Study of toxic ion concentration of underground water used for irrigation in Sriganganagar and Hanumangarh District of Rajasthan (India)

[1] Sanjay kumar bhati and [2] Dr. H.K. Singh
1. Department of Chemistry , D.A.V. College, Sri Ganganagar (Raj.)
2. Department of Chemistry , Tantia University, SriGanganagar (Raj.)

1 Abstract - Water is the source of energy and governs the evolution and functions of the universe on the earth. The global environment is changing continuously due to unfavorable alteration of surroundings, Fertilizers and pesticides are major contributors to water pollution and nitrates, water heavy metal sulphate, phosphate, pesticides, chloride, detergents, soaps arc the common chemical pollutant. The present studies of toxic ion parameters of irrigation water of IGNP, Bhakra and Gang canal system in Sriganganagar and Hanumangarh district of Rajasthan revealed that toxic ion changed the quality of irrigation water and ultimately reduce plant growth and crop yield.

Keyword : IGNP (Indra Gandhi Nahar Project),NO_3^-(Nitrate ion),F^- (Fluoride ion)

2 Introduction- Water is a wander of the nature. "No life without water' is a common saying depending upon the fact that water is the one of the Naturally occurring essential requirement of all life supporting activities since it is dynamic system, containing living as well as insoluble substances, so its quality is likely to change day by day and from source to source. Boron, Fluoride and Nitrate are common toxic ions in underground water which used for irrigation in Rajasthan (India).Soil irrigated with Groundwater continuing high concentration of toxic ion ultimately reduce the plant growth and productivity. Fertilizers and pesticides are major contributors to water pollution in the form of nitrates. . Fluoride occurance in ground water is a natural phenomena influenced by the local and regional setting and hydrogeological condition of the regions. The F^- problem are serious in Rajasthan (India) .

3 Materials and Methods-

3.1 Collection of underground water samples

Total 101 ground water samples were collected from tube wells located in the farmers fields in each canal command area of IGNP, Bhakra and Gang. At the time of collection of water samples it was kept in mind that the tube wells represent both the sides (left and right) of branch/distributory/minor at varying distances. These water samples were collected in the month of March-April 2015, July-August 2015 and February-March 2016 from IGNP, Bhakra and Gang canal commands, respectively. Each water sample was collected after running the tube well for at least half an hour. A volume of about half litre water sample was collected in throughly washed double lid polyethylene bottles. The bottles were carefully closed, properly labeled and brought to the laboratory for further analysis.

3.2 Analysis Methods- The ground water samples were analysed for specific ion toxicity F^-, B, NO_3^- by standard methods.

1	Boron (B)	Calorimetric method using carmine as a colour developing agent	Hatcherard Wilkox[7] (1950) (5)
2	Fluoride	Alizarin Red method	14th Edition APHA[1] (1975)
3	NO_3^-	Phenol disulphonic acid method	AWWA[8] (2012). P-76 and 39B – 2, P-77

4 Results and Observation-

Table 1 Mean Value of Fluoride Content (MgL^{-1}) in Underground water of IGNP,Bhakra and Gang canal command Area.(100 Sample from each canal area)

Sr., No.	Sampling Area	Mean Value (MgL^{-1})	Permissible Limit(MgL^{-1})	Maximum Permissible Limit(MgL^{-1})
1	IGNP	0.5-8.0	1.0	1.5
2	Bhakra Canal	0.5-8.5	1.0	1.5
3	Gang Canal	0.5-5.5	1.0	1.5

Table 2 Mean Value of Boron Content (MgL^{-1}) in Underground water of IGNP,Bhakra and Gang canal command Area.(100 Sample from each canal area)

Sr., No.	Sampling Area	Mean Value (MgL^{-1})	Permissible Limit(MgL^{-1})	Maximum Permissible Limit(MgL^{-1})
1	IGNP	0.02-5.70	1.0	2.0
2	Bhakra Canal	1.05-7.73	1.0	2.0
3	Gang Canal	0.05-6.37	1.0	2.0

Table 3 Mean Value of Nitrate Content (MgL^{-1}) in Underground water of IGNP,Bhakra and Gang canal command Area.(100 Sample from each canal area)

Sr., No.	Sampling Area	Mean Value (MgL^{-1})	Permissible Limit(MgL^{-1})	Maximum Permissible Limit(MgL^{-1})
1	IGNP	5.70-82.11	<45	100
2	Bhakra Canal	0.34-50.76	<45	100
3	Gang Canal	0.50-278.68	<45	100

(classification of permissible limits of different parameter based on Gupta et all ,WHO and BIS standards)

Table 4 Different Range of Fluoride (F^-) Content in Underground water Sample (100 sample from each canal area.)

