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Assessment Of Hazardous Ions from Various Water Resources of Jodhpur District

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Abstract

A planned and structured study was done in order to assess the water quality of jodhpur (rural) district. Samples was collected from the rural regions of Jodhpur district where water is used for the drinking purpose. Physicochemical analysis of water samples like conductivity, pH, total hardness (TH), total alkalinity (TA), total dissolved solid (TDS), Calcium, magnesium, fluoride, chloride, nitrate was carried out. This investigation revealed that certain samples contained chemical elements that exceeded the Bureau of Indian Standards' allowed limits. These unsafe levels of contaminants can cause health effects. This paper consists of various prescribed standards for different categories and areas of water. Constructed on findings of this study, it is suggested that any water source which comes under this study area should be inspected before use in order to check the quality of local drinking water. If water is used from these respective areas for drinking purposes, the physiological damages may have been noted in human beings and others.

Keywords

heavy metals, jodhpur, Physicochemical analysis, pollutions, water

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INTRODUCTION

Water is an essential need for the survival of all living forms on the planet. It is safe to claim that water is the cause that the earth is the only planet on which life can exist. One of the most important resources we have on our planet is this universal solvent. Without water, life would be hard to sustain. After all, it accounts for over 70% of the planet's surface area. As a result, a shortage of water or the ingestion of polluted water can create major health issues in people. As a result, the quantity and variety of water we drink is critical to our physical health and fitness. [1] Water which is fit for drinking and free from any impurities is potable water.[2] We get water from various sources sources, like streams, lakes, rivers, ponds, rain, springs and wells

Water is necessary not only for our existence but also for a happy and healthy life.[3] Everyone has witnessed the situation in water-scarce nations such as Africa, where inhabitants live in misery. It is past time for everybody to awaken and recognise the need of water conservation. In other respects, a planet lacking water would make it impossible for humanity to survive. All animals and plants fall within this category. In fact, without water, the entire planet will suffer. The only planet with liquid water on its surface is Earth. Although water covers around 71 percent of the earth's surface and the seas retain approximately 96 percent of the earth's water, we only have access to 2.5 percent of it for our daily needs. Every day, the human body needs consume 3 litres of water. Water is an essential component of our lives and the environment. Water contamination

occurs for a variety of causes. Some of the causes had a direct impact on water contamination, while others had an indirect impact. As a result of massive water pollution, many companies and enterprises discharge polluted water, chemicals, or heavy metals into important rivers. The employment of modern farming practices is another source of water contamination. Chemical fertilizers, manure, and sludge are used by farmers to apply nutrients including phosphorous, nitrogen, and potassium. It causes significant amounts of agrochemicals, organic waste, and salty drainage to be discharged into water bodies, resulting in indirect water contamination. [4] Water is a vital part of humans, and it is directly attached to human welfare. There are many states in India where more than 90% people depend on ground water for domestic purposes. So, there is a need to prevent the pollution of water. [5]

Heavy metals are toxic in nature present in environment and are well known pollutants in atmosphere and water. Example, lead (Pb), cadmium (Cd), cobalt (Co) etc. are non-essential elements widely found around can cause various health issues. These elements do not disintegrate neither are biodegradable in nature. They get piled up in tissues of organisms and cause serious health problems.[6] Anemia is treated through cobalt but excess of it is harmful for human lives. Hence, heavy ions are main source of water contamination. Heavy metal detection in water has increased, which can be done using electro chemical detection. [7-8] Although many water contamination remedies must be implemented at a macro level, individuals, businesses, & communities may have a major and meaningful effect on water quality. Companies and factories must appropriately dispose of unused chemicals & containers according to product details.

STUDY AREA

The district spans the latitudes of 27.62 N' and 72.92 E', as well as the longitudes of 26.00 N & 73.87 E'. This neighborhood is located between 200 and 250 meters above sea level. The alluvial plains, sand dunes, and escarpments make up the Jodhpur district's three major physiographic units. Sand dunes may be found in the western and northwestern areas of Jodhpur district. The district's land surface is largely flat and sandy, except for some areas of Bilara & Osian tehsil.

Jodhpur region comes under arid zone and there is scarcity of rainfall, so the potential source of water is pond, surface water, rainwater etc. But it is depleting rapidly due to pollution. As it is highly used for drinking and other domestic purposes, there is a need for examination of the water for various framework to test its appropriateness for the same.

