

# Evaluation of Ground Water Quality with Special Reference to Nitrate in and Around Jaipur City

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**Abstract-** This paper describes the results of analysis of drinking water collected from different locations of Jaipur city. The study was carried out to assess the ground water quality with special reference of Jaipur city areas. For this purpose, 47 samples were collected from government and private tube wells of outskirts agriculture area and new developed residential colonies of Jaipur city and were analyzed for a number of physico-chemical parameters such as pH, EC, TDS and NO<sub>3</sub><sup>-</sup>. The results revealed that the values of Nitrate concentration varied from 27 mg/L to 669 mg/L. A large number of samples having nitrate level above permissible limit that is 45mg/L as NO<sub>3</sub><sup>-</sup> or 10 mg/L as NO<sub>3</sub>N. Nitrate has been found to be an environmental limiting factor for infants, adults, animals as well as some plant species.

**Keywords-** Groundwater, Nitrate, Health, Jaipur.

## 1. INTRODUCTION

This study pertains to high nitrate concentration in drinking water. Due to the consumption of food and water containing high nitrate concentration, a large number of repercussions have been reported such as methaemoglobinaemia, miscarriages and reproductive problems, thyroid problems, respiratory problems and even cancers. Nitrates pollute groundwater and cause human health disorders (Majumdar and Gupta, 2000). Methaemoglobinaemia, Recurrent diarrhea in children, recurrent respiratory tract infection in areas with high nitrate concentration in drinking water were reported by various workers. (Gupta et al, 2000). Absorption and accumulation of nitrate in plants and influence on environmental factors were also reported by Bose and Srivastava (2001). Dietary nitrate also affects blood pressure by Larsen, Ekblom and Sahlin (2006). Ward et al (2010) reported nitrate intake and the risk of thyroid cancer and thyroid disease due to high nitrate contents in drinking water. Pregnancy loss and maternal Methaemoglobin level and adverse effect on mother and fetus also have been reported by Mohorovic et al, (2010). Venkatesh (2014) studied cow's milk as an unusual cause of methemoglobinemia in an infant. The aim of the paper is to analyze water from 47 locations in and around Jaipur city.

## 2. STUDY AREA

In the present study the observations have been conducted from the agricultural area and new developed residential colonies in and around Jaipur, the capital city of the Indian state of Rajasthan. It is located in the eastern boundary of Thar Desert, a semi-arid territory. Jaipur is usually known as the pink city and is one of the well-designed cities in India.

## 3. MATERIAL AND METHODS

### 3.1 Ground water sampling

Ground water samples of a total of 47 areas in and around Jaipur city were collected in pre-cleaned and rinsed polythene bottles of one liter capacity with necessary precautions. Samples were collected from government and private tube wells of outskirts agriculture area and new developed colonies of Jaipur city and were analyzed for different physico-chemical parameters.

### 3.2 Physico-chemical analysis

All the ground water samples were analyzed for the following physico-chemical parameters—pH, Electrical Conductivity (EC), Total Dissolved Solid (TDS) and Nitrate. The analysis of water samples was carried out in accordance to standard analytical methods (APHA).

**Table-1:** Parameters and methods used for analysis of water samples

S. No.	Parameter	Unit	Method Employed
1.	pH	-	Digital pH-meter
2.	Electrical conductivity	µmhos/cm	Digital conductivity meter
3.	Total dissolved solid	Mg/L	Digital conductivity meter
4.	Nitrate (as NO <sub>3</sub> <sup>-</sup> N)	Mg/L	Nitrate electrode method

**4. RESULT AND DISCUSSION**

The respective values of all water quality parameters in the groundwater samples are mentioned in Table-3. All the results are compared with standard permissible limit recommended by the bureau of Indian standard (BIS), Indian Council of Medical Research (ICMR) and World Health Organization (WHO) - Table-2.

**Table 2:** Standards for drinking water quality

Para-meter	BIS:2012	ICMR:1975	WHO:2006
pH	6.5-8.5	6-.8.5	6-8.5
EC	-	-	1400
TDS	500mg/L	500mg/L	500mg/L
NO <sup>3-</sup>	45mg/L	45mg/L	45mg/L

**4.1 pH**

The result revealed that pH values varied between 6.86 to 9.15. The maximum pH (9.15) was recorded at Mahal Yojana Pratap Nagar and minimum (6.86) was recorded at Ricco Industrial area.

