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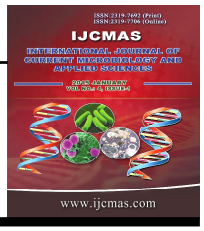

Original Research Article

Assessment of ground water quality of Hamirpur District, Uttar Pradesh, India

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A B S T R A C T

The study was designed to predict the water qualities at different areas of Hamirpur District Uttar Pradesh, India. Physico-chemical parameters were investigated TDS, pH, fluoride, nitrate, chloride, sulphate, hardness and alkalinity. The results were compared with drinking water quality standards prescribed by the Beauro of Indian Standards (BIS). Ground water sampling carried out in January 2014 to April 2014. Most of the water samples were found to have total dissolved solids, alkalinity and hardness values more than their permissible level. The values of heavy metals (Cd, Cu, Fe, Pb, Ni and Co) also determine in collected water samples. The high values of these parameters might have health complications and so they need attention. The above studies are helpful to understand the ground water quality and their subsequent fitness or unfitness of water for drinking domestic purpose at various sites undertaken.

Keywords

Ground water quality, Heavy metals, Fluoride and Hamirpur

Introduction

Hamirpur district located on the right banks of the Yamuna river, Latitude 2507'N & 2607' N and Longitude 79017'E & 80021'E. According to the 2011 Indian census, Hamirpur has a population of 1,104,285.

The total area covered in Hamirpur is 4,121.9 sq. km. Tropical wet and dry climate with average temperatures ranging between 20 to 28°C. Average rainfall was 72 cm (Singh et al 2011).

Ground water contamination by the heavy metals has become a striking problem for last two decades as results of discharge of industrial effluent, untreated domestic waste and increasing the use of Agrochemicals, i.e. fertilizers and pesticides in our farming. Today, heavy metals are frequently present in our water, soil and air due to extensive use of their compounds (Gupta et. al., 2014). The water for the consumption at human beings comes in different forms and from different sources. There were two main sources of drinking water; one is a surface water resources river, lakes and other one is underground water in the subsoil and in previous rock. About 945 of total available water over the global in the form of ground water in villages the main source of drinking water is underground water accessible from bore wells or hand pumps (Ray et al., 2000).

Groundwater contamination in contrast to others is very critical, as once an aquifer becomes contaminated, it's terribly tough, expensive and time consuming affair to clean it up and may remain unusable for decades. As a decentralized source of drinking water and myriads of other services for millions of rural and urban families, groundwater as a natural resource plays a crucial role which, accounts for nearly 80 per cent of the rural domestic water needs and 50 per cent of the urban water needs in India (Kumar et al., 2005). Water is the most crucial resource for the living organism to survive. It possesses a number of physical and chemical properties that help the molecule to act as the best suited medium for the life activities. Most of the biochemical reaction that occurs in the metabolism and growth of living cell involve water. Hence, it has been referred to as dissolving agent (Tandy et al., 2004).

Ground Water Scenario of India (2009-10) is highly complicated due to the occurrence of diversified geological formations with considerable lithological and chronological variations, complex tectonic framework, climatological dissimilarities and various hydro-chemical conditions. Studies carried out over the years have revealed that aquifer groups of alluvial / soft rocks even transcend the surface basin boundaries. Broadly, two groups of rock formations have been identified depending on characteristically different hydraulics of ground water, Viz. Porous Formations and Fissured Formations (Manimaran, 2012).

The global awareness and concern for the environment have paved way for the installation of various policies to control and prevent environmental pollution. Implementation of these policies has resulted in the development of various technologies, which will allow for the sustainable utilization of earth's resources. Thus preventing and controlling the overall degradation of the quantity and quality of these resources. Hence, proper management of available water resources is essential for the survival of mankind (Brabec et al., 2002).

Gupta et al. (2014) assessed the physico-chemical characteristics of hand pumps water of Banda city and found that the values of pH, TDS and hardness were 7.8 to 8.3, 320 to 370 and 200 to 341 mg/L respectively. They observed that values of chloride, iron and alkalinity were 28 to 36, 0.11 to 0.23 and 120 to 240 mg/L respectively. Rao et al., (2012) assessed ground water quality for application in Kakinanda coast and found that the values of TDS, hardness and chloride were 171 to 2662, 65 to 515 and 64 to 446 mg/L respectively.

