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STUDY OF TRACE METALS IN GROUND WATER IN MEDAK, RANAGAREDDY AND HYDERABAD DISTRICTS

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ABSTRACT

The ground water samples were collected during, November 2005, May 2006, November 2006 and May 2007 from eleven locations in Hyderabad, Rangareddy and Medak districts for analysis of toxic/trace metals. The ground water samples were analyzed for Cd, Co, Cr, Cu, Fe, Mn, Ni, Pb and Zn on Atomic absorption spectrometer. The metals concentrations detected in Osmansagar, Budvel, Singoor village, Nizampur village and Vikarabad were found below the acceptable levels prescribed by Bureau of Indian Standards (2004) for drinking water purpose. The ground water collected from Hassan agar (Near Mir Alam Lake), Domalguda, Saroornagar, Uppal tube-wells recorded most of trace metal above acceptable level prescribed BIS 2004.

Key words: Trace metals, Ground water, Medak, Rangareddy, Hyderabad.

INTRODUCTION

Trace metals are intrinsic, natural constituents of our environment. Apart from the natural sources, several anthropogenic ones also contribute to metal concentrations in the environment[1]. Some of the anthropogenic sources of the metals in the environment are industrial emissions, waste dumping, leaching of waste dumps, urban runoff, sewage effluents and agricultural runoff. By percolation and leaching the trace/toxic metals enter and pollute the ground water. The under ground water and surface water, soil collected from fields near the industrial city of Ludhiana, Punjab, India identified with lead, chromium

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cadmium and nickel in sewage water[2]. The ground water samples of Shivapuri district of Madhaya Pradesh report the boron, copper, mangese and iron found in ground water samples. The ground water samples collected from tube-well in Kanpur, Varanasi recorded the metal viz., Cd, Cr., Cu, Fe, Pb, and Mn. In the some villages and residential areas in towns and cities still ground water is using as drinking water. Hence to know the level of concentrations of metals is essential to compare the levels of metals with drinking water specification Maximum contamination Level (MCL) Prescribed by BIS-2004.

EXPERIMENTAL

11 ground water locations were selected mostly the ground water using as drinking in Medak and Rangaareddy districts and also to study the levels of metal concentrations ground water also collected in residential areas of Hyderabad city. The ground water samples were collected from 11 locations viz., Osmansagar, Budvel, Singoor village, Nizampur village Vikarabad, Hassanagar, Domalguda, Uppal village, Saroornagar. After purging the water from tube-well, the ground water samples collected were filtered and acidified with concentrated nitric acid till the pH was adjusted to 2[3]. The samples were analyzed for trace metals on AAS after pre-concentration. The total nine metals viz., Cd, Co, Cr, Cu, Fe, Mn, Ni, Pb and Zn were determined on Atomic absorption spectrometer.

RESULTS AND DISCUSSION

The ground water collected near Osmansagar tube-well during post monsoon 2005, pre-monsoon 2006, post monsoon 2006 and pre-monsoon 2007 detected Mn (0.189 mg/L^{-1}, 0.245 mg/L^{-1}, 0.153 mg/L^{-1} and 0.421 mg/L^{-1}), Fe (0.261 mg/L^{-1}, 0.154 mg/L^{-1}, 0.183 mg/L^{-1} and 0.207 mg/L^{-1}), Zn (0.178 $mg/L^{-1,}$ 0.369 mg/L^{-1}, 0.214 mg/L^{-1} and 0.466 mg/L^{-1}). The average of four seasons for Mn (0.252 mgL^{-1}0, Fe 90.206 mgL^{-1}), Zn (0.307 mgL^{-1}) shows that metals were below the acceptable limit prescribed by Bureau of Indian Standards 2004[4]. The metals viz., Cr, Cu, Co, Ni, and Pb were not detected. The concentrations of the Fe and Mn were above MCL.

The ground water samples collected from Budvel was detected with Mn (0.213 mg/L^{-1}), Fe (0.081 mg/L^{-1}) and Zn (0.095 mg/L^{-1}) during post monsoon 2005, and in pre-monsoon 2006, Mn (0.102 mg/L^{-1}), Fe (0.063 mg/L^{-1}) and Zn (0.065 mg/L^{-1}) were detected. During post monsoon 2006 the samples were identified with Mn (0.162 mg/L^{-1}), Fe (0.060 mg/L^{-1}) and Zn (0.092 mg/L^{-1}), but in pre-monsoon 2007 samples were detected with Mn (0.113 mg/L^{-1}), Fe (0.091 mg/L^{-1}) and Zn (0.087 mg/L^{-1}). The average concentration of four

seasonal samples were 0.148 mg/L^{-1}, Fe 0.074 mg/L^{-1} and 0.068 mgL^{-1} for Mn, Fe, and Zn respectively. The metals viz., Cr, Cu, Co, Ni, Cd and Pb were not detected. Among the toxic meals detected in the samples of four seasons, Mn concentration is above the MCL.

