Indian J.L.Sci. 4(1) : 143-147, 2014

ISSN: 2277-1743 (Print)
ISSN: 2278-7879 (Online)

COMPARATIVE STUDY OF GROUNDWATER QUALITY OF TEHSIL MOHAMMADABAD GOHNA AND SADAR DISTRICT MAU

PREM YADAV[1]

Department of Chemistry, S.G.N. Government P.G. College, Mohammadabad Gohna, Mau, U.P., India

E Mail- prem77yadav@gmail.com

ABSTRACT

Water plays important role for irrigation of growing crops, fisheries and aquaculture to ensure food security of people. Mau district is surrounded by Ballia, Azamgarh, Gorakhpur, Ghazipur district. Mau District has 4 Tehsil (Madhuban, Ghosi, Mohammadabad Gohana and Maunath Bhanjan), 9 Block -Badraon, Fatehpur Madaun, Kopaganj, Ghosi. Doharighat, Mohammadabad Gohna, Pardaha, Ranipur and Ratanpura. In this paper we discuss ground water quality of two tehsils of Mau district, Muhammadabad and Sadar Mau, which have been included in my report. The pH observed in summer maximum 7.8 and minimum 7.5 and in rainy season it is maximum 7.4 and minimum 7.3 in Mohammadabad while the pH observed in summer maximum 8.6 and minimum 7.4 and in rainy season it is maximum 7.5 and minimum 7.4 in Sadar Tahsil Mau district. pH of All sampling stations between 7.4 to 8.6 which are acceptable limit. Hardness, Alkalinity, TDS, Cl^-, F^-, Ca^{-2}, Turbidity, DO. BOD, COD value matched with National and international authorities such as Indian Standard Institution (ISI), Bureau of Indian Standard (BIS) set the IS 10500:2012, Indian Council of Medical Research (ICMR), World Health Organization (WHO) et and finally find that ground water quality in both tahsil is suitable for drinking and agricultural purpose.

KEYWORDS: Ground Water, TDS, pH, Mau District Water Quality

Water plays a vital role for survival and sustaining all forms of living being, ecosystem, development of economic, agricultural and food production. For survival of every living species such as microorganisms to humans and plants required water. About 60-70% of human body makes up by water which plays biological functions like digestion, blood circulation and temperature regulation. It is also playing important role for irrigation of growing crops, fisheries and aquaculture to ensure food security of people. Water is the key component for maintaining ecosystems, biodiversity, regulate climate, hydrological cycle, humidity control etc. Industrial and economic growth such as hydroelectric power to generate electricity, mining and construction, cooling and reproduction etc. required water. For survival of human body three components air, water, and food are compulsory. Human body can survive 3 to 5 minutes without air, 3 to 7 days without water and 30 to 60 days without food. It is no surprising to say that there would be no existence of life on earth without water. Most of the people think that groundwater is the synonymous of underground water but hydrologists consider groundwater which is the below of water in the zone of saturation. Groundwater is form when rainwater and surface water by infiltration and percolation seep into the soil and becomes stored underneath the Earth's surface. An aquifer which can stores groundwater between rock, sand, gravel and silt, transmit sufficient amount of water act as 'highway' for groundwater flow. This is a vital part of the hydrologic cycle for maintaining the ecosystems and human activities. Groundwater is a vital source of drinking water for millions of people, used for irrigation to support agriculture and food production, help to maintain good health of our ecosystems supporting plants and animals' life and used in various industrial processes like manufacturing and energy production

AREA OF RESEARCH AND SAMPLE COLLECTION

Mau District situated in the south eastern part of the state Uttar Pradesh is one of the 75 Districts. It is a part of Azamgarh Division and established as a new district on 19 November 1988. The administrative headquarter of district in Maunath Bhanjan. Mau district is surrounded by Ballia, Azamgarh, Gorakhpur, Ghazipur district. Mau District has 4 Tehsil (Madhuban, Ghosi, Mohammadabad Gohana and Maunath Bhanjan), 9 Block (Badraon, Fatehpur Madaun, Kopaganj, Ghosi. Doharighat, Mohammadabad Gohna, Pardaha, Ranipur and Ratanpura). I have taken two tehsils of Mau district, Muhammadabad and Sadar Mau, which have been included in my report. Economy of the people in Mau district depend upon agriculture in which both surface and groundwater are used for irrigation and other household.

