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Physico-Chemical Characterization of Ground water Quality in the Hard rock Aquifers of Karad Tahsil of Maharashtra State, India

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ABSTRACT

Groundwater quality of bore wells from the hard rock aquifers of Karad Tahsil of Maharashtra State and its suitability for domestic and agricultural purposes has been examined. Twenty one ground water samples from bore wells were collected from the study area and hydrochemistry for these samples was determined. Ground water contains a few polluting influences, regardless of the fact that it is unaffected by human exercises. The sorts and centralizations of characteristic pollutions rely on upon the way of the land material through which the groundwater moves, and the nature of the energize water. Groundwater travelling through sedimentary shakes and soils may get an extensive variety of mixes, for example, magnesium, calcium, and chlorides. A few aquifers have high regular convergences.

Graphical Abstract

Bore water in study area

Keywords: Dengue, Schiff base, DCC, Tetracyclic compounds.

INTRODUCTION

Fresh water is a finite resource essential for agriculture, industry and for human existence. Today, most of the population of our country depends on ground water for drinking and other purposes. Water is one of the important gifts of nature. Water sources available for drinking and other domestic purposes must possess high degree of purity, free from chemical contamination and microorganisms. Due to urbanization and industrialization the ground water of our country becomes unpleasant for drinking. Industrial effluents discharged into the aquatic system change the physico-chemical properties of water such as pH, EC, Ca, Mg, Hardness, TDS, Chloride, Sodium, Phosphate, Nitrate, etc. there by affecting the aquatic flora and fauna[**1, 17**]. Keeping in view of this, it is proposed to carry out a systematic study on the water samples collected from twenty one sampling stations in the surrounding areas of Karad Tahsil of Satara District (Maharashtra) Water quality is a critical factor affecting human health and welfare. Studies showed that approximately 3.1% of deaths (1.7 million) and 3.7%of disability-adjusted-life-years (54.2 million) worldwide are attributable to unsafe water, poor sanitation and hygiene [**2**]. More than 88%of the global diarrheal diseases are water-borne infections caused by drinking unsafe and dirty water. Different reports showed that water sources and distributions systems are contaminated with water quality indicators such as turbidity, organic matter and fecal microorganisms. These bacteria indirectly determine the risk of ingesting pathogens with polluted water [**3**].

Pesticides, manures, herbicides and creature waste are farming wellsprings of groundwater tainting [**4**]. The horticultural defilement sources are shifted and various: spillage of manures and pesticides amid taking care of, spill over from the stacking and washing of pesticide sprayers or other application gear, and utilizing chemicals tough from or inside of a couple of hundred feet of a well.

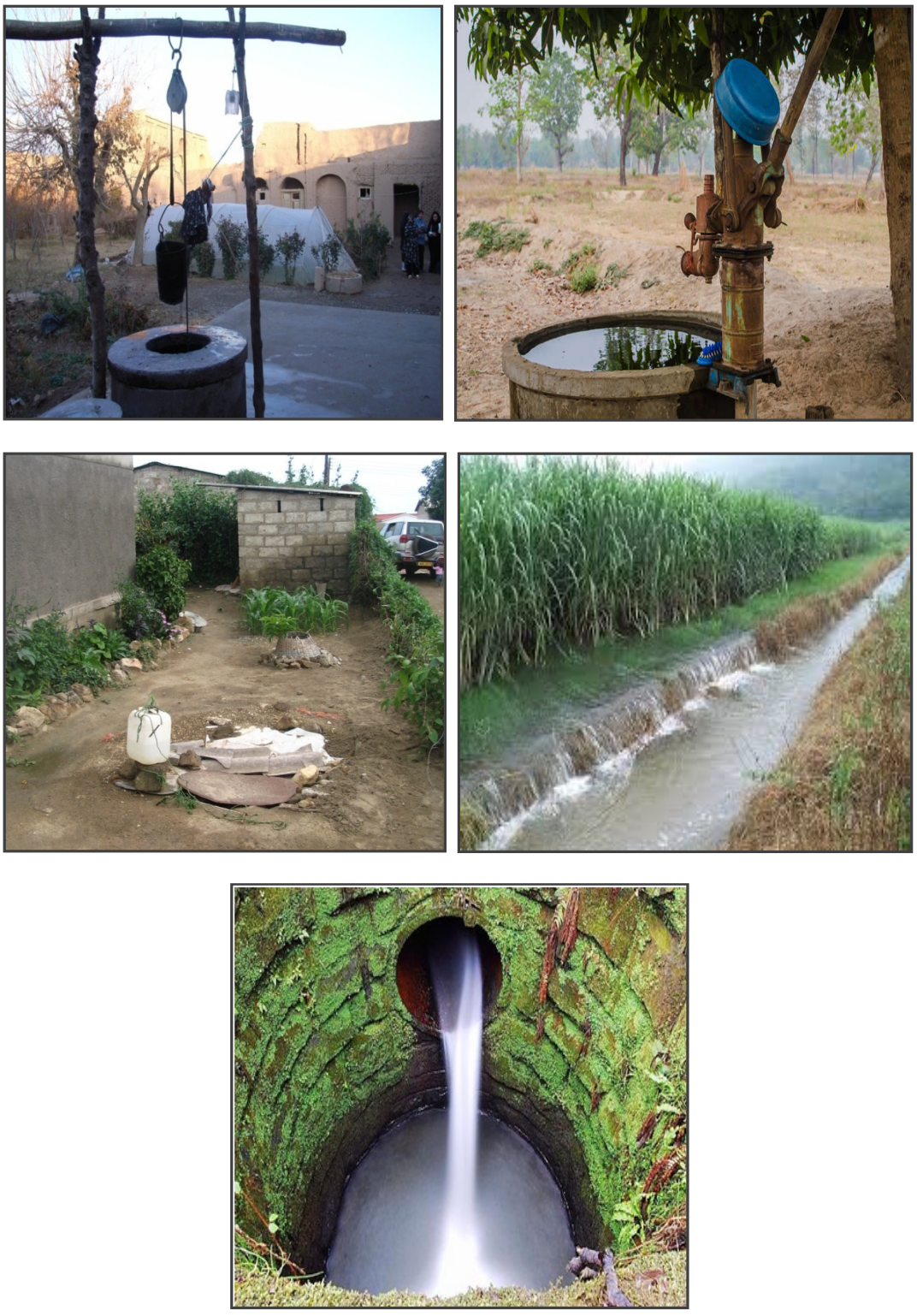
Assembling and administration businesses have levels of popularity for cooling water, preparing water and water for cleaning purposes. Groundwater contamination happens when utilized water is come back to the hydrological cycle [**5**]. Current monetary movement requires the transportation and capacity of material utilized as a part of assembling, handling, and development. Along the route, some of these materials can be lost through spillage, spillage, or disgraceful taking care of. The transfer of squanders connected with the above exercises adds to another wellspring of groundwater defilement [**6**]. A few organizations, more often than not without access to sewer frameworks, depend on shallow underground transfer. They utilize cesspools or dry openings, or send the wastewater into septic tanks [**7, 8**].