The ground water samples collected from Singoor village tube-well were recorded with Mn (0.036 mg/L^{-1}), Fe (0.019 mg/L^{-1}) and Zn (0.062 mg/L^{-1}) during post monsoon (Oct. - Nov., 2005), while in pre-monsoon (April - May, 2006) samples were detected with Mn (0.028 mg/L^{-1}) and Zn (0.083 mgL^{-1}). The post monsoon (Oct. - Nov., 2006) recorded Zn (0.092 mg/L^{-1}) only and in pre-monsoon (April - May, 2007) Mn (0.033 mg/L^{-1}) and Zn (0.059 mg/L^{-1}) were detected. The mean of four seasons was 0.024 mg/L^{-1} (Mn), 0.0005 mg/L^{-1} (Fe) and 0.074 mg/L^{-1} (Zn). The concentration of metals were below the MCL, therefore the ground water is safe for drinking purpose.

The ground water samples collected nearer to Nizampur village (Manzeera basin) detected with Mn (0.130 mg/L^{-1}), Fe (0.141 mg/L^{-1}) and Zn (0.050 mg/L^{-1}) in post monsoon (Oct. - Nov., 2005), while in pre-monsoon (April – May, 2006), Mn (0.090 mg/L^{-1}), Fe (0.151 mg/L^{-1}) and Zn (0.069 mg/L^{-1}) are identified. Post monsoon (Oct. - Nov., 2006) sample are shown with Mn (0.078 mg/L^{-1}), Fe (0.193 mg/L^{-1}) and Zn (0.061 mg/L^{-1}) while, the samples of pre-monsoon (April – May, 2007) are identified with Mn (0.083 mg/L^{-1}), Fe (0.152 mg/L^{-1}), and Zn (0.060 mg/L^{-1}). The average of four seasons for the contaminants viz., Mn (0.095 mg/L^{-1}), Fe (0.159 mg/L^{-1}) and Zn (0.060 mg/L^{-1}). Among the detected metals, Zn and Mn were below MCL while Fe is above the MCL prescribed by BIS.

The ground water samples near by Vikarabad are detected with Fe only during all four seasons from post monsoon 2005 to pre-monsoon 2007 ranged 1.089 mg/L^{-1}, 2.115 mg/L^{-1}, 1.135 mg/L^{-1} and 1.221 mg/L^{-1}, respectively with an average of 1.365 mg/L^{-1} for four seasons. The Fe detected in the ground water is above MCL, while other metals were not detected.

The ground water samples collected Hussannagar (Mir Alam) during the investigation period from post monsoon 2005, pre monsoon 2006, post monsoon 2006 and pre-monsoon 2007 recorded metals and their concentrations are Cu (0.220 mg/L^{-1}, 0.250 mg/L^{-1}, 0.180 mg/L^{-1}, 0.150 mg/L^{-1}), Mn (0.370 mg/L^{-1}, 0.540 mg/L^{-1}, 0.350 mg/L^{-1}, 0.490 mg/L^{-1}), Fe (0.081 mg/L^{-1}, 0.089 mg/L^{-1}, 0.081 mg/L^{-1}, 0.093 mg/L^{-1}), Zn (0.480 mg/L^{-1}, 0.422 mg/L^{-1}, 0.399 mg/L^{-1}, 0.378 mg/L^{-1}) respectively. The mean of four seasons is Cu (0.200 mg/L^{-1}), Mn (0.438 mg/L^{-1}), Fe (0.86 mg/L^{-1}), Zn (0.377 mg/L^{-1}). The ground water samples were detected with Cu and Zn were above MCL, while other detected were below MCL.

Table 1: The concentration (mg L^{-1}) of toxic metals in ground water of Osmansagar, Budvel and Singoor

Metal (mg/kg)	Osmansagar tube-well					Budvel tube-well					Singoor village tube-well				
	Nov. 2005	May 2006	Nov. 2006	May 2007	Mean (mg/kg)	Nov. 2005	May 2006	Nov. 2006	May 2007	Mean (mg/kg)	Nov. 2005	May 2006	Nov. 2006	May 2007	Mean (mg/kg)
Mn	0.189	0.245	0.153	0.421	0.252	0.213	0.102	0.162	0.113	0.148	0.036	0.028	ND	0.033	0.024
Fe	0.261	0.154	0.183	0.207	0.206	0.081	0.063	0.060	0.091	0.074	0.019	ND	ND	ND	0.005
Zn	0.178	0.369	0214	0.466	0.307	0.095	0.065	0.092	0.087	0.068	0.062	0.083	0.092	0.059	0.074

