Journal of Basic and Applied Engineering Research
p-ISSN: 2350-0077; e-ISSN: 2350-0255; Volume 6, Issue 9; October-December, 2019, pp. 553-557

http://www.krishisanskriti.org/Publication.html

Monitoring and Assessment of Heavy Metals in Ground Water of Mathura City, U.P. India

Salman Ahmed[a], Shadab Khurshid[b], Athar Hussain[c]* and Mridul Sharma[c]

[a]Department of Geology, Aligarh Muslim University, UP 202002, India
[b]Department of Chemical Engineering, Aligarh Muslim University, UP 202002, India
[c]Department of Civil Engineering, Ch. Brahm Prakash Government Engineering College, New Delhi 110073, India
E-mail: [1]salmanahmed.rs@amu.ac.in, [3]athariitr@gmail.com

Abstract—*The study has been carried out to assess the groundwater quality of Mathura City U.P. India. About 20 water samples were collected during pre monsoon period for the year 2016 and analyzed for Heavy metals (Cu, Cd, Cr, Fe, Mn, Ni, Pb,) to understand their behaviour in the environment. The result are compared with the specification prescribed by the Bureau of Indian standard (BIS) 1993 and World Health organization (WHO) 2004. It is revealed that the concentration of, Cd, Ni, Pb, Fe, Mn and Cr is higher than the permissible limit prescribed by the Bureau of Indian standard (BIS) 1993 and World Health organization (WHO) 2004. A lot of untreated/mostly treated residential wastewater, strong waste, mechanical waste, go into the Yamuna stream amongst Delhi and Mathura. This quality debasement is further aggravated by the low flow states of the Yamuna.*

Keywords: *Groundwater, Water quality, Contamination, Mathura, India.*

INTRODUCTION

Water is most key segment on planet earth and basic for all types of life process (flora, fauna and human beings). It is considered as copious and in costly normal assets since ancient period. The fundamental wellsprings of water in nature are surface and ground water. In shaping the economic and social wealth of many urban cities of India, ground water plays a vital important role. The nature of different water framework relies upon the nearness of Inorganic and organic ingredients in dissolved and suspended form and their balance is essential to maintain the water quality.

To identify the various sources of contamination in ground water, several investigations has been carried out in recent years and in most of the cases industrial waste is found to be the main source of pollution. (Lee and Stuebing, 1990; Molle,2002; Fukushi et.al.,2003; Ozmen et al.,2004; Kruawal et al, 2005). The information of the event, renewal and recuperation of consumable groundwater expect unique hugeness in quality crumbled locales, on account of rare nearness of surface water. Also, ominous climatic condition i.e. low precipitation with visit event of droughts, high dissipation and so forth on one hand and an unsatisfactory geographical set up on the other, an unequivocal point of confinement on the adequacy of surface and subsurface repositories (Todd 1980).

In well established industrial area monitoring of ground water chemistry is very important. Amid late years, expanding contamination and losing of water sources have changed abuse strategy of water and soil sources. The vital administration of water framework may cause significant issue in accessibility and nature of water (Rao and Rao 1995, Kumar and Saha 1991, Nag and Das 1994, Sharma 2004, Sharma at al 2012) since stream are a noteworthy wellsprings of water and their water should be kept up (Omezvreuke et al., 2008, Murthy and Ravanaidh 2011, Yadav et al., 2012, Jajawara and Shringi 2012) for water to be depicted as consumable.

It must be finished with certain physico compound standard which are designed to guarantee that the water is permissible to drink (Bis 1991, APHA 1989) Mathura arranged on the privilege bents of the Yamuna River around 145 KMS-South-East of Delhi and 58 Kms North West of Agra, Mathura is quickly developing as a main Industrial and business city the quantity of enterprises in as far as possible Have Increased to 180 comprising of Sari Printing colors, substance, Nickel and silver cleaning, electroplating supari, Industry drain preparing, raw petroleum, sugar and so on the improvements of city has caused straightforwardly various water quality issues (Khube and Durgpal 1993, Kumar et al., 1994, who 1993 and Khana 2011).

