

Evaluation of Ground Water Quality with Special Reference to Fluoride and Nitrate in Area near by Kota

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Abstract: - A Study was undertaken to check the ground water quality in some villages of area near Kota city. Fifteen samples were collected from different tube wells & wells of the area and analysed in Laboratory of the institute for pH, EC, F⁻ and NO₃⁻ contents by standard methods. The study reveals that only one sample of Meghwall well (Bhadana) was found safe (F⁻ = 1.5ppm) from fluoride content point of view. Rests of all are having fluoride content > 1.5 ppm and need treatment. However pH, E.C. & NO₃⁻ of all other samples were found normal for irrigation as well as domestic purposes.

Keywords- Spadns dye, Phenol disulphonic acid, fluoride, Nitrate, Spectrophotometer .

I. INTRODUCTION

In India ground water is the major source of potable water and over 94 % of the drinking water demand is met by tube well or well water. Therefore, ground water quality is essential to be studied when the overall focus is sustainable development keeping mankind at focal point, Since it is directly linked with human welfare. Major problems are being faced due to the presence of excess fluoride and nitrate in ground water in certain parts of country. Being highly electronegative fluorine is always found in combined state as fluoride & not in elemental form. It represent about 0.06 to 0.09 % of the earth crust [1]. It is essential for normal mineralization of bones and formation of dental enamel. Excess of fluoride concentration in potable water has deteriorious effects on human health and causes fluorosis disease, [2], [3], [4]. Its permissible limit is 1 to 1.5 mg/l (Indian Standard).

NO₃⁻ concentration in ground water is due to intensive use of fertilizers and it has become a serious problem in rural areas. The level of nitrate in ground water has been increasing over the last 3 decads [5], [6]. Leaching of nitrate from agricultural land & from other sources to ground water is a global phenomenon and is influenced by rainfall. In India, as high as 530 mg/L of NO₃⁻ has been report in Churu district of Rajasthan. Drinking water with NO₃⁻ at concentration > 45 mg/L can be detrimental to human health[5]. The permissible limit of NO₃⁻ in drinking water is 45 mg/L by W.H.O. Infants under one year old are particularly at risk from excessive amount as it cause Methamoglobinaemia, commonly called "blue baby syndrome"[7].

Review on literature showed that very less studies have been taken in this study area with regard to physico – chemical characteristics of water yet. So this study was to investigate the quality of underground water with special reference to fluoride and nitrate in area near by Kota city (Raj.)

II. MATERIAL AND METHODS

Kota city is situated in south-east of the Rajasthan (India) and on Delhi–Bombay main Railway tract. Adequate amount of water is available thereby area is highly potential from agriculture point of view. The average rain fall of the area is 850 mm. and the maximum temperature in summer season rises up to 48^oC and minimum temperature in winter falls up to 2- 3^oC. The soil of the area is highly fertile and clay to clayloam in texture. The major crops of the kharif season are paddy and sayabean while in Rabi season these are wheat and mustard. On small scale all crops are possible.



Fig.1 Reaction of fluoride in the range 0.0–3.0 mg L⁻¹ with 2×10^{-4} M of fluoride reagent.

Some susceptible points having the fluoride and NO₃⁻ contents in ground waters were surveyed and ground water samples were collected from these points in neat & clean plastic bottles and analyzed for pH, EC, F⁻ and NO₃⁻ contents by standard analytical methods[8],[9]. All the chemicals used were of AR grade & double distilled water used for preparation of solutions. The pH and electrical conductivity were measured by digital pH meter and digital conductivity meter respectively while fluoride (F⁻) and Nitrates (NO₃⁻) were analyzed by spectrophotometric method using Spadns Dye and Phenol disulphonic acid for color development

III. RESULTS AND DISCUSSIONS

The respective values of all water quality parameters in the collected ground water samples are illustrated in Table II. All the results are compared with standard permissible limit recommended by Bureau of Indian standard (BIS), Indian

council of Mercal Research (I.C.M.R.) and World Health organization (WHO) as depicted in

Table I

STANDARDS FOR DRINKING WATER QUALITY

S.No.	Parameters	BIS : 1999	KMR : 1975	WHO : 2000
1	PH	6.5 – 8.5	7.0 – 8.5	6.5 – 8.5
2.	EC (ds/m)	-	-	1.40
3	NO_3^- (ppm)	100	50	45
4	F (ppm)	1.5	1.5	1.5

TABLE II

ANALYTICAL RESULTS OF GROUND WATER QUALITY PARAMETERS OF SAMPLES COLLECTED FROM AREA NEAR BY KOTA CITY.

