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"A Pragmatic Analysis of Ground Water Quality in Amer Tehsil of Jaipur"

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ABSTRACT

Water, next to air is a vital natural resource responsible for the existence and development of life on the Earth. Groundwater is an important source for drinking water and its quality is a critical issue around the world. Groundwater quality is affected by different natural as well as anthropogenic processes. As no significant work appears to have been done in quality analysis of ground water in different villages of Amer Tehsil, Jaipur, Rajasthan, prompted us to undertake a pragmatic study of this area. The groundwater quality of various tehsils of Jaipur city viz Amer Tehsil have experienced degradation due to rapid urbanization and industrialization. Thus it seems appropriate to analyze the quality variables of available ground water. The different parameters determined in current research study are pH, TDS, Electrical Conductivity, chloride, total alkalinity and total hardness on ten sample sites of selected tehsil. The analysis of water samples reveals that the water in few samples is suitable for both domestic and irrigation purposes. The study clearly indicates that most of the parameter under taken to assess the water quality is in the permissible limits. Research concludes that there is interplay of various factors that govern access and utilization of water resources and in light of the increasing demand for water it becomes important to look for holistic and people-centered approaches for water management.

Key words- *Amer, Ground Water, Hardness, Water Resources, Parameters, Quality.*

INTRODUCTION:

Water is nature's most magnificent, copious and valuable compound. Water is treated as the basis of all lives–ecological resources for the flora and fauna of our earth and a fundamental necessity for all lives. Without a facility of water supply, it is difficult to imagine productive human activity, be it agriculture or forestry, livestock, farming or fisheries, trade or industry.[(1)]

Water has been regarded as the largest natural resource in the form of groundwater and surface water. Groundwater makes up about 20% of the world's fresh water supply, which is about 0.61% of the entire world's water, including oceans and permanent snow. Deterioration of groundwater quality due to different geogenic and anthropogenic activities are of great concern (CGWB 2010). Groundwater quality in an area is dependent on various physical, chemical and biological factors. The chemical, physical and bacterial characteristics of ground water determine its usefulness for municipal, commercial, industrial, agricultural, and domestic water supplies. *(2)*

Rajasthan state is considered as arid and semi-arid region. Due to scarcity of surface water, majority of the people in Rajasthan, have to depend upon ground water resources. In many areas, ground water is the only available source for drinking water. In this context, rapid increase in human population coupled with expanding urbanization and industrialization has led to a greater imbalance between water availability and water demand. At the same time, good quality of water in adequate quantity should be available to sustain a healthy life. According to Prasanna et al., (2011) quantitative study is not sufficient for the management of ground water. Qualitative study of the groundwater is equally important component of groundwater management. *(3)*

Jaipur City (Longitude: 95°24' E; latitude: 27°18' N), the capital city of Rajasthan (INDIA) is one of the fastest growing cities in the country, is undergoing rapid urbanization and industrialization. Urbanization has led to immense pressure on ground water resources and has resulted in quality deterioration of ground water as well. Amber is a Tehsil / Block (CD) in the Jaipur District of Rajasthan. According to Census 2011 information the sub-district code of Amber block is 302028. There are about many villages in Amber block. *(4)*

Water quality parameters of ground water, river water & industrial water have been reported by several researchers in various places of subjective interest. But unfortunately no qualitative analysis had ever been conducted in Amer Tehsil Ground Water Qulaity, which motivated the researcher to analyze the same.

REVIEW OF LITERATURE:-

Vijayram et al. (1989) found the concentration of total hardness, calcium, chloride, magnesium and sulphate beyond permissible limit in ground water of sembattu, Tiruchirappalli due to presence of tanneries. Shankar and Muthukrishaman (1994) observed the concentration of total dissolved solids, total hardness, chloride and calcium, were higher then the permissible limit in the ground water of Madras city due to rapid industrialization.

Prasad and Ramchandra (1997) studied the ground water of industrial zone in Jeedimetala
(AP) and found the concentration of total dissolved solids, Fluoride, Nitrate greater than the permissible limit. Bhat and Ganesh Hegde (IJEH 1997) in their paper on ground water quality in Uttar Kannada district of Karnatatka describes physico-chemical quality of water of that area. The study indicates that nearly 50% of the water range is moderately hard to very hard types. Tiwari (IJEH, 2001) "Hydro geochemistry of under ground water in and around Hattpur city (M.P.)" describes physico-chemical characteristics of collected water samples. The study of ground water quality involves a description of the occurrence of various constituent in ground water and relation of these constituents to water use. Kulshresta (2002) studied about physicochemical characteristics of ground water and effluents in Sanganer of Jaipur district in Rajasthan.