**4.2 Electrical Conductivity (EC)**

In the present investigation maximum conductivity (5100 µS) was observed at Jaishinghpura Khor and minimum (402 µS) at Bhawani Niketan.

**4.3 Total Dissolved Solid (TDS)**

Total dissolved solids are composed mainly of carbonates, bicarbonates, chlorides, phosphates and nitrates of Calcium, Magnesium, Sodium, Potassium, Manganese, organic matter salt and other particles, in the present study TDS value varied from 234 mg/L to 2920 mg/L .Maximum TDS (2920 mg/L) were recorded at Jaishinghpura Khor and minimum (234 mg/L) at Bhawani Niketan.

**Table-3** Analysis of ground water quality parameters in and around Jaipur city.

Sample Code	Sampling Site	pH	EC (µS)	TDS (ppm)	Nitrate (ppm )
S1	ICG College	7.50	728	423	144
S2	Ramsinghpura Sanganer	7.76	1560	900	200
S3	MGH Sitapura	8.59	2930	1700	290
S4	Mahal Yogana ,Pratap Nagar	9.15	1330	770	48
S5	Apex Circle, Malviya Nagar	8.23	1030	590	260

S6	RTO Office, Jhalana	8.39	725	420	50
S7	Satya Sai College, Jawahar nagar	7.98	1950	1300	600
S8	Khole Ke Hanumanji	8.26	1130	650	27
S9	Amer	8.88	2870	1650	205
S10	Hari Nagar, Shastri Nagar	8.34	694	404	158
S11	Vidhyadhar Nagar Circle	8.54	790	624	350
S12	Bhawani Niketan	8.46	402	234	42
S13	Kalwar Road,Jhotwara	8.73	527	330	41
S14	Khatipura	8.35	789	460	232
S15	Vidhut Nagar,Vaishali	8.42	599	344	135
S16	Vivek Vihar ,Sodala	7.94	2040	1190	425
S17	Nirman Nagar	8.46	509	293	79
S18	Golyawas	8.94	804	965	85
S19	Madamrampur a ,Civil Lines	7.91	1340	770	310
S20	Lalpura Colony ,Sindhi Camp	7.84	1410	820	406
S21	ITI Banipark	8.10	730	425	331
S22	Sanjay Colony,Panipe ch	8.28	812	468	359
S23	Science Park,Shastri Nagar	7.81	1210	700	493
S24	Bhatta Basti,Shastri Nagar	7.93	1100	630	413
S25	Ambabari ,Vidhyadhar Nagar	6.89	1070	710	506
S26	Jagdamba Colony Vaishali	7.15	464	364	268
S27	Heerapura Girdharipura	7.17	592	337	355
S28	Bhankarota	7.83	817	471	292
S29	Devi Nagar	6.90	1250	730	504
S30	Mahesh Nagar	7.24	1260	730	669

S31	Kartarpura	7.55	1420	810	562
S32	Chainpura,Jaw ahar Nagar	7.59	535	310	234
S33	Ricco Industrial Area	6.86	1210	700	179
S34	Rampura,Sang aner	7.92	988	569	365
S35	Patrakar Colony, Mansarovar	8.34	891	513	306
S36	Prithviraj Nagar	7.92	810	464	206
S37	Gram Dholai	7.91	981	567	399
S38	Subodh College Sanganer	7.80	796	468	205
S39	SFS Agarwal Farm	7.05	1100	650	294
S40	Lalkothi	8.03	866	547	459
S41	Gandhinagar	7.64	736	427	443
S42	Sisodia Garden	7.44	1250	720	449
S43	Jaishinghpura Khor	7.54	5100	2920	396
S44	Budhhsinghpu ra	7.87	702	396	316
S45	Radha Vihar Colony,Iskon	8.5	872	506	297
S46	Mahima Nagar	7.36	1020	590	293
S47	Jaisinghpura At Bas Beelwa	7.17	4380	2560	596

