Research Article

Study of ground water quality of Sangamner Tahasil in Ahmednagar district, Maharashtra, India

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Abstract

Introduction: Water samples were collected from 25 sampling sites during pre monsoon season in Sangamner tahasil, Ahmednagar district. Different physicochemical parameters were measured and the samples were also analysed. The surface water physicochemical parameters included pH, temperature, total alkalinity, total dissolved solids, electrical conductance (EC) bicarbonate, calcium, magnesium, chloride etc. . The ranges for the physicochemical parameters were 28-32 degrees for temp, 8.10 to 8.35 for pH 0.62 to 3.67 dSm-1 for EC, 442 to 2350.4 mgl -1 for TDS , 4.30 to 11.52 for bicarbonate, 7.00 to11.45 for Ca , 3.30 to 12.38 for Mg 9.32 to 35.0 mgl -1for Cl. Based on multivariate analysis and correlation analysis.

Keywords*:* physico chemical study water parameter, ground water, correlation analysis, Sangamner tahasil.

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INTRODUCTION

Hydrochemistry is an important aspect of ground water in order to know its use for domestic irrigation and Industrial purpose .Analysis of water and its interpretation and assessment will determine the various uses of ground water Soil and water are important abiotic factor of environment. Water is the most vital resource for all kinds of life on the planet, adversely affected both qualitatively and quantitatively by human activities on land, in air or in water. The increasing industrialization, urbanization and developmental activities and consequent pollution of water is of major concern. Today most of the rivers of world receive millions of litrs of sewage, industrial and agricultural leachates containing substances varying in characteristics from simple nutrients to highly toxic / hazardous substances. The fate of ground waters is also same in most of the areas. The cities and industries continue to be the most significant causes of pollution of aquatic ecosystems due to a diverse kind of wastes produced (Trivedy and Goel, 1984). The quality of water play an important role concern to humanbeing .It is directly related to health of humanbeing. Increasing in growth of population of human is directly related industrialization there is also increasing urbanization .These all things impact on natural resources like water, Soil etc.Therefore quality of ground water is an important as a quantity. In agricultural field use of chemical fertilizer, pesticide AND insecticide use to enhance the crop yield it also increase the pollution of ground water. Water plays an important role in agriculture. A quality of water has the impact on soil, crops and productivity. The suitability of irrigation water depends upon many factors including the quality of water, soil type, salt tolerance characteristics of the plants, climate and drainage characteristics of the soil. Ground water always contains certain amount of soluble salts. The kind and quality of these salts depend upon the sources for recharge of the ground water and the strata through which it flows. The excess quantity of soluble salts may be harmful for many crops; hence a better understanding of the chemistry of

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ground water is essential. Therefore, water samples were analysed of for physico-chemical parameters *viz* hardness, amount of various ions in water, pH, chloride, carbonate, bicarbonate, sodium, calcium, magnesium.

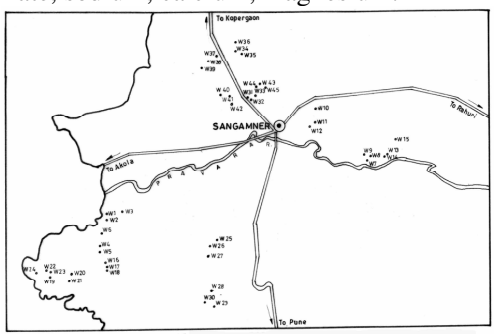

Figure 1: Location of water sampling station in the study area

MATERIAL AND METHODS

The study area

Sangamner area is located in the northern part of the Ahmednagar district of Maharashtra State. The Sangamner tahsil lies between 18^0 36' N and $19^0 1'$ N latitude and between 74^0 1' W and 74^0 56' W longitude. The Sangamner town is located on the confluence streams of Pravara and the Mhalungi Rivers, which is at a distance of 150 km from Pune, on Pune-Nasik National Highway No. NH-50. The area is drained by the Pravara river, which originates in the hilly region of Western Ghats at Ratangarh. Geologically, basalts underlay the Pravara basin.

Climate

In general the climate is dry and hot the average maximum temperature during summer is as high as 42^0C in month of May and average minimum temperature falls up to 10^0 C during the month of December. The area receives rainfall, chiefly from the south waste monsoon between June and September as the area falls under the rain shadow zone of Western Ghat and receives very low precipitation, annual rainfall ranging from 290 to 594 mm. A co-operative sugar factory known as the Sangamner Bhag Sahakari Sakhar Karkhana (SBSSK) Ltd, was established in the year 1967 at Amruitnagar, The unit is having a capacity of 3500 tons per day of crushed sugarcane. The production is white crystal sugar, molasses and bagasse. The consumption of water is 1200 CMD. The total effluent generated during the processing from sugar unit is 400 CMD; which is being treated using primary and secondary treatment methods. The treated effluent from sugar industry is stored in lagoons and then flows in natural stream of about 8 to 9 km. Due to such treatment and disposal methods the effluent infiltrates through the soil, leading to contamination of water nearby dug wells affecting natural ground water quality.