S. No.	Sampling Site	Type of well	pH	E.C. (ds/m)	NO_3^-	F ⁻
1	M.L.Floormill,naya Bhdhana.	Hand pump	8.5	0.352	17.8	3.0
2	Laxmi narayan Temple,Bdhana	Bore well	8.5	0.240	21.1	2.5
3	Meghwal Mohalla,Bdhana	Hand pump	7.0	0.377	19.4	2.5
4	Meghwal Mohalla,Bdhana	Well	9.0	0.366	20.9	1.5
5	ShriNathji,gaushala Gangai villege	Well	8.5	0.108	26.4	2.5
6	Main Road Near land Gangai villege	Bore well	7.5	0.218	30.6	2.5
7	Gavdi Jagir, Rangpur Road	Bore well	8.5	0.280	40.5	3.0
8	Infront of Mataji Temple	Bore well	7.5	0.250	44.6	2.5
9	Kishanpura Takya Nayagav,Bypas.	Bore well	8.5	0.324	25.7	2.0
10	Near Bhawanishankar Home,Kishanpura Takya	Bore well	7.5	0.348	35.8	3.0
11	MAIT,Ranpur,Kota	Tube Well	8.2	0.388	20.77	1.8
12	Kala Talab Villege	Tube Well	8.1	0.412	38.40	1.2
13	Kota city,Mahaveer Nagar area	Tube Well	7.8	0.402	22.20	1.0
14	Railway station Area, Kota	Tube Well	8.0	00.348	25.70	1.2
15	Ranpur Area, Kota	Tube Well	8.4	0.512	40.50	1.1

Results of the different parameters are discussed as under

- 1 pH: All chemical and biological reactions are directly dependent upon the pH of water system [12]. In this

study pH varied between (7.0 to 9.0). Maximum pH(9.0) was recorded in the sample collected from the well situated in Meghwal Mohalla at Bhdhana Village (Kota). This ground water sample, being alkaline in nature is not suitable for drinking purposes. Rest all ground water samples are having PH under permissible limit [13],[14]. The PH of water is very important indication of its quality and provides inform action in many types of geo chemical equilibrium or solubility calculations[15].

- 2 *Electrical Conductivity (EC)*: The electrical conductivity of water depends upon the conc. of ions & its nutrient status. Based on EC values the water quality can be classified as poor, medium or good. In the present study maximum EC (ds/m) values was observed in the sample collected from Ranpur area (EC : 0.512 ds/m) and minimum values in the sample collected from the well of Shri Nath Ji of Gangai Village. The maximum limit of EC in drinking water is prescribed as 1.4 ds/m . None of the Ground Water samples was found above permissible limit of EC in present study.

- 3 *Fluoride*: Fluoride (F⁻) concentration in sampling sites ranges from 1.0 ppm to 3.0 ppm in ground water samples with lowest range value 1.0 mg/L in the sample collected from Mahaveer Nagar area in Kota city and highest value 3.0 mg/ L was found in two sites i.e. in the tube wells of Gavdi Village on Kota Rangpur Road and in the tube well of Bhawani Shankar of Kishanpura Takya Village.

The study reveals that out of 15 samples of different sites 5 samples found safe from fluoride content point of view, rest 10 samples are having higher fluoride content beyond permissible limit of 1.5 ppm. (Table II).

The main source of fluoride in ground water is basically from the rock minerals. These minerals are commonly associated with country rock, through which the ground water percolates under variable temperature conditions Besides these minerals, alkali rocks, hydrothermal solution, phosphate fertilizers coal burning, manufacturing process of Aluminium, steel & bricks may also contribute to higher concentration of fluoride in ground water.

Other facts which influence the concentration of fluoride in Ground water may be source of water, solvent action of water on the rocks & soil porosity of rocks or soil through which water passes, the speed of water, temperature of rocks & water, the hydrogen & calcium ion conc., amount of rain fall etc.

Fluoride in drinking water has both positive and negative effects on human health low level of fluoride in drinking water makes the teeth resistant to decay & development of dental caries but high intake fluoride cause immediate abdominal pains, excessive

salivation & Vomiting, seizure of muscle spasm & numbness of mouth etc. Excessive fluoride causes pain and damage to bones and joints and imparts ill effect on soft tissues organs and system also, categorized as non – skeletal fluorosis Repeated abortions male infertility are also some of the complications

- 4 *Nitrate*: Nitrate (NO_3^-) content of ground water samples are depicted in Table – 1. Data reveal that none of the ground water samples from different sites falls above the range of 0-45ppm indicating safe limit from NO_3^- contents point of view. The NO_3^- in the ground water samples ranged from 17.8 to 40.50ppm. Highest value being 40.5ppm and lowest value was found to be 17.8ppm, rest of the samples fall in between them.

Nitrate (NO_3^-) contamination of ground water is mainly due to the intense use of fertilizers. Leaching of nitrate to ground water is due to excessive application of N-fertilizers, absence of proper soil and water management practices, septic tanks, improper disposal of domestic wastes.

Nitrate content in ground water serves as a basis for detecting pollution. High NO_3^- level found in drinking water have been proven to be the cause for numerous health conditions. Across the world such as gastro intestinal cancer, methamoglobinemia Alzheimer disease, vascular dementia, multiple sclerosis in human being. Nitrate contamination leads to Eutrophication of water bodies Some scientific evidences suggest that ingested nitrites and nitrates might result birth defects related to ovarian cancers.

IV.CONCLUSION

The results of current study indicate that the drinking water, used by the people residing in study area is not potable. So the proper environmental management plan must be adopted to control drinking water quality immediately. Based on these results and analysis of ground water samples, it is recommended to use water only after reverse Osmosis or any suitable method of removing fluoride treated for drinking purpose by the individual to prevent adverse health effects[15].

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