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### Salinity of ground water in some semi-arid tracts in North Gujarat during year 2003-2004

Patel K. C.<sup>1</sup>, Vyas K. B.<sup>2</sup>, Nimavat K. S.<sup>2</sup>, M. V. Hathi<sup>1\*</sup>

<sup>1</sup>Department of Chemistry, R. R. Mehta College of Science and C. L. Parikh College of Commerce, Palanpur, Gujarat.

<sup>2</sup>Government Science College, Gandhinagar, Gujarat.

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#### Abstract

The northern part of Gujarat state may be classified as a semi-arid region. About fifty samples of ground water were collected from different tracts in these regions during pre-monsoon 2003, post-monsoon 2003 and pre-monsoon 2004 and tested for their EC and PH values. These water samples were further tested for cations and anions. The data obtained were used for classification of water into different categories on the basis of EC (Electrical Conductivity). In general it was found that there was no area having EC within, 250 micro mhos/cm in ground water during year 2003-04. Thus, the water quality has improved during pre-monsoon 2004, as compared to pre-monsoon 2003 due to the recharging of ground water by high rainfall in year 2003.

**Key words:** Water Analysis, Salinity, Electrical Conductivity.

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#### Introduction

Water is a universal solvent[1] and it dissolves the minerals from the rock in which, it is stored and thus, chemical and physical parameters of a particular area will be changed. Till some time ago, the quality of ground water was considered to be relatively very good in comparison to surface water. Handa[2] has carried out ground water contamination studies in various parts of the country. Study on ground water quality with respect to drinking, irrigation, and industrial purposes have been carried out in different part of India [3-7]

Under ground water in North Gujarat have diversity of quality problems. Ground water which is always in motion interacts with the subsurface environment during this movement. It dissolves transports and deposits mineral matter. The health and economic prosperity of community rest on the supply of clean water to individual. In our Nation, it is estimated that

about 75 million work days are lost every year due to water related diseases. The quality of ground water varies from place to place.

In the arid and semi-arid region, majority of ground water are of poor quality. i.e. either saline or alkali. Soil degradation through salination has seriously affected the productivity of over 1.214 Mha of land in Gujarat state out of which 55 percent of the area comes under moderately to highly saline which is unsuitable for cultivation of the crops. The remaining 45 percent area has low to moderately salinating problems. The problems related with water quality are more servers in North Gujarat.

Quality of irrigation water is one of the main factors to be understood in irrigated agriculture. Injudicious irrigations even with good quality water turn many agriculturally good soil in to saline or alkali condition. Quality of water is an important consideration in any appraisal of salinity or alkali conditions in an irrigated area. Generally all irrigation water that have been used for successfully for a long period have a conductivity value less than 2250 micro mhos/cm. Water of higher conductivity may be used with suitable amendments and precautions, but under normal conditions they are harmful to the soil structure and their continuous use will result in salinity hazard, with ultimate effect on plant growth. Salinity hazards affect the plant through the effects of excessive salts and osmotic pressure of soil solution which restricts the water and nutrient absorption. The first effect of salinity under field situation is the reduction in germination. The salt concentration are measure in terms of micro mhos/cm (or  $\text{dsm}^{-1}$ ), mg /L (ppm) and meq/L.

## **Materials and Methods**

### ***Experimental***

The northern part of Gujarat state may be classified as a semi arid region. The mean annual temperature of the area is 26.0°C. The maximum temperature in May being 31.1°C. The average annual rainfall of the area is 25-30" there being fairly wide variations from year to year. There is no any permanent river in this region. The ground water is also very deep.

The area under study lies between Sabrakantha and Banaskantha district of North Gujarat. The area is a semi arid region. The major water resources of the area are wells and tube-wells. During the year 2003-2004, about 42 ground water samples were collected during pre-monsoon 2003, 48 samples during post monsoon 2003, and about fifty (50) samples during pre monsoon 2004. The samples collected from the wells were analysed for major ion chemistry, employing the standard water quality procedures APHA[8]. pH and electric conductance were measured using pH and EC meter. Total dissolved solids were computed by multiplying the EC by conversion factor 0.65 as suggested by Hem[9]. Total hardness as  $\text{CaCO}_3$  was measured by using standard EDTA solution. Mg was calculated taking the difference of TH and ca. Chloride was determined volumetric method using standard  $\text{AgNO}_3$  solution. Sulphate was estimated through turbidimetric method. Table-II presents the results of some typical ground water samples. The data obtained were used for classification of water into different categories on the basis of electrical conductivity(EC).