Different researchers studied the importance of hydrogeochemical characteristics of groundwater in different aquifers to solve the issues related to groundwater management (Panigrahy et al., 1996; Atwia et al., 1997; Ballukraya and Ravi, 1999; Ramappa and Suresh, 2000) while others have done extensive study on groundwater across India including

Rajasthan (Kulashersta et al., 2002; Gupta et al., 2004; Garg et al., 2006; Jain et al., 2006; Kumar and Singh, 2010; Kaur and Singh, 2011; Saxena and Saxena, 2013).

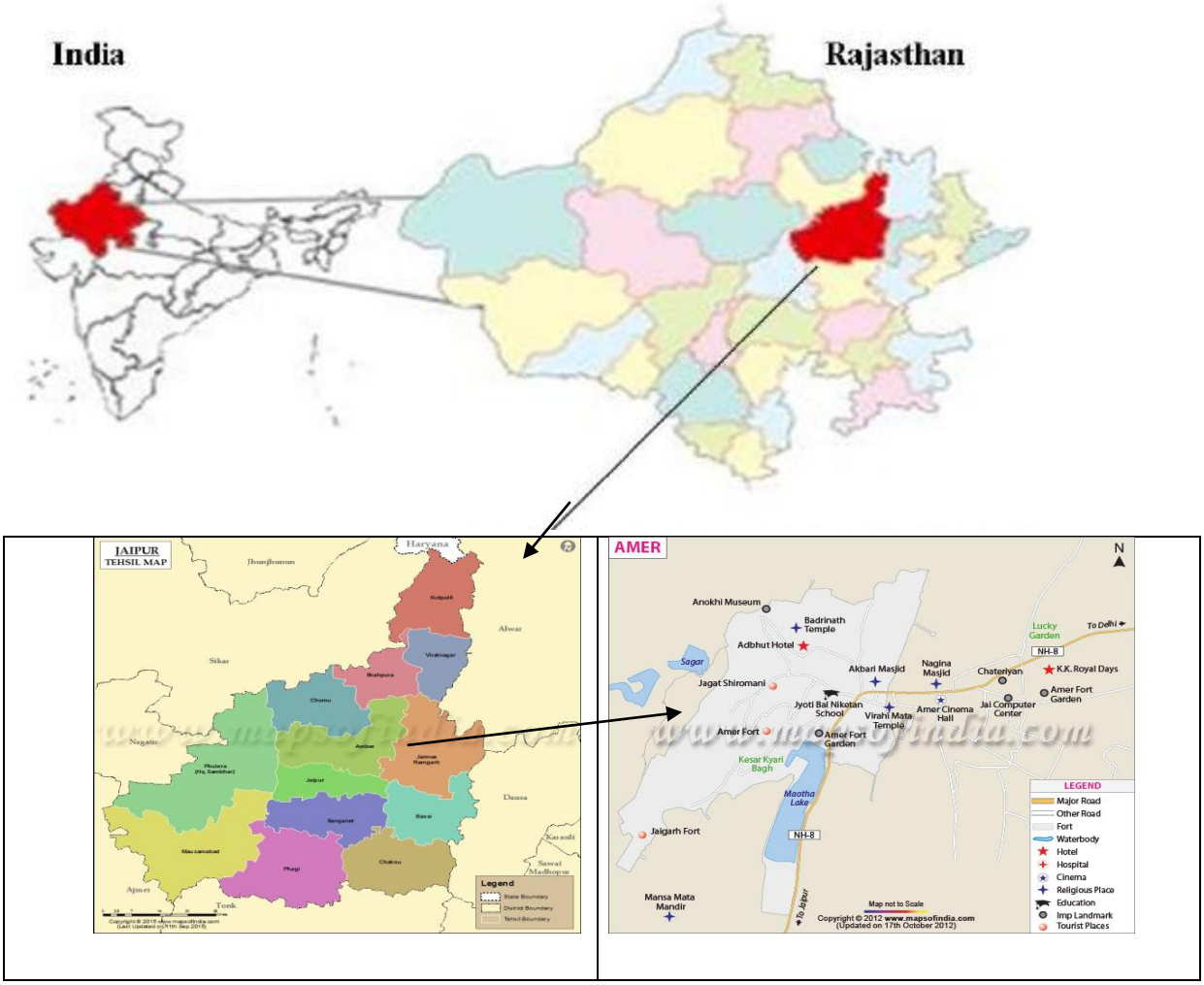
Review on the literature showed that no studies have been undertaken in the study area with regard to physico-chemical characteristics of ground water yet. So the objective of this study was to investigate the quality of grund with special reference to the concentration of various parameters of ground water viz (pH, Alkalinity, TDS etc) at Amer Tehsil of Jaipur, Rajasthan, India.