PARAMETERS OF WATER QUALITY AND STANDARD VALUE

Water quality standards are guidelines developed by different agencies to define the acceptable and permissible limit of water like physical, chemical and biological parameters and its safe use in different purposes such as drinking, domestic use, irrigation,

[1]**Corresponding author**

industrial process, human health and system. National and international authorities such as Indian Standard Institution (ISI), Bureau of Indian Standard (BIS) set the IS 10500:2012, Indian Council of Medical Research (ICMR), World Health Organization (WHO), United States Environmental Protection Agency (EPA) and United States Public Health Standards (USPHS) etc. set standards for drinking water, Irrigation standards, Bacteriological standards, Effluent standards. There is about 11 standards are consider in two tehsils of Mau district, Muhammadabad and Sadar Mau. These parameters are pH, TDS, Turbidity, Total Hardness, Total Alkalinity, Fluoride, Chloride, Calcium (Ca), Dissolved oxygen (DO), Biochemical Oxygen Demand (BOD), Chemical Oxygen Demand (COD). These water quality standards play a role to evaluating the suitable use of water for domestic, agricultural and industrial uses.

These standards are helpful for designing and operating water treatment system and regulating the water pollutants for future sustainability.

RESULTS AND DISCUSSION

For determination of different parameter, sample collection is done in summer and rainy season at two place in both tehsil Mohammadabad (MB 01 Mohammadabad Market Chauk Hand Pump and MB 02 SGN Government PG College Campus) and in Sadar Tahsil (MN 01 Maunath Bhanjan Station and MN 02 Vikash Bhavan mau) in Mau district and analyze 11 data with help of pH Meter, Spectrometer, different titration method available in my lab.

Table 1: Physico-Chemical parameters of groundwater in Mohammadabad Gohna (MB) Tehsil

Sampling Station Code	Seasons	p^H	TDS	Turbidity	Hardness	Alkalinity	Chloride	Floride	Calcium	DO	BOD	COD
MB 01	Summer	7.5	610	1.1	289	352	27.0	0.79	41	5.1	3.7	8.5
	Rainy	7.3	380	0.9	249	298	24.0	0.77	42	6.5	2.5	6.1
MB 02	Summer	7.8	480	BDL	299	350	22.0	0.73	49	5.2	3.6	7.7
	Rainy	7.4	334	BDL	233	234	18.6	0.74	39	6.5	2.7	5.6

Table 2: Physico-Chemical parameters of groundwater in Maunath Bhanjan (MN) Tehsil

Sampling Station Code	Seasons	p^H	TDS	Turbidity	Hardness	Alkalinity	Chloride	Floride	Calcium	DO	BOD	COD
MN-1	Summer	8.6	497	1.8	239	233	34	0.30	47	5.1	3.8	7.9
	Rainy	7.4	410	1.9	299	181	28	0.22	39	5.7	3.3	6.0
MN-2	Summer	7.4	639	2.4	233	215	38	0.19	40	3.5	5.9	11.1
	Rainy	7.5	488	1.6	209	191	33	0.16	39	5.2	3.7	7.5

The pH of ground water indicates the acidity and alkalinity of water. pH of most of the sampling station in summer season is greater than rainy season due to vaporisation of water concentration of soluble compound increase. The pH of groundwater in Mau district between 7.5 to 8.6 in summer season and 7.3 to 7.5 in rainy season. The pH of ground water in both summer and rainy season in Mau district in desirable limit According to BIS 2021 (IS 10500:2012) and WHO standard acceptable limit 6.5 and permissible limit 8.5. The analysis of pH ensuring that alkaline water with pH is less than 8.5 better for drinking, agriculture and industrial uses. In Mohammadabad Gohna Tehsil, the pH observed in summer maximum 7.8 and minimum 7.5 while in rainy season it is maximum 7.4 and minimum 7.3. In Maunath Bhanjan Tehsil, the pH observed in summer maximum 8.6 and minimum 7.4 at while in rainy season it is maximum 7.5 and minimum 7.4. The pH of All sampling stations between 7.4 to 8.6 which are acceptable limit.