Category IV	Nitrate concentration between 101-150 mg/l
Category V	Nitrate concentration above 150 mg/l

Samples were distributed as per their concentration range categories

**Nitrate Categorization of sites of Jaipur City**

Nitrate Concentration as No <sup>3</sup> -N (mg/L)	Representing Samples
Category I (<45)	S8,S13,S12
Category II (45-50)	S4,S6
Category III (51-100)	S17,S18
Category IV ( 101-150)	S15,S1
Category V (>150)	S2,S3,S5,S7,S10,S11 ,S14,S16,S19,S20, S21 to S47

**4.4 Nitrate**

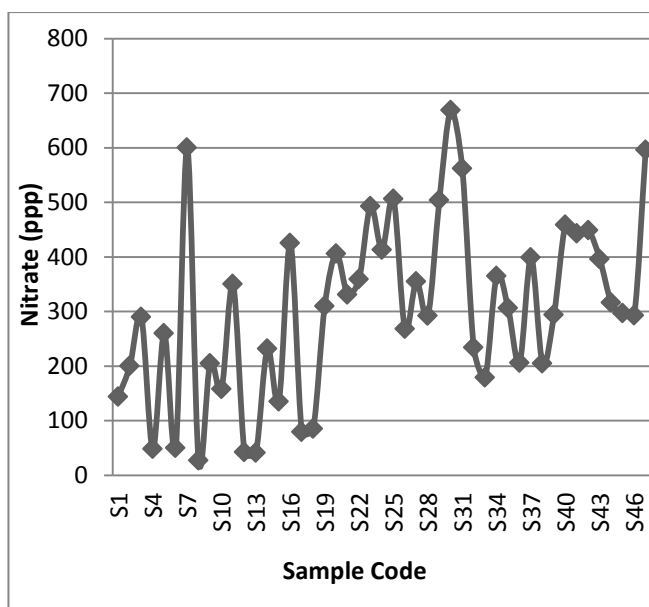
Nitrate concentration in ground water sampling sites ranges from 27 mg/L to 669mg/L. Lowest value (27 mg/L) was recorded at Khole Ke Hanumanji and highest value (669mg/L) at Mahesh Nagar.

The variation of nitrate values in groundwater samples of study area is depicted in Figure-1

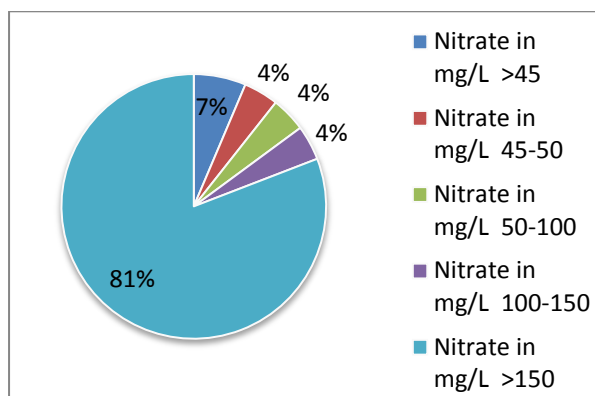
**4.4.1 Distribution of Nitrate in and around Jaipur city**

All the sites were categorized according to following concentration range

Category I	Nitrate concentration below 45 mg/l
Category II	Nitrate concentration between 45-50 mg/l
Category III	Nitrate concentration between 51-100 mg/l



**Figure 1:** Nitrate Concentration Ranges as per sampling site code



**Figure 2:** Percentage of samples as per Nitrate Concentration Ranges

The study reveals that out of 47 sampling sites only 3 sites (7% samples) contains nitrate concentration within the limit, and remaining 93% samples were above the permissible limit that is 45 mg/L for nitrate concentration in drinking water.

## 5. CONCLUSION

The analysis of 47 ground water samples collected from different sites of in and around Jaipur city revealed that, in almost all samples water quality parameters (pH, electrical conductivity, TDS, and nitrate) are beyond the permissible limit as per BIS, ICMR and WHO standards. In comparison to all other parameters there is an acute problem of extremely high levels of Nitrate ranging from 27 to 669 mg/L. There is a need to attracting the attention of different agencies about high nitrate concentration in the drinking water supplied to in habitance to Jaipur city. If water containing high concentration of nitrate is consumed by citizens there is likelihood of increase in number of patients of methaemoglobineamia, miscarriages and reproductive problems, cancer, thyroid problems respiratory problems etc.