MATERIAL AND METHODS:-

Study Area:

Jaipur district with geographical area of 11,151 sq. km forms East-central part of the Rajasthan which is administered by 13 tehsils and 13 blocks. The district covers about 3.3% of total area of the State. Jaipur, the capital city is also popularly known as Pink city and is situated towards central part of the district. The semi-arid district receives normal annual rainfall of 527mm (1901-71) while average annual rainfall for the last 30 years (1977-2006) is 565mm. Over 90% of total annual rainfall is received during monsoon. (CGWB, 2007; JDA,2012). ***Amer Block of Jaipur is selected as study area.***

Amer Block Tehsil of Jaipur (Rajasthan) The climate of the area under study is hot semiarid with extremes of temperature (15-45°C) having average rainfall around 650 mm (26 inch.). The location of study area is shown in the Map-1 given below:



Map 1: Study Area (Amer Tehsil of Jaipur, Rajasthan

EXPERIMENTAL

The present study provides a detailed description of the chemical criteria of ground water. Ten representative samples of entire study area were collected and analyzed for pH, total dissolved solids (TDS), fluoride, chloride, nitrate, sulphate, total alkalinity, total hardness. The sampling sites were identified and then the samples were collected from different sources after allowing some amount of water to flow out. The samples were collected in clean plastic bottles, which were pre cleaned, dried in dust free environment and sterilized. The instruments were used in the limit of précised accuracy and chemicals used were of analytical grade.(Description of instruments utilized is explained in table 1). All the water sample were properly labeled as A1, A2, A3, A4, A5, A6, A7, A8, A9, A10 (**A** represents Area i.e Amer Block) and a record was prepared indicating the source of the sample, location of the source and data of collection.

Table 1: Parameters and methods Utilized in the physiochemical investigations on water samples

S.no	Parameter	Method Employed
1.	pH	Digital pH Meter
2.	Free Cl_2(ppm)	Titremetric Method (With $AgNO_3$)
3.	Total Hardness (ppm)	Titremetric Method (With EDTA)
4.	TDS(ppm)	Digital Conductivity Meter
5.	Electrical Conductivity(mS)	Digital Conductivity Meter
6.	Free CO^2(ppm)	Titremetric Method
7.	Alkalinity(ppm)	Titremetric Method (With HCL)

Values obtained are compared with the standards values of physico-chemical examination of water sample have been reported in table -2. These values are given by BIS-Bureau of Indian Standard, ICMR- Indian council of medical Research, WHO - world health Organisation.

Table 2 Standard Specifications for Water Quality

S.No	Parameters	BIS:1999	ICMR:1975	WHO:2003
1.	pH	6.5-8.8	7.0-8.5	6.5-9.5
2.	EC	-	--	1400
3.	TDS	2000	500	600
4.	Ca^{+2}	200	200	100
5.	Mg^{+2}	100	200	150
6.	Cl_1	1000	200	250
7.	SO^{-2}_4	400	200	250
8.	NO^{-3}	100	50	50
9.	Total hardness, Mg/L	600	600	500