Sr.No.	Range(MgL^{-1})	IGNP Canal	Bhakra Canal	Gang Canal
1	<1.0	13	9	5
2	1.0-1.5	12	13	13
3	>1.5	85	78	82

Table 5 Different Range of Boron (B) Content in Underground water Sample (100 sample from each canal area.)

Sr.No.	Range(MgL^{-1})	IGNP Canal	Bhakra Canal	Gang Canal
1	<1.0	28	00	50
2	1.0-2.0	20	12	27
3	2.04-4.0	13	57	22
4	>4.0	02	31	01

Table 6 Different Range of Nitrate(NO_3^-) Content in Underground water Sample (100 sample from each canal area.)

Sr.No.	Range(MgL^{-1})	IGNP Canal	Bhakra Canal	Gang Canal
1	<45	95	100	98
2	45-100	5	00	2

5 Discussion-The results are indicating to the fragile nature of ground water for fluoride and this zone should be declared as "Hot spots". Fluoride occurrence in groundwater is natural phenomenon, influenced by the local and regional geological setting and hydro-geological conditions of the area. Due to presence of acid in the soils. dissolution of fluoride from the country rocks occurs. use of phosphatic fertilizers leads accumulation of excess fluoride in soils that may eventually get into the groundwater as well as soil run to surface waters. This also eventually ends up in food chain through agricultural activities.Yadav and Verma[6] found that fluoride content in underground water of Jayal Tehsil (Nagaur district of Rajasthan) ranged 0.2 to 12.0 mgL^{-1} and had positive correlation with pH and SAR. It was also noted that fluoride content in wheat straw and grain ranged from on 7.51 to 25.38 and 0.16 to 0.54 $mgKg^{-1}$ Respectively.57% of water samples in bhakra canal command were in the high hazard group and no samples was found in low hazard group of Boron. The fifty percent of groundwater samples in Gang canal command were under low hazard group of boron (<1.0 mgL^{-1}). In relation to boron toxicity, water quality rating with respect to B is as <1.0, 1.0-2.0, 2.0-4.0 and >4.0 mgL^{-1} for low, medium, high and very high hazard group.Khandelwal and Lal[5] worked on effect of sodicity and Boron of irrigation water on the soil properties and yield of wheat. They found that boron content in soil increased with an increase in EC and SAR. The results showed that there was no toxicity of NO_3^- in underground water samples.

6 Conclusion -The study was undertaken to assess the Toxic ions in underground water sample of Sriganganagar and Hanumangarh district of Rajasthan. The high concentration of Fluoride observed in irrigation water. Boron toxicity was also found in some water sample more than permissible limit.There was no toxicity of nitrate in underground water sample. Toxic ions also disturb the physico -chemical property of irrigated soils and ultimately reduce the crop yields

7 Bibliography

1. APHA (2005) –standered methods for the examinations of water and waste water (21th ed.) Washington DC: American Public Health Association.
2. WHO (1993)- Guidelines for drinking water quality I. Geneva WHO :Recommendations second edition.
3. Eaton, F.M.(1950) significance of carbonates in irrigation waters soil science 69:123.133.
4. Wileox, I.V. (1955) Classification and use to irrigation waters. P.S. Deptt. Agric. Circular No. 969. Washington D.C. pp 19
5. Khandelwal, R. B. and Lal, P. (1991) Effect of salinity , sodicity and Boron of irrigation water on the properties of soils and yield of wheat. Journal of the Indian Society of Soil Science. 38 :358
6. Yadav , R. C. and Verma ,B. L. (2002), Status of nitrate and Fluoride in underground irrigation water of Jayal Tehsil (Nagaur) and their effect on wheat crop. M. Sc. Thesis. Rajasthan Agricultural University, Bikaner.
7. Hatchar, J. T. and Wilcox, I. V. (1950), Colorimetric determination of boron ,using carmine Analyt.Chem. 22:567-569.
8. AWWA. (2012), Standard methods for examination of water and waste water . 22nd ed. Washington , American Public Health Association . 1360_{pp}