NOTE

Pollution Studies of Ground Water of Pipariya (Madhya Pradesh) Township

H.C. KATARIA
Department of Chemistry
Government P.G. College, Pipariya-461 775 India

In the present note, the author has analysed the ground water sample of Pipariya

Groundwater is about 95% of the total available water all over the world. Due to various human activities, excessive use and overpumping and percolation of sewage, the quality of groundwater is decreasing day-by-day by releasing chemical and biological pollutants. Groundwater is the most important source of water supply for irrigation, industries and drinking purposes. The quality of water is of vital concern for mankind since it is directly linked with human welfare.

Physico-chemical characteristics of hand pump water has been studied twice in a season in winter, summer and monsoon for one year (1997–98). Temperature, pH, electrical conductivity, free CO_2, chloride, total alkalinity, total hardness, Ca-H, Mg-H are observed in the range of 20–32°C, 6.6–7.5, 280–840 μ mhos/cm, 8–40.00, 76–138.4 ppm, 115–252, 56.6–106.4, 36–74.8 and 13.8–32.4 ppm respectively, while D.O., B.O.D., C.O.D., nitrate, sulphate ranged from 1.18–2.4, 2.4–5.6, 21.4–84.6, 3.6–12.4 and 33.2–72.4 ppm respectively. Most probable number of faecal coliforms/bacteria in index/100 mL were recorded in the range of 3.6–1020 at different sampling stations.

Pipariya town is situated in Hoshangabad district of M.P., India. The samples of hand-pumps at different mohallas were collected in pre-sterilized bottles/jerrycans for analysis. Samples were preserved for D.O. and B.O.D. at spot. Temperature and pH were measured on spot; specific conductivity, hardness alkalinity, chloride, free CO_2, C.O.D., B.O.D. were analysed the same day as prescribed by APHA and NEERI[1, 2].

Landfills used for dumping refuses and municipal wastes contribute groundwater pollution. Organic and inorganic matter is present in crude wastes and products that decompose and can be leached by water passing through wastes. Higher values of nitrates are due to excess use of nitrogenous fertilizers. The pollution potential is influenced by the rate of self-purification.

In the present study temperature ranged from 22–32°C. Temperature influences the biological reactions in water. Higher values of temperature accelerater the chemical reactions in water. Turbidity as insoluble particulates impedes the passage of light through water by scattering and absorbing the rays. Turbidity measurement is important from the aesthetic point of view. Turbidity in water has a significant effect on the microbiological quality of drinking water due to the presence of bacteria and virus. In this study turbidity is measured as 14 and 8 in

TABLE-1
BIO-CHEMICAL ANALYSIS OF GROUNDWATER OF PIPARIYA TOWNSHIP, 1997–98

(Mean seasonal values are given)

Parameters	Units	SS_1	SS_2	SS_3	SS_4	SS_5	SS_6	SS_7	SS_8
Temperature	°C	20.0	26.2	22.0	31.5†	29.6	28.2	24.0	27.8
Turbidity	N.T.U.	16.0	6.0*	8.0	28.0	32.0†	14.0	12.0	16.0
pH	—	6.8	6.4	6.9	7.8†	7.6	6.4	6.2*	7.0
Electrical conductivity	μmhos/cm	280.0*	312.0	790.0	810.0	840.0†	660.0	620.0	580.0
Free CO_2	ppm	6.0*	6.4	7.2	6.9	36.0	38.2	40.0†	28.4
Chloride	ppm	78.0*	118.6	78.2	96.4	138.2	140.4†	124.8	130.0
Total alkalinity	ppm	140.0*	132.8	142.0	246.0	248.0†	209.0	218.0	190.0
Total hardness	ppm	56.8*	84.6	60.0	68.4	220.0†	124.8	132.0	120.0
Ca—H	ppm	36.4	50.2	32.8*	34.0	158.4†	108.0	112.0	104.0
Mg—H	ppm	20.4	34.4	27.2	24.4	41.6†	16.8	20.0	16.0*
Dissolved oxygen	ppm	1.12*	2.04	1.58	1.98†	1.80	2.0	1.80	1.36
B.O.D.	ppm	2.40	2.24	3.40	4.2	4.8†	2.08*	2.16*	2.20
C.O.D.	ppm	58.4	42.8	36.8	32.4*	78.8†	68.4	74.0	28.4
Nitrate	ppm	0.22*	0.32	9.3	30.6	32.4†	0.72	2.2	1.4
MPN	Index/100 mL	12.0*	380.0	460.0	980.0	1010.0†	92.0	140.0	1080.0
Sulphate	ppm	32.4*	48.6	36.8	52.4	78.0†	64.8	64.8	58.4