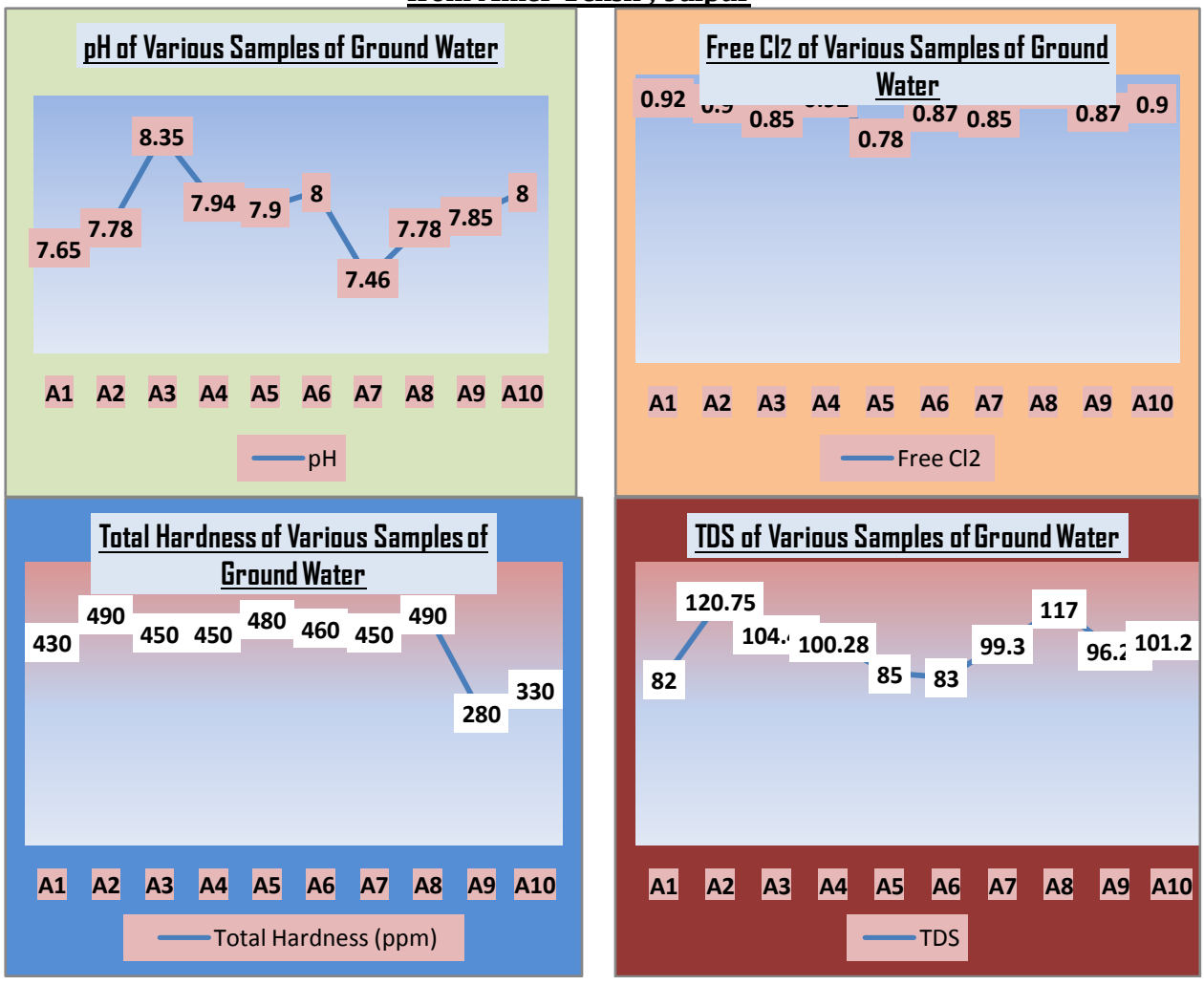
4. RESULTS & ANALYSIS:-

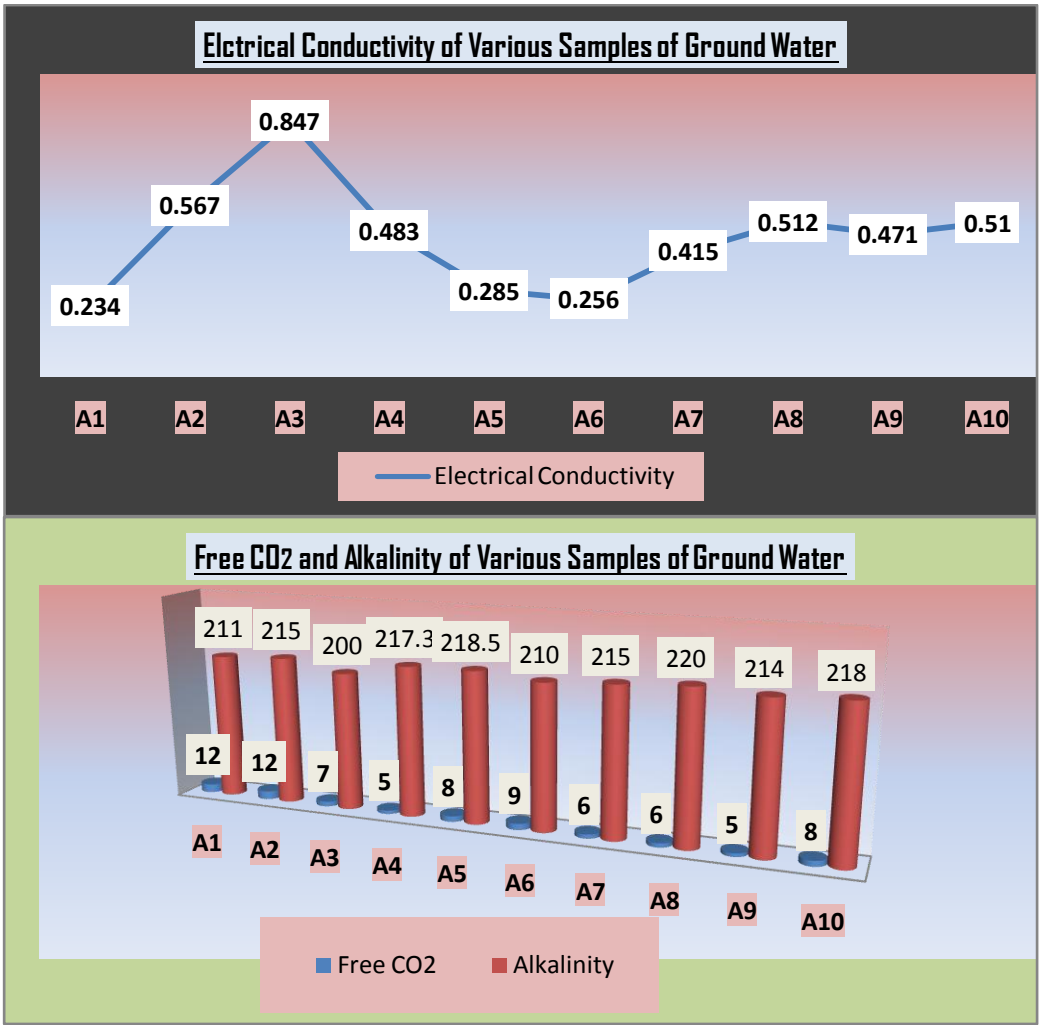
The respective values of all water quality parameters in the groundwater samples are illustrated in Table-3 and Graph 1 below.

Table 3 Physio Chemical Analysis of Ground Water Quality Parameters of Samples from Amer Tehsil , Jaipur

Sample Code	pH	Free Cl_2 (ppm)	Total Hardness (ppm)	TDS (ppm)	Electrical Conductivity (mS)	Free CO^2 (ppm)	Alkalinity (ppm)
A1	7.65	0.92	430	82.0	0.234	12	211
A2	7.78	0.90	490	120.75	0.567	12	215
A3	8.35	0.85	450	104.41	0.847	7	200
A4	7.94	0.92	450	100.28	0.483	5	217.3
A5	7.90	0.78	480	85.00	0.285	8	218.5
A6	8.00	0.87	460	83.00	0.256	9	210
A7	7.46	0.85	450	99.30	0.415	6	215
A8	7.78	0.95	490	117.00	0.512	6	220
A9	7.85	0.87	280	96.24	0.471	5	214
A10	8.00	0.90	330	101.20	0.510	8	218

Graph 1 Physio Chemical Analysis of Ground Water Quality Parameters of Samples from Amer Tehsil , Jaipur





Statistical analysis of water quality samples from ten sample sites and all the parameters was undertaken and reported in table 4 below:-

Table 4 Statistical Analysis of Ground Water Quality Parameters of Samples from Amer Tehsil , Jaipur