TDS is an essential parameter that measures the concentration of soluble matters such as clay, cations like Na^+, K^+, Ca^{2+}, Mg^{2+} etc. anions like CO_3^{2-}, SO_4^{2-}, Cl^-, F^-, NO_3^-, PO_4^{3-} etc., organic and inorganic compound in ground water. TDS of ground water in Mau district between 480 mg/L to 639 mg/L in summer season and 334 mg/L to 488 mg/L in rainy season. TDS of ground water in both summer and rainy season in Mau district in desirable limit. Most of the sampling station TDS in summer season is greater than rainy season due to vaporisation of water, concentration of soluble compound increase. According to IS 10500:2012 the acceptable limit for TDS is 500 mg/L and the permissible limit 2000 mg/L and WHO limit 500 mg/L to 1000 mg/L. The analysis of TDS ensuring that water is safe for consumption as drinking, domestic, agriculture and industrial uses. In Mohammadabad Gohna Tehsil, TDS observed in summer maximum 610 mg/L and minimum 480 mg/L while in rainy season it is maximum 380 mg/L and minimum 334mg/L. The TDS of All sample in Mohammadabad Gohna tahsil is the acceptable limit. In Maunath Bhanjan Tehsil, TDS observed in summer maximum (650 mg/L) at MN-7 and minimum (350 mg/L) at MN-11 while in rainy season it is maximum 639 mg/L and minimum 497 mg/L. The TDS of All two-sampling station between 410 mg/L to 639 mg/L which is in desirable limit.

The hardness of groundwater is due to presence of salt $Ca^{2+,}$ and Mg^2 with bicarbonate (Temporary Hardness) and chloride (Cl^-) sulpHate (SO_4^{2-}) and nitrate NO_3^- (Permanent Hardness). Most of the sampling station hardness in summer season is greater than rainy season due to vaporisation of water concentration of soluble compound increase. Due to hardness, it affects taste, gastro problem in human health and form scale in pipes, boilers, heater, power generation machine and immersion coil to reduce their efficiency. Hardness of water also reduces soap lathering and crop growth. In Mohammadabad Gohna Tehsil, Hardness observed in summer maximum 299 mg/L and minimum 289 mg/L while in rainy season it is maximum 249 mg/L and minimum 233 mg/L. In Maunath Bhanjan Tehsil, Hardness observed in summer maximum 239 mg/L and minimum 233 mg/L while in rainy season it is maximum 299 mgL^{-1} and minimum 209 mgL^{-1}.

The alkalinity of groundwater arises by presence of ions such a carbonate ion, bicarbonate ion and hydroxide ion. The main cause of alkalinity in groundwater is industrial and agricultural runoff and alkaline detergents. Alkalinity within permissible limit support healthy digestion and maintain pH. Most of the sampling station alkalinity in summer season is greater than rainy season due to vaporisation of water concentration of soluble compound increase. Alkalinity of ground water in both summer and rainy season in Mau district in desirable limit According to BIS (IS 10500:2012) and WHO standard recommended limit 200 mg/L to 600 mg/L. In Mohammadabad Gohna Tehsil, Alkalinity observed in summer maximum 352 mg/L and minimum 350 mg/L while in rainy season it is maximum 296 mg/L and minimum 234 mg/L. In Maunath Bhanjan Tehsil, Alkalinity observed in summer maximum 233 mg/L and minimum 215 mg/L while in rainy season it is maximum 191 mg/L and minimum 181 mg/L.

Chloride ion (Cl^-) of groundwater in Mau district arises due to purification of drinking water using chlorination process, use of chloride containing fertilizers and pesticides, domestic sewage, industrial effluents and waste dumps. Most of the sampling station Chloride ion in summer season is greater than rainy season due to vaporisation of water concentration of soluble compound increase. Chloride ion of ground water in both summer and rainy season in Mau district is in desirable limit according to BIS (IS 10500:2012) and WHO standard acceptable limit is 250 milligram/L and permissible limit is 1000 milligram/L. In Mohammadabad Gohna Tehsil, Chloride ion observed in summer maximum 27.0 mg/L and minimum 22.0 mg/L, while in rainy season it is maximum 24.0 mg/L and minimum 18.0 mg/L. In Maunath Bhanjan Tehsil, Chloride ion observed in summer maximum 38.0 mg/L and minimum 34.0 mg/L while in rainy season it is maximum 33.0 mg/L and minimum 28.0 mg/L.