In Mathura area water logging and saltiness in ground water have turned into a general issue. The extensive amount of ground water is of no utilization because of its high saltiness. A large portion of the ground water in Mathura region of Uttar Pradesh (U.P) happens under unconfined and semi-bound condition while close surface it is found submerged table condition. The general nature of ground water is observed to be salty. The water quality at Mathura has been differing throughout the years because of some activity designs which were not, be that as it may, be powerful for different reasons(Bhargava,1992,2000)

In spite of consumptions running into crores of rupees, the Yamuna water quality at Mathura couldn't show any improvement (HT, 2004a,b,d,e,f,g). Considering the significance of Mathura as are religious place for the Hindus, ample opportunity has already past that genuine endeavours be attempted towards re-establishing the nature of the Yamuna. According to the water quality criteria of the Central Pollution Control Board (CPCB, 2002), the water nature of the Yamuna at Mathura is of class-D level (a few times, even class-E). According to the bio mapping water quality criteria, it has a place with class-C level (river in eutrophication stage). The broke up oxygen (DO) level at Mathura (downstream) boils down to low esteems, bringing about intermittent mass executing of fish and other sea-going life.

To sustain human development in an area it became very essential to monitor the concentration of toxic trace elements in view of continued degraded water. Therefore an attempt has been made to study the distribution of trace elements in ground water of Mathura city industrial area during pre-monsoon season (2015).In this study an endeavour has bee of ground water quality fr n made to ponder the substance nature om settled 20 inspecting station in Mathura region (U.P) and its spatial dissemination. Uncommon accentuation has been given to the concoction nature of the ground waters in regards to their convenience for drinking and irrigation utilization.

MATERIALS AND METHODS

Study Area

Mathura area is flanked by Haryana state in the north and by Rajasthan state in the west. It is between latitude 27°14' to 27°58' North and longitude 77°17' to 78° 12' East in the top sheet No 54E and 54I of Study of India covering a total of 3797 sq. Km. Yamuna waterway isolates Mathura locale in two physiographic units Yamuna and trans Yamuna. Agra waterway is another surface water asset utilized as a part of the range under investigation.

RESULT AND DISCUSSION

The result analysis of the collected samples has been carried out and is summarized in Table1. The result summarized in Table 1 indicates that **Cd** concentration in all the samples is observed to be 0.117mg/L to 0.182 mg/L. Also the concentration of **Cr** lies between 0.052 mg/L to 3.009 mg/L and the concentration of **Pb** lies in the range of 1.123 to 5.321 mg/L, and the concentration of Zn lies in the range of 0.087mg/L to 1.972mg/L, however the concentration of **Ni** lies between 1.077mg/L to 1.529mg/L and Cu has the concentration of 0mg/l to 0.331mg/L and the concentration of **Mn** and Fe were found in the range of 0.221mg/l to 0.965mg/L and,0.106mg/l to 0.402 mg/L respectively.

Table 1: Heavy metals concentration in sampling locations of the present study area

S. No.	Location	Cu	Pb	Fe	Cr	Mn	Ni	Cd	Zn
1	Kolahar,Naujhil	0.234	2.132	0.311	0.161	0.309	1.091	0.127	0.895
2	Edalgarhi, Naujhil	0	1.324	0.106	0.087	0.221	1.169	0.138	0.141
3	Bazna,Naujhil	0.256	2.513	0.402	2.198	0.263	1.339	0.149	0.381
4	Chandoli, Naujhil	0.331	1.381	0.366	0.169	0.224	1.232	0.159	0.384
5	Matholi, Naujhil	0.007	1.127	0.264	0.226	0.965	1.433	0.174	0.961
6	Khajpur,Naujhil	0.004	1.392	0.254	0.078	0.323	1.224	0.168	1.972
7	Nanakpur,Naujhil	0.199	1.521	0.229	1.114	0.277	1.233	0.149	1.041
8	Masumna, Naujhil	0	3.433	0.297	1.119	0.314	1.297	0.139	0.497
9	Yamuna, Naujhil	0.189	1.494	0.163	0.089	0.422	1.077	0.143	0.087
10	Mukdumpur, Naujhil	0.009	5.321	0.385	0.052	0.312	1.431	0.133	0.118
11	Chinnpari, Naujhil	0	1.863	0.389	0.14	0.274	1.277	0.163	0.095
12	Naujhil market, Naujhil	0	2.615	0.348	2.126	0.281	1.109	0.136	0.444
13	Pithora, Naujhil	0.211	1.467	0.236	0.069	0.291	1.322	0.142	0.147
14	Sultanpur, Matt	0	2.663	0.329	0.077	0.285	1.335	0.117	0.632
15	Surir kalan Naujhil	0	1.123	0.352	3.135	0.295	1.347	0.124	0.096
16	Garhipisurti, Naujhil	0.254	1.887	0.371	0.089	0.326	1.367	0.171	0.091
17	Karahari, Matt	0	1.564	0.233	3.099	0.271	1.236	0.129	0.136
18	Taintigaon, Matt		3.655	0.388	0.065	0.457	1.529	0.182	1.848
19	Gadhi, Matt	0.014	1.712	0.269	2.008	0.321	1.208	0.151	0.241
20	Bera, Matt	0.018	2.179	0.398	1.046	0.328	1.399	0.118	0.107

