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Der Pharma Chemica, 2009, 1(2): 292-295
(http://derpharmachemica.com/archive.html)

ISSN 0975-413X

Chemical properties of ground water in Gadhawada region

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Abstract

Irrigation of Crops is an essential input for attaining high yields, but the quality of the irrigation water is also equally critical for long term achievable production goals. Poor quality water, if used for a long time will make the soil less productive or even barren depending on the amount and type texture of soil. Low or marginally saline waters sometimes appear to stimulate crop growth because of the nutrient ions present. However, the excess of soluble salts in water lauds to their accumulation in the surface particularly in heavy textured or in poorly drained soils.

Many areas of country are facing a serious problem of not only scarcity of water but also of critical poor quality of irrigation water. Tube-well and on well waters generally pose such problems more than surface water.

Introduction

Ground water is water that occupies the pores or crevices in sand, sand stone, limestone and other rocks[1]. The crucial role which ground water plays as decentralized sources of drinking water for millions of rural and urban families can not be overstated. According it some estimates, it accounts for nearly 80 percentages of the rural domestic water needs and 50 percentages of the urban water needs in India[2].

As the assessment of ground water quality has not been given due importance, water borne disease have become very common. About 80 percentage of the disease in the world are due to poor quality of drinking water[3].

Once the groundwater is contaminated, its quality cannot be restored by stooping the pollution from the source. It therefore becomes imperative to regularly monitor the quality of groundwater and to device ways and means to protect it. Water quality index is one of the most effective tools[4-7]to communicate information on the quality of water to the concerned citizens and police makers.

Electrical conductivity of water is a direct function of its total dissolve salts[8]. Hence it is an index to represent the total concentration of soluble salts in water[9]. The permissible total dissolved salts for drinking water is 500mg/L. In the absence of potable water source the permissible limit is upto 2000 mg/L. High values of TDS in groundwater are generally not harmful to human beings but high concentration of these effect persons, who are suffering from kidney and heart disease[10]. Water containing high solids may cause laxative or constipation effects[11].

Our nation is an agro based country. Agriculture is very essential for economical develop ment of the Nation. Quality of irrigation water is directly related to crop production so farmers must have knowledge of quality of irrigation water which they use for irrigation purpose and must to know its effects on soil and crop growth.

Quality of irrigation water is one of the main factors to be understood in irrigation agriculture. All the water (well/tube well water) used for irrigation purpose always contain soluble salts irrespective of their source, but total concentration and the kind of salts present in any irrigation water are important in deciding whether the water will be suitable for irrigation or not.

The investigation in ground water resources in any region in primarily concerned with its utility for irrigation. The quality of water is influenced by nature the rock. Minerals through which it passes, it may undergo changes due to ion exchange, dissolution of salts and hydrolysis of the material of the rocks as well as surface soils. The ground water resources are generally classified on the basis of total dissolved salts. (TDS) as measured by electrical conductivity (EC), as well as the ratio to total cations, ratio of chloride to bi-carbonate and the excess of bi-carbonate over calcium plus magnesium.

All irrigation waters that have been used successfully for a long period have a conductivity value less than 2250 micro mohs. per centimeter. High TDS ground water may be used for irrigation purpose, with suitable condition and precautions, but under normal conditions they are harmful to be soil structure and their continuous use will result in salinity hazard, with ultimate effect on plant growth.

Usually the surface water are relatively free from electrolytes but the ground water (well or tube well water) applied for irrigation, create some problems of either salinity and/or alkalinity in the soil due to use to dissolved salts.

Salinity hazard which is associated with high soluble salts in water and measured in terms of Electrical conductivity (EC). The Alkali hazard is related to the development of alkalinity in the soil and is expressed as SAR(Sodium adsorption ratio). Residual sodium carbonate (RSC) is an indirect expression of CO_3^{-2} and HCO_3^{-1} of sodium in ground water. Various workers have suggested the criteria of irrigation waters on the basis of analysis made (Richards 1954, Paliwal and Yadav 1976, Agers and Westcott 1976). Some important acceptable ratings are given below.