Materials and Methods

The sampling was done at different location in Hamirpur district and analyzed in

laboratory according to APHA/ AWWA-2012 (22nd Edition). Seven ground water samples were collected from different areas of Hamirpur. These were of Kurara, Sumerpur, Sarila, Gohand, Rath, Muskra, and Maudaha (Table 1). All the samples were collected from India mark II hand pumps in Hamirpur district. Samples for physico-chemical analysis were collected in plastic sterilized bottles, before filling the samples these bottles have been rinsed three times with water, whereas for the analysis of metals in these water samples 1.0 mL of nitric acid (HNO_3) was added in each bottle and taken it to the laboratory. The complete process of sample preparation and analysis of physico-chemical and metals was made as mentioned in standard methods for examination of water and wastewater (APHA/ AWWA-2012).

Result and Discussion

The physico-chemical parameters of water samples collected in Hamirpur area are shown in Fig. 1. The parameters were determined such as pH, hardness, alkalinity, TDS, sulphate, Nitrate, fluoride and chloride content. The samples were collected in January 2014 to April 2014 of Hamirpur District. All parameters were compared with Drinking water standards prescribed by BIS (Is: 10500: 2012).

pH, Fluoride, Nitrate, chloride and Sulphate content

The minimum and maximum pH was observed 7.5 ± 1.9 at muskra and 8 ±1.4 at kurara respectively (Fig. 2). These values were within the limits prescribed by BIS. The low pH does not cause any harmful effect (Boominathan and Khan, 1994). The minimum Fluoride and nitrate was observed 0.1 ± 0.02 and 0.88 ± 0.4mg/L at Rath and maximum 0.4 ± 0.13 at kurara and 1.77 ± 0.97mg/L at Sumerpur (Fig. 2). Garg et al. (2004) reported that the fluoride content in rural habitations of Jind district between the ranges of 0.3 and 6.9 mg/L. whereas chloride was observed 20 ± 8 mg/L minimum at Sarila and 40 ± 11.3 mg/L maximum at Muskra and Sulphate was observed 9.6 ± 2.5 mg/L minimum at Muskra and 48 ± 15.7 mg/L maximum at Sumerpur (Fig. 2). The amount of the chloride present in the ground water samples was under the permissible limit. High chloride reacts with sodium and makes water salty in taste, which in unacceptable for human consumption. It also increases the total dissolved solid values thereby affecting the quality of water. It produces salty taste at 250 mg/L to 500 mg/L (Trivedy and Goel, 1984).

TDS, Hardness and Alkalinity content

The value of TDS were observed minimum 450 ± 100 mg/L at Sarila and Maximum 630 ± 121 mg/L at Rath. Whereas Hardness value observed Minimum 260 ± 90 mg/L at Sarila and Maximum value 380±121mg/L at Kurara (Fig. 3). Hardness of water is seemed to be the capacity of water for reducing and destroying the soap lather. Hardness in water is due to the natural accumulation of contents of calcium ions and magnesium ions and salts or both. The sum of the calcium and magnesium hardness is called total hardness. Durfor and Becker (1964) observed that no water samples are soft, 23% are moderately hard, and 73% are hard in nature. Rout and Sharma (2011) observed that total hardness varied in between 116.6-129.4 mg/L, which indicated that water in the deep aquifer was moderately hard. So, it suggested to the cantonment localities to soften the tube well water before consumption. Alkalinity observed value Minimum 320 ± 108 mg/L at Muskra and Maximum 420 ± 134 mg/L at

Kurara (Fig. 3). It is caused due to presence of lots of number of suspended substances like peat, sludge, organic and inorganic matter, soluble color organic compound, plankton and other micro substance etc in water. The carbonate alkalinity was found to be absent indicating that the total alkalinity recorded was due to accumulation of bicarbonate only (Jameel and Hussain, 2007). Rout and Sharma (2011) observed that total alkalinity of analyzed water samples varied from 90.83 to 187.70mg/L.