METHODOLOGY

Sampling methods:

Before the monsoon season, twenty water samples were taken from different locations in Jodhpur(rural). These groundwater resources are used in a variety of ways, both directly and indirectly. More than a period of time, several individual distinct samples were collected at regular intervals. High-density polypropylene bottles were used to collect water samples. All of the plastic bottles had been adequately cleaned. Before being used to collect samples, bottles were cleaned first with dilute acid and with double distilled water. Analytical Reagent (AR) grade chemicals were utilized. For collection, conservation, analysis, and explanation, proper method and technique were followed.

Analysis method:

All data were reviewed within 8 hours of collecting the water sample, and portable metres were used to test pH, temperature, and electrical conductivity. Magnesium, calcium, total hardness, chloride, and alkalinity concentrations were determined using volumetric methods, nitrate concentrations were determined using a spectro-photometer, and fluoride concentrations were determined using a UV-visible spectro-photometer technique, and the results were compared to BIS standards.[9]

Table 1: Methods employed to examine the parameters and their units [10]

S. No.	Parameters	Unit	Method Employed
1.	pH		Digital pH-meter
2.	Electrical Conductivity (EC)	mhos/cm	Digital Conductivity-meter
3.	Total Hardness (as $CaCO_3$) Total Alkalinity	mg/L	Titration method (With EDTA)
4.	Total Alkalinity	mg/L	Titrimetry method (with HCl)
5.	Calcium Hardness (as $CaCO_3$)	mg/L	Titrimetry method
6.	Magnesium Hardness (as$MgCO_3$)	mg/L	Titrimetry method
7.	Chloride (as Cl^-)	mg/L	Titrimetry method (With AgNO3)
8.	Nitrate (as NO^{3-})	mg/L	Spectrophotometric method
9.	Fluoride (as F^-)	mg/L	UV Visible spectrophotometer
10.	Total Dissolved Solids (TDS)	mg/L	Digital Conductivity-meter

Location of sampling sites

The samples were collected before monsoon season from twenty different places of jodhpur (rural) region; namely, Balesar(Agoli p) (Jod_1), Bap(Duda bhera) (Jod_2), Bapini (kapuria) (Jod_3), Bapini(Denok) (Jod_4), Bapini(Parasala)(Jod_5), Dechu(Khanodi) (Jod_6), Lohawat(Nosar) (Jod_7), Luni (pheench)(Jod_8),Phalodi (Nokhra charna) (Jod_9), Phalodi (ugras) (Jod_{10}),Sekhala (Bhaku-kallan)(Jod_{11}), Bhopalgarh (Darmi) (Jod_{12}), Mandor(Jajiwal gehlota) (Jod_{13}), Pipar(kagal) (Jod_{14}),Pipar (Ratkudia) (Jod_{15}),Baori (Anwana) (Jod_{16}),Baori (Ramchowki P) (Jod_{17}),Mandore (Dangiawas) (Jod_{18}),Shergarh (Chakdar) (Jod_{19}),Bilara(olvi) (Jod_{20}),

RESULTS AND DISCUSSION

The chemical ground water quality in the Jodhpur region varies widely depending on the properties of the water bearing formation, ground water circulation, depths to water levels, & leaching. Table 2 shows the BIS's standard allowed & excessive levels for a few of the parameters examined and assessed. [11].

Table 2: BIS standards of permissible and excessive limits of various parameters

Parameters	Permissible Limit	Excessive Limit
pH	6.5	8.5
TDS	500 mg/L	2000 mg/L
TH	200 mg/L	600 mg/L
TA	200 mg/L	600 mg/L
Chloride	250 mg/L	1000 mg/L
Fluoride	1 mg/L	1.5 mg/L
Nitrate	45 mg/L	100 mg/L

The below table shows the analyzed results of the physic chemical parameters of the water samples collected for examination from various regions of Jodhpur(rural).