Variation of heavy metals at sampling locations

The concentration of heavy metals in all the locations of Mathura city has been assessed and is shown through Fig. 1to2. From Fig.1, it can be inferred that no concentration of Cu has been found in the samples of Edalgarhi, Masumna, Chinnpari, Naujhil market, Sultanpur, Surir kalan, Karahari location and highest concentration of 0.331mg/L in Chandoli. location. The variation in concentration of Pb at all locations of the study area is shown through Fig. 2. Perusal of the data from from Fig 2, it can be concluded that the lowest Pb concentration of 1.123mg/L has been observed in Surir Kalan and highest Pb concentration of 5.321mg/L is observed in sample of Mukdumpur location. Fig 1 shows a variation of Fe in recorded places. The concentration of Fe is lowest in Edalgarhi, which is registered as 0.106 mg/L and highest in Bazna, which is 0.402mg/L. Fig 1 also shows a variation of

Cr in recorded places. The concentration of Cr is lowest in Mukdumpur as 0.052mg/L and highest in Surir kalan as 3.135mg/L. Fig 1 also shows the variation of Mn in recorded places. From Fig 1, it can be concluded that the concentration of Mn is lowest in Edalgarhi as 0.221mg/L and highest in Matholi as 0.965mg/L. Fig 2 also inferred a variation of Ni in recorded places. The concentration of Ni is lowest in Yamuna, which is marked as 1.007mg/L and highest in Taintigaon 1.529 mg/L and .Fig 2 also shows the variation of Cd in recorded places. From Fig 2, it can be concluded that the concentration of Cd is lowest in Sultanpur as 0.117mg/L and highest in Taintigaon as 0.182mg/L. Fig 2 also inferred the variation of Zn in recorded places. The concentration of Zn is found to be lowest in the Yamuna as 0.087mg/L and highest in Khajpur as 1.972mg/L