Concentration of heavy metals in ground water samples

Heavy metals in ground water samples were determined (Figs 4 and 5). The concentration of Fe was found maximum in all the ground water samples. At Kurara, the concentration of Fe was found 0.837±0.018 followed by Sumerpur, Rath, Maudaha, Gohand, Sarila and Muskara. Among all the metals, the concentration of Co was very less (0.001±0.00045) in all samples.

Fig. 4 showed the area representation of the heavy metals concentration at different sampling location of Hamirpur district whereas Fig. 5 showed the graphical representation of mean concentration having standard deviation. The values of heavy metals concentration in all the samples were within prescribed limit for drinking water (BIS-2012). Iron concentration in water more than 2.0 mg/L causes staining on clothes, sanitary ware and imparts bitter astringent taste (Raval and Malik, 2010).

The water quality assessment study carried out in the representative blocks, has indicated that water quality of the selected blocks was almost was fit for domestic and irrigation purposes. The high values of total dissolved solids, hardness and alkalinity shows water is not directly potable uses without filter. Occurrence of lime stone and dolomite rocks produced hardness and alkalinity in the study area. In most of the blocks, bore wells with hand pumps are the protected water supplies to the rural communities. With continued ground water withdrawal, the concentrations showing increased levels are likely to go up further. Long term and continued water quality surveillance by the state agency (PHED) is bonded for quality assurance. One must consider springs, streams and rivers as alternate sources for water supply, after application of necessary treatment. Specific technology packages for defluoridation, desalination, iron removal need to be considered for installation in selected areas of high contamination. These results must be shared with people of the area and necessary remedial cure must be suggested to them to improve the water quality more and upgrade the quality of water for a safe and healthy life.

Fig. 1 Hamirpur district map showing sampling locations of Ground water samples

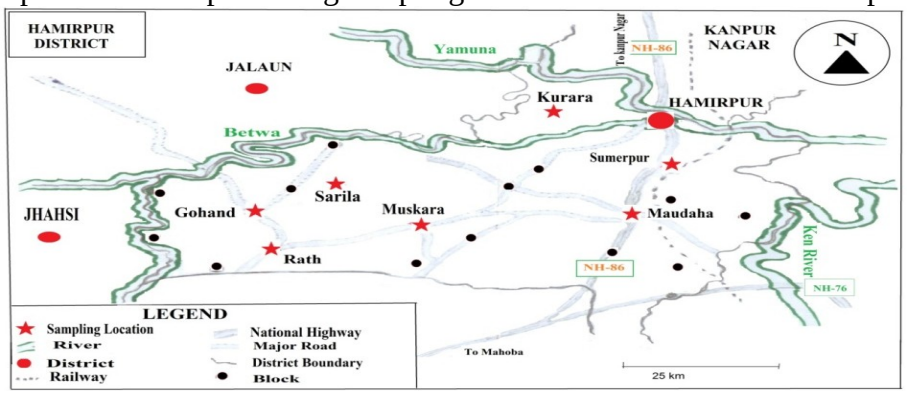


Fig.2 pH, Fluoride, Nitrate, Chloride and Sulphate content in Ground Water samples