## REFERENCES

- [1] Majumdar, D; Gupta, N. (2000): Nitrate pollution of ground water and associated human health disorders. *Indian Journal of Environmental Health*, 42(1), pp.28-39.
- [2] Gupta,S.K. ;Gupta ,R.C. ;Seth , A. K. ;Gupta ,A.B ; Bassin,J.K.;Gupta,A.(2000):Methaemoglobineamia in areas with high nitrate concentration in drinking water .*The National Medical Journal of India*, 13(2),pp.58-61.
- [3] Gupta,S.K., Gupta R.C.; Gupta, A.B.; Seth, A.K. ;Basin,J.K.; Gupta A.:(2000): Recurrent Diarrhea In Children Living In Areas With High Level Of Nitrate In Drinking Water. *Archives of Environmental Health*, 56(4), pp.369-373.
- [4] Gupta,S.K.;Gupta,R.C.;Gupta,A.B.;Seth,A.K.;Basin,J.K.;Gupta,A.(2000): Recurrent Acute Respiratory Tract Infections in Areas With High Nitrate Concentration In Drinking Water .*Environmental Health Perspectives* ,108(4),pp.363-366.
- [5] Boss,B.;Srivastava,H.S,(2001):Absorption And Accumulation of Nitrate In Plants :Influence Of Environmental Factors. *Indian Journal of Experimental Biology*, 39[Feb], pp.101-110.
- [6] Larsen,F.J.;Ekblom,B.;Sahlin,K.;Lundberg,J.O.; Weitzberg, E.,(2006) :Effects Of Dietary Nitrate on New England *Journal of Medicine*,355(26),pp.2792-2793.
- [7] Ward,M.H.;Kilfoy,B.A.;Weyer,P.J.;Anderson,K. E.;Folsom,A.R.;Cerhan,J.R.,(2010): Nitrate Intake and The Risk o f Thyroid Cancer and Thyroid Disease.*Epidemiology*,21(3),pp.389-395.
- [8] Mohorovic,L.;Petrovic,O.;Haller,H.;Micovic,V., (2010):Pregnancy Loss And Maternal Metemoglobin Levels : An Indirect Explanation of The Association of Environmental Toxics and Their Adverse Effects On The Mother and The Fetus. *International Journal of Environmental Research and Public Health*, 7, pp.4203-4212.
- [9] Venkatesh, H.A.,(2014) : Cow's Milk-An Unusual Cause Of Methemoglobinemia In An Infant. *International Journal of Life Sciences Research*, 2(3), pp.136-137.
- [10] Umbreit,J.:(2007):Methemoglobin-It's Not Just Blue ;A Concise Review. *American Journal Of Hematology*, 82, pp.134-144.
- [11] SaxenaU.; Saxena S.,(2014) :Ground Water Quality Evaluation With Special Reference To Fluoride And Nitrate Concentration In Bassi Tehsil Of District Jaipur, Rajasthan, India. *International Journal of Environmental Sciences* 5(1), pp.144-163.
- [12] Khandare,H.,(2013): Scenario of Nitrate Contamination in Ground Water : Its Causes and Prevention. *International Journal of Chem Tech Research*, 5(4), pp 1921-1926.
- [13]Knobeloch,L.;Salna,B.;Hogan,A.;Postle,J.; Anderson,H.,(2000) : Blue Babies And Nitrate Contamination Well Water. *Environmental Health Perspectives*, 108(7), pp.675.
- [14]Maheshwari,R.;Chauhan,A.;Lal,B.;Sharma,A.(2013):Nitrate Toxicity In Groundwater: Its Critical Manifestations ,Preventive Measures and Mitigation Strategies .*Octa Journal of Environmental Research* , 3,pp.217-230.
- [15]Sharma,M.;Sharma,H.;Bapna,N.(2013) :Toxic Effects of High Nitrate Intake in Oesophagus and Stomach of Rabbits . *International Journal of Medical Research and Health Science*, 2(3), pp.407-411.