Location	Source	Ph	EC Ms/cm	TDS mg/L	TH mg/L	Ca^{+2} mg/L	Mg^{+2} mg/L	F^- mg/L	Cl^- mg/L	NO_3^- mg/L
Jod_1	Well	8.5	6740	3880	300	20	61	0.82	1943	14
Jod_2	Well	7.5	4250	2306	440	40	83	1.82	1276	53
Jod_3	Well	8.5	1460	762	80	8	16	3.03	262	4
Jod_4	Well	7.6	2530	1394	340	20	71	3.63	681	4
Jod_5	Well	8.0	810	432	115	16	18	0.00	99	34
Jod_6	Well	8.1	1690	938	125	12	23	1.82	234	34
Jod_7	Well	7.9	900	485	160	24	24	0.00	163	52
Location	**Source**	**Ph**	**EC Ms/cm**	**TDS mg/L**	**TH mg/L**	**Ca^{+2} mg/L**	**Mg^{+2} mg/L**	**F^- mg/L**	**Cl^- mg/L**	**NO_3^- mg/L**
Jod_8	Well	8.2	2550	1434	150	28	19	2.49	596	76
Jod_9	pond	7.7	4470	2518	690	261	10	3.63	1135	12
Jod_{10}	Well	8.1	3210	1782	320	32	58	3.03	830	12
Jod_{11}	Well	8.1	830	467	125	38	7	2.83	50	12
Jod_{12}	Pond	8.0	12400	7440	00	00	00	6.90	4113	16
Jod_{13}	Well	7.4	8200	4835	1520	100	309	0.75	1404	892
Jod_{14}	Well	7.5	6650	3762	490	96	62	1.76	2071	75
Jod_{15}	Well	8.5	4070	2351	270	68	24	2.62	908	198
Jod_{16}	Well	7.7	4080	2449	470	92	58	2.16	1135	242
Jod_{17}	Well	7.5	6250	3330	960	148	143	2.16	1986	9
Jod_{18}	Pond	8.0	6690	3739	730	148	88	2.82	1900	22
Jod_{19}	Well	8.0	1600	907	185	46	17	0.68	355	60
Jod_{20}	Well	8.6	1900	1033	250	64	22	2.90	376	18

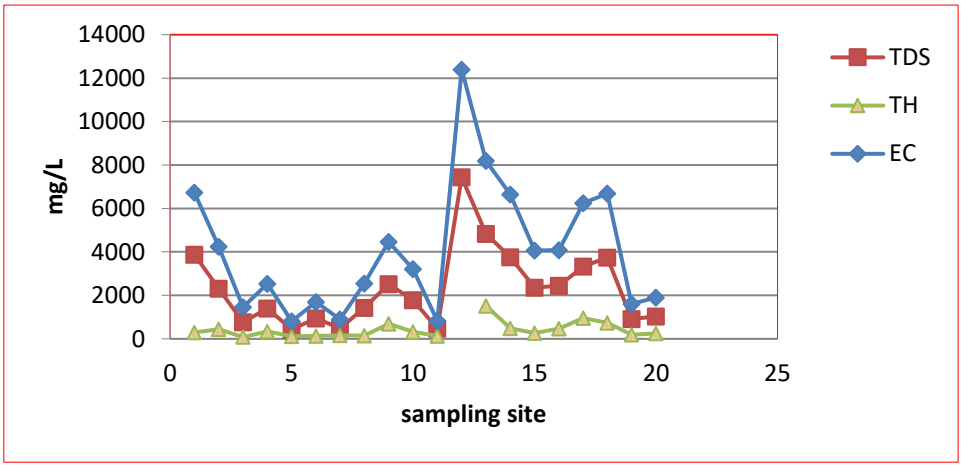
Electrical Conductivity (EC):

The EC findings for the groundwater of the study area ranged between 810 and 12400 mhos/cm. As we all know, electrical conductance is a measurement of dissolved solids, and high sodium levels in water are dangerous for irrigation and render the soil uncultivable in the future. The United States Salinity Laboratory classifies ground water into 4 groups based on electrical conductivity: excellent, 250-750 mhos/cm, good, 750-2250 mhos/cm, fair, and >2250

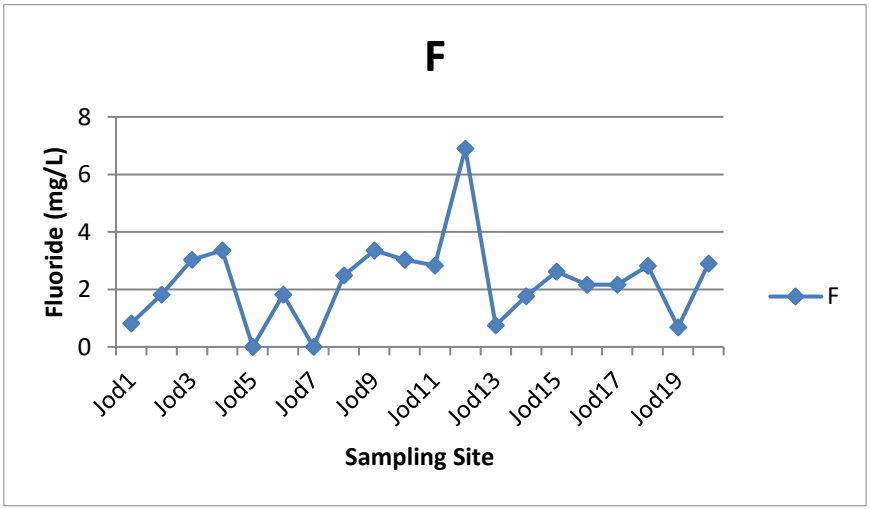
mhos/cm. Just two water samples, Jod5 and Jod11, are classified as good, while six water samples, Jod3, Jod6, Jod7, Jod11, Jod19, Jod20, are classified as fair, and the remainder are classified as bad.[12]