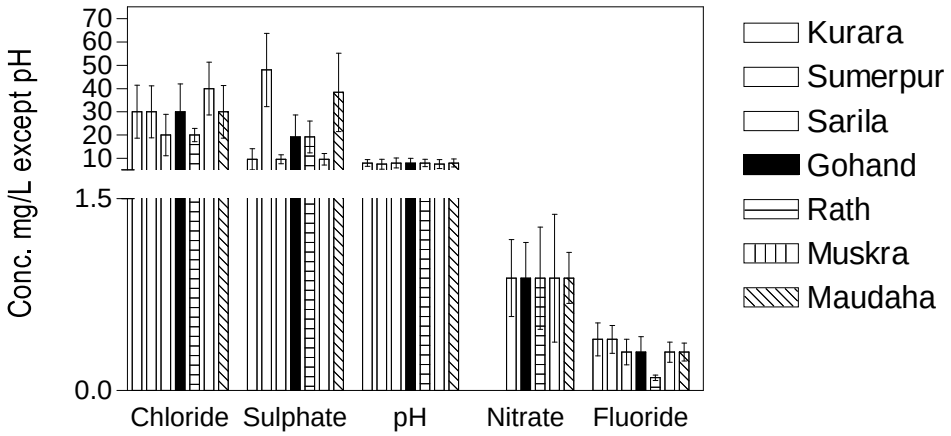


Fig.3 TDS, Hardness and Alkalinity content in Ground Water samples

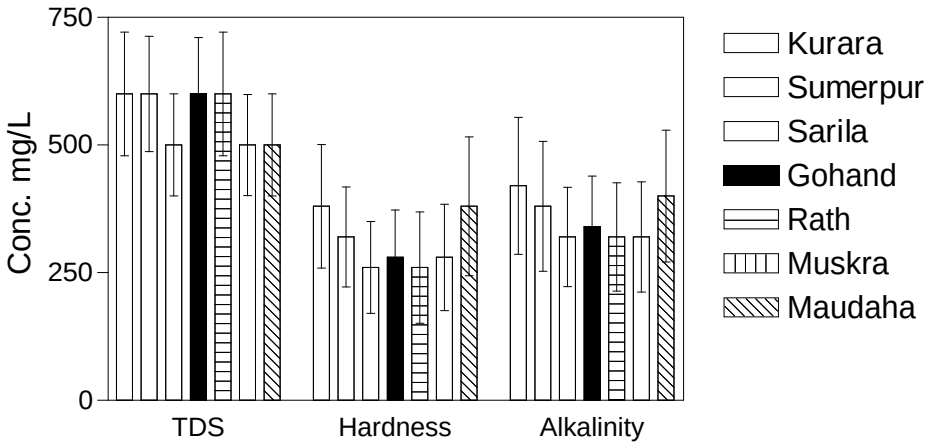


Fig.4 Metals concentrations in Ground Water samples

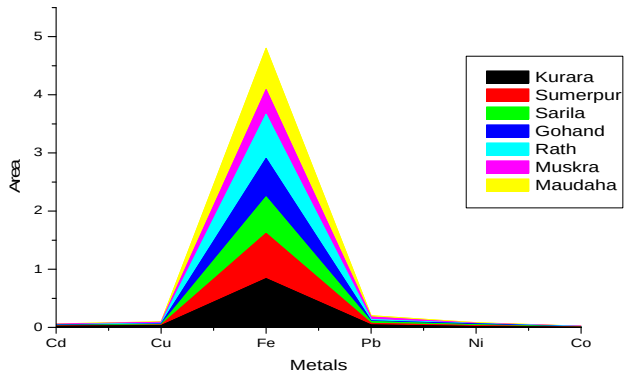
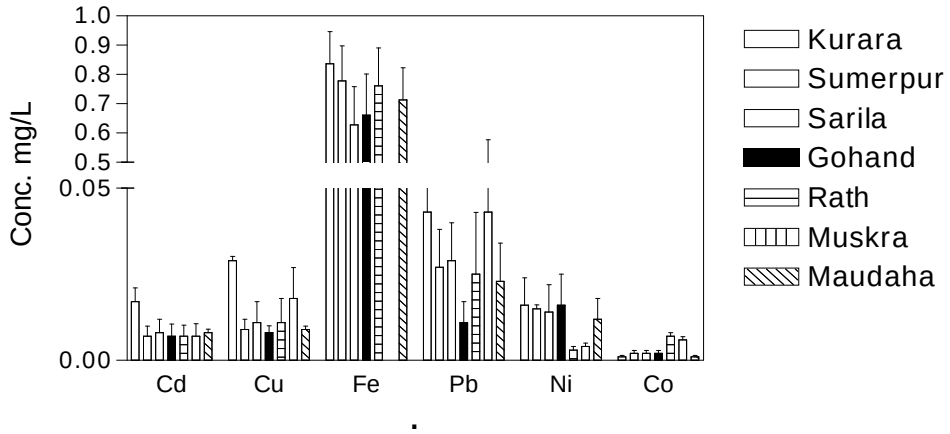


Fig.5 Metals concentrations in Ground Water samples



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References

Boominathan R. and Khan S.M., (1994). Effect of distillery effluents on pH, dissolved oxygen and phosphate content in Uyyakundan channel water. Environmental Ecology, 12: 850-853.