The Calcium ions (Ca^{2+}) in the groundwater of Mau district are due to dissolution of limestone, gypsum and waste water. Calcium ion in summer season is greater than rainy season due to vaporisation of water concentration. Calcium ion of ground water in both summer and rainy season in Mau district in desirable limit According to BIS(IS10500:2012) acceptable limit is 75 mg/L and permissible limit is 200 mg/L.WHO guidelines provide optimal concentration range 40 to 80 mg/L. In Mohammadabad Gohna Tehsil, the Calcium ion observed in summer maximum 49 mg/L and minimum 41 mg/L while in rainy season it is maximum 42 mg/L and minimum 39 mg/L. In Maunath Bhanjan Tehsil, the Calcium ion observed in summer maximum 47 mg/L and minimum 40 mg/L while in rainy season it is maximum and minimum are same 39 mg/L. DO, BOD, COD- It is an indicator to determine the quality of water. The groundwater carries oxygen when rain water and surface water perchlorates through soil. DO of groundwater influenced by factor temperature, pressure, depth of water level and geochemical condition. DO in summer season is lower than rainy season due to high temperature solubility of oxygen dissolve according to Henry's law. The BOD of groundwater measures the amount of dissolved oxygen

(O_2) necessary for microorganism to cleavage of organic compound. COD of ground water measure the mass of oxygen (O_2) involved for oxidising organic and inorganic compound present in groundwater. Greater the COD indicate higher the contamination in water. In Mohammadabad Gohna Tehsil, DO, BOD and COD observed in summer maximum 5.2, 3.7 and 8.5 mg/L and minimum 5.1, 3.6 and 7.7 mg/L while in rainy season it is maximum 6.5, 2.7 and 6.1 mg/L and minimum 6.5, 2.5 and 5.6 mg/L respectively. In Maunath Bhanjan Tehsil, DO, BOD and COD observed in summer maximum 5.1, 5.9 and 11.1 mg/L and minimum 3.5, 3.8 and 7.9 mg/L while in rainy season it is maximum 5.7, 3.8 and 3.7, and 7.5 mg/L and minimum 5.2, 3.3 and 6.0 mg/L.

CONCLUSION

The pH of groundwater in Mohammadabad Gohna and Sadar tahsil in Mau district is present in between 7.4 to 8.6 in summer season and 7.3 to 7.5 in rainy season. The pH of ground water in both summer and rainy season is in desirable limit according to BIS (IS 10500:2012) and WHO standard acceptable limit 6.5 to permissible limit 8.5. The analysis of pH ensuring that alkaline water with pH is less than 8.5 is better for drinking, agriculture and industrial uses. Hardness of ground water in Mau district between 233 mg/L to 299 mg/L in summer season and 209 mg/L to 299 mg/L in rainy season. Hardness of ground water in both summer and rainy season in both tahsil of Mau district in desirable limit according to BIS (IS 10500:2012) and WHO standard acceptable limit is 200 mg/L and permissible limit is 600 mg/L. From the above mention data, both tahsil Mohammadabad and Sadar, Mau, ground water quality arevary in Sammer and Rainy season due to waste water, pond water and Tamsha River water quality. Higher level of BOD in Mau district is due to industrial discharge such as chemical dyes, oil, paint and agricultural runoff such as fertilizer, pesticides, waste disposal and leakage from septic tank etc. BIS and WHO do not specify any limit but generally BOD level less than 3 mg/L is safe for drinking water, moderate value 3-5 mg/L show slightly polluted water and greater than 5 mg/L suggest water is more contaminated and need special water treatment. Higher level of COD in Mau district is due to industrial discharge such as chemicals, dyes, oil, paint and agricultural runoff such as fertilizer and pesticides.

