Study of Nitrate concentration in Ground water of Mandawa Town and it's Surrounding Area of Jhunjhunu District (Rajasthan)

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Abstract

Efforts were made to evaluate the level of nitrate in Mandawa town and it's surrounding villages of Jhunjhunu district of Rajasthan, India. A total of 326 groundwater samples from different villages/town were collected and analyzed for nitrate (as NO_3^-) parameter. NO_3^- level in groundwater was 2–255 mg L^{-1} for individual samples. The sources of NO_3^- in groundwater of this region may be N-fertilizer, animal waste, organic manure, geology of sub-surface soil layers, pit latrines, etc. Results thus indicated that groundwater of this area is severely polluted due to anthropogenic activities. The continuous consumption of such water may cause serious health hazardous in local residents.

Keywords: Nitrate, Groundwater, Mandawa

INTRODUCTION

Nitrate is the most common chemical contaminant in the world's groundwater aquifers. [1-2] Nitrate is very important nutrient in soil and water. Nitrate is formed by the oxidation of ammonia and this process is time taking in nature. Nitrate is in the highest oxidized form of nitrogen most of the surface water are deficient in nitrate. Ground waters have significant quantities of nitrates due to leaching of nitrate with the percolating water. High amounts of nitrates are generally cause of pollution. Nitrate is one of the common contaminants in the present day ground waters resulting from increased population associated with poor sanitary conditions in the habitat area and increased agricultural activity.

According to studies, exposure to higher levels of nitrates or nitrites has been associated with increased incidence of cancer in adults and possible increased incidence of brain tumors, leukemia, and nasopharyngeal (nose and throat) tumors in children. High dose of nitrate and nitrites over a span of time can produce symptoms of following.

- Develop Methemoglobinemia
- Birth defects
- Cancer risk

The concentration of nitrates above 45 mg/L is causing infant methemoglobinemia. In this disease the skin becomes blue due to decreased efficiency of hemoglobin to combine with oxygen.

EXPERIMENTAL

A survey was conducted in Mandawa town and surrounding villages of Jhunjhunu district, Rajasthan. Samples were collected from tube wells, hand pumps and open wells present in this area. Samples were collected in clean polythene bottles and rinsed three to four times with the water samples before the samples were analyzed in the laboratory.

In laboratory, nitrate is determined by spectroscopic method as follows:

Nitrate was determined Spectrophotometrically by using UV-Visible Spectrophotometer (Model No. 301) at single wavelength of 220nm. It follows the lambert-Beer's law up to nitrate concentration of 11 mg/l. Water sample was acidified with 1 N HCl to prevent interferences of hydroxides or carbonate concentration up to 100 mg./l. as $CaCO_3$.[3–4]

RESULT AND DISCUSSION

The maximum permissible limit of Nitrate in drinking water is 45 ppm according to BIS and WHO. Investigation shows that nitrate level ranges from 2-255 ppm.

S.No.	Village	No. of Samples	Range of Nitrate
1	BHADARWAS	12	6-195
2	PHOOSKHANI	7	45-155
3	RANJEETPURA	12	18-133
4	SESWAS	7	40-123

5	BHAROO	14	17-156
6	CHAKWAS	4	27-117
7	HETAMSAR	8	31-215
8	JAISINGHPURA	5	17-180
9	JUHARPURA	4	40-223
10	BHOJASAR	17	2-160
11	HARNATHPURA	6	20-193
12	LADSAR	8	24-117
13	SANJAY NAGAR	6	15-72
14	CHOORI AJEETGARH	5	70-235
15	DEENWA	5	40-180
16	GOVINDPURA	3	45-70
17	CHURI CHATARPURA	2	60-124
18	HANUMAN PURA	10	11-197
19	JEETAS	10	35-230
20	KISARI	3	70-100
21	MEETHWAS	5	35-84
22	TETARA	6	4-208
23	BAS KUHAROO	2	41-85
24	GODOO KA BAS	5	19-105

25	KHALSI	3	30-100
26	KUHAROO	9	19-191
27	MOJAS	3	73-79
28	CHANDRAPURA	1	36
29	KOLALI	2	66-251
30	MAHRADASI	10	14-179
31	MUKHWAS	4	25-173
32	PIPAL KA BAS	1	172
33	TODARWAS	2	115-151
34	WAJIDSAR	3	76-109
35	HAMEERWAS	4	40-123
36	KAMAL NAGAR	2	45-140
37	NOOAN	19	38-255
38	SHYAMPURA	5	40-136
39	KUMAS	3	97-254
40	MOTISAR	1	106
41	SHEKHSAR	4	45-177
42	BAS DARIYA KA	3	60-118
43	MORSARA KA BAS	4	42-60
44	ROONAGAR	5	40-115

45	SEEGRA	8	11-197
46	SEEGRI	9	49-197
47	TOLIYASAR	3	41-167
48	DHANI JOSHIYAN	4	35-68
49	LOOMAS	11	25-154
50	SHYOPURA	6	40-137
51	WAHIDPURA	3	51-91
52	NP MANDAWA	28	10-247

It is observed that in many areas groundwater is highly contaminated with nitrate. The main source of nitrogen in soil is through interaction with the atmosphere, which is about 78 % nitrogen by volume. Small amount of nitrate occur naturally in ground water as a result of atmospheric nitrogen contained in precipitation and minerals found in soils and rock. Most nitrate which enters ground water comes from land application of animal manure at farms, application of fertilizers to agricultural crops and urban yards.

Such high nitrate levels in water are responsible for methemoglobinemia or blue baby syndrome, a condition found especially in infants less than six months. Methemoglobinemia is caused by the decreased ability of blood to carry vital oxygen around the body. The stomach acid of an infant is not as strong as in older children and adults. This causes an increase in bacteria that can readily convert nitrate into nitrite.[5]

Exposure to higher levels of nitrate has been associated with increased incidence of cancer in adults and possible increased incidence of Brain tumors, leukemia & naso phansyngeal tumor.

CONCLUSION

The analysis shows that nitrate level is high in area under investigation and it is producing various health effects in the native of these areas. It is clear that nitrate concentration in ground water in this region, is on higher side and there is a need of developing low cost water treatment schemes for the habitants, which they can sustain.

Removal of excessive nitrate from drinking-water is difficult and expensive. The preferred option is to find a supply of safe drinking-water with safe nitrate levels. Where access to safe water is already limited, nitrate removal may be the only solution.

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