Durfor C.N. and Becker E., (1964). Public water supplies of the 100 largest cities in the United States. In Geological Survey Water Supply. U.S. Government Printing Office, Washington, Paper No. 1812: 364.

Ground Water Scenario of India 2009-10. Central Ground Water Board Ministry of Water Resources Government of India, Faridabad, 2010.

Guideline for Drinking Water Quality Recommendation, 1994. World Health Organization, Geneva, 1:1-130.

Gupta G.S., Gupta M.K., Gupta Alpana and Gupta Anjani 2014. Assessment of physic-chemical characteristics of hand pumps water of Banda city Indian J. Environ. Prot. 34: 51-54.

Indian standards for drinking water Speciation. Bureau of Indian Standard, New Delhi (BIS 10500: 2012).

Jameel A.A. and Hussain A.Z. 2007. Assessment of ground water quality on bank of Uyyakonda channel of river Cauvery at Tiruchirappalli, Indian J. Environ. Prot. 27: 713-716.

Kumar R., Singh, R.D. and Sharma K.D. 2005. Water Resources of India, Current Science, 89: 794-811.

Garg M., Kavita V.K. and Malik R.A., 2004. Groundwater quality in some villages of Haryana India: focus on fluoride and fluorosis, Journal of Hazardous Material, 106B: 85-97.

Raval V. H. and Malik G.M. 2010. Physico-chemical characteristics of ground water in around Surat City (India). J. Environ. Sci. and Engg. 52: 343-348.

Rao R., Satyanarayan T. and Machiraju P.V.S. 2012. Assessment of ground water quality for application in Kakinada Coast, Der Chemica Sinica. 3: 287-291.

Rout C. and Sharma A. 2011. Assessment of drinking water quality: A case study of Ambala cantonment area Haryana India, Inter. J. of Environ.

Sci. 2: 933-945.

Standards methods for Examination of Water and Wastewater. 2012. American Public Health Association, American Water Work Association and Water Pollution Control Federation, 22nd, Washington, DC.

Tripathi I.P., Singh R.C. and Singh R. 1996. Fluoride distribution in ground water at the around Chitrakoot, Indian J. Environ. Prot. 16: 805-807.

Trivedy R.K. and Goel P.K. 1984. Chemical and Biological Methods for Water Pollution Studies, Environmental Publications, Karad, India.

Susan Tandy, Karin Bossart , Roland Mueller , Jens Ritschel , Lukas Hauser , Rainer Schulin and Bernd Nowack. 2004. Extraction of Heavy Metals from Soils Using Biodegradable Chelating Agents. Environ. Sci. Technol. 2004, 38 (3), pp 937–944.

Manimaran D. 2012. Groundwater Geochmistry Study Using GIS in and Around Vallanadu Hills Tamilnadu, India. Research Journal of Recent Sciences. 1: 52-58.

Ray D., Ravindar Rao R., Bhoi A. V., Biswas A. K., Ganguly A. K. and Sanyal P. B. 2000. Physico-chemical quality of drinking water in Rohtas district of Bihar. Environmental Monitoring and Assessment. 61: 387-398.

Brabec, Elizabeth, Stacey S. and Paul R. L. 2002. Impervious Surfaces and Water Quality: A Review of Current Literature and Its Implications for Watershed Planning. Journal of Planning and Development. 16, 4, 499-514.

Singh K. C., Shashtri S., Singh A. and Mukherjee S. 2011. Quantitative modeling of groundwater in Satluj River basin of Rupnagar district of Punjab using remote sensing and geographic information system. Environmental Earth Science. 62, 871-881.