Sampling

Twenty five sampling site (Table 1) in Sangamner tahasil were identified for analysis during pre monsoon season (2010) Water samples from the dug-wells were collected after pumping the water for half an hour. The tube well irrigation water collected after 15 minutes discharge in plastic bottles. Each sample was labeled properly. The pH and EC were measured immediately by using portable kits to avoid changes in pH and EC.

Physico chemical analysis

The samples were analyzed 15 parameter. Physical parameter like The chemical analysis of the water samples was carried out to determine pH, electrical conductivity, calcium (Ca^{2+}), magnesium (Mg^{2+}), carbonate (CO_3^{-} $^{-}$), bicarbonate (HCO_3^{-}), sodium (Na^{+}); potassium (K^{+}), sulphate (SO_4^{2-}) and chloride (Cl^{-}). The standard methods APHA *et al* (1995) were adopted for analysis of water. The following formulas were employed for calculating the sodium absorption ratio (SAR), Kelly's ratio (KR) soluble sodium percentage and permeability index. WHO (1979) standards were used for comparison. The parameter and their techniques analysis are listed in Table 2.

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RESULTS AND DISCUSSION

The result obtained using techniques documented above are in Table 3. The chemical analysis of water from lift irrigation area showed the alkaline pH of irrigation water (8.14) The variation in pH of irrigation water were associated with source, quality and quantity of irrigation water used, types and quantity of fertilizer added and cropping pattern followed .The electrical conductivity of irrigation water from lift irrigation area were low and within safe limit (1.75 dSm-1) The total dissolved solids are more in irrigation area (1127.1 mgl-1) .The higher dissolved solid was due to excess use of irrigation water in irrigation area. The carbonates were absent in the irrigation water from all the areas of experimentation. The calcium, magnesium, sodium, potassium, chlorides and sodium absorption ratio of irrigation water from area were within safe limit. Residual sodium carbonate content of irrigation water from lift irrigation area area showed negative values. The negative values of RSC indicated that the need of drainage for the soil where such type of irrigation water is practiced as source of irrigation to avoid the further degradation of soil. The Kelly's ratios are higher (1.65) The soluble sodium percentages (57.99) It indicates such type of water was unsuitable for agriculture use Permeability index of all regions are within suitable class.

Correlation studies

The correlation coefficient between pH, electrical conductivity, total dissolved salts, bicarbonate, calcium,

magnesium, sodium, potassium and chlorides of irrigation water from irrigation are reported in Table 4

CONCLUSION

The quality of ground water samples collected analysed and studied. The ground waters from Sangamner area to evaluate the impact of irrigation which shows that intensive irrigation has effect on quality of water .The irrigation water during 2010 from irrigation areas was alkaline in reaction, low in electrical conductivity, calcium, magnesium and bicarbonates. Correlations between chlorides and electrical conductivity were significantly positive and negative in chlorides with bicarbonate in irrigation water of irrigation

Table 1: Sampling sites

SR. No	Sampling Station
W1	Sangavi
W2	Sangavi
W3	Sangavi
W4	Sangavi
W5	Sangavi
W6	Nimgaon paga B.K.
W7	Nimgaon paga B.K.
W8	Nimgaon paga B.K.
W9	Nimgaon paga B.K.
W10	Nimgaon paga B.K.
W11	Jorve
W12	Jorve
W13	Jorve
W14	Jorve
W15	Jorve
W16	Kolhewadi
W17	Kolhewadi
W18	Kolhewadi
W19	Kolhewadi
W20	Kolhewadi
W21	Rahimpur
W22	Rahimpur
W23	Rahimpur
W24	Rahimpur
W25	Rahimpur

Table 2: List of techniques for the analysis of required parameter

Sr. No	Parameter	Technique
1	Ph	pH meter
2	Temp	Thermometer
3	EC	Conductometry
4	Calcium	Versenate titration
5	Magnesium	Versenate titration
6	Carbonates	Volumetry
7	Bicarbonates	Volumetry
8	Sulphates	Turbidimetry
9	Chlorides	Volumetry

Table 3: Physico chemical parameters of collected water sample Characterization of water in lift irrigation area, during summer 2010

