3):733-738.
28. Odeyemi AT, Dada AC, Ogunbanjo OR, Ojo MA. Bacteriological, physicochemical and mineral studies on Awedele spring water and soil samples in Ado Ekiti, Nigeria. Afr. J. Environ. Sci. Technol. 2010; 4(6):319-327.
29. WHO. Guidelines for drinking water quality. 3rd Edn.World Health Organisation, Geneva, Washington, D.C, 1973.
30. Devi S, Premkumar K. Physico-chemical analysis of groundwater samples near industrial area, Cuddalore District, Tamil Nadu, India. Int. J. Chem Tech Res. 2012; 4(1):29-34.
31. Rao VS, Prasanthi S, Shanmukha KJV, Prasad KRS. Physico-chemical analysis of water samples of Najendle area in Gunter District of Andhra Pradesh, India. Inter J. Chem. Tech. Res. 2012; 4(2):691-699.
32. WHO. (2003) International year of fresh water. General assembly resolution A/RES/55/196. Official website: www. wateryear2003.org., Retrieved on 01-10-2012.
33. Gebrekidan, M. and Samuel, Z. Concentration of Heavy Metals in Drinking Water from Urban Areas of the Tigray Region, Northern Ethiopia., *M. E. J. S.*, 2011; 3(1): 105-121.
34. Hardman, D.J., Mceldowney, S. and Watte, S. Pollution, ecology and biotreatment. Longman Scientific, Technical, England, 1999.
35. Banat, I.M., Hassan, E.S., El-Shahawi, M.S. and Abu-Hilal, A.H. Postgulf- war assessment of nutrients, heavy metal ions, hydrocarbons, and bacterial pollution levels in the United Arab Emirates coastal waters. *Environ. Inter.*, 1998; 24(2): 109-116.
36. Hanaa, M., Eweida, A. and Farag, A. Heavy metals in drinking water and their environmental impact on human health. International Conference on Environmental Hazards Mitigation, Cairo University, Egypt., 2000; 542-556.
37. Nassef, M., Hannigan, R. EL., Sayed, K.A and Tahawy, M.S.El. Determination of some heavy metals in the environment of Sadat industrial city. Proceeding of the 2nd Environmental Physics Conference, Cairo University, *Egypt*., 2006; 145-152.
38. Rajappa, B., Manjappa, S. and Puttaiah, E.T. Monitoring of heavy metal concentration in groundwater of Hakinaka Taluk, India., *Contemp. Eng. Sci.*, 2010; 3(4):183-190.