STUDY ON UNDERGROUND WATER QUALITY OF RAYA BLOCK, DISTRICT MATHURA (U.P.)

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ABSTRACT

An attempt has been made to study the physico-chemical condition of the ground water of Raya Block Mathura district (U.P.). Eight water samples, 4 from hand pumps and 4 from tube wells were collected from different villages of Raya block. The duration of study was from January to June 2012. The physico-chemical parameters analysed were pH, temperature, DO, BOD, COD, chloride ions and fluoride ions. It was observed that all other parameters are within range when we compared with WHO standards, only fluoride ions and chloride ions were present in excess amount in tube well water at Karab village. It has also been observed that tube well water samples have higher fluoride ions concentration as compared to hand pump water samples.

Keywords: *Mathura District, fluoride, ground water.*

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INTRODUCTION REVIEW OF LITERATURE :

Water is essential for life and is an important component of the living system. It is being used by man for various purposes like drinking, cooking, bathing, washing, house hold activities, irrigation, electricity generation, industrial production and disposal of sewage and industrial waste.

Now a days menace of water born diseases and epidemics still looms layer on the horizon of the developing country. Ground water is the major source of water supply for domestic purposes in the urban as well as in rural parts of India. Various reasons for this include the non-availability of potable surface water and a general belief that ground water is pure and safer than surface water due to earth covering. The ground water contributes only 0.6% of the total water resources on earth. The ground water is the preferred and major source of drinking water in rural as well as in urban areas particularly in the developing countries like India as treatment of this water is often not required. The 90% of the total drinking water requirement and 50% of the agricultural requirement is fulfilled by the ground water in India but in the era of economical growth, groundwater is getting polluted due to urbanization and industrialization. The ground water is generally colourless but contains salts such as chlorides, sulphates, nitrates etc. of different metals. Water is one of the most important component for sustaining life but it is also the source of several sickness in human beings. The presence of hazardous contaminants like fluoride, nitrate, sulphate, toxic heavy metals etc. have been reported in many parts of India (Sahu *et.al.*, 2006 & Jagmohan Oberoi and K.C. Gupta, 2010).

Fluoride is commonly found above the normal values in ground water of many states like U.P., M.P. Punjab, Haryana etc. Indian standards (Meenakshi *et.al.* 2004) for drinking water prescribes the desirable limit 1.0 mg/l. According to WHO (1997) permissible limit for fluoride in drinking water is 1.5 mg/l whereas United States Public Health Sciences (1962) has set a range of allowable concentration of fluoride in drinking water for a region depending on its climatic conditions. The amount of water consumed and consequently ingested being influenced primarily by the air temperature (Heyroth, 1952 & Galagan & Lamson, 1953). According to USPHS, the maximum allowable concentration of fluoride in drinking water in Indian conditions comes to 1.4 mg/l while as per Indian standards it is 1.5 mg/l (Meenakshi *et.al.* 2004).

In India, the fluorosis was first identified in Tamilnadu in 1937 (Shortt *et.al.*, 1937). later, this disease was also identified in different states. At present more than 30 million people in 13

states have been affected by this disease (Aggarawal *et.al.*, 1982 & Susheela, 1993). The disease is making its appearance in newer non-fluorotic areas due to geo-environmental conditions. According to WHO (1970), one hospital bed out of four in the world is occupied by a patient who is sick because of polluted water.

Fluoride ion concentration in drinking water is playing a vital role in human health systematic fluorosis (Basin, 2003 & Kumar *et.al.*, 2003) and is an endemic problem in several developing countries like India, Pakistan and Africa etc. Exposure to high level of fluoride can cause endemic fluorosis, arthritis, cancer stiff joints, weight loss, brittle bones, anaemia and weakness and characterize endemic fluorosis. Discoloured, blackend, white teeth characterize dental fluorosis (Damel, 2002). Fluoride can damage a foetus and adversely affect the I.Q. of children (Semmala & Vineetha, 2004). Right level of fluoride in drinking water can provide beneficial effects like developing tooth buds, makes the structure of the enamel and dentin harder and more resistant to acid attack produced by bacteria. Fluoride from saliva enters enamel of newly erupted teeth and enhances enamel classification (Hari *et.al.*, 2000).