Site Site Paramter	pH	EC dSm^{-1}	TDS mgl^{-1}	CO_3 mel^{-1}	HCO^-_3 mel^{-1}	Ca^{++} mel^{-1}	Mg^{++} mel^{-1}	Na^+ mel^{-1}	K^+ mel^{-1}	Cl^- mel^{-1}	SAR	RSC	KR	SSP	PI
S1	7.79	0.67	420	-	11.4	7.63	12.3	9.90	0.22	13.6	2.67	-8.5	0.50	33.1	44.5
S2	7.85	0.66	413	-	11.2	7.65	12.3	9.85	0.25	13.7	2.65	-8.8	0.49	32.9	44.2
S3	7.84	0.65	418	-	11.1	7.61	12.3	9.81	0.20	14.0	2.64	-8.84	0.49	32.9	44.1
S4	7.83	0.67	417	-	11.3	7.59	12.3	9.87	0.24	13.8	2.66	-8.67	0.49	33.0	44.3
S5	7.80	0.62	412	-	11.0	7.65	12.3	9.82	0.24	13.8	2.64	-8.96	0.49	32.9	44.1
S6	8.20	0.64	447.	-	8.35	8.34	3.30	12.2	0.32	9.40	3.87	-3.29	1.05	51.2	63.3
S7	8.28	0.69	446.6	-	8.39	8.37	3.35	12.1	0.35	9.35	3.83	-3.33	1.04	50.9	63.0
S8	8.31	0.72	442.0	-	8.33	8.35	3.31	12.2	0.30	9.32	3.86	-3.33	1.05	51.1	63.2
S9	8.26	0.68	440.10	-	8.38	8.40	3.33	12.1	0.31	9.37	3.84	-3.35	1.04	50.9	63.0
S10	8.29	0.70	443.00	-	8.36	8.33	3.31	12.1	0.36	9.35	3.85	-3.28	1.05	51.1	63.2
S11	8.15	2.93	1881	-	4.74	7.10	7.40	39.2	0.09	18.9	11.9	-9.76	2.71	73.0	77.0
S12	8.18	2.96	1885	-	4.80	7.08	7.43	39.2	0.10	19.0	11.9	-9.71	2.70	72.9	77.0
S13	8.21	2.94	1887	-	4.75	7.11	7.45	39.5	0.10	18.2	11.8	-9.81	2.69	72.8	76.9
S14	8.20	2.93	1880	-	4.74	7.00	7.46	39.1	0.09	18.2	11.9	-9.72	2.71	73.0	77.0
S15	8.13	2.91	1882	-	4.82	7.02	7.45	39.1	0.12	18.4	11.9	-9.65	2.71	73.0	77.1
S16	8.10	3.67	2347.2	-	4.35	9.43	7.90	39.9	0.20	35.0	10.9	-12.9	2.30	69.7	73.3
S17	8.12	3.66	2349	-	4.37	9.45	7.95	39.8	0.16	35.5	10.8	-13.0	2.29	69.6	73.2
S18	8.19	3.65	2350	-	4.30	9.42	7.92	39.8	0.17	35.5	10.9	-13.0	2.30	69.6	73.3
S19	8.15	3.66	2350.4	-	4.32	9.43	7.93	39.8	0.20	35.0	10.8	-13.0	2.29	69.6	73.2
S20	8.20	3.64	2347.2	-	4.31	9.42	7.95	39.8	0.17	35.3	10.9	-13.0	2.30	69.6	73.2
S21	8.33	0.80	540	-	11.5	11.4	4.54	27.4	0.45	14.7	9.71	-4.44	1.72	63.2	71.0
S22	8.35	0.89	550	-	11.4	11.4	4.56	27.4	0.40	14.6	7.41	-4.54	1.71	63.1	70.9
S23	8.30	0.82	543	-	11.5	11.4	4.50	27.5	0.42	15.0	7.44	-4.41	1.73	63.3	71.1
S24	8.32	0.87	542	-	11.4	11.4	4.52	27.4	0.42	14.7	7.40	-4.55	1.72	63.1	70.9
S25	8.29	0.83	545	-	11.4	11.4	4.54	27.4	0.40	14.5	7.41	-4.54	1.72	63.1	70.9
Mean	8.14	**1.75**	**1127.1**	-	**8.02**	**8.78**	**7.21**	**25.7**	**0.25**	**18.3**	**7.43**	**-7.8**	**1.65**	**57.9**	**65.7**

Table 4: Correlation coefficient between pH, electrical conductivity, total dissolved solids, bicarbonate, calcium, magnesium, sodium, potassium and chloride of irrigation water in lift irrigation area

Variable	EC dSm^{-1}	TDS mgl^{-1}	HCO^{-}_3 mel^{-1}	Ca^{++} mel^{-l}	Mg^{++} mel^{-l}	Na^{+} mel^{-l}	K^{+} mel^{-l}	Cl^{-} mel^{-1}
pH	-0.239	-0.239	-0.132	+0.210	-0.488	+0.210	+0.283	-0.021
EC dSm^{-1}	-	+1.00	-0.460	-0.249	+0.133	+0.493	-0.265	+0.669**
TDS mgl^{-1}	-	-	-0.460	-0.250	+0.132	+0.493	-0.265	+0.669**
HCO^{-}_3 mel^{-1}	-	-	-	+0.323	+0.067	-0.721**	+0.244	- 0.602*
Ca^{++} mel^{-l}	-	-	-	-	-0.457	+0.139	+0.223	+0.028
Mg^{++} mel^{-l}	-	-	-	-	-	-0.125	-0.239	+0.280
Na^{+} mel^{-l}	-	-	-	-	-	-	-0.203	+0.696**
K^{+} mel^{-l}	-	-	-	-	-	-	-	-0.314

*Significant at 5% level ** Significant at 1% level.

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