PARAMETER	Minimum	Maximum	Average	Standard Deviation
pH	7.46	8.35	7.871	0.236
Free Cl_2(ppm)	0.78	0.95	0.881	0.048
Total Hardness (ppm)	280	490	431	70.150
TDS(ppm)	82.0	120.75	98.918	13.255
Electrical Conductivity(mS)	0.234	0.567	0.458	0.180
Free CO^2(ppm)	5	12	7.8	2.573
Alkalinity(ppm)	200	218.5	213.88	5.830

The data revealed that pH ranged from 7.46 to 8.35. The minimum pH was observed in A7 and maximum pH was detected in A3 village sample site. pH is the negative exponent of H+ concentration. According to WHO (1992) standards, best and ideal pH value for human consumption is 7.0, but it may vary from 6.9-9.2. Thus, all the samples tested were slightly alkaline; water of A3 village is basic in nature due to presence of excessive salts basic water can cause stomach problems so it must be treated prior to its use. Until recently, concerns about drinking water focused on eliminating pathogens. The chlorine used to reduce the risk of infectious disease may account for a substantial portion of the cancer risk associated with drinking water. Chlorination of drinking water was a major factor in the

reduction in the mortality rates associated with waterborne pathogen. The use of chlorine was believed to be safe. This view is evident in an article, which appeared on the back page of the New York Times. The report stated that with the use of chlorine, "Any municipal water supply can be made as pure as mountain spring water. Chlorination destroys all animal and microbial life, leaving no trace of itself afterwards". This statement reflected opinion accepted until recent years when halogenated organic compounds, such as chloroform, were identified in chlorinated drinking water supplies. Recent surveys show that these compounds are common in water supplies throughout the United States.

These concerns about cancer risks associated with chemical contamination from chlorination by-products have resulted in numerous epidemiological studies. These studies generally support the notion that byproducts of chlorination are associated with increased cancer risks. The concentration of free residual chlorine should be between 0 to 1 ppm. Excess chlorine in water can lead to various negative health effects. But all collected samples have free chlorine level within limits.

Further value of total hardness of different sample villages of Amer ranges from 280 to 490 ppm. The desirable limit of drinking water hardness is 300 ppm (ICMR) and for washing water is 500 ppm. Water hardness is generally because of the geochemical formulations of water and due to presence of various salts of calcium and magnesium (bicarbonates, carbonates, sulphates, chlorides etc.).Inadequate intakes of calcium have been associated with increased risks of osteoporosis, nephrolithiasis (kidney stones), colorectal cancer, hypertension and stroke, coronary artery disease, insulin resistance and obesity. Increased intake of magnesium salts may cause a temporary adaptable change in bowel habits (diarrhoea) and is the cause of hypermagnesia in which human and animals are unable to excrete magnesium from body (WHO) Temporary hardness of water can be reduced by boiling and permanent hardness can be treated by various methods.

Samples are also tested to estimate TDS (total dissolved solids),specific conductivity, conductivity and alkalinity. Alkalinity due to hydroxides is absent in samples and mainly due to the carbonates and bicarbonates.

6. CONCLUSION:-

Ground water is increasingly being sought as a source of drinking water due to the scarcity, non-availability and bacteriological pollution of surface water. This paper describes the important results of the Physico-chemical analysis of the ground water samples of the villages sites of Amer Tehsil, Jaipur of Rajasthan State.

Although it was a representative sample study of the ground water quality of Amer, Jaipur town, but the results are quite significant satisfactory and not much alarming. The different parameters determined are pH, TDS, fluoride, chloride, nitrate, sulphate, total alkalinity and total hardness. All parameters were found within permissible limits. The general taste of water is also good. A layman cannot determine the possible hazards of water quality. This fact makes the study important. There is few industrial growth in Amer Jaipur, dense population but thus ground water indicates some alarming scenario in upcoming years after the impact of industrialization. A follow up study must be initiated regularly to keep the quality check for safety and efficacy of water. Irrigation is the main occupation of the surrounding population and chemical fertilizers are more commonly being used.

There can be little doubt that water is a basic necessity for the survival of humans. There is interplay of various factors that govern access and utilisation of water resources and in light of the increasing demand for water it becomes important to look for holistic and people-centered approaches for water management.

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