*Minimum values; †Maximum values.

winter, 28 and 32 in summer and 13, 11 N.T.U. in monsoon. Higher values are due to influence of domestic sewage. pH indicates the acidity and alkalinity and measures H^+ in water. In this study minimum pH 6.6 and maximum 7.4 was observed in summer and monsoon season. Electrical conductivity, which measures the dissolved ions, ranged from 282 to maximum of 640 μ mhos/cm. Groundwater is extra rich in CO_2 as water comes from percolation through various strata and absorbs a large amount of it. Free CO_2 ranged from 6.0 to 36.0 ppm in this study. In this study chloride, total alkalinity, T-H, Ca-H and Mg-H ranged from 78.1–124.2, 199.0–244.0, 58.4–102.8, 37.0–49.8 and 14.4–30.8 ppm respectively in different seasons at different sampling stations. Results are summarised in Table-1. Alkalinity measures capacity to absorb H^+ ions without significant change in pH. Hardness is the result of geological formations of the water sources. The findings are similar to previous workers[4, 5].

Dissolved oxygen is the primary cause of corrosion of pipes. B.O.D. is the amount of oxygen required to stabilize the biodegradable organic matter by micro-organisms of water under aerobic conditions. C.O.D. determines the oxygen required for chemical oxidation of organic matter with oxidants. In the present study, D.O., B.O.D. and C.O.D. ranged from 1.12–1.52, 2.0–3.1 and 20.4–78.0 ppm respectively. The findings are similar to previous reports[4–9].

Nitrate in significant quantities in groundwater is due to leaching of nitrate by percolation of sewage water. It causes methmoglobinemia in infants. Sulphate is an important constituents of hardness with Ca and Mg. Excess amount of sulphate in water has carthartic effect on human health[12]. The estimation of the number of presumptive coliform (MPN Court) present in water was done by inoculation of appropriate volume into a number of tubes of medium (MacConkey broth). 10, 1 and 0.1 mL of sample were inoculated in 3 sets of 5 test tubes each containing 10 mL of medium. On incubation, it was assured that in each tube 1 or more viable organisms in the inoculum show growth and a positive reaction to the medium used. Nitrate, sulphate and MPN in this study ranged from 0.22–32.4, 32.4–78.0 ppm and 12.0–1010 index/100 mL.

Most of the parameters are found within permissible limits recommended by WHO[11–13], while turbidity, C.O.D., M.P.N. are found beyond the limits of ISI 1983[3].

Excessive use of manures and fertilizers and disposal of organic water are deteriorating the groundwater quality of water. Higher values are found at sampling station No. 5 and sampling station No. 6 because these stations are situated in low lying areas of Pipariya and near the sewage nallahs. Suitable measures should be adopted to prevent the pollution.

Sampling stations: SS_1 = Ashok Ward, SS_2 = Sandiya Road, SS_3 = Bankhedi Road, SS_4 = Silari Village SS_5 = Anand Bag, SS_6 = Hatwas, SS_7 = Sardar Ward, SS_8 = Shcbhapur Road.

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REFERENCES

1. Standard Methods for the Examination of Water and Waste Water, American Public Health Association. APHA, New York (1986).

2. B.K. Handa, *J. Groundwater Tech. Div. NWWA.* (1975).

3. Indian Standards Specification for Drinking Water, IS:10500, Indian Standards Institute, New Delhi (1983).

4. H.C. Kataria and R.K. Sharma, *J. Hydrobiol*, **10,** 7 (1994).

5. H.C. Kataria and O.P. Jain, *Ind. J. Environ. Bot.*, **15,** 569 (1995).

6. H.C. Kataria, *Ind. J. Environ. Bot.*, **15,** 208 (1995).

7. H.C. Kataria, S.S. Gupta and O.P. Jain, *Poll. Res.*, **14,** 455 (1996).

8. H.C. Kataria, *Orient. J. Chem.*, **12,** 181, 225 (1996); **13,** 126 (1997).

9. M. Paramsivam and A. Sreenivasam, *Indian J. Environ. Health*, **23,** 222 (1981).

10. K.S. Rangwala and P.S. Rangwala, Water Supply and Sanitary Engineering, Charater Publ. House, Anand, 12th Edn., p. 43 (1927).

11. Environmental Health Criteria, Vol. 5 WHO, Geneva (1978).

12. Health hazard from nitrates in drinking water, Report on a WHO Meeting, Copenhagen (1985).

13. Environmental Health Critera, Vol. 5, WHO, Geneva (1978).