Total Dissolved Solids (TDS): TDS concentrations in the study region ranged from 432-3880 mg/L. TDS stands for total dissolved solids in water. TDS levels of up to 500 mg/L are good, with TDS levels above 2000 mg/L falling within the BI's maximum allowed category. Groundwater can be classed as desired for drinking up to 500 mg/L, legal for drinking between 500 and 1000 mg/L, and helpful for irrigation between 1000 and 3000 mg/L based on TDS concentration levels.[13] As a consequence of the findings, we may conclude that just two water samples, Jod5 and Jod7, are desired for drinking, but only 3 water samples are permitted for drinking.[14]

Total Hardness (TH): Due to hardness of water lather formation does not takes place. [4] The water samples tested varied from 80 to 1520 mg/L, according to the results. When the findings are compared to the allowed and excessive limit (200-600 mg/L) criteria established by BIS, we can see that the ground water in the Jodhpur region varies greatly. The TH of 55 percent of the water samples was within acceptable levels. [15]

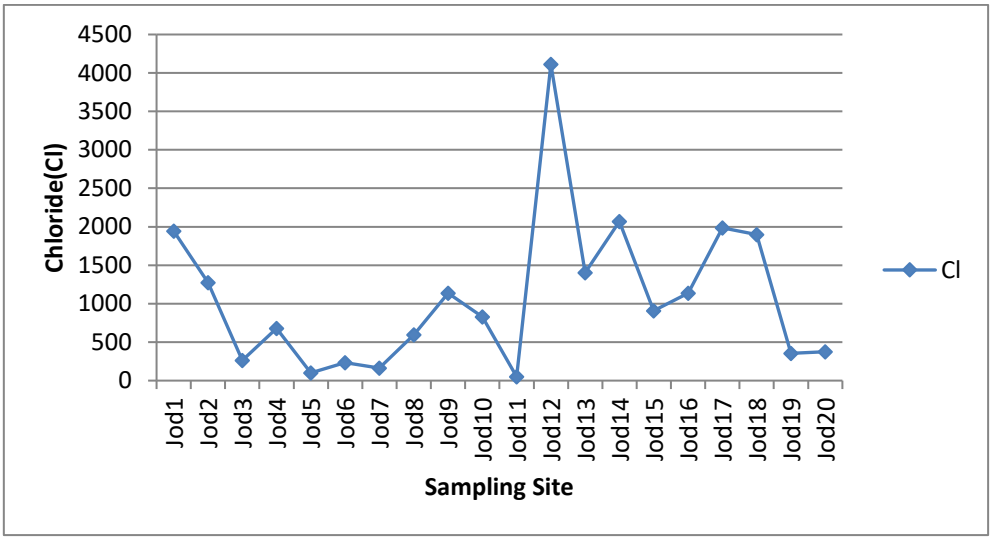


Fluoride (F^-): Fluoride is found in Rajasthan's groundwater. Long-term use of fluoridated groundwater has resulted in the development of widespread fluorosis illness, which ranges from minor dental fluorosis to debilitating skeletal fluorosis. Fluoride contents in water samples are positively correlated with alkalinity and pH. Fluoride concentrations vary from 0.00 to 3.63 mg/L in the current investigation. BIS has defined admissible limits for 10 of the 20 samples, accounting for 60% of the total water samples.[16]



Chloride (Cl^-): Chlorides are formed due to reaction between chlorine gas and metal. Chloride generally forms salt by combing with calcium, magnesium, or sodium [17-18]. High concentration of sodium salt of chloride may cause heart problems and high blood pressure The concentration of chloride in the groundwater sources in the study region ranged from 50 to 4113 mg/L. According to BIS, the allowable maximum of chloride in drinkable water is 250 to 1000 mg/L. As a result, 40% of the water samples fall