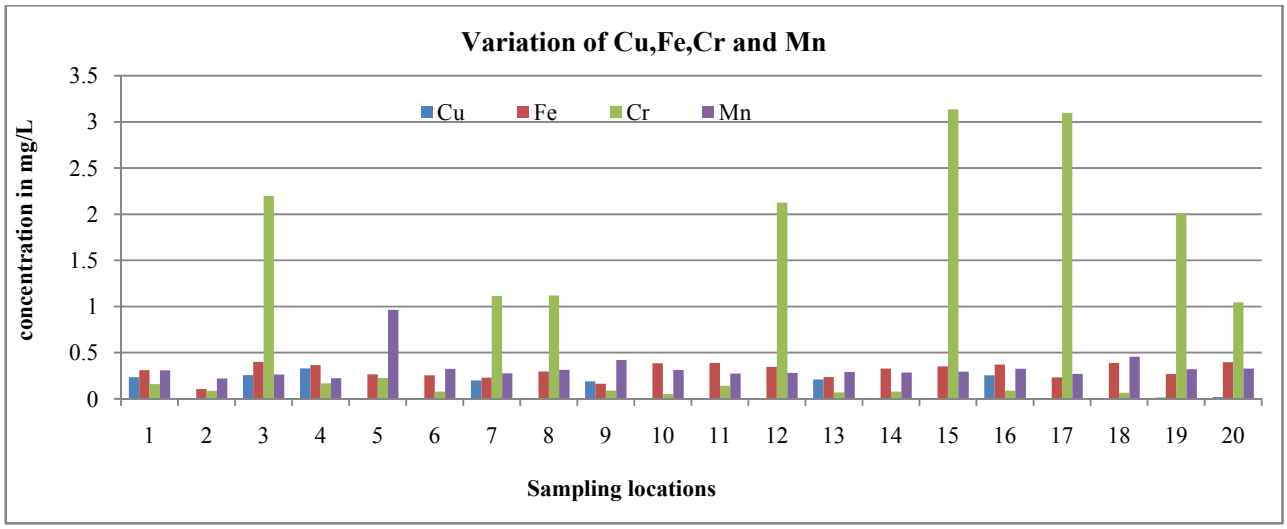

Fig.1

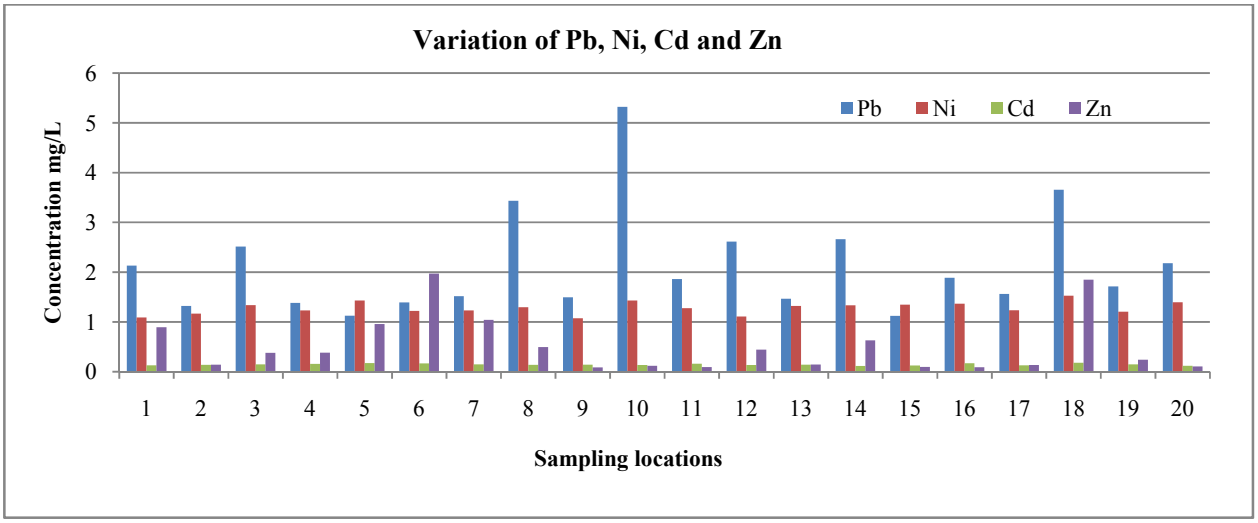

Fig.2

Table 2: Statistical analysis of the determined metals concentration in all sampling locations

METALS	MEAN	SD	MAX	MIN
Cu	0.09084	0.11974	0.331	0
Pb	2.1183	1.03840	5.321	1.123
Fe	0.3045	0.08343	0.402	0.106
Cr	0.85735	1.07296	3.009	0.052
Mn	0.33795	0.15760	0.965	0.221
Ni	1.28275	0.12054	1.529	1.077
Cd	0.1456	0.01899	0.182	0.117
Zn	0.5157	0.56693	1.972	0.087