MATERILAS AND METHODS :

Eight water samples from hand pumps (H1 – H4) and tube wells (T1 – T4) were collected in polythene bottles. The samples were analysed for pH, temperature, turbidity, DO, BOD, COD, chloride, fluoride, sulphate, nitrates and total hardness in the months of January to June 2012.

Temperature was measured by Celsius thermometer, pH and turbidity were measured by digital pH meter (type – 335) and nephlotubiditymeter respectively. DO, BOD and COD were determined in laboratory using the method suggested by APHA (1985) and NEERI manual (1986). Chloride was estimated by volumetric titration with $AgNO_3$. Fluoride concentration was determined spectrophotometrically using Alizarin red – S and SPAND reagents. The Alizarin red-S method was found useful in higher fluoride range while SPANDS reagents was employed in low fluoride range. (Gupta *et.al.*, 1993). The results for ground water are presented in table 1 and table 2.

Table-1 Physico-chemical analysis of water samples collected from hand pumps of various villages

Parameters	Site	Jan	Feb	Mar	Apr	May	Jun
pH	H_1	7.56	7.84	7.29	7.24	7.46	7.81
	H_2	7.39	7.19	7.18	7.45	7.52	7.62
	H_3	7.30	7.50	7.42	7.45	7.55	7.33
	H_4	7.77	7.45	7.62	7.63	7.89	7.46

Temperature (^oC)	H_1	17.91	21.15	23.13	24.52	27.95	28.15
	H_2	18.37	22.11	23.33	26.52	26.78	28.11
	H_3	17.17	21.96	22.18	25.14	26.74	27.79
	H_4	18.12	22.10	24.23	25.78	27.00	28.14
Turbidity (NTU)	H_1	3.9	3.6	3.6	3.9	3.8	3.7
	H_2	0.7	0.9	0.8	1.0	1.0	0.7
	H_3	1.8	1.6	1.7	1.6	1.9	1.7
	H_4	1.1	1.1	1.2	1.4	1.4	1.1
DO (mg/l)	H_1	5.94	5.87	5.8	6.10	6.16	6.21
	H_2	6.37	6.11	5.84	5.67	5.77	5.93
	H_3	5.90	5.57	5.67	6.12	6.13	6.41
	H_4	6.31	6.42	5.91	5.87	5.60	5.98
BOD (mg/l)	H_1	10.00	9.90	8.40	9.40	9.60	9.20
	H_2	9.10	8.40	8.40	8.90	9.60	9.20
	H_3	10.50	12.10	10.40	10.40	10.50	11.20
	H_4	10.30	10.20	8.60	8.90	8.80	10.50
COD (mg/l)	H_1	79	78	81	82	84	79
	H_2	77	79	82	74	78	81
	H_3	76	74	81	84	80	76
	H_4	77	79	81	80	84	85
Chloride (mg/l)	H_1	680	680	690	675	675	690
	H_2	230	241	240	240	245	250
	H_3	1150	1190	1200	1175	1175	1170
	H_4	420	415	420	470	470	460
Fluoride (mg/l)	H_1	0.80	0.70	0.90	0.80	0.90	1.00
	H_2	0.70	0.80	1.00	1.00	0.80	0.80
	H_3	1.00	0.80	0.70	0.80	0.70	0.90
	H_4	0.90	0.70	0.70	0.80	1.00	1.00

H_1 – Karab; H_2 – Raya; H_3 – Ganga Nagla; H_4 – Sardargarh

Table-2 Physico-chemical analysis of water samples collected from tube wells of various villages