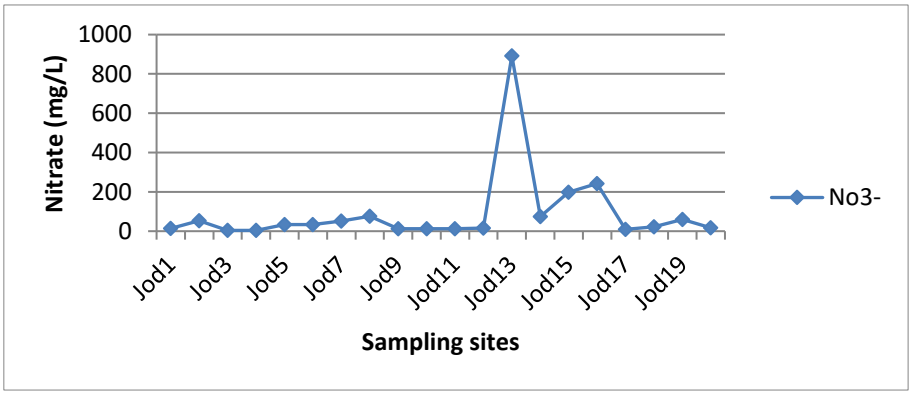
inside the permitted level, while the remainder exceed it.[19]



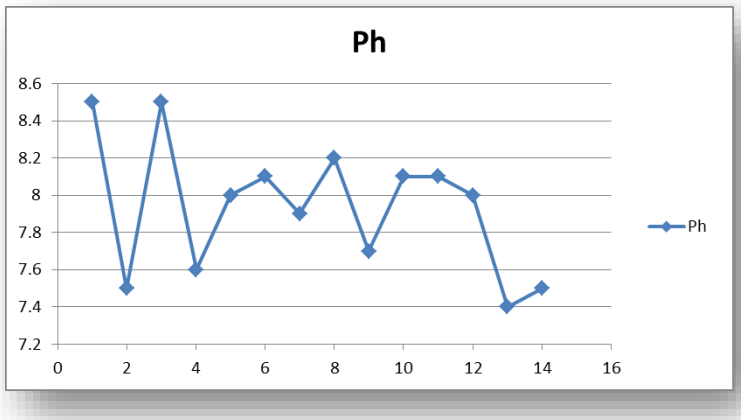
Nitrate (NO_3^-): The main source of nitrate is agricultural fields that is leached to groundwater. Nitrate levels equal to 100mg/l.5 can lead to Blue Baby syndrome and can hamper oxygen transportation in blood. Nitrate concentration increased by 45 mg/l in water can led to methemoglobemia in infants.[20]

Excess of nitrate can also cause hypoxia and can be toxic. The high level of these ions in groundwater is mostly due to the discharge of wastewater from domestic activities and excessive use of nitrogen fertilizers in agricultural lands. [21-22]

According to the BIS, a nitrate content of 45 mg/ml is safe to consume. Nitrate concentrations in water samples range from 4 to 892 mg/L. The assessment of nitrate content in drinking water is critical since levels exceeding 50 mg/L have negative health consequences. Out of the 20 samples evaluated in this study, 55 percent are within the permitted level.



pH: pH determines the of acidity or basicity of water. All the reactions depend on hydrogen ion concentration of water. [23] In this study pH varied from 7.0-8.1. Maximum pH was recorded 8.6 at Jod20 and minimum pH was 7.4 noticed at Jod13, which was not in the permissible limit prescribed by BIS, ICMR and WHO. The pH parameter being very important decides the quality of water and gives information in many solubility and equilibrium calculations.[24]



CONCLUSION

Study of ground water on the various physico-parameters shows excessive concentration of chloride and nitrate in the samples of water region of Jodhpur (rural) districts. Regions under study area have higher values of TH, TDS and fluoride, nitrate while EC and pH of the almost all water samples exceed the permissible limits. Through the results it is concluded that most of the water samples are not good for drinking purpose. So, low-cost water purification and treatment unit should be established in areas of jodhpur (rural). Also, there is need to look into water quality in holistic manner for benefit of society. It includes wastewater treatment, water purification, recycling etc. Local participation should be ascertained through education, operation, and maintenance.

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