Parameter	Permissible	Moderately Safe	Moderately Unsafe	Unsafe
RSC(Meq/L)	<1.25	---	1.25 to 2.50	> 2.50
SAR	<10	10 to 18	18 to 26	> 26
EC.mmoh/cm	0.0- 0.75	0.25 --- 0.75	0.75 – 2.25	>2.25

Materials and Methods

The area under study lies between Sabarkantha and Banaskantha (North Part of Mehsana district) the area is a semi arid region. The major water resources of the area are wells and tube wells.

Table II : Chemical properties of the Ground water of Gadhwada Region

Sr. no.	Sample No.	Milli equivalents perliter					
		$Ca^{+2} + Mg^{+2}$	Na^{+}	K^{+}	CO_3^{-2}	HCO_3^{-1}	Cl^{-1}
1	2	6.5	2.698	0.048	1.6	5.4	3.0
2	5	3.8	1.520	0.005	0.4	3.8	1.8
3	7	2.8	4.080	0.015	1.2	6.8	1.8
4	9	4.3	0.958	0.038	0.8	3.8	1.2
5	12	9.2	1.475	0.030	0.8	4.6	3.6
6	15	4.0	0.870	0.005	0.8	3.8	1.0
7	16	4.2	0.956	0.028	0.8	3.8	1.4
8	18	2.4	13.485	0.028	1.6	9.8	4.6
9	19	3.9	1.045	0.008	0.6	4.0	1.2
10	20	7.3	1.125	0.025	0.8	4.8	2.4

Table III : Chemical properties of the Ground water of Gadhwada Region

Sr. no.	Sample No.	SAR Sodium Ad. Ratio	RSC Residual Sodium Carbonate	Categories.
1	2	1.49	0.5	Safe
2	5	1.10	0.4	Safe
3	7	3.44	5.2	Un Safe
4	9	0.65	0.3	Safe
5	12	0.68	-3.8	Safe
6	15	0.62	0.6	Safe
7	16	0.66	0.4	Safe
8	18	12.31	9.0	Un Safe
9	19	0.75	0.7	Safe
10	20	0.57	-1.7	Safe

Table I : Chemical properties of the Ground water of Gadhwada region

Sr. No.	**Sample No.**	**Location /Village**	**Type (well/ tube well)**	**Depth in mtr.**	**Water Level**	**PH**	**Ec. (at 25c) (mmoh/cm)**	**Total Dissolved Solids (PPM)**	**Categories (EC)**
1	2	Telegadh	Well	20	18	7.5	0.820	450	High
2	5	Umarecha	Well	30	25	7.6	0.470	265	Med.
3	7	Navavas	Tubewell	130	70	7.6	0.748	410	Med.
4	9	Varetha	Tubewell	80	40	7.5	0.470	265	Med.
5	12	Khetharana	Tubewell	50	45	7.3	0.986	550	High
6	15	Dharoi	Well	25	20	7.5	0.436	240	Med.
7	16	Shahpura	Tubewell	80	60	7.4	0.490	280	Med.
8	18	Ankaliyara	Tubewell	135	60	7.7	1.398	780	High
9	19	Gothada	Tubewell	100	90	7.4	0.432	245	Med.
10	20	Satalasana	Tubewell	150	50	7.4	0.780	435	High

In all about twenty samples of ground water were examined for electrical conductivity, PH, TDS and the proportion of various cations and anions the chemical analysis was carried out following standard procedures. Chemical analysis of some typical samples is given in Table I and Table II presents different ratio to judge the quality of these waters from irrigation view points.

Results and Discussion

As per results of chemical analysis, PH of most of the ground water samples is nearly 7.5. About 40% ground water samples may be classified as high EC value. As per RSC value most of the ground water samples may be classified as per permissible safe water. Only twenty percent as doubtful to unsafe (UN suitable) for irrigation purpose. On the whole, the ground water of Gadhavada region may be considered suitable for irrigation.

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