Parameters	Site	Jan	Feb	Mar	Apr	May	Jun
pH	T_1	7.50	7.61	7.64	7.20	7.53	7.80
	T_2	7.58	7.39	7.71	7.82	7.45	7.42
	T_3	7.42	7.39	7.54	7.85	7.49	7.89
	T_4	7.52	7.45	7.31	7.96	7.19	8.10
Temperature (^oC)	T_1	17.81	22.15	22.95	26.15	26.86	28.10
	T_2	17.77	21.97	23.15	26.55	26.98	27.95
	T_3	18.25	19.45	21.23	25.14	27.82	28.47
	T_4	17.15	20.45	21.22	22.95	26.88	27.47
Tubidity (NTU)	T_1	1.8	1.9	1.6	2.0	1.9	1.9
	T_2	1.4	1.3	1.3	1.2	1.5	1.5
	T_3	0.7	0.8	0.8	0.8	0.7	0.6
	T_4	5.0	4.9	4.9	4.7	4.9	4.8
DO (mg/l)	T_1	6.37	6.15	5.57	5.92	6.32	6.40
	T_2	6.50	6.19	6.07	5.77	5.78	5.61
	T_3	6.33	5.47	5.53	6.13	6.15	6.11
	T_4	6.27	6.11	6.05	5.87	6.38	5.55

BOD (mg/l)	T_1	11.2	11.0	10.8	11.5	11.3	10.8
	T_2	8.6	10.6	10.8	9.5	9.3	10.5
	T_3	9.1	9.8	10.8	11.5	9.3	10.7
	T_4	11.2	9.5	10.8	11.5	11.3	10.8
COD (mg/l)	T_1	84	76	74	78	74	80
	T_2	76	76	84	78	86	79
	T_3	63	66	71	68	70	69
	T_4	69	66	72	68	72	69
Chloride (mg/l)	T_1	1220	1200	1240	1250	1215	1195
	T_2	465	465	500	490	485	480
	T_3	990	970	975	975	970	980
	T_4	1210	1170	1170	1175	1160	1200
Fluoride (mg/l)	T_1	1.10	1.50	1.00	0.95	0.90	1.00
	T_2	0.80	0.90	0.90	0.80	1.00	1.00
	T_3	0.90	0.90	0.70	0.80	0.70	0.70
	T_4	0.60	0.50	0.60	0.70	0.50	0.60

T_1 – Karab; T_2 – Raya; T_3 – Ganga Nagla; T_4 – Sardargarh

RESULTS AND DISCUSSION :

Results obtained during the analysis have been given in table 1 and 2. The pH of samples collected from various villages were in the range of 7.18 to 7.89 (hand pump) and 7.20 to 8.10 (tube well), Temperature ranged 17.17 to 28.15 °C (HP) 17.15 to 28.47 °C (TW), turbidity ranged 0.7 to 3.9 NTU (HP) and 0.7 to 5.0 NTU (TW), DO ranged 5.57 to 6.42 mg/l (HP) and 5.47 to 6.50 mg/l (TW), BOD ranged 8.40 to 12.10 mg/l (HP) and 8.60 to 11.50 mg/l (TW), COD ranged 74.0 to 85.0 mg/l (HP) and 63.0 to 86.0 mg/l (TW), chloride ranged 230 to 1200 mg/l (HP) and 465 to 1250 mg/l (TW), fluoride ranged 0.70 to 1.00 mg/l (HP) and 0.50 to 1.50 mg/l (TW).

CONCLUSION :

It is shown that all other parameters are within range when we compare with WHO standards, only fluoride and chloride is present in excess amount in tube well water of Karab village, that is sample no. 4. it has been observed that tube well water samples have higher fluoride concentration as compared to hand pump water. Regular intake of fluoride rich water seems to be main course for high incidence of fluorosis. Chemical weathering under arid to semiarid conditions with relatively high alkalinity seems to have favored high concentration of fluoride in ground water.

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