**Table-1 : Chemical properties of ground water in some semi-arid tracts of North Gujarat during year 2003-04.**

Sr No.	EC. dsm-1 at 25°C	pH	TDS (ppm)	mg / L.							
				Ca <sup>+2</sup>	Mg <sup>+2</sup>	Na <sup>+1</sup>	K <sup>+1</sup>	CO <sub>3</sub> <sup>-2</sup>	HCO <sub>3</sub> <sup>-1</sup>	Cl <sup>-1</sup>	SO <sub>4</sub> <sup>-2</sup>
1	2.32	9.01	1150	0.6	3.5	24.6	0.05	1.8	8.8	9.4	8.6
2	0.84	8.3	440	1.4	3.4	5.4	0.01	0.8	5.7	2.4	1.5
3	1.70	8.23	930	1.0	2.4	19.6	0.02	1.6	10.1	5.6	5.1
4	1.75	8.92	940	0.8	0.7	19.5	0.03	2.2	8.1	6.4	4.7
5	2.58	8.3	1310	1.5	5.1	20.5	0.02	1.5	6.0	13.5	6.1
6	2.60	8.5	1320	1.2	5.6	19.4	0.06	0.8	7.2	13.2	5.8
7	5.01	8.3	2530	1.3	21.0	28.2	0.15	1.8	8.8	26.4	14.0
8	5.49	8.0	2800	6.5	8.5	32.5	0.05	0.6	4.5	38.2	4.8
9	3.36	8.4	1700	4.2	4.8	23.2	0.15	0.8	3.8	20.0	7.6
10	4.38	8.6	2220	1.0	6.5	29.2	0.28	2.8	10.3	23.6	0.5

Table -2 to Table -4 gives an information about the distribution of samples under various ranges of salinity in the ground water during the pre-monsoon 2003, post monsoon 2003 and pre- monsoon 2004[10-13].

**Table-2 : Distribution of ground water samples , under various ranges of salinity. During the Pre-monsoon 2003**

Sr. No.	Electrical Conductivity In m mhos/cm.	Pre-monsoon 2003	
		No of samples	% of samples
1	0-250	Nil	Nil
2	250-750	01	2.38
3	750-2250	20	47.61
4	2250-5000	17	40.47
5	>5000	04	9.52

**Table -3 : Distribution of ground water samples, under various ranges of salinity. During the post-monsoon 2003.**

Sr. No.	Electrical conductivity in m mhos/cm	Post-monsoon 2003	
		No. of samples	% of samples
1	0-250	Nil	Nil
2	250-750	01	2.08
3	750-2250	28	58.33
4	2250-5000	16	33.28
5	> 5000	03	6.24

**Table 4: Distribution of ground water samples, under various ranges of salinity. During the Pre-monsoon 2004.**

Sr.No	Electrical conductivity in m mhos/cm	Post-monsoon 2004	
		No of samples	% of samples
1	0-250	Nil	Nil
2	250-750	01	2.0
3	750-2250	26	52.0
4	2250-5000	19	38.0
5	> 5000	04	8.0

## Results and Discussion

The quality of water is influenced by the nature of rock minerals through which it passes. It may undergo changes due to ion exchange, dissolution of salts, and hydrolysis of materials of the rocks, as well as the surface soils. The total concentration of soluble salts as measured by electrical conductivity. The categories of water on the basis of their electrical conductivity are as follows: (Table-5)

**Table-5 : Classification of water**

Sr. No.	EC Value micro mhos/cm at 25°C	Category
1	< 250	Excellent
2	250-750	Good
3	750-2250	Permissible
4	2250-5000	Doubtful
5	> 5000	Unsafe

It can be seen from the above tables that there was no sample having EC within 250 micro mhos/cm in ground water during year 2003-2004. During pre-monsoon 2003, 2.38 percent water samples had EC values between 250 to 750 micro mhos/cm which was slightly decreased to 2.08 percent during post monsoon 2003 and it was again slightly decreased to 2.0 percent during pre-monsoon 2004. There was 47.61 percent samples having EC. Between 750 to 2250 micro mhos/cm during pre monsoon 2003 it was increased to 58.33 percent during post-monsoon 2003 and it was again decreased to 52.0 percent during pre monsoon 2004. There was 47.61 percent samples having EC. Between 2250-5000 micro mhos/cm during pre monsoon 2003. It was decreased to 33.28 percent during post monsoon 2003. and it was increased to 38.0 percent during pre monsoon 2004. There was 9.52 percent water samples having EC more than 5000 micro mhos/cm during pre monsoon 2003. it was decreased to 6.24 percent during post monsoon 2003 and again it was increased to 8.0 percent during pre monsoon 2004.

## Conclusion

The water quality has improved during pre monsoon 2004, as compared to pre monsoon 2003 in North Gujarat due to the recharging of ground water by high rainfall in year 2003.

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