Private wastewater frameworks can be a wellspring of numerous classes of contaminants, including microbes, infections, nitrates from human waste, and natural mixes. Infusion wells utilized for local waste water transfer (septic frameworks, cesspools, seepage wells for tempest water overflow, and groundwater revive wells) are of specific worry to groundwater quality if found near drinking water wells. Shamefully putting away or discarding family unit chemicals, for example, paints, manufactured cleansers, solvents, oils, meds, disinfectants, pool chemicals, pesticides, batteries, gas and diesel fuel can prompt groundwater defilement [**9, 10**].

MATERIALS AND METHODS

Study Area: Karad is located at 17.28°N 74.2°E. It has an average elevation of 566 m (1856 feet). Karad is located near Agashiva 17.237506°N 74.15205°E. It has been referred in great epic Mahabharata. As per 2011 India census, Karad town and surrounding villages had total population of 74,355. Karad has the Taswade MIDC in its vicinity which boasts many industries giving employment to people in the Satara District. Karad has the presence of Emerson Climate Technologies and Pidilite Industries Ltd. Karad is famous for its Jaggery and Cattle markets in entire Maharashtra.

Water samples were collected from 21 bore wells from the study area. The water samples were analyzed for pH, EC, Ca, Mg, Hardness, TDS, Chloride, Sodium, Phosphate, Nitrate, etc (Table 1).



Different water sources for the present study

Table 1. Physico chemical parameters of water samples

S.No	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
pH	6.6	6.8	7.01	6.9	7.2	7.4	7.00	7.01	7.02	5.8	7.1	7.02	6.8	6.9	7.4	7.3	7.5	7.6	7.9	7.3	7.4
EC	96	98	102	142	161	149	139	154	136	139	141	152	168	170	157	159	168	171	170	169	168
Ca	42	58	56	63	59	78	63	61	68	62	78	73	71	69	64	61	62	67	64	78	71
Mg	23	21	26	27	24	36	34	39	41	48	52	29	24	26	27	25	28	31	33	36	30
Hardness	128	136	132	159	143	139	142	156	469	178	183	211	236	231	242	238	267	296	278	263	284
TDS	52	46	48	49	57	51	69	78	83	79	68	64	67	69	64	73	76	71	75	72	69
Chloride	67	60	132	141	139	165	205	214	231	246	276	279	286	294	276	296	279	281	293	279	284
Sodium	14	19	17	16	09	11	13	19	17	12	8	9	11	12	16	17	18	21	17	18	16
Phospate	11	09	13	14	15	12	17	13	12	16	14	08	09	12	14	15	13	14	12	13	14
Nitrate	13	18	26	24	21	28	31	36	19	42	39	33	28	26	27	31	36	38	42	41	39

RESULTS AND DISCUSSION

The groundwater quality analysis of different groundwater samples have been carried out for pH, EC, Ca^{2+}, Mg^{2+}, Na^{+}, Cl^{-}, SO_4^{-}, NO_3^{-} and TDS, etc,. The data were used for understanding the spatial distribution of ions, suitability for domestic and irrigation purposes. The groundwater samples show slightly acidic nature. pH is dependent on the carbon-dioxide-carbonate equilibrium. pH is considered as an important ecological piece factor and piece of information on many types of geochemical equilibrium of solubility calculation [**11**]. The pH is measured in the field at the time of collection of samples. Drinking water with a pH range of 6.5-8.5 is generally considered satisfactory. pH is one of the most important factors which serves as an index of the pollution. The purpose of finding the pH values is to determine whether the drinking water is acidic or alkaline in nature. Here, pH ranges between 5.8- 8.9.