REFERENCES

APHA, Standard Methods for the Examination of Water and Wastewater, 21st ed., Washington, D.C.: American Public Health Association, 2005.

Bhatnagar S.K. and Sharma P.K., 2001. Hydrochemical evaluation of groundwater in Jhansi District, Uttar Pradesh. Poll. Res., **20(3)**: 243–247.

Bharambe P. A., Rodge R.P. and Ambegaonkar P.R., 1992. Depth and quality of underground water is affected by canal irrigation. J. Indian Soc. Soil Sci., **40**: 344–347.

CPHEEO, Manual on Water Supply and Treatment, Ministry of Urban Development, New Delhi, 1991.

Charles D., 1985. The Marine and Fresh Water Plankton, Michigan State University Press.

Chandra S., 2001. Hydrochemical assessment of groundwater quality in vicinity of Bhilai Steel Plant, Chhattisgarh. J. Geol. Soc. India, **58**: 331–339.

De A.K., 2001. Environmental Chemistry, 4th ed., New Delhi: New Age International Publishers.

Das S. and Gupta R.K., 1995. Groundwater quality in rural areas of Midnapore District, West Bengal. Indian J. Environ. Prot., **15(10)**: 741–745.

Jarneel A., 1998. Physico-chemical studies in Uyyoakondan channel water of river Cauvery. Poll. Res., **17(2)**: 111–114.

Kumaar R., Yadaav S.S. and Singh R.T., 2012. Water quality index evaluation of groundwater in Koilwar block of Bhojpur. J. Chem. Pharm. Res., **4(3)**.

Kadu M.V., 2011. Drinking water analysis of Buldana District, Maharashtra. Current World Environ., **6(2)**: 295–297.

Krishnamurthy R.R. and Elango S.P., 2002. Groundwater quality in Cuddalore District, Tamil Nadu. Poll. Res., **21**(1): 25–30.

Limbachhiya M.C., Patel K.K., Nimaavat K. and Vyyas K.B., 2011. Study on quality of irrigation water of Vijpura Taluka of Mehsana District, Gujarat (India). Elixir Appl. Chem., **40**: 5471–5473.

Madhurambal G. and Ponsadai Lakshmi S., 2010. Groundwater quality assessment for diverse purposes in Nagapattinam District, Tamil Nadu, India. Int. J. Chem., **1(2)**: 108–119.

Meena H.S. and Singh V. P., 2004. Hydrochemical studies of groundwater in Bharatpur District, Rajasthan. Poll. Res., **23(2)**: 145–149.

Prassad D. S., Rajendra C., Sadashivaiah, and Rangana, 2011. A comparative study of techniques for

prediction of water quality parameters. Int. J. Earth Sci. Eng., **4(6)**: 423–428.

Ramakrishnaiah C.R., Sadashivaiah C. and Rangana G., 2009. Assessment of Water Quality Index for the Ground-water in Tumakur Taluka, Karnataka State, India. E-J. Chem., **6(2)**: 523–530.

Singh D.F., 1992. Studies on the water quality index of some chief rivers of Pune, Maharashtra. Proc. Acad. Environ. Biol., **1**: 61–66.

Singh G., Rao P.S. and Raju B.R., 1994. Impact of industrial effluents on groundwater quality in Patancheru, Andhra Pradesh. Indian J. Environ. Prot., **14(11)**: 841–846.

Sinha P.C. and Chaturvedi D.K., 1997. Groundwater quality assessment in Gorakhpur District, Uttar Pradesh. Indian J. Environ. Prot., **17(5)**: 361–365.

Subramani V., Rajmohan S., Elango L. and Srinivasalu S.K., 2002. Groundwater chemistry of the hard rock areas of Erode District, Tamil Nadu. Indian J. Environ. Geol., **42**: 109–120.

Swami M.L. and Sharma D.C., 1996. Fluoride contamination in groundwater of Tonk District, Rajasthan. Indian J. Environ. Prot., **16(9)**: 667–671.

Yadav R.P. and Pathak B.S., 2000. Groundwater quality in Aligarh city, Uttar Pradesh," Poll. Res., **19(3)**: 225–229.