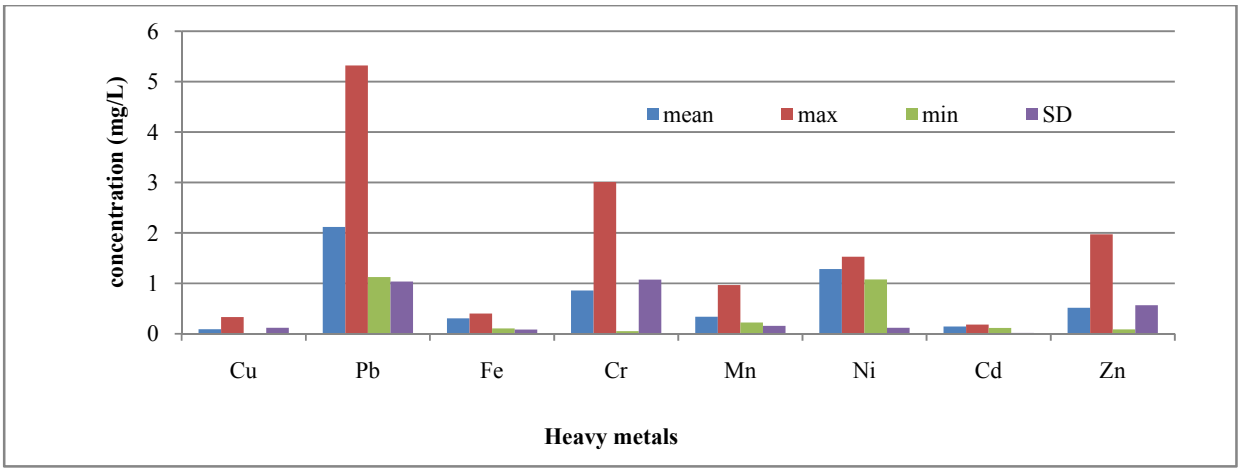

Fig. 3: Comparison of variation of heavy metals concentration at all locations

The statistical analysis of collected samples has been carried out in terms of mean values, standard deviation, maximum values, and minimum values and shown in table 2. However, the mean concentration of heavy metals is calculated and is shown through Fig. 3. From Fig 3 it can be observed that mean concentration of Pb is found to be maximum and mean concentration of Cu is found to be minimum. In the study area, Chromium concentration in groundwater samples has a mean value of 0.857mg/L. It was found that all the samples are having a high concentration of chromium in groundwater samples of different sampling points of Mathura. In the study area, 100% of the samples exceed the BIS(1991) limit of 0.01 mg/L.

The mean concentration of iron in all the groundwater samples of study area is found to be 0.304mg/L. The Bureau of Indian Standard has recommended 0.3 mg/L as the permissible limit of ground water from results it is clear that, about 55% of samples are having concentration above permissible limit. Manganese has a concentration of 0.03mg/L as a allowable limit for drinking water (BIS 1991). In the study area, concentration of manganese varies a mean value of 0.337mg/L. About 50% of the water samples are exceeding the permissible limit of 0.3mg/L. The presence of Mn above the allowable limit imparts alien taste to water and adversely affect domestic uses and water supply structure.

Cadmium is a metal with an oxidation condition of +2. It is chemically like zinc and happens normally with zinc and lead in sulphide metals. The Bureau of Indian Standard has recommended 0.003 mg/L as the permissible limit. All the samples are having concentration above the BIS.

Lead is naturally derived from galena, occurs as oxides, and replaces the potassium in potassium feldspar (SDWC 1977). The Bureau of Indian Standard has prescribed 0.1mg/L as the permissible limit for drinking water. In the study area, mean concentration of lead is found to be 2.118mg/L. 100% of samples are exceeding the permissible limit of drinking water. Lead can cause neurological and behavioural disorders, especially in children, anemia: impaired kidney and testicular function (Barzilay et al. 1999). The study area, the mean value of a nickel is found to be 1.282mg/L. From the study, it was found that all samples are

having a concentration higher than the permissible limit of 0.1mg/L for drinking water as recommended by BIS. Therefore it was found that the groundwater of the area is highly nickel contaminated.

To aquatic fauna, copper is highly toxic at lower alkalinities (Train, 1979). The permissible limit of copper in drinking water is 1.5 mg/L, as recommended by BIS 1999. The mean concentration of copper is found to be 0.090 mg/L; not a single samples is exceeding the permissible limit prescribed by BIS. There is no copper present in the study area. Zinc is the naturally occurring substance. In the study area, the concentration of zinc is having a mean value of 0.515mg/L. Not a single samples is exceeding the permissible limit recommended by BIS.

CONCLUSION

From the present study it can be concluded that the concentration of Fe has been found to be higher in the samples of Kolahar, Bazna, Chandoli, Mukdumpur, Chinnpari, Naujhil market, Sultanpur, Surir kalan, Garhipisurti, Taintigaon, Bera of Mathura city than the limits prescribed by Indian Standard for drinking water BIS (IS:1050). However the concentration of Mn has been found to be greater than the limits prescribed by the BIS in the samples obtained from Kolahar, Matholi, Khajpur, Masumna, Yamuna, Mukdumpur, Gadhi, Bera of the study area. However, the concentration of Cr, Cd, Ni and Pb in all the samples of the study area has been found to be greater than the limits prescribed by the BIS for drinking water. The high concentration of Cr, Cd ,Ni, Pb, Fe and Mn in ground water may be due to percolation of wastewater emanating from industries such as electroplating, chrome plating, leather tanning through the soil and thus contaminating to ground water reservoirs. Therefore there is a need to control the disposal of untreated wastewater and proper management of water is required in order to control the further worsening of the situation.

Acknowledgement

Authors are thankful to prof. Abu Talib, Chairman, Department of Geology, AMU, Aligarh for providing necessary facilities.

REFERENCES:

[1] APHA 2005, Standard methods for the examination of water and waste water, 17th Ed. Washington DC.

[2] BIS 1991 – Drinking water specification IS No. 10500. Bureau of Indian Standards. New Delhi, PP 1-5.

[3] Subba Rao, C. And N.V.Subba Rao1995 – Ground water quality in residential colony. Indian Journal of Environmental Health 37(4):295-300.

[4] Kumar S. and L.C.Saha 1999 – Composition of water quality and the chemical nature of the sediments and river water and wells at Bhagalpur. India Aeta, Hydrochom, Hydrobiology 19(4);411-417.

[5] Nag J.K. and A.K.Das 1994 – Quality of drinking water in the Bibhum District of West Bengal. Indian Journal of Environment 14(7):516-519.

[6] Sharma Ajit Kumar 2004 – Water quality problem in Mathura and its effect on the physicology of major crop in the region.Ph.D.Thesis.Dr. B.R.University Agra.

[7] Murthy Narsimha C. V. and G. Ravanaidh 2011 – Impact of Industrial pollution on the change of physic – chemical characteristics of the water of the nelapatte bird sanctuary, Nellore District A.P. Indian Journal of Environmental Science 15(1):39-42

[8] Omezurlike O I, A.O.Damilola O.T. AdealaFajobi, A. Enobang and B.O.Shettoi 2008 – Microbial and1(5):617-621.

[9] Yadav, Rajesh Kumar, Smita Sharma, YashodaSani, SudhaKalla and Ajay Singh 2012 – Comparativeanalysis of water quality of different grats of pushkar lake. For two decades. Indian Jounal of Environmental Science 16(1):23-27 WHO 1984, Guideline for drinking water quality (1) Geneva. 26

[10] Jajawara, Seema and Surendra Kumar Shringi 2012 – Studies on quality assessment of chanraloi river water near Kota, Rajasthan, India.Indian Journal of Environmental Science 16(1):43-46.

[11] D.K. Todd, "Groundwater hydrology," John Wiley and Sons, New York. Microbial Community Fingerprinting at a Waste Disposal Site, 1980, pp. 1–11.

[12] CPCB: 2000, 'Water quality status of Yamuna river,' Central PollutionControlBoard,NewDelhi,seriesADSORBS/32/1999–2000. April 2000

[13] HT: 2004a, 'Yamuna water too polluted for religious rites,' Hindustan Times, New Delhi., 27–3–2004, p 3.

[14] HT: 2004b, 'Fast, dharna against Yamuna river pollution,' Hindustan Times, New Delhi., 29–3–2004, p 3.

[15] HT: 2004d, 'Pollution in Yamuna river cause of alarm,' Hindustan Times, New Delhi., 14–11–2004, p 3.

[16] HT: 2004e, 'Fishes found dead in Yamuna,' Hindustan Times,New Delhi., 20–11–2004, p 3.

[17] HT: 2004f, 'Experts ring Taj alarm bells : clean Yamuna, remove corridor remnants, says UNESCO report,' Hindustan Times, New Delhi., 26–11–2004, p 13.

[18] HT: 2004g, 'Mathura water unfit for drinking,' Hindustan Times, New Delhi., 22–11–2004, p 3.

[19] Barzilay,J.I., W.G.Weinberg, and J.W.Eley.,(1999) The water we drink: water quality and its effect on health :New Brunswick, New Jersey, Rutgers University Press, PP.152.