Calcium may dissolve readily from carbonate rocks and lime stones or be leached from soils. It is one of the important nutrients for organisms and as such has no hazardous effect on human health. Depending on the type of rocks, its quantity in natural water varies from 10 to 100 mgL^{-1}. Ca^{2+} is an essential nutrition element for human being and aids in maintaining the structure of plant cells and soils. [**16**] Insufficiency of Ca^{2+} causes severe rickets; excess causes concretions in the body such as kidney or bladder stones and irritation in urinary passages [**14, 19**]. The value of Ca^{2+}concentration varies in the range of 42 to 78 mgL^{-1}. For most of groundwater samples, the Ca^{2+} values are found within the maximum permissible limit (200 mgL^{-1}). The continuous high intake of Ca^{2+} may cause stone problem which is also noticed in the area Magnesium (Mg^{2+}) is present in the groundwater from natural sources like granitic terrain which contain large concentration of these elements. A large number of minerals and rocks contain Mg^{2+} and it dissolves in surface and groundwater. Mg^{2+} generally occurs in lesser concentration than Ca^{2+} because of dissolution of Mg^{2+} rich minerals is slow process and calcium is more abundant in the earth crust [**14**].

Total Hardness is caused primarily by the presence of cations such as Ca^{2+}, Mg^{2+} and anions such as CO_3^{2+}, HCO_3^{2+}, Cl^{-}, SO_4^{2-} in water and Eutriphication of the water containing excess hardness is not desirable for potable water. It consumes more soap during washing of cloths. Water hardness has no adverse effects; however, some evidence indicates its role in heart diseases [**15**]. Hardness of 150-300 mgL^{-1} and above may cause kidney problems and kidney stone formation, as it cause unpleasant taste and reduce ability of soap to produce lather. Hard water is unsuitable for domestic use. In this region, the total hardness varies between 128 to 296 mgL^{-1}.

TDS is the concentration of all dissolved minerals in water indicates the general nature of salinity of water. To ascertain the suitability of groundwater for any purposes, it is essential to classify the groundwater depending upon their hydro chemical properties based on their TDS values [**12**]. The groundwater of the area is fresh. Most of the groundwater samples are within the maximum permissible limit for drinking as per the BIS standards. Water containing high TDS is of inferior palatability and may produce unfavorable physiological reaction in the transient consumer [**13**]. Total

dissolved solids indicate the salinity behavior of groundwater. The TDS observed from this area is between (46 -83 mgL^{-1}).

Chloride in groundwater may originate from both natural and anthropogenic sources. Atmospheric precipitation, dissolution of salt deposits and weathering of halite and evaporate are considered as the major lithogenic source of Cl^- in the groundwater. Possible anthropogenic source of Cl^- are septic, industrial and animal waste, fertilizers leaches from landfill and waste dump [**16**]. People who are not accustomed to high chloride are subjected to laxative effect. The Cl^- value of all the samples varies in the range 60 to 296 mg L^{-1}. Cl^- imparts a salty taste and some times higher consumption causes the crucial for the development of essential hypertension, risk for stroke, left ventricular hypertension, osteoporosis, renal stones and asthma in human beings [**11**]. Although, the Cl^- plays an important role in balancing the level of electrolyte in blood plasma, but higher concentration can produce some physical disorders. Soil porosity and permeability also play an important role in building up the chloride value.

Source of nitrates in groundwater include human activity such as application of fertilizer in farming practices, human and animal waste. According to the Indian standards, the concentration of nitrate in the area is low and ranged from 13 to 42 mgL^{-1} which is below the permissible limit of 45 mgL^{-1}. Nitrate is an important pollutant in the environment, generally derived from atmospheric precipitation, agricultural fertilizers, human and animal excrete, biological fixation and nitrification of organic N and NH_4 [**13**]. Toxicity of nitrates in infants causes health disorders such as metheamoglobiaemia, goiter, hypertension, cyanosis and asphyxia (blue baby syndrome) in infants less than 3 months [**15**]. Nitrate-nitrogen (NO_3-N) in groundwater may results from point sources such as sewage disposal systems and livestock facilities, nonpoint sources such as fertilized cropland.

APPLICATION

This study is done in the rural area of Karad Tahsil. And most important part is, in the rural area peoples are using the water for both drinking as well as for domestic purposes, without any filtration process. Hence, this study gives an idea about the quality of water quality.

CONCLUSION

The quality of the groundwater in the bore wells good. However, Health effects are some of the greatest risks associated with groundwater pollution. In areas where septic systems have not been installed or kept up correctly.

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