Table 2: The concentration (mg L^{-1}) of toxic/trace metals in ground water of Nizampur, Vikarabad and Hussannagar

Metal (mg/kg)	Nizampur tube-well (Manzeera basin)					Vikarabad tube-well					Hussannagar (Mir Alam) tube-well				
	Nov. 2005	May 2006	Nov. 2006	May 2007	Mean (mg/kg)	Nov. 2005	May 2006	Nov. 2006	May 2007	Mean (mg/kg)	Nov. 2005	May 2006	Nov. 2006	May 2007	Mean (mg/kg)
Cu	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.220	0.250	0.180	0.150	0.200
Mn	0.130	0.090	0.078	0.083	0.095	ND	ND	ND	ND	ND	0.370	0.540	0.350	0.490	0.438
Fe	0.141	0.151	0.193	0.152	0.159	ND	ND	ND	ND	1.365	0.081	0.089	0.081	0.093	0.086
Zn	0.050	0.069	0.061	0.060	0.060	ND	ND	ND	ND	ND	0.313	0.422	0.399	0.378	0.377

Table 3: The concentration (mg L^{-1}) of toxic/trace metals in ground water of Domalguda, Uppal, Saroonagar.

Metal	Domalguda tube-well					Uppal village tube-well					Saroornagar tube-well				
(mg/kg)	Nov. 2005	May 2006	Nov. 2006	May 2007	Mean (mg/kg)	Nov. 2005	May 2006	Nov. 2006	May 2007	Mean (mg/kg)	Nov. 2005	May 2006	Nov. 2006	May 2007	Mean (mg/kg)
Mn	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Fe	0.591	0.733	0.588	0.835	0.687	0.292	0.371	0.358	0.457	0.369	0.181	0.165	0.179	0.291	0.204
Co	ND	ND	ND	ND	ND	0.037	0.040	0.041	0.046	0.041	ND	ND	ND	ND	ND
Zn	1.328	1.412	1.014	1.350	1.236	0.013	0.029	0.018	0.019	0.020	1.042	1.098	1.038	1.213	1.098

ND: Not detected

Note: The water samples analyzed for Cd, Co, Cr, Cu, Fe, Mn, Ni, Pb and Zn only detected metals were shown in the tables

The ground water samples collected Domalguda, during post monsoon 2005 to pre-monsoon 2007 recorded with metals viz., Fe (0.591 mg/L^{-1}, 0.733 mg/L^{-1}, 0.588 mg/L^{-1}, 0.835 mg/L^{-1}), Zn (1.328 mg/L^{-1}, 1.412 mg/L^{-1}, 1.014 mg/L^{-1}, 1.350 mg/L^{-1}). The average contamination of four seasonal samples for various metals are 0.687 mg/L^{-1} for iron and 1.236 mg/L^{-1} for zinc. The Fe recorded higher than the MCL and remaining metals were below the MCL.

The ground water samples collected for four seasonal samples from Uppal village tube-well detected with metal and their concentrations Fe (0.292 mg/L^{-1}, 0.371 mg/L^{-1}, 0.358 mg/L^{-1}, 0.457 mg/L^{-1}), Co (0.037 mg/L^{-1}, 0.040 mg/L^{-1}, 0.041 mg/L^{-1},0.046 mg/L^{-1}), Zn (0.013 mg/L^{-1}, 0.029 mg/L^{-1}, 0.180 mg/L^{-1},0.019 mg/L^{-1}). The mean of four seasonal concentration was 0.369 mg/L^{-1} (Fe), 0.041 mg/L^{-1} (Co), 0.020 mg/L^{-1} (Zn). The tube-well is adjacent to the lake, hence the ground is also found to be contaminated with Fe above MCL.

The ground samples near Saroornagar tube-well identified with Fe (0.181 mg/L^{-1}, 0.165 mg/L^{-1}, 0.179 mg/L^{-1}, 0.291 mg/L^{-1}) and Zn (1.042 mg/L^{-1}, 1.08 mg/L^{-1}, 1.038 mg/L^{-1}, 1.213 mg/L^{-1}) and mean of four seasonal samples was 0.204 mg/L^{-1} (Fe) and 1.098 mg/L^{-1} (Zn). The ground water also recorded Fe is above than MCL.

The ground water samples recorded Fe metal above maximum contamination level (MCL- BIS-2004) in all the samples except Singoor ground water. Hussanagar ground water samples recorded Fe, Cu, Zn, Pb, Mn and Cd above the Maximum Contamination Level (MCL) prescribed of (BIS 2004). The results finding are similar to results of heavy metals in water of river Gomath[5], Lake Egirdir in Turkey[6] and Lake Kainji and Lake Jebba of Nigigeria[7].

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