

Study of Physico-chemical parameters of Underground Water used for Irrigation in IGNP command Area of Hanumangarh district of Rajasthan

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Abstract: The Physico-chemical parameters changed the quality of Underground water used for irrigation in IGNP command Area of Hanumangarh district of Rajasthan. The pH, EC, Total Hardness, Mg^{2+} , Ca^{2+} , Na^+ , K^+ , Cl^- , F^- , SO_4^{2-} and SAR are the main components of Underground water used for irrigation. A systematic calculation has been carried out between different analyzed parameter. Most of the soils as well as water samples show the alkaline & saline in nature and residual sodium carbonate range of the soil sample also marginal to high alkalinity in nature.

Keywords: IGNP (Indra Gandhi Nahar Project), EC (Electrical conductivity), SAR (Sodium Absorption Ratio) etc.

Introduction – Relative water supply (RWS) indices of Indira Gandhi Nahar reduced to less than one which indicates that supply of canal water is less than crop demand of the area, Rainfall is also poor and erratic. Most of the time crops suffer for want of water at critical stages of growth resulted in poor yield and thus agriculture become uneconomical. Due to unavailability of sufficient canal water for irrigation farmers are forced to develop their own irrigation system by digging of tubewell and started irrigating the crop without considering the quality of ground water whether it is suitable or not for irrigation. Continuous usage full or partly, of such poor quality waters deteriorates the physical and chemical properties of soils and ultimately the crop productivity. Therefore, the groundwater quality is as important as its quantity. The soils of Rajasthan have problems of salinization and alkalization which are adversely affecting the productivity of around one million hectares land in the state.

Material and Methods

3.1 Study area - Rajasthan is the largest state of the Indian union with a geographical area of 34.3 million hectare. The study area in Hanumangarh district of Rajasthan, located between 28.4° and 30.3° north latitude and 72.3° to 75.3° east longitude at an altitude of 175.6 meters above mean sea level. 15 water sample from different sites of IGNP canal were collected. The sample were collected in high grade plastic bottles of 2.0 & 2.5 liter capacity after rinsing with distilled water.

3.2 Analysis methods - The analysis of ground water were carried by instrumental and volumetric method. P^H and EC measured by digital P^H meter and conductivity meter. The quantitative analysis of Na^+ , K^+ made through Flame photometer and Ca^{+2} , Mg^{+2} , F^- , SO_4^{2-} and NO_3^- done by volumetric methods. Richard (1954)

1. Result and Observations

S.No	Village	Water Sample code no.	pH	EC (dSm ⁻¹)	Ionic Composition (meqL ⁻¹)						
					Ca ²⁺ +Mg ²⁺	Na ⁺	K ⁺	CO ₃ ²⁻	HCO ₃ ⁻	Cl ⁻	SO ₄ ²⁻
1	5 NDR	Pw ₁	9.21	3.36	3.30	30.70	0.03	2.10	6.60	21.60	3.73
2	20 LLW	Pw ₂	8.34	3.45	2.50	31.90	0.11	2.40	6.90	18.60	6.61
3	45 SSW	Pw ₃	9.11	3.52	2.40	33.40	0.09	1.40	10.20	20.80	3.09
4	6 CSR	Pw ₄	9.15	3.26	2.00	20.40	0.02	1.40	4.70	16.00	1.02
5	2 KNG	Pw ₅	9.10	3.30	4.20	28.60	0.02	4.00	10.60	15.00	2.84
6	11 NMK	Pw ₆	9.05	3.72	4.50	33.30	0.04	1.80	11.20	22.80	2.04
7	4 NG R	Pw ₇	7.98	3.22	3.30	30.70	0.03	2.10	6.60	21.60	3.73
8	2 SD	Pw ₈	8.93	2.30	3.40	19.70	0.04	2.20	7.30	12.40	1.24
9	31 NDR	Pw ₉	8.03	4.92	4.30	20.10	0.06	0.50	4.00	21.00	2.06
10	16 MOD.	Pw ₁₀	8.14	2.51	7.30	18.00	0.07	0.80	4.20	19.90	1.57
11	23 HMH	Pw ₁₁	8.87	5.21	11.40	41.00	0.07	1.30	11.80	38.00	1.37
12	11 NTR	Pw ₁₂	8.98	4.69	7.50	40.10	0.09	1.00	8.00	36.20	2.49
13	46 SSW	Pw ₁₃	8.96	2.26	3.40	19.60	0.06	3.20	4.30	14.60	0.96
14	7 SNM	Pw ₁₄	8.98	6.50	7.10	58.40	0.07	1.80	7.60	53.20	0.97
15	25 LLW	Pw ₁₅	8.66	2.85	7.00	19.70	0.14	0.40	2.60	22.00	2.84
16	16 Brani	Pw ₁₆	8.72	4.02	4.40	36.30	0.07	0.80	6.00	28.40	5.57
17	15 LLW	Pw ₁₇	7.78	4.97	5.00	45.40	0.18	0.20	0.90	47.60	1.88
18	21 HMH	Pw ₁₈	9.08	6.56	7.30	54.80	0.22	1.90	7.20	51.40	1.82
19	50 NGE	Pw ₁₉	8.50	3.15	4.20	28.60	0.04	4.00	10.60	16.00	2.84
20	11 KRW	Pw ₂₀	8.42	4.00	5.80	34.50	0.15	0.50	4.20	28.50	7.25

Table 4.1 Chemical characteristics of underground water used for irrigation in IGNP command area.

(WHO , BIS Standard used for irrigation water)

2. Discussion-The water samples of the study area were analysed for EC, pH, ionic composition i.e. cations (Calcium, Magnesium, Sodium and Potassium) and anions (Carbonate, Bicarbonate, Chloride and Sulphate). The data related to the chemical analysis of the irrigation water are presented in table 4.1 and discussed below:

5.1- pH- A perusal of the data in table 4.1 revealed that the pH of irrigation Water of sampling sites of Hanumangarh district varied from 7.78, to 9.21 with an average value of 8.72 water sample Pw₁₇ had minimum pH (7.78) and maximum pH (9.21) was recorded in Pw₁. Verma *et.al.*, (2003).

5.2- Electrical conductivity (EC)- The Electrical Conductivity of the irrigation water of study area varied between 2.26 to 6.56 dSm⁻¹. The lowest value of EC (2.26 dSm⁻¹) was observed in Pw₁₃ and highest value of EC (6.56) was recorded for Pw₁₃ These results are supported by the findings of Deo and Lal (1982), Verma *et.al.*, (2003).

5.3- Soluble cations and anions- The data presented in table 4.1 revealed that the soluble cations like Ca²⁺ + Mg²⁺ Na⁺, K⁺ of irrigation water of the Hanumangarh district ranged between 2.0 to 11.4, 18 to 58.4 and 0.2 to 0.22 meqL⁻¹, respectively. The lowest value of Ca²⁺ + Mg²⁺ were recorded in Pw₄ irrigation water. Whereas, lowest content of Sodium was found in Pw₁₀ Similarly, lowest value of Potassium was obtained in Pw₄. The highest values of Ca²⁺ + Mg²⁺ were recorded in Pw₁₁ and Potassium in Pw₁₈, respectively. In general, sodium was found as dominant cation in the irrigation water followed by Ca²⁺ + Mg²⁺ and K⁺. The results of the present investigation are in accordance with the findings of Singh *et. al.*, (1995) .Sood *et.al.*, (2003) and Balkrishana (2003). It is evident from the data given in table 4.1 that in irrigation water of study area, soluble anions like: CO₃²⁻ 0.20-4.0 meqL⁻¹, HCO₃⁻ .90-11.80 meqL⁻¹, Cl⁻ 14.6-51.4 meqL⁻¹ and SO₄²⁻ 0.96 -7.25 meqL⁻¹, respectively. Maximum content of CO₃²⁻ was present in Pw₁₉. Similarly, Maximum value of HCO₃⁻ was observed in Pw₁₁. The maximum values of Cl⁻ and SO₄²⁻ ions were found in Pw₁₈ and Pw₂₀ respectively. The minimum CO₃²⁻ was recorded in Pw₁₇. However, minimum HCO₃⁻ content was found in Pw₁₇. The minimum Cl⁻ was found in Pw₁₃, whereas, minimum SO₄²⁻ in Pw₁₃. Similar results were also reported by Singh *et. al.*, (1998) and sood *et. al.*, (1998).

Conclusion- The water sample collected from these areas show the pH range from 7.78 to 9.21, Electrical conductivity range from 2.26 to 6.56 dSm⁻¹. Most of the soils as well as water samples show the alkaline & saline in nature and residual sodium carbonate range of the soil sample also marginal